

Chapter 1: Surviving the Unexpected Emergency¹

Everyone is a prepper. You may not think you are, but you are. To make a decision not to prepare is to make a decision. All you have available to you is your current store of provisions. An examination of most people's homes or apartments usually reveals at least three days of provisions. This is often enough to survive a three-day snowstorm or similar type of disaster. Do you need more protection? The level of protection desired is framed by the *Surviving the Unexpected Emergency Model* discussed later in this chapter. It is a series of choices everyone makes regarding their level of preparedness. The current provisions approach may prove satisfactory for a three day snow storm, but it may fall short in the aftermath of Hurricane Katrina or Sandy.

The purpose of this chapter is for people to position themselves in terms of their prepping. Its purpose is to help the preppers frame their prepping activities. It is about making choices. Prepping involves allocating time, energy and resources. It becomes a decision to determine what level of commitment one is willing to commit toward being prepared. No decision to commit is still a decision to commit. It is a decision where what you have with you is all that you will have. At the other end of commitment is building, stocking and maintaining a doomsday bunker. This is beyond what most people are willing to commit let alone to be able to allocate sufficient resources toward. It is easy to be all over the place regarding preparedness. It is like a cookie store where everything looks good. And the literature reinforces this also. The model helps the reader to make basic choices about their level of preparedness.

Toward this purpose, this chapter is divided into three sections. First, it explores several prepper stereotypes. This sets up the *Surviving the Unexpected Emergency Model*. The third section is a self-survey designed to help people position themselves as a prepper.

Prepper Stereotypes

The purpose of this section is to present several stereotypes of preppers for the reader to self-identify. There are different strategies to prepping. Visit the internet and it abounds with stereotyping the different types of preppers. Many of the categories duplicate or overlap other categories. Many of the stereotypes go for the punch line or the barb. Regardless, there is a nugget of truth behind most of the stereotypes. The stereotypes allow the reader to categorize themselves. Also, the stereotypes will permeate the discussion in later chapters.

Sheeple – This group is the non-preppers. Like sheep, they are foolish, docile and easily led. For this group, nothing bad will ever happen. The irony is that when people in this group are asked about their prepping, they actually believe that they are prepared. And the reason they are prepared is because nothing will ever happen or the government will provide a solution.

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Doomsday Preppers – As the name suggests, these preppers are preparing for doomsday. They are the bunker builders. They are the apocalyptists. Usually their focus is on man-made catastrophes. The world is going to collapse. Nuclear war is often a common thread. There is a sub-group focusing on natural catastrophes. This group includes the global warming and other cataclysmic calamities that can befall the earth. Many liberals and environmentalists fall into this group. The issue is if and when they cross over the line of believing in cataclysmic calamities and actually begin to prep. Then they become doomsday preppers.

Rainy Day Preppers – Some preppers will *store provisions for a rainy day*. They store sufficient food, and other provisions, to survive the unexpected emergency. There are two key characteristics of this group. Typically, the stored provisions of freeze-dried and other foods are very different from their normal diet. If needed, their diet will change abruptly. Second, this strategy is a low active involvement approach. Essentially, the prepper stores his supplies away for a rainy day. It is like an insurance policy. It is there if and when needed. Until needed, the prepper pretty much forgets about it. This is the author's basic approach to prepping.

Survivalists – Characteristic of this group is a focus on weapons and tactics. It is advanced weaponry and not primitive technologies. This group easily overlaps with other categories including the doomsday preppers and rainy day preppers. Normal prepping includes defensive measures including weapons and tactics. However, for survivalists, weapons and tactics seem to dominate the conversation.

Homesteaders – This group is as much about a lifestyle as it is about prepping. Homesteaders live their prepping. They are into farming, canning, and preserving foods. Typically, they have at least one year of grain stored along with other foods preserved and stored in the cold cellar. These foods are part of their normal lifestyle where the stored foods are rotated through their normal diet. Crossing over into actual prepping is more of a change in attitude for the homesteader. They become true preppers when their preparations expand to over a year and when they actively begin to consider other prepping issues.

Primitive Technologies – Essentially, this group seeks to *live off the land*. They plan to hunt, fish and forage for food. Philosophically, this group believes that when an unexpected emergency occurs, people will need to live at a more primitive level and people will need to rely on the skills of our ancestors. Starting fires with flint and steel or navigating using natural methods are examples of this approach. Part of foraging includes plant identification with an emphasis on survival skills. Primitive technologies are a part of the heritage of this country. Also, primitive technologies complement the use of other more technological forms of navigation. The use of natural methods of navigation forms the foundation for and complements other more technical forms of navigation.

Preppers can mix and match strategies and utilize other strategies. As with any stereotypes, they are generalities. When considering them, the reader should consider the following questions. To which profile do I gravitate? Which of the profiles can I see myself doing? These stereotypes are fun. As noted, the stereotypes will reemerge in later discussions.

Surviving the Unexpected Emergency Model

The Surviving the Unexpected Emergency model spatially depicts the conceptual foundations for this book (Figure 1.1). In the center of the model is a prepper's objective. It is to "survive" or be "enjoyment." The components of the model are explained in more detail in the following sections.

The *Surviving the Unexpected Emergency Model* in Figure 1.1 was developed by this author. Its title was borrowed from a text and not so similar model with the same name developed by Fear (1972). Many of the elements used in the model are echoed in Bradley (2011) and others. The model is significantly different from models developed by Fear (1972) and the Fear and Mitchell (1977) model titled: *Fundamentals of Outdoor Enjoyment*. However, it owes a debt of gratitude to these models conceptually, and in particular, it owes a debt to the principle of linking enjoyment with survival. This principle is fundamental yet often overlooked.

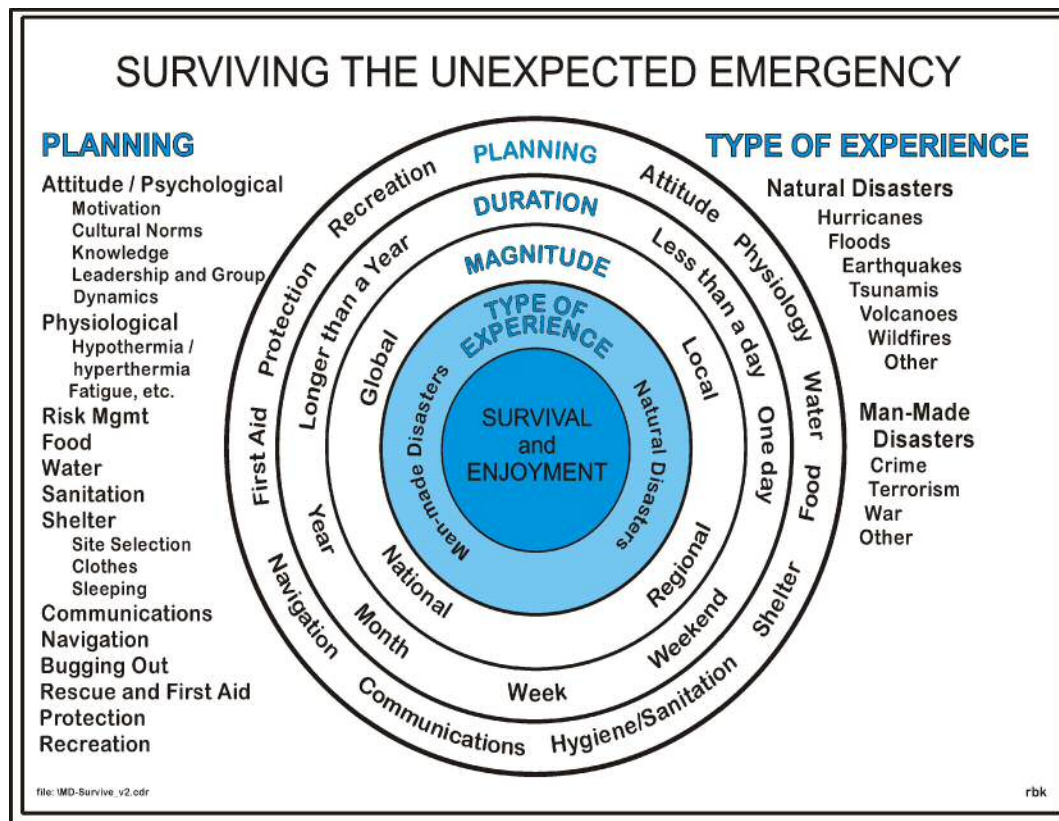


Figure 1: Surviving the Unexpected Emergency – Source: Author.

The Title: Surviving the Unexpected Emergency – This title was chosen for the model for two reasons. First, it is a tribute to Fear’s (1972) work of the same title. Second is its focus. Conceptually, surviving is living one minute longer or one day longer. It is about the short term more than about the long term. Emergencies denote short term or potentially everyday occurrences rather than big disasters that loom over the horizon. Emergencies are what most of us encounter on a fairly routine basis. It is sleeping comfortably in the car overnight in a rest stop or being homebound during a three-day snowstorm. It is about becoming complacent. During winter, we jump into the car underdressed expecting to use the car’s heater to keep us warm or to duck into a heated building if needed. But what happens if the car breaks down and we no longer have use of the car’s heater. How do we keep warm? Although it is important to focus on the large disasters potentially looming over the horizon, it is equally or even more important to focus on the unexpected emergencies that we continually encounter in our daily lives. The title of the model helps us focus in surviving those unexpected emergencies.

Do a pocket dump (Figure 1.2). In terms of surviving the unexpected emergency, all you have in a survival situation is what you have with you. In modern society, a phone and money could be a lifesaver. Normally used as a key ring, a carabiner can also be used as brass knuckles. Keys can be used as a weapon also. A pocket knife has a screw driver and knife. A leatherman ® or similar multi-purpose tool has more tools, but most people will find it more cumbersome to carry. Do you have a source of fire? Do you need a source of fire? Do you have food and water with you? Perhaps you can carry these items in your car to survive the unexpected emergency. Again, it is about making choices. If you don't have it with you, you don't have it.

Survival and Enjoyment – The key objective is to survive but also to live comfortably. Whether it is outdoor travel or surviving a disaster, people seek to have an enjoyable experience. If possible, it is survival with comfort and enjoyment. It may seem obvious, but it isn't necessarily obvious to the "uninitiated." Ask yourself the simple question. Do you want to have an enjoyable experience outdoors or not? Of course you do. Enjoyment leads to survival and to comfort regardless of whether it is an outdoor or disaster experience. The key element is survival. Making it enjoyable makes it more palatable.

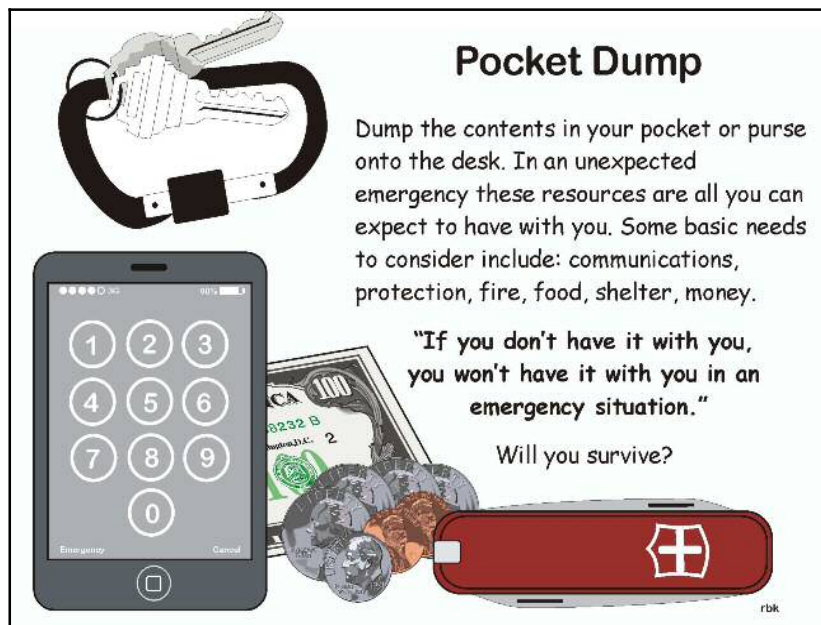


Figure 1.2: Pocket Dump. Source: author.

Most people create a comfort zone around them. Simply put, the body and specifically, the brain seeks to be comfortable. Surviving is about maintaining the comfort zone surrounding the brain and body. People modify and arrange the environment to make their surroundings comfortably support their activity. It is the astronaut thing where we are all astronauts traveling through space. It may be a car, boat, or backpack. The problem arises when people are no longer able to maintain the comfort zone around them. The body seeks to maintain its comfort zone. It seeks to keep the brain comfortable. The body extends its comfort zone by wearing clothes. The body extends its comfort outwardly into the environment to include the vehicle in which people are traveling. The car has a heater and air conditioner to maintain temperature control. It has a radio for entertainment.

In a natural or man-made disaster, people's comfort zones are upset. People may voluntarily choose to upset their comfort zone in an outdoor recreation activity. Many outdoor recreation activities upset the normal comfort zone surrounding the individual. It could be argued that most rides at amusement parks are designed to upset people's comfort zone. Regardless, people tend to maintain a comfort zone around them.

People should realize that disaster situations are not fun. They are not fun because a person's comfort zone is upset. They are survival situations in the truest sense. Never-the-less, the body seeks to reestablish its comfort zone, even if this new comfort zone is at a lower comfort level. If the body can't reestablish a comfort zone, injury or death can result. At least, the new comfort zone results in a less than an enjoyable experience.

Surviving and having an enjoyable experience is the result of preparation. Preparation involves resources, knowledge and attitude. What you have in your pocket may be all that you have in a survival situation (see Figure 1.2). Knowledge is knowing how to utilize the resources. For example, a 20-gallon trash bag can easily be fashioned into a rain coat and temporary shelter. Constructing it may not be obvious if you don't have the previous knowledge. In addition, your attitude toward surviving and your motivation play an important role.

Type of Experience – Two types of experiences are depicted in the model: natural and man-made disasters. The types of experiences are reflected in the different scenarios associated with the unit and with the Disaster Survey. They represent very different types of experiences for which to plan. Originally, the model included outdoor experiences. The same skills required for a camping trip are those required for surviving natural or man-made disaster. The overlap is apparent. Outdoor activities were deleted from the model because the focus is on surviving the unexpected emergency. Regardless, the connection is still there.

Many natural disasters are regional events and to a degree predictable. Earthquakes tend to be associated with plate tectonics. Wildfires tend to be associated with the western states. Hurricanes tend to be found on the east coast. Past natural disasters provide a foundation for which natural disasters to prepare. In contrast, man-made disasters are less predictable and to a degree a matter of choice.

Magnitude – Normally, magnitude denotes the size of the area impacted by the disaster. Magnitude easily fits with natural disasters. Obviously, a global disaster such as Chicxulub is of greater magnitude than the eruption of the Yellowstone caldera which is more national in scope or Katrina or Sandy which were more regional in their scope.

Regarding man-made disasters, magnitude may be a little looser in its interpretation. During WWII, the fire bombings of Tokyo and Dresden, Germany were regional or national disasters. It could be argued that they were local events. However, with the overall destruction of infrastructure created by the war in general, the impacts of the fire bombings were easily one of regional or national magnitude.

Often man-made disasters have greater psychological impact than actual impact on the infrastructure. The DC sniper is a good example of this phenomena. It had a huge psychological impact on the psychic of the population in the District of Columbia as well as elsewhere. However, there was little impact on the actual infrastructure. It could be argued that 911 and the Twin Towers were a local event in terms of its impact on the infrastructure. However, it had a long-term national impacts.

For those who believe in man-made global warming or man-made climate change, they could make a case of pending man-made disaster on a global level. If Al Gore is correct, the issue is what can a person do to prepare for the pending doom resulting from the inverted hockey stick. Please note that his prediction for ten years hence has not come due as predicted ten years later. However, that is another issue for another day.

Duration – In terms of natural and man-made disasters, the longer the duration the more planning and preparation needed. Most people have sufficient resources necessary to survive a three-day snowstorm with the food in their cupboards and pantry. Most grocery stores work on a three-day recycling process. Any disaster that interrupts the infrastructure and the recycling process can result in the shelves of the grocery store becoming bare fairly quickly. Without prior preparations, a disaster such as Katrina, Sandy or the Yellowstone caldera would require a store of food resources for more than three days. In terms of survival, surviving these events would become more problematic. They would require sufficient stores of supplies prior to the event in order to survive.

The general rule is that the longer the disaster's duration, the more planning and preparation required. The same is true for an outdoor experience. Usually, a one day hike requires considerably less planning than a ten-day wilderness trip. Most people can make it through a one or two day experience under most circumstances. They may have an uncomfortable experience, but they will normally survive. Sleeping in a rest stop overnight may be less than a pleasurable experience. However, it is usually survivable.

Planning – To plan for surviving a disaster, you need to prepare and plan for that activity. In terms of the model, consider the following factors for planning purposes: attitude (psychology), body considerations (physiology), food, water, shelter, hygiene and sanitation, communications, navigation, first aid, protection, and recreation. These planning factors form the major sections or units in this course. For the most part these factors are the same factors used in planning an extended camping trip. Hence, the close connection between the survival and camping industries.

The *Survival and Enjoyment* section covered earlier discussed comfort zones and zones of comfort expanding out from the body. That discussion applies to the planning criteria also. It is all about keeping the body and specifically the brain comfortable. Perhaps the most important factor in this respect is attitude and the psychology of survival followed by physiology. These factors are often overlooked or ignored in the survival literature. Or these factors are simply assumed.

Discussion of the planning process often foregoes a discussion of these two factors (e.g. attitude and physiology). Conceptually, building a doomsday bunker that will survive an atomic bomb is a shelter that is nothing more than an extension of clothes worn, and other forms of shelter designed to protect the body and keep it warm and comfortable. Or, stockpiling six months of food and water is nothing more than an extension of feeding the human engine over an extended period. Also, it serves an important psychological benefit in that the person who has stockpiled these resources *believes* that he or she has the ability to survive. In this respect, it provides a feeling of security. The operative term here is “*believes*.” Whether or not a person can actually survive is a matter of what they do during a disaster. It is no different than taking an extended outdoor trip.

Link to Recreation and Camping – The original model had three types of experiences, disasters, natural, man-made, and recreational experience. It reflected the connection between prepping and the camping movement. Subsequently, the recreational experience component was deleted from the model because disasters focus on negative events while the recreational experience component is generally viewed as a positive experience. Even so, there is a strong connection with the camping movement and camping skills are directly applicable to prepping.

Planning – Many of the same planning and technical skills used in taking a camping trip are the same skills and techniques used by preppers. In fact, there is overlap between the two industries with many companies supplying both industries. Freeze-dried food companies are most notable. Conceptually, prepping can be thought of as a camping trip where the prepper prepares for a trip into the backcountry. Readers will note the similarity between many of the skills and techniques described elsewhere and those used in the camping movement.



Figure 1.3 – Eleven Day Everglades Trip – Many camping skills are directly transferable to prepping. They both have a lot in common.
Source: Author – [file:\DSC_0112.pdf]

Virtually, all the planning skills listed in the *Surviving the Unexpected Emergency Model* are the same planning skills used in taking a camping trip. Bugging out is generally a new topic for recreational campers. Also, many would consider protection a new topic for preppers from camping. However, it is a topic area that has gained considerable discussion in today's society.

Magnitude – For outdoor recreation experiences, magnitude may be interpreted as *remoteness*. The more remote the activity the greater its magnitude and impact. An example of remoteness in wilderness medicine is where “frontcountry” is defined as less than three hours from a hospital and “backcountry” is defined as more than three hours from a hospital. A backcountry experience is more remote and many of the protocols change because the victim is beyond the “golden hour” of care.

An overnight camping experience in the backyard is not very remote. If it rains or if the children become scared, they can easily pack up their bags and move back into the house where it is warm, dry and secure. In contrast, a 11-day canoe trip in the Everglades is fairly remote. If assistance is needed, it is a two-day paddle out by the group. Rafting the Grand Canyon is even more remote where access to civilization can be several days. It should be noted that with most commercial trips they have satellite phones and helicopter access points have been identified if there is a critical emergency.

Duration – Duration is pretty straightforward. The overnight camping experience in the backyard is short term with few consequences. A weekend camping trip is of moderate duration. Generally, a screw up is not a survival situation because the duration is not too long. In contrast, the 11 day Everglades or Grand Canyon trip are of sufficient duration that they require considerable planning.

Surviving the Unexpected Emergency Survey

The purpose of this section is to help you determine the level of preparedness that you seek in your life. The survey frames this in terms of the *Surviving the Unexpected Emergency Model* (see Figure 1.1). The scenarios represent a sampling of the *type of experiences* (i.e. natural and man-made), *magnitude* and *duration* of events or disasters. There are no right or wrong answers. Readers will use the results to position themselves in terms of their planning for surviving the unexpected emergency.

It is important to “frame” your prepper preparations. Prepping is about making choices. To say that you will not be a prepper is still to be making a choice. The choice made is that whatever you have in your pantry is what you will have if a three-day snowstorm engulfs you or if a regional hurricane like Katrina or Sandy hits you. The bottom line is that everyone is a prepper even if they choose not to be a prepper. So, prepping is making a choice about the level of prepping desired and allocating sufficient resources toward prepping.

Prepping requires resources in terms of time and money. Once you choose the level of prepping you desire, it then becomes a matter of allocating resources at a sufficient level to prepare and maintain that level of prepping. This involves time and money. Prepping requires time. Time to plan. Time to construct. Preparing for and stocking the pantry in preparation for a three-day snowstorm takes some time and moderate resources. It is an extension of visiting the grocery store. In contrast, building, stocking, and maintaining a bunker takes considerable time and financial resources.

Survey Instructions – Representing the attributes in the model, several natural and man-made disasters are presented. They are designed to be hierarchal in terms of magnitude and duration. They are designed to be illustrative and to help people focus on making choices about the level of preparation desired.

The instructions are simple. For each of the scenarios, indicate whether you want to be prepared for the event or disaster within the next year. Whether you actually do or don’t prepare for the situation remains to be seen. As previously noted, being prepared involves time and resources. Resources and commitment follow desire. It is about making choices. The real question that you are answering is whether you have the desire to be prepared for this event or disaster. If you have the desire, the resources will eventually follow. As a practical matter, the cost of resources and the time involved does temper desire. Otherwise, everyone would want to be prepared for all scenarios. Who wouldn’t?

Survey – Review each scenario and indicate whether you would like to be prepared for a similar situation by this time next year. Remember, it doesn’t indicate whether you will be prepared for the scenario this time next year, only that you desire to be prepared.

Type: Natural Disaster
Magnitude: Regional
Duration: 2 to 3 days
Scenario: Major Snow Storm

A major regional snowstorm is dropping four feet of snow on your local area. You are going to be housebound for two to three days until everyone digs out. The grocery store is sold out of bread and milk (joke). In addition, assume that you might lose your electricity for part or all of this time. This may affect your heating your building and cooking.



Major Snow Storm

My Preparedness:

By this time next year, I plan to be prepared for this type of event or disaster: (Check one)

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

Scenario #1: Snowstorm – Source: author – [IN-DisasterScenarios0102[144].jpg]

Type: Natural Disaster
Magnitude: Regional
Duration: 1 week to 3 months
Scenario: Katrina or Sandy

This is aerial view of Katrina as it hit New Orleans. It could be Sandy on New Jersey or New York City. It pretty much knocked out everything from anywhere from one week to three months. There will be no utilities (e.g.: electricity, sanitation, water, cell phone, cable, etc.). This means that your refrigerator won't work unless you have a generator, and when you flush the toilet, the wastes won't go anywhere. For purposes of survival, you will need a gallon of water per person per day to survive.



Hurricane: Katrina

My Preparedness:

By this time next year, I plan to be prepared for this type of event or disaster: (Check one)

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

Scenario #2: Hurricane Katrina – Source: author [IN-DisasterScenarios0103[20].jpg]

Type: Man-made Disaster - Riots
Magnitude: Local/Regional
Duration: Two days to one week
Scenario: Watts/Baltimore Riots

In 1965 there were the Watts Riots in LA and more recently there were the Baltimore riots during 2015. Both riots closed down significant sections of each city. The effect on individuals will depend on where they live. Those in the specific location of the riots may not have food, water, and supplies for several days. In addition, they have protection needs. Those living in the general area may have disrupted services similar to those experienced in a major snow storm. Figure this disaster as a two day to possibly a week experience.



Source: <http://images.rapgenius.com/f3umcurfftg8odkvob02h1au.5>



Watts Riots, Los Angeles, CA
 Source: Wikipedia



BREAKING NEWS
 Burning Senior Center, Baltimore, MD
 Source: <http://fox43.com/2015/04/27/baltimore-riots-a-timeline/>

My Preparedness:

By this time next year, I plan to be prepared for this type of event or disaster: (Check one)
☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

Scenario #5: Watts/Baltimore Riots – Source: author – [IN-DisasterScenarios0201[144].jpg]

Type: Man-made Disaster - War
Magnitude: National
Duration: 1 week to 2+ years
Scenario: Tokyo Firebombing

What is worse than an atomic bomb? It is an incendiary firebombing of a city. It is a war of attrition and the destruction of all infrastructure (National Magnitude). On March 9-10, 1945, Tokyo was firebombed using incendiary bombs as was Hamburg, Dresden and Kassel, Germany. The bombing was designed to create a firestorm where the fire feeds on itself creating huge convection currents that feed oxygen into its massive firestorm. The Wikipedia account indicates that in the Tokyo bombing "[T]here were 267,171 buildings destroyed, and between 83,793 and 100,000 killed, making this the most lethal air raid in history, with destruction greater than that caused by the atomic bombing of Hiroshima." All infrastructure was destroyed. For our purposes, the first issue is surviving the initial attack. Second, surviving the post-attack is problematic. The infrastructure has been destroyed and there isn't much to be scavenged either.



Aerial Photo - Tokyo Firebombing, March 9, 1945

My Preparedness:

By this time next year, I plan to be prepared for this type of event or disaster: (Check one)
☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

Scenario #6: Tokyo Firebombing – Source: author – [IN-DisasterScenarios0204[144].jpg]

Analysis – In Figure 1.4, list the scenarios with which you agree or strongly agree on the right and those with which you disagree or strongly disagree on the left. This list helps your to determine the type of experiences for which you seek to prepare and the degree of your preparation. A strongly agree or strongly disagree indicates the strength of your commitment and a desire to be prepared for that experience.

Figure 1.4: Analysis of Scenarios	
Instructions: List those scenarios with which you agreed and strongly agreed on the right and those with which you disagreed or strongly disagreed on the left.	
Strongly Disagree/ Disagree	Agree/Strongly Agree
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.

Type of Experience, Magnitude and Duration – Second, review your answers in terms of the type of experience, magnitude and duration. If you responded with agree or strongly agree, you indicated that you would like to be prepared for that scenario. Compare the responses between the natural and man-made disasters. Did you favor being prepared for one type of disaster over the other?

Again, review your responses in terms of magnitude and duration? Were they hierarchal? Hierarchal means that if you wanted to be prepared for the Yellowstone Caldera, you also indicated that you wanted to be prepared for Katrina and the snowstorm.

Local Conditions – Third, consider the types of natural and man-made disasters which are most likely to occur where you live. The types of disasters to which you are most susceptible will temper your preparations in terms magnitude and duration. Usually, past history is a good indicator of the types of experiences to which you are most likely susceptible. This becomes an important consideration in the section on bugging out.

People living on the east coast are susceptible to hurricanes. People living further inland are susceptible to the tropic depressions left over from hurricanes. They are also susceptible to flooding from these left over hurricanes, particularly if they live in a flood plain.

People living in coastal areas are susceptible to tsunamis. People living on the west coast or in Japan where there is active movement in the tectonic plates, active volcanos, and underwater earthquakes are more susceptible to tsunamis than people on the east coast of the United States where there are fewer tsunamis producing activities.

Tornados are generally found in the mid-western states. However, they can occur on the east coast also. Generally, they are short lived and the area affected is limited. Although their path of destruction is limited, what lies in their path can be devastating.

As a footnote, don't be surprised if you experience an unexpected natural or man-made disaster. This author lives in western Maryland. Tornados are known to the area, but they tend to be small and more ephemeral. In contrast to left-over hurricanes which are a more frequent occurrence, tornados are infrequent and not high on the preparation list of natural disasters. On June 2, 1998, a major F4-F5 tornado passed close to this author's house. It took a house four houses away leaving only the first floor sub-flooring and foundation. This author sat humbly in his basement as the tornado passed through. The experience dramatically changed his attitude about tornados potentially occurring in western Maryland.

For the most part, wildfires are a western phenomena. This is not to say they can't occur on the east coast, but generally, the east coast is too green and too wet to sustain major wildfires.

Two man-made scenarios were provided. In general, the first scenario depicts a localized breakdown of the infrastructure. The second scenario depicts a general breakdown of the infrastructure. Prepping can expand on these scenarios. For example, prepping for a nuclear conflict could be added.

Summary Paragraph – Write a brief summary of your findings. One paragraph normally suffices. Indicate the types of experiences for which you seek to prepare. Localize your disasters. Indicate both the magnitude and duration for which you seek to prepare. Think of your summary as a mission or vision statement. It is what you envision can occur. It helps you to make choices about your preparations. It frames your preparedness. It does so in practical terms. If appropriate, reference one or more of the prepper stereotypes in your discription.

This book presents a lot of diverse information. Your summary helps you to determine what is relevant information to your needs and what is extraneous or an interesting sidebar. Your summary helps you to frame your preparations as a prepper.

Summary

It is easy to become overwhelmed by the degree of preparation and planning necessary for all contingencies of disasters and activity. The *Surviving the Unexpected Emergency Model* provides a basic structure and framework to approach the planning and preparation process for prepping. A review of the literature suggests that the factors used (e.g. type of experience, magnitude and duration) are consistent with other source materials. Most of the categories in the planning process denote a relatively standard delineation of categories. There are two significant additions to the traditional categories. The first is recreation or what you do to keep from getting bored and the need to stimulate the mind. The second focuses on the factors of attitude and physiology.

In preparing for disasters or recreational activities, first focus on the commonalities. The basic structure of the model helps to focus on the commonalities rather than the nuances. In doing so, it helps to establish decision trees with which to handle increased complexity and nuance. Second, focus on the body and the brain. Everything centers around protecting the body and the brain. As noted, a doomsday bunker is really an extension of protecting the body from harm and maintaining its comfort. Third, an underlying theme focuses on the importance of attitude and physiology in survival. All planning and

preparation can easily go for naught if a person has a poor attitude, makes poor decisions, or has not taken care of the body's needs.

The model provides the basic structure for organizing, preparing and planning for a disaster or recreational event. Also, it is the cornerstone of this book. Its planning component forms the basic organizational structure for this book.

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Chapter 2: Psychology of Survival – Who Survives ¹

The psychology of survival stresses the mental aspects of who survives in disasters and time of crisis. In this chapter, several of the topic headings are the titles of the books reviewed in the section. Generally, these titles reflect who lives and who doesn't in a survival situation. There are a lot of books written on the subject of how to survive disasters, particularly after 911, the Twin Towers, and hurricane Katrina and Sandy. Who survives and who dies is actually an interesting topic. The chapter starts with the physiology of fear because the mind and body are intertwined closely in their reaction to fear and a crisis situation.

Physiology of Fear – In discussing the psychology of survival, this section begins with a discussion of the physiology of fear. It is an example where the human body acts as a whole rather than its parts. It is included here because it is integral to how people react to disasters and crisis situations.

The body's reaction to fear is primeval. It is based on years of evolution. The body's initial reaction to fear is to prepare the body for fight or flight. Literally, the body's chemistry changes. In preparing the body, the changes both giveth and taketh away normal body functions.

LeDoux (1999) considers the amygdala as the center of the brain's defense system (Figure 2.1 and Figure 2.2). It stimulates the sympathetic nervous system's reaction. These are unconscious reactions by the body. Typical reactions include the change of the blood chemistry so that it coagulates more quickly. Blood vessels constrict to reduce bleeding. The heart rate and blood pressure increase significantly. Vision narrows and is more focused. Gonzales (2005, p.64) notes that the field of sight narrows by 70 percent and periphery vision becomes virtually non-existent. The adrenal gland secretes cortisol and epinephrine. Adrenaline is the trade name for and used synonymously with epinephrine.

As part of the body's reaction to fear, the body taketh away non-necessary functions such as digestion. Secreted by the adrenal gland, cortisol interferes with the part of the brain that handles complex thinking. It reduces the functions of the cortex and reasoning functions. This explains why training is very important. It makes it easier for the brain to react properly to crisis situations when reasoning functions are

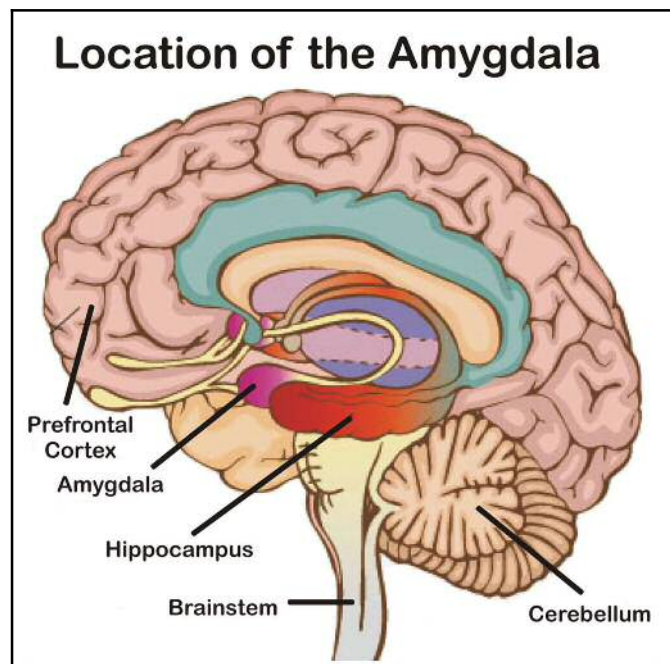


Figure 2.1: Location of the Amygdala – Source – author [file: \AT-Brain.cdr]

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hampered.

In summary, the mind and body go through a series of complex changes in reaction to fear. They are intertwined. The issue is whether high level mental functioning is needed in the crisis situation. If it is needed, it may not be there because the hormones produced affect thinking, perception, and memory retrieval. They dampen conscious memory. Again, this explains why training in all forms is valuable because it makes it easier to react without requiring high conscious thought processes.

Surviving the Extremes – A Doctors Journey to the Limits of Human Extremes

– In his book with the same title as this section, Kramler, K., (2004) explored who survived in extreme environmental situation such as the desert, ocean, wilderness, and outer space. In his conclusion, he offers several factors that led to survival in harsh situations. The first factor is **knowledge**. The tools of survival lie in people's brains. (Kramler, p.275). Knowledge is power and in this case, it is one of the keys to surviving. Consider it one of the cornerstones of surviving. All the knowledge learned about how to survive the unexpected emergency is but one factor to surviving. Knowledge about the disasters and about all the planning items listed in the *Surviving the Unexpected Emergency Model* can aid a person in surviving.

The second factor Kramler (2004, p.275) suggests is **conditioning**. A healthy body in good condition is better able to handle the stress of a survival situation.

The third factor is **luck**. In the survival situations examined by Kramler (2004, p.275) there is usually an element of luck. However, he suggests not placing too much emphasis on this factor. There is an adage that “*people make their own luck.*” To simply rely on luck is a foolish notion for fools who will perish. To a degree, luck is tied to knowledge and the ability to adapt to changing situations. In a survival situation, where little is going one's way, a little luck can be helpful. However, don't think that it covers a whole host of other shortcomings.

Kramler (2004, p.276) notes that all survivors have some combination of the factors of knowledge, conditioning, and luck. However, without the fourth factor, **the will to survive**, the people would have perished. He notes that it is the spirit to go on. It is an attitude. In the face of all odds, it is the ability to continue. It is not giving up. This attitude is discussed again in the recreation section with POWs who have suffered torture and long term confinement. It is the brain that goes soft. It is the brain that gives up the fight for survival.

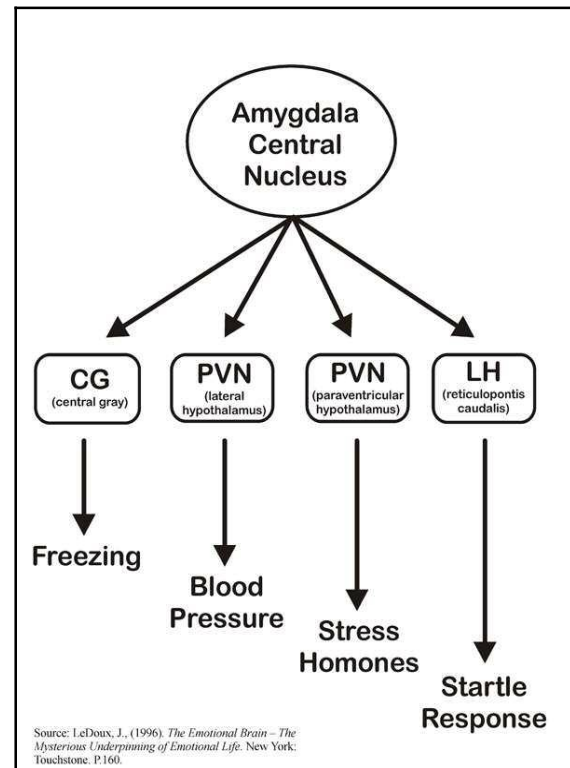


Figure 2.2: Amygdala – Different Outputs of the Amygdala Control Different Conditioned Fear Responses.

Deep Survival – Who Lives, Who Dies and Why – In his book with the same title, Laurence Gonzales (2005) studied accidents to determine why those who survived, survive and those who die, die.

Although there is some denial for survivors, they have acceptance of their reality. Denial is a defensive mechanism to protect the body from harm. However, it can lead to further harm. If the victim's leg is broken, they recognize that it is broken. If they are lost, they recognize that they are lost. Accepting their reality enables the victim to act.

When acting, survivors stay calm. Gonzales (2005, p.287) notes that survivors “think/analyze/plan.” Consider the acronym STOP. It stands for “Sit,” “Think,” Observe,” and “Plan” (Note: The acronym SSTOP is use elsewhere and is essentially the same concept.). By sitting, the survivor stays calm. Think is to analyze the situation. Observing takes in the environment for what it is, and planning is planning a course of action. The objective of planning is to create small tangible tasks that can be completed. “I will crawl twenty yards to the tree stump.” “I will dig a snow cave for the night.” “I will splint my broken arm.” Completing small manageable tasks is a critical point because it can lead to success, if ever so small. In *the Survivor's Club*, Sherwood (2009, p.327) summarizes this principle quite well with the question “How do you eat an elephant” The answer is “One bite at a time.”

Survivors take corrective and decisive action. This is where some knowledge is helpful because it helps in making the correct decisions. Although this may seem like a contradiction, survivors are both bold and cautious at the same time. It is taking care of the big picture by taking care of the small manageable tasks to move the agenda forward.

According to Gonzales (2005, p.288), survivors see the beauty, the humor in their situation, and count their blessings because they are still alive. This is the yin and yang of their situation. It provides perspective. Survival is as much about the mind and its attitude toward survival.

Last, survivors have a *will to survive*. They believe that they will succeed. They succeed by completing little task by little task. It is a series of “baby steps.” They have perseverance. They do what is necessary to survive, and they never give up. They are not discouraged by setbacks. They accept their situation and environment for what it is. They complete small manageable tasks which create successes that move them toward their goal of surviving.

The Survivor's Club – In *the Survivor's Club*, Sherwood (2009, p.313) lists 12 survival traits used in profiling an individual's survivor profile. He notes that survivors draw upon a common set of psychological strengths. The following attributes were used in developing a survivor profile and topology with five categories: the fighter, believer, connector, thinker, and realist.

Adaptability is the capacity to adjust quickly to different situations. It includes changing one's attitude and behavior to changing situations. He notes that adaptability is a critical survival tool.

Resilience is the ability of a material placed under stress to return to its original form. It is the elasticity of a material or its ability to change. Sherwood notes that for people it is the ability to pick oneself up, dust yourself off, and persevere. Essentially, he equates resilience with perseverance.

He suggests that “*faith* is the most powerful and universal survival tool” (Sherwood, 2009, p.317). He suggests that it is a person's trust in God, that God has a plan, and that he will look after people. Including in tough time, God will show the way.

Hope is a combination of optimism and realism. It is probably best to frame hope in terms of the Stockdale Paradox, the Vietnam War POW. It is the belief in surviving while accepting the reality of the situation. Untempered optimism can easily lead to disappointment and perseverance reduction.

Purpose gives a person the power and drive to persevere in periods of severe crisis. Sherwood (2009, p.319) quotes Viktor Frankl, an eminent psychiatrist and Holocaust survivor, that “everything can be taken from a man but one thing: the last of the human freedoms – to choose one’s attitude in any given set of circumstances, to choose one’s own way.” With a purpose, people live. Without a purpose, people die.

Tenacity is the ability to persist with determination. It is an attribute of perseverance.

Love is a variation of purpose. People will do anything for the people they love. The bonds with family and friends are unbreakable. When soldiers are asked who they fight for. Often, their response is for the soldier next to them in their foxhole.

As a survival tool, Sherwood (2009) suggests that **empathy** may be counterintuitive. However, in a crisis the ability to feel a deep connection for others and to care for others not only helps the recipient but the giver to survive.

Sherwood (2009, p.323) suggests that **intelligence** is the ability to acquire and use knowledge to solve problems, in this case survival. It is the ability to diagnose, analyze, and act. Elsewhere, he notes that over and over experts told him it’s not *what* a person knows in a survival situation, but *how* that knowledge is *applied* or *used*. “*Applied knowledge is the key to survival*” (Sherwood, 2009, p.314).

Ingenuity involves being clever, inventive and resourceful. It is real life ability to be a MacGyver. It can be seen as a variation of adaptability or applied intelligence.

He notes that when water hits a rock in the river it flows over and around it. Like the river, he suggests that **flow** is the ability to move forward, effortlessly, steadily, relentlessly and with ease.

He refers to **instinct** as the ability to simply act. It is the power of intuition. It is what the gut tells the person to do. It feels right and is right.

In summary, the five survivor types deal with how people approach survival situations. The twelve strands used in the development of the topologies relate to the underlying factors in determining who survives and why. As noted by Kramler (2004) the will to survive is perhaps the most important factor in survival. Resilience, faith, hope, purpose, and tenacity are attributes related to the will to survive. Even love and empathy can be said to relate to this factor. Regarding the factor of knowledge, intelligence, instinct, and ingenuity can be considered as attributes of it. Most importantly is the concept of applied knowledge.

The Unthinkable – Who Survives When Disaster Strikes – and Why – In her book on who survives when a disaster strikes, Ripley (2008) advances the theory of the “*survival arch*.” She notes that in disasters and the subsequent survival situations there are three phases that the survivors pass through. These are *denial*, *deliberation*, and the *decisive moment*. She uses case studies as the primary method to illustrate the survival arch.

Denial is the overarching category she uses to cover a person's initial reaction to the disaster. She discusses denial in terms of delay and risk. The two are interrelated. After the initial event, delay or the decision to act is based on the calculation of risk. Risk is intuitively determined based on past experience. For example, older people tended to stay and ride out Katrina, a Level 3 hurricane. They had weathered stronger hurricanes in the past. What they didn't know was that the wetlands which offered protection had changed. They viewed the risk as low and delayed evacuation. It was as costly miscalculation on their part.

One reason for the delay is what psychologists call the "*normalcy bias*." It is that accidents, bad things, and disasters happen to other people. People tend to develop patterns of behavior. Older people built up a pattern of behavior based on past hurricanes that lead to delay. This author has an office in concrete building with two large hallways leading directly to different exits. It would be difficult for the building to burn. It is viewed as low perceived risk. There was a period where the fire alarm would periodically go off accidentally. People stayed in their offices. It was perceived low risk situation leading to delay and denial based on past patterns of behavior (i.e. false alarms). In the event of a real fire, we most likely would have delayed our exit until real symptoms of a fire such as smoke, flames or firemen appeared. In a different building, it could be fatal.

The second phase is **deliberation**. Once people get through the denial phase where they know something is terribly wrong, they deliberate before entering into action. She divides it into three sub-phases. The first is the fear reaction or what the pre-programmed primeval responses programmed into people prepares them to do to survive. The second is what she terms resilience or what the more rational portion of the brain does as it reenters the survival picture. The third factor is groupthink or how people are affected in group situations.

In the survival arch, the third phase is the **decisive moment** or what the person actually does in a disaster situation. Responses include panic, paralysis, or heroism. She notes that paralysis is an evolutionary response of playing dead. The attacking animal believes that the animal playing dead is sick or diseased and ceases its attack.

Perhaps the key component to surviving is training. Training creates muscle memory. It creates the patterns of behavior. It helps move people through the deliberation phase and into taking the correct action in the decisive moment phase. One interesting case study she uses is the story of Rick Rescorla a former Vietnam soldier and Morgan Stanley executive working in the Twin Towers on 9/11. She notes that based on his attitude and training, he correctly predicted the 1993 attempt on the World Trade Center where a truck full of explosives was placed in the parking garage underneath the towers. In response, he developed evacuation procedures and then actually executed the drills at considerable lost time and money to Morgan Stanley.

An example of his plan was when evacuating the Trade Center, the people on the top floors would go down the stairwells first because they have the furthest to go. People on the lower floors would then fill in after those on the top floors. If they went first, the people on the top floors who have the furthest to go, would get out last.

A component of training is to recognize the danger. Rick saw the flames from the first Twin Tower. Over the loudspeaker, the Port Authority stated that people should remain at their desks in their office. This was a response to help prevent panic. It facilitated delay and denial. Rick knew otherwise and initiated the stairwell drill. The prior training paid off as people exited orderly and as pre-planned. He saved

countless number of lives that day.

Another component in training relates to attitude and preplanning. It need not be complicated. When getting onto a plane, note where the emergency exits are and reading the pamphlet on exiting procedures. They are a form of training. In a hotel, it is mentally noting where the stairwells are in case of an emergency. In the chapter on bugging out, having determined the bug-out site and completing some simple preplanning becomes similar to performing the stairwell drill in time of an emergency. Also, it is a reinforcement of the rescue curve in chapter five which focuses on preparation and safety, self-rescue, and rescue by others in your group before rescue by others outside your group including the rescue squad and government officials.

The Five Factors on Who Survives – Synthesizing from the previous summaries, this author suggests five factors that determines who survives in a survival or crisis situation. Keeping it simple, a summary of the attributes needed in a survival situation in this author's opinion are a variation of what Kramler (2004) concluded. They are summarized below.

First, and foremost, survivors have a ***will to survive***. Key to a will to survive is having the right attitude. It is one of accepting one's reality while having the belief that things will eventually change. It is perseverance, tenacity, and resilience. It is having a purpose. As noted by the Stockdale Paradox, it is optimism wedded with the stark reality of the situation. It is confidence that one will be successful.

Second, Gonzales (2005), noted that perhaps the key component to survival is the ability of the survivor to ***break down tasks into smaller tasks***, no matter how small, that can be completed. This component could be merged into one of the other categories, but this author believes this approach is worthy of its own category. For example, "I will crawl twenty yards to the tree stump" and then doing it. Think about this for a moment. It is a very small task. Or as noted by Sherwood (2009), it is eating an elephant one bite at a time. Survivors take "baby-steps," one small step at a time. From an attitude perspective, this approach is extremely important because by taking baby-steps, it helps a survivor from becoming overwhelmed by the enormity of their situation.

The third component is ***knowledge*** or better stated ***applied knowledge***. Knowledge is necessary, but being able to use it and apply it in a survival situation is what is important to survival. The material presented in this book increase the reader's knowledge. However, it is the reader's ability to apply it in a crisis situation that ultimately matters.

Fourth, survivors need some ***luck***. People make their own luck with applied knowledge and by breaking down tasks into smaller tasks. However, occasionally, some luck in the traditional sense is needed and a good thing. The author considered not including luck as a factor because it can easily become an excuse for ignoring the first three factors.

Fifth, we will throw in ***conditioning***. Depending on the survival situation, the body should be healthy and with some degree of physical fitness. Healthy people have a better propensity to survive. Numerous studies and common sense suggest this to be the case. This does not mean the person needs to be a fitness junkie, only that they are reasonably healthy.

Stockdale Paradox – The Stockdale Paradox is named after Admiral James Stockdale, a pilot who was shot down in Vietnam in 1965 (Greitens, 2015, p.30). Need-less-to-say, he withstood extreme torture, deprivation, and hardship as a POW. Yet, not only did he survive, he flourished as best as one could do

as a POW. It was mentioned under “*hope*” in the Survivor’s Club section and developed more in depth in this section.

The paradox is as follows. On the one hand, the person in the survival situation needs to be honest in assessing their situation. There needs to be a clear appraisal of the harsh reality surrounding their situation. There is no sugar coating. It is the cold reality of the situation. On the other hand, and at the same time the person in the survival situation needs to maintain hope. There must be the belief that a person will endure and eventually find a solution. There is always a choice and each person has some control over their destiny, no matter how limited it is. Having hope juxtaposed with accepting the harsh reality would seem to be incongruent with each other and hence the paradox. It is not blind hope but the belief that the person will eventually succeed.

In terms of the five factors, Stockdale’s Paradox could be a combination of the first two factors, a will to survive breaking down tasks into smaller tasks that can be accomplished. Stockdale chose his destiny even though there didn’t seem to be much of a choice to be had. Stockdale always saw the potential opportunities even in the most desperate situations. He saw a path to where he wanted to go even when there was no obvious path. He was in control of his destiny even in the most oppressive of times. The Stockdale Paradox is revisited again in this chapter by Joe Simpson in *Touching the Void*.

Benefits of Training – Emphasizing the need for training, Ripley (2009) advances the *survival arch* paradigm based on the consecutive factors of denial, deliberation and decisive moment. It is a useful paradigm. Also, she advances the importance of training as preparation for disasters and crisis situations, a common theme throughout this book. Training and preparation cannot be over emphasized. The need for training originates with the physiology of fear. It is a common theme of the books reviewed as it is in the materials presented in this book. The theme is often summarized in the military axiom of the “Eight P’s”: “Proper prior planning and preparation prevents piss-poor performance.” Outward Bound is one program that seeks to prepare people for crisis situations.

Outward Bound – Teaching the attributes necessary to survive are teachable skills. Outward Bound is an example of a program that was originally designed to develop these attributes. The Outward Bound program was developed by Kurt Hahn. During WWII, ships were sunk in the North Sea. When the ship went down, the sailors clinging to the life rafts were exposed to immersion hypothermia and the elements. When looking at the data, there was an anomaly. The older sailors survived the ordeal, not the younger sailors. The younger sailors in the prime of their lives and who were the most likely to survive weren’t surviving. The older sailors had the will to live. They had perseverance. The younger sailors simply gave up and died. The older sailors believed that they could survive. They didn’t give up. The purpose of the Outward Bound program was to challenge people to accomplish what they mentally didn’t think they were originally capable of accomplishing.

The classic or traditional Outward Bound program featured an obstacle course which morphed into the challenge course (Figure 2.3). The semantics of the challenge course emphasizes the positive aspects of challenge



Figure 2.3: The Wall – The wall is the classic challenge course challenge. The group needs to work together to get all participant up and over the wall. [Source: nhlbruins.tumblr.com]

rather than an obstacle being placed in front of the individual. The program evolved into using the outdoor environment as the stimulus to challenge people beyond what they perceive to be their normal limits.

Survival in the Movies – There are numerous movies depicting survival situations. This author uses the movie *Touching the Void* to illustrate the principles. It is the story of Joe Simpson's and Simon Yates' climb of the 21,000 foot Siula Grande mountain in South America (Figure 2.4). The story and movie can be viewed from several different perspectives. From a risk management perspective, it is the story of two hot-shot climbers climbing alpine style to quickly reach the summit. I don't use the term hot-shot with disrespect. They were 28 and 29 year olds at the peak of their physical fitness and mentally without having experienced failure. It is amazing that their approach to this challenge didn't result in the death of one or both participants. Another issue is whether Simon should have cut the rope. The thread viewed here is Joe's quest to survive after Simon cut the rope. Last, Joe's ordeal exemplifies the Stockdale Paradox.

Even under ideal conditions, climbing Siula Grande is a daunting task. There is the potential of altitude sickness. There is frostbite and hypothermia. There are limited resources. They ran out of fuel to heat water and they could carry only limited supplies in their quest of the summit. Under ideal conditions and circumstances, this climb was on the edge. There was no "margin for error."

Joe took a major fall and broke his leg (Figure 2.5). As he described it, the lower leg was driven up through the knee cap into the femur. Not only was he in extreme pain, but he was dangling over a cliff belayed by Simon over 100 feet away. He tried to ascend the rope, but the cold and difficulty of ascending he failed. Belayed, he was dangling at the end of the rope. With no choice but to save himself, Simon cut the rope.



Figure 2.4: Joe Simpson – In the movie and book *Touching the Void*, Joe and Simon provide a narrative of their climb and ordeal with other climbers reenacting the events.



Figure 2.5: Joe at the End of His Rope – Joe is dangling unable to ascend. Eventually, to save himself, Simon cuts the rope. Source: Movie.



Figure 2.6: Crawling 20 Feet – Not knowing if there is a way out, Joe sets small tasks to complete and does them. Source: Movie.

Joe dropped into the crevasse below him. The movie doesn't say how far he dropped, but it was at least 50-70 feet. The movie notes he had some luck. He landed on a ledge. Had he been three feet to the right he would have fallen an unknown distance. He is lying there in excruciating pain not knowing if there is a way out of the crevasse. He set a goal of crawling 20 yards (Figure 2.6). He accepts his situation for what it is. He crawls over a snow bridge knowing that it could collapse under his weight and the fall would kill him. There was no guarantee that there was an exit from the crevasse. Eventually, he found a glimmer of hope and crawls to the light where he breaks through the snow to the surface.

His ordeal is not over. He has to trek down the snow and then the rocky terrain to base camp (Figure 2.7). Remember, he has a broken leg and is in major major pain. However, think of his situation for a moment. If Simon has left the base camp, Joe is alone and by himself three days travel to the nearest civilization. Imagine the impact on his physic and his will to live if he trekked back to their base camp only to find that the base camp was no longer there.



Figure 2.7: Base Camp – If Simon has left the base camp, Joe is a three day walk to any civilization. He lost 1/3 his body weight. Fortunately, the tent was lit and Simon was there. Source: Movie.

Consider Joe's experience in terms of the Stockdale Paradox. Joe had a clear appraisal of the harsh reality surrounding his situation.

He didn't sugar coat his situation. He understood the cold reality of his situation. On the other hand, and at the same time, Joe maintained hope. Hope may not be the right term. Joe did have the belief that he person would endure and eventually find a solution. There is always a choice and each person has some control over their destiny, no matter how limited it is. Even if it was crawling twenty yards to a rock.

In summary, assess Joe's survival in terms of the five criteria. There is no question that Joe had a will to survive. He had perseverance. His desire to survive cannot be overstated. Consider the Stockdale Paradox. Second, Joe knew the problems he faced and he had the knowledge to deal with some of his situations. Third, he broke his tasks down into small tasks that can be accomplished. He wasn't overwhelmed with the enormity of his situation (Note: He had every reason to be overwhelmed.). Fourth, he did have some luck. Joe found an exit where none were likely, and when he fell, he landed three feet from having a more severe fall. Last, regarding conditioning, Joe lost one-third of his body weight through the ordeal. His original health and conditioning helped him to survive.

Summary:

This chapter focuses on who survives in a survival or crisis situation. The reader needs to remember that not all prepper situations are extreme survival situations as the ones from which the observations were gleaned. The focus here was on disasters or crisis situations where the incident places the victim in a major survival situation. With this understanding, there were five suggested criteria necessary for survival.

The first criteria needed for survival is a will to survive. Following Joe's ordeal, he had a will to survive. This is first and foremost. A will to survive covers many but not all deficiencies. Second, the survivor

needs to have some knowledge. It needs to be applied knowledge. How much knowledge necessary to survive is debatable. But, some knowledge is needed. Third, the survivor needs to break down task into meaningful tasks the tasks to be accomplished. This goes to frame of mind and not becoming overwhelmed. Fourth, applied knowledge reduces the amount of luck needed. Regardless, there is usually some luck that usually occurs. However, to totally rely upon luck is to be foolish. Last, healthy people tend to survive better than those who aren't. This is simply fact of the matter. The first three criteria are perhaps the most important criteria for those who have survived a survival or crisis situation. The fourth and fifth components are important, but lesser so than the first three.

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Thermoregulatory Physiology¹

Man is a tropical animal. This means that in order to survive in temperate or polar environments (i.e. non-tropical) environments, man needs protection or insulation. Stated another way, the human body is designed to run within a narrow temperature range. Specifically, the body seeks to maintain the heart, lungs and brain (body core) at 98.6°F mean temperature. Mean temperature means that some people operate at a slightly higher temperature and some people operate at a slightly lower temperature. On average, the operating temperature of the core is 98.6°F (Figure 1).

Think of the body as an engine. It consumes food and converts it into fuel to fuel the muscles and feed the brain. The brain is in control of the body. It controls the nervous system and all of the organs. It has two major wants. It wants to be kept warm (i.e. 98.6°F mean temperature), and it wants to be fed sugar. When these two things occur the brain is happy. When these two things don't occur, the brain will take corrective steps to make it happen. It will go to extensive measures to make it happen. The discussions in this section and on hypothermia and hyperthermia illustrate how the body reacts to cold and heat stress.

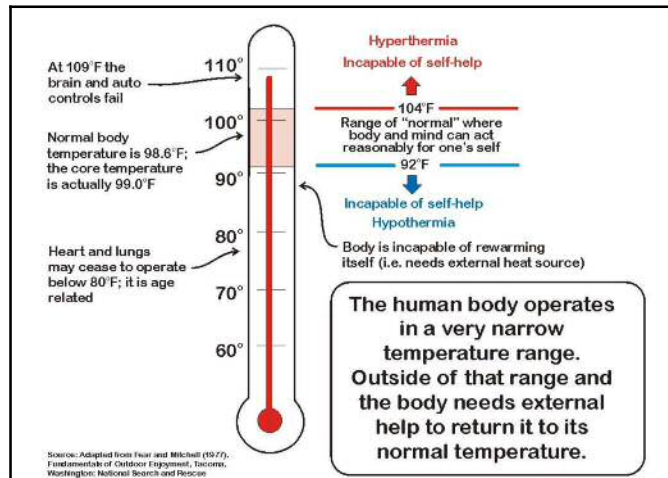


Figure 1: Operating temperature range of the body.

The muscles in the body provide mobility and bodily functions. The heart is a muscle that pumps blood throughout the body. Two major by-products of muscles working are heat and wastes. The heat generated needs to be dispersed and the wastes eliminated.

Thermoregulation of the Body – From a survival perspective, the first area of focus is on thermoregulation or maintaining the optimum temperature of the body. Thermoregulation involves the body's ability to dissipate heat and its ability to gain and reduce the loss of heat. There are four ways to transfer heat (Figure 2). These are conduction, convection, radiation, and evaporation.

Conduction is the transfer of thermal energy through a solid or between two solids in contact with each other. Touching radiator in Figure 2 transfers the heat in the radiator directly to the fingers touching it. Sitting on a rock at ground temperature (55°F), the person's buttocks will get cold. Actually, the body heat is lost through conduction to the rock or the buttocks is heating the rock.

Convection is the transfer of heat by the circulation of a fluid (e.g. water) or gas (e.g. air). The purpose of a convection current is to equalize the temperature differential between the hot and cold areas. The

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greater the differential between the hot and cold areas, the greater the potential for the creation of a convection current and the stronger the current. In the radiator in Figure 2, the air is heated by the radiator. Since warm air is less dense, it rises and heats the room. In doing so, it cools. It becomes denser and sinks to the floor where it circulates back into the radiator where it is again reheated. In theory, the process continues until the temperature is the same throughout. The primary method to insulate against convection losses is to create dead air spaces which interfere with or prevents the circulation process.

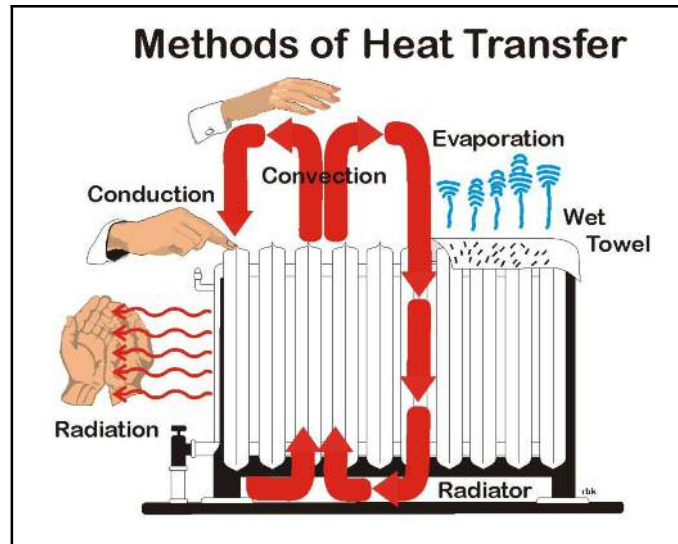


Figure 2: How the body gains and loses heat.

Consider the following example as illustrating the differences between convection and conduction heat transfers. There is a cubic foot of goose down, and a cubic foot of fine steel wool. Which is the better insulator? It could easily be argued that their ability to insulate against convection losses is the same. Remember, both materials create small dead air spaces that resist circulation or movement of the air. One could argue that goose down creates dead air spaces more effectively than steel wool, but you get the point. It is the ability to impede the circulation process associated with convection currents.

In contrast, there is no question regarding conduction losses. Steel is an excellent conductor of thermal energy. Comparatively, goose down is a poor conductor. Thermal transfer of energy through the steel is many time greater than through the goose down. Regarding insulation, steel is a poor insulator against conduction losses. Goose down is much better. The point is that the same material can have different abilities to retard heat transfer and to insulate against heat transfer.

Radiation is energy that is transferred through waves radiating from the emitting substance. The radiator in Figure 2 is the emitter. The waves cause the molecules in the object being heated to vibrate. The friction from their vibration generates heat in the object being heated. Microwaves cook food using this method. People sitting around a campfire are heated by the heat radiating from the campfire. Dead air spaces or even a vacuum has no effect on stopping or retarding radiating heat. The radiating energy passes through a dead air space or vacuum. The sun radiates energy that travels through the vacuum of space and heat the earth.

Evaporation is the conversion of a liquid to a gas. In order to do so, the liquid needs to absorb energy to convert it to a gaseous state. The energy is absorbed from the environment which results in cooling the environment. Evaporation of sweat is the method used by the body to cool itself and keep it within its proper operating temperature. Evaporation plays an important role in how the body cools itself which is discussed in its own section.

The body attempts to maintain its core temperature (heart, lungs, brain) at a mean operating temperature of 98.6°F. It performs a balancing act between using heat generated by the operation of the body, gaining heat from outside sources, and retaining body heat with insulation. The body generates heat through its

operation. This heat can be used to maintain the operating temperature of the body. Shivering is the classic example of the body generating heat to heat itself. These processes will be discussed in more depth in the next section as well in the hypothermia and hyperthermia sections.

The body changes the mix of these three options to maintain its core temperature and to be comfortable. It does this through a combination of voluntary and suggested choices by the brain and the autonomic nervous system changing body functions. First, the body can gain heat from outside sources. Or it can lose or dissipate heat from the body. If the body is cooling down, a person can step directly into the sun's rays from the shade and feel the heating effect of the sun. The body gains the radiating heat from the sun. Conversely, if the body begins to overheat, a person can step into the shade to cool off by no longer receiving solar radiation. A step to the right into the sun's rays and the person begins to overheat. A step to the left back into the shade and the person's body begins to cool off.

In a second example, a person standing in a room is heated by the heating system that heats the room. If the thermostat is set at 70°F, there is an equilibrium established where the convection losses from the body to the room are offset by the production of waste heat by the body. The person feels comfortable. Turn the thermostat down to 65°F. Now, the convection losses from the body to the room become stronger. The equilibrium is upset. The body becomes uncomfortable. If the thermostat isn't turned back up to 70°F, the body has two choices to reestablish this equilibrium. It can increase heat production or it can increase its insulation. A person may stand-up and walk around the room temporarily generating additional waste heat which temporarily warms the body.

The third alternative is that the person could increase their insulation and put on additional layers of clothes. Since 20% to 30% of the body's heat is lost through the head, putting a hat on provides considerable insulation. Most people will add a sweater or sweat shirt to provide sufficient insulation in an effort to readjust the equilibrium. The clothes add insulation. It retards convection losses to the environment, and it maintains the equilibrium between the heat lost to the room and the body's production of heat. The body is again comfortable and the body's core temperature is easily maintained at 98.6°F. The brain is happy and goes on to other things.

The Sweating Process – Under normal situations, the sweating process is the primary method the body uses to cool itself. It should be noted that the body can lose heat through other functions including respiration, urination, and defecation. Of these, respiration can often become a significant contributor of heat loss.

The sweating process works as follows (Figure 3). Heat is produced by the body. It needs to be dissipated. The warm blood is shunted to the skin for cooling. The skin secretes water through the sweat glands. The water evaporates. In order to evaporate, the water absorbs energy. The energy is absorbed from the skin cooling the skin and cooling the blood in the capillaries. The cooled blood is transported back to the body's core or muscles where it becomes reheated. The process is repeated.

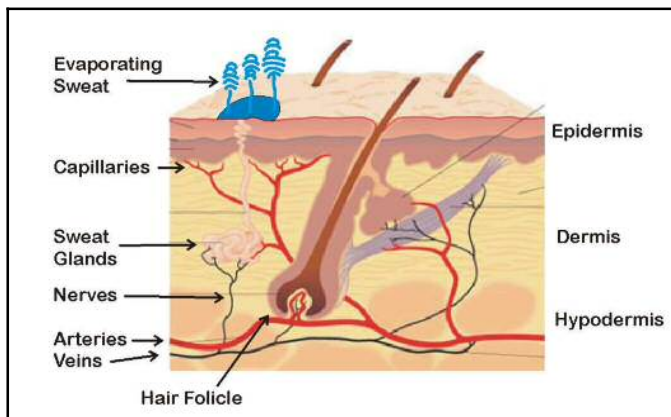


Figure 3: The skin sweating.

For water to evaporate, it needs to gain energy from its surroundings to transform it from a liquid to a gas state. It absorbs this energy from the skin. The result is that the temperature of the skin is lowered and the blood in the capillaries is cooled. Sweating can consume large amounts of water. In a hot environment the body can easily lose 1.5 quarts a day and over five quarts a day with heavy exercise. If this water is not replaced, it can quickly lead to dehydration. Dehydration is discussed in more depth in its own section.

Clothes and Shelter – Shelter is defined as anything that protects the body. In terms of the thermoregulation process, shelter can include clothes, campsite, car, the home, etc. Shelter can be viewed on a continuum extending outward from the body. The clothes worn is a form of shelter surrounding the immediate body. A home is a more remote shelter. Shelter is discussed in more depth under its own unit.

Compensatory and Decompensatory – The thermoregulatory process described so far is a compensatory process. *Compensatory* is when the body seeks to compensate and readjust to the stresses placed on the body, in this case the thermal stresses of hot and cold. As noted, it does this by increasing its heat production, by increasing or reducing energy received from outside sources, and/or by adding or subtracting insulation. Technically, the body seeks *homeostatus*. “Homeo” means “like” and “status” mean “state.” The process just described is a process by which the body readjusts to changes in temperature and reaches homeostatus.

The body seeks to compensate. When the body is no longer able to compensate and maintain homeostatus, it shuts down. The shutting down process is *decompensatory*. In terms of thermoregulation, heat exhaustion and shivering are compensatory processes. Heat stroke and hypothermia are decompensatory. These processes are described sections discussed under separate cover titled *Hypothermia* and *Hyperthermia*.

Summary – Thermoregulation is the body’s process of attempting to maintain its operating temperature at a mean temperature of 98.6°F. Normally, it is a compensatory process where the body seeks homeostatus. The body gains and loses heat through conduction, convection, radiation and evaporation. Using these process, the body uses one or all three methods to maintain its optimum operating temperature. It can increase heat production. Exercise and shivering are examples of heat production. It can gain or lose heat due to external sources. Sitting in front of a campfire is a method of gaining an external source of heat. Or the body can change the amount of insulation surrounding the body. This can be as simple as putting on or removing a hat or sweater as needed.

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Dehydration¹

The body is an engine that consumes food and converts this food into energy to fuel the muscles and organs of the body. A by-product or waste of the muscles working and contracting is heat. The body needs to dissipate this heat or the body will overheat. Stated another way, the body seeks to maintain the core temperature of the heart, lungs and brain at 98.6°F. The two primary mechanisms that the body uses to dissipate this heat are sweating and respiration. Between 80% to 85% of the heat loss is from sweating and the 10% to 15% is from respiration. Hence, water becomes an important ingredient needed to cool the engine and the body needs to continually input water into its system for it to function properly.

The Loss of Water from the Body – Every time a person exhales, there is moisture in the breath. This is evident in winter when the moisture in your exhaled breath condenses in the cold air. There is very little that you can do to prevent the loss of heat and moisture through respiration. In winter it can be a significant loss of body heat and it can easily contribute to dehydration. In summer, it is generally less of an issue. As a sidebar, dogs don't sweat and respiration is the primary method that they use to dissipate extra heat. This is why dogs pant. They are preventing overheating.

Sweating is the primary method that the body uses to dissipate heat and prevent overheating of the body (Figure 1). Analogously, the cooling system in a car using the radiator to dissipate the engine's heat accomplishes the same end in a somewhat similar manner.

In the body, the cooling process under heavy exertion is primarily the function of the skin. Actually, in normal situations, urination is the primary loss of water. When cooling is needed, the warm blood is circulated to the skin for cooling through the arteries by the heart. In the skin, the pores open and the sweat glands secrete sweat (water) onto the skin. In order for water to transform from a water to gas (evaporation), it needs to absorb energy. It absorbs this energy from the skin. The skin is cooled by several degrees as the sweat evaporates into a gas. The blood in the capillaries is cooled and it is transported back through the veins where it becomes reheated by the different bodily functions. The brain coordinates this complex process without having to think about it.

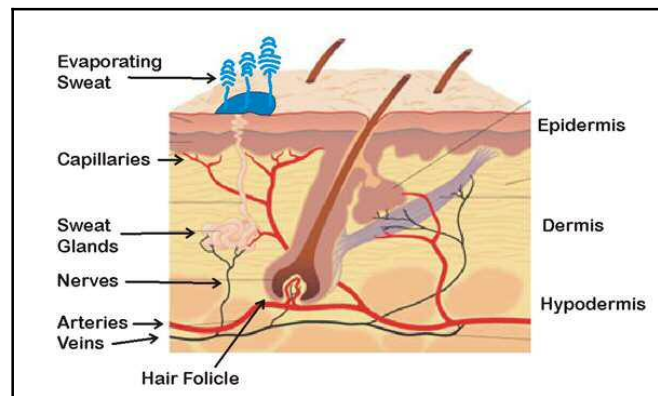


Figure 1: How the skin dissipates heat and prevents overheating.

Three situations are presented representing different water loss scenarios. Figure 2 presents typical water losses for a normal person living in a normal climate controlled residency or building. As noted, urination accounts for the primary loss of water. In this situation an individual loses roughly 2 ½ quarts of water daily. Of this, rough 1 ½ quarts or 62% of the water lost is lost through urination. Upon reflection, it is not unexpected that the primary loss of water is through urination. However, as activity

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increases, or as the environment changes, the body's need for water changes significantly.

Figure 2: Hydration Requirements ¹			
Normal water losses per day due to:	Minimum Exertion ²		
	ml	quarts	% of Total
Urination	1,400ml	1.48	62%
Respiration	350ml	.37	15
Skin (insensible loss)	350ml	.37	15
Sweating	100ml	.10	4
Defecation	100ml	.10	4
TOTALS:	2,300ml	2.42	100%
¹ Source: <i>SOLO's 2010 Wilderness First Responder Review</i> . P.O. Box 3150, Conway, New Hampshire: SOLO, p.57. ² Minimum exertion is defined as normal activity in a climate controlled building.			

In a hot environment such as the one depicted in the beach scene (Figure 3), the body's need for water for cooling purposes increases significantly. Figure 3 reinforces the methods of gaining and losing heat. During a hot sunny day on the water, the body gains heat. This heat is gained from several sources. The long wave radiation from the sun heats the body directly. In a very real sense, the recreationist exposed to the sun has exactly the same problems as someone in a hot desert where there is little or no shade. They may be totally exposed to a hot sun with very little shelter to protect them and this can easily lead to dehydration.

The scene pictured in Figure 3 is typical of the "hot temperature" category reported in Figure 4. In this scenario, total water losses increase by an additional quart of water over the minimum water use depicted in Figure 2. Although the amount of water lost to urination remains roughly the same, its percentage of the total water losses reduces from 62% to 36% of the total. As might be expected, sweating increases from four percent to 43% of the total. Respiration remains roughly the same.

In contrast, heavy exercise generates massive amounts of heat as a by-product from the muscles working. As might be expected, water losses to sweating needed to the body increases to 76% of the total and slightly less than seven quarts of water are needed to replace the lost water. The increased respiration losses most likely reflect the increased respiration activity associated with the heavy exercise.

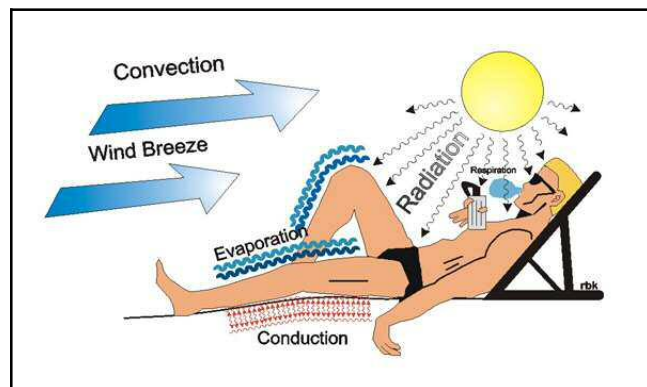


Figure 3: Methods of gaining and losing heat.

Figure 4: Hydration Requirements ^{1,2}

Normal water losses per day due to:	Hot Temperature			Heavy Exercise		
	ml	quarts	% of Total	ml	quarts	% of Total
Sweating	1,400ml	1.48	43%	5,000ml	5.28	76%
Respiration	250ml	.26	7	650ml	.68	10
Urination	1,200ml	1.27	36	500ml	.53	8
Skin (insensible loss)	350ml	.37	11	350ml	.37	5
Defecation	100ml	.10	3	100ml	.10	1
TOTALS:	3,300ml	3.48	100%	6,600ml	6.97	100%
¹ . Source: <i>SOLO's 2010 Wilderness First Responder Review</i> . P.O. Box 3150, Conway, New Hampshire: SOLO, p.57. ² . The table is organized by heavy exercise.						

The primary method to replenish water lost from the body is to simply drink water. A secondary source of water is through the food eaten. Even deep fried foods or over-cooked foods still contain moisture. Regardless, the primary source is through drinking. The water is absorbed into the body through the digestive tract where it is used to replenish lost water due to respiration, sweating and urination. As a sidebar, dehydration is the reason that dysentery and cholera can kill its victims. The body is unable to absorb water into the body. It becomes severely dehydrated and this leads to death.

Symptoms – Percent of body weight is usually used to indicate the degree of dehydration. A gallon of water weight slightly less than eight pounds. A three percent loss in water for a 180 pound person is 5.4 pounds or approximately two-thirds of a gallon of water. Although there are other factors present, it is easy to see how a person may need to consume up to a gallon of water each day. In backcountry planning, the often quoted planning dictum is that people will use on average a gallon of water each day. This can easily be inferred from Figure 4.

With mild dehydration, the body loses up to 3% to 4% of its body weight. Mild dehydration is normal and fairly benign. The body maintains appropriate fluid levels by borrowing water from between the cells. Mild dehydration is a state with which the body is used to dealing and the primary focus of this essay. As noted in Figure 4, heavy exercise can easily deplete the body of its water resources.

The color of the urine provides an excellent monitor of the body's fluid balance. A key symptom of mild dehydration is a dark yellow and arid smelling urine. The role of the kidneys is to remove wastes from the blood and flush these impurities out of the body in the urine. A deep dark yellow and arid smelling urine is a usual indicator that the body is becoming dehydrated. Two words of caution. First, don't confuse the need to urinate as an indication of not being dehydrated. The body still has a need to rid itself of wastes and it does so through urination. The impurities become concentrated in a reduced stream of urine and this is the reason why the urine is dark yellow and arid smelling.

A second word of caution is that coffee, soda, alcohol and other diuretics can result in clearer colored urine. A diuretic is any substance that makes you urinate. It only makes sense that diuretics containing

large volumes of water will have less effect on dehydration than diuretics with little or no water content. Drinking soda will require more soda to be consumed to compensate for its diuretic effects than simply drinking water. However, a person on medication that is diuretic will need to consume additional water to offset the diuretic effects of the medicine. They should consult their doctor before going into a hot environment.

Other symptoms of dehydration include thirst, headache, nausea, dizziness, constipation, and loss of strength. Although these are all indications of dehydration, the monitoring of the urine is generally the best indicator. As the body approaches 15% dehydration based on body weight, internal organs are severely affected. They begin to shut down and death results. Determining dehydration by the percent of body weight is not a precise measure and in the field, it is problematic at best.

Dehydration can affect performance which can lead to inattentiveness and accidents. However, studies indicate that this is less of a problem than it may seem, particularly if the participants are motivated. In the research studies reviewed, there were no significant differences between motivated dehydrated and non-dehydrated people.

Heat Loss Mechanism – In situations when the body gains large amounts of heat including exercise or exposure to the sun, the body can easily lose several quarts of water over several hours in an effort to cool the body. The actual amount of water lost depends on the air temperature, the individual's body mass, whether clothing is worn, and the amount of activity or exercise (see Figure 4). Generally, greater water loss will occur in bigger people, when the air temperature increases, when the individual avoids wearing clothing (e.g. no shirt and/or pants), and in people who are active (e.g. walking) or exercising (e.g. working, jogging).

As activity increases, the surplus heat gained by the body **must** be lost or the body's core temperature (heart, lungs, brain) will increase. As noted in Figure 4, the body accomplishes this by evaporating sweat. As sweat converts from a liquid to a gas, it absorbs large amounts of heat from the body (see Figures 1). This cools the body, and the core temperature remains at 98.6°F. The cooling process is often helped by a breeze or wind (see Figure 3).

If dehydration continues beyond mild levels, the body readjusts in a manner very similar to the way it deals with hypothermia. As mild dehydration becomes more severe the blood becomes upset and out of balance. Heat exhaustion and heat stroke can often result. With no intervention, death can eventually result. When the blood and its electrolyte balance become upset, the victim is no longer able to correct the balance by themselves and they need the medical attention of a doctor.

Protection against Dehydration – Activity level and the amount of shade can have a significant impact on dehydration (Figure 5). In one study, three of the categories are sitting unclothed in the sun, sitting clothed in the sun and sitting in the shade. The average consumption of water for the person sitting in the shade was ½ a pint of water an hour in contrast to ¾ of a quart an hour for the person unclothed sitting in the sun.

Protection against dehydration is the obvious. If possible limit activity during the hottest periods of the day. For outdoor recreationists, consider traveling early in the day and avoid the late afternoon sun. Seek shade. Drink water. Replenish electrolytes. Look for the symptoms of dehydration and monitor the urine flow.

Most recreationists never pass beyond a state of mild dehydration. Usually the day ends, the heating effects of the sun diminish and the boater seeks shelter as part of his normal activities. People re-hydrate by drinking water. They rest. They relax and they recuperate. These activities are also the recommended treatment for dehydration. A not so obvious sidebar on rest and relaxation is that a resting person is not producing surplus heat. Activity creates heat from muscle contraction which requires more cooling and water. Rest and relaxation produce less heat as a by-product and hence, reduces the likelihood of dehydration.

Whitewater boaters, sailboard users, personal water craft operators and divers who wear wetsuits and drysuits out of the water can easily become dehydrated. The neoprene wetsuit prevents sweat from evaporating and it can easily lead to a situation that creates a sweat machine. The wetsuit retains body heat causing its wearer to become overheated. The body reacts by sweating. However, the wetsuit prevents the sweat from evaporating and cooling the body. The body continues to sweat in an effort to cool itself and very quickly it becomes dehydrated while the body remains overheated.

Summary – Today, an argument can be made that people are over hydrated, or perhaps the argument could be made that they replenish fluids more rapidly than really needed. The human body is resilient and designed to handle mild dehydration as part of its normal routine. It compensates very quickly by sweating and increasing respiration, if necessary, to remove excess heat. Regardless, it is still important to replenish water losses and electrolytes. It is important to recognize the potential magnitude of these water losses and that under the right circumstances, they can easily be over a gallon of water a day. Nausea, headaches and constipation are typical symptoms of dehydration. However, the best indicator is the color and flow of your urine. Dehydration is associated with a deep dark yellow color and a reduced flow. Drink plenty of water. Add some electrolytes or salt. Monitor your urine and you should be okay.

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Figure 3: Average Sweat Losses on a 95°F Day¹

Environmental Factors	Water Loss Per Hour at 95°F	Percent Body Loss Over 4 hour Period ²
Walking Unclothed In the Sun Subject walking unclothed (e.g. bathing suit only) directly exposed to the sun	1.15 quart	6%
Working Clothed in the Sun Subject wearing clothes performing moderate work directly exposed to the sun	1 quart	5%
Sitting Unclothed in the Sun Subject sitting unclothed directly exposed to the sun (e.g. see Figure 1)	3/4 quart	4%
Sitting Clothed in the Sun Subject wearing clothes sitting exposed to the sun	1 pint	2%
Sitting Clothed in the Shade Subject wearing clothes sitting in the shade	1/2 pint	1%

¹. Source: E.F. Adolph and Associates. Psychology of Man in the Desert. Interscience Publishers, Inc., New York, 1947. An old study, it serves to show how the differences in protection of the body can aid in reducing water losses.

². The percentage of weight calculations were based on a person with an average weight of 150 pounds and water weighing 8 pounds per gallon. Also, the calculations assume that the person is not drinking water during this period.

Hypothermia¹

Hypothermia results when the core temperature of the body (heart, lungs and brain) drops below 95°F. “Hypo” means “low” and “thermia” refers to temperature. Hence hypothermia refers to low body temperature. It should not be confused with hyperthermia which is a high temperature or overheating of the body. Physiologically, the body is designed to handle cold stress and it results in a systematic shutdown of the body to maintain the core temperature of the body for as long as possible. If untreated hypothermia can cause death. Hypothermia is a secondary cause of death in that the actual or primary cause of death is usually something else such as heart failure or drowning. The key to preventing hypothermia is to spot it early and take appropriate action. This may seem simpler than it seems, but prevention is key because in the field there are often few options once hypothermia becomes advanced.

Types of Hypothermia – Generally, there are two types of hypothermia. The first is “*chronic hypothermia*.” Chronic hypothermia occurs over a long period of time. Typically, it is found in backpackers and the elderly. For the backpacker, the onset may occur over a period of a day or more and for the elderly, its onset may occur over several days or even weeks. The critical difference between chronic and immersion hypothermia is that with chronic hypothermia, the body undergoes physiological changes that result in chemical unbalances.

“*Immersion hypothermia*” results from a rapid onset of hypothermia. Perhaps a better title is “rapid onset hypothermia,” but since most cases involve cold water immersion, it is referred to immersion hypothermia. Typically, the ship goes down. The passenger jumps into the frigid water. Within several minutes, the passenger becomes hypothermic and if untreated is dead within twenty or thirty minutes. Because of its rapid onset, the chemical balance of the body doesn’t become significantly upset.

For boaters and water related activities, often, the participant initially experiences chronic or long-term hypothermia. Usually, its effects such as impaired coordination lead to immersion in the water and immersion hypothermia. Hence, the hypothermia is a combination of both types of hypothermia. It has some of the elements of chronic hypothermia, but it is eventually overshadowed by immersion hypothermia.

Symptoms – The symptoms of hypothermia are listed in Figure 1. As a practical matter, the best symptom of the beginning stages of hypothermia is shivering. Shivering is the body’s reaction to cold stress. Shivering is the involuntary contraction of the muscles. It is like running a marathon without going anywhere. The purpose of shivering is to produce heat and the heat produced is used to heat the body. The problem is that shivering consumes large amounts of energy. It is a temporary fix because if unabated, the body will quickly run out of energy to fuel the shivering process. This is why it is important to recognize the onset of hypothermia quickly and to take action to treat it.

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Figure 1: Core Temperatures versus Symptoms of Hypothermia ^{1,2}

Core Temperature	Symptom/Comment
98.6°F to 96°F	Intense shivering at rest – In terms of the hypothermic progression, the importance of this symptom cannot be over emphasized. Also, it is usually a good sign. The victim is capable of rewarming himself and hypothermia can easily be abated. At rest is added because activity creates surplus heat that can mask shivering.
95°F to 91°F	Violent shivering, slurred speech and slurred thinking (e.g. The victim claims that “I’m not hypothermic” when the symptoms indicate otherwise.)
90°F to 86°F	Shivering stops or diminishes; with this there is a loss of muscular coordination and thinking. – If rewarming efforts have not occurred, diminished shivering is not a good sign.
85°F to 81° F	Irrational, muscle rigidity, slowed respiration and pulse – In the field, these symptoms are hard to assess. Usually, the symptoms manifest themselves in lack of coordination, stumbling and not being able to perform simple functions like zippering a zipper.
80°F to 78°F	Unconsciousness, failing reflexes, erratic heartbeat – In the field, the victim becomes lethargic. They want to stop and rest, etc.
Below 78°F	Death – Usually the heart stops, but at this point most internal functions have shut down. It is which cause is selected as the cause of death.
¹ Source: Adapted from Fear and Mitchell (1977). Fundamentals of Outdoor Enjoyment, Tacoma, Washington: National Search and Rescue. ² The key to the treatment and prevention of hypothermia is to identify the primary symptom of shivering early and taking action.	

Shivering is a good symptom because if the proper steps are taken, the body will rewarm itself. Treatment is three-fold. First, increase the victim’s insulation. Remove wet clothes and put on dry clothes. Insulate the head with a cap. Place them in a sleeping bag. Second, replenish the fuel in the human engine. Provide the victim with warm sugary food and liquids. Note that feeding the victim is not recommended in the later stages of hypothermia since the body shuts down the digestive tract in its attempt to conserve energy. Third, provide the victim with external heat. A campfire or car heater are examples of external sources of heat.

“At rest” is added for the following reason. As previously noted, physical activity produces heat that can temporarily mask the onset of shivering. Simply the body doesn’t need to shiver because the heat produced as a by-product of activity heats the body. If working with groups, sit everyone down for a brief break and check to see if anyone begins to shiver. If they do, it is time to take action.

Physiologically, the body reacts to cold stress with a systematic shutdown of the body. First, it shuns cold blood to the extremities in an effort to keep the core warm. This can lead to “after shock” which will be discussed later. Coordination is adversely affected. Zippering a zipper may become a difficult task. Second, in its effort to conserve energy and keep the core warm, the body will begin to shut down bodily functions. The body will restrict blood flow to the digestive system and digestion will cease. Consumed food and water may simply sit in the digestive tract. Mentally, cold stress initially affects the higher levels of cognitive thought. The result is poor judgement and impaired rational thought. All of these

events can easily lead to accidents and mishaps in and of themselves.

As the victim's core body temperature continues to lower, shivering will diminish and eventually stop. Essentially, the body runs out of fuel to feed the human engine used to create the heat for shivering. The brain is now cold and not functioning properly. High cognitive levels of rational thought are affected the most. Hence, the victim has bad judgement and makes poor decisions which can often result in additional harm. The more primitive autonomic nervous system is still functioning and slower in shutting down. At this point in the hypothermic process, the body is not able to rewarm itself and needs external assistance.

As the hypothermic process continues, the body continues its systematic shutdown. The victim becomes unconscious and eventually death results. Usually death is due to heart failure.

Treatment in the Field – Treatment of hypothermia in the field differs from treatment in a clinical setting. In both settings, the patient is rewarmed. The difference is how this rewarming is performed. In a clinical setting, there are techniques available that can warm the core of the body more directly and reduce after-shock.

In the field, the best treatment of hypothermia is early detection and treatment. The best symptom is shivering at rest. Shivering is the body's first line of defense. In addition, shivering is a good indicator that the body can rewarm itself. There are three strategies to aid in this rewarming. First, is to increase insulation of the body with warm dry clothes. Don't forget the head. Second, stoke the fuel tank to feed the human engine. Sugary foods and fluids are a good source for this energy. Third, provide an external source of heat such as a campfire or car heater.

Rewarm the hypothermic victim until they begin to sweat. Sweating is an indication of the body cooling a slightly overheated body. Small beads of sweat on the forehead are an indication that the victim is no longer hypothermic and that the person has been completely rewarmed. Technically, there are three key indicators of rewarming: return of subcutaneous blood flow, a bump in heart rate and beads of sweat. In the field, the first two indicators are difficult at best to determine. In addition, the rewarming person will often feel a flush feeling of warmth. This is a sign that rewarming is approaching conclusion, but not quite there yet. Continue to rewarm until beads of sweat appear on the forehead.

A footnote about thermometers and temperature. Even when the body is operating under normal operating conditions, the body is operating at different temperatures. The heart, lungs and brain are operating at optimum temperature. Most of the body is operating at a slightly cooler temperature than 98.6°F. The temperature under the tongue is pretty close to 98.6°F. The reading of a thermometer placed there will be fairly representative of the core temperature. The rectum is cooler and the readings on a rectal thermometer are adjusted to account for this lower temperature. By definition, a hypothermic person has a cold body. Thermometer readings are going to be inaccurate measures of the core temperature. Second, in the field, measuring the temperature doesn't really matter since the treatment is still the same, rewarm the victim.

After-shock – "After-shock" results when the body begins to rewarm. As a defense to protect the core, the body shuns cool blood into the extremities. As rewarming occurs, this cold blood is reintroduced and re-circulated back into the core of the body. The result is that the hypothermic victim's core temperature decreases further before it increases. After-shock refers to this effect where rewarming the victim actually results in a lower body temperature. In cases of severe hypothermia, it can result in death. In mild hypothermia, it should not present a problem. Again, in the field, it doesn't change the treatment

which is to rewarm the victim.

The more hypothermic the victim the greater the risks from after-shock and the more likely that death can result. In the field, there is little that can be done to prevent after-shock. This underlines the need for early detection and treatment of hypothermia. After-shock is also the reason for the differences in treatment in a clinical setting and in the field. Rewarming techniques in a clinical setting are specifically designed to reduce after-shock.

Alcohol and Hypothermia – Alcohol dilates the capillaries. In the early stages of hypothermia, it increases blood flow to the extremities and accelerates the onset of hypothermia. Conversely, alcohol should not be given as part of the treatment. Again, it dilates the vessels which can enhance after-shock. In addition, it has no nutritional value.

An interesting twist or paradox in the hypothermia literature is that those people found in a snow bank with a core temperature of 80°F were also intoxicated. On the one hand, there is no question that alcohol will increase the onset of hypothermia and eventual death more quickly. On the other hand, those who survive the longest were intoxicated. This author asked numerous experts regarding this question. Eventually, one expert suggested that the reason that intoxicated victims survive longer is because alcohol interferes with and represses shivering.

Summary – The human body is used to dealing with cold stress. The brain's strategy is a simple one: keep the body's core warm and let the extremities get cold. Unfortunately, cold extremities are also clumsy extremities. Often, a hypothermic victim stumbles and falls leading to additional injuries. The best treatment is to recognize its symptoms early and rewarm the victim. The body's reaction to cold stress is to generate heat to warm itself by shivering. Shivering is an early indicator of hypothermia. Check for shivering while the potential victim is sitting or at rest. If appropriate, insulate, feed and/or provide an external source of heat.

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Hyperthermia¹

Hyperthermia results when the core temperature of the body (heart, lungs and brain) elevates above 99.5°F. “Hyper” means “elevated” and “thermia” refers to temperature. Hence hyperthermia refers to an elevated body temperature. It should not be confused with hypothermia which is a low temperature of the body. Physiologically, the body is designed to handle heat stress and it results in a systematic shutdown of the body to maintain the core temperature of the body for as long as possible. If untreated hyperthermia can cause death. Hyperthermia is divided into two types: heat exhaustion and heat stroke. Heat stroke is life threatening and people who have survived heat stroke, often have permanent thermoregulatory damage.

Heat Exhaustion – Heat exhaustion is “compensative” meaning that the body attempts to compensate for the stress and return the body to normal operating temperature. Generally, heat exhaustion results when the body is above 99.5°F and below 105.1°F. Heat Exhaustion is caused by the body overheating. Usually, it is sun related.

Heat exhaustion and dehydration are closely related. They have similar symptoms: Prolonged and profuse sweating, muscle cramps, clammy skin, nausea and disorientation (Figure 1). The difference is that with heat exhaustion, the body is no longer able to control its temperature. Water losses are significant (Figure 2). The body in a “hot environment” can easily lose 3.5 quarts of water a day, mostly through sweating. Add exercise and water losses can easily exceed a gallon of water a day. In its attempt to cool the body, it is easy to see how the body can easily become dehydrated.

Figure 1: Core Temperatures versus Symptoms of Hyperthermia (Heat Exhaustion and Heat Stroke) ¹	
Core Temperature	Symptom/Comment
105.1°F	Heat Stroke: (Note: Heat stroke is life threatening) 1) Sweating stops 2) Victim’s skin turns pink or red
99.5°F to 105.1°F	Heat Exhaustion: (Note: similar symptoms to dehydration) 1) Prolonged and profuse sweating 2) Muscle cramps 3) Clammy skin 4) Nausea 5) Disorientation
Source: Fear, G., and Mitchell, J., (1977). Fundamentals of Outdoor Enjoyment, Tacoma, Washington: National Search and Rescue.	

Treatment for heat exhaustion is two-fold. First, remove the victim from the source of the overheating. Usually, this is the sun. This means moving the victim to the shade. Second, replenish water and electrolytes. As noted in Figure 2, water losses can be significant and need to be replenished.

¹ This essay was written by Robert B. Kauffman who is solely responsible for its content. This article is copyrighted © Robert B. Kauffman, 2015. Robert B. Kauffman, Professor of Recreation and Parks Management, Frostburg State University, Frostburg, MD 21532. e: rkauffman@frostburg.edu.

A fever and heat exhaustion have overlapping temperature ranges. Heat exhaustion is caused by environmental factors, external to the body. Other than for the heat stress, the body is operating normally. In contrast, a fever is purposely caused by the body to kill pathogens. Normally, a fever is the result of an illness.

Heat Stroke – Heat stroke usually occurs when the temperature of the body rises above 105.1°F. Heat stroke is “decompensatory” where the body can no longer compensate and literally shuts down. In simple terms, it is crashing and crashing quickly. Heat stroke is life threatening and death can easily result. People who have experienced heat stroke and recovered often have permanent thermoregulatory damage.

The differences in symptoms between heat stroke and heat exhaustion are readily evident (Figure 1). With heat exhaustion, the victim is sweating profusely. Their skin is clammy. With heat stroke, sweating stops. The sweating mechanism has stopped. The victim’s skin turns pink or red. This is due to the body shunning the hot blood to the extremities in an attempt to keep the core temperature cooler. Physiologically, it is a process similar to hypothermia. The victim is in a life threatening situation. They must be cooled down immediately with water, ice or whatever is available. Move them to shade and out of the sun. Since long-term damage can occur, seek medical assistance.

Figure 2: Hydration Requirements ^{1,2}						
Normal water losses per day due to:	Hot Temperature			Heavy Exercise²		
	ml	quarts	% of Total	ml	quarts	% of Total
Sweating	1,400ml	1.48	43%	5,000ml	5.28	76%
Respiration	250ml	.26	7	650ml	.68	10
Urination	1,200ml	1.27	36	500ml	.53	8
Skin (insensible loss)	350ml	.37	11	350ml	.37	5
Defecation	100ml	.10	3	100ml	.10	1
TOTALS:	3,300ml	3.48	100%	6,600ml	6.97	100%
¹ . Source: <i>SOLO's 2010 Wilderness First Responder Review</i> . P.O. Box 3150, Conway, New Hampshire: SOLO, p.57. ² . The table is organized by heavy exercise.						

References:

- Fear, G., and Mitchell, J., (1977). *Fundamentals of Outdoor Enjoyment*, Tacoma, Washington: National Search and Rescue.
- Kauffman, R. (1995). *Boating Fundamentals: A Manual of Boating Safety*. Arlington, Virginia: National Recreation and Park Association, 126 pp.
- Source: *SOLO's 2010 Wilderness First Responder Review*. P.O. Box 3150, Conway, New Hampshire: SOLO, p.57.

Chapter 4.1: Barrier Analysis for Preppers ¹

Barrier analysis is a conceptual cornerstone of the accident process and accident prevention. Although it is an important component within the Management Oversight and Risk Tree (MORT), it is a stand-alone analysis that is useful in identifying the accident process and in accident prevention. Using the analysis to identify barriers prior to the occurrence of an accident makes barrier analysis a useful tool in accident prevention. The following section is adapted from a technical paper titled *Barrier Analysis* by the Technical Research and Analysis Center (Trost and Nertney, 1995). For Preppers, it is a useful technique in preparing for the unexpected emergency.

The concept of barrier analysis is not difficult. As its name suggests, the object of safety prevention is to place barriers between the target (people or objects) and the potential hazard to prevent the transfer of unwanted energy (Figure 4.1). All barriers are less than adequate (LTA) meaning that they are not 100% effective. In the MORT analysis, an incident is defined as an event where there is a transfer of energy and an accident is defined as an incident where an adverse consequence results. Assume you slip on a banana peel and fall to the ground. The fall (kinetic energy) and hitting the ground are an example of a kinetic energy transfer. If you dust yourself off, get up unharmed, and leave, it is an incident without injury, damage, or loss. If you break your arm from the fall, it is an incident or accident with injury, damage, or loss.

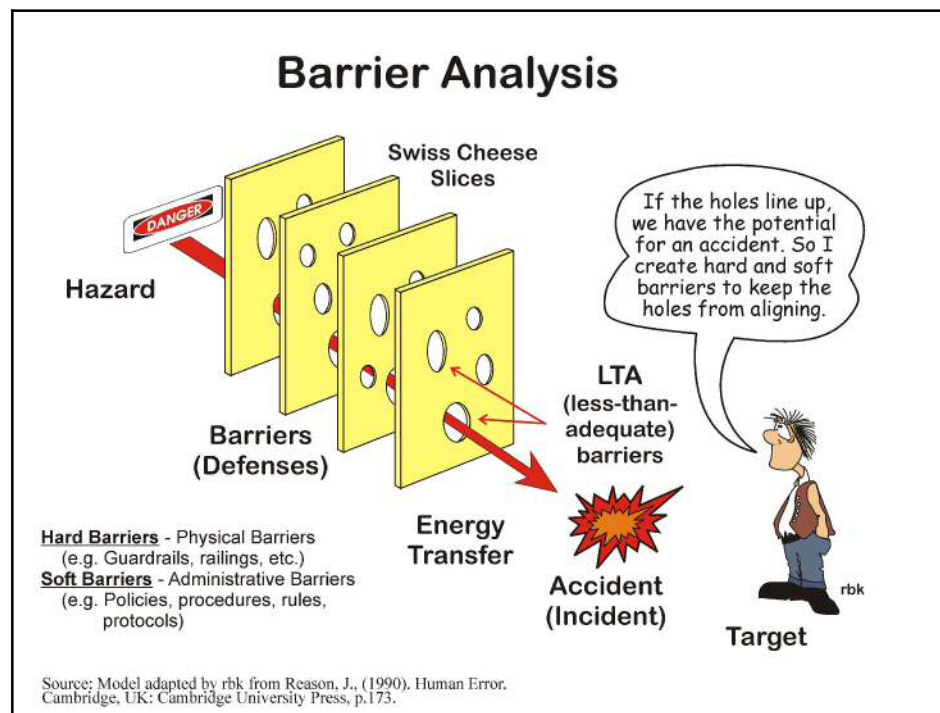


Figure 4.1 - Barrier Analysis

If you are a prepper, you are already utilizing the principles of barrier analysis. You and your family are the target. Using the *Surviving the Unexpected Emergency Model* and the Disaster Survey, you picked the natural and man-made scenarios that could harm you and for which you chose to actively prepare. The overnight in the rest stop or the three-day snow storm can be included. Or, it could be a major hurricane like Katrina or Sandy. Although any of the

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disasters can create an energy transfer to harm you, your selection prioritizes and focuses your prepper efforts.

Some of the traditional energy forms are kinetic, chemical and biological, thermal, electrical, and ionizing and non-ionizing radiation. The disaster or emergency itself could be the cause of the energy transfer or your preparation or lack of preparation to handle the disaster or emergency could create the energy transfer also.

For preppers, the energy transfer will result from the different scenarios. **Kinetic energy** results from the movement (velocity) of an item with mass. Although it is usually associated with falls, debris being blown by a hurricane or tornado can injure or kill also. The eruption of the Yellowstone Caldera would release a huge amount of kinetic energy in its initial blast. **Chemical** transfer can result from a chemical spill from local industry or a railroad accident transporting chemicals. In the Chicxulub disaster, it rained sulfuric acid, a chemical transfer that expunged many species. Iodine may be one of the chemicals used for water purification. In higher concentrations, it is a poison. Also, gasoline or other fuels used in your stove may harm you. **Thermal** transfer can result from a winter storm with a power outage. Hypothermia is always an issue. It too is a thermal transfer resulting from loss of body heat. **Electrical** transfer can result from not turning off the electricity in your house before bugging-out, or it can easily result for a faulty generator or lack of familiarity with the operation of the generator. A lightning strike results in an energy transfer.

Energy transfer is normally divided into **wanted** (controlled) and **unwanted** (uncontrolled). Usually, wanted energy transfer is associated with the work being performed and is necessary to accomplish the work. Generally, unwanted energy transfer is not desired and can lead to a mishap and injury. For example, a prepper uses a gas stove to boil a pot of water. The energy transfer is controlled, desired, and accomplishes the task of boiling the water. Inadvertently, the prepper knocks over the stove and the pot of boiling water sitting atop the stove. There is an unwanted energy transfer as the boiling water spews over everything. Also, there is the unwanted energy transfer resulting from the open flame from the stove. The question is whether the water hits the earth harmlessly (no injury, damage, or loss), or burns the cook (injury, damage, or loss). In this example the open flame does not result in injury, damage, or loss.

There are four components to an accident. These are listed below. They are significant for several reasons. First, they reflect the concept of energy transfer from the hazard to the target. Second, all four components are *necessary* for an accident to occur. This depicts a causal relationship where if one of the elements doesn't occur, an accident doesn't occur. Third, the causal relationship is reflected as a component of the MORT tree analysis (not discussed here). The MORT diagram is considered one of the premiere accident investigation tools and the utilization of the tree analysis reinforces the importance and general acceptance of these concepts. Fourth, the components are the basis of barrier analysis used herein. These components are incorporated in Figure 4.1 also.

- 1) A hazard which can lead to an unwanted energy transfer. (SB1)
- 2) Barriers and controls (LTA – less than adequate) (SB2)
- 3) Targets (Vulnerable people or objects) (SB3)
- 4) Multiple causal events of the first three factors. (SB4)

The concept of energy transfer is built upon the work of Haddon (1973). He developed the concept that the energy transfer leading to the harmful event could be controlled by one or more of a succession of

barriers or measures. He referred to the successive steps as “energy barriers.” They include both hard and soft barriers. Hard barriers refer to physical barriers while soft barriers refer to administrative practices, procedures, and protocols that are often intangible. His recommendations provide a starting point for adapting his points to a different field. His ten steps are listed below.

- 1) **Prevent the marshaling** (do not produce or manufacture the energy) – If you don’t use a stove to cook, you won’t have the unwanted energy transfer from knocking over the stove.
- 2) **Reduce the amount** (e.g. voltages, fuel storage, etc) – Unfortunately, most preppers will be increasing the amount of items that can lead to an energy transfer. Examples include storing fuel and other potentially harmful chemicals.
- 3) **Prevent the release of energy** (e.g. strengthen the energy containment) – Turning off the gas or the main in the electrical box of the house before bugging-out prevents an electrical short circuit elsewhere in the system.
- 4) **Modify the rate of release** (e.g. slow down burning rate, speed, etc)
- 5) **Separate in space or time** (e.g. electric lines out of reach, etc) – For the prepper, having a bug-out location is separation by space. If you bug-out prior to the potential disaster, this is separation by time.
- 6) **Interpose material barrier** (e.g. insulation, guards, safety glasses, etc) – A bunker is an iconic example of a material barrier. It is a material barrier protecting you from the pending disaster and the harm.
- 7) **Modify shock concentration surfaces** (e.g. round off and make soft, etc) – Installing rounded corners rather than normal square corners on counters and tables.
- 8) **Strengthen the target** (e.g. earthquake-proof structures, etc) – Hadden (1973) viewed this in terms of structures. Measures taken to strengthen your bunker or storage measures are examples of this measure. In addition, the knowledge, skills, abilities and experiences that you develop as a prepper (i.e. the target) directly relate to your ability as the target to defer the energy transfer from a hazard.
- 9) **Limit the damage** (e.g. prompt signals and action, sprinkler, etc) – Your bunker, its contents, and all the prepper measures that you take seek to limit the damage from the original disaster or emergency. Having a readily available fire extinguisher is a more traditional example of limiting damage.
- 10) **Rehabilitate persons and objects** – Rotating the water in storage tanks and food with expired dates are two examples of this measure. Reading a book and other materials on prepping and changing procedures or thinking is an example of rehabilitation involving people. In this sense, it complements “strengthening the target.”

Creating barriers for all ten steps is not always possible, necessary or even desirable. Sometimes they are not practical. Prepping usually involves storing more of the things you will need. This tends to preclude or go counter with Item #2, reducing the amount. Regardless, the other strategies can be applied to the storage of potentially harmful items.

Barrier Classification

Trost and Nertney (1995) developed a barrier classification process based on type, location, and function (Figure 4.2). The purpose of barrier classification is to address how barriers can be designed and utilized to reduce the energy transfer and an accident from occurring. The following is a discussion of each of these classifications.

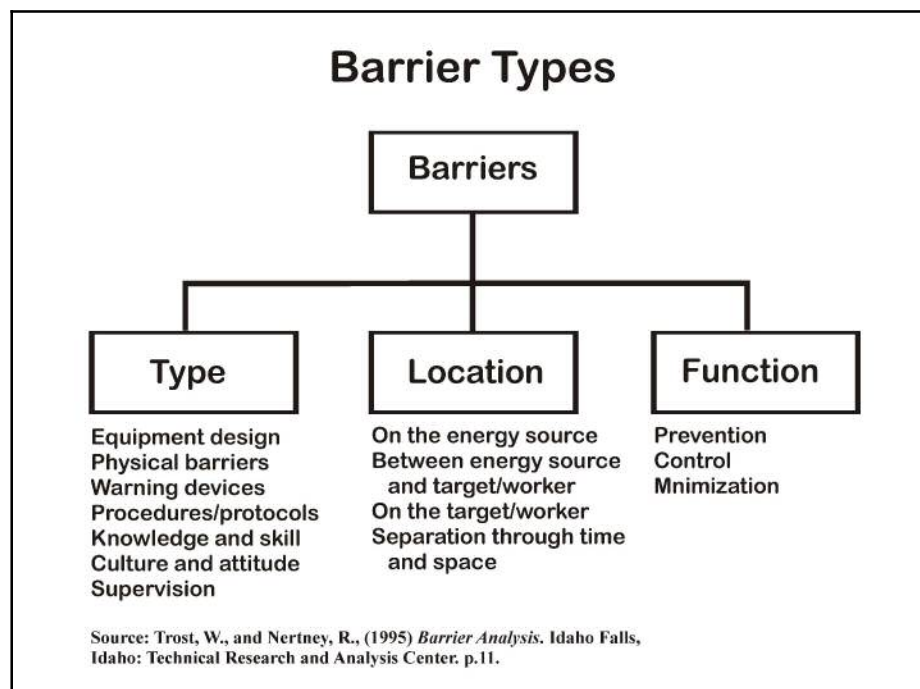
Type. Type includes design (e.g. equipment and facilities), physical barriers, warning devices, procedures/processes/protocols, knowledge and skill, attitude, and supervision.

Equipment design. Historically, the safety industry has traditionally focused on design solutions of equipment and facilities over other methods of controlling hazards. Automobile safety provides an example with which most people are familiar. In generally, there are three legs to the stool of automobile safety: the highway, the automobile, and the

driver. The next time you travel down an interstate highway play the following mental game. If you wanted to create an accident on the interstate how would you do it. After a few miles of travel, you will most likely conclude that highway engineers have played the same game. Jersey barriers prevent head-on crashes. Guard rails prevent you from hitting bridge abutments or running into ravines. You get the general idea. Seat belts, air bag, and crumple zones begin the engineering list for

making automobiles safer. However, what has been done to improve the driver's ability to drive more safely? Comparatively, not much. This is an inferred editorial note by this author. Automobile safety needs to focus on all three legs.

For the prepper, equipment design can become critical. Any injury can be exacerbated because traditional emergency services are not available. Poor bunker design can lead to injury. Because there is a disaster or an emergency, circumstances often require people to make do with what is available. This means jerry-rigging items or using equipment in ways for which it wasn't designed. This can increase the likelihood of an accident occurring.



Physical barriers are barriers that are placed between the hazard and target to modify their behavior. Normally, physical barriers include guard rails, the construction of walls, or the placement of temporary barriers. For a prepper, creating a bunker is an iconic example of creating a physical barrier. If there is nuclear war, it provides shelter from the blast and radiation.

Warning devices warn people of the hazard. The familiar yellow caution sign warns people that they could slip on the wet floor. In your preparation, consider including warning devices. If there is a low beam, mark it with warning tape. If there is a short step which could cause someone to trip, mark it. In time of emergency when people are focused on other things, these warnings can help prevent an unwanted accident. Use by themselves, warning devices are less-than-adequate. None-the-less, they are important and work in combination with other approaches.

Procedures and protocols refer to administrative practices that are designed to create safety barriers. Requiring a first aid and CPR certification of at least one person in your cohort might be prudent. Identifying the person with the most medical skills as the primary deliverer of first aid and medical services is a protocol. Developing a list of emergency phone numbers is a procedure. Who you call first is a protocol.

Preppers would be wise to develop a protocol regarding when you and your family will bug-out for adverse weather conditions (e.g. thunderstorms, tornados, hurricanes, flash floods, snow storms, etc). A procedure is how you do something. A protocol is a directive regarding how you should perform the procedure. A family may identify the procedure which everyone will use to evacuate the house in case of a fire. It may involve a protocol for using fire extinguishers and calling for the fire department.

Increasing the **knowledge and skill** of the target can place a barrier between the hazard and the target. Addressing the *Surviving the Unexpected Emergency Model* in terms of type, magnitude and duration of the disaster for which you want to prepare was the beginning. Completion of the survey helped tailor your response to your situation. Completing the units in this course increase your knowledge and skills to survive an unexpected emergency.

Organizational culture and worker attitudes are an extension of the procedures and protocols and is directly related to supervision. In the management literature, there is an adage “manage the culture, manage the organization. The culture is the collective attitudes and practices of the organization. For a prepper, this point relates to the family and how they behave. It is how the kitchen is managed? Who can cook? Who can use the stove, etc? Are family members provided with personal space of their own? When members leave the house or bunker during an emergency, are there protocols on travel, if only informal? Do people travel in pairs or indicate where they are going and when they will return?

In the accident literature, the organizational culture is the foundation of safety. It really focuses on how people behave and carry out their activities. Do they think safely? Do they play “the what if game?” Or, do they take chances and act recklessly? For example, a person falls asleep at the wheel of the car and drives through the guardrail into a tree. In looking at the causes of the accident it would be easy to conclude that the cause was falling asleep at the wheel. Assume that it is found that the person was working consistent double shifts at work and that management encouraged the practice. The management practice of encouraging double overtime shifts is an example of how the organizational culture influences behavior and in this case, was the underlying cause of an accident. To really prevent this accident, the organization needs to change its attitude toward working double shifts or devise ways to insure those working double shift have the physical and mental stamina to do so. Regardless, it is the organizational

structure where safety really begins within any organization and setting. It is the norms that are understood by everyone without having to ask anyone what they are.

Supervision refers to barriers that supervision at both the administrative and leadership levels can create. For preppers, most likely it is the parents who are making the supervisory decisions discussed in the previous section.

Location. Conceptually, the barrier can be placed on the *energy source*, on the *target*, or *between the target and the energy source*. The barrier can be physical such as a guard rail or a fence around a swimming pool, or it can be administrative. There is an effort to separate the hazard from the target through time and space. If accidents occur during late afternoon in the heat of the day, separate the target (participants) from the hazard (heat of the day) by conducting the activity early in the day. If a foul ball (hazard) from an adjacent baseball field nearly misses your group (target) playing next to the field, move your activity to another area (separation by space) or wait until the game is over before returning (separation by time).

“Bugging-Out” separates the target (you and your family) from the hazard (e.g. hurricane) by time and space. Bugging-out is traveling to a new location out of harm’s way. The hurricane is the hazard. There are numerous potential energy transfers that it can create that can harm the target, you and your family. It can blow your house down around you. It can hurtle debris that can injure or kill you. Depending on where the bug-out site is located, the hurricane could still impact you and your family. However, at the bug-out site, its force is hopefully, diminished significantly.

Separation by time and space is an important consideration after the emergency or disaster also. If your home is self-contained, you and your family can bunker down and avoid the disaster or emergency that is going on outside. This too is separation by space. If you limit going out of your home or bunker to only during the day, this could be considered separation by time.

Function – Function focuses on how you address the barrier. Generally, *prevention* refers to the removal of the hazard, *control* refers to managing the hazard, the target, or the relationship between them, and *minimization* refers to lessening the impact of the energy transfer between the hazard and the target.

As a general rule, there is little chance for preventing or controlling the primary disaster or emergency whether natural or man-made. There is little chance for you or your family to prevent the pending hurricane or riot. It is out of your control. The same is true for control. Many of the previously discussed actions are really efforts to lessen the impact of the energy transfer between the hazard and target. Bugging-out was a good example of this approach.

In those areas under your control, you and your family can prevent, control and minimize. Most of your preparation actions create barriers to prevent, control, and minimize an energy transfer. You have a store of food and water. Your water supply prevents the illness and disease associated with drinking contaminated water. Purification of the water emphasizes minimizing or lessening the impact of any contamination in your water. Purification is the barrier between the hazard (e.g. water borne pathogens) and the target (you).

Limitations of Barriers

There are limitations on the barriers. They may be limited because they are not practical, because they fail, or because they are not used. Several impractical barriers and barriers not used have been noted in this chapter already and are mentioned again in the following discussion.

Placement of a barrier may *not be practical*. You may want to build a bunker in your backyard. There may be local ordinances preventing you from doing so. Also, you may not have the financial resources with which to build the bunker.

Barriers *fail*, either in part or totally. Guardrails need maintenance or they will fail. Policies, procedures and protocols need review and updating to keep them current and appropriate. Skills and training need to be kept current. For example, first aid training normally has a half-life of six months. This means that most people will forget half of what they learned after six months and three fourths of what they have learned after a year. Even freeze-dried food has a recommended shelf life of 25 years after which it should be replaced.

Barriers may *not be used*. There may be empty water jugs in the basement that need filling. Until they are filled with drinking water, the barrier is not being used.

There is no barrier that is guaranteed 100% effective. The technical term is LTA (less than adequate). The limitations indicate some of the reasons why they aren't effective. Building a bunker is no guarantee that you will survive a disaster. Stocking food, water and emergency supplies is no guarantee that you will survive the disaster. It is no guarantee that you won't become ill or injured. Regardless, implementing these actions significantly increase the probability of your survival.

Barrier assessment analysis. For preppers, assessment of barriers occurs on several different level. As noted, the first level was addressed when you completed the disaster survey based on the *Surviving the Unexpected Emergency Model*. You prioritized your priorities. You performed triage. You identified those disasters most likely to affect you. At the other end, you identified those disasters least likely to affect you. In the middle you identified those disasters which may affect you. The benefit of this exercise was to provide guidance to your preparations.

Using the instrument in this section, you can formally assess the potential hazards and the barriers used to prevent or minimize them. Even if you don't formally use this instrument, you should consider using it as part of your thought processes where you identify the potential energy transfer or hazard, the target and what you can do to prevent or minimize the incident from occurring. Its basic approach is a good way to think as a leader, programmer, manager or prepper.

The instrument in Figure 4.3 is a modified instrument presented in Table 2 of the NRI MORT User's Manual (NRI MORT User's Manual) and an accident investigation tool presented by Oakley (2003). The first three columns identify the energy transfer (hazard), the target, and the barriers & controls. The basic purpose of the barrier and controls is to separate the energy from the target.

The fourth and fifth column identify operational and management issues. In the fourth column, you identify the purpose and how the barrier will prevent or minimize the energy transfer. The fifth column addresses the practicability of implementing the barrier.

Two examples were used for the preppers, food and water (Figure 4.3). In a practical sense, the barrier analysis approach starts with identifying potential hazards and then identifying barriers that could be used to reduce their impact. The food barriers were freeze-dried and dehydrated food. Other measures could be listed in addition. The barriers for water include storage and filtration method. They are not an exhaustive list of barriers.

In the first column, list all the hazards or sources of energy transfer that you can identify (Figure 4.4). In this case, it was water borne pathogens and food spoilage or poisoning. Note, these are only two of the numerous potentially harmful hazards that could be identified. Next, move to the third column and list all of the barriers that you identified within the system with which you are dealing. Listed in the third column are most of the barriers discussed within the previous sections. Although this isn't in line with the conceptual flow, most people will find it intuitively, easier. Then identify the target or who needs to be protected is presented in the second column. In this case, the target is you and your family. If you have different targets for the same hazard, consider sorting or rearranging the lines so that the common targets are grouped together for the same hazard.

In the fourth column, describe the purpose of the barrier or how it will prevent the energy transfer from the hazard to the targets. In the fifth column, note limitations to the barrier. Is the potential barrier feasible or cost prohibitive? Both the hazards and barriers can be determined through brainstorming or through a logical tree analysis.

Summary

Barrier Analysis is a risk management technique used to reduce the likelihood of an accident. By prepping, preppers are already practicing the principles of barrier analysis. Barrier analysis is also useful in preventing accidents and mishaps after the disaster or emergency. The technique is straightforward. It seeks to place barriers between potential hazards or dangers and the target (see Figure 4.1). These barriers can take numerous forms including policies, practices and protocols as well as physical barriers. It is an approach to protect you and your family. It should affect how you think and approach the things you do more safely.

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Figure 4.3 - Barrier Identification Table

Activity or Program: _____

Energy Transfer (Hazard) or harmful Agent, adverse environment condition	Target Vulnerable person or thing	Barrier & Controls to separate Energy and Target	Purpose/Prevention	Limitations
1.				
2.				
3.				
4.				
5.				
6.				

Directions:

- 1) Identify the activity or program. This identifies the system level.
- 2) In Column #1, list all the potential hazards that can affect the program.
- 3) In Column #3, list the potential barriers or controls for each hazard. Consider the following barriers: equipment and facility, physical barriers, warning devices, procedures/work/protocols, knowledge and skills, attitude and culture, and supervision. (Conceptually, the flow is from Column 1 through 3. Most people will address the barriers and controls second, in response to the hazard.)
- 4) In Column #2, identify the target or the vulnerable person or thing.
- 5) In Column #4, indicate whether the barrier will prevent, control, or minimize the hazard. Indicate how.
- 6) In Column #5, indicate any limitations to placing the barrier in place (e.g. cost, feasibility, administrative feasibility, etc).

Source: adapted from Table 2 in NRI MORT User's Manual and Oakley (2003)

Figure 4.4 - Barrier Identification Table

Activity or Program: My Prepper Preparations

Energy Transfer (Hazard) or harmful Agent, adverse environment condition	Target Vulnerable person or thing	Barrier & Controls to separate Energy and Target	Purpose/Prevention	Limitations
1. Food Poisoning	Family	Freeze-dried food	Stored in #10 cans, the purpose is provide a long-term food supply free of contamination.	Needs a purified water to reconstitute. Taste and variety issues.
	Family	Dehydrated foods	Stored in varmint proof contains, the purpose is to provide a long-term food supply free of contamination.	Shorter life span than freeze-dried foods. Increased maintenance. Doesn't require water to reconstitute.
2. Water Borne Pathogens	Family	Tap water stored in 2-liter bottles.	Purpose is to store drinking water for long-term use.	Inexpensive and convenient, they are difficult to maintain and replace water on a periodic basis.
	Family	Tap water stored in 55 gallon drums	Purpose is to store drinking water for long-term use.	Barrels occupy considerable space. Difficult to move without emptying.
.	Family	Water pump	Purpose is to filter water with 1 micron filter	With stored tap water, this may be an unnecessary redundancy.
.	Family	Iodine treatment	Purpose is to chemically treat water for pathogens	With stored tap water, this may be an unnecessary redundancy. Also, there are taste issues.
3.				
4.				
5.				
Directions: 1) Identify the activity or program. This identifies the system level. 2) In Column #1, list all the potential hazards that can affect the program. 3) In Column #3, list the potential barriers or controls for each hazard. Consider the following barriers: equipment and facility, physical barriers, warning devices, procedures/work/protocols, knowledge and skills, attitude and culture, and supervision. (Conceptually, the flow is from Column 1 through 3. Most people will address the barriers and controls second, in response to the hazard.) 4) In Column #2, identify the target or the vulnerable person or thing. 5) In Column #4, indicate whether the barrier will prevent, control, or minimize the hazard. Indicate how. 6) In Column #5, indicate any limitations to placing the barrier in place (e.g. cost, feasibility, administrative feasibility, etc). Source: adapted from Table 2 in NRI MORT User's Manual and Oakley (2003)				

Chapter 4.2: Rescue Curve for Preppers¹

The rescue curve was first developed in 1992 by Kauffman and Carlson (1992) (Figure 4.1). Since then, it has gone through several refinements. Although the model was originally developed in the context of outdoor activities, the model was generalized to non-outdoor activities (Kauffman, 2003). It has been applied to fire safety, rock climbing, motor boating, and automobile driving. For preppers, the rescue curve is a way of thinking and approaching rescue. It helps frame why preppers prep and why they need to be self-reliant. They know that once an incident occurs, they can easily slide through the different phases to injury, damage, or loss.

The Rescue Curve answers the question why preppers are preppers. Preppers are self-reliant. They abhor or seek to avoid rescue by other outside your group (i.e. government rescuers) (Figure 4.1). Because they are self-reliant, they focus on prevention measures. If a disaster occurs, what can they do to rescue themselves (i.e. self-rescue) or what can their family do (i.e. rescue by other in your group). Conceptually, the rescue curve provides a justification for preppers prepping.

The Rescue Curve states that once an incident occurs that can result in injury, damage or loss, as time increases and without intervention, the probability of survival or in not having injury, damage, or loss falls from near certainty (1.0) to zero. The first line of defense against injury, damage or loss includes: prevention and safety, self-rescue, rescue by others in your group, rescue by others outside your group.” (Kauffman and Carlson 1992, Kauffman 2003, and Martin et al 2006)

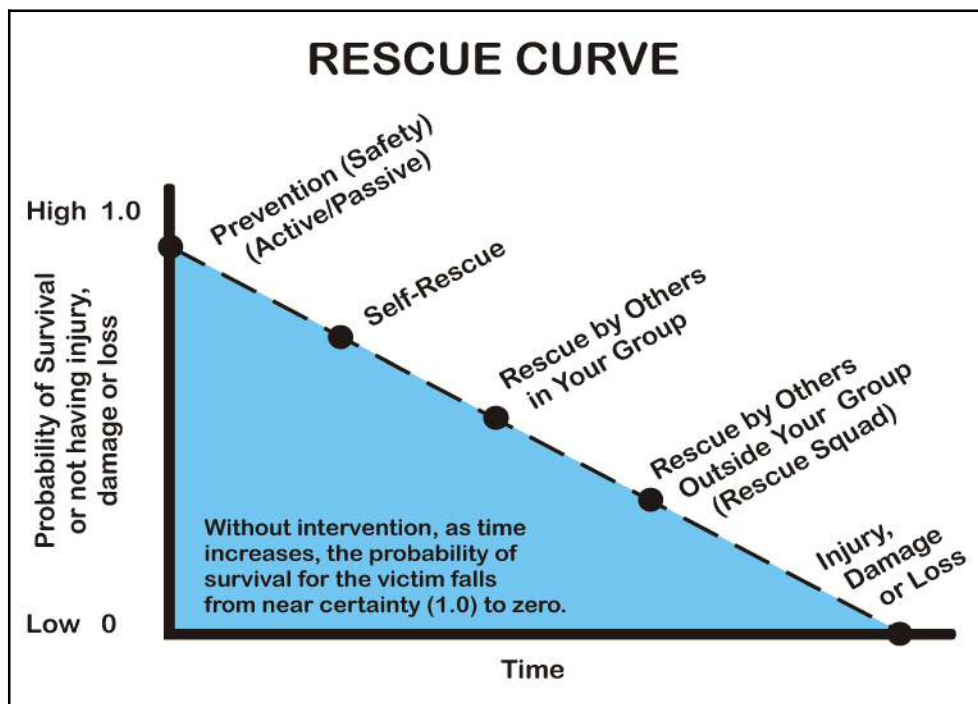


Figure 4.1: Rescue Curve

¹ This section was written by Robert B. Kauffman who is solely responsible for its content. This article is copyrighted © Robert B. Kauffman, 2016.

Prevention – A potential victim's first line of defense is *safety and prevention*. These are the measures taken prior to an incident occurring. They include the active and passive measures that a person takes to avoid a rescue situation or if a rescue situation occurs to better help you survive the situation. Actually, prevention includes those measures taken in case something happens. In and of itself, the act of prepping falls into this category. All the preparations taken prior to a crisis are a form of prevention. Building a bunker, stocking it with food, water and other supplies, and learning about what to do in time of a crisis are all acts by the prepper that fall into this category.

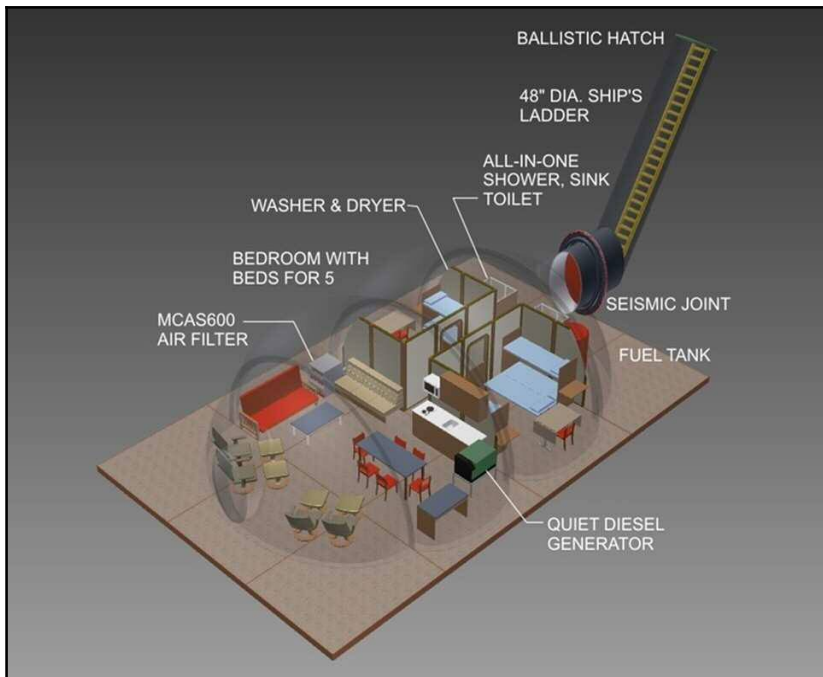


Figure 4.2: Prevention – The bunker is a classic example of prevention. Source: Internet Photo.

Passive Measures – are those measures a person takes that normally don't help prevent the initial incident but help the person in any or all of the rescue phases if an incident occurs. Normally, for the climber, the use of ropes and protection are only for protection against a fall. Ropes and protection don't aid in the actual climb. Actually, in an unpublished study by this author, climbers indicated that ropes and protection actually interfered with their climbing experience. The paddler's life jacket aids the paddler if they come out of their boat. It doesn't provide much benefit otherwise. The spare tire has little value to the driver until there is a flat time. Actually, in time of emergency, the spare tire can be set on fire to signal location for rescuers. It burns with a thick black smoke. Be sure to deflate it first.

For preppers, their first line of defense are passive measures. Passive measures include all the measures taken prior to the disaster. Most prepping involves passive measures. Building a bunker or stocking a basement with a cache of food, water, medical and other supplies typifies this approach (Figure 4.2). It includes the knowledge, skills and abilities learned about prepping. For the most part, barrier analysis discussed in the previous chapter complements this approach.

Active Measures – Active measures are those measures a person takes to help prevent the incident from occurring. A climber's climbing ability, a paddler's paddling ability, or a driver's driving ability are examples of active safety measures. The participants use of their knowledge, skills, and abilities to avoid the rescue situation. For preppers, the most notable active measure is bugging out where the prepper travels to a safer location. It is avoidance of the natural or man-made crisis that can inflict harm.

Incident – An incident was defined in the previous chapter on barrier analysis. There is a *hazard* or *event* (i.e. disaster) which can result in an *energy transfer* to harm the *target* (i.e. prepper). If the barrier(s) used to protect the target are *less than adequate* an incident or accident can occur. Last, there can be *multiple causes*.

For preppers, there are two levels of incidents. The first level is the *macro* or *original incident*. It is the disaster for which preppers prep. Using the *Surviving the Unexpected Emergency Model*, these disaster events can include hurricanes, floods earthquakes, tsunamis, volcanos wildfires, snowstorm, riots and war.



Figure 4.3: Incident – The Cumberland River flooding Nashville in 2010. Source: Internet Photo.

The second level is the *micro incident* or the accident that occurs during macro incident. Turn to the *planning side* of the *Surviving the Unexpected Emergency Model*. Faulty food preservation or food spoilage, tainted water, improper sanitation, shelter failures, communications failures, etc. are examples micro incidents that can easily occur during the larger incident. It includes trips and falls, and a host of things that can occur in a new environment.

Self-rescue – An incident has occurred. The first level of defense is *self-rescue*. It is what you can do to rescue yourself (Figure 4.4). In terms of the accident process, a transfer of energy most likely has occurred. Regarding elapsed time, the victim is the first person who can respond and assist. A climber falls and drops several feet as the rope suspends his weight. Reaching out, the climber grabs hold of the rock face and continues on with the climb. The paddler uses an Eskimo roll or swims with his boat to the shore. The swiftwater swimmer uses “defensive swimming” and swims to shore (Figure 4.5). Taking the spare tire from the trunk, the driver changes the flat tire and moves on down the road.

On the macro level, self-rescue for the prepper, is the use or implementation of the preparations taken for the anticipated disaster. It is using the bunker, the cache of food and water, and other measures to protect oneself. Also, it is the knowledge, skills, abilities and experiences gained to aid



Figure 4.4: Self-rescue – Two paddlers in a boat during hurricane Katrina. (Source: Getty)

the prepper in surviving. Anyone who has used flint and steel or a bow drill to create a fire knows that the time to learn how to do it is not during an emergency.

On the micro level self-rescue is what the victim can do to rescue himself. There is an energy transfer leading to a potential accident. What can the victim do to prevent harm. For example, what does the victim do if there is an accident cooking, an accident while traveling on an ATV, getting lost or disoriented while hunting, or some other incident. Self-rescue is catching the item before it spills, righting the ATV and moving on, or reorienting oneself and reaching the destination safely.

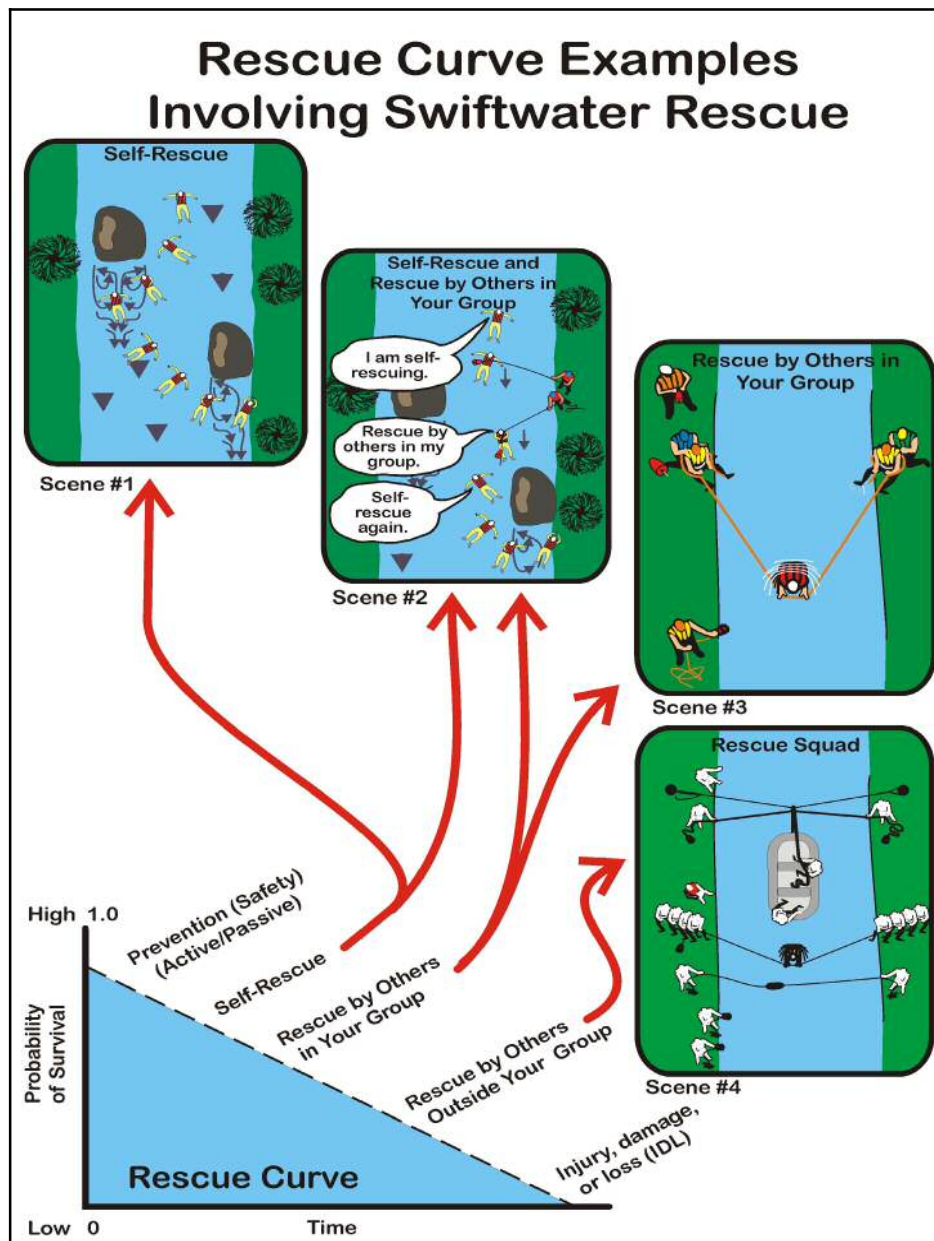


Figure 4.5: Rescue Curve for Swiftwater Rescue – The four diagrams indicate the difference between self-rescue, rescue by others in your group, and rescue by others outside your group for swiftwater rescue. Note in the second scene how a simple decision by the swimmer can move the swimmer from self-rescue to rescue by others in your group. (Source: Kauffman, 2015)

Rescue by Others in Your Group – *Rescue by others in your group* is the next line of defense. In terms of time, it is usually others in your group who can render assistance most quickly. If the climber is belayed, the belayer may lower the victim to a safe area. A member of your group throws a victim a throw bag line or paddles over and extends their stern and grab loop to the swimmer and then paddles them to shore. The passenger in your car helps you change the tire or perhaps assists by directing traffic.

In the second scene in Figure 4.5, a member of the group on shore throws a rope to the victim swimming (rescue by others in your group). It is interesting to note that this simple act transfers the swimmer from self-rescue to rescue by others in your group. Regardless, the victim is still responsible for his actions and safety. In the scenario, the victim realizes that swinging in on the rope is not in his best interest. He lets go and reverts back to self-rescue. Although there is a tendency for the victim to be helpless, the victim still has a responsibility and the ability to act on his or her behalf.

On the macro level, there is often not much difference between self-rescue and rescue by others in your group for preppers. The family rides out the disaster together. They hunker down together in their bunker, basement or home.

On the micro level, rescue by others in your group is what your family or others in your group do to rescue the victim. If there is an accident cooking, the family member renders first aid. If the ATV overturns, the family searches for the victim, rights the vehicle and renders first aid if needed. If the victim becomes lost or disoriented during hunting, the family may effect a search or simply call on a walkie talkie and provide directions.

As a sidebar note, it is important for preppers to have overlapping skills. If victim is the only person with first aid training, it may be difficult for the victim to render first aid. Comparatively, others in your group will only have the ability to render marginal assistance to the victim if an incident occurs.

Rescue by Others Outside Your Group – *Rescue by others outside your group* includes the rescue efforts of the rescue squad or EMS (Figure 4.6). Also, it includes people passing by, other family groups, or in other groups of people. The fallen climber is injured or the rescue escalates beyond the capabilities of the other climbers. A rescue squad with specialized training is summoned. Regarding the flat tire example, a tow truck is summoned. It arrives and the operator changes the tire onsite or tows the car to the local garage where the tire is fixed.

In a recreational setting, the rescue squad usually has large amounts of resources available to them in terms of equipment and personnel. In the whitewater rescue depicted in Figure 4.5, this is the primary difference between the rescues depicted in scene three and four. Both scenes are the same rescue. The difference is that the paddlers (rescue by others in your group) are limited by the rescue equipment available to them and personnel. For example, if there are five people in the group, four people are available to aid in the rescue. Four people can easily be used in setting up a stabilization line depicted in the second scene but not much else. If they carry two carabiners each, they have a total of eight carabiners to use in the rescue. In contrast, the rescue squad arrives on the scene with lots of equipment and personnel (scene four). It requires more coordination and control and the incident command model is usually employed.

On the macro-level, rescue by the rescue squad might occur if the bunker fails, the cache of food and water become destroyed or simply emptied. Some of the nuances are discussed further in the bugging-out chapter, Rescuers are there to rescue victims. Problems can occur when the rescuers are there to rescue the victim when the victim doesn't want to be rescued. Then there are problems associated with government run centers.



Figure 4.6: Rescue by Others Outside Your Group – A helicopter rescue during hurricane Katrina. (Source: AFP)

Also, rescue by others outside your group can include other families. It is not unusual for families to band together in emergency situations and assist each other in time of trouble.

On the micro-level, the cooking accident requires outside medical assistance. The ATV accident requires outside assistance. The same is for the lost hunter.

For preppers, there are several other lessons to extrapolate. For the prepper, rescue by others outside your group usually involves calling 911 and summoning EMS assistance. This assumes that in a time of crisis, EMS will be able to respond. The magnitude of the crisis may prevent them from responding. They may be overwhelmed with the number of calls, they can't respond in a timely manner. At least, they may need to triage their calls. Physically, they may not be able to respond. Bridges out, debris, flood waters, unplowed snow and other impediments may physically impede their movement. Or as noted above, their task may be to rescue large numbers of people and transport them centers where they are warehoused.

For preppers, this situation ties back directly to the prevention and safety phase. Intuitively, preppers recognize that in a time of crisis rescue squads and EMS may not be forthcoming. This is stated with no disrespect to them either. This is why preppers emphasize the prevention and safety phase. This is why they prep in the first place. It is because they recognize that in a time of crisis, they are most likely on their own. In addition, preppers believe that in a time of crisis, self-sufficiency can aid in your survival. Part of this attitude is derived from the fact that the rescue squad and EMS may not be available and in part, it may be due to their prevailing attitude that it is their job to rescue you, even when you don't want to be rescued. Over reliance on the rescue squad is discussed later in this chapter under the 911 Syndrome.

Injury, Damage, or Loss – If no one rescues the victim, *additional injury, damage, or loss* normally occurs. If severe enough, death can result. If the climber isn't injured from the initial fall, they will experience additional injury or even death without intervention. The same is true for the paddler. They may eventually flush through the rapids and naturally wash up on the shore. In Figure 4.5, if no one rescues the foot-entrapped victim in scenes three and four, the victim will most likely drown. If no one intervenes on behalf of the driver, they too have few alternatives available to them.

For preppers, this is why preppers prep in the first place. An incident can very quickly escalate into a situation where no one can render assistance and some form of injury, damage, or loss occurs. For this reason, knowledgeable people in the field start their preparations by being heavily invested in the preparation and safety phase. They seek to prevent the incident before it happens and if it does occur, they seek to handle it quickly and efficiently. By the very act of preparing, preppers have already front-loaded their preparation efforts by being prepared in the safety and preparation phase.

As noted, through no fault of their own, EMS and rescue squads may not be able to act in a time of crisis. They may be overwhelmed and somewhat helpless themselves. This emphasizes the need to front load preparations in the earlier phases of the rescue curve. In addition, potentially not having EMS and rescue services emphasizes the need for self-sufficiency and for thorough pre-preparation.

Available Resources and the Rescue Curve

The rescue curve is useful in helping to explain the resources available to or impacting the rescuers. Generally, there are initially fewer potential rescuers available for the rescue. For the climbers, you might have two instructors and ten youth. Although you may have twelve people, only two are well trained unless one of the instructors is also the victim. A paddling group of five or six is not an unusual group size. That leaves five people to conduct the rescue assuming one person in your group is the victim. This is not a lot of people for a whitewater rescue. In contrast, changing a tire by yourself is doable.

Also, there is usually a difference in the amount of equipment available as well as the type of specialty rescue equipment available. Although the climber takes a lot of equipment with them, they usually don't have the rescue pulleys and stoke's litter with them. The rescue squad does. The paddler group is lucky to have two carabineers per person and several rescue bags available for a rescue. In contrast, the rescue squad usually arrives with large amounts of specialized rescue equipment. Open the back of your car trunk and look at your spare tire and the jack. It is minimal. If the lug nut was put on too tightly, the short wrench provided with the jack may be insufficient to remove the lug nuts. As a sidebar, this is why this author carries a half-inch breaker bar and socket in the trunk. Compare this to the amount and type of specialized equipment on the back of the tow truck that arrives to help rescue you.

In contrast, preppers strive to be prepared for an eventual crisis. They understand the need to have sufficient emergency resources available to them and they prepare accordingly. They understand that the rescue by other phase may not be available to them, they may be overwhelmed and not able to respond, or their response significantly delayed because the crisis prevents them from traveling. Where the recreationist may not have a lot of rescue equipment resources because it increases weight and bulk and limits their performance in the activity, preppers are not normally encumbered with these type of constraints. In a very real sense, this point underscores the purpose for prepping. And this is why preppers prep, to avoid the last alternative of having to rely on governmental agencies that may not be able to fully provide the services to which people are accustomed.

911 Syndrome

The rescue curve has additional implications. The “*911 Syndrome*” focuses on the difference between inexperienced or “activity for a day” participants and the more serious or more specialized participants. It is called the 911 Syndrome because the victim starts their rescue efforts by calling 911 on the telephone. In prepping, the 911 Syndrome the prevailing approach of many people in our society today. They wait

for the government to tell them what to do in time of an emergency. It is like calling 911 and waiting for help to arrive.

The more specialized participant tends to start their rescue efforts with safety and prevention. They focus on their equipment, developing their skills, and rescue techniques. They know that if a potential incident occurs, their first line of defense rests with their self-rescue. For the kayaker, it may be the Eskimo roll or for the climber it may simply be on-rope. The more specialized participant knows that if they don't self-rescue, they can often move very quickly through the rescue curve stages and quickly run out of options. For this reason, more specialized or experienced participants tend to front load their experience with safety and prevention. They know their survival is dependent on it.

In contrast, inexperienced or “activity for a day” participants tend to begin their rescue efforts with rescue by people outside their group. In terms of the rescue curve, they begin their rescue efforts with their last option, rescue by others outside of their group. For them, they have few options left if they aren't rescued. They rely almost totally on the resource manager or the rescue squad for their survival. Hence, the term “911 Syndrome.” They call 911 and hope someone comes and rescue them.

Because of their lack of planning, they quickly skip over the first three phases of rescue (i.e. safety and prevention, self-rescue, and rescue by others in your group) and immediately go to the fourth phase, rescue by others outside your group. They don't have the skill, knowledge, or training. Most likely they don't have the rescue equipment nor do they know how to use it. Last, their attitude is one where it is the responsibility of someone else to rescue them (Kauffman and Carlson, 1992, Kauffman, 2003, Kauffman et.al. 1991).

A similar parallel applies for prepping (Figure 4.7). Unfortunately, it may be the rescue by others outside your group that might not be available to the non-prepper, the very group from which the non-prepper is expecting help. Non-preppers quickly skip over the first three phases expecting EMS and rescue personnel to assist them in time of a crisis. As previously noted, they may not be able to provide assistance. In this case, the non-prepper quickly passes into the last phase where injury, damage, or loss occurs. With few evident resources, the group sitting on the roof in Figure 4.5 are waiting for rescue during hurricane Katrina. They are waiting for someone else to come and rescue them. If no one comes, they will most likely perish. In contrast, by the very act of prepping, preppers have made a concerted effort to avoid the 911 syndrome. Some of these reasons are described in the next section.



Figure 4.7: Probable 911 Syndrome – The group sits on the roof top waiting for rescue by helicopter or boat. From the lack of resources on the roof, this group most likely qualify for the 911 Syndrome. Also, note the oil slick in the water from the cars. (Source: AFP)

Rescue by Others Outside Your Group

For preppers, rescue by others outside your group has additional implications (Figure 4.8). As previously noted, EMS and rescue squad services may not be available. In terms of the rescue curve, non-preppers and preppers can easily pass over this phase and go directly to the injury, damage, or loss phase.

Preppers may voluntarily choose to pass over this phase which is why they prep. Second, there may be significant differences in the goals between the rescuers and preppers that can easily lead to conflict. Third, for well prepared preppers, the services offered by government providers may be less than adequate and marginal at best.



Figure 4.8: Rescue by Others Outside Your Group – Living arrangements in the Superdome during the hurricane, Katrina. Authorities had their hands full simply maintaining order and feeding people. Note the people sleeping sideways on the seats. (Source: Reuters)

In his post game analysis of surviving Katrina, Fr Frog (2008) notes the difference in goals between preppers and the rescue squad and how it can easily lead to conflict. Rescuers arrive on the scene with a mind set to rescue helpless victims who appreciate being saved. In contrast, the preppers may have no desire to be rescued. They are self-sufficient and not in need of rescue. Rejecting rescue can lead to conflict. In the view of the rescuers, the victim is not playing the game according to the script. The rescuers can become insistent on your rescue. That is what they are there for, and you like everyone else, needs help. They can even become hostile because you are not doing what they want you to do. For preppers, the corollary is that if you don't want to be rescued, don't make yourself known to rescuers flying overhead or passing by. In this case, avoidance is a good strategy for avoiding potential conflict.

In time of a crisis, if you didn't prepare for the crisis and if you don't bug out to a safe location, you may quickly slide into the third phase where you rely on governmental services. You may find this experience less than satisfactory. This is not to demean what they do. They have their problems also. They need to maintain order. They need to warehouse large groups of people for which they know very little of anything about anyone. It can be a daunting task. Temper the following account with this in mind. Fr. Frog is writing about his lessons learned after Katrina. Regardless, it strikes a certain truth.

13. **Don't rely on government-run shelters if at all possible.** Your weapons WILL be confiscated (yes, including pocket-knives, kitchen knives, and Leatherman-type tools); you will be crowded into close proximity with anyone and everyone (including some nice folks, but also including drug addicts, released convicts, gang types, and so on); you will be under the authority of the people running the shelter, who WILL call on law enforcement and military personnel to keep order (including stopping you leaving if you want to); and so on. Much, much better to have a place to go to, a plan to get there, and the supplies you need to do so on your own.....

.... I hope that these "lessons learned" are of use to you. I'm more and more convinced that in the event of a disaster, I must rely on myself, and a few friends, and never count on Government or relief organizations for the help I'll need. Also, I'm determined to bug out for a fairly long distance from a disaster in my home area, so as to be clear of the post-disaster complications that may arise. Once again (as it has countless times throughout history), we see that to rely on others (let alone Government) for your own safety and security is to invite complications at best, disaster at worst. (FrFrog, 2008)

Also, what Fr Frog (2008) echos in his passage is the need for self-reliance and the avoidance, if possible, of rescue by others outside of your group. You may not know the quality of the experience being provided to you in a government run shelter. In contrast, you may find being prepared with an emphasis on prevention and safety a better alternative.

Summary

The rescue curve was developed for outdoor recreationists. Its message is one of being prepared because once an incident occurs it can quickly escalate to the last phase where injury, damage, or loss can occur. Intuitively, preppers understand the rescue curve and the need to be self-reliant in time of a pending crisis. The rescue curve provides a conceptual framework for and a reason why preppers prep. It provides a reason why preppers might not want to rely upon governmental services and rescue by others outside their group. Why rely on others when you can rely on yourself and on your preparations? The first proposition of self-reliance is what can a person and their family do for themselves. It is what prepping is all about.

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Risk Management Primer ¹

Risk management is a term that has different meanings to different fields. It means one thing in the stock market, insurance and legal fields. The term is bandied about a lot. Even so, there is commonality to their parts. Two areas of risk management are discussed. The legal and engineering concepts of risk management are the primary focus of this section. Second, for preppers the purpose of introducing risk management is because it is important because you don't want to become injured or have an accident yourself. What is treatable in normal situations can easily be life threatening in times of emergency. Risk management and avoiding accidents cuts across all the topic areas in the following chapters. In terms of accident prevention, the primary focus is on barrier analysis which provides a good backdrop for understanding risk management. This is discussed in the next section.

Risk Management in the Legal Community – In the legal community, risk management has a legal focus in its approach toward handling risks. In the traditional approach there are four components or steps in the risk management process (Figure 1). These are 1) identification of the risks, 2) determine severity (probability and impact), and 3) apply a risk management strategy 4) in an effort to reduce the likelihood of injury, damage, or loss occurring to the individual. Although the main focus here is on the risk management strategies, a brief discussion of the first three components is necessary.

The first step is to identify the risks. In traditional risk management, this includes a plethora of risks including virtually anything and everything that can impact you or the organization. The focus here delimits the discussion to accidents. However, you can apply the process to include anything including sexual harassment, life insurance, automobile insurance, etc.

The second step is to determine the *severity* of the risk to you or the organization. Severity is composed of two factors, probability and impact. *Probability* refers to the frequency of occurrence. Getting sunburn has a high probability or frequency of occurrence. An automobile accident is hopefully a low probability although it might have a medium probability. *Impact* refers to the damage it will have on the organization or in this case, you. Generally, sunburn has a low impact on you and an

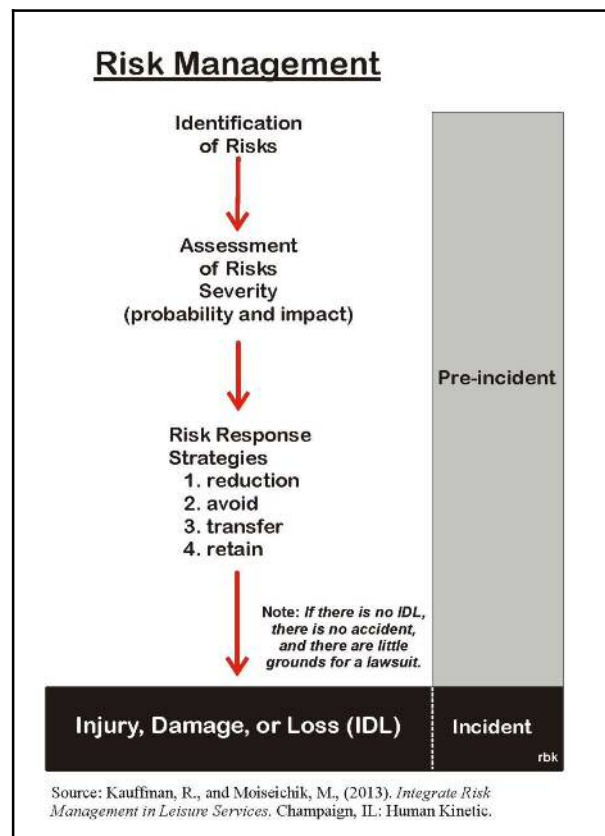


Figure 1: Risk Management Model – The four elements of the traditional risk management process.
file: \\RK-RiskMgmtModel[36].jpg

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automobile accident has a high impact. The probability and impact are combined to create severity. This is done using a table not provided here. However, most people can calculate severity intuitively. Even though sunburn has a high probability, its low impact would suggest a low severity also. Even with a moderate probability, the high impact on you of an automobile accident suggests a high severity. For a more in depth discussion of this process, consult Chapter 8 in *Integrated Risk Management* (Kauffman and Moiseichik, 2013).

The third step in the risk management process is to determine the appropriate risk management strategy and apply it. There are four approaches: *reduction*, *avoidance*, *transfer* and *retention*. Reduction and avoidance focus on dealing with the risks. Transfer and retention focus on who handles the cost of the injury, damage, or loss once the mishap occurs. Transfer is a strategy where you seek to transfer the cost of the injury to someone else. This can be to the participant with a *waiver*, to the *insurance company*, or to a *subcontractor*. With retention, you absorb the cost yourself. The deductible portion of your automobile insurance is an example of retention. With a \$500 deductible policy, you pay the first \$500 (retention) before your insurance (transfer) kicks in.

Reduction and avoidance focus on dealing with the actual risks that lead to injury, damage or loss. In the legal community there are four processes usually associated with reduction. These are *inspect*, *warn*, *remove*, and *repair*. For the prepper, you might inspect your food supply to maintain its viability. If it is past the expiration date, you might consider removing the food from your stores. Repair might include replacing the removed food. Placing a sign in the pantry indicating when the food should be inspected is an example of warning. Again, remember that the intent of these strategies is to reduce the likelihood of being negligent and being sued. Most preppers are more interested in surviving than being sued. Regardless, at some level, the process is intuitive where you determine the likelihood of something occurring and its impact to you if it occurs. Then you determine a strategy regarding how to handle it.

The Four Ts – In the engineering field, the four risk management strategies are *terminate*, *treat*, *transfer* and *tolerate* (Stephenson, 1991). People familiar with risk management will note the similarity of the 4Ts with the risk management alternatives of reduction, avoidance, transfer, and retention. For convenience, the legal risk management strategies are often placed in parentheses in this section. From an engineering perspective, the underlying principle in the 4Ts is that all risks should be eliminated or that any risk is a bad risk. Unfortunately, for the prepper or for that matter anyone else, elimination of all risk is not a possibility.

There are two ways to *terminate* (i.e. avoidance) the risks. First, the activity can be terminated, eliminating the activity. Generally, this is a difficult alternative for preppers. Second, major risks can often be engineered out of the system. Creating a water storage system engineers many of the problems associated with water purification out of the system. In this sense, storing water engineers water purification and avoids the problem of contaminated water.

The application of administrative controls can be used to *treat* (i.e. reduce) and reduce the level of risks. This usually includes warning devices, safety devices, procedures, and training. Packing your car prior to a bug-out is an example of training. You are determining the contents taken with you and whether everything fits in your car prior to the actual event. Plus it is a trial run that provides you with experience.

Risks can be *transferred* (i.e. transferred). Stephenson (1999) indicates that insurance is the usual method for transferring the risk. It is important to note that this approach does not diminish the risks, it only transfers from one party to another who is responsible for the risks. This is no different from the legal

approach to risk management.

If the risks can't be terminated, treated, or transferred, they are *tolerated* (i.e. retention). Inherent in toleration is the reality that not all risks can be eliminated. If the risks are treated, there is often a residual risk which is tolerated. For the prepper, this means that no matter what your preparations, in time of disaster or emergency, what you have with you is what you have (Note: Think of the pocket dump). You have to make due with what you have.

Summary – Risk management is bandied about and has evolved into a generic term. Although this section is brief, it introduces the concept of risk management and provides a frame for barrier analysis. For preppers, the emphasis is on survival rather than on being sued for being negligent. In this respect, the focus is more on reducing accidents and barrier analysis is the better tool. Regardless, you should have a fundamental understanding of risk management because as a general strategy, it has utility. Determine the likelihood of an incident occurring and its impact to you if it does occur. Then determine a strategy how to best handle it. Basically, the approach is still sound although its primary focus is on negligence and being sued.

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Chapter 5.1: Fire and Heat ¹

Introduction

Returning to the section on physiology, man is a tropical animal. Below 70°F and the body needs an external source of heat or more insulation. Above 70°F and the body needs to be cooled or protected from the heat source. One of the ways to gain heat is from an external source. Fire is one of the primary sources of heat. Fire is also needed in cooking.

This chapter begins with the principles of creating a fire. Strike a match and a flame results instantly. Turn on the gas stove and an electric spark ignites the flame. In a lighter, spin the wheel against the flint and a spark ignites the lighter fluid. There are many ways to create fire in a modern society. It is easy to take them for granted. In time of emergency, many of easy ways to create a fire may not be available. The electricity to ignite the gas burner on the stove may not be available. If matches are available, it is still easy to ignite the gas stove. Understanding the principles helps in creating and nurturing a fire in time of emergency when modern conveniences may not be available.

Next, the chapter integrates “primitive technologies” along with other emergency methods used to create fire. In primitive technologies, the term “primitive” is a misnomer because the techniques and technology required to use these methods to start a fire can be quite sophisticated. They are only primitive only in the sense that they use natural materials or materials that are readily available in nature. Because they can be quite sophisticated, it is wise to practice them prior to an emergency situation. They are included here because they are novel and because creating fire without modern conveniences is not always a simple task.

The next section focuses on improvising within an emergency situation. It focuses on alternative heating sources that can be used when centralized heat is no longer available. The last section focuses on alternative cooking sources.

Principles

Fire is really part of the oxidation process. It is linked with the fire triangle and the pyrolysis process. Understanding these processes provides a conceptual foundation which is useful when building a fire. Without the use of petrochemicals such as lighter fluid or kerosene, a fire is built and nurtured. Again, building a fire illustrates the underlying principles of building a fire.

Fire Triangle (Figure 5.1) – Three components are necessary and sufficient for fire to occur. These are fuel, oxygen and sufficient heat. Necessary and sufficient are code words for causal. Necessary means that if the component is missing, fire will not occur. Extinguishing a fire usually involves removing one or more of the components. A CO₂ extinguisher both lowers the temperature of the fire and

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smothers the fire with carbon dioxide which is non-flammable and denies the fire oxygen. Sufficient means that if all three elements are present, a fire will occur. If all three elements are present, a fire will occur.

Pyrolysis Process (Figure 5.1) – A burning candle is illustrative of pyrolysis process and how a fire actually burns. The wax or paraffin is the fuel. Careful inspection of a burning candle reveals that the wax is present as a solid, liquid and gas. It is the gas that burns. The solid (i.e. wax) must be converted into a gas where it combines with oxygen from the surrounding environment. The burning candle has sufficient heat to maintain the fire. In addition, the heat of the burning candle melts the wax converting it into a liquid. The candle's wick transports or "wicks" the liquid wax into the flame where it is converted to a gas by the flame and then it burns. It is the gas that burns, not the solid or the liquid.

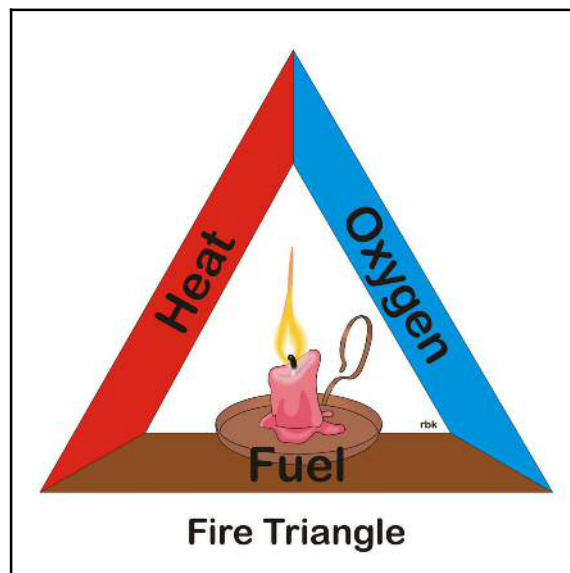


Figure 5.1: Fire Triangle – In order to create a fire, it needs fuel, oxygen, and sufficient heat. Conversely, eliminate one of the elements and the fire will go out. Source: author – [file:\FR-FireTriangle.cdr]

The traditional candle snuffer is a small cone-shaped device with a handle on it that is placed over the burning candle. As the candle burns, the combustion process creates carbon dioxide (CO_2). When the snuffer is placed over a burning candle, the carbon dioxide fills the cone of the candle snuffer denying the burning candle the oxygen it needs. Without oxygen, one of the three necessary components is eliminated and the flame is extinguished. Careful inspection of the extinguished flame reveals the end of the wick is usually still glowing. It is smoldering. There is insufficient heat remaining to maintain the flame and to melt the wax. Hence, the flame is denied fuel. It quickly goes out. Without the flame, it has insufficient heat to maintain the flame.

Building a Fire – A fire is built carefully. It is not thrown together. Conceptually, it is fairly simple. The objective is to raise the temperature of the fuel to a temperature where the pyrolysis process can

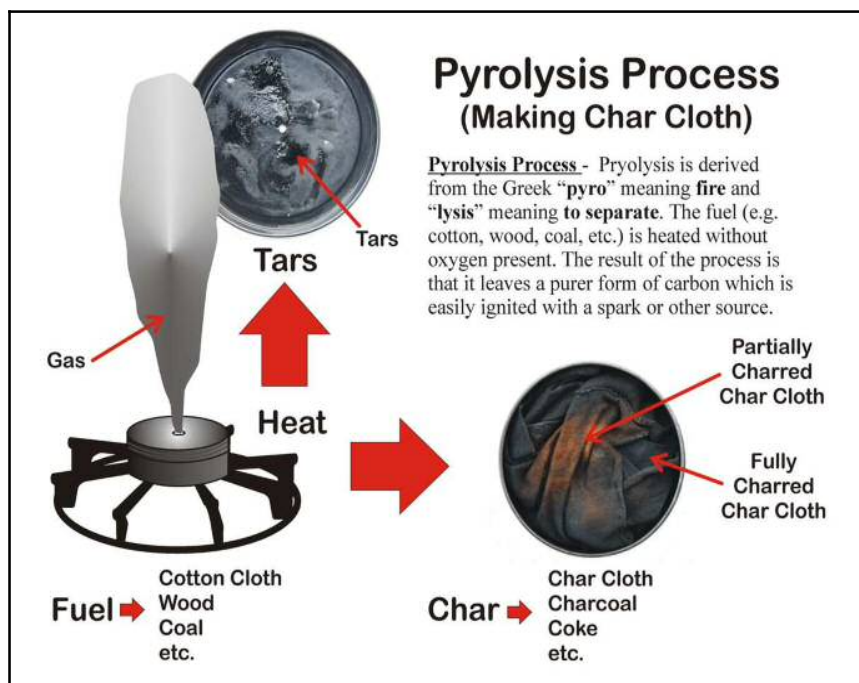


Figure 5.2:Pyrolysis Process – “Pyro” is Greek for fire and “lysis” is to separate. The pyrolysis process results in the fuel becoming a purer form of carbon. Source: author – [file:\FR-Pyrolysis.cdr].

sustain itself. In practice, it is not so simple unless a blow torch or petroleum products are used. For discussion purposes, there are three phases. The first is the initial source of heat. Essentially, it is the spark or initial friction as discussed. The second phase is igniting the tinder. The third phase is creating a fire that is self-sustainable. All that needs to be done in this phase is add fuel to the fire.

<c>**Initial Source of Heat** – There is an initial source of heat. Usually, it is the result of friction and chemical action. The flint striking against the steel creates a spark of burning metal. Lighting a match creates friction with powdered glass embedded in the head against the striker that ignites the sulfur in the match head. The electric energy from a battery heats the steel in steel wool to the point where the steel begins to burn.

The initial source of heat can be divided into four phases (Figure 5.3). The first phase is the initial source of heat as previously noted. The second phase is the smouldering phase. There is sufficient heat for the fuel to burn, but there is no flame and it is not sustainable. When using a bow-drill, this phase occurs when the sawdust is heated to become a smouldering coal. There is plenty of smoke produced but there is no flame. When a match passes over the striker, this phase occurs fairly quickly as the match ignites. The third phase is when the gas ignites. Blowing on the glowing coil produced by the bow-drill creates a glowing coil that may easily transform into a small flame that is used to light the tinder. The match lights and its flame lights the tinder. In the four phase, the fire becomes self-sustainable. As long as fuel is added, the fire has sufficient heat to maintain itself.

Figure 5.3: The Pyrolysis Process and the Four Phases of Starting a Fire		
Phases:	Characteristics:	Notes:
1 st Phase – Initial Source of Heat	Can be friction generated, a chemical reaction, or both	1) Bow drill is an example of a friction only device. The spark from flint and steel is the result of friction.
2 nd Phase – Smoldering	The fuel is burning but no flame is present	1) Fuel is burning but no flame is present (i.e. smoldering) 2) Fire is not sustainable
3 rd Phase – Gas Ignites	The fuel is burning and a flame is present	1) There is sufficient heat present to convert the solid or liquid into a gas, and the gas begins to burn. 2) Often increasing the oxygen (e.g. blowing on the ember) is sufficient to create a flame. 3) Lighting a match combines the first three phases within one act.
4 th Phase – Self-sustaining	There is sufficient heat to maintain the flame as long as fuel is added to the fire.	1) With the addition of more fuel, the fire has sufficient heat and oxygen to maintain itself. 2) Add more fuel and if adding wood, gradually add larger pieces.

Phases can be bypassed. Using a butane lighter bypasses the smoldering phase. The spark directly ignites the vapor. It might even be argued that lighting a match bypasses the smoldering phase. However, occasionally, a lighted match smolders and doesn't ignite into a flame.

<c>**Tinder** – When building a fire consider the following three principles. The first is to start small and get bigger. Twigs, give way to larger twigs and eventually to logs. This is self-evident but in practice, it is easier said than done. Second is the concept of sustainability. This means that there is sufficient heat present to maintain pyrolysis. The burning candle illustrates this concept. The candle's flame creates sufficient heat to melt the wax and transport it up the wick to burn. The heat of the candle's flame is sufficient melt the wax, transport it, and maintain the flame at a constant level. The candle continues to burn. It is sustainable. Third is a minor point but worthy of consideration. Different fuels burn at different temperatures. Be sure not to decrease the energy value of the fuel. The classic example is burning leaves which burn at a lower temperature than the twigs and branches used to burn the leaves.

<c>**Self-sustainable** – The key element is that the fire has sufficient heat to maintain itself as long as sufficient fuel is supplied. The burning candle that continues to burn exemplifies self-sustainability. Without a constant soft blowing on the glowing coil produced by the bow-drill, the glowing coil is not sustainable and will quickly go out. Usually, burning tinder is sustainable as long as additional fuel is added. But then that is the definition of self-sustainable.

<c>**Double the Fuel** – Tinder burns quickly. Small twigs burn quickly. As a rule, double the twigs and fuel perceived to be needed to build a fire. This is an experience thing. It is easy to under estimate how quickly the tinder can burn. It is a common mistake.

Sources of the Initial Source of Heat

The initial source of heat can be generated one of several ways. Usually, friction is involved in some way in generating the initial source of heat. In a match, usually powder glass or a similar abrasive creates sufficient friction to ignite the chemicals. In the bow drill, the friction of the twirling spindle raises the sawdust created to its ignition temperature. The flint in flint and steel strikes the steel. The small flake of steel is ignited by the friction of the striking action.

Flint and Steel (Figure 5.4) – Flint striking against steel produces a spark of burning steel in the range of 2,498°F. Although it can ignite small tinder, this author prefers directing the spark onto char cloth or steel wool. The striker is made from high carbon steel.

The striker is held in one hand, The flint is struck downward against the steel striker. The flint peels off a small flake of steel. The friction ignites the small flake of steel. It is rapid oxidation. Care needs to be taken when striking the striker with the flint. The flint is sharp and it can easily cut the hand holding the striker. With a little practice, the use of flint and steel to start a fire can easily be mastered.



Figure 5.4: Flint and Steel – Striking the flint against the steel can send a spark which is burning steel with a temperature of 2,498°F. Source: author – [file:\FR-Flint&Steel05.jpg].

Bow-drill (Figure 5.5) – The bow-drill is a sophisticated fire starting device. The literature suggests that a person can construct a fire drill using a pocket knife, and vines found in the woods. This author won't deny the possibility, but it is a hard device to use even under the best of circumstances. If a prepper thinks he or she is going to go into the woods and start a fire without prior experience, good luck.

The bow-drill is a friction device. Conceptually, it is fairly simple to understand. The spindle is rotated by the bow creating friction between the spindle and fireboard. The friction creates sawdust which is heated to kindling temperature. The heated sawdust is collected in the cut “V” and begins to smoulder. Gently blow on the ember and transport it to the tinder. This can be a bird's nest or other small twigs. is

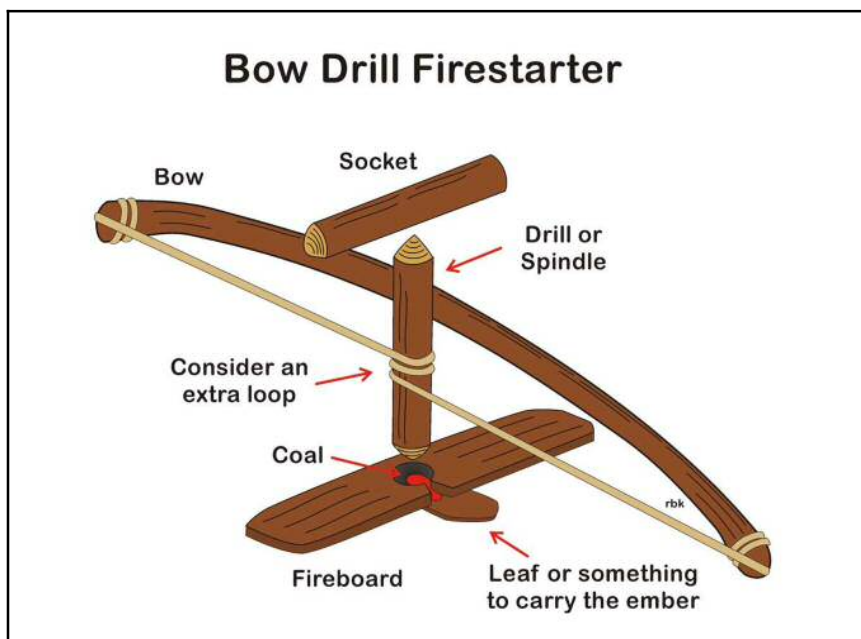


Figure 5.5: Bow-drill – Using a fire drill is not easy and requires considerable experience. Source: author – [file:\FR-BowDrill.cdr].

The color and texture of the sawdust is an indicator of the effectiveness of the bow-drill. A sawdust that is dark brown/black with a fuzzy consistency is an indicator that the system is working properly. It indicates that sufficient pressure is being applied on the spindle. A light brown thick sawdust is an indicator of inadequate pressure on the spindle and that it not rotating fast enough. A dark brown sawdust (i.e. not blackened) is an indicator of adequate pressure on the spindle but not adequate rotating speed.

Normally, the spindle and fireboard are constructed from the same type of wood. The wood should be non-resinous with a low kindling temperature. Yucca is considered the ideal wood because it is non-resinous and has a low kindling temperature (i.e. 200°F). Other choices include aspen, buckeye, basswood, and white cedar can be used.

Ferrocerium Rod Fire Starters (Figure 5.6) – Ferrocerium fire starters are found in the commonly found flints used in lighters and ferrocerium rods. “Ferro” is the chemical term for iron and “Cerium” is an element that ignites at the low temperature between 300°F to 350°F. When combined the mixture gives off burning



Figure 5.6: Ferrocerium Rod Fire Starter – The rod is composed of Ferro (iron) and the element, cerium. When scraped with a hard metal, the ferrocerium rod gives off hot sparks that can be used to start a fire. Source: author – [file:\FR-FerroceriumStick04.jpg].

sparks when scraped with a hard metal surface, particularly a high carbon steel.

Magnesium Fire Starters –

Magnesium fire starters are ferrocerium fire starters using magnesium rather than iron as the material combined with the cerium. Magnesium burns at 3,000 °F . Also, it burns longer than the iron in a ferrocerium rod.

Battery and Steel Wool (Figure 5.7)

– The battery provides electric current. The steel wool provides a short circuit with some resistance. Steel wool comes in several different sizes. It is rated similar to the gauge system used rate the diameter of electric wire or shotgun pellets. Four ought (i.e. O₄) is the finest steel wool and is the grade with which this author has played. Thicker grades should work equally well.



Figure 5.7: Battery and Steel Wool – The battery provides an electric current that shorts out and ignites the steel wool. Source: author – [file:\FR-Battery&SteelWool07.jpg].

Surprisingly, even small batteries can deliver sufficient current to ignite the steel wool. Small nine volt batteries work as do the one and one-half volt C or D cell batteries. The steel wool shorts out the battery and usually begins glowing near the terminals. The steel burns at a hot 2,498°F which is sufficient to ignite tinder. A word of caution. Once a section of steel wool burns it leaves a cinder which won't ignite again if current is applied to it.

Matches (Figure 5.8) – Matches come in basically two varieties, either safety matches or strike anywhere matches. In safety matches the red phosphorus in the striking surface converts into white phosphorus vapor that spontaneously ignites. The friction for powdered glass or a similar material in the head rubbing across the striking surface is used to create friction and generate the initial heat. In turn, the potassium chlorate in the head of the match decomposes and liberates oxygen which ignites the sulfur in the head. The match head burns, In turn, it ignites the wood or paper match stick. In a strike anywhere match, the phosphorus is contained in the head of the match along with the potassium chlorate and sulfur.



Figure 5.8: Matches – Waterproof, strike anywhere matches (lower left), waterproof matches (upper left), common kitchen matches (upper right), and wind proof matches (lower right). Source: author – [file:\FR-Matches03.jpg].

For preppers, keeping matches dry is important. They can absorb moisture which will render them useless. Storing them in a watertight

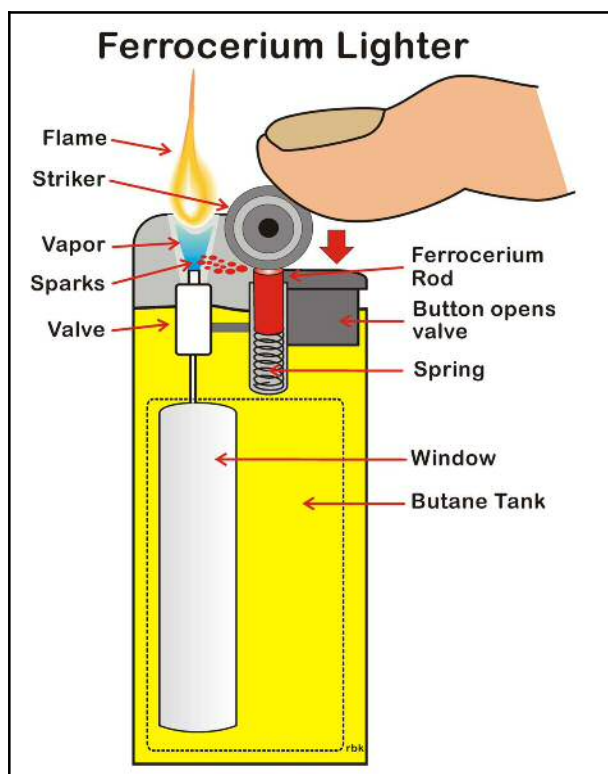


Figure 5.9: Ferrocerium Ignited Lighter – This is the traditional lighter where a striker wheel strikes the ferrocerium stick creating sparks that ignite the vapor. Source: author – [file:\FR-LighterFerrocerium.cdr].

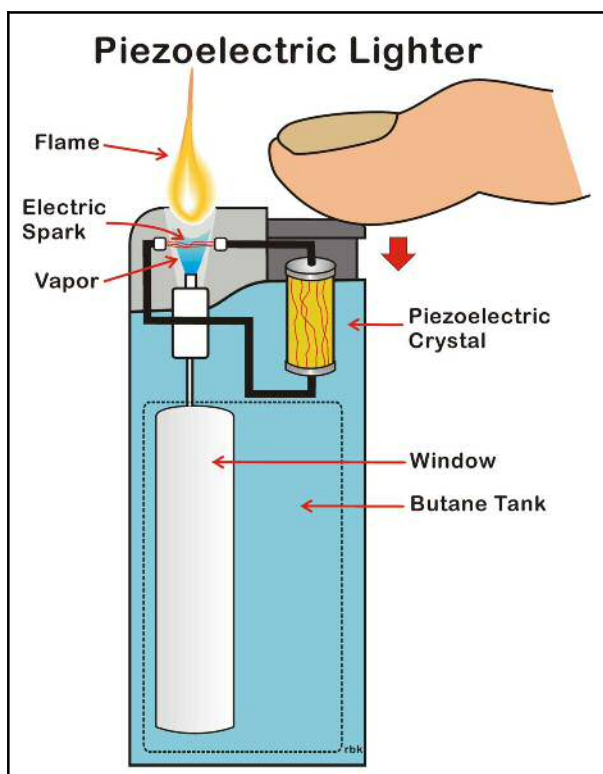


Figure 5.10: Piezoelectric Ignited Lighter – Pressing the button down puts pressure on the piezoelectric crystal which creates an electric charge and spark that ignites the butane vapor. Source: author – [file:\FR-PiezoelectricLighter.cdr].

container is prudent. Also, matches can be waterproofed. If the match is waterproofed, both ends of the match need to be waterproofed. Moisture can be absorbed through the stick end of the match. Common waterproofing materials include dipping the match in paraffin, nail polish or lacquer.

Lighters (Figure 5.9 and Figure 5.10) – Lighters have two major components the fuel and the igniter. Lighter fluid or butane are commonly used fuels. Lighter fluid requires a wick and conceptually, works similarly to a candle wick. In contrast, butane released under pressure vaporizes quickly and can be ignited directly.

There are two commonly used ignitor systems. The first is the traditional flint striker. It consists of ferrocerium which is a man-made flint like substance that ignites when rubbed against a rough metal surface (Figure 5.9). The second approach uses a piezoelectric crystal for its ignition system. When placed under pressure, the piezoelectric crystal creates an electrical current that ignites the gaseous vapor, usually butane (see Figure 5.10). The use of piezoelectric crystals have found their way into numerous appliances including butane lighters and ignition systems including outdoor grills.

Propane Tank – Most home owners have a propane tank and flint starter used to solder copper pipes. It may be overkill when starting a fire, but that should not discount its use. It is mentioned here because it is easily overlooked as a fire starting source. Don't overlook the steps used in starting a fire. Small tinder may be bypassed, but be sure there are ample quantities of larger tinder to grow the fire. Add larger pieces of wood as would occur with building any fire.

Tinder

Tinder is a readily combustible material. When building a fire, it is the first level of combustible material. The original source of heat is delivered to the tinder. Several of the more readily available materials that can be used as tinder are presented. When building a fire without many of the modern petrochemical products, tinder becomes an important component in building a fire. When using these petrochemical products such as charcoal starter or gel strips, the tinder phase is often bypassed. Not all sources of tinder are covered here.

<c>**Char Cloth** (see Figure 5.11 and see Figure 5.2) – Char cloth is made using the same process used to make charcoal from wood or coke from coal. It is the pyrolysis process. “Pyro” is Greek for *fire* and “lysis” means *to separate*. Place cotton cloth or a similar material in a small canister. Drill a hole in the lid of the canister. This allows the gases to escape during the pyrolysis or charring process. The cotton cloth or a similar material is heated to high temperatures without oxygen. Denied oxygen, the material can’t burn. The high-heat without oxygen separates and drives out the tars and gases leaving char cloth. Char cloth is a purer form of carbon than the original cotton cloth.



Figure 5.11: Char Cloth – Using the pyrolysis process, the cotton cloth is heated without oxygen. The lighter colored fabric is not yet fully processed. Source: author – [file:\FR-CharCloth03.jpg].



Figure 5.12: Bird's Nest – Most bird nests are constructed from densely interwoven twigs that makes them an excellent fire starter. Source: author – [file:\FR-Bird's Nest.jpg].

Char cloth works well with flint and steel. For this author it works better than hemp and other materials. In Figure xx0502, the canister is being heated on a stove. In the frontier days, the canister was placed in the campfire and retrieved after the process was completed.

<c>**Bird's Nest** (Figure 5.12) – Most birds construct their nests using small twigs and grass. A bird's nest provides an excellent source of concentrated twigs and makes an excellent fire starter. In a very real sense, they have done all the work gathering all the twigs.

<c>**Birch Bark** (Figure 5.13) – Birch bark contains an oil which burns hot. When it burns, the burning oil in the bark gives off a black sooty smoke. The bark can easily be harvested from dead birch trees. The oil in the bark acts as a preservative and the bark is waterproof. Because the bark is waterproof, the tree literally rots out inside the bark. In the woods, the bark of the trunk can be found supporting a rotting interior where without the bark the tree would fall to the ground. When harvesting the bark from live

trees, cut the outer layer of the bark. This doesn't kill the tree and leaves the inner bark intact. The bark can be stored in ziplock bag or since it is water resistant, by itself.

There are several species of birch trees. The most common is the white birch which is naturally found in the northern states with their cooler climates. It is identified by its bright white bark. Other birch trees include the river and yellow birch trees. The bark from any of the birch trees can be used as a fire starter. Since birch trees are popular ornamental trees used in landscaping, they are readily available in time of emergency. The fire starter may be growing on the front lawn.

<c>**Pine Knots** (Figure 5.14)– The resin in dead pine trees drains toward the trunk of the tree where it collects. The resin preserves the knot and the rest of the tree rots away around it leaving the resin rich knot intact. In theory the resin rich knot is supposed to burn like a fire starter with intense heat. The pine knots are also called fatwood. This author has had little success with using pine knots.

Summary

This section focuses on starting a fire using primarily primitive technologies.

The section covers several of the more common methods. The take-away is that if anyone is planning to utilize some of the primitive technologies like flint and steel or a bow drill, practice with them prior to being immersed into an emergency situation when one has to rely on using that technology to create a fire.

If there is any doubt, buy several boxes of matches and store them in airtight containers. This author has several boxes of unused waterproof wooden matches that are over ten years old. They work as well today as they did ten or fifteen years ago. That is good insurance and reassuring. In addition, this author likes the butane lighter with a piezoelectric crystal igniter. It is simple and effective. This author still hasn't mastered the bow drill. There has been lots of smoke, but no ember.



Figure 5.13: Birch Bark – Birch bark contains an oil which burns with a hot and black sooty smoke. It makes an excellent fire starter. Source: author – [file:\FR-BirchBark.jpg].



Figure 5.14: Pine Knots – Pine knots are resin rich which in theory makes them good fire starter. This author hasn't had great success with their use. Source: internet – [file:\FR-PineKnots.jpg].

Chapter 6: Food Strategies for Preppers ¹

Essentially, food preservation is the prevention of something else from eating your food. Generally, the prevention falls into two groups. The first is protection from other animals. This can include large and small ranging from insects, mice up to raccoons and bears. Usually, protection against varmints involves placing a physical barrier between the food source and potential varmint. It involves storing the food in a good container. The second need for protection is from bacteria and other microorganisms. Called “spoiling,” bacteria eat dinner also. Essentially, food preservation becomes a strategy of storing food in a suitable container and denying bacteria dinner.

Bacteria

Bacteria tends to live in a narrow range of temperatures, usually similar to the host environment. Bacteria tend to have difficulty surviving temperatures above or below this optimum range. Using heat such as boiling water will usually kill the microorganisms. In contrast, refrigeration or even freezing will result in bacteria becoming inactive or hibernating. When the temperature once again returns to a warm temperature range the bacteria once again becomes active.

Types of Bacteria – There are three general groups of bacteria: psychrophiles, mesophiles and thermophiles (Figure 6.1). Close examination of the graph reveal relative narrow optimum survival ranges.

<c>**Psychrophiles** – Psychrophiles are found the freezing waters of the polar regions. They don’t pose much of an issue in terms of food preservation. Psychrotrophs live in temperature ranges similar to those found in refrigerators, around 36 degrees F, and can result in low temperature food spoilage in the refrigerator.

<c>**Thermophiles** – Thermophiles are found in temperatures similar to hot tap water. Hyperthermophiles are found in hot springs associated with volcanic activity and generally are not an issue in food spoilage. The

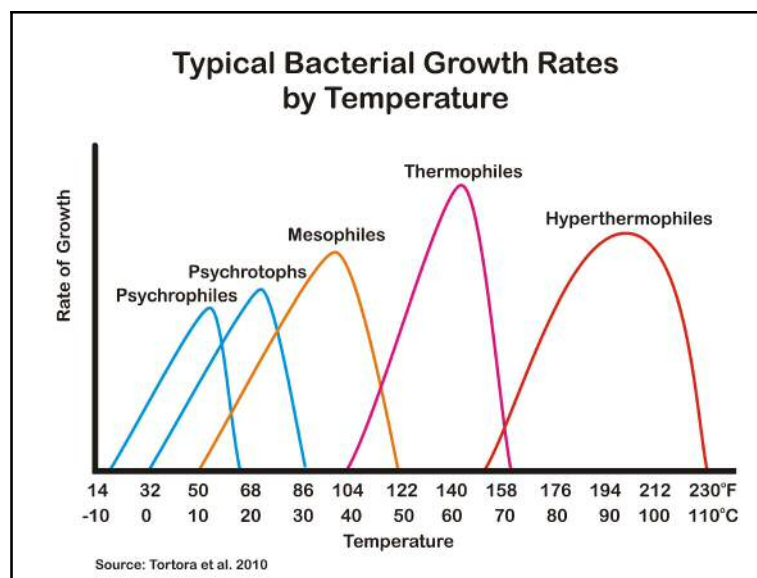


Figure 6.1: Bacteria Types and Temperature Ranges – Bacteria survive in relatively narrow temperature ranges. However, they have adapted to survive in relatively hot and cold environments. Source: (Tortora et al. 2010) – [file:\BacteriaGrowthRanges.cdr]

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endospores of thermophiles are heat resistant and can survive the canning process and result in food spoilage.

<c>**Mesophiles** – Mesophiles are the bacteria most commonly associated with food spoilage and diseases. They live and thrive at temperatures similar to their host. (Tortora et al. 2010)

What Bacteria Need to Thrive

– Food preservation becomes a strategy of denying bacteria what they need to survive and thrive. The previous section noted the narrow range of temperatures in which bacteria can live. As with most organisms, bacteria need the following elements to survive. These elements are food, heat or a warm temperature, oxygen, and water or moisture (Figure 6.2). Hence, the first strategy for food preservation focuses on the environment and on denying one or more of the factors needed for bacteria and microorganisms to survive. A second strategy is to kill bacteria outright. Both strategies require proper storage in a container to prevent or reduce the reintroduction of bacteria into the food.

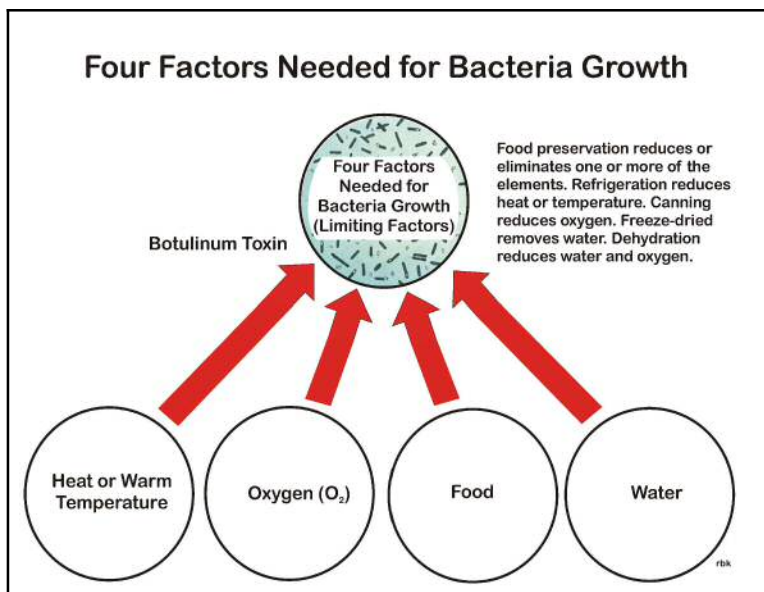


Figure 6.2: Bacteria – In order to survive and thrive, bacteria the appropriate temperature, oxygen, food, and water or moisture. survive in relatively narrow temperature ranges. Food preservation strategies becomes one of reducing or eliminating one or more of these elements. Source: (Tortora et al. 2010) – [file:\FD-/Bacteria.cdr]

Food Preservation Strategies

Food preservation involves three strategies. The first strategy involves storing the food in an appropriate storage container. This serves two functions. It provides a physical barrier between insects and animals and the food. The container becomes an important component in the preservation method and the reduction or elimination of the factors needed for bacteria to survive. The second strategy focuses on killing bacteria. Pasteurization and boiling are examples of killing strategies. The third strategy focuses on reducing or eliminating one or more of the factors needed for bacteria to survive and thrive.

The following preservation methods are discussed in this section. They are freezing, refrigeration, canning, MREs, freeze-drying, dehydration, and chemical. Figure 6.3 provides a summary table of the different methods ranked by their length of preservation. There is some overlap or redundancy in methods. For example, MREs are really a variation of the canning process.

Figure 6.3: Length of Food Preservation Methods		
Preservation Method	Length of Preservation (years)	Notes:
Freezing	Indefinitely	This is based on freezing at -10°F to -20°F
Canning	50+ years	Based on current studies using canned foods from WWII. Although the food remains edible, there is a loss of nutrition over time.
Freeze-dried	7-25 years	The literature suggests 25 years. However, stored in number #10 cans, there is no reason to expect its storage to be longer.
Dehydration	10-15 years	Dehydration removes water content to the 10% to 15% range which reduces bacterial growth. Also, it depends on other preservation methods such as containers and lack of oxygen.
MREs	3 years	Longevity is temperature related. It is really that simple. Even at cool temperatures in the thirties, MREs will last roughly three years.
Refrigeration	less than one year	Refrigerator temperatures are normally between 36°F to 40°F.
Chemical	(Varies) less than one year	Depends on methods used. Consider it short-term preservation.
Note: View the times as generalizations. Length of preservation times are influenced by many factors including temperature, packaging, source of preservation, etc.		

Freezing (Figure 6.4) – Normally, freezing food does not kill all bacteria, however, it renders them inactive. Freezing occurs below 32°F when the water in the food crystalizes and becomes a solid. If possible store food below zero degrees Fahrenheit. Between -10°F to -20°F is considered optimum.

For all practical purposes, freezing food at low temperatures can preserve it indefinitely. Ron Miksha notes that Buttercup the Mammoth discovered in May 2013 and dug out of the permafrost on an arctic island in the East Siberian sea after being frozen for 40,000 years had perfectly edible flesh. He notes that the locals have feed these remains to their hunting dogs for a long time (Miksha, R., 2015).

Freezing may kill some bacteria. However, it normally does not kill all bacteria, but merely renders them inactive or places them into a dormant state. Once the frozen food thaws, bacterial action begins where it left off prior to being frozen. This can happen even when placed in a air tight container.

In times of emergency, the problem for most people is electricity to run the freezer. There are two approaches. Use the frozen foods



Figure 6.4: Freezer – Typical stand alone freezer freezes food between -10°F and -20°F. Source: internet – [file:\Freezer[24].jpg].

as they thaw or use a generator to keep the frozen foods frozen.

Another tip is to fill empty two liter soda bottles with water and freeze them. The ice extends the cooling capabilities of the freezer in time of emergency.

Figure 6.5: Refrigerators – Typical refrigerator maintains the temperature of its contents between 36°F and 40°F. Source: internet – [file:\Refrigerator[34].jpg].



Refrigeration (Figure 6.5) – Refrigeration lowers the temperature below the range of temperatures needed to survive. For mesophiles, they become inactive below 40°F. However, psychrotrophs thrive in these temperatures and can result in food spoilage in a refrigerator. Although refrigeration is the most common method of food preservation, it is an ephemeral preservation at best (see Figure 6.3).

It is recommended that refrigerators operate at a temperature between 36°F and 40°F. It should be noted that water begins to freeze at 36°F. The molecules begin to realign themselves by their electrical charge. They begin to realign themselves into a hexagon configuration. This is most likely why 36°F is the lower limit of refrigeration.

Canning – The strategy behind canning is to sterilize or kill any bacteria and pathogens, and to remove any oxygen from the food. Although most people typically associate metal cans with canning, glass and foil can be used as containers also. Most MREs are really an example of the canning process packaged in foil containers. Glass bottles are the staple container in home canning (see Figure 6.19).

There is evidence that canned food can last indefinitely. The military has done studies on leftover canned food from World War II testing its durability. Although there is some loss of nutrient value, the food remained edible over fifty years after being canned. It is expected that properly canned food can last indefinitely (see Figure 6.3).

Whether a commercial operation or home canning, the canning process is relatively the same process (Figure 6.6). The food is placed in the can and place in boiling water. The can's lid is sealed prior to boiling or tighten during the boiling process. Boiling sterilizes or kills pathogens. The use of the pressure cooker raises the temperature to over 240°F and it doesn't require making the contents acidic. Tightening the lid during the boiling process creates a vacuum or low pressure in the container which further aids in sealing the container. In addition to killing any pathogens present, canning eliminates the oxygen needed for bacteria to grow and reproduce also.

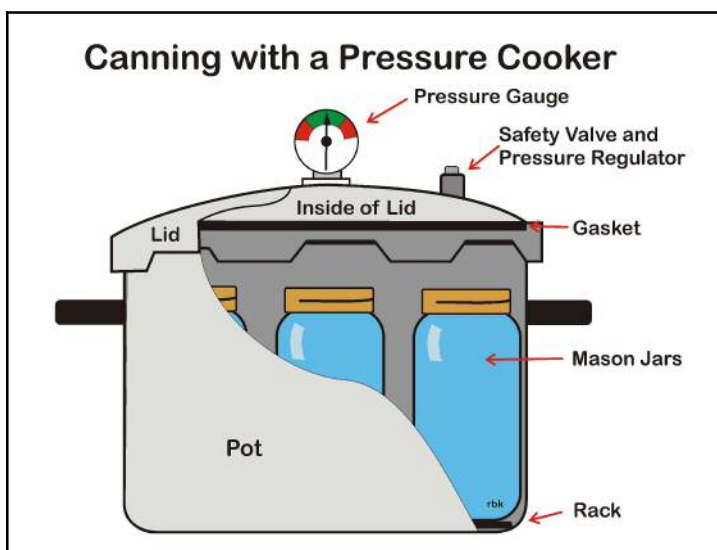


Figure 6.6: Canning Process – Placed in an air tight can or jar, the can and its contents are boiled killing any pathogens. The use of the pressure cooker raises the temperature to over 240°F and doesn't require making the contents acidic. Source: author – [file:\FD-PressureCooker[144].cdr].

If the top of the can has popped outward, it is an obvious sign that the food in the can has been compromised. Bacteria produces carbon dioxide as a byproduct and the gas trapped in the can causes the lid to pop outward. Another sign to check for is a slight hissing sound of trapped gas escaping when the can is opened. Also, there may be a foul odor or discoloration of the food around the rim due to bacterial action.

As a rule, properly sealed cans that maintain their original integrity can last indefinitely. Cans with dents or other imperfections purchased in the store and used as part of the normal food cycle are normally okay to use. However, for long term survival storage, use only containers with no dents or other imperfections including rust. Again, when opening a can, inspect it first and as it is opened check it for signs that its contents have been compromised.

MREs

The shelf-life of MREs is heat sensitive. If stored at 50°F, MREs can last 60 months or five years. However, if stored at 120°F the shelf-life is shortened to one month. At 70°F or normal room temperature, the shelf-life is 40 months. Hence, the rule of thumb is three and one half years for MREs. For this reason, they are generally considered a short-term rather than a long-term solution survival strategy. In addition, MREs should not be frozen.

Dehydration



Figure 6.7: MREs – MREs or Meals Ready-to-Eat are a variation of the canning process. Since they have roughly a three and one-half year shelf life at 70°F, they are not considered a long-term prepper strategy. Source: author – [file:\FD-MREs01.jpg].

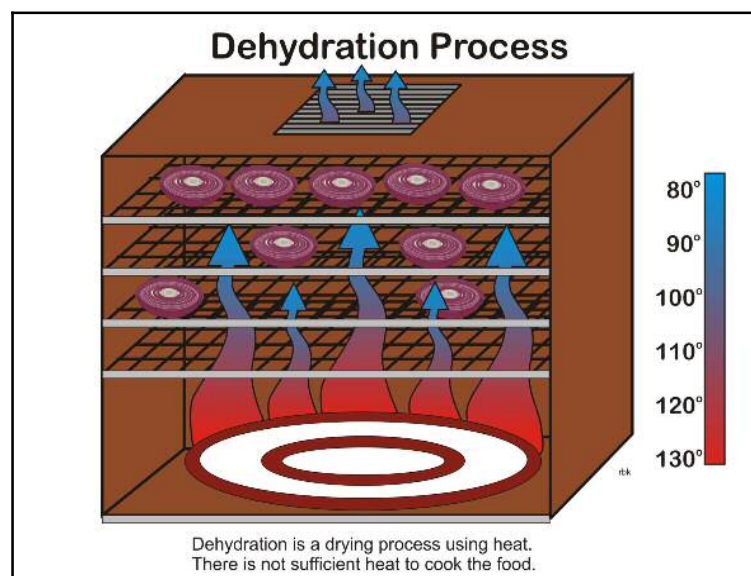


Figure 6.8: Dehydration – The dehydration process uses heat to dry-out and remove the water content of food. The heat dries but does not cook the food. Source: author – [file:\FD-Dehydrator.jpg].

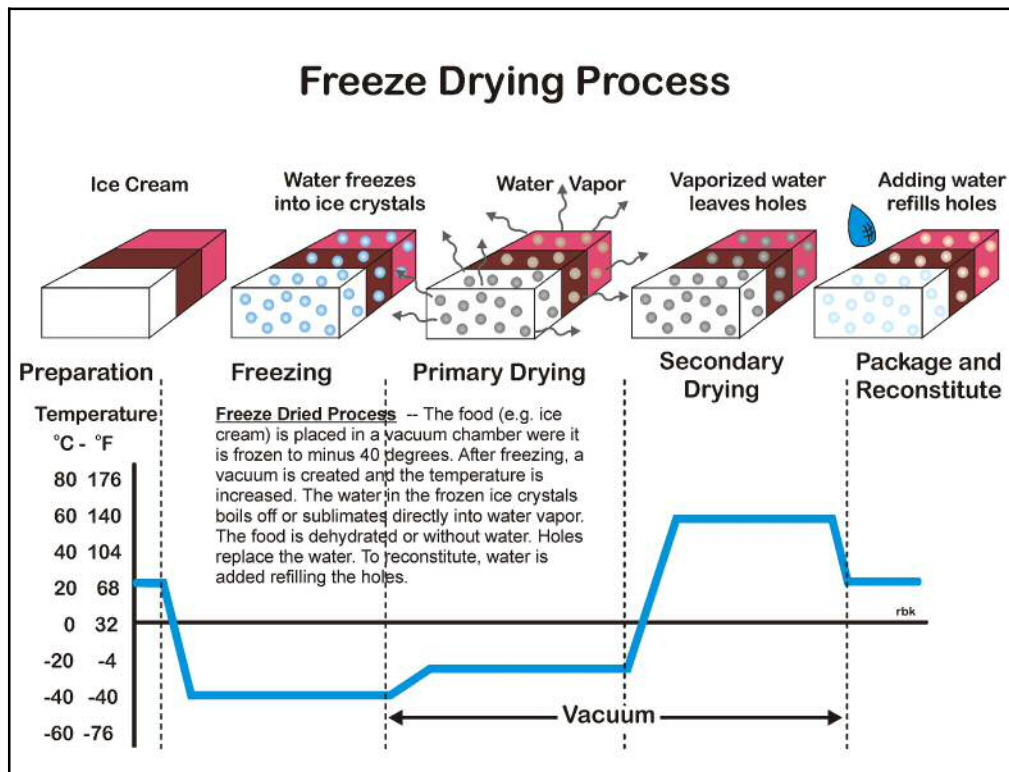


Figure 6.9: Freeze-drying – Freeze-drying is a variation of the dehydration process where the food is frozen in a vacuum and the ice crystals in the food sublimate or boils off as the temperature is raised.

Source: author – [file:\FD-FreezeDried.cdr].

process preserves the food by removing most of the water from the food. Some common foods like raisins and prunes are actually dehydrated grapes and plums, respectively. Jerky is the dehydration of meat. Spaghetti noodles and most other pasta are purchased from the store in dehydrated form and reconstituted in boiling water. Depending on how it is stored, dehydrated foods can last ten to fifteen years (see Figure 6.3).

Freeze-drying (Figure 6.9) – Freeze-drying is a variation of the dehydrating method. The food is frozen to roughly 140°F in a vacuum chamber. The temperature is raised slightly and the ice crystals in the food sublimate or boil off leaving holes or empty spaces in the food where the water once occupied. The freeze-dried food is packaged water and air tight containers. The food is reconstituted by simply adding water. The water and air tight container prevents accidental rehydration from the humidity in atmosphere. Properly stored freeze-dried foods can last up to 25 years.

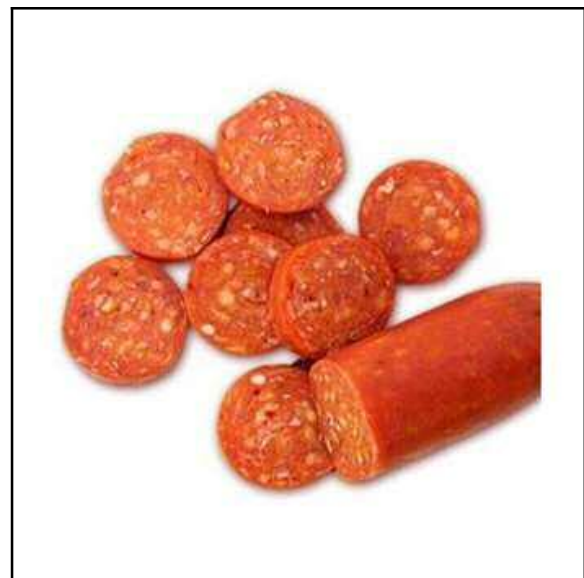


Figure 6.10: Chemical Preservation – Sodium nitrite is commonly used to preserve pepperoni (pictured) and sausage. Source: internet – [file:\Pepperoni[48].jpg].

Chemical Preservation (Figure 6.10 and Figure 6.11) – The strategy in the chemical approach is to make the food less edible to bacteria while still being edible to humans. Although it may sound draconian, it is a commonly used food preservation strategy both historically and currently. The addition of chemicals either kills the pathogens or simply makes the food less hospitable for bacteria growth (FAO, 2016).

The first approach is to create a less hospitable environment by making foods more acidic. This approach is often used as part of the canning process. Lactic acid is a byproduct of fermentation and the breakdown of simple sugars in food. Lactic acid lowers the pH of foods sauerkraut and pickles making them less susceptible to some types of bacterial action. Acetic acid is also a byproduct of lactic acid fermentation. Also, it lowers the pH and is used in pickles, sauces and ketchup.

A second approach is to add other foods or chemicals to the food. High concentrations of sugar often added to jellies, jams, and preserves. Salt is added to water creating a brine or added to meats such as salted cod to extend their life before spoilage. Sodium Benzoate is commonly added to fruit juices, jellies and other foods. Sodium nitrite is added to meats as a preservative and it is a common ingredient in processed meats such as pepperoni or sausage.

In the third approach, a gas such as carbon dioxide (CO₂) is often added to vegetables to delay their ripening and to inhibit the growth of microorganisms. Dry ice can be added to stored grains during packing. As it sublimates, it displaces the air in the container and help preserve the grain.



Figure 6.11: Salt – Salt is a commonly used preservative. Source: author – [file:\FD-Salt[144].cdr].

Containers

Food storage containers are important. As a rule, don't skimp on them. They need to protect against varmints, bacteria and other microorganisms.

Varmint Protection (Figure 6.12) – In terms of barrier analysis, varmint protect is placing a physical barrier using material and creating a barrier by "space." Placing a material barrier is one placing a steel or heavy duty plastic container between the varmint and food source. In order of size, typical varmints include insects, mice, chipmunks and squirrels, rats, raccoons, and bears. Bears are a special topic and not covered here. In



Figure 6.12: Nocturnal Scavengers – Raccoons are thwarted by sealed containers. It should be noted that they will pull smaller packs back into the woods where they will attempt to ransack their bounty. Source: author – [file:\EV07_ 321.jpg].

their search for food, mice, chipmunks, squirrels and rats can easily gnaw their way through many materials that are seemingly impenetrable. It is also placing a barrier by “space.” For this reason, it is good to store food stores where there is also good visual inspection.

<c>**Barrels** (Figure 6.13) – Barrels come in an assortment of sizes and shapes. The parameter for choosing them is whether they are constructed from food grade high-density polyethylene (HDPE). Next, check the closing mechanism and how the lid seals on the container. Some barrels have screw tops and some have steel rings that wedge the lid downward evenly. Also, check the gasket and how the lid seats on the barrel. The seal should be air and water tight. If the barrel is used, consider what was stored in it during its prior use. If there are any doubts, use a mylar or similar liner. They are inexpensive and pretty much guarantee purity.

<c>**Five and Six Gallon Buckets** (Figure 6.14)– The five and six gallon bucket is a staple of storage, including food storage. The five and six gallon buckets have the same lid size and are interchangeable in this respect. The lid can be replaced with a Gamma lid which allows a threaded insert to be screwed and unscrewed. An inexpensive lever can be purchased to pry the lid off the bucket (Figure 6.15).

The Gamma lid is designed to replace the standard lid (Figure 6.14). It allows easier access to the contents than the standard lid. The outer rim replaces the old rim and a threaded insert easily screws in and unscrews. The treaded insert has a gasket and remains water tight. The lid has “X” shaped handles molded



Figure 6.13: Barrels – Barrels come in a wide assortment of sizes and shapes. They should be food grade high density polyethylene and have air tight sealing lids. Source: author – [file:\FD-BlueBarrell02.jpg].



Figure 6.15: Lid Lever – A lid lever can be purchased for under ten dollars. Source: author – [file:\FD-LidOpener01.jpg].



Figure 6.14: Five and Six Gallon Buckets with Gamma Lids – Five and six gallon buckets utilize the same lid sizes. The gamma lid (pictured) is a screw in insert which allows easier access of the contents. Source: author – [file:\FD-GammaLid02.jpg].

in the lid which help to make screwing and unscrewing the lid easier.

<c>**Mylar Liners** (Figure 6.16) – If there is any question regarding the prior use of the container or its purity, consider using a Mylar liner. The liner is inserted in the bucket. The food is stored in the liner and the top is turned over on itself. A oxygen absorber can be added to remove the oxygen from the container also.

<c>**Ammunition Boxes** (Figure 6.17) – Ammunition boxes come in a variety of sizes. Shown is a 50 caliber ammunition box. The advantages of the ammunition boxes are that they are indestructible, water proof and varmint proof. Also they are heavy. There are better alternatives for storing bulk food. However, they are useful for storing foods packaged i foil such as MREs.

Smaller than the 50 caliber ammunition box pictured, the 30 caliber ammunition box is not shown. It is useful for storing odds and ends more than food storage. Both the 30 caliber and 50 caliber boxes come in a plastic version. Larger ammunition boxes include the 30 mm and 40 mm ammunition boxes.

<c>**Metal Cans** (Figure 6.18) – Metal cans are a staple of food storage. The number #10 can pictured in Figure 6.17 is storing freeze-dried scrambled eggs with ham. The use of metal cans has found more favor commercially than in home use since canning requires specialized equipment to fasten the



Figure 6.16: Mylar Liner – If there is a question regarding the prior use or purity of the container consider using a mylar liner which will help to protect the integrity of the food stored in the container.
<cl>Source: author – [file:\FD-MylarLiner.jpg].



Figure 6.17: 50 Caliber Ammunition Box– Ammunition boxes are relatively inexpensive. They are waterproof and varmint proof. There are better containers for bulk storage, but they are good for incidentals or items packed in foil like MREs. Source: author – [file:\FD-50CalibarBox01.jpg].



Figure 6.18: #10 Metal Can – The staple of commercial food service is the #10 can. Source: author – [file:\FD-FreezeDried01.jpg].

lids onto the can. Also, once the can is opened, the can is not reusable. For these reasons, mason jars, have gained favor in home canning.

<c>**Mason Jars** (Figure 6.19)– Mason jars are glass jars with metal lids. Essentially, the jars are a home surrogate for the commercial canning process using metal cans and lids. Unlike metal cans, mason jars are reusable which helps to make them ideal for home use.

Food Grade – The FDA (Food and Drug Administration) approves plastics that are suitable for packaging foods. These plastics are purer than other plastics and they do not contain dyes or other substances that can leach out of the plastic into the stored food. Most five gallon buckets are made from a high-density polyethylene (HDPE), usually a type 2 HDPE. The bucket should be labeled as “food safe.”

The rule is that if the plastic container was used food storage, it is most likely usable for food storage as long as it hasn't been used for other uses. A five gallon pickle bucket from McDonalds can most likely be recycled as a safe food storage container. This author has done so. The same is true for bucket obtained at the donut store or bakery used to store dough. If it has been used for other purposes such as storing pre-packaged food, a mylar bag might want to be used inside the container just to be safe.

Oxygen Absorbers (Figure 6.20)– As their name suggests, oxygen absorbers absorb or removes the oxygen from in a container. Removing the oxygen removes one of the components necessary for bacterial growth and reproduction. The contents of the absorber are usually iron powder. The oxygen combines with the filings to form iron oxide or rust. Most of the absorbers come with a pink button to indicate when the absorber is no longer usable. When they turn blue, it indicates that the absorber is no longer usable.

Oxygen absorbers are available in different sizes. One rule of thumb suggests to use 300 cc oxygen absorber per gallon of food. Larger 2,000 cc oxygen absorbers are available for five and six gallon buckets. Remember, the food in the container displaces air and reduces the need for a larger oxygen absorber.



Figure 6.19: Mason Jars– The use of mason jars is essentially a canning process for the home canner. Source: internet – [file:\MasonJars[36].jpg].



Figure 6.20: Oxygen Absorbers – In the oxygen absorber, the oxygen combines with the iron filings and depletes or removes all the oxygen in the container. Source: author – [file:\FD-OxygenAbsorber.jpg].

Food Storage Strategies

The following are several food storage strategies. The strands used to differentiate the approaches include philosophy, duration of the storage and specialized storage techniques. Philosophically, the “rainy day” approach is a low involvement approach whereas the “bulk storage” tends to require high involvement and often it involves a lifestyle approach with it also. The “extended stores approach” is an extension of the “current stores approach” and the “bulk storage approach is an extension of the “extended stores approach.” Home canning can be considered a specialized storage technique. So can a free-standing freezer be considered a specialized storage technique. Obviously, the approaches can be mixed and they are not mutually exclusive of each other. Again, the reader can choose which approach is most appropriate for them.

Current Stores Approach (Figure 6.21) – This is the default option. This is the strategy or option where if no decision is made regarding prepping, the decision made is that all the person has in a time of emergency is what is in the refrigerator, freezer and pantry.

Actually, most people have sufficient supplies on hand to weather a three-day emergency such as a major snow storm. As a homework activity, students take inventory of their refrigerator, freezer and pantry in their apartment or home. Using what is available, they develop a menu for three days. If two people live there, the menu is adjusted for two people. Most students have little trouble filling out a three-day menu on current supplies even if it is a steady diet of peanut butter and jelly sandwiches or Romen Noodles ® . These are examples of the current stores strategy.

As a sidebar, most grocery chain stores are on a three-day cycle. This means that they have sufficient stocks on hand for three days. In a time of emergency such as a major snow storm where the grocery store is not able to restock its shelves, their shelves can become relatively empty. An indicator of a pending storm for this author is that the milk and bread aisle is empty. Because of the pending storm, everyone runs to the store and stocks up on bread and milk.

The bottom line is as follows. Review the Surviving the Unexpected Emergency Model and determine the type, magnitude, and duration of the emergency. If the emergency is equivalent to that of a three day snow storm, and if there are sufficient food supplies available in the refrigerator, freezer and pantry for this emergency, then the current stores strategy is a sufficient strategy.



Figure 6.21: Current Stores Strategy – The author’s pantry is an example of a current stores strategy. Close examination reveals that in many respects there are an extended stores present. Source: author – [file:\FD-PantryRBK.jpg].

Extended Stores Approach

– The extended stores approach is essentially an expansion of the current stores strategy. There are two propositions to this approach. First, there is no change in the prepper's diet. The menu remains the same. The food types in the refrigerator, freezer and pantry remains the same. The second proposition is that the prepper simply doubles their store of food and rotates it as part of normal consumption. Instead of one jar of peanut butter in the pantry, there are two jars of peanut butter.

Differentiating this storage approach from the bulk storage approach in the next section is the length of time and specialized storage techniques used.

Generally, foods are stored for less than two months. It is the storing foods in the freezer attached to the refrigerator at +10°F to +20°F, rather than the long-term storage offered by a free-standing freezer storing food at temperatures between -10°F to -20°F.

As with the current stores approach, perform the same exercise. Determine the menu and needed stores of food necessary for duration. The extended stores strategy can easily incorporate other strategies. Incorporating the “rainy day” approach, some canned items can be stored in the pantry.

As an interesting sidebar, this author searched the internet for images of pantries. The purpose was to find an image typifying a current stores strategy. It was as if every photo of a pantry showed what the author would consider to be an extended stores strategy. The pantry shown in Figure 6.22 was chosen because it was an under the counter pantry and limited in what it could contain. The purpose of including its discussion here is because it helps the reader to see and analyze from a different perspective a scene they look at each day unquestioningly.

The pantry in Figure 6.22 can be analyzed two ways. The first is a reflection of what the family eats. The pantry contains three jars of peanut butter, six cans of tuna fish, three jars of mayonnaise, several cans of soup, granola bars, some other canned foods, and other assorted items. There are three jars of peanut butter and no jars of jelly. Of course, the jars of jelly could be in the next pantry. This is a reflection of the family's food consumption practices. Or, as a footnote, it could be a stocked pantry in preparation for a photo shoot with little or no pre-planning.

Second, use the contents of this pantry to develop a menu for three days. Again, there is peanut butter, but no jelly. Nor is there bread to make sandwiches. There are six cans of tuna fish. They could be mixed with the mayonnaise for sandwiches. The bread could be in an adjacent drawer. Regardless, it provides



Figure 6.22: Pantry – Analyze this under the counter pantry in terms of developing a three day menu. There are three jar of peanut butter and no jars of jelly. Remember, the bread could be in the next drawer. Source: internet – [file:\Pantry[51].jpg].

the reader with a general idea of analyzing food stores to determine a menu.

Bulk Stores Approach

– Conceptually, this is an extended version of the extended food stores strategy. What differentiates it from the extended food storage strategy is time and specialized storage requirements. Where the extended food storage approach lasts one to two months, the bulk storage approach focuses on storing bulk food over one to two months. Often, it requires specialized storage techniques such as canning, oxygen absorbers, and specialized food grade containers. It can include stand-alone freezers. This approach includes homesteaders discussed in the first chapter who focus on a lifestyle of self-sufficiency characterized by subsistence agriculture and home preservation of food. It also includes bulk buyers of food at Costco, Target or similar stores.

“Rainy Day” Approach

– Unlike the extended food stores strategy, this approach literally stores food away for when it is needed. Normally, this food store is not rotated through normal food usage. Most often it is the long-term storage of freeze-dried or canned food in case a time comes when they are needed. As noted, freeze-dried foods can last up to 25 years and canned food can last indefinitely. Usually, there are sufficient food resources for extended period ranging from three to twelve months. Also, the freeze-dried and canned foods provide a different diet to what the prepper is normally accustomed.

An advantage of this approach is that the stores of food can be stockpiled and they require little maintenance of attention until needed. They are stored away for the rainy day, if and when it comes. This is also a disadvantage of this approach. It is easy to forget about even minimal maintenance.

As second word of caution with this approach. Actually, it is an issue of any extended survival situation. It is what may be termed the “ripple” or “domino effect.” Storing number #10 cans of freeze-dried foods is a start. However, water in sufficient amounts is needed to rehydrate the food. As part of the rehydration process, the water needs to be heated. This requires a stove, fuel and matches. And don’t forget a good can opener to open the #10 cans. The reader gets the drift regarding this issue. Extended survival multiples like a series of ripples or domino other items that are necessary to perform, in this case, the seemingly simple task of rehydrating freeze-dried food.

Barrier Analysis

Chapter 4 introduced the concept of Barrier Analysis (Figure 6.23). Conceptually, barrier analysis is a straightforward process. The hazard which create the accident and energy transfer is identified and possible barriers are placed between the hazard and the target to prevent or reduce the likelihood of the accident occurring. The barriers are less than perfect or there are limitations to their effectiveness. Although different models could be used, it will work in terms of food storage.

From an organizational perspective, this chapter is divided into three major sections. Bacteria are the vectors or the agent of harm. Varmints are discussed as agents of harm also. Food preservation strategies and containers are examples of barriers. Food storage strategies are convenient stereotypes of how preppers prepare.

The prepper is the target. The bacteria or varmint are the hazard, harmful agent, or adverse environmental conditions. Food preservation strategies and containers are the barriers. Each method has limitations and weakness. Time limits on the preservation techniques suggest that they are less-than-adequate. The methods can be used in conjunction with each other to complement preservation strengths and extend

shelf life.

Figure 6.23 is the working table that identifies barrier analysis for an activity or program. In this case, the activity chosen was food preservation. First, the reader should choose their basic storage strategy. This sets the tone or parameters for the prepper's preparation. Next, the harmful agent or adverse environmental condition is selected (Column #1). The target is the prepper (Column #2). The potential barrier or in this case food preservation strategies are identified (Column #3). Its purpose or how it creates a barrier is identified (Column #4). The limitations or weaknesses of this approach are identified in the last column (Column #5).

The working table serves as a "Cliff Notes" for the chapter or a summary table of the chapter. Also, it serves to focus specific remedies toward identified disasters or crisis situations that the prepper has identified using the *Surviving the Unexpected Emergency Model*. The table provides a systematic approach toward protection. However, for most people it provides a way of thinking and toward approaching crisis situations. It asks the question of what can I do to protect myself from the potential injury, damage or loss.

Figure 6.23 Barrier Identification Table Activity or Program: Food – Rainy Day Strategy				
Energy Flow (Hazard) or harmful agent, adverse environmental condition	Target – Vulnerable person or thing	Barrier & Controls to separate energy and target	Purpose/ Prevention	Limitations
Varmints	Preppers	high-density polyethylene (HDPE) container	Separates by space food from varmints	Thick containers are more effective than thin containers.
	Preppers	Mousetraps	Kills small varmints	Although it doesn't directly protect the food supply, the traps indicate the presence of mice and other small varmint.
Bacteria	Preppers	Freeze-dried food	Limits growth of bacteria by limiting water content of food.	Needs can opener, water, stove matches, etc. to rehydrate food.
		Freeze-dried food stored in #10 cans	Prevents infiltration by bacteria and moisture	Prevents visual inspection of contents. Contain needs to remain intact with no creases, dents or rust.
Source: Adapted from Table 2 in NRI MORT User's Manual and Oakley (2003) by Kauffman and Moiseichik (2013)				

Summary

Food preservation can be reduced to three strategies. The three strategies are choosing the appropriate container, limiting factors which bacteria need to grow and multiply, and killing the bacteria outright. The first strategy of food preservation involves placing a physical barrier between the varmint or bacteria and the food being stored. Usually, a metal or heavy duty food grade plastic container will suffice as protection.

Bacteria need food, water, oxygen, and heat in order grow and reproduce. The second strategy is to limit one or more of these factors. Freezing and refrigeration lower the temperature of the food below a temperature where bacteria can grow and reproduce. Oxygen absorbers remove the oxygen needed for bacteria to grow and reproduce. Dehydration removes water from the food which retards bacteria growth.

The third strategy is to kill bacteria outright. If done properly in a storage container, the food can last a long period of time. Using boiling water, the canning process kills bacteria in the food stored in the can. Adding chemicals to the food either kills the existing bacteria present or retards the growth because of an inhospitable environment.

These food storage strategies are not mutually exclusive of each other and be used in conjunction with each other. Canning uses metal containers with sealed lids. The canning process kills any bacteria present. Since the can is full, oxygen is not present. Through the dehydration process freeze dried food removes water from the food and an element needed for bacteria to grow and reproduce. Freeze-dried food packaged in #10 cans has long-term protection and if packaged in an inert gas, bacteria are denied oxygen also.

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Chapter 7: Drinking Water ¹

Water is a unique compound (Figure 7.1). It is a molecule formed by one oxygen and two hydrogen atoms. The hydrogen atoms arrange themselves at an angle of 105°s to each other. The asymmetrical arrangement of the water molecule gives water some unique features. The water molecule has a slight positive charge created by the asymmetrical hydrogen atoms and a slight negative charge on the oxygen side of the atom. This feature of water makes it a universal solvent. When water freezes the molecules realign themselves into hexagons due to their electrical charge. This is why ice is less dense than water. If ice were not less dense than water, ice would sink to the bottom of the oceans and the oceans would become solid ice.

The adult human body is roughly 50% to 65% water. It averages around 57% to 60% water. Jokingly, it is said that the human body is a bubble of water swimming through a sea of air. Fish are a bubble of water swimming through a sea of water. Water is necessary for life. Deprived of water, people can survive three to five days, sometimes a week. In this respect, water is more important than food.

When viewed from outer space, Earth is the blue planet. It is the planet of water. Approximately, 70% of the earth's surface is covered with water. Most of it is sea water which is not potable. Only 2.5% of the world's total water is freshwater. However, only 1% of the freshwater is available with the majority of freshwater being locked up in glaciers and icecaps. Although Earth is the planet of water, very little of the water is available and potable for human consumption. This chapter focuses on obtaining potable drinking water in order to survive.

Without water, most people will live for several days. Without food, most people can live for several weeks. Contaminated water can make a person severely ill or even kill them. It is important to have a source of potable water for surviving the unexpected emergency. This chapter provides methods with which to obtain potable water.

Sources of Contamination

The EPA lists six sources of freshwater contamination. In general, there are five freshwater sources of contamination. These are aesthetic, biological, organic, inorganic, disinfectant and by-products and radionuclides. Each source of contamination is discussed below.

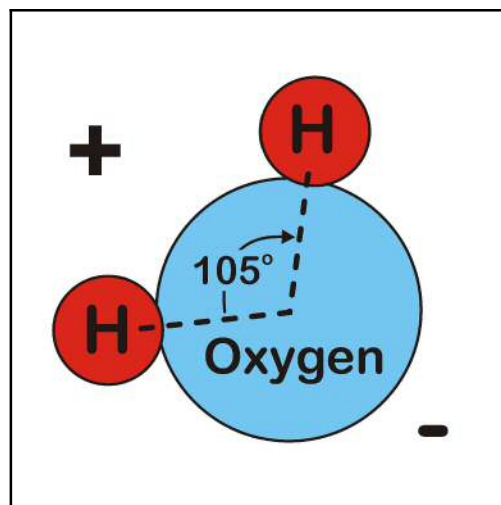


Figure 7.1: H₂O - Because of its asymmetrical bonding, the water molecule has many unique attributes. Source: author – [file:\WA-FreezingWater.cdr]

¹ This chapter was written by Robert B. Kauffman who is solely responsible for its content. This chapter is copyrighted © Robert B. Kauffman, 2015.

Aesthetic – This category includes offensive taste and odors from either unnatural or natural sources. It includes particulate matter such as sand, mud, or other sediment. Sulfur water from a well is drinkable but has a bad taste and odor. Unless, there are other contaminants present, this water is drinkable. Sediments can be filtered or settled out of the water. Chemicals can be added to sulfur water to make it more palatable. The addition of iodine to the water neutralizes the sulfur in sulfur water.

Biological – Pathogens are micro-organisms including bacteria (E. coli, Salmonella, Legionella, Shigella, etc.), viruses (e.g. Hepatitis, etc.) and parasites (e.g. Giardia, tapeworms, etc.). Typically, bacteria ranges from one to ten microns in length and 0.2 to 1 micron in width (Bacteria and Virus Issues, 2016). Roughly 100 times smaller than bacteria, virus range from 0.004 to one micron in size. Protozoan cysts such as Giardia are typically 2 microns to 50 microns in size and can typically be removed with fine filtration.

Organic and Inorganic Compounds – Organic compounds are compounds composed of carbon. In general, organic compounds refer to organisms that are or were alive. Dead or rotting animals are a source of organic compounds in the water. Organic compounds can also include other carbon based chemicals.

Inorganic compounds refer to all other chemical compounds that were not alive and/or non-carbon based substances. These include pesticides, herbicides and chemicals of all sources. Household products include cleaners, gasoline, herbicides, pesticides, charcoal lighter, paints, paint cleaners, etc.

Disinfectants and by-products – These are by-products of sewage treatment plants. Generally, they are not our focus.

Radionuclides – This is a specialized group of contaminants associated with radioactive fallout from a nuclear conflict or meltdown of a nuclear reactor.

Purification Strategies

In general, there are three strategies used to obtain drinkable water. These are *avoid the contamination*, *remove it*, or *kill it*. Storage of potable water or selecting a site without contamination are examples of avoiding contamination. Filtering or distilling water are examples of removing contamination. Boiling water, iodine, or UV lamps are examples of killing the contamination. The next section discusses sources of contamination. Not all methods of purification work on all types of contaminated water. For example UV lamps are effective in killing pathogens but are ineffective against organic or inorganic compounds.

Generally, there are six methods of water purification (Figure 7.2). These are discussed in more depth in the following sections. In addition, water storage is discussed although technically it is not a water purification method. Regardless, it is a strategy for obtaining or having potable water. Disinfectants and by-products was not included because these sources of pollution are usually associated with sewage treatment plants.

Figure 7.2: Summary Table of Purification Methods		
Purification:	Eliminates:	Doesn't Affect:
1. Boiling	Pathogens	Organic and Inorganic, Radionuclides
2. Filtering	Pathogens	Organic and Inorganic, Radionuclides
3. Chemical	Pathogens	Organic and Inorganic, Radionuclides
4. Distilling	Pathogens, Organic and Inorganic, Radionuclides	na
5. Reverse Osmosis	Pathogens, Organic and Inorganic, Radionuclides	na
6. UV Light	Pathogens, Organic	Inorganic, Radionuclides

Water Storage – Storing water is a strategy of avoidance. Tap water is treated water. Depending on circumstances, the shelf life of water can be indefinitely. Bradley (2011, p.93) recommends storing water in FDA-approved DOT #34 opaque containers. Storing water out of sunlight reduces the likelihood of algae and bacteria growth. The opaque container reduces the likelihood of algae and bacteria growth also. Store away from pesticides, gasoline, paints and other solvents. Pre-treat water with a water stabilizer which is normally stabilized sodium hypochlorite (Figure 7.3). Most experts recommend rotating or replacing the water every six months.

A counter viewpoint is that prudently stored water will last indefinitely. Tap water is treated water. Non-contaminated water sealed in a container will remain uncontaminated for as long as the container remains unopened and sealed.

Stored water will last most people through most short-term crisis situations. It is helpful to examine the type of disasters presented in the *Surviving the Unexpected Emergency Model*. For example, if the reader's home is prone to flooding, stored water should be stored above the expected flood levels. To store the water in the basement where the stored water can become contaminated by flood waters is to compromise the stored water. If there is any doubt, purify the water.

For planning processes, a rule-of-thumb is a gallon of water per person per day (Figure 7.4). A gallon of water weighs roughly eight pounds. Two liter soda bottles can be used for water storage. Two two-liter soda bottles equals a gallon of water. Divide the number of bottles by two and the number of days of water is calculated for one person.

Common storage containers include recycled two-liter soda bottles, commercially purchased water bottles (see Figure 7.5), five and six gallon camping water containers (Figure 7.5), five gallon emergency containers (Figure 7.6), and barrels (Figure 7.7). Emergency containers will be discussed in a later section in this chapter.



Figure 7.3: Stabilizer – Water preserver is a stabilized source of sodium hypochlorite. Source: internet – [file:\WaterTreatment[40].jpg].

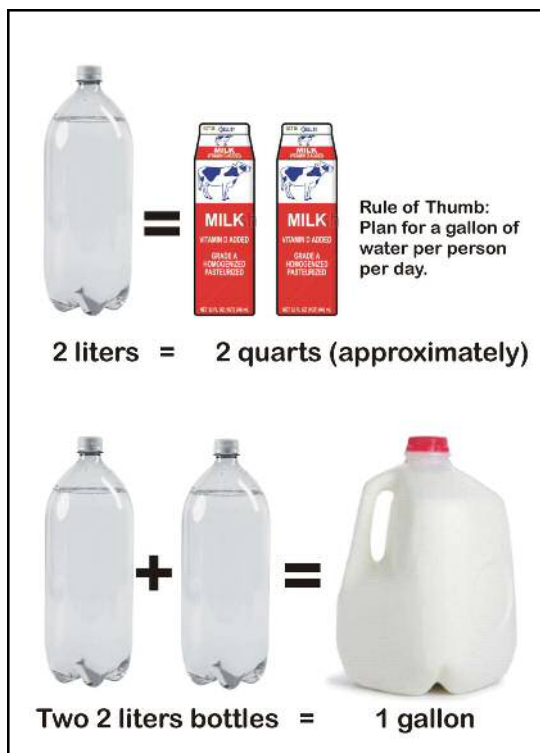


Figure 7.4: Two Liter Containers – Two two-liter soda bottles equals a gallon of water. A gallon of water weighs roughly eight pounds. Plan on a gallon of water per person per day. Source: author – [file:\WA-LiterBottles.cdr].



Figure 7.7: Five Gallon Emergency Containers – Commercially purchased five-gallon containers provide convenient stacked storage. Remember, each full container weighs 40 pounds. Source: internet – [file:\FiveGallonWaterContainers.jpg]



Figure 7.5: Commercially Purchased Water Bottles – For short-term situations, liter bottles of water are a practical storage method. Source: internet – [file:\StoredWaterBottles.jpg]



Figure 7.6: Five and Six Gallon Camping Jugs – Five and six gallon water containers line the canoes on a eleven day backcountry trip in the brackish water of the Everglades. Source: author – [file:\DSC_0056.jpg]



Figure 7.8: Barrels – Polyethylene barrels provide high volume water storage. Remember, a 55 gallon drum of water weighs 440 pounds. Source: internet – [file:\WaterStorageBarrels.jpg]

Boiling – Boiling water kills all pathogens forms of pollution (Figure 7.9). As a rule, bring the water to a “*rolling boil*” for one minute. After the water reaches a rolling boil for one minute, all pathogens are normally killed. Boiling water doesn’t remove particulate matter. Nor does it remove organic and inorganic pollution or radionuclides.

After reaching a rolling boil, allow the water to cool naturally. The container of water can be placed in a stream or lake to augment its cooling. If the water tastes flat, shake it. This will aerate the water. A disadvantage of boiling water is that it is energy consumptive. It takes a lot of energy to boil a small amount of water. The campfire pictured provides large amounts of inexpensive energy.

Filtration (Figure 7.10) – Filters use paper, ceramic, or other substances to filter out unwanted particulate and pathogens from contaminated water. The pump pictured in Figure 7.10 is a typical camping pump filter that pumps the water through a 0.2 micron ceramic filter. Used alone, the pump will protect against bacteria and protozoa cysts such as *Giardia*. It will not provide protection against viruses. Also, filtration is ineffective against organic and inorganic and radionuclides contaminations.

Often the literature differentiates between filtration and purification. Filtration is a strategy of removing the contamination. Generally, purification focuses on killing the contamination. The two methods often complement each other and are used in concert with the other.

Also, when choosing a site for filtration, choose a site that will most likely be free of contamination (i.e. avoidance). Water taken out of the center of a lake is less likely to be contaminated than water from a stream. Muddy or dirty water will require more frequent cleaning of clogged filters also.

Chemical Disinfectant (Figure 7.11 and Figure 7.12) – The purpose of chemical purification is to kill contaminants in the water. On the periodic table, generally, one of the halogens or salt producing elements is used. There are five halogens: fluorine (F), chlorine (CL), bromine (Br), and iodine (I), and astatine (At). Most commonly used halogens are chlorine and iodine. Bromine has seen some use in



Figure 7.9: Boiled Water – Bring water to a rolling boil for one minute. All pathogens will be destroyed. Source: internet – [file:\BoilingWater.jpg]



Figure 7.10: Water Filter – The hand pump pumps the unfiltered water through a ceramic filter. Source: author – [file:\WA-Pump03.jpg]

purifying swimming pool water.

Chlorine is effective against most diarrheal producing diseases. Against bacteria such as *E. coli*, it is highly effective (The Safe Water System – Chlorine, 2012). Against viruses such as Hepatitis A, the use of chlorine is rated as moderately effective. In contrast, protozoa such as *Giardia* are much more resistant (i.e. highly) to chlorine. In the case of protozoa such as *Giardia*, consider using a complementing strategy to obtain potable water. First, select water that is unlikely to contain the cyst. Next, use good filtration in case the cyst might be present. Then finish off purification with the use of a chemical disinfectant. Respectively, these complementing strategies are ones of avoidance, removal, and killing the *Giardia* cyst.

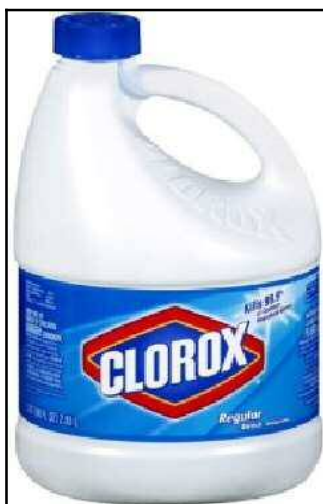


Figure 7.11: Clorex ® – Clorex is chlorine bleach and can be used to purify water.
Source: internet – [file:\ClorexBottle[38].jpg]



Figure 7.12: Iodine – The bottle contains iodine crystals. The bottle is filled with water. The iodine is water soluble. The water is poured into the container of water. Source: author – [file:\WA-Iodine03[92].jpg].

If using chlorine bleach add eight drops or 1/8 tsp per gallon of water. Double the amount of drops for cloudy or turbid water (i.e. 16 drops or 1/4 tsp per gallon of water). Letting the water sit for 30 minutes prior to drinking it will allow sufficient time for the bleach to work. If there is any doubt, allow 60 minutes or one hour.

Distillation – Distillation is the process of heating water (Figure 7.13). The water vapor is cooled and condenses back into a liquid. Distillation is a good method for filtering out organic and inorganic substances. A disadvantage is that it is a slow process. For those familiar with whisky stills, it is the same distillation process.

Reverse Osmosis – Osmosis is the process of equalizing concentrations on both sides of a semipermeable membrane where the molecules of a solvent pass through the membrane from a less concentrated or dense solution into the more concentrated or dense solution. This is the problem with drinking sea water. The denser saltwater in the intestines draws freshwater out of the body and through the semipermeable membrane of the intestine to dilute or make less dense the saltwater in the intestines. This osmotic process can lead to dehydration and death.

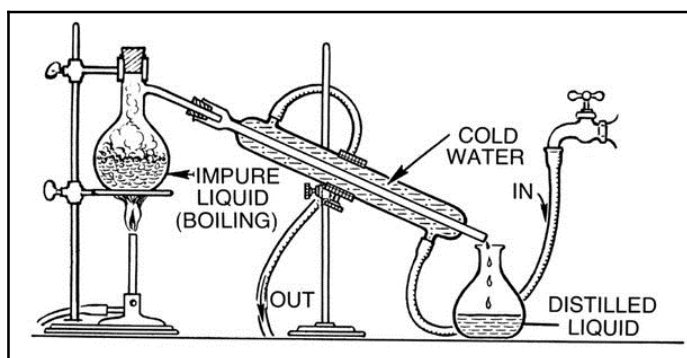


Figure 7.13: Distillation – The liquid is boiled and the steam is condensed back into water as it cools leaving the pollutants behind. It is a slow but effective process. Source: internet – [file:\Distillation[85].jpg].

Reverse osmosis is the process of forcing a more concentrated solution through a semipermeable membrane into the less concentrated solution. The process is useful to remove virtually all impurities from the water. Also, it can be used to remove radionuclides. The downside of the process is that it consumes large amounts of water to produce small amounts of water.

UV Light (Figure 7.14) – Ultra violet light kills micro-organisms including pathogens, bacteria and viruses. The short-wave length light disrupts the cell functions. It is not effective against organic and inorganic or radionuclides contaminations. For UV filtration to work effectively, the water needs to be exposed to the UV light for a sufficient amount of time. Turbidity decreases the effectiveness of UV radiation and increases the time required to expose water to UV radiation. Typically, the UV radiation is emitted from a florescent light bulb. The bulb requires electricity. Camping versions require batteries to use.



Figure 7.14: UV Light – UV light is a short wave length light that disrupts pathogens, bacteria, and viruses. Source: author – [file:WA-UVlight01.jpg]

Disaster/Environment Influence

When considering the method of water purification or storage, consider the types of disaster or crisis situations most likely encountered. Two examples are provided to illustrate this consideration.

Water Contamination from Flooding (Figure 7.15) – Floods introduce numerous sources of contamination to the water. Flooding could be due to hurricanes or rivers flooding. Petrol chemicals from cars create inorganic contamination. Raw sewage from septic systems and centralized sewage systems create organic contamination. Trash, chemicals, insecticides, etc. stored in garages create inorganic pollution. All forms of water contamination other than radionuclides contamination can easily be present during floods. As a general rule, water storage is a good strategy and the water needs to be stored in a location above the flooding waters.

Giardia (Figure 7.16) – Although Giardia is a protozoan associated with beavers, it can be transmitted to humans through contact with feces where the cyst lies dormant in the soil or on surface of foods that have come in contact with the cyst. It is associated with beavers because the cyst is excreted by the beavers into streams where the seemingly crystal clear drinking



Figure 7.15: Water Contamination with Flooding – Floods introduce numerous sources of pollution. Petrol chemicals from cars. Raw sewage from septic systems or centralized sewage systems. Trash, chemicals, insecticides, etc. stored in garages. Source: internet – [file:Flood01[54].jpg]

water becomes contaminated with the cyst.

Normally, Giardia is a recreational illness associated with backcountry use and beavers (Figure 7.17). Although a one micron filter is recommended, the two micron filters used in most backcountry filters and pump filters will suffice (see Figure 7.9). Consider supplementing filtering with chemical or UV purification also. Also, more vigilance is needed when there are signs of beaver habitat. Again, water taken from the middle of a lake is less

likely to be contaminated than water taken from a stream where beaver sticks are found floating next to the shore (i.e. beavers eat the bark off the sticks for food.).

When human or infected animal's feces is used for fertilizer, the dormant cyst can be transmitted through the soil or through foods coming in contact with the cyst bearing soil. Although this tends to be a third world concern, it can occur in this country where feces are used as fertilizer. In these situations, food and hands require proper washing.

Emergency Water Storage

This section investigates sources of tapping into water sources in the house prior to a crisis situation. The main problem with most of these methods is making the decision to use them prior to the pending crisis. If people wait until the emergency crisis and the water becoming contaminated, it is of little avail to fill a bathtub with potable water.

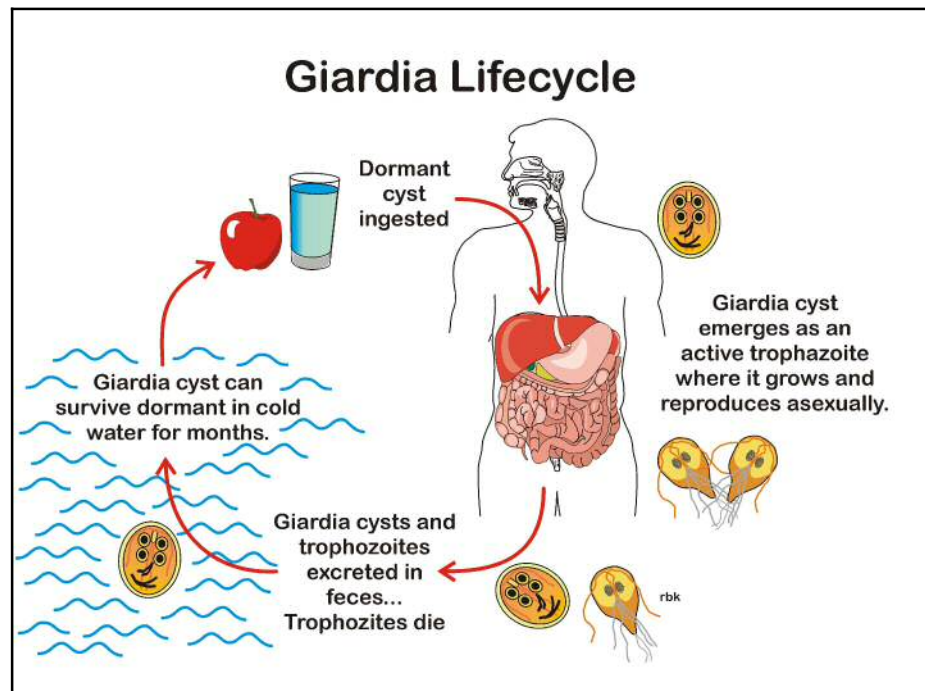


Figure 7.16: Life Cycle of Giardia – Although Giardia is usually associated with beavers and drinking water, the protozoan can also be transmitted through the soil and other means. Source: author – [file:\WA-Giardia.jpg].



Figure 7.17: Beaver Habitat – For backcountry users, Giardia is usually associated with beavers and drinking unfiltered and purified water. Source: author – [file:\Beaver-002[gd].jpg]

Five Gallon Buckets – Having several five-gallon bucket available can be used to quickly store water in case of an emergency. One five-gallon bucket is enough water for one person for five days. Remember, it will weigh roughly 40 pounds.

Bathtub – The standard bathtub can hold between 35 to 50 gallons of water. Soaking tubs can hold between 60 to 80 gallons of water. Filling an unlined bathtub has three disadvantages. First, the bathtub may not be sanitary. Second, most drain plugs are not perfect seals and will slowly drain over a short period of time. Third, the bathtub does not normally fill past the overflow drain.

There are commercially available bathtub liners or bags that use the bathtub to provide structural support for the liner or bag (Figure 7.18). In addition, the bag may come with a hand pump or siphon to withdraw the stored water. As with most of these emergency devices, the issue is when to use the bag in time of a crisis. Also, a false alarm can be problematic since the bag may not be designed to easily drain the water if it is not needed.

Water Heaters – Most homes have a water heater that stores up to 40 gallons of potable water. Initially, it may be hot water, but it is drinkable water. Be sure to turn the water heater off. All water heaters have a faucet to drain the water heater. The faucet contains threads that allow a garden hose to be connected to the water heater for draining purposes (Figure 7.19). If needed trim a short length of garden hose to facilitate draining. Also, if the water coming into the house could be contaminated, turn off the main water line coming into the house.

Toilets (Figure 7.20) – The tank of the toilet contains what is usually potable water. Today, it is more of a novelty source than a practical source of water. Older toilets contained three and one half, five, or even seven gallons of water. Although today's toilets flush with 1.6 gallons of water, they hold more in the tank than 1.6 gallons but less than what they used to hold. Remember, the water in the toilet bowl is contaminated and should not be used. Also, some experts suggest that the water in the tank should be used with caution because it can contain mold and other contaminants. If there are any questions, purify the water.



Figure 7.18: Bathtub Liner – The bathtub liner uses the bathtub as the structural form for the liner. The liner is really a bag that is filled with water in time of crisis. Source: internet – [file:\BathtubLiner[40].jpg].



Figure 7.19: Drain Faucet – The drain faucet on a hot water heater. Note that it threaded to couple a garden hose to it for draining purposes. Source: internet – [file:\DrainFaucet[40].jpg].



Figure 7.20: Toilets – Depending on the age of the toilet, the tank may contain three to five gallons of potable water. Some experts suggest treating the water regardless. Source: internet – [file:\WA-Toilets.cdr].

Water Pipes – Depending on the size of the house and the amount of water pipes, the water pipes in a house can easily contain up to 2.5 gallons of water. Again, turn off the water main coming into the house if there is potential water contamination of the water supply. Drain both the cold water and hot water pipes into bottles as needed or until drained. A sink in the basement with a faucet can easily do this. To facilitate quicker draining open a sink faucet on the second floor.

Waterbeds – A king sized waterbed holds roughly 235 gallons of water. A queen sized waterbed holds roughly 196 gallons. Treat the water as if it is untreated.

Swimming Pools – If the pool is properly treated and filtered, its water can be considered potable. If the pumps have stopped or if the pool has become inoperative, consider the water as untreated. A child's inflatable pool can be used to store water also.

Ponds (Figure 7.21) – Consider the water as untreated and purify it using the same methods that would be used for treating water from streams or other natural sources.

Cisterns (Figure 7.22) – A cistern is used to collect rain water and to store it for some time of use. The surface of a roof multiplies and concentrates water collection. In normal sustainability situations, water from cisterns is used to water plants and used for non-potable water situations. However, in times of emergency crisis, water stored in a cistern can be used for consumption if it is purified.

Dew Collection – In the morning, dew can be collected using a towel or rag. Wipe the dew until the rag is saturated. Wring out the rag into a container. Repeat the process. Bradley (2011) notes that this can be a relatively efficient method to collect water. Treat the water collected as untreated water.



Figure 7.21: Ponds – Ponds can provide a source of water. Treat it as non-potable water. Source: author – [file:\DSC_0122[20].jpg].



Figure 7.22: Cisterns – Cisterns are used to store water. Often they collect water from the roof of a building. Source: author – [file:\WA-Toilets.cdr].

Solar Stills (Figure 7.23) – Using the sun as the heating source, solar stills utilize the greenhouse effect and the distillation process to purify water. The solar radiation passes through the polyethylene and heats whatever water bearing material is present in the still. The water condenses on the polyethylene and drips into the cup or container. The hose is useful because once the seal is broken, the still needs to be reestablished.

Bradley (2011) is not a fan of the process. It works better in theory than practice. This author last attempted to use a solar still numerous years ago as a Boy Scout. It requires full sunlight and semi-specialized equipment to work. As noted, it works better in theory than practice.

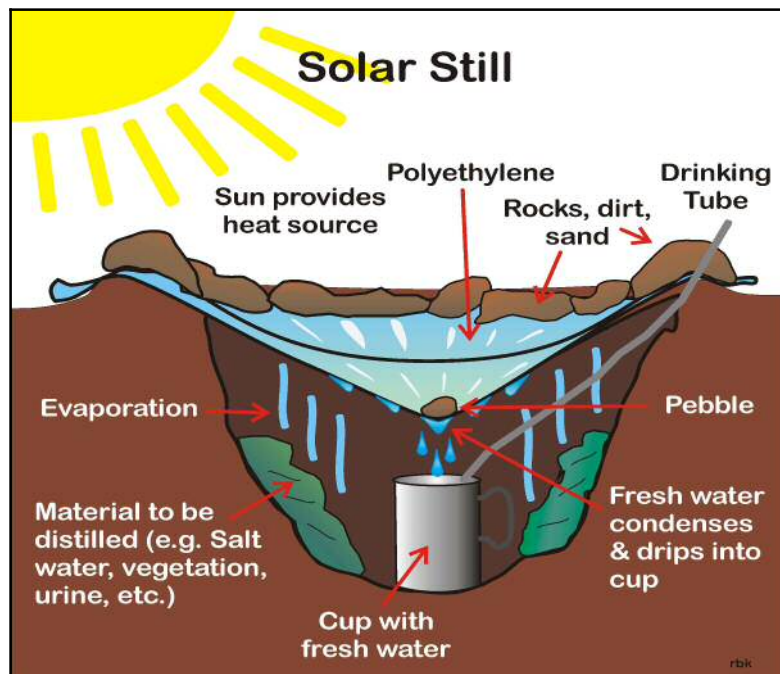


Figure 7.23: Solar Stills – Solar Still can work under the right conditions. They need the materials pictured to create the still. Source: author – [file:\WA-SolarStill.cdr].

Barrier Analysis

Chapter 4 introduced the concept of Barrier Analysis (Figure 7.24). Conceptually, barrier analysis is a straightforward process. The hazard which create the accident and energy transfer is identified and possible barriers are placed between the hazard and the target to prevent or reduce the likelihood of the accident occurring. The barriers are less than perfect or there are limitations to their effectiveness.

From an organizational perspective, this chapter is divided into four sections. Sources of contamination and the influence of disasters constitute the hazard, harmful agent, or adverse environmental condition that can lead to the energy transfer. The purification strategies and emergency water sources constitute barriers to contaminated drinking water. They are less than adequate (LTA).

Figure 7.24 is the working table that identifies barrier analysis for an activity or program. In this case, the activity was chosen for drinking water during a flood. Other relevant disasters could be chosen also and a working table applied to them. Second, the energy flow (hazard) harmful agent, adverse environmental condition is identified. In this case sources of contamination were limited to flood situations. It was divided into pathogens and organic and inorganic contamination. If desired, pathogens could have been subdivided into viruses, bacteria and protozoa. This would allow for a more exacting analysis of potential barriers. Also, it results in redundancy since water storage can be used as a barrier for viruses, bacteria, and protozoa protection. Next, the target is identified in the second column which in this case is an unchanging prepper. Fourth, the barriers and controls are identified in the third column to separate the energy from the target. In the last two columns of the table, the table identifies how the barrier works and the limitations of the barrier or how it is less than adequate.

The working table serves as a “Cliff Notes” for the chapter or a summary table of the chapter. Also, it serves to focus specific remedies toward identified disasters or crisis situations that the prepper has identified using the *Surviving the Unexpected Emergency Model*. The table provides a systematic approach toward protection. However, for most people it provides a way of thinking and toward approaching crisis situations. It asks the question of what can I do to protect myself from the potential injury, damage or loss.

Figure 7.24: Barrier Identification Table				
Activity or Program: Drinking Water – Flooding				
Energy Flow (Hazard) or harmful agent, adverse environmental condition	Target – Vulnerable person or thing	Barrier & Controls to separate energy and target	Purpose/ Prevention	Limitations
Pathogens	Preppers	Water Storage	Separates water by space from hazards	Maintenance and storage space requirements need to be above flood waters.
	Preppers	Rolling boil of water for one minute	Kills pathogens in the water	Doesn't affect organic or inorganic contamination which is likely too be present. Stove may not be operable. Campfire maybe impractical.
	Preppers	UV Light	Kills pathogens in the water	Doesn't affect organic or inorganic contamination which is likely too be present. Needs electricity or batteries. Electricity may not be available
	Preppers	Pump water using two micron filter	Separates (filters) pathogens from drinking water	Doesn't affect viruses, organic or inorganic contamination which is likely to be present in flood waters.
Organic and Inorganic Contamination	Preppers	Water Storage	Separates by space the target from the contamination	Maintenance, storage space, water rotation, Specific source of contamination (e.g. flood, tornado, etc)
	Preppers	Distillation	Separates by distillation process contaminate and water	It is a slow process requiring specialized equipment, and a cooling source.
	Preppers	Reverse Osmosis	Separates by reverse osmosis organic and inorganic contamination	It requires large amounts of water which in a crisis situation may not be available.
Source: adapted from Table 2 in NRI MORT User's Manual and Oakley (2003) by Kauffman and Moiseichik (2013)				

Summary

Water is necessary for life. A rule of thumb is that people need one gallon of water per person per day. Different sources of contamination and strategies of purification were discussed. Storage of water is a simple and effective strategy. Water heaters and toilet tanks can be used as water sources if needed, particularly in short term crisis situations. Water sources can easily be contaminated by the type of disaster present (e.g. flooding). Or it can be unaffected. Determine the most likely crisis situations and this will help to determine the strategy used. Use barrier analysis to help structure prevention strategies.

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Chapter 8: Sanitation and Hygiene ¹

This chapter focuses on sanitation and hygiene factors for preppers. Its primary focus is on the disposal of human effluent. On average a person produces 128 grams or a little over one quarter of a pound of fecal matter a day. Fecal matter is nutrient rich and eventually it is converted into compost by bacteria and microorganisms where its nutrients are recycled into the soil. It is a matter where and how this decomposition occurs. Unfortunately, fecal matter is also a source of disease that can be transmitted to other people if care is not taken.

For preppers, there are essentially three approaches to disposing of human effluent. The first method is to decompose it onsite. The hot and cold composting approaches are examples of this approach. The second approach is to store it and transport it to another site where it is decomposed. The vault systems typify this approach. The third approach is to flush it where it is transported to another site for decomposition. There is no onsite storage of the human effluent. Central sewage treatment plants exemplify this approach.

For most preppers, disposal of human effluent is determined by the existing facilities being used, whether those facilities work, and the length or duration of the crisis situation. For homesteaders using a composting toilet or outhouse, most likely continue using their outhouse or composting toilet in a crisis situation. People on a septic system will most likely continue using their septic system during a crisis situation. However, they may need to add an external water source to operate the system. People on central sewage will use it as long as it works. When any of the systems normally used become inoperative, alternative approaches are needed.

This chapter discusses the three disposal methods. Each section provides a basic understanding of how the disposal system works and how to use it in an emergency situation. The last section focuses on hygiene factors which can be used to reduce fecal disease transmission.

Principles of Disposal

This section focuses on categorizing and describing the three basic disposal approaches. Eventually, fecal matter is broken down and eaten by bacteria. The issue is how and where it is done. Where it occurs focuses on whether it is done in the backyard or onsite or in a sewage treatment plant? How it is done focuses on hot composting, cold composting or storing it in a tank for later disposition. The other concern involves the byproducts or harmful substances remaining from the decomposition process. There are two types of composting: hot and cold composting. The alternative is that the waste products are held in a storage tank until they are disposed of at a later date.

Composting (Figure 8.1) – In order to compost, a proper environment needs to be created in which bacteria and microorganisms can thrive and consume the fecal matter. First, there needs to be *food* present for the microorganisms to consume. This can be any decaying organic substance. For this

¹ This chapter was written by Robert B. Kauffman who is solely responsible for its content. This chapter is copyrighted © Robert B. Kauffman, 2015.

discussion, the primary food source is human effluent. Because it is human fecal matter, care needs to be taken to prevent diseases from being transmitted to others.

Second, there needs to be **microorganisms** and **bacteria** present. These microorganism are naturally found in the soil and provided with the right environment they will thrive and reproduce.

Third, bacteria needs **water** to thrive or better stated it needs a damp and moist environment. Often, saw dust, peat or similar water absorbing substances are added to absorb the water. When the compost pile is sitting in water, the pile is denied oxygen and an aerobic bacterial action.

The fourth element is **oxygen**. Bacteria need oxygen to consume the food source. It may be necessary to periodically turn the compost pile to ensure complete digestion of the compost and to ensure oxygen is present.

Fifth, composting needs **heat** to start the reaction. Composting is an exothermic reaction which produces heat as a byproduct. In hot composting, there is sufficient food present (feces or other materials present) that the heat produced from the consumption of the food results in sufficient heat to stimulate the bacteria to reproduce and consume even more food. This creates a chain reaction of reproduction and consumption. In order to facilitate the bacterial action, an external heat source may be applied to the compost pile. This could be sunlight or an electric heating element.

Cold Composting – Usually, the food supply (i.e. decaying material) is the limiting factor which results in a much slower decomposition of the food material. It is still an exothermic reaction, but not as noticeable as in hot composting (see next section). Normally, the limited heat generated is not hot enough to kill pathogens. Outhouses, pit privies, catholes, and composting toilets are examples cold composting toilets. As a rule, the food source in a outhouse and pit privy is added intermittently. This tends to limit the food source and the potential for hot composting.

Although cold composting is usually associated with third world countries, many of the same issues face those in this country which are composting fecal matter as part of homesteading or because they are living in a more primitive setting due to a crisis situation. Consideration needs to be given to passing fecal borne diseases through the soil, water, and poor hygiene practices. Hygiene practices are covered in a section toward the end of this chapter.

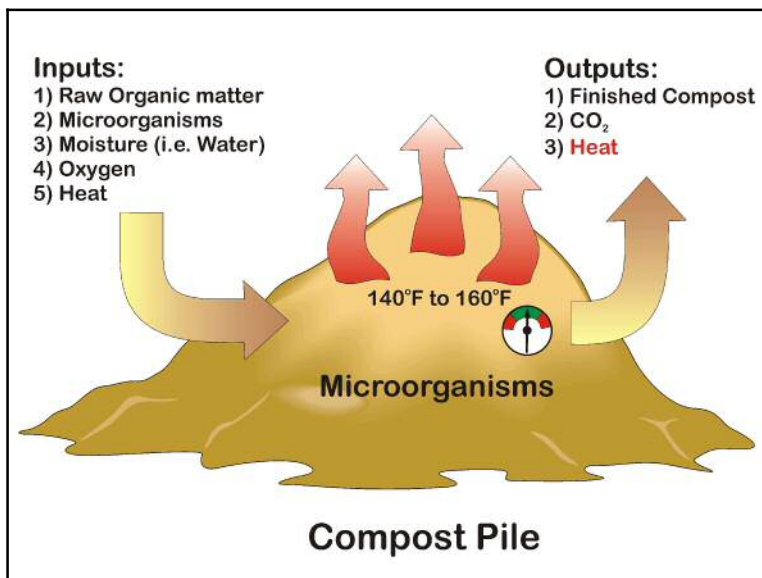


Figure 8.1: Compost Pile – A compost pile needs food, moisture, oxygen, and heat for the microorganism to thrive and reproduce. Source: internet – [file:\CompostPile[96].jpg].



Figure 8.2: Dry Composting Toilet – This scene depicts a dry composting toilet in a third world setting. Source: internet – [file:\DryComposteToilet[120].jpg].

Fecal borne diseases can be transferred from compost back into the soil and transferred to vegetables grown in the soil. Plants grown in the soil like potatoes or vegetables that come in contact with the soil can be contaminated. Figure 8.2 presents a typical dry composting situation used in third world countries. It is easy to see how human borne diseases can easily be passed on to other people through the soil and garden.

View the diagram in Figure 8.2 from a risk management perspective and placing barriers between potential hazards and the target. First, the cistern collecting water from the roof is uphill from the toilet and compost area. This reduces contamination by space. In the toilet, any leaching of protozoa, viruses and bacteria is downhill of the cistern. From a risk reduction standpoint, the location of the cistern reduces the likelihood of contamination of the water source. However, the toilet as pictured could be a problem with contaminating the garden.

The toilet is not far from the kitchen. The close proximity enables flies and other varmint to potentially contaminate the activities occurring in the kitchen. Good hygiene and sanitation practices are necessary to reduce contamination.

The next concern involves the compost used in the garden. Since the composting process is a cold composting process, pathogens may not be killed. Several barriers can be used to prevent or reduce contamination. The compost can be used only in those areas of the garden with vegetables bearing vegetables above ground. This separates the potential contaminants by space. Next, the vegetables can be thoroughly washed and clean to remove potential contaminants. Or third, the compost can be used in

other non-garden areas where the transmission of contamination is less likely (e.g. flowers).

In summary, cold composting generally occurs where there is an intermittent addition of a food source (e.g. fecal matter). Generally, several people contributing intermittent contributions is not sufficient to create a hot composting situation. Traditionally, cold composting is associated with outhouses, catholes, pit privy, and similar disposal methods.

Hot Composting (see Figure 8.1) – In hot composting, there is sufficient food (feces or other materials) present for the bacteria to reproduce and consume even more food. The exothermic reaction and heat produced can be felt and seen. Normally, a temperature range between 140°F to 160°F is desirable (Rodale's Organic Life, 2013). This is sufficient heat to kill most weeds and diseases that might be present.

In the literature, there is little to no emphasis on hot composting. The strategies focus on either cold composting or storage for transport and disposal at a later date and location. The limiting factor for hot composting is having a sufficient food supply for the microorganisms. The storage method can be used in conjunction with the hot composting method. Storing wastes in five-gallon buckets provides a sufficient food supply for hot composting. The fecal matter and urine can be combined with sawdust or other organic matter to create a hot composting compost pile that will kill the pathogens present.

In an outdoor recreation setting, the Appalachian Mountain Club (AMC) developed a technique of using a vault toilet system using a 55-gallon drum to store the fecal matter (Figure 8.3). The effluent was mixed with sawdust and placed in a pit composter (Figure 8.4). With the aid of sunlight which provide some heat, the fecal matter experienced a hot compost pile. This approach can easily be applied to moderate or long-term survival situations where the fecal matter is stored and then disposed of locally in a hot compost pile. This author has constructed hot compost piles. Although he has not constructed a compost pile with five or ten gallons of fecal matter and urine, if properly



Figure 8.3: Pit Composter – People defecate into a 55 gallon drum. The drum is removed from the outhouse and mixed with sawdust in Figure xx0836 where it undergoes hot composting. Source: author – [file:\cc51 pit toilet01.jpg] |>Source: author – [file:\cc51 pit toilet01.jpg].



Figure 8.4: Pit Composter – People defecate into a 55 gallon drum. The drum is removed from the outhouse (Figure xx0837) and mixed with sawdust where it undergoes hot composting (i.e. this picture). Source: author – [file:\cc52 pit toilet02.jpg].

combined with organic matter such as saw dust to absorb the urine, there is no reason why this method shouldn't work well in producing uncontaminated compost.

Storage – Traditionally, the storage method stores fecal matter and urine for transportation and disposition at a later date. Usually, it is transported to another site where it is properly disposed. As noted in the previous section, the effluent can be stored and hot composted onsite. However, this is not the mainstream recommendation in the literature. As noted, the effluent can be stored and hot composted onsite. Examples of traditional storage methods covered in the following sections include vault and chemical systems.

Flush It Approach – The last strategy of waste disposal is to flush it to another site (i.e. transport) where it is disposed of in a suitable fashion. There is no short-term or long-term storage of the human effluent before transport. Centralized sewage treatment plants epitomize this approach. Septic systems are also included in this category.

Composting Toilets

Most of the disposal methods discussed below utilize a cold compost approach. As noted with this method of composting, the temperature of the compost pile is below that needed to kill most pathogens. Therefore, the compost should not be used with food sources that could become contaminated. Also, it is important to take appropriate hygiene practices including proper washing of hands.

Dry Earth Toilets (Figure 8.5) – In the mid-1800s two strategies emerged for dealing with fecal material. These were the dry earth and flush toilets. The dry earth toilet was patented in 1860 by Henry Moule, an English clergyman. It is not a true composting toilet. It has more in common with cat litter boxes where the feces is covered with peat or earth. Over time, the dry earth toilets lost out to flush toilets.

In an emergency, a cat litter box filled with cat litter can be used. The feces can be rolled in the cat litter, scooped, bagged

Figure 8.7: Composting Toilet – The modern composting toilet is not much different from the standard flush toilet in appearance. Source: internet – [file:\CompostToilet[32].jpg].



Figure 8.5: Dry Earth Toilet – Patented in 1860 by Henry Moule, the dry earth toilet was the forerunner of WAG bag and composting toilet. Source: internet – [file:\DryEarthToilet[53].jpg].

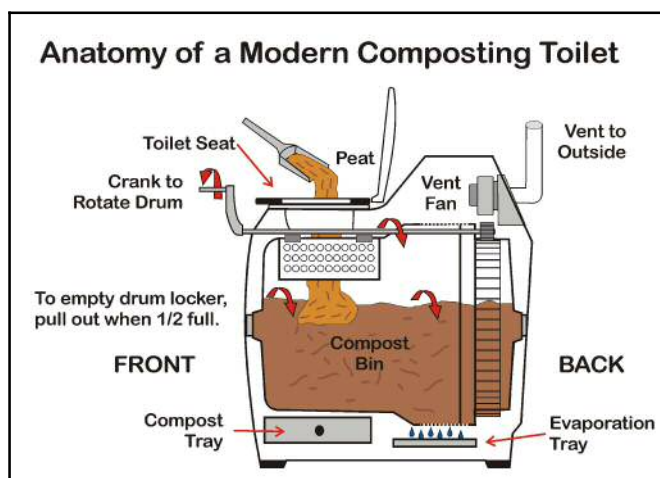


Figure 8.6: Anatomy of Modern Composting Toilet – The diagram shows how the modern composting toilet works. Source: author – [file:\CompostingToiletDiagram[63].jpg].



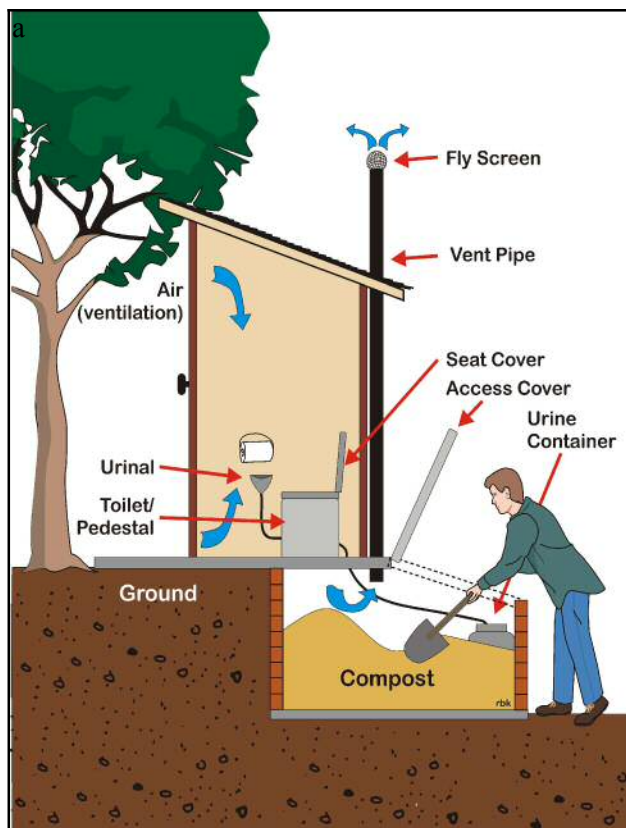


Figure 8.8: Composting Toilet Diagram – The diagram shows how a typical outdoor composting toilet works. It may look like a vault system, but it is really a septic system. Source: author – [file:SA-CompostToilet[144].cdr].

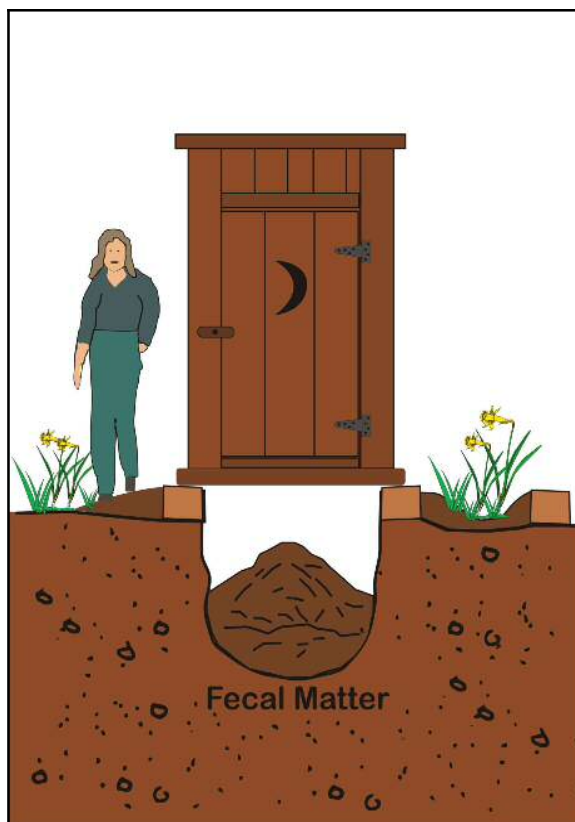


Figure 8.9: Outhouse – The outhouse and its variations are a cold composting method of composting the feces. Source: author – [file:\Outhouse[144].cdr].

not working, it can be buried outdoors or stored for future disposal.

and sealed. Assuming the flush toilet system is

Composting Toilet (Figure 8.6 and Figure 8.7) – The modern composting toilet uses a cold composting method to compost feces. It is an updated and modernized version of the dry earth toilet where it actually composts the feces. Again, the compost can be recycled. However, caution should be used in recycling it in a garden producing food.

Figure 8.8 presents a more traditional version of the composting toilet. Its variations are used by homesteaders and third world countries where human compost is recycled and used to fertilize gardens. Unlike the outhouse, purposeful cold composting occurs. The the compost can be turned and organic matter can be added to absorb the urine and to aid in the composting. Or the urine can be collected separately and disposed of separately from the compost pile. This helps to keep the pile moist but not saturated with water.

In a crisis situation, composting toilets functions no differently than they do under normal circumstances. The only difference is that there is a crisis situation.

Outhouse (Figure 8.9) – With the half-moon on the door, the outhouse is the classic cold composting method to deal with effluent. A hole is dug in the ground and the feces and urine fill in the hole over time. The urine leaches out into the soil. Think of the toilet as a bucket toilet with the bottom cut out of the bucket and it fills a hole rather than the bucket. Variations of the outhouse includes any hole dug in the ground where the feces is deposited in the hole. To reduce the leaching of bacteria, viruses, chemicals, and nutrients, the outhouse or similar area used for waste disposal should be 200 feet from water supplies. In most crisis situations, outhouses are still usable.

Cathole (Figure 8.10) – A Cathole is a hole dug in the ground and the feces is buried in the ground. As pictured, they are generally for individual use. Normally, the toilet paper is burned or carried out. Essentially, the Cathole is a miniature version of the outhouse. In an emergency situation, a trench or hole can be dug in the backyard which is larger than a Cathole but not as formal a structure as an outhouse. As people use the trench, dirt is used to cover the fecal matter after each use. This reduces flies.

Arborloo (Figure 8.11) – An interesting variation of the outhouse is the arborloo. Essentially, after the outhouse is filled, the outhouse is moved to a new site. The hole is covered with soil and a fruit tree is planted in the hole. The tree feeds off the nutrient rich soil where the outhouse was located. Any contamination in the soil is filtered and not passed from the soil to the fruit of the tree. Also, with the tree planted where the outhouse was located eliminates people digging in the previously contaminated area. Although the Arborloo doesn't directly relate to a crisis situation, it is an interesting adaptation.



Figure 8.10: Cathole – The Forest Service notice describes how to dig and use a Cathole. Source: internet – [file:\Cathole[68].jpg].

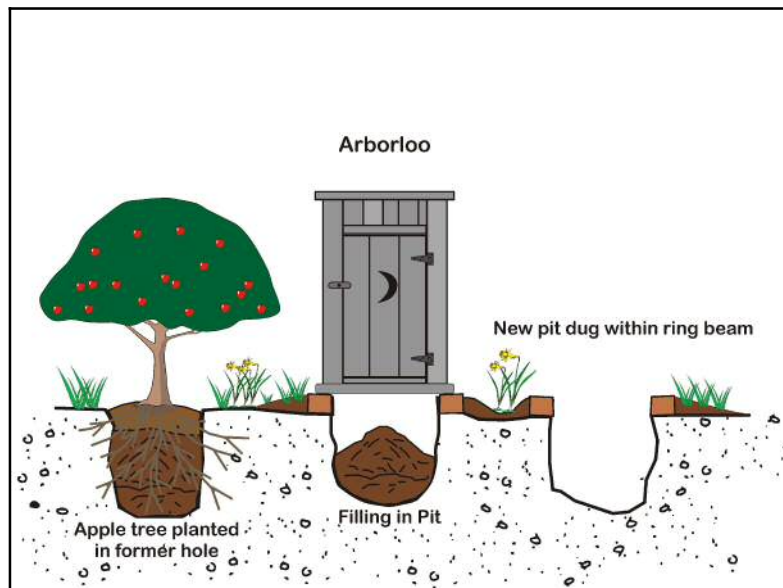


Figure 8.11: Arborloo – Classic recycling, a fruit tree is planted where the old outhouse was located. Source: author – [file:\Arborloo[144].jpg].

Vault Systems

The strategy behind vault systems is that the human effluent is stored until it is transported to another site where it is decomposed. The vault acts as a waterproof holding tank until the effluent can be pumped out of the holding tank and transported elsewhere where it is disposed. Smaller vault systems such as the bucket toilet and WAG bags are included in this section because they store and transport the human wastes somewhere else where it is decomposed. In addition, chemical systems are essentially vault systems where the human effluent is stored in a chemical disinfectant.

Vault Toilet (Figure 8.12) – Often vault toilets are prefabricated units that are easily installed in campgrounds and similar uses. For the user, it is similar to an outhouse. Unlike an outhouse which has porous sides and where the human effluent is not transported, the tank in a vault system is waterproof which prevents leaching into the surrounding soils and the human effluent is pumped out of the tank and transported elsewhere where it is decomposed.

In time of a crisis, a vault toilet is usable until it becomes full. If the length of the crisis is over before the tank becomes full, the tank can be commercially pumped out, emptied, and transported elsewhere. If the tank becomes full before the crisis is over, one of the other disposal methods will need to be used.

Bucket Toilet (Figure 8.13 and Figure 8.14) – Bucket toilets come in many variations. Typically, the system consists of a five-gallon bucket with a toilet seat fastened to the top of the bucket. They are a vault system where the feces are stored in a five-gallon bucket until proper disposal can be arranged. Bucket toilets are generally used during crisis situations.

The bucket in Figure 8.13 has a seat and can be sealed. Often a plastic liner is used in addition. The bucket pictured in Figure 8.14 is a make-shift design. If other normal disposal options are not available (e.g. flush toilets), the bucket toilet is the most likely option to use in a crisis situation.

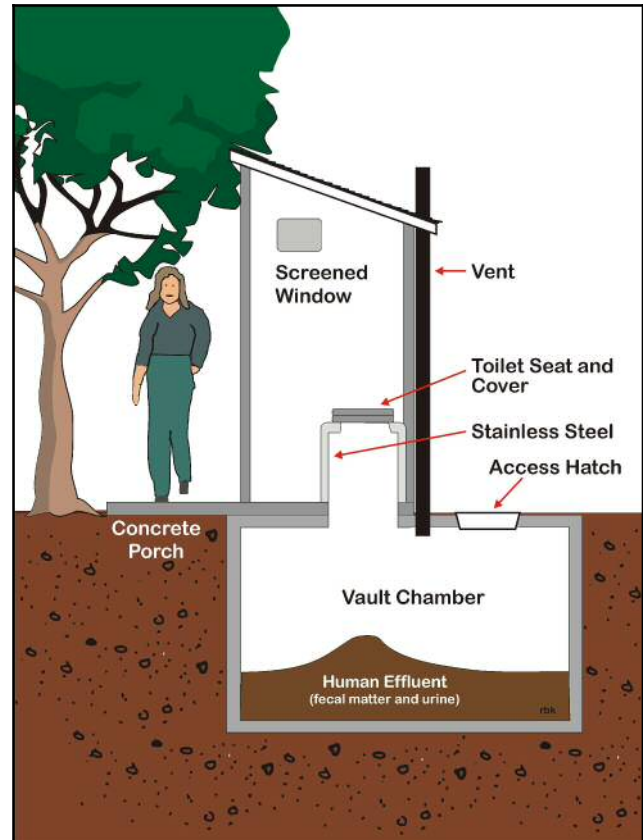


Figure 8.12: Vault Toilet – A vault below the toilet holds the human effluent until it is pumped out, transported, and disposed of elsewhere. Source: author – [file:\SA-VaultToilet.jpg].



Figure 8.13: Bucket Toilet – It is a five-gallon bucket with a toilet seat attached. It is a vault system used in time of emergency. Source: internet – [file:\BucketVault02[36].jpg].

Groover (Figure 8.15) – A variation of the bucket toilet, the name of groover derives its name because the original bucket was a s 20mm or 40mm ammunition box. The user sat directly on the ammo box which left grooves on the rear end of the person using it.

Hence, its name. The modern version used by rafters is a stainless steel container with a seat on top of it. The seat comes off and the top can be sealed tightly. The one shown has a liner in it also. It is another variation of the bucket toilet.

WAG Bags (Figure 8.16) – Waste Alleviating and Gelling (WAG) bag contains a gel material that works similar to cat litter. Most WAG bags are individual use bags where the person uses it, zips it, and tosses it. They can be used in time of crisis and are quite useful when bugging out (see Chapter 14).

Porta-a-John (Figure 8.17) – A chemical system, the Porta-a-John is a familiar site at construction sites, campgrounds, concerts, and large events. Also, they are known as a Port-a-Pottie, Port-a-John, Job Johnnie, or simply as a chemical toilet. Their design is relatively consistent. Essentially, it is a holding tank with a toilet seat on top of it. Some contain a urinal that drains directly into the holding tank. In a crisis situation, few people will have a Job Johnnie onsite to use.

Chemical Toilet (Figure 8.18) – The chemical toilet pictured is suitable for use in recreational vehicles or similar situations. The bottom is detachable. In a crisis situation, chemical toilets can be used for short term events. However, they need to be emptied into a larger sanitary holding tank.



Figure 8.14: Bucket Toilet – A home made version of the bucket toilet. Source: internet – [file:\BucketVault03[48].jpg].

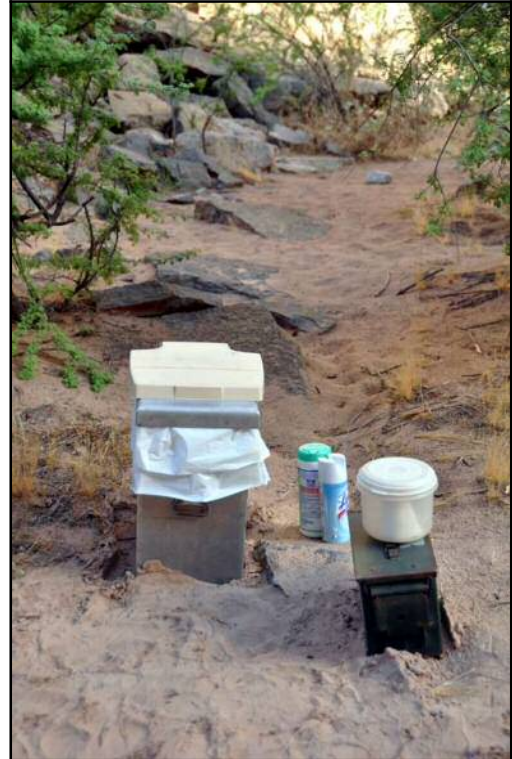


Figure 8.15: Groover – The groover is a variation of the bucket toilet used by rafters on extended trips. Source: author – [file:\DSC_0613.jpg].



Figure 8.16: Groover –WAG Bag – Waste Alleviating and Gelling (WAG). Source: internet – [file:\WagBag02[48].jpg].



Figure 8.18: Chemical Toilets – These portable toilets are found in recreational vehicles. Source: internet – [file:\ChemicalToilet05[60].jpg].

Flush Systems

Flush Systems utilize water as the vehicle to flush effluent through the system to where it is processed. The water is drained off from the system. The two main flushing systems are septic systems and centralized treatment plants.

Septic System (Figure 8.19) – Particularly in more rural areas, houses typically use septic systems to dispose of wastes. Along with the fixtures in the home, the two main components are the septic tank and the drain field. The system uses water to move the wastes from the fixtures in the house to the septic tank. In the tank the solids settle out and undergo anaerobic bacteria action (Figure 8.20). The water drains out of the top of the septic tank and into the drain field where it percolates into the ground.

Unless the crisis situation is a flood, there is generally no reason why the septic system can't be used. In some developments, they have centralized water and individual septic systems. In times of crisis, if the centralized water supply is



Figure 8.17: Port-a-John – The familiar sit at construction sites, concerts, and large events. Source: author – file:\DSC_0344[60].jpg].

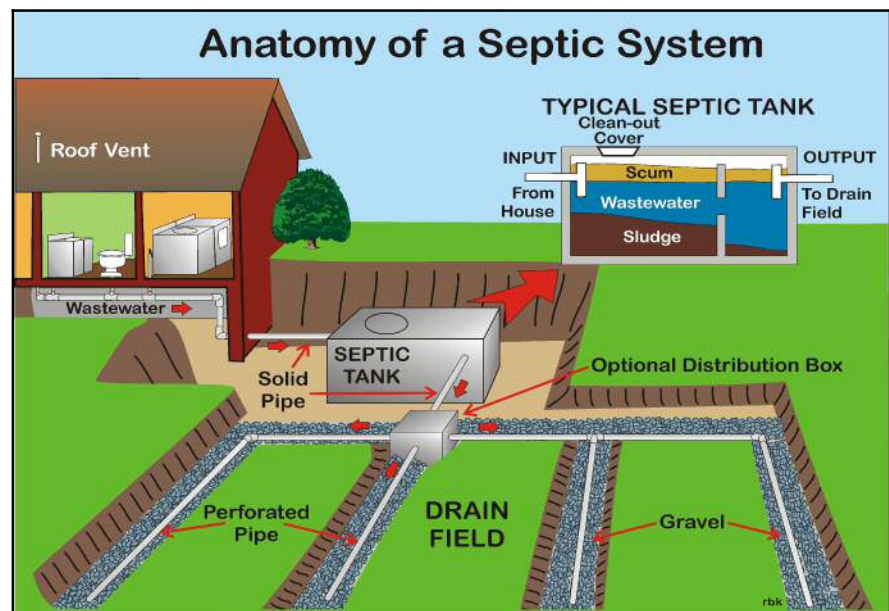


Figure 8.19: Anatomy of a Septic System – Typical septic system uses water to flush effluent into a septic tank where the water drains out of the tank into the drain field. In crisis situations, most septic systems are still usable. Source: author – [file:\SA-SepticSystem.cdr].

not available, a bucket of water can be used to periodically flush wastes down the system.

If the house and septic system lie within the flood plane, it may be necessary to install a “back flow valve” to prevent flood waters from pushing the waste material in the septic tank back through the pipes and into the house (see Figure 8.22). Also, in a flood, the septic system is most likely inoperable.

Figure 8.20 represents a low technology septic system that at first glance looks like a vault system. Close examination of the system reveals the same elements present in a traditional septic system. There is a water source. Anaerobic bacteria action occurs in the digester and there is a drain field.

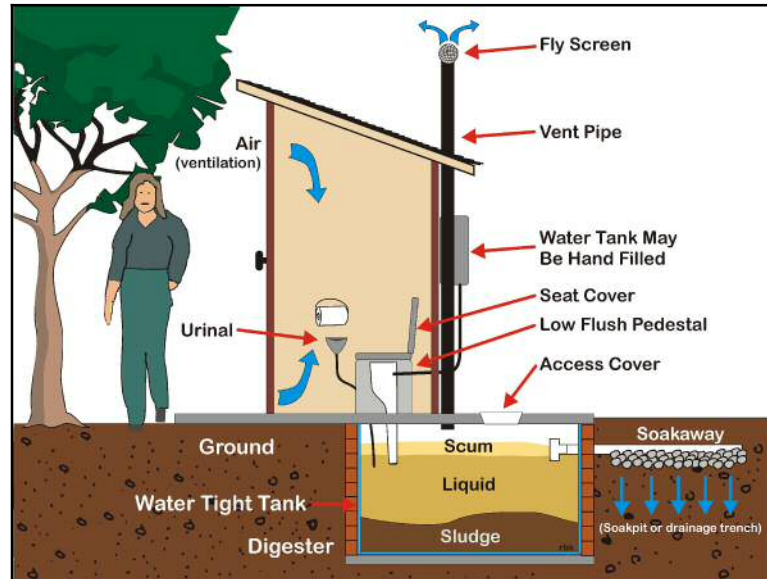


Figure 8.20: Alternative Septic System – It looks like a vault system. However, closer inspection reveals it is really a septic system. Note, the water flush system and drain field. Source: author – [file:\SA-SepticAlter01[144].cdr].

Central Sewage System (Figure 8.21) – Since centralized sewage systems work on gravity, they follow the low point in the topography which includes following rivers and streams. Generally, sewage treatment plants are located within the flood plane or adjacent to it. This means that they may be prone to floods.

The first problem encountered with sewage treatment plants is the dispersal of sludge, scum and wastewater from the primary treatment. Sludge is the nutrient rich before anaerobic action during the secondary treatment. Scum is the grease and oils floating on the surface. Wastewater settles in between the sludge and scum. In time of flood all three elements may be present in the flood waters.

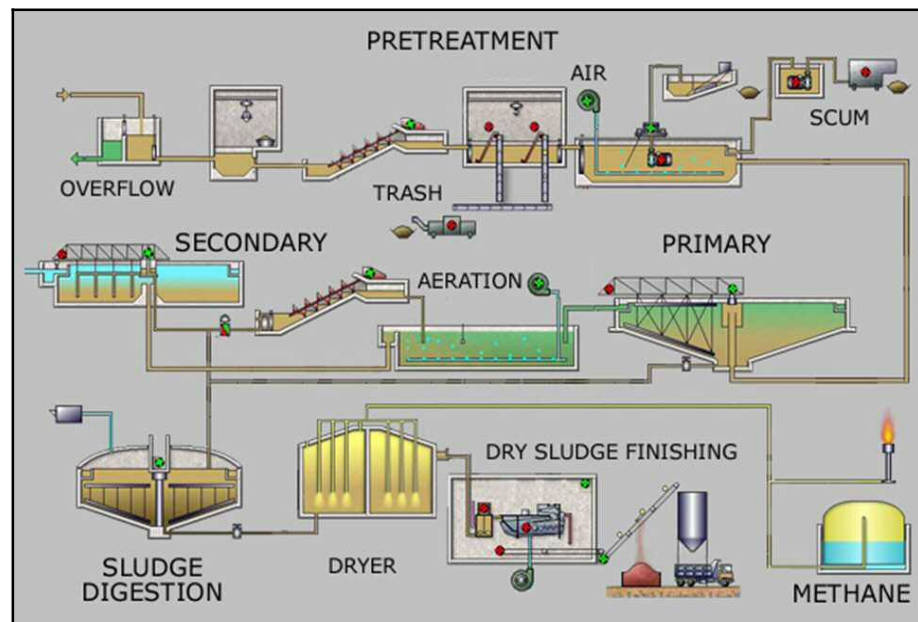


Figure 8.21: Central Sewage System – Typical centralized sewage treatment plant. Depending on the type of crisis situation, it may be inoperable. Source: internet – [file:\CentralSewageSystem[130].jpg].

The second problem is that depending on the topography, raw sewage can easily backup within the system and flow backwards into the basement of houses filling them with raw sewage. This can be caused two ways. First, the flood waters can flood the main pipes and push everything backwards into the basements of houses. It is a reverse siphon. Second, if the main system becomes inoperative or clogged and if people continue to use the system, the uphill users will cause the sewage to flow backwards into the houses below them. If either situation is a possibility, install a “back flow valve” which prevents sewage from flowing back into the house (Figure 8.22).

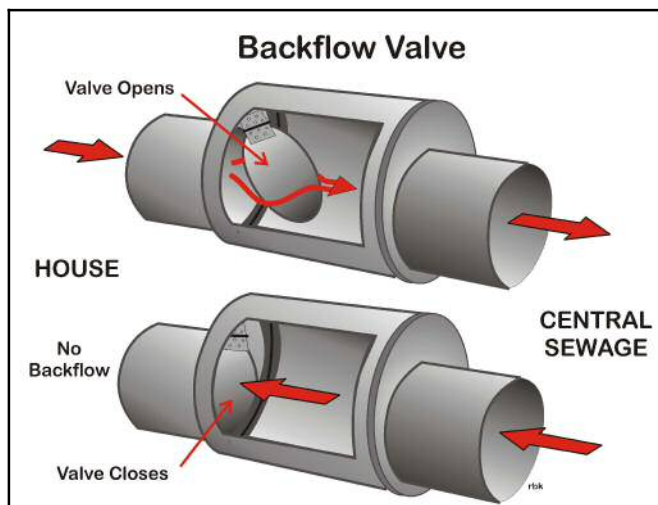


Figure 8.22: Back Flow Valve – A back flow valve is a one way valve that prevents raw sewage from flowing back into and flooding the house with raw sewage. Source: author – [file:\SA-BackFlowValve.jpg].

In a crisis situation, the sanitary sewer system may still be working but the water system isn't. A bucket of water can be used to periodically flush the effluent down the toilet. The water can be poured into the tank and the toilet flushed, or the water can be poured directly into the toilet bowl.

Hygiene

Hygiene involves creating the conditions or practices that are conducive to maintaining health and preventing disease, especially through cleanliness. The emphasis is on cleanliness. The main focus of this section is preventing fecal disease transmission by washing the hands.



Figure 8.23: Soap – Soap kills and washes away bacteria. Source: internet – [file:\Soap[37].jpg].

Two components are involved in washing the hands. The first is the approach or substance used and the second are the mechanics involved in washing the hands. Generally, either soap (Figure 8.23) or a hand cleaner (Figure 8.24) is used to wash the hands. Both strategies seek to kill bacteria. When using soap and water, the water washes away the bacteria also.



Figure 8.24: Hand Cleaner – Alcohol is the primary ingredient used to kill bacteria. Source: internet – [file:\Purell[30].jpg].

The second part of washing the hands involves the mechanics of hand washing (Figure 8.25). For the most part, the palm of front of the hand is washed. The areas typically missed are between the fingers. In contrast, the back of the hand is most likely to be missed. Common areas missed are the back of the thumb, the finger tips and between the fingers.

Having reviewed the diagrams in Figure 8.25, the reader should wash his/her hands in the normal fashion. Assess which areas are typically missed. See if the back of the thumb and finger tips are missed. If this is the case, consider changing how you wash your hands to include these areas of the hand.

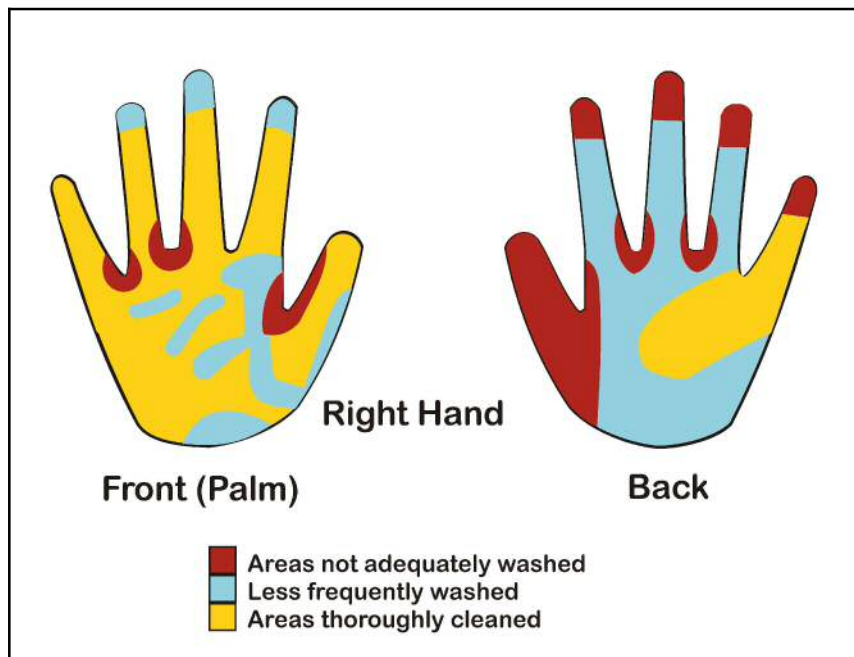


Figure 8.25: Washing the Hands – The mechanics of washing the hands suggests areas typically missed. Source: author – [file:\SA-WashingHands.cdr].

Barrier Analysis

Chapter 4 introduced the concept of Barrier Analysis (Figure 7.24). Conceptually, barrier analysis is a straightforward process. The hazard which create the accident and energy transfer is identified and possible barriers are placed between the hazard and the target to prevent or reduce the likelihood of the accident occurring or in the case of sanitation becoming diseased. The barriers are less than perfect or there are limitations to their effectiveness. Although sanitation and hygiene issues are not what would be considered traditional accidents, barrier analysis can still be applied.

The main focus of this chapter is on preventing the transmission of fecal transmitted diseases. Also, it focuses on methods used to dispose of fecal wastes. This chapter focuses on sanitation and hygiene. Sources of contamination are from fecal borne diseases which constitutes the hazard, harmful agent, or adverse environmental condition that can lead to the energy transfer. The disposal methods and hand washing techniques constitute barriers that are often less than adequate (LTA).

Figure 8.26 is the working table that identifies barrier analysis for an activity or program. In this case, the activity chosen for preppers was sanitation and hygiene. The disaster wasn't specified. However, it would influence the approach used. Second, the energy flow (hazard) harmful agent, adverse environmental condition is identified. In this case sources of contamination were limited to sanitation and hygiene factors related to fecal disease transmission. Next, the target is identified in the second column which in this case is an unchanging prepper. Fourth, the barriers and controls are identified in the third column to separate the energy from the target. In the last two columns of the table, the table identifies how the barrier works and the limitations of the barrier or how it is less than adequate.

The working table serves as a “Cliff Notes” for the chapter or as a summary table of the chapter. Also, it serves to focus specific remedies toward identified disasters or crisis situations that the prepper has identified using the *Surviving the Unexpected Emergency Model*. The table provides a systematic approach toward protection. However, for most people it provides a way of thinking and how they approach crisis situations. It asks the question of what can I do to protect myself from the potential injury, damage or loss.

Figure 8.26: Barrier Identification Table
Activity or Program: **Prepper Sanitation and Hygiene**

Energy Flow (Hazard) or harmful agent, adverse environmental condition	Target – Vulnerable person or thing	Barrier & Controls to separate energy and target	Purpose/ Prevention	Limitations
Fecal Disease Transmission	Preppers	Hot Composting	Kill pathogens in the fecal matter and converts fecal matter into compost	May require storing fecal matter until there is a sufficient amount to create a compost pile. Specialized thermometer is helpful.
	Preppers	Cold Composting	Converts fecal matter into compost	May not kill pathogens in fecal matter which can limit recycling strategy (i.e. limited use in garden)
	Preppers	Vault System	Holds fecal matter until it can be transported and disposed of elsewhere.	In time of crisis, if the duration of the crisis is longer than the holding capacity of the vault, there is a problem.
	Preppers	Outhouse located 200 feet from water supply	Reduces leaching by separation of space	Normally, as a practical protocol issue of having to walk the extra distance.... Issue of violators.
	Preppers	Bucket Toilets	A vault system, it holds fecal matter until it can be transported and disposed of elsewhere.	Small capacity and issue of cleaning and disinfecting bucket. Issue of transporting to where? Note: Can be combined with hot composting.
	Preppers	Wag Bags	“Bag it, transport it, dispose it”	Issues with long term use. In crisis situation, disposing it where could be a problem.
	Preppers	Chemical Toilet	A vault system, it holds fecal matter until it can be transported and disposed of elsewhere.	The duration and size of the holding tank may be problematic. Transport and disposal may be an issue.
	Preppers	Septic System	Use of existing system	Floods are problematic. May need external source of water to operate
	Preppers	Central Sewage System	Use of existing system	Floods and back flow are problematic. May require external source of water to operate. May not be operable.

Energy Flow (Hazard) or harmful agent, adverse environmental condition	Target – Vulnerable person or thing	Barrier & Controls to separate energy and target	Purpose/ Prevention	Limitations
Hygiene	Preppers	Hand washing sign above sink	Reminds people of proper hand washing ritual	It is a soft or administrative barrier. There is the problem of compliance or use of the information.
	Preppers	Bar of soap or hand sanitizer at each sink	Provides easy access and use	Requires multiple bars of soap or hand sanitizers.
Source: adapted from Table 2 in NRI MORT User's Manual and Oakley (2003) by Kauffman and Moiseichik (2013)				

Summary

Human fecal matter is nutrient rich organic matter. Eventually, it is broken down or consumed by microorganisms into compost which can be recycled. The issue is two-fold. The first issue is how and where it is decomposed. The first strategy focuses on treating the wastes onsite usually with either cold or hot composting of the human effluent. The second strategy focuses on storing the human effluent and transporting it to another site where it is decomposed. The third strategy is to flush the human effluent without storing it to another site for processing. Different disposal methods were discussed and how they are applicable during crisis situations. Often existing disposal methods will still be available in a crisis situation. If not, the bucket toilet is usually chosen.

The second issue focuses on preventing fecal related diseases from being transmitted to other people and causing illness. Washing one's hands is important, but equally important is how one washes their hands.

References

- Bradley, A., (2011). Handbook to Practical Disaster Preparedness for the Family.
Kauffman, R., (2015). *Surviving the Unexpected Emergency Model*.
“How Hot is Your (Compost) Heap?” Rodale’s Organic Life. November 13, 2013.
<http://www.rodaleorganiclife.com/garden/how-hot-your-compost-heap>

Chapter 9.1: Shelter – Overview ¹

Shelter is defined as “*anything that protects your body.*” Man is a tropical animal. People need environmental protection. Conceptually, think of shelters as a layering system. It is more than a tent or house, it includes clothing, sleeping gear and the site selection where you locate your home or tent. It can be viewed as an expanding series of spheres of insulation (Figure 9.1). It starts with your clothing. Next are outer garments including wind breakers and jackets. The next sphere of insulation includes what is normally considered shelter. It might be a tent, trailer, or home. These traditional shelters are located on a site, the next sphere. Site selection can affect the heat gained or lost to the tent or home and its contents, including you. This section is structured on the concept of successive spheres of shelter.

There is an outdoor and camping focus in this chapter. Again, the linkage between the two industries. The home as a shelter and bunkers are discussed in subsequent chapters.

The first layer protecting the human body and providing it with shelter is clothing. Clothing is next to the body and layered outward to include jackets, coats and other garments. There are three ways the body gains or loses heat. It can generate heat as a byproduct of muscles contracting, exercise, and shivering. It can gain heat from an external source such as the sun or a campfire. Third, insulation can be added to retain heat or subtracted to allow more heat to escape from the body. The main function of clothing is to add or subtract insulation.

The second layer is sleeping gear. For the most part it is an option to clothing or viewed as a variation of clothing. If pajamas or polypropylene undergarments are worn while sleeping, the sleeping bag is the second layer. Either treating sleeping gear as an additional layer or as an equivalent layer to clothing is okay. It is still a layering process.

The third layer is the tent or shelter. The tent or shelter can trap some of the heat lost by the body. As any camper knows, sleeping under the stars without a tent is a cooler experience. Not only is it a cool experience, but it is a cooler experience because there is no tent to trap additional heat lost from the body. Unzip the flaps

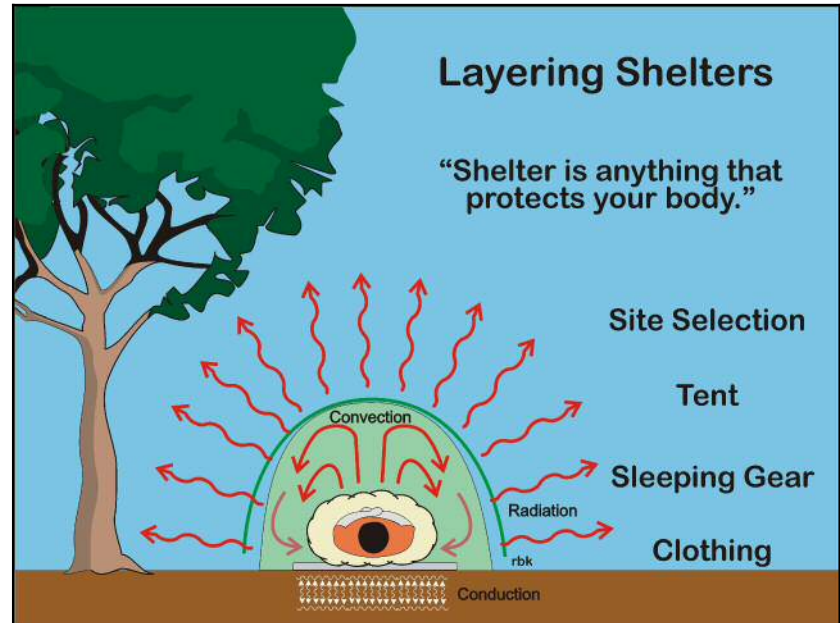


Figure 9.1: Layering Shelters – Generally, people consider layering clothing. Shelters can be layered also. Source: Author. [file:\SH-Shelter.cdr]

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and there is little heat trapped. Close the flaps and a tent can retain noticeable amounts of heat. Several survival type shelters are included also in the discussion.

The fourth layer is site selection. Usually, most people would not considered it as a form of shelter, but it is. An enclosed site can retain heat. An open site can lose heat more readily. Site selection applies equally well to locating homes and other structures.

Chapter 9.2: Clothing as Shelter ¹

Man is a tropical animal. People need environmental protection. Conceptually, think of it as a layering system. The first layer protecting the human body and providing it with shelter is clothing. Hence, clothing as shelter. The focus of this section is on underlying principles rather than critiquing different types of garments.

Principles

In selecting the clothes that a person wears, there are several principles that should be considered. These includes layering, differential heating and wicking. In addition, some garments insulate better against different types of heat losses (i.e. convection, conduction, radiation, evaporation) than others. The last concern is protection against insects.

Layering – Simply, layering is the process of adding and subtracting garments (Figure 9.2). If you are cold, put on a sweater. You have added another layer. If you are still cold, put on a windbreaker. You have added yet another layer. Conversely, if you become overheated, remove layers. As a general rule, several small layers work better than one big layer. This enables a more gradual layering process. Also, different layers can serve different functions. A caplin layer next to the skin can help wick away moisture from the skin. The windbreaker reduces air movement and convection losses.

Differential Heating/Insulation –

Layering is qualitative also. It makes a difference what you protect. There is an old saying that *“If your feet are cold, put on a hat.”* There is some truth in the saying and it illustrates the principle of differential heating. As noted in the section on physiology, the brain seeks to maintain a core temperature at 98.6°F. This includes the head. It is the following strategy. *“Conserve precious heat for the core, let the limbs get cold.”* (CWA, 2013) The corollary is that if the feet are becoming cold, may be it is time to put on a hat or another

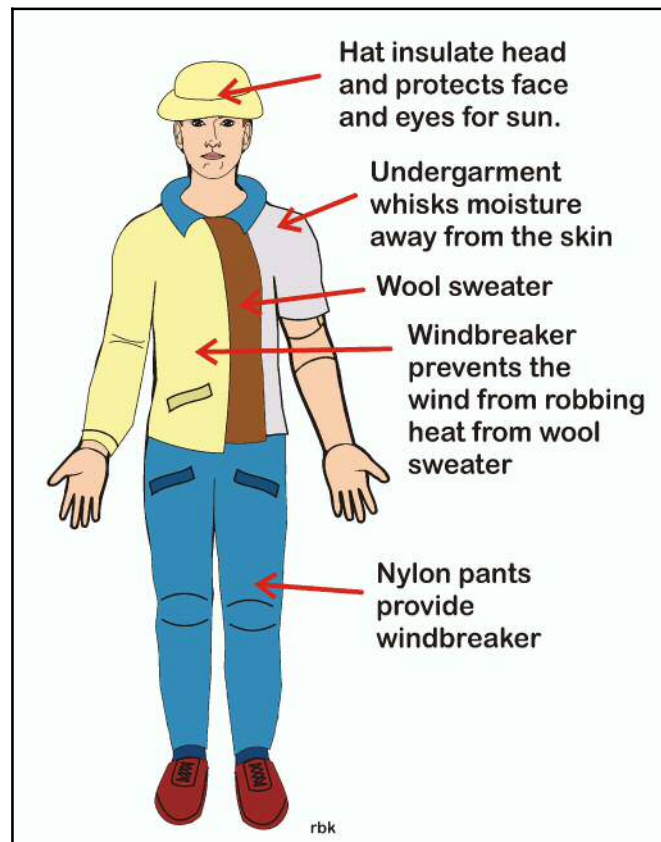


Figure 9.2: Principles of Layering – Source: author.
[file:\SH-Layering02]

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garment.

In the first aid community, there is the Rule of Nine's (SOLO, 2006, p.26). Used in assessing burns, it can be utilized in the discussion here because it represents the amount of surface area that needs to be insulated. Heat loss through the skin is related to its surface area. For example, putting on a sweater adds insulation to 36% of the body's surface area. In contrast, wearing a hat insulates only 9% of a person's surface area (Figure 9.3).

Figure 9.3: Rule of Nine Applied to Clothing		
Body Area	Total Body Surface Area (TBSA)	
	Parts	Total
Head	--	9%
Chest and Abdomen		36%
Anterior Chest/Abdomen	18%	
Posterior Chest/Abdomen	18%	
Both Arms		18%
Left Arm	9%	
Right Arm	9%	
Both Legs		36%
Left Leg	18%	
Right Leg	18%	
Genitalia	--	1%
Total Body Surface Area (TBSA):	--	100%

As previously noted, heating of the body parts does not occur equally. Perhaps a better way of saying it, is that the body prioritizes what it heats. It emphasizes keeping the brain warm as well as the core of the body (chest and abdomen). Fear and Mitchell (1977, p.45) note that the brain and head receives 20% of the oxygen and 25% of the blood flow. In terms of surface area, 25% of the blood flow is going to 9% of the surface area.

There is an old adage that you can lose over half your heat production through your head. Recent research suggests that it may be a myth (Bookspan, 2009). The adage can be traced back to the U.S. Army Field Manual. In terms of differential heating, her research for the military regarding survival reinforces the adage but suggests that it is of a lesser percentage.

First, Bookspan (2009) found that heat loss through the head generally ranges from 20%-30%. Although it is not over half the heat loss, it is still significant. Roughly 20%-30% of the body heat is lost from nine percent of the body's surface area (i.e. the head). Her findings support the concept of differential heating within the body. Also, this is consistent with the percentage of blood flow to the head (25%).

Second, she found that the percentage of heat loss through the head is a function of activity. This would be expected to occur also. Activity utilizes muscles and muscles create surplus heat. This includes moderate exercise and even normal activities such as walking or doing household chores. Hence, as activity increases, the percentage of the heat lost to the head decreases as a percent of the total. If a person runs outdoors in the cold, the amount of heat generated and lost by the legs (36% of TBSA) becomes significant and the amount lost by the head will become relatively insignificant as a percent of total heat loss. In contrast, during sleep, the muscles of the limbs and body are not producing surplus heat. As would be expected, the percentage of heat lost through the head would increase as a percent of the total. A heat loss 30% is not unexpected.

Third, heat loss is a function of the cold or ambient temperature. She notes that the percentage of heat loss is linear with temperature. At 0°C, heat losses can reach 30%-35% heat loss through the head. This finding is not unexpected either and is consistent with the body attempting to keep the brain warm.

Bottom line is the adage is essentially correct. If you want to keep warm, put a hat on your head. The above discussion illustrates how data can be manipulated to prove different objectives. For an active person, the heat loss through the head is minimal as a percentage of the total heat loss. For an inactive person, the heat loss through the head is substantial although most likely less than 50%.

Wicking – Wicking is the ability of a material to transmit or disperse a fluid through the material (Figure 9.4). When a candle burns, paraffin is melted and converted into a liquid by the heat of the flame. The melted paraffin is wicked up the cotton wick where it is converted into a gas by the heat of the flame where it burns as a gas. Cotton makes good wicks. In contrast, if the wick were made from wool, the candle wouldn't work. It wouldn't burn. Wool doesn't wick moisture well. The moisture tends to stay put in the material. With a wool wick, the paraffin would melt. However, it wouldn't be wicked up the wool wick to burn. Once lit, the candle goes out quickly.

There are three different ways that wicking affects clothing. First, in the heat of summer, wicking moves sweat more evenly throughout the material which facilitates increased evaporation. The often maligned cotton to wick the moisture well. In this application, shirt cotton and pants is an appropriate choice of fabric.

In cold weather, cooling the body is usually counter productive. It is not desired. The same wicking action in summer which facilitates evaporation and cooling the body is not desirable in cool weather. In contrast, materials like wool tend to hold the moisture where it is in the fabric and they do not facilitate wicking it throughout the fabric. Evaporative losses are reduced because there is less wet surface area to evaporate.

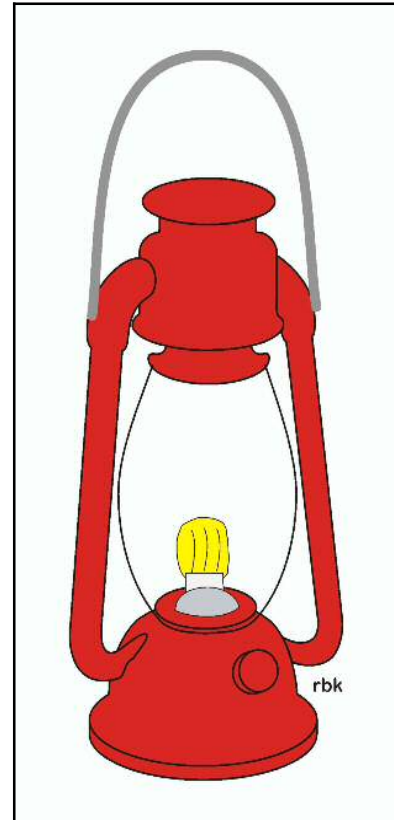


Figure 9.4: Wicking – The wick transports the kerosene from the base up the wick where it burns. – Source: author. [file:\SH-Wicking]

Third, there is a need to wick moisture away from the body to keep the body relatively dry. It does not seek evaporative losses and cooling of the body. Many of the man-made materials are good at this function.

Thermos bottle – Returning to the vacuum thermos bottle, there are four ways for insulation to retard heat loss (Figure 9.5). The first is protection against convection losses. This is the ability of a fabric to create dead air spaces in the fabric. The fabric does this by creating air pockets so small that the trapped air can't establish convection currents to transfer the heat. Hence, the reference to dead air space. Most clothing worn protects the body against convection heat losses.

Assisting in retarding convection heat losses is a windbreaker or wind proof garment. The wind or even normal air circulation in a room can reduce the effectiveness of a material like a sweater to insulate. One study showed that a five mile an hour wind can remove as much as 40% of the insulating ability of normal fabrics. A five mile an hour wind is a little more than a fast walk. This phenomena has some obvious implications which everyone has experienced. First, most people adjust by over insulating themselves. Most people will put on a sweater or slightly heavier garment. If they experience a 30% heat loss, they feel comfortable. This becomes noticeable in a room where there is either a draft or no draft. If there is no draft, a person over dressed by 30% becomes uncomfortable and they want to remove a garment. Conversely, if there is a draft, they will quickly feel its affect and want to put on another garment.

Third, a person can put on a windbreaker. The windbreaker prevents the wind and air currents in a room from penetrating the clothing and removing the heat trapped in its outer layers. Most people putting on a windbreaker will immediately feel its warming effect on the body.

The second approach is to retard radiation losses. Anyone who has used a space blanket has used this form of protection. The shiny surface of the space blanket reflects the body's heat back inwardly. In addition, the space blanket will retard some convection losses also. However, it is clearly not designed to do so. Regardless, the primary strategy of the space blanket is to reflect inwardly the heat radiating outwardly from the body. If your garment has a shiny inner surface, it is seeking to reduce heat losses due to radiation.

The third approach focuses on retarding conduction losses. In clothing this is usually not much of an issue. It becomes an issue if sitting on a rock or ground. When sleeping, it is sleeping on a closed cell foam pad.

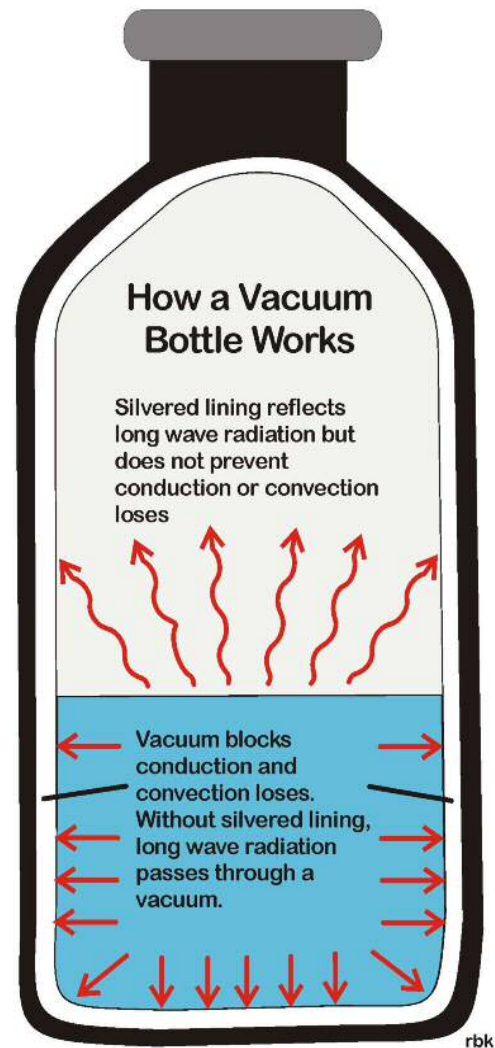


Figure 9.5: How a Vacuum Thermos Works –
Source: author. [file: \PH-ThermosBottle]

The fourth insulation approach focuses on retarding evaporation losses. Normally, evaporation works in conjunction with the wind, breeze, or other convection currents in the air. Breaking the air's ability to penetrate a fabric and evaporate moisture is the primary defense against evaporative losses. A windbreaker provides this function well. During summer, evaporation can greatly aid in helping to cool the body. Wearing a windbreaker would not be a good choice.

An easily overlooked situation that can lead to overheating is wearing a wetsuit out of the water in the hot sun (Kauffman, 1995). A wetsuit insulates the body with a neoprene layer of closed cell foam. If not careful, it could become life threatening. The same problem can occur to a lesser extent with a dry suit. The wetsuit creates a micro-environment of water next to the body. Normally, in a cold water environment, the body heats the water between the body and the wetsuit to body temperature. The wetsuit insulates and helps to maintain the body's temperature. Like the windbreaker, a full body wetsuit prevents evaporation of the sweat. When standing in the sun, the body begins to overheat. In reaction, the body sweats even more. The wetsuit prevents evaporation. No cooling occurs and the body remains overheated. It continues to sweat in an effort to cool the body. A perpetual sweat machine is created that can easily lead to dehydration and overheating. The easy solution is to remove part of the wetsuit or open it up to allow the body to cool. Closely monitor your temperature and prevent overheating.

Wind Breakers – As its name denotes, a wind breaker is a tightly woven garment that is designed to reduce the penetrating effects of the wind. In technical terms, a wind breaker creates a dead air space which reduces

convection losses (Figure 9.6). Loosely woven clothing including shirts and sweaters can easily lose up to 70% of their insulating capability in a five mph wind. In a very real sense, people over dress to compensate for the heat loss in normal everyday living. Simply walking can create a two to three mph air current. Also, it explains why a room with no drafts can feel so warm. Conversely, a drafty room quickly increases convection losses making it feel drafty. The use of a wind breaker reinforces the need to address different methods of heat gain and loss. It also explains why wind breakers are effective barriers against convection losses.

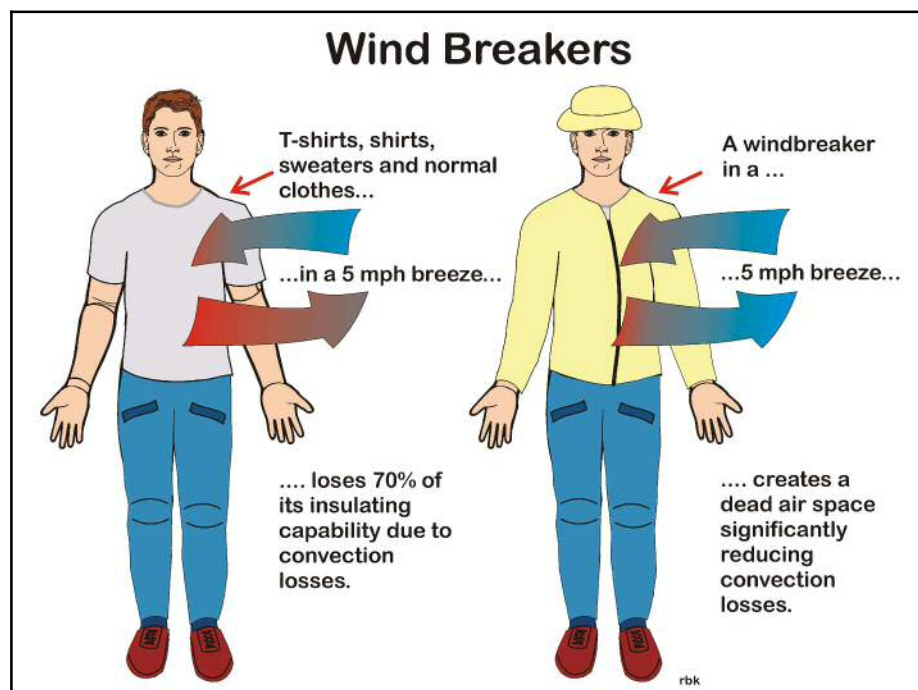


Figure 9.6: Wind Breakers – Source: Author. [file: \SH-Windbreaker2]

Insect Protection – In North America there are three insects that are of primary concern regarding clothing and protection. These are mosquitos, black flies and no-see-ums. In the southwest there are scorpions and spiders but these are generally of a lesser concern in terms of the clothing worn. Generally, there are three approaches to insect protection, specifically mosquitos, black flies and no-see-ums. These include changing your behavior (avoidance), chemical barriers and physical barriers.

Mosquitos, black flies and no-see-ums have similar life cycles. The female needs to feast on blood in order to nourish its eggs and reproduce. The males do not bite. Since the objective is to suck blood from the victim, the female injects an anti-coagulant into the skin. The anti-coagulant may cause an irritation or rash on the skin that can last for several days or longer. There is no question, that these insects are a nuisance.

Changing Your Behavior – The first approach seeks to change your behavior and avoid the mosquitos, black flies or no-see-ums. Black fly season in the northern states is from late April to July. If traveling into the backcountry consider July or August to avoid black flies.

Mosquitos and no-see-ums are more temperature and habitat oriented. Both require stagnant water for the larva to mature. Swamps are an obvious source of stagnant water. However, hollowed out tree knots collect water and provide excellent breeding grounds in areas that would seemingly not favor mosquitos. Also, discarded containers collect water and offer breeding grounds. Unfortunately, mosquitos and no-see-ums can be found most anywhere. No-see-ums favor low coastal lands. And if the temperature is warm enough, mosquitos can be found anytime during the year. The supplement reading titled *Attack of the Killer Vampires* describes a mosquito attack during a particularly warm Everglades trip in January (Kauffman, 2006).

Mosquitos and no-see-ums tend to be more active at dawn and dusk. In the Everglades, the mosquitos seemed to be most active between 6-8 pm after which they subsided. The exception was if the daily temperature went into the 90°F. The larva hatched and there was a mosquito attack.

Chemical Barriers – The second approach is to create a chemical barrier. This author has found that the chemical barrier approach is generally ineffective. It may deter some of the bugs, but in an area where there is a plethora of mosquitos, black flies or no-see-ums, the only really effective deterrent is the physical approach. Even if the chemical barrier deters 25% of a horde of mosquitos, you still have a horde of mosquitos attacking you. As a footnote, some of the bug traps that work on carbon dioxide to attract bugs do work particularly in areas where there are a limited number of insects. Essentially, the bugs are attracted to the carbon dioxide in the bug trap rather than the carbon dioxide in your exhaled breath.

Physical Barriers – Physical barriers involve clothing and netting. It can include tents and shelters also. Clothing can offer good protection against mosquitos, black flies and no-see-ums (Figure 9.6). However, a couple of caveats. It may take two layers of clothes or a tightly woven nylon fabric to protect against mosquitos. No-see-ums and black flies will crawl around tightly fitting cuffs and collars to reach the skin. Mosquitos are less adept at penetrating tightly fitting cuffs. Creating barriers includes wearing gloves, multi-layered or impervious socks, and head netting. The strategy is to leave no area of the body uncovered. This author finds this approach to be the most satisfactory approach.

An integral part of providing protection is the inclusion of netting (Figure 9.7). All different levels of netting are available. These range from full enclosures or structures, full or partial body suits and head

netting. Generally, this author has found the full-body suits unsuitable. They tend to impede activity, get holes in them and the students who have used them quickly transition to head netting only. Head netting comes in many different variations. Some will go over hats and some are self-supporting. Whatever design is used, make sure that the netting can be enclosed around the shoulders. In one instance, eating was nearly impossible because as soon as the bottom of the netting was lifted to take a spoonful of food, in came ten mosquitos also. This was the exception and generally, the head nets proved most satisfactory. Standing structures constructed from mosquito netting are available but not discussed here.



Figure 9.7: Head Nets – In mosquito country, typical dress includes head netting, nylon pants and jacket to enclose all of the body. The students were not wearing gloves. – Broad River Campsite, Everglades, Florida. – Source: author. [file: \EV07_ 148]

Summary

In summary, Bookspan's (2009) findings support the concept of *differential heating* and it supports the adage that 20% to 30% of heat production can be lost through the head. The more active a person is, the more heat that is lost through other body areas. The less active a person becomes, the more heat that is lost through the head.

Layer clothes is a simple but fundamental principle. It is simply easier and more efficient to use several layers of clothes rather than one big layer. Also conceptually, layering can include the tent and site selection. *Wicking* is the ability of clothing to transmit moisture throughout the material. Cotton wicks well which can aid in cooling the body during summer. In winter, the same principle is not desirable. Wool and many synthetics do not wick well which makes them good insulators during cold weather. Last, most people overdress because simple air currents easily rob up to 30% of a garment's insulating ability. Putting on a windbreaker reduces these losses and can significantly aid in insulating the body.

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Chapter 9.2: Sleeping Gear as Shelter ¹

Conceptually outward, the second layer protecting the human body is sleeping gear. It provides shelter to the body while sleeping. Actually, it is place of clothing worn while active. Again, the emphasis of this section is on underlying principles to keeping warm while sleeping.

When discussing sleeping gear, the discussion usually turns to sleeping bags. Sleeping bags have become fairly inexpensive and they have replaced bedrolls and other pre-sleeping bag methods. Regardless, the traditional bedroll can be of benefit during time of emergency. An example of how to construct the bedroll is provided. This section discusses sleeping gear with a specific emphasis on sleeping bags.

Physiological Considerations while Sleeping

Physiological considerations continues the discussion at the beginning of the clothes section. The discussion focused on water losses, layering, differential heating and protection against types of heat loss

Water Losses – When you sleep, you lose water through respiration (breathing), transpiration (sweating), and urination. In terms of the water loss table, the closest category was the “minimum exertion” category (Figure 9.1). The main water loss is through urination which accounts for rough half a quart of water overnight. This is followed by respiration and the skin which accounts for half-pint each. Sweating is minimal since the body is not normally overheated. Urination and respiration water losses are normally dispersed directly into the environment. These water losses impact the use of a pea bottle and sleeping in your clothes worn during the day.

Water losses through *respiration* while sleeping can account for roughly a half-pint of water. The 0.12 quart is roughly four ounces or a half-pint of water. This is not insignificant and can easily account for considerable condensation on the inside of a tent, particularly when all the flaps are closed. The same applies to sleeping in a car without the window cracked.

Approximately an equal amount of water vapor (half-pint) is lost through the skin. Considering the surface area of the skin, this amount of moisture can normally be accommodated without creating discomfort. Since the body is not usually overheated, there is little water loss due to sweating.

¹ This section was written by Robert B. Kauffman who is solely responsible for its content. This article is copyrighted © Robert B. Kauffman, 2016.

Figure 9.1: Hydration Requirements ¹

Normal water losses per day due to:	Minimum Exertion ²		Sleeping (6 hrs) ³		Sleeping (8 hrs) ³	
	quarts	% of Total	quarts	% of Total	quarts	% of Total
Urination	1.48	62%	0.37	62%	0.49	62%
Respiration	.37	15	0.09	15	0.12	15
Skin (insensible loss)	.37	15	0.09	15	0.12	15
Sweating	.10	4	0.03	4	0.03	4
Defecation	.10	4	0.03	4	0.03	4
TOTALS:	2.42	100%	0.61	100%	0.79	100%

¹ Source: adapted from – *SOLO's 2010 Wilderness First Responder Review*. P.O. Box 3150, Conway, New Hampshire: SOLO, p.57.

² Minimum exertion is defined as normal activity in a climate controlled building.

³ Water losses while sleeping was extrapolated from the minimum exercise table. Sleeping conditions are most similar to minimum exercise conditions. For the calculations, sleep was assumed to be six hours or 25% of the day. This may not be accurate. Actual losses will depend on environmental condition.

Pea Bottle – When camping, this author uses a Nalgene ® bottle for urination. As a sidebar, there are several advantages to using a pea bottle. First, it is convenient. Second, it avoids the problem with allowing mosquitos into your tent as you exit and reenter the tent. This ignores any mosquitos accumulated while urinating. Third, it conserves heat. You don't have to reheat your sleeping bag. Fourth, you don't have to be completely awake to use the pea bottle. Nalgene bottles are marked on their side in ounces and milliliters. The unintentional consequence is that measuring the amount of urine overnight becomes something you begin to monitor. The amount of overnight urine can vary dramatically. Some evenings filling half of the Nalgene ® bottle occurred. Other evenings the bottle would be completely filled and then some. There was no obvious predictor of how full the bottle would be. Regardless, approximating a quart of water was not uncommon and it represents a significant loss of water during sleep.

Sleeping in Your Clothes – Many neophyte campers sleep in the clothes that they wore during the day thinking that they will sleep warmer. They reason that along with the sleeping bag, the clothes offer extra layer of insulation. Unfortunately, this strategy invariably leads to sleeping cold. The problem is that during the day the body is easily perspiring over a pint of water. There is residual moisture in your clothes. Rather than having a dry sleeping bag absorb the half-pint of water during sleeping, the overnight perspiration continues to supply moisture to the already moist clothes. The sleeper sleeps cold.

Can you wear your clothes to bed? The answer is yes. It can add another layer of insulation. It can be used to increase the effective rating of a sleeping bag. It is the application of the layering principle. The trick is to put on dry clothes, clothes that are not worn during the day. If you use this technique, keep an extra set of garments with your sleeping gear specifically for the purpose of sleeping. Usually, this includes an extra polypropylene sweater and leggings. Also, it includes wool socks and a pull over wool cap or similar cap for the head. As with your sleeping bag, make sure it has ample time to air out and dry in the morning or before using it again. If you don't and sleep in the clothes or even the undergarments worn during the day, it is a recipe for sleeping cold.

Layering – Demonstrating the principle of *layering*, dry garments can be worn while sleeping to augment insulation and effectively increase the temperature rating of a sleeping bag. Again, don't sleep in the clothes you wore during the day and expect to keep warm.

Differential heating – In the section on hypothermia, the test for hypothermia was shivering while sitting or at rest. When sitting, the muscles aren't producing heat which can heat the body and mask hypothermia. In the section on clothes, it was noted that 20%-30% of the body's heat loss can be from the head. Again, the amount of heat lost through the head is a function of activity. The waste heat from exercise and activity heat the body and the percentage of heat lost through the head decreases because so much of the heat generated by the extremities dwarf the heat lost by the head. The legs alone account for 36% of the body's surface area compared to 9% for the head. Conversely, while sleeping the major muscle groups are inactive. The extremities are producing little or no waste heat to heat the body. Heat lost through the head as a percentage of the total increases.

The corollary is three-fold. During sleep, the body is not producing waste heat and needs more insulation. This is axiomatic. Second, the head can be insulated, thereby reducing heat loss. Generally, people accomplish this one of three ways. First, they add additional insulation to the rest of the body to compensate for the heat lost to an exposed head. Second, they can add insulation to head. Wearing a wool cap provides this benefit. Third, they can pull the covers over their head, thereby adding additional insulation to the head area. Last, a person can exercise before going to bed. This increases heat production. The surplus heat warms the sleeping bag. Unfortunately, this is ephemeral. Once in the sack heat production subsides and the body is back to needing additional insulation. Regardless, exercise prior to getting into the sack does pre-heat the sleeping bag and in this sense it works well.

Protecting Against the Types of Heat Loss – There are four types of heat loss identified in the section on physiology (Figure 9.2). These are convection, conduction, radiation and evaporation. The issue of evaporation and more specifically moisture was addressed in the section on sleeping in the clothes worn during the day. Traditionally, sleeping bags protect against the two biggest sources of heat loss, convection and conduction. Preventing or retarding convection losses relates to the ability of the insulating material to trap dead air spaces. Creating dead air spaces reduces the movement of air and transferring heat. Generally, in sleeping bags, this is done through the creation of baffles which hold the insulating material.

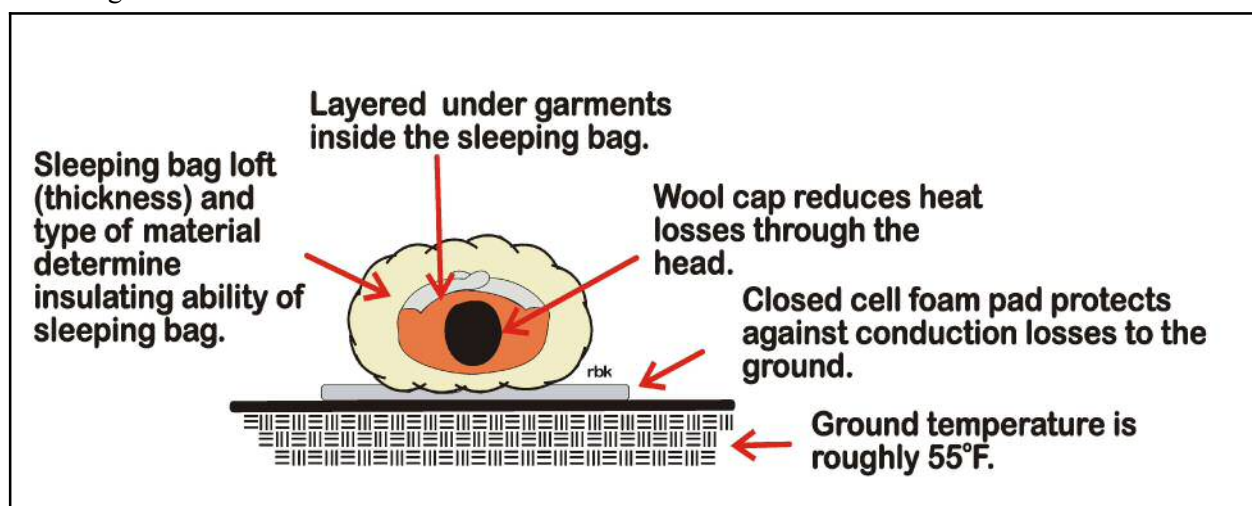


Figure 9.2: Sleeping Bag – Sources of loss through conduction, convection, etc. – Source: author

Sleeping bags come in stuff sacks. When traveling, the stuff sack provides good storage of the sleeping bag. However, for long term storage, remove the sleeping bag from the stuff and place it loosely in a large container. Many manufacturers provide a large breathable bag for this purpose. Stuffed in a stuff sack, the insulating material can become compressed and long term storage can reduce loft significantly. When unpacking the sleeping bag in the evening, allow the insulating material to naturally expand and loft to its full capability.

Conduction losses are reduced through the use of a foam pad rather than the sleeping bag itself. The ground is roughly 55°F. This presents a source of heat loss to the body. The body sleeping tends to compress the sleeping bag where it comes in contact with the ground. The closed cell foam pad provides this insulation. Closed cell foam will not absorb water and is better in retarding heat loss than open cell foam.

Creech (2015) notes that *electromagnetic radiation* or radiant energy is being transmitted by a sleeping body. Traditionally, sleeping bags have not addressed this energy loss and it simply escaped into the atmosphere. In a vacuum thermos bottle, the silver lining reflected the radiant energy back into the thermos. The space blanket is the classic insulating device that works solely on reflecting radiant energy back toward the victim. In a sleeping bag, this can be accomplished by creating a reflective surface facing the interior of the bag to reflect the radiant energy back toward the body.

Sleeping Bags

The discussion of sleeping bags focuses on the type of sleeping bags, the materials used for insulation, sleeping bag ratings, and sleeping pads. In addition, there is a section on bedrolls and their construction.

Types of Sleeping Bags – Sleeping bags are identified primarily by their shape. These include mummy sacks, rectangular, modified rectangular, etc.

Mummy sacks are contoured to the body (Figure 9.3). This minimizes the amount of exposed surface area and maximizes the insulating capability of the sleeping bags. Actually, the better bags have considerable flexibility in movement and the contoured shape is not restrictive. Because of its inherent insulating advantages, the better quality sleeping bags tend to be mummy sacks or a variation of the design. Look at the closure mechanism around the head.

The high quality designs can become quite sophisticated which is good for extreme camping circumstances. Often the less sophisticated designs are more practical for normal use.



Figure 9.3: Mummy Sack



Figure 9.4: Rectangular Sleeping Bag



Figure 9.5: Tapered Rectangular Sleeping Bag

As their name suggests, rectangular sleeping bags are rectangular in shape (Figure 9.4). They provide more freedom of movement for the legs in the sleeping bag. Also, the opening for the head is wide and usually there is no mechanism to draw the sleeping bag down around the head. Because this design is inherently less efficient than the mummy sack, the design tends to be used more with the less expensive sleeping bags. A modified rectangular sleeping bag is a rectangular sleeping bag with a tapered bottom (Figure 9.5).



Figure 9.6: Not All Goose Down Is the Same – Source: from John Francis Maggio – Western Mountain Sports in Creech (2015).

Materials – Goose down was originally the premier fill in sleeping bags. It has many good qualities including its ability to create dead air spaces and light weight. It has one big drawback. When it becomes wet, it is like a wet sponge and loses all of its insulating ability. Because of its disadvantages when wet, down lost favor during the 1980s and 1990s. However, with the advent of breathable waterproof materials like Gore Tex ® and similar materials and their use in sleeping bags, goose down has made a comeback in recent years.

Not all goose down is the same quality (figure 9.6). As with most natural materials, goose down is graded according to its quality. Figure 9.5 shows the loft for one ounce of different grades of goose down. The loft ranges from 300 to 400 for the low end goose down and 600 to 700 or nearly twice the loft for the high quality goose down. Clearly, not all goose down is the same. As a rule, you will get what you pay for. Deal with reputable manufacturers.

There are a plethora of artificial materials used for insulation in sleeping bags. They include names such as Polarguard ®, Hollofil ® and Thermolite ®. As a general rule, these sleeping bags take more material to provide the same level of insulation as goose down. However, they handle the water issue much better. On one Everglades trip, this author accidentally got his sleeping bag thoroughly wet. The next day it was hung up to dry in a brisk wind and within an hour and one half, it was completely dry.

Sleeping Bag Ratings – Creech (2015) notes that sleeping bag ratings are left to the discretion of the manufacturer. Also, he notes that they are rated for survival rather than comfort. The result is that they are significantly underrated. He notes that most people will need a sleeping bag rated about 20° to 25° colder than the expected nighttime temperature on their camping trip. If you are expecting 30° to 40° degree nights, buy a 10° to 30° sleeping bag and sleep comfortably.

Sleeping Pads – The first benefit of a sleeping pad is comfort. It is the equivalent of a mattress. A second benefit is that it insulates the body from the ground and its ambient temperature of roughly 55°F. Generally, a closed cell foam provides better insulation than an open cell foam which will allow for more air movement through it. Also, closed cell foam is impervious to water. Open cell foam can act like a sponge.

Foam pads are not the only alternative. Air mattresses are available. In theory, air mattresses provide less thermal protection than a foam pad. However, they do offer protection from direct contact with the ground. Also, there are combined foam and air mattresses which combine the comfort of the air mattress with the thermal protection of a foam pad. In addition, the foam pad provides cushioning if the air mattress is low. For the non-backpacker types, there are other alternative including portable cots.

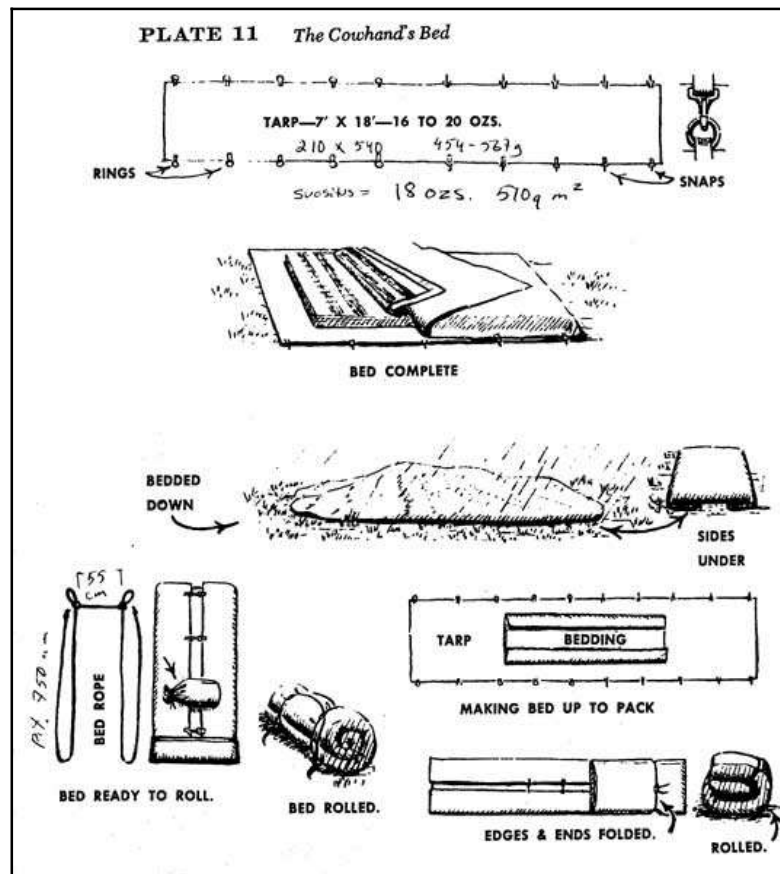


Figure 9.7: Cowboy Bedroll – Source: Bedroll (2007)

Bed Rolls – There are alternatives to sleeping bags. A quick search of the internet reveals several alternatives. However, several of the alternative are really built around a sleeping bag and requires a sleeping bag as part of their construction. In contrast, Web (2014) and (Bedrolls, 2007) provide instructions for a Cowboy Bedroll. Figure 9.7 is from Bedrolls (2007). The cowboy bedroll utilizes a canvas tarp in its construction. Although the canvas tarp is not waterproof, it is water resistant. When canvas gets wet, its fibers expand and seals the fabric from water penetration.

Summary

The test for hypothermia was to determine if a person is shivering while at rest. Normally, at rest was sitting down for a brief period. In contrast, sleeping can be considered truly at rest. The result is that a sleeping person needs additional insulation to keep warm. The easiest way to increase insulation is to purchase a sleeping bag that is rated for temperatures 20°F to 25°F colder than the temperatures you are actually expecting. You can increase insulation by adding layers with additional clothing. Just don't wear the clothes that you wore during the day. Be sure to use a closed-cell foam pad underneath your sleeping bag to reduce losses to conduction. A good night's rest is important to good performance during the day. Also, it reduces the likelihood of mishaps and accidents.

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Chapter 9.4: Tents and Natural Materials ¹

Shelter is anything that protects the body. Shelter was suggested to include clothing, sleeping gear, and site selection. This section discusses what most people would traditionally associate with shelter. It focuses on the structure or dwelling in which a person resides. Conceptually, it could be viewed as creating an effective roof over your head that helps protect you from the elements. It includes emergency structures made out of natural materials, tents and similar structures, basements and bunkers. This chapter has an outdoor and camping field focus. Basements and bunkers are covered in separate chapters.

Natural Materials

As the title suggests, natural materials include materials found in the forest or surrounding. In addition, it can include improvised materials such as a tarp or plastic tarp that might be found. In general, the use of natural materials focuses on emergency situations. The discussion is not exhaustive. It is introductory and designed to introduce some principles. Factors to consider include the following. The first principle is that of a thatched roof and how it impacts the design of an emergency shelter. This is covered in the next section.

Second, the time invested in creating a shelter depends on whether you are in a fixed location or on the move. If you are staying at a fixed site, more time and energy can be invested in the shelter. Third, people tend to spend too much time and energy on creating a shelter. Keep it small, simple and efficient. Digging a snow cave is generally, easier and more efficient than constructing an igloo. Fourth, the environment will determine the type of shelter constructed. In a desert environment, protection from rain is generally not an issue. In winter, protection from the cold and hypothermia prevention are the issues. In the east, protection from the rain is always an issue. Fifth, having some understanding of shelters constructed from natural materials is always advantageous since one never knows when a backup shelter is needed.

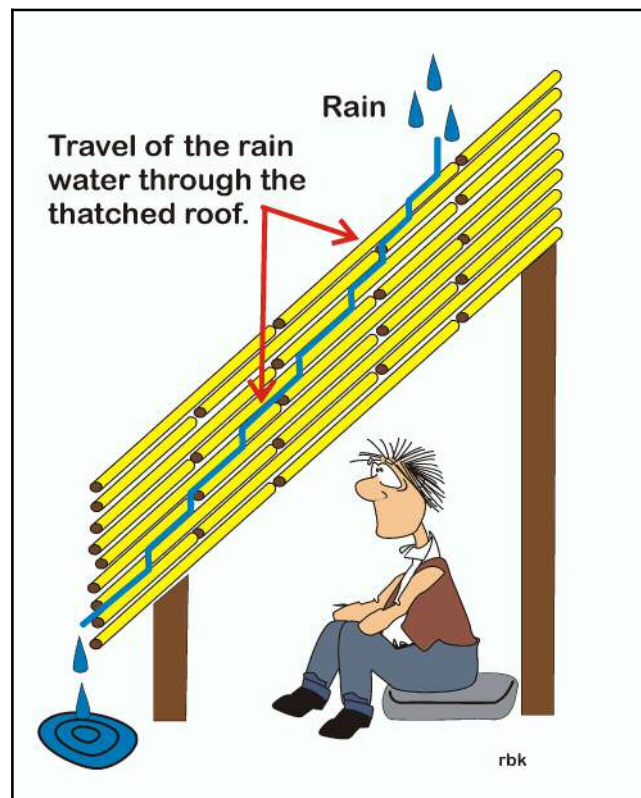


Figure 9.15: How a Thatch Roof Works – Traditional thatch roofs work on pitch of roof, depth of material, and overlay. – Source author.. [file:\SH-ShelterThatched.cdr]

¹ This section was written by Robert B. Kauffman who is solely responsible for its content. This section is copyrighted © Robert B. Kauffman, 2016.

Thatched Roof – Most people are not going to construct a traditional thatched roof in their lifetime. Other materials have superseded thatch as a roofing material. However, the principle of how a thatched roof works is important because the basic principle is useful in creating roofs using natural materials.

There are three factors to consider. First is the steepness of the roof. A steeply pitched roof sheds water faster than a shallow pitched roof. This is intuitive.

Second, thickness of the thatch is important to how a thatched roof works (Figure 9.15). This is shown in Figure 9.15. Traditional thatch is made from a grass material. The rain hits the thatch. It runs down and around the thatch material. It drips to the next layer of thatch where it runs down and around the thatch. The process repeats itself until the runoff runs out onto the ground. The key to the success of this process is the thickness of the thatch and a steeply pitched roof.

The third consideration involves the natural materials used to construct the shelter. When using natural materials such as branches, the portion of the branch closest to the tree should be placed upward or toward the top of the shelter. This facilitates the natural flow of the water off the branches. Construction should begin at the bottom and work upward. This creates an overlapping effect seen in a typical shingled roof. Figure 9.16 shows this effect using bark as the shingles. Note how the shingles overlap each other. If additional material is piled onto the roof after it is constructed, the new material will not aid in the proper runoff of the water. Technically, the thatch needs to be lifted and the new pieces place underneath it so that the thatch works properly.

The last rule involving a thatched roof is that if you can see light through the roof, it will leak. This point seems self-evident.

Snow Cave – Figure 9.17 shows the construction of a typical snow cave carved out of a snow drift. A snow cave is definitely not four-star living, but it provides a significant alternative to being exposed to the elements. A temperature of 32 to 38 degrees inside the shelter can seem quite cosy to a sub-zero wind swept exposure outside.



Figure 9.16: Bark Shelter – Shows the overlapping shingle effect. – Source: author. [file:\SH-ShelterBark.cdr]

When constructing a snow cave, the first consideration is to find a suitable drift. Drifted snow tends to be denser and packed tighter than snow laying on the ground. This becomes readily evident when cutting blocks of snow with a shovel. Also, drifts tend to have sufficient depth and thickness to create a snow cave. If needed, blocks of snow can be added to enhance the thickness of a drift.

With a shovel, burrow an entrance in from the bottom and then tunnel upward. The shelf where you sleep or reside should be elevated above the top of the entrance tunnel. This helps to retain the heat in the shelter. Poke ventilation holes in the roof.

Place twigs or snow markers so that no one steps through the

roof. The outer wall should be roughly two feet thick. If needed, augment the thickness with cut blocks of snow. Your body heat and/or the heat from a candle lantern will ice the walls. The heat melts the snow which refreezes as ice. This strengthens the structure of the walls. Also, it will result in some drainage of the water which needs to be channeled into the bottom of the shelter. Last, store your shovel inside the shelter overnight in case you need to dig yourself out in the morning.

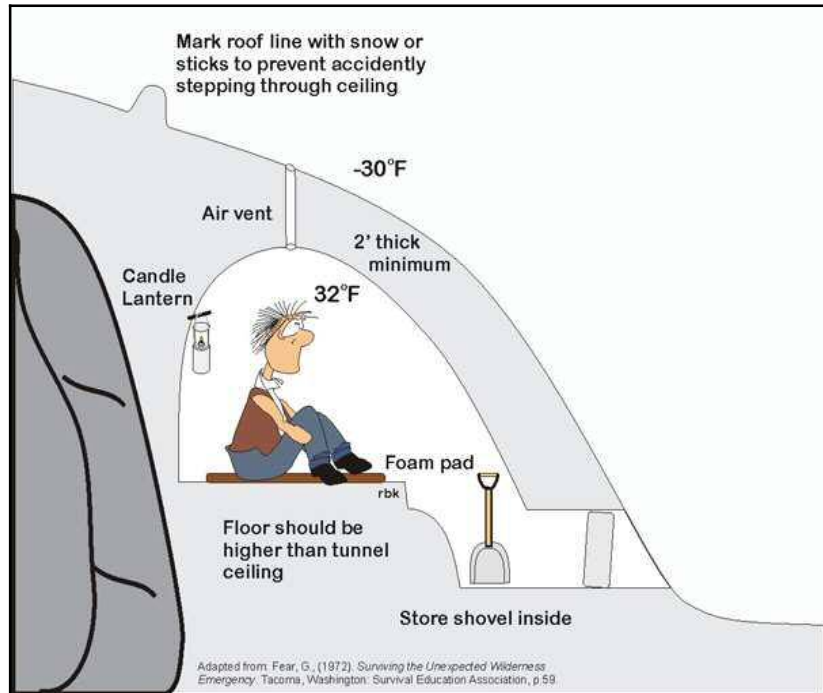


Figure 9.17: Snow Cave – A typical snow cave carved out of a snow drift. –
Source: author. [file:SH-SnowCave.cdr]

Shelter as a Roof – Think of shelters as a roof over one's head that protects the body from environmental impacts such as rain, snow, wind, sun, etc. A quick review of the natural material shelters discussed in this section reveals that shelters are really a roof over one's head. The thatched roof is designed to protect the body from rain. The overlapping bark roof is also designed to protect the body from the rain. These designs provide some thermal protection although they are really designed to protect the body from rain. In contrast, the snow cave is designed to protect the body from the wind, snow and cold temperature. Conceptually, it is a roof that shields the body from the elements and reduces the onset of hypothermia.

Summary – This section is not a complete dissertation on naturally made shelters. It provides several principles and examples which should help anyone in an emergency situation. Create a small shelter. Create one that is appropriate for the conditions you are facing. Different environments have different needs and requirements for protecting the body. In many instances, your shelter is really creating a roof over your body. The principles of a thatch roof are applicable here. The snow shelter provided contrast and shows the creation of an efficient and effective winter shelter. You never know when you will need to create an emergency shelter.

Tents

The purpose of this section is to discuss tents in a general sense. Its purpose is not to be a user guide for tent selection. Tents run the gambit in their purpose, size, construction, materials used weight, etc. For example, a tent used by a backpacker on an expedition will be very different in size, shape, weight, and design than a tent used by a family while car camping.

Purpose – The purpose for which the shelter will be used is generally the primary determinant regarding tent selection. The expedition backpacker's or mountaineer's life may depend on a quality tent. They may experience harsh winds and adverse weather. In addition, they may need to carry the tent themselves. In contrast, the needs of a car camper differ greatly. If the tent fails, there is always a motel. Also, weight is less of a problem since the car is carrying the tent. Influencing the purpose to which the tent will be used are the factors of mode of transportation, durability, and many of the factors discussed in the following sections.

Dispersing Moisture and Vapor Barriers – As the temperature of air decreases, its ability to hold moisture decreases. In meteorology, the dew point is the temperature at which the water vapor condenses and changes from a gaseous state to liquid. For a simple verification of this principle, examine the cold and hot water pipes in a house. Condensation forms on the cold water pipes and not on the hot water pipes.

From the section on sleeping gear, the body gives off roughly 0.25 quarts or a pint of water while sleeping (i.e. respiration, sweating, and skin). A pint of moisture can coat the inside of a tent or automobile with a layer of frost by early morning. Generally, tents are designed with a waterproof fly which protects a breathable tent beneath it (Figure 9.18). This allows the air to move underneath the fly and through the tent. Also, it reduces the temperature differential between the inside and outside of the

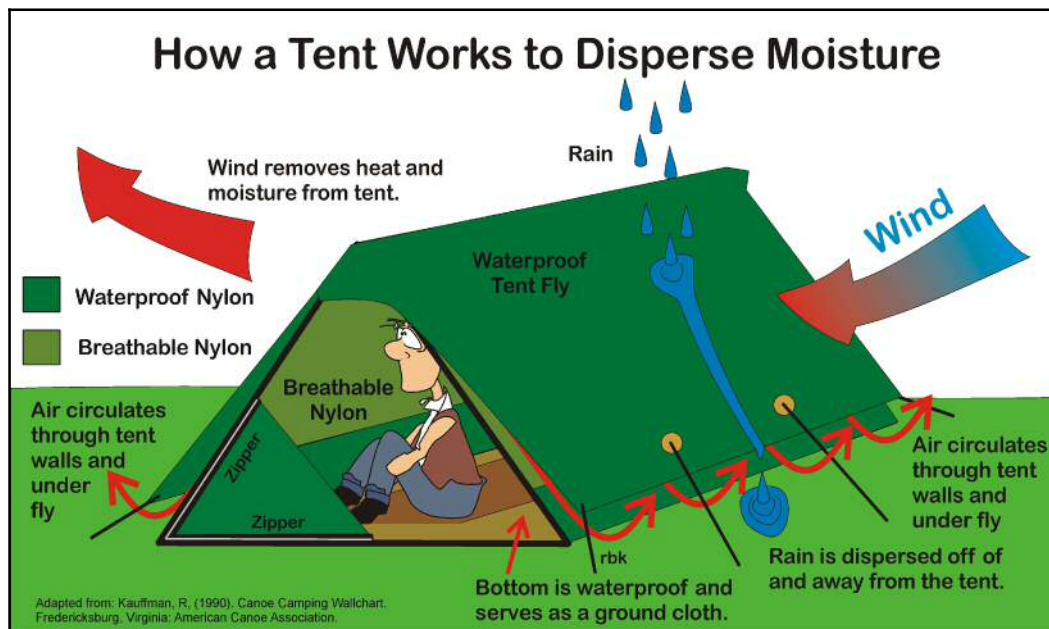


Figure 9.18: Anatomy of a Tent – The waterproof coated nylon fly sheds rain from the tent. The sides of the main tent are constructed using breathable nylon which is breathable. – Source: Author.
[file:\SH-TentHowWorks.cdr]

tent and it reduces condensation. If a flap of the tent is partially unzipped, there is even less of a temperature differential between the inside and outside of the tent.

The principle of a vapor barrier is an important consideration in house construction regarding water vapor condensing as it passes through the exterior walls of the building (Figure 9.19). Placing the vapor barrier incorrectly can lead to the eventual rotting out of the studs of the house. In older homes that were not well insulated or were drafty, this was less of a problem. However, in today's buildings that are well insulated and tightly sealed, moisture has no way to exit.

In Figure 9.19, Andersen (2016) traces the temperature differential between the inside and outside of a house. The temperature drops from 70° to 7° outdoors. The proper placement of the vapor barrier is as close to the inside wall as possible. There is only a five degree differential. The vapor barrier is made from a waterproof or vapor proof material. If the impervious vapor barrier is placed on the exterior wall, the water vapor passing through the wall will condense into water which decreases the insulating value of the insulation and over time, it can rot out the studs.

The principle behind Gortex ® and similar materials is that the material allows water vapor to pass through what would otherwise be an impervious material. The material acts as a barrier to wind and water.

Materials – Today, three materials are generally used in tent construction. These are nylon, canvas, and Gortex ® or a similar type of breathable material.

Nylon – The predominate material used in tent construction today is nylon. Coated nylon is waterproof and used for tent flies, tent floors, and parts of the sides (Figure

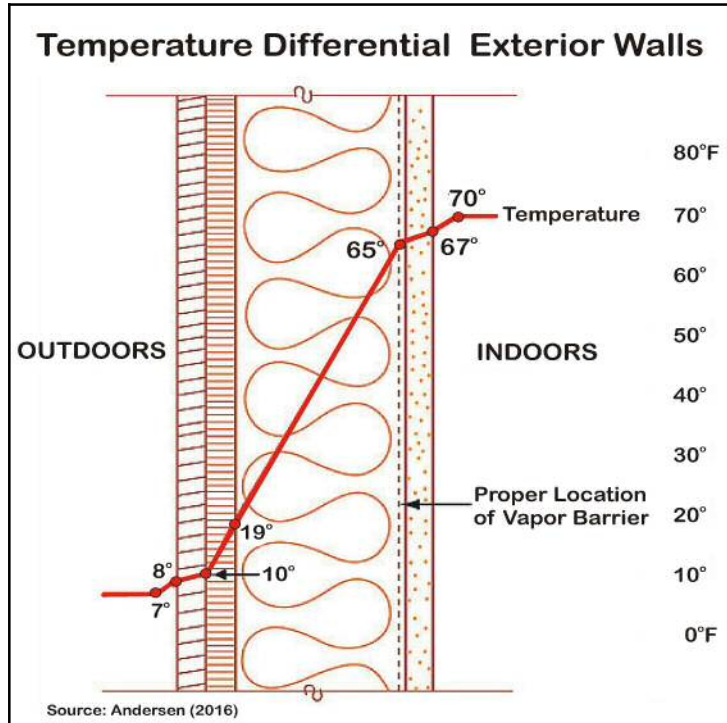


Figure 9.19: Vapor Barrier – Source: Andersen (2016).
[file:\VaporBarrier.cdr]



Figure 9.20: Nylon Tent Without the Fly – As the sun sets on the Gulf, the tent without the fly shows the supporting pole structure and mosquito net windows. – Northwest, Cape, Florida. – Source: author. [file:\EV07_275.jpg]

9.18). Breathable nylon is used on the parts of the tent protected by the tent fly (Figure 9.20). It allows the easy transfer air and moisture from inside of the tent to the outside. Nylon is also use in creating the mosquito netting which is often used portions of the tent.

Canvas – Seventy years ago, the predominate material used in tent construction was canvas (Figure 9.21). Many of the tents were army surplus that had been used in the Korean War. Canvas has a unique property in that it is both breathable and water repellent. Canvas is a cotton fabric. When it becomes wet, it swells which makes the fabric water repellent. Tents were constructed both with and without flies (Figure 6). Canvas tents without a fly had one layer of fabric between the rain and the people inside the tent. The tent in Figure 6 was a typical canvas tent used in car camping.



Figure 9.21: Canvas Tent – This is a vintage canvas tent that would be used in car camping or similar functions. – Source: author. [file:\DSC_0125.jpg]

Canvas has several disadvantages. First is its weight. Its weight is generally prohibitive for backpacking. Even in other forms of camping such as car camping, it has been replaced by nylon. Historically, canvas tents have not been fully enclosed. This was particularly true with surplus tents. This means that they are open to insects like mosquitos, black flies or no-see-ums. Even so, many of the canvas tents designed for the consumer market were fully enclosed. At one time there was a cost savings with canvas tents where they were appreciably cheaper than nylon tents. This is no longer the case.

Gortex ® or Similiar
Breathable Materials – Some tents will use Gortex ® or a similar breathable material. Gortex and similar materials allow moisture to pass from the body through the fabric to the outside. However, the material is impervious to rain. It is waterproof. The advantage of using this material is that the tent can be constructed without a fly. This saves weight. The disadvantage is cost. The bivy sack pictured in Figure 9.22 is made from Gortex. The author can testify to fact that Gortex ® works. The author was camping for several days on an island in the St. Lawrence River and there were several inches of rain over a two day period. There is not much room to maneuver in the bivy sack. However,



Figure 9.22: Bivy Sack – Sleeping on the dock in the Everglades, the bivy sack is a one person tent where the sleeping bag fit snugly into the Gortex ® bivy sack. Lostman's Camp, Florida. – Source: author. [file:\E050W1.jpg]

he remained perfectly dry within the bivy sack.

Warmth – Generally, warmth is considered a secondary benefit of a tent. In general, a smaller and more confined tent will be warmer than a larger tent. Also, a tent that can be sealed is warmer than a tent with openings to the outside in it. Conceptually, it is no different that putting a windbreaker on over normal clothing. It reduces air movement and heat losses. A Gortex ® tent can be sealed up tightly which maintains additional warmth. The bivy sack in Figure 9.22 can be zipped so that it is totally closed.

Size – As a general rule, the size of a tent is determined by its use. Bigger tents weight more. This makes bigger tents less desirable for backpacking. Bigger tents offer more room. In a time of confinement, a bigger tent allows more activity to occur within it. Conversely, being confined in a bivy sack all day during a rain storm can be very confining. In the previously mentioned two day rainstorm, the author eventually pitched a normal two person tent simply because it was less confined.

Generally, the size rating of tents is understated. A four-person tent is generally a tight fit for four people. And this is generally without their equipment in the tent also. Two people will sleep in it comfortably. Equipment can account for significant space within a tent. If possible, pitch the tent prior to purchasing it. A visual inspection will suggest the true rating of the tent.

Pole Design – Pole design should be considered as an important criteria. A quick examination of tent design reveals that tents have moved to the use of longer poles that are required for the integral support and structure of the tent. Without them, it would be virtually impossible to setup the tent. Most poles are interconnected with each other using elastic shock cord. This makes assembly of the poles a breeze. The poles snap easily together in their proper order and the elastic helps keep them together. Also, many of the tents have long poles that may be up to seven feet long that are bent in arches to provide structure to the tent.

An superficial analysis would suggest that tents with lengthy seven foot long interlocking arching poles is not a durable design. Intuitively, this would seem to be true. Having noted this, most tents built by reputable manufactures seem to fair quite well. It is always wise to carry an extra pole or plastic connector where the pole interlock. On one trip, this instructor had to carve a wooden plug that was inserted into a broken pole to patch the two halves. The patch was complicated because the poles were arched placing an undue stress on the patched pole. It was not ideal, but it worked. Regardless, and to the continued surprise of this instructor, tents with this type of construction have been surprisingly durable.

Stand-alone Design – A stand-alone design is a tent that does not need an external item to help support the tent. It is a good feature in tents. For example two trees are needed to tie each end of a hammock. The natural bark shelter in Figure 9.16 needs a large rock or similar feature to form one or more of its walls. Most tents today are stand-alone or self-supporting structures with aluminum or fiberglass poles used for the support. The nylon tent pictured in Figure 9.20 and canvas tent pictured in Figure 9.21 use aluminum poles for their supporting structure. Even the bivy sack in Figure 9.22 uses fiberglass poles to create arches over the head area of the bivy sack.

People tend to think that in the wilderness there are plenty of trees and things to help support your tent. Unfortunately, this is not usually the case. Camping on a beach is usually devoid of trees. Expecting two trees to be of the right distance apart in a campsite is wishful thinking. Even staking the tent can be problematic. The surface of the Keys south of Florida is tri-Miami limestone. Tri-Miami limestone is solid rock with numerous little potholes. The problem is that two or three of the tent stakes go into the

ground easily. The remaining one or two stakes are positioned directly over solid rock. No matter how you try to position the tent, one or two of the stakes are invariably positioned over solid rock.

Insect Protection – In North America there are three insects that are of primary concern when it comes to tent design. These are mosquitos, black flies and no-see-ums. In the southwest there are scorpions and spiders but these are generally of a lesser concern with the use of self-enclosed tent. As a footnote, with scorpions, it may be important to keep shoes inside the tent overnight or you may find an unpleasant surprise inside one of the shoes in the morning.

The first protection against mosquitos, black flies and no-see-ums is a tent that is fully enclosed. Generally, this is not a problem since most tents manufactured today are fully enclosed. This means that the only entrance into the tent for bugs as well as people is the entrance. When the entrance is zipped up, the tent has a barrier of material and/or mosquito netting everywhere between the occupants and the outside.

The second barrier is mosquito netting. Mosquito netting is a generic term used to describe a nylon mesh that resembles screening used in windows. This allows air to pass through the screen but not the mosquitos. Not all mosquito netting is the same. Because of their larger size, virtually all mosquito netting will protect the occupants from mosquitos and black flies. However, no-see-ums are sufficiently small in size that they can pass through larger inexpensive mosquito netting. The bottom line is when purchasing a tent, check the size of the mesh of the mosquito netting and make sure it will stop the no-see-ums.

Summary – Tent design and construction has gravitated toward nylon tents with coated waterproof nylon flies. This combination provides lightness, breathability, and protection from elements including the rain. Most tents are stand-alone using poles to provide structural support. Although the poles may seem vulnerable, they are actually durable.

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Chapter 9.5: Site Selection ¹

Normally, most people don't think of site selection as a form of shelter. Conceptually it is. Shelter was defined as anything that protects the body. Site selection is an extension of clothing worn along with the tent and shelter. Proper selection of a campsite can conserve heat loss or provide shade from solar radiation. Placing your site next to a body of water can provide a cooling breeze that reduces the temperature of the site. Often, when wilderness camping, the campsites are designated. The result is that you make the best of what may be a poor situation. Also, not everything regarding site selection is under your control such as a cloudless evening.

Scenic Amenities – Most people select a campsite because of the scenic amenities it offers. Under normal circumstances, this is always a consideration. People seek the site with a scenic overlook. They want to view the sun setting in the west or the sun rising in the morning. Although these are worthwhile considerations, it may be desirable to consider the shelter effects of campsite selection. In addition, in time of emergency, a site normally selected may be exposed and less desirable.

Heat Gained – Normally, heat is gained during the day and it is lost during the night. Heat gained or lost can be either wanted or unwanted (Figure 9.23). Wanted heat can be used to warm the tent and person in it. Wanted reduced heat is usually gaining heat but at a reduced rate. Unwanted heat gain is usually being drenched in the sun. Often, it results in seeking shade. In the northern hemisphere, the sun rises in the southeast and sets in the southwest. In the summer the sun closely approaches an east and west movement. An eastern exposure captures the morning sun. If the western exposure is blocked, the site will tend to be cooler in late afternoon and into the evening. A western exposure will capture the late afternoon sun which tends to be hot. This energy can be stored in the ground. If you want to maximize the heating effect of the sun, choose a western or an all day exposure and capture the sun's rays. If heating is unwanted, choose a western exposure that is blocked by vegetation or other obstructions.

The ground can store heat during the day that is released during the evening. In turn, this heat can heat the tent and its occupants. This stored heat can be

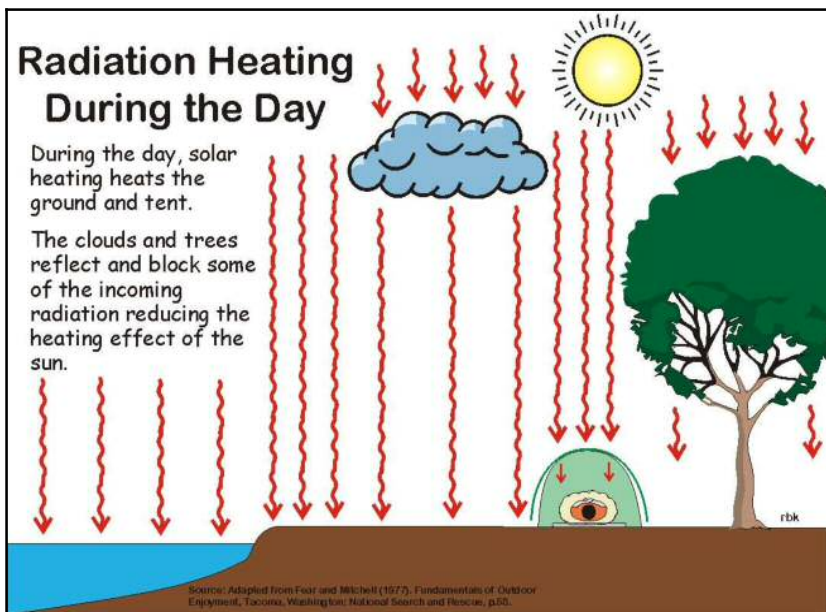


Figure 9.23: Radiation Heating During the Day – Source: author.
[file:\SH-SiteDay.cdr]

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detrimental to the experience also. In the Grand Canyon, the campsites gain significant solar heating during the day before the sun goes over the canyon wall around 4:00 pm. The problem is that when pitching the tent on the sand, the tent becomes a classic oven.

The classic oven works as follows. A fire is built to heat the masonry structure. After the structure is heated and the energy is stored in the masonry structure, the fire is often extinguished or it is left to go out. The heat stored in the masonry structure bakes the bread or pie. It is primarily radiant heat. In this case the sun is equivalent to the fire which heats the sand rather than the masonry.

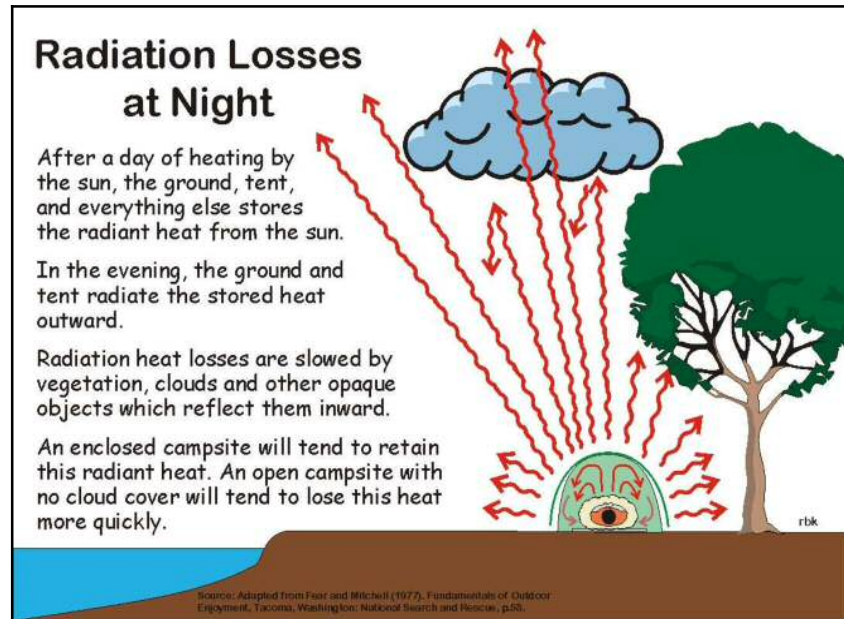


Figure 9.24: Radiation Losses at Night – Source: author. [file:\SH-SiteNight.cdr]

In the Grand Canyon, the problem was that until 2:30 in the morning when all the stored heat eventually dissipated you were like the bread being baked in the oven in your tent. You roasted. A trick was to dump a bucket or two of water on the campsite and let the water evaporate before pitching the tent. It cooled the campsite underneath the tent. After the site has cooled, the tent can be pitched without baking yourself in it.

Heat Lost – Heat gained during the day is dissipated during the night unless of course you choose not to gain heat during the day. At night, heat is radiated from everything that was heated during the day (Figure 9.24). This includes the rocks and ground underneath the tent, the tent and everything else that the sun's rays touch. Radiation can be blocked or reflected by clouds and vegetation (e.g. tree foliage, etc.). In general, a cloudless night is cooler than a night with cloud covered. The clouds reflect back to earth some of the solar radiation. Camping under a canopy of vegetation is generally warmer than a site without a canopy for the same reason.

Invariably, the author could tell when it was 2:30 am in the morning. This was when the energy stored in the ground had fully dissipated. There was no energy to radiate outward. The result was that at 2:30 am there was a sudden chill because there was no more stored energy in the ground.

Lake to Shore Breeze – Locating a site next to a large body of water can result in a lake (sea) to shore breeze (Figure 9.25). This results from a differential heating effect during the day. Land is more readily heated by the sun than the water during the day. The result is that it creates a temperature differential which in turn, creates a pressure differential. Warm air is less dense than cold air. The super heated land warms the air above it. The warm air is less dense than the air over the cooler water. The pressure difference creates a convection current where the cooler air over the water moves inland to equalize the pressure. As the air moves inland, a lake to shore breeze is created. In the upper atmosphere, the same process is occurring except that the air is moving from the land to the sea.

Safety Hazards – Site selection can include a wide range of safety hazards to avoid. In the previous example, selecting a site that is exposed may collect heat during the day. However, an exposed site may be more susceptible during a passing storm.

Deadfalls are dead branches or limbs that can fall during a storm or strong wind. Deadfalls can and have been fatal. Deadfalls can also be created by rocks that become dislodged from a rock wall above the campsite. If there is a pile of debris rock at the base of the wall, this might be a sign of a potential deadfall.

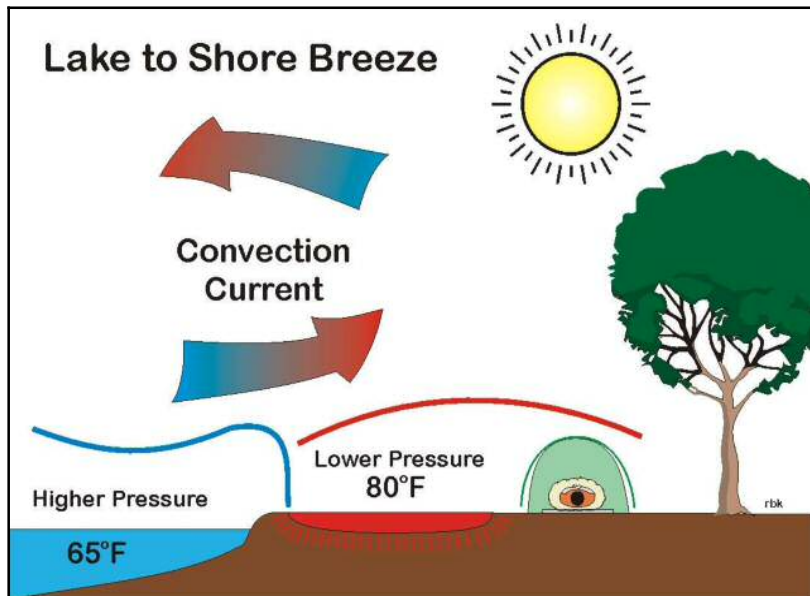


Figure 9.25: Lake to Shore Breeze – Source: author. [file:\SH-Site-SeaBreezeDay.cdr]

In canyon country, flash floods present a danger. A thunderstorm strikes further up the watershed. Little or no water is absorbed into the ground. Most of the water becomes runoff. The result is a flash flood. Selecting a campsite in the canyon can be fatal. It can result in being swept away by a storm further up the canyon. Most likely there is no warning and there is no rain occurring at your site either.

In tidal areas, something seemingly as benign as a rising tide can threaten a campsite. When the campsite is a foot or two above the water level, a tent can easily be misplaced and become too close to an incoming tide. Boats that are not secured properly can float away or sink.

In addition, safety hazards can include animals. In bear country, food should be hung away from the site in bear proof containers. Raccoons can break into most anything and will drag items off into the woods (Figure 9.26). The outdoor writer, Cliff Jacobson, notes how to bear proof the campsite. He notes that the bears become fairly adept at obtaining the properly hung food in the tree (Jacobson, 2014). It is an evening play that plays out every evening with a new group staying at the campsite. Usually there is one tree of sufficient height in the campsite to hang the food. Jacobson notes that the bears learn how to obtain



Figure 9.26: Raccoons Invade the Campsite when Everyone Is Sleeping – Cape Sable, Florida. – Source: author. [file:\EV07_323.jpg]

the food hung in the tree. They have enough practice since the ritual is repeated nightly with each new group. He describes the choreographed acrobatics of the bears as they systematically obtain the food out of the tree. They obviously have their food gather down to a science.

LNT Considerations – The Leave Not Trace practices suggest several practices that may interfere with the previous discussion on site selection. As a normal camping practice, the recommendation is to select a campsite 200 feet from a body of water. Although most people prefer camping next to a body of water, there are some sound reasons for suggesting this practice.

First, camping in an exposed area results in visual pollution. If everyone is camping on the shore and if everyone is in visual sight of everyone else, the concept of “solitude” is not enhanced. Second, there are sanitation considerations. In many areas, urine and defecation result in the pollutants leaching through the soil, hitting bedrock and draining directly into the freshwater body of water. The lake becomes atrophic.

Prepper Considerations – In an emergency or survival situation, a camping scenario may become a reality. In discussing bugging-out, Stewart (2014) uses camping as his primary mode of shelter. His bug out site was a camping site. Consider the site location in terms of heat gained and heat lost. In addition, locating your site next to a water supply provides a readily available supply of water. Consider downplaying the LNT considerations. Unfortunately, the camping ethic becomes a lesser priority in a survival situation.

An important consideration is seclusion, An exposed campsite is a visible campsite. A visible campsite is a campsite that is more difficult to defend and potentially invites intruders. Depending on the emergency, it may be more desirable to be secluded and out of sight and mind of others passing through the area.

Summary – Site selection is an extension of the concept of shelter. Proper site selection can provide heat gain and at night, it can protect against heat losses. Think of site selection as another way of protecting the body.

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Chapter 10:

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Chapter 11: Bunkers and Safe Rooms ¹

Generally, a **bunker** is defined as “a reinforced underground shelter, typically for use in wartime.” It is a form of shelter. It protects the body. Although bunkers can be above or below ground, typically, they are below ground. Being below ground helps protect those in the bunker. Also, the use of bunkers has spread to include natural as well as other man-made disasters and crises other than war.

A **safe room** is generally defined as “a room in a house or other building that is invulnerable to attack or intrusion, and from which security operations can be directed.” Essentially, it is a bunker within the home. In contrast with the definition, it may not always be invulnerable to attack or intrusion. It may be designed to simply slow down and delay intruders until the police arrive. Depending on the situation, a safe room can be an inconspicuously looking hardened room or it can be an impenetrable concrete bunker.

In terms of Surviving the Unexpected Emergency Model, bunkers and safe rooms can be used for both natural and man-made disasters. Typically, a review of their protective ability can be group into tornadoes, crime and war. Of the natural disasters listed, tornadoes are the most likely natural disaster for which a bunker or safe room offers protection. Safe rooms are generally associated with home invasions. However, variations of a safe room can be used for protection from tornadoes also. Although bunkers are usually associated with war, they can also provide protection against tornadoes or crime. It is an issue of tailoring the facility to its intended use.

Tornadoes and Safe Rooms

Referring to the Surviving the Unexpected Emergency Model, tornadoes are the most likely natural disaster requiring a safe room or bunker. Figure 11.1 is a map of the United States showing the likelihood of tornadoes occurring.

Since tornadoes are short term events, the main purpose of the shelter is to provide protection from the tornado. Food, water, sanitation and other amenities are not really needed. Protection can be either above or below ground. Figure 11.2 shows a

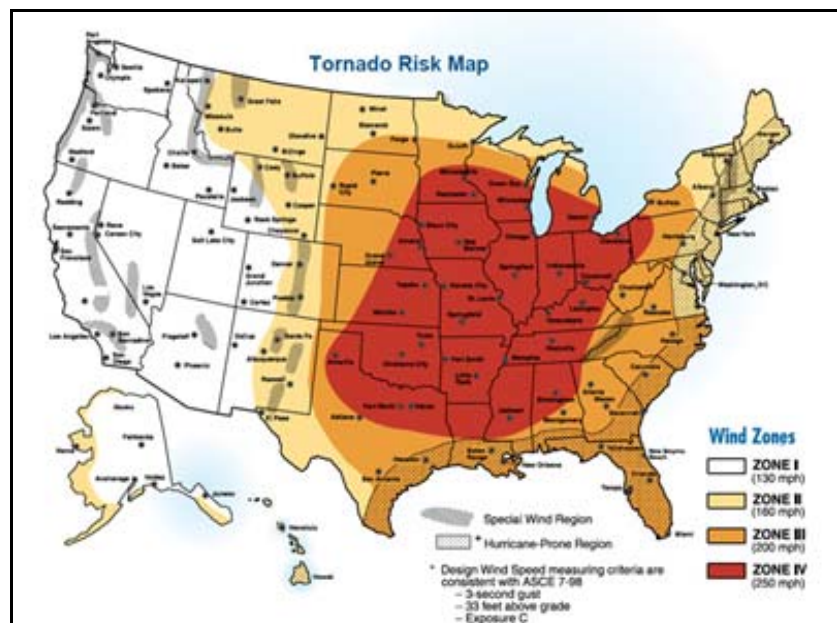


Figure 11.1 – Tornado map of the United States. Source: internet – [file:\SH-TornadoMap[55].jpg].

¹ This chapter was written by Robert B. Kauffman who is solely responsible for its content. This chapter is copyrighted © Robert B. Kauffman, 2017.

typical prefabricated below-ground storm shelter. Given its size, it is clearly a short-term living arrangement.

In contrast, Figure 11.3 shows an above-the-ground storm shelter that has weathered the storm. Imagine sitting in this structure during the storm. It would be a harrowing experience to say the least. The sound of the tornado. Hearing the house being demolished around the structure. Hearing debris bouncing off the structure. Feeling helpless and knowing that your survival is totally dependent upon the structural integrity of the safe room.

Crime and Safe Rooms

Safe rooms can offer protection against home invasions and to a lesser extent burglary. In general, the emphasis of a burglar is on robbing personal property when the home owners are not home. As a general rule, burglars operate during the day when people are not at home. They operate alone and seek to avoid confrontation. They are deterred by security signs on the lawn, bars on doors and windows, dogs, alarms, and of course, locks on the doors.

In contrast, home invasions occur when people are at home. They focus on both robbing personal property and on intimidating the occupants. They tend to operate as a group or gang. Usually, the home invasion is purposely done while the occupants are home and it often includes power, intimidation, control, terror, and possible physical injury or death to the occupants. Home invasions tend to focus on women, seniors, or wealth people. Generally, home invasions occur in the evening or on weekends. A burglary gone wrong can easily turn into a home invasion, but given their druthers, most burglars prefer homes without occupants.

In general, there has been a rise in home invasions. Part of the reason is that convenience stores and other traditional targets are less attractive and they have become more difficult targets. They have less cash on hand. They have installed surveillance systems, video camera, and silent alarms. Comparatively, homes have become an attractive alternative.

Home Invasion Strategies

– Essentially, home invasions can be divided into four phases: Entering the home, controlling the occupants, delaying capture, and calling the police. The premise of this strategy is that a safe room or hardened room can delay capture of one or more persons long enough to call the police and for the police to arrive onsite. To be successful, one or more people need to be able to access the room once a home invasion begins. Also, the room should contain a charged cell phone.



Figure 11.2 – Typical below-the-ground storm shelter. Source: internet – [file:SH-Tornado01[50].jpg].



Figure 11.3 – An above-the-ground storm shelter. The experience would be harrowing. Source: internet – [file:SH-Tornado02[63].jpg].

<c>**Entering the Home** – Home invaders can use a variety of methods to enter the house. They can simply kick down the door or enter through an unlocked door. They can use trickery and deception by impersonating a delivery person with flowers or a package. Or they may simply knock on the door and people open the door not expecting that a home invasion is occurring.

Assume being surprised. Whether the home invaders knock down the door, impersonate a delivery person, or simply knock on the door, their entry into your home will create surprise and disorientation. Initially, surprise gives the invaders an advantage.

<c>**Controlling the Occupants** – Using the element of surprise, the home invaders will immediately seek to obtain control of the inhabitants. The fewer people present, the easier this becomes for the invaders. A senior alone in the house is fairly easy to control once entry has been obtained.

<c>**Delay Capture** – Initially, the invaders will enter the home and will seek immediate control over its occupants. One or more of the occupants needs to quickly recognize the situation and make their way safely to the safe room where they will call the police. This may involve some pre-planning and practice so that it is a practiced activity. Also, this means that the safe room needs to be located so that it is easily accessible in time of an emergency or invasion. Analyze likely points of entry such as the front or rear doors. Remember, for this strategy to work, at least one family member needs to make it safely to the safe room.

<c>**Call the Police** – In most cases, once the police are called the invaders will leave. Leave a charged disposable cell phone in the safe room at all times. A land line can be used, but the invaders may cut the line prior to entering the building.

<c>**Rescue Curve** – Consider this scenario in terms of the rescue curve. Creating the safe room is “*safety and prevention*.” By design, the scenario advocates moving directly to “*rescue by others outside your group*,” in this case the police. “*Self-rescue*” and “*rescue by others in your group*” can be considered getting one or more of the family members into the safe room. However, given the element of surprise, it may be challenging to have family members safely access the safe room. Also, if the family members fight back, it is “*rescue by others in your group*.”

Creating an Inexpensive Safe Room – As with many things, it is easy for safe rooms to become sophisticated, expensive and out of reach for most people. They can easily become reinforced concrete bunkers with heavy steel doors. They can easily become a special use room concealed secretly behind bookcases. They can easily become expensive wasted space in a small house where space is at a premium.

Return to the basic strategy advanced in the previous section, delay capture and call the police. A safe room needs to provide sufficient protection to delay capture before the arrival of the police. In most cases, the home intruders will leave once they realize the police are on their way.

The purpose of this section is to provide a practical and inexpensive safe room. Other than the three deadbolts, there is little visual evidence that the door is different from other doors. First, this section shows how a normal door is hung and why it offers little protection in a home invasion. In contrast, modifications can be made to inexpensively harden the door and walls of a room to create a safe room that will protect its occupants long enough until the police arrive.

<c>**Typical Interior Door Construction** (Figure 11.4) – Walls are constructed using 2"x4" studs sheathed with sheet rock or wallboard. In many homes and buildings today, metal studs may have replaced the 2"x4" wood studs. Structurally, there is no difference. The wall may slow down a home invader, but it

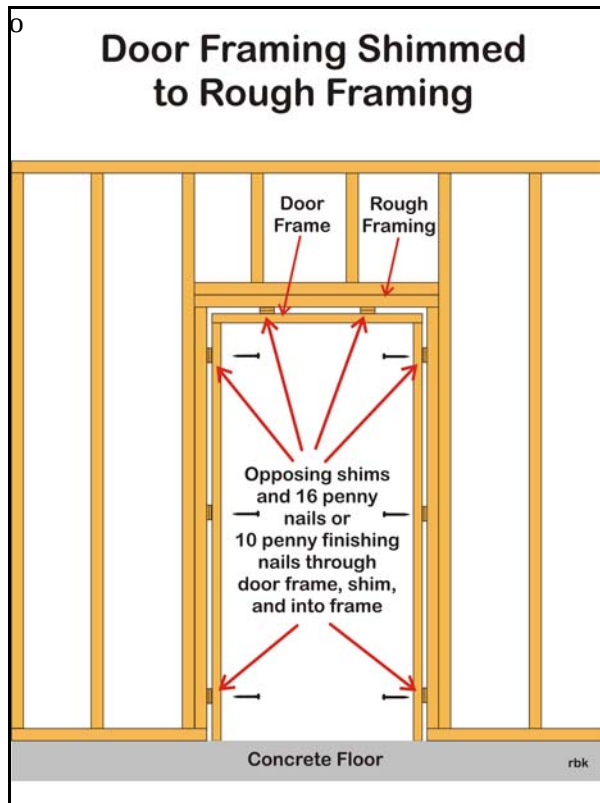


Figure 11.4: Framing Out the Door – Normally, the door frame is fastened to the rough framing with opposing shim, three sets on each side. Source: author – [file:\SH-DoorConstruction05.cdr].

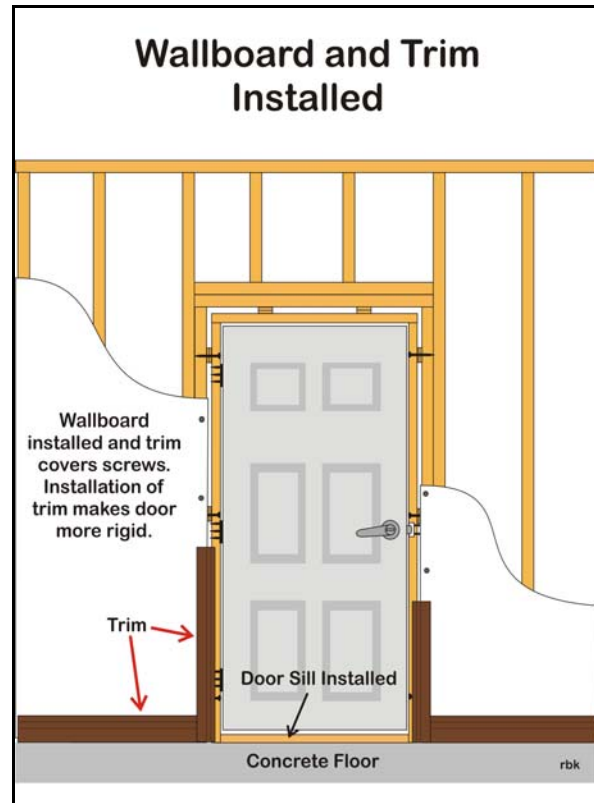


Figure 11.5: Wallboard and Trim Installed – Nailing the trim stiffens up the door. From a security standpoint the typical door installation is designed to prevent an intrusion. Source: author – [file:\SH-DoorConstruction02.cdr].

ffers little protection to a determined invader. A hammer can easily and quickly break through the wallboard and wall.

Typical interior door construction offers little protection against an intruder. A rough door frame is framed using 2x4s (Figure 11.4). On an interior door, this is usually two 2x4s back-to-back. In some cases, people will install a header which is usually two 2x10"s standing on their sides.

Next, the door frame is installed within the rough frame (Figure 11.4). If the door is pre-hung, the entire door is installed. Using opposing wooden shims, the door frame is shimmed on the sides until it is plumb. Usually, the door frame is shimmed and fastened at three points on each side of the frame using ten penny finishing nails driven through the shims into the rough frame. In a secure door, FEMA recommends five points of fastening on each side of the door rather than the typical three points.

The hinges are fastened to the door frame with wood screws (Figure 11.5). Normally, the hinges are connected to the door frame but not directly into the rough framing. From a home intrusion perspective, this creates a weak point in the door. Interior doors usually open outwardly. This places the hinges facing outward. An intruder can easily take a hammer and nail and pop the pins out of the hinges. The door can be opened. Most likely, the intruder will simply break down the door.

The door knob is installed (Figure 11.5). The receptacle is installed with two screws into the door jam. The screws may or may not screw into the rough frame. This creates one point of contact on this side of

the door and in terms of security, it is a vulnerable point. When breaking down a door in the movies, the police usually kick down the door knob side of the door. It is the obvious weak point. A home intruder will normally break down the door on the door knob side also.

Finishing the door, the wallboard is hung on the walls and the trim is nailed to the door jam and wall. Installing the trim stiffens up the door considerably. For normal use, this door installation is perfectly satisfactory.

As noted, normal construction is susceptible to a home intruder breaking into the room. The intruder can take a hammer and easily pound a hole through the wallboard. Another approach is that most interior door locks are designed to be opened with a pin or small nail inserted into the door knob from the outside. This prevents people or children from purposely locking themselves in a room. Another method of entry is that the intruder can easily remove the pins from the hinges and remove the door from its hinges. Most likely, the intruder will simply kick down the door on the door knob side and enter the room as shown in the movies.

<c>**Hardened Door and Walls** (Figure 11.6)

– The strategy is to delay long enough for the police to arrive. The safe room needs to provide sufficient protection until the police arrive. Consider the following approach to hardening the door and walls to create a safe room. It is not impenetrable, but it can provide considerable protection and in most cases it will offer sufficient protection until the police arrive. Also, it is inexpensive and other than the three deadbolts, it looks like any other interior door.

Sheath the wall studs with 5/8" exterior plywood sheathing and apply the wallboard directly over the plywood. The plywood can be applied on either one or both sides of the studs. If the room is serving a dual function as a tornado room, sheath both sides. Sheathing the studs makes for a rigid and sturdy construction. Also, the sheathing binds everything together. In addition, if a pre-hung door is being used, the door jam can be extended using a 1/2"x3/4" parting bead to accommodate the additional thickness of the plywood sheathing.

The following steps are used to harden the door. Buy a standard steel door. It can be a four or six panel door that looks identical to the other interior doors. It may be an exterior door. Use three four inch hinges. If the door opens outward, it is imperative that the hinges have closed pins or interlocking hinges when closed. This prevents removing the door by removing the hinge pins. At least one of the screws fastening

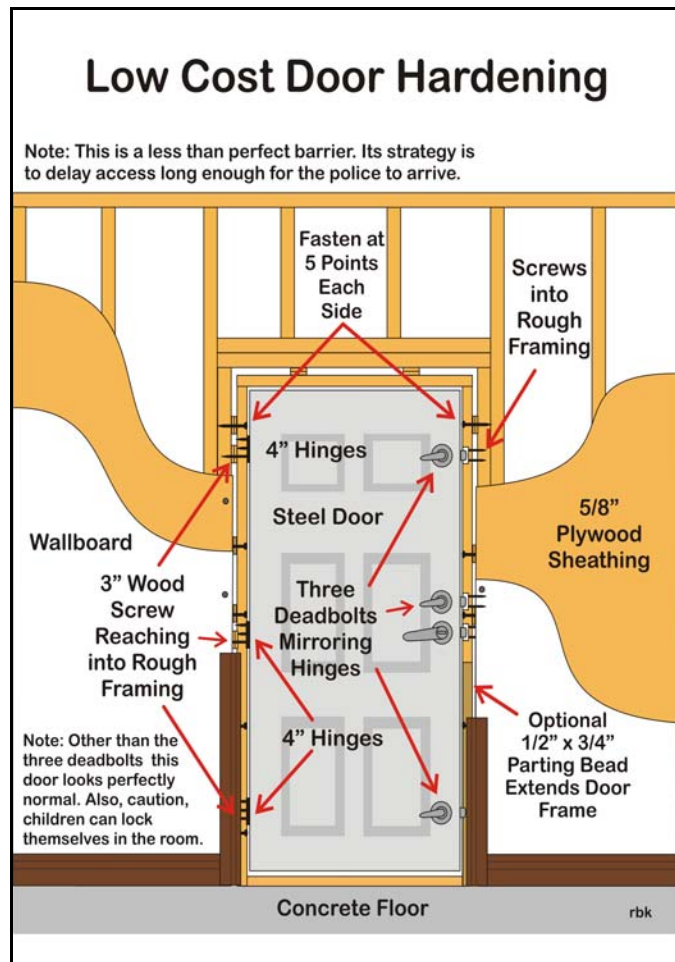


Figure 11.6: Low Cost Door Hardening – The design is to delay intrusion long enough for the police to arrive. The 5/8" plywood sheathing delays entry through the wall. The steel door, three deadbolts and other measures makes this door hard to break down. Source: author – [file:\SH-DoorConstruction01.cdr].

the hinge to the door jam should be of sufficient length to extend through the door jam and into the rough framing. Generally, it is a good idea to shim between the door jam and rough framing for this screw.

Vault Type Door (Figure 11.7) – The previous section utilized a standard metal door. Typically, it is a wood core with a thin metal veneer. This type of door can easily be upgraded to a vault door for approximately \$4,000. It is a heavier gauge steel and it has multiple tenons that extend into mortices in the steel frame. In addition, the door usually meets the FEMA specifications described in the next section. The door can look like a normal interior six panel door or they can look like a typical vault door. In addition, these doors find usefulness in gun vaults or rooms designed as gun vaults.

FEMA Specifications (Figure 11.8) – Figure 11.8 provides the recommended door specification for safe rooms. Examination of the door reveals three dead bolts mirroring the hinges. The door is no wider than three feet and it is constructed out of 12 gauge or 14 gauge steel depending on the doors internal reinforcement. In addition, the door uses three heavy duty 4" hinges. The FEMA specifications are important for commercial producers of safe room doors who need to conform to the recommended specification to sell their product.



Figure 11.7: Vault Type Door – A steel door, note the one vertical and five lateral mortices. Also, the door is a typical six panel door. Source: internet – [file:\SafeDoor01[86].jpg].

Examination of the door in Figure 11.6 reveals that the basic construction of that door incorporates the basic features of the FEMA door. Again, it provides a low cost alternative that is reasonably secure.

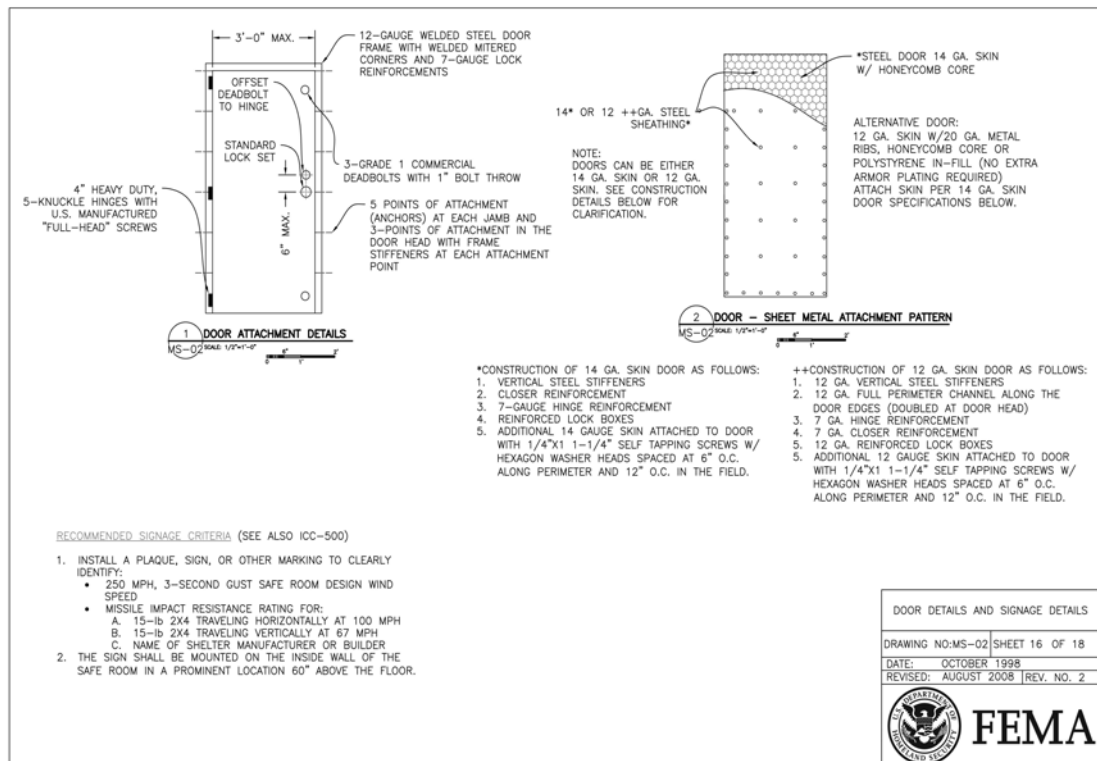


Figure 11.8: FEMA Door Specifications – Source: internet – [file:\FEMA_SafeDoor02[685].jpg].



Figure 11.9: Book Shelf Entrance – Door Closed – The book shelf is a concealed door hiding the safe room or gun vault. There is a secure vault type door protecting the room. Source: internet – [file:\SafeDoor05[44].jpg].



Figure 11.10: Book Shelf Entrance – Door Opened – The book shelf is opened revealing the open vault type door and safe room. Source: internet – [file:\SafeDoor06[44].jpg].

Concealed Safe Rooms (Figure 11.9 and Figure 11.10) – Normally, bookshelves or other pieces of furniture can be used to conceal the entrance to a safe room or gun vault. The bookshelves are not the secure door. They only camouflage or conceal the secure door to the safe room or gun vault located behind the bookshelf.

In the opinion of this author, concealed rooms have more practicality for gun vaults and in large homes not lacking for space. It is an issue of access and convenience. A safe room with a constantly opened bookshelf to provide convenient access to the room quickly loses the element of concealment. Also, in a home invasion, the invaders have the element of surprise and they usually know there are people somewhere in the building. Also, a concealed entrance can delay accessing the safe room. It should not reduce quick access into the room by family members fleeing the invaders and seeking security in the safe room.

Gun vaults tend to be smaller and they are accessed less often than a safe room that is doubling as a normal bedroom. A concealed bookcase door makes more sense for this type of use.

Masonry (Figure 11.11) – Maximum protection usually involves a reinforced concrete wall. This is poured concrete with both horizontal and vertical steel reinforcement in the concrete. An alternative is to use concrete block and fill the empty space in the block with concrete. Again, concrete block filled with concrete is reinforced both vertically and horizontally with steel reinforcing rods. Normally, the ceiling is poured concrete

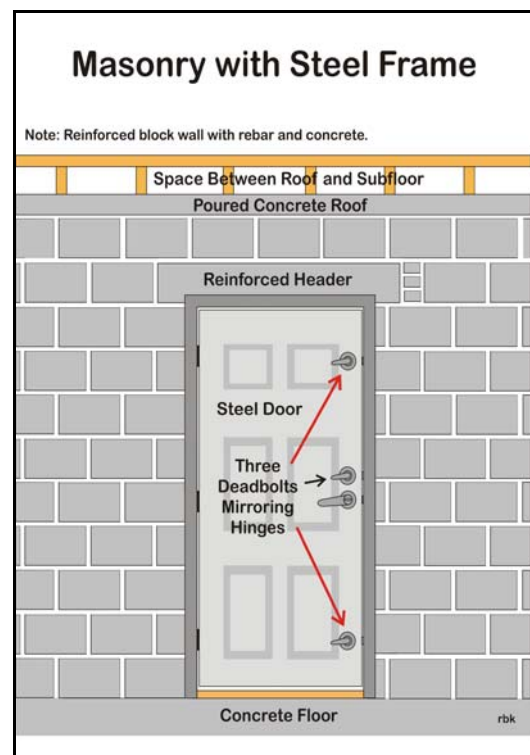


Figure 11.11: Masonry – For maximum protection, use poured concrete or concrete block filled with concrete with both horizontal and vertical steel reinforcing rods. Source: author – [file:\SH-DoorConstruction07.cdr].

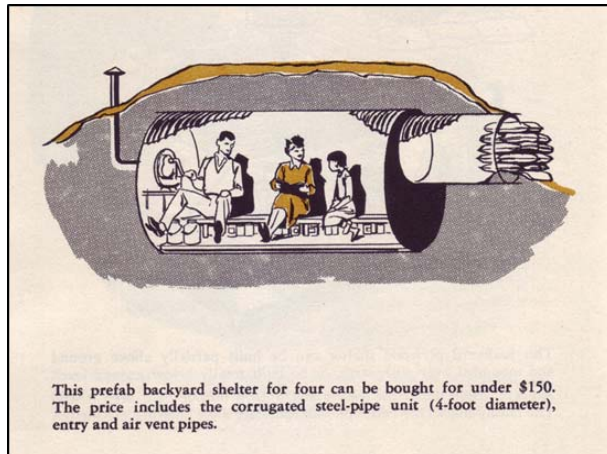


Figure 11.12: 1950s Bunker – The caption reads “This prefab backyard shelter for four can be bought for under \$150. The price includes the corrugated steel-pipe unit (4-foot diameter), entry and air vent pipes.” Source: Department of Defense – [file:\SH-Bunker01[76].cdr].

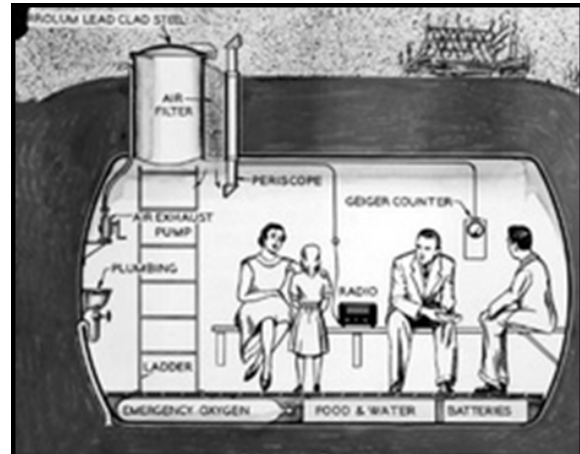


Figure 11.13: 1950s Bunker – In time of a nuclear war, the bunker is a close living area. Note the Geiger Counter hanging on the wall. Think food, water, sanitation, etc. in terms of living conditions. Source: Department of Defense – [file:\SH-Bunker02[65].cdr].

with steel reinforcement rods.

Reinforced concrete offers a significant improvement in protection over a plywood sheathed wall. However, it should be noted that a concrete wall on anything other than ground floor would need considerable reinforcement to support the weight of its structure. This may preclude its use in retrofitting a safe room to an existing structure.

Bunkers

From a design perspective, safe rooms can quickly and seamlessly merge into bunker designs. In the beginning of this chapter, bunkers were essentially defined as underground protection in case of war. Whether underground or above ground, most people would expand the definition of a bunker to include above ground and uses other than war.

1950s Bunkers (Figure 11.12, Figure 11.13, and Figure 11.14) – During the 1950s in the height of the cold war, home bunkers became a topic of discussion. Three bunker designs were chosen from the internet for discussion.

In a nuclear war, *Underground Bunkers* (2017) indicates that the major killer after the initial blast is from fallout. An underground bunker helps to provide protection from fallout and they recommend as a thumb rule to remain two weeks underground. The length of time underground is a function of the distance from the initial blast zone, time, and other factors such as prevailing winds. The closer to the blast zone the longer the time underground. People several miles away may be

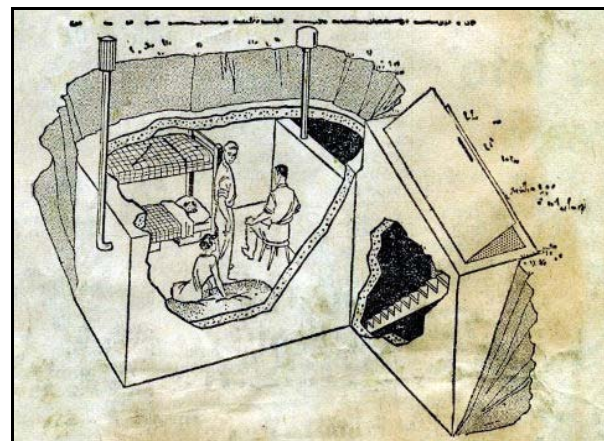


Figure 11.14: 1950s Bunker – A slightly larger bunker with beds. Note the space behind the entrance steps is wasted space that could be used for storage if access can be provided. Source: Department of Defense – [file:\SH-Bunker[66].cdr].

able to leave their shelter after 72 hours. In most cases after two weeks, initial radiation levels will have diminished to 1% of their initial levels. Hence, the thumb rule of two weeks underground.

Also affecting the time required in the bunker are those areas targeted and resulting in fallout. In a nuclear attack, Figure 11.15 indicates the areas that would largely be affected by fallout. The missile silos in the mid-west states would be targeted by enemy missiles resulting in large amounts of fallout.

<c>**Backyard Bunkers** – The bunker pictured

in Figure 11.12 is designed to be a low cost bunker that can easily be constructed in the backyard. The caption reads “*This prefab backyard shelter for four can be bought for*

under \$150. The price includes the corrugated steel-pipe unit (4-foot diameter), entry and air vent pipes.”

The \$150 is in 1950s dollars and would be considerably more today. Three days (72 hours) in this bunker would be survivable. However, two weeks in the pictured bunker would be more problematic.

Underground Bunkers (2017) recommends a minimum of three feet of earth on top of the bunker. As pictured, this bunker may be a little shy on soil overhead.

Analyze the bunker in terms food, water, sanitation and the other planning elements in the *Surviving the Unexpected Emergency Model*. At one gallon per person per day, this family of three should have a minimum of 42 gallons of water in the bunker. This would be 82 two-liter bottles or a 55 gallon drum. Consider sanitation. A five pound bucket toilet would most likely suffice or a chemical toilet might be a good alternative. Three days would be survivable. Two weeks more problematic.

Figure 11.13 pictures what is most likely a commercial pre-fabricated bunker. It contains an air filter, periscope, and Geiger counter. Analysis of planning resources would be similar to those for the bunker pictured in Figure 11.12.

The third 1950s bunker is pictured in Figure 11.14. A larger space, bunk beds have been installed. However, two comments. The door and stairwell offer little protection in terms of exposure from fallout. Second, note the considerable amount of under-utilized space behind the stairs. If the stairs can be hinged and raised with a pulley system, there is considerable storage space available for food, water and other supplies.

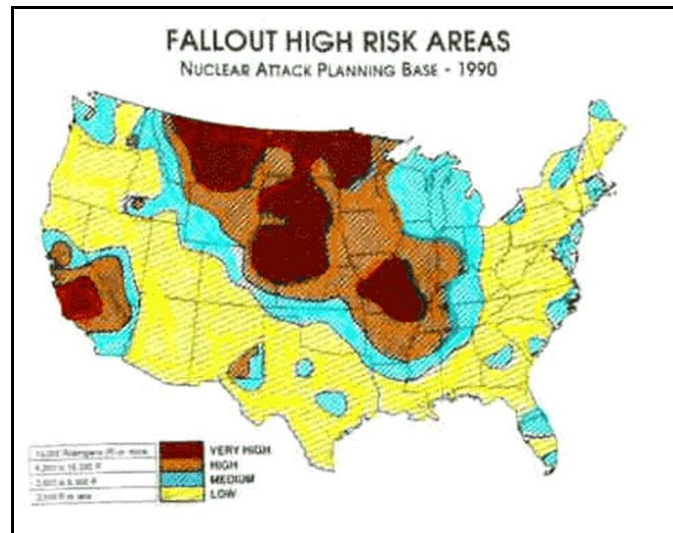


Figure 11.15: High Risk Fallout Areas – Source: internet – [file:\FallOutMap[90].jpg].

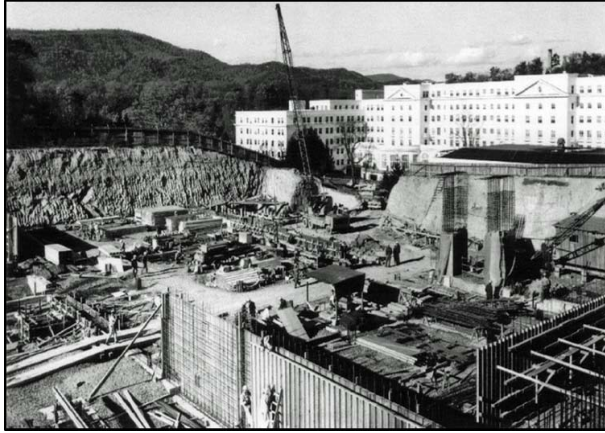


Figure 11.16: Greenbrier Bunker Construction – The 112,500 square foot bunker was built below the Greenbrier resort in Sulphur Springs, West Virginia in 1959. Source: Dept. of Defense – [file:\GreenbrierConstruction[104].jpg].



Figure 11.17: Food Supplies – The bunker maintained sixty days of food supplies for 1,100 members of Congress and their families. Source: Dept. of Defense – [file:\GreenbrierFood[92].jpg].

<c>**Greenbrier** – At the other end of the spectrum is the bunker at Greenbrier in Sulphur Springs, West Virginia. During the height of the cold war in the 1950s, the government built a secret bunker for Congress at the Greenbrier resort, in Sulphur Springs, West Virginia. Authorized in 1956, construction began in 1959 of the 112,500 square foot bunker that would withstand a nuclear attack (Figure 11.16). It was designed to support 1,100 people including members of Congress and their families. The bunker contained a power plant, decontamination chambers, communications equipment, meeting rooms, and a great hall for joint sessions. Sixty days of food supplies were rotated through the facility (Figure 11.17). It had medical facilities and dormitories for sleeping facilities. The bunker was protected by four 25-blast doors that could withstand a nuclear blast (Figure 11.18).

Contemporary Pre-fabricated Shelters– Modern bunkers are constructed from fiberglass, steel and concrete. They can be made in modules and assembled onsite or they are manufactured in parts and assembled onsite. Figure 11.19 is a tubular design manufactured out of fiberglass. It can easily be carried on a flatbed truck from the manufacturer to the site where it is buried in the ground.

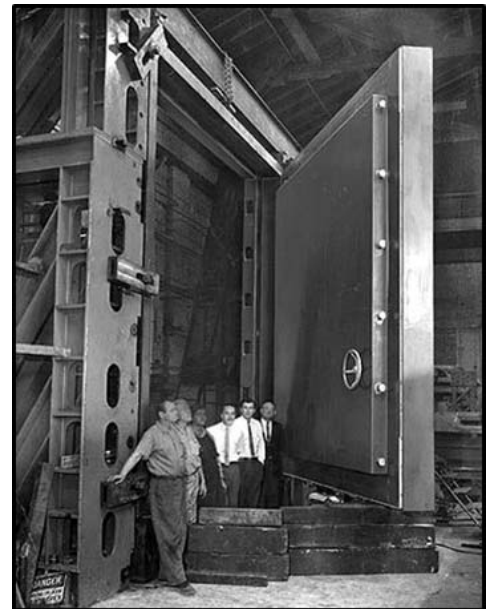


Figure 11.18: Blast Doors – Four 25 ton blast door protected the underground facility against a nuclear attack. Source: Department of Defense – [file:\GreenbrierDoor[49].jpg].

Figure 11.20 and Figure 11.21 shows the interior of the bunker in Figure 11.19. The photos are taken looking toward each end of the bunker of the bunker in Figure 11.19. Compared with the 1950s examples, this bunker is a lot more spacious. Careful inspection of the two interior scenes suggest that its confined layout is similar to recreation vehicles and trailers. Floor plans are discussed in more depth in the next section.



Figure 11.19: Fiberglass Bunker – Prefabricated bunker can be carried to the site on an 18 wheeler and backfilled in the ground. Source: Internet – [file:\TubularFiberglassShelter[62].jpg].

A larger fiberglass bunker is shown in Figure 11.22. Except for the end units (Figure 11.23), the units come in two parts that are bolted together onsite and placed on top of a concrete slab. The entire bunker is covered with the dirt originally excavated from the site. The shovel in the background gives a sense of scale. The interior of the end unit shown in Figure 11.23 helps to provide a sense of spaciousness.



Figure 11.22: Fiberglass Bunker – Providing scale, note the large shovel in the background. When complete, the entire unit will be buried. Source: Internet – [file:\ModularFiberglassBunker01[70].jpg].



Figure 11.20: Fiberglass Bunker – Interior – One of two interior pictures. Source: Internet – [file:\TubularInterior01[62].jpg].



Figure 11.21: Fiberglass Bunker – Interior – One of two interior pictures. Source: Internet – [file:\TubularInterior02[70][49].jpg].



Figure 11.23: Large Fiberglass Bunker – End Unit – The end unit attempts to create a spacious interior setting. Source: Internet – [file:\ModularFiberglassBunker02[90].jpg].

Steel is a commonly used material for bunker construction. In the internet literature, there is a heated debate over the advantages of using steel over fiberglass. Most of the steel bunkers resemble modified cargo containers. In fact, cargo containers can be modified into bunkers. The steel bunker shown in Figure 11.24 is constructed from a series of interlocking containers to provide a spacious living space of 6,500 square feet in the bunker.



Figure 11.24: Modular Steel Bunker – When backfilled, the modular steel construction creates a 6,000 square foot bunker. Source: Internet – [file:\ModularSteelBunker[80].jpg].

Floor Plans (Figure 11.25 and Figure 11.26) – In terms of *Surviving the Unexpected Emergency Model*, the type of experience and its duration will determine the amount of space needed for and the design of the safe room or bunker. Generally, the rule is that as time increases in a safe room or bunker, the more functions and resources that will need to be provided to the inhabitants. Tornadoes are short lived. Protection for an hour or two hours is needed. Storage of food, water, and sanitation are not normally an issue. Sleeping areas are not an issue. Other than a flashlight, not a lot is needed to survive an hour or two underground in a bunker.

Assuming the typical home invasion scenario depicted in this chapter, the same can be said for the design and supplying of a safe room. It needs to provide sufficient protection from the home invaders until the police arrive. Hopefully, this would be an hour at most. This section suggests adapting a bedroom or other room to the purpose of creating a safe room. Since the bedroom serves a dual purpose, the floor plan of the safe room is that of a bedroom.

As the duration of the experience increases, safe room design merges with bunker design and they essentially become one and the same. In general, bunker design has much in common with RV trailer and 5th wheel designs. Both are designed to maximize space utilization within limited spaces.

<c>**Avoid Hallways** – The purpose of a hallway is to connect spaces (i.e. rooms) with each other. Generally, the larger the rooms or the more rooms present, the more the need for hallways to connect them. A hotel is an example of many rooms connected by a hallway. Although they may be necessary, they are, in general, wasted space. In confined areas such as safe rooms, bunkers, RV trailers, and 5th wheel designs, the use of hallways may be an indication of a poor design and an inefficient use of space.

Figure 11.25 is a diagram of a commercially available bunker floor plan. The hallways have been identified. If the floor plan can be redesigned to eliminate the hallways, more space will be available. The author redesigned the floor plan to eliminate the hallways. The analysis of the revised floor plan is discussed in the next section titled “walking the plan.”

<c>**Walking the Plan** – The floor plan is a diagram of the actual layout. Walking the plan is just that. It is walking the floor plan as if it were the actual layout. Move about the layout. Sit in the chairs. Prepare food in the kitchen. Turn and place the prepared food on the table. As is illustrated by the two examples below, it is important to examine floor plans critically. Walking the plan helps to critically evaluate the layout because once the structure is built, it is difficult to change walls.

Walk the original floor plan in Figure 11.25. Walk down the steps. Enter the bunker. Pass by the lounge and TV. The placement of the TV helps to define the lounge area. Work the kitchen area. Prepare dinner. It is a tight fit for anyone working the kitchen area with those sitting at the table. It is a potential problem. Perhaps a smaller table would solve the problem? Walk into the storage area for food or other items. Storage and access are conveniently located. To access the master bedroom, walk down the hallway, enter through a door, and walk down another hallway. Also, note that there is little separation between the master bedroom and the bunk bed rooms which may not be desirable.

Now walk the redesigned floor plan in Figure 11.26. The hallways have been eliminated which adds space to the main living area. The master bedroom, bathroom, and bunk bed rooms are identical in size. The vault room is slightly larger. Eliminating the hallways creates a larger common area. The dining area table can be moved slightly allowing a person to actually work in the kitchen area while people are sitting at the table. Also, the bathroom provides some separation between the master bedroom and the bunk bed room.

<c>**Minimize Utilities** – In a 20'x30' bunker, minimizing utilities is not usually a critical issue. Typically, most electrical wires are stretched to the kitchen. From an efficiency perspective, the location of the main electrical box in close proximity to the kitchen minimizes electrical costs.

In modern buildings, find the drinking fountain and find the restrooms. Locating the drinking fountain and restrooms in close proximity minimizes plumbing costs. Water and drains need to be provided to both the kitchen and bathroom. In a 20'x30' bunker the relocation of the bathroom in Figure 11.26 will most likely have little effect on plumbing.

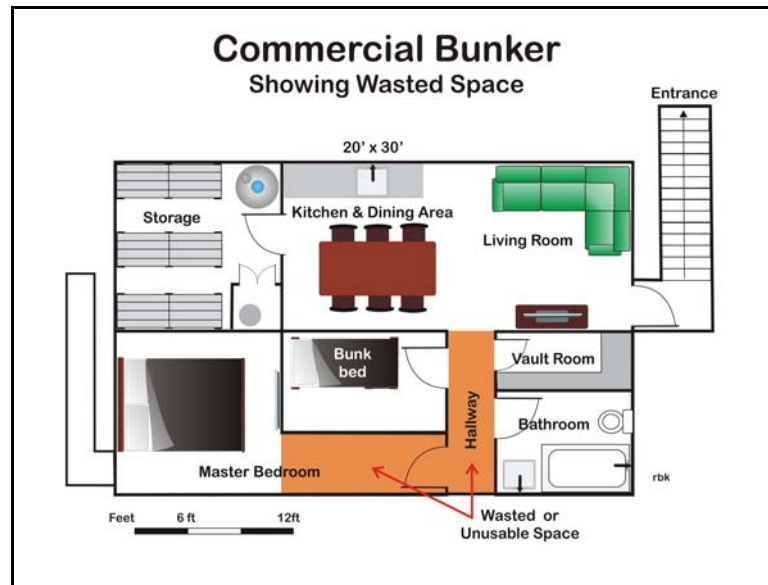


Figure 11.25: Bunker Floor Plan with Wasted Space – Examine spatial relationships and “walk-the-plan.” Hallways connect spaces and they may be an indication of wasted space in a confined area such as a bunker. Source: author – [file:\SH-Bunker02.cdr].

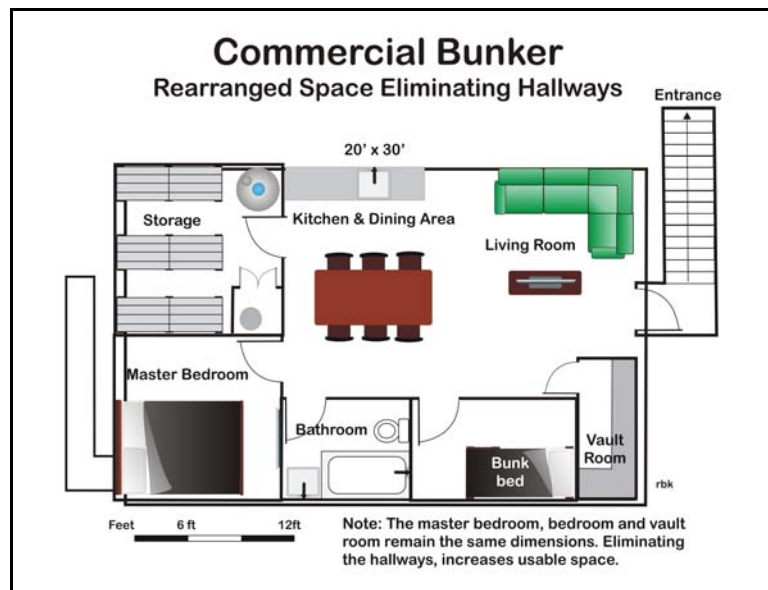


Figure 11.26: Bunker Floor Plan Redesigned – This is the redesign floor plan in Figure 11.8 to eliminate the hallways. Note the increased space and the separation of the master bedroom from the bunk beds. Hallways are dead space. Source: author – [file:\SH-Bunker03.cdr].

Innovative Designs

– Perhaps the most innovative bunker is the conversion of abandoned missile silos into a bunker (Figure 11.27). The bunkers are already hardened to nuclear attack and offers extensive space that can be converted into living space.

Home as a Bunker

– Intuitively, people think their home would be a good safe place because during normal times it offers protection. Analyzing the types of experiences in *Surviving the Unexpected Emergency Model*, the home does not normally make a good bunker for most of the natural and man-made disasters. Also, the chapter on protection discusses the home as a fortress.

Hurricanes can destroy the house and if the bunker is in the basement, the basement can easily flood. Houses built in flood plains are prone to flooding. An earthquake can crumble the house on top of the bunker. A house prone to tsunamis is also prone to flooding and collapse. Volcanoes destroy everything in their path including homes and bunkers. Wildfires will burn the house to the ground above the bunker and if the fire is big enough it will bake everything in the ground or suck all the oxygen out of the air.

Man-made disasters include crime, terrorism, and war. Regarding crime, a safe room or bunker can provide adequate protection. Both were discussed in this chapter. The discussion of terrorism and war is deferred to the chapter on protection. However, for most people, the home will offer their source of protection during times of terrorism or war, no matter how imperfect the home may be in terms of providing protection.

Summary

This chapter focuses on bunkers and safe rooms. It discusses safe rooms and bunkers in terms of the *Surviving the Unexpected Emergency* model. In terms of the model, the discussion includes designing safe rooms and bunkers for tornados, crime and war. A major focus is on designing a practical and inexpensive safe room for protection during a home invasion. A primer on bunker design is provided also. The bunker discussion emphasizes protection during a war situation.

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Figure 11.27: Converted Missile Silo – A converted missile silo is spacious enough to create an underground communal living situation.
Source: internet – [file:\MissileSiloBunker02[76].jpg].

Chapter 12:

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Chapter 13: Navigation ¹

Think of navigation as a hierarchal progression. The first level is using natural features to orient yourself. This is important because you will always have your knowledge, but you may not have navigational aids with you. It does not rely on any external features or instruments with which to assist your navigation. This includes the watch method to determine north, differential heating, and celestial navigation. The second level uses traditional or what people might now consider “primitive technologies” for navigation. This includes the use of maps and compass for navigation. It also includes navigational charts and compass. The use of map and compass is still a staple of navigation today. The third level includes navigation using ancillary methods such as GPS (Global Positioning Satellites) or similar methods.

It is important to view these three levels of navigation as complementing each other. They are not used in isolation of each other. For example, GPS may provide one route. However, this route should correspond with what you perceive to be the correct route using natural features. You should always be evaluating what is occurring in terms of natural features and navigation and seek congruence between them.

This chapter views navigation in terms of the three levels. These are the use of natural features, map and compass, and high technology. The map and compass section is divided into three sections maps, compass and map and compass

Chapter 13.1: Use of Natural Features

The first level focuses on the use of natural features for orientation and navigation. These techniques rely on your knowledge and on the use of your brain. It is your last line of defense. Actually, it is your first line of defense. In a very real sense, you will always have these two elements with you. If you lose your compass and don’t know how to navigate using natural features, you will become lost or disoriented more quickly. In time of a disaster or war, satellite communications may become useless. The use of GPS (Global Positioning Satellites) will most likely become useless. Any device utilizing GPS will become useless also. Several of the methods presented in this section are common sense, once understood. Having a sense of orientation and awareness of your surroundings to orient yourself is comforting. It reduces panic and it reduces the likelihood of becoming disoriented.

Conceptually, think of orientation and navigation as hierarchal or a three tier approach. Ground level is using natural features for orientation and navigation. It is the making of mental maps and being interconnected with the environment in which you are traveling. The second tier is the use of map and compass. These are low tech tools that if you have them with you, you can navigate. The third tier is the use of high technology including GPS. The focus of this first section emphasizes the use of natural features for orientation and navigation.

Orientation – Orientation is “*knowing where you are in relationship to features in the landscape around you.*” It is the comparison of features in the landscape with a person’s mental map in his/her mind. It is your first line of defense. It is the base line approach. Even if you use the technological methods of orientation such as GPS or other electronic approaches, the use of natural features to orient yourself

¹ This article was written by Robert B. Kauffman who is solely responsible for its content. This article is copyrighted © Robert B. Kauffman, 2015.

complements these technological approaches. It is a form of validation. It connects you with where you are and with your surroundings. This is important because if for any reason, GPS or a similar technologies fail, it helps to prevent becoming disoriented.

Navigation – Navigation is defined as “*the art of knowing where you are and where you want to go.*” Usually, it uses a reference point (e.g. north) to provide the orientation necessary to navigate from one location to another. The reference point need not be north. It could be a lake, cliff or other prominent landmark. In an era of GPS, global positioning, MapQuest®, Google Maps®, and other internet tools, navigation can utilize a user friendly map or series of commands. It is still navigation because you are moving from point A to point B using a fixed reference point even if it is a GPA satellite.

This section focuses on the first tier of the navigational hierarchy. This section focuses on the use of natural features to provide orientation with the surroundings and mental maps of the landscape. This is the use of your surroundings to orient yourself. The second section is the use of mechanical methods to navigation. This is the traditional area of using map and compass. The third section focuses on the use of electronic means of navigation. Currently, the last two sections are in separate sections from this one.

Mental Maps

Mental maps are a person’s first line of defense. When all other systems fail, mental maps are the fall back position. And when all other systems are operating, mental maps complement the other systems. Gatty (1983) identifies three different ways people orient themselves to their surroundings. These are covered in this section. In addition, taking mental pictures and looking back on the fork in the trail discussed in the next section can greatly aid in orienting yourself upon returning.

Home Centered Reference System – In the home centered reference system, Gatty (1983) notes that the native starts from the home and explores an unfamiliar area that becomes familiar area #1 (Figure 13.1). Next, the native explores a new unfamiliar area that becomes familiar area #2. Once this area becomes familiar, the native explores a third unfamiliar area that becomes familiar area #3. Key to all these explorations is that the home is the center or place from which the search originates and returns. Hence, the reference to it as the home centered reference system.

Also, this approach is used by people today where they use their house as the origin of their search and they explore outwardly within their community to find the grocery store, park and other nearby services.

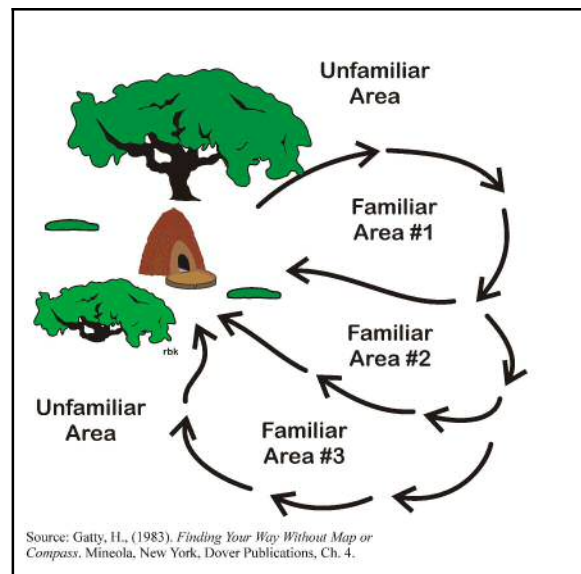


Figure 13.1 – Home Centered Reference System – Source: author – [file:\NA-HomeCentered[144].jpg]

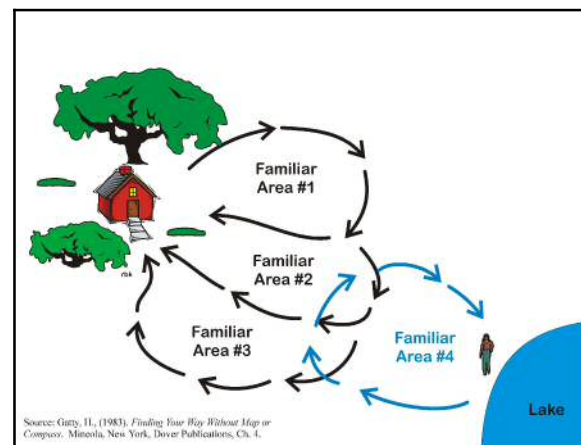


Figure 13.2 – Local Reference System – Source: author – [file:\NA-LocalReferenceSystem[144].jpg]

Local Reference System – The local reference system is really an extension or modification of the home centered reference system (Figure 13.2). In contrast to the home centered system that uses the home as the reference point, the local reference system uses prominent features within an area as the reference point with which to orient other features.

Self-centered Reference System – In the self-centered system, everything is oriented or centered around the individual (Figure 13.3). It is typically used by the modern traveler, particular those who use GPS. Gatty (1983) notes that the traveler divides the horizon into north, south, east, and west. They use a compass to orient themselves with its modern version being GPS. He notes that if there is a disconnect anywhere in the system, the traveler easily becomes disoriented and lost because they are now in an unfamiliar area.

Modern GPS and similar navigational devices are examples of the modern variation of a self-centered reference system. They are useful tools that can easily lead to disorientation when they fail or become inoperative. It is easy to plug into the computer two locations and then blindly follow the directions. If everything goes correctly, you get to where you want to go. However, you are not oriented regarding where you are in terms of your surroundings. You are blindly following the directions. And, it is easy to fall into this situation where you are blindly following the directions without being oriented to your surroundings. It makes it easier to become lost and totally disoriented.

Local Reference Maps – The logical extension of the local reference system is the local reference map (Figure 13.4). It uses symbols to represent prominent features. In Figure 13.4, features might include the lake, stream, home, and trail. A simple legend can be added indicating the features as can a scale. These features help make the map transferable to other people.

Used in combination with the identification of natural features in the environment, the use of high tech and natural methods can complement each other. This author uses GoogleMaps® extensively to both navigate and orientate in new locations. GoogleMaps® is used to locate a park amenity in a city where the author is going to visit. When onsite, the map is used to navigate a trip to the location. The map provides orientation because the objects in reality are in the same location as they are on the map. The examination of the map leads to such familiarity with the location, it is as if this author had lived there and was totally oriented with the surroundings. The familiarity with the surroundings provided by the maps becomes in reality a variation of the local reference system.

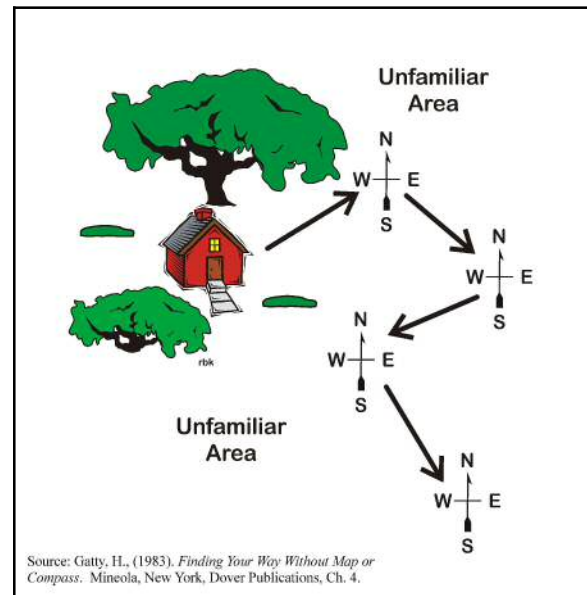


Figure 13.3 – Self-centered Reference System – Source: author – [file:\NA-SelfCentered[144].jpg]

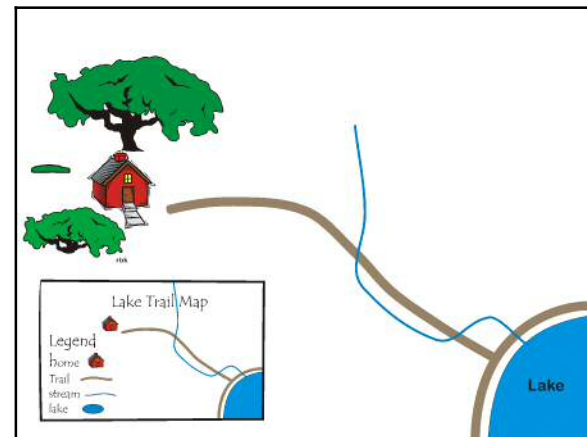


Figure 13.4 – Local Reference Maps – Source: author – [file:\NA-LocalReferenceMap[144].jpg]

Finding North Using Natural Methods

A compass or GPS can easily determine north. However, there are numerous methods using natural methods for locating north. Several of these are covered in this section. They are good to know because they are useful in orienting yourself even if you are using more technological methods. They serve as a useful backup or verification to the more technological methods. There should be congruence between the methods used.

Effects of Differential Heating – In the northern hemisphere, the sun is in the southern portion of the sky. In winter, the sun's rays create *differential heating* between the southern and northern facing side of objects such as trees, lamp post, bollards and other objects (Figure 13.5). The differential heating will melt more of the snow on the southern facing portion of the tree than the northern facing portion. This method actually works and is reasonably reliable. As always, sample several trees. Try not to rely on just one example.

A less reliable method utilizes differential heating during summer. The differential heating results in the southern facing portion of the tree being dryer than the northern portion of the tree (Figure 13.6). This differential results in moss and ferns growing on the moister northern portion of the tree. This method is less reliable because there can be many intervening factors affecting the growth of different species. If the over-story is fairly dense, the entire forest floor will be moist and lined with ferns. Conversely, the differential heating may be insufficient to cause moss to grow on just the north side and not to grow on the east, west, or south sides.

Having noted this, larger areas often reflect the effects of differential heating. On the east coast where a stream or creek cuts through a hill, the side of the canyon on the south side receives less sunlight than the slope on the northern side. Often, dense stands of hemlocks will be found on the more sheltered side of the canyon than on the more exposed northern side. Again, this is a generalization that is not always true.

Rather than using it to predict north, this principle usually works well in reverse. If you know a north/south orientation and you look at the stream cut through a hill, the differences in vegetation on the north and south slopes often seem to correspond to this principle.

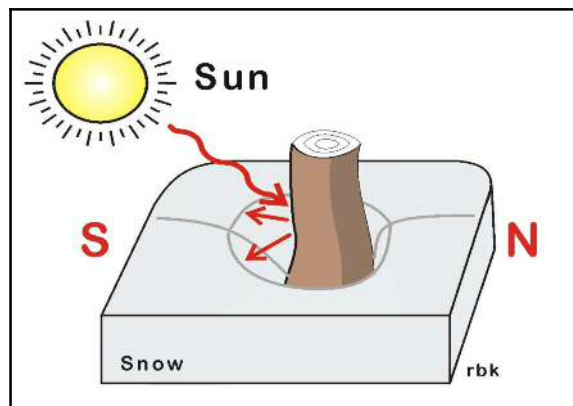


Figure 13.5: Differential Heating – Winter – Actually, this method of orientation is fairly reliable.

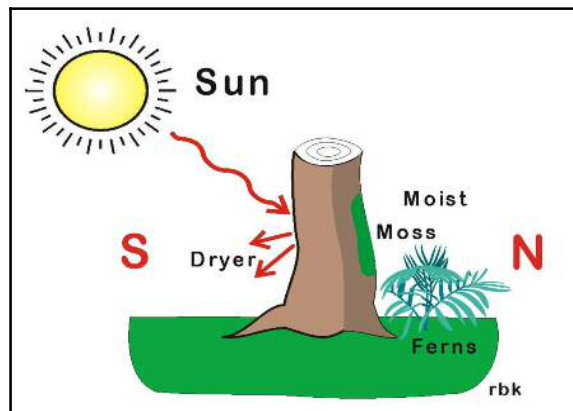


Figure 13.6: Differential Heating – Summer – Be careful using this method since it is very unreliable.

Prevailing Winds and Tree Growth – An additional method of orientation that often works includes the effect of *prevailing winds* and *tree growth*. In the northern hemisphere the prevailing winds are generally from the west. The upper air currents tend to move from the west to the east. This affects tree growth. The westerly winds tend to retard tree growth on the west side of the tree. This is true for exposed trees standing alone in their surroundings. Protected trees in a forest area would not normally demonstrate this principle. In addition, the limbs on the southern portion tend to grow longer than those on the north side. They are seeking the sun and extending their limbs outward toward the sun.



Figure 13.7: Affect of Westerly Winds on Trees – Source: Author

Examine the evergreen trees next to the road in Figure 13.7 and a closeup of the top of the same two trees in Figure 13.8. The area and the trees are exposed. They are susceptible to the wind. They are bent. The top branches are longer on the lee or down wind side of the tree (Figure 13.8). The dramatic difference is most likely due to two reasons. First, the east side of the tree grows toward the sun. Second, the exposed needles on the branches on the west side are literally sandblasted by the wind and snow. Close examination of the trees along the edge of the field reveals that they are also bending toward the left. Their growth is congruent with the effects occurring to the two evergreen trees.



Figure 13.8: Affect of Westerly Winds on Tree Tops – Source: Author

Before rendering an opinion, it is important to examine the trees and their surroundings. Trees overhanging roads tend to lean toward and overhang the road. Care needs to be taken that this is not the case for these two trees. Also, visual examination of the trees in the forest exhibit similar growth and shaping behavior as the two exposed trees but to a lesser degree. A complete examination of the trees and their surrounding in the pictures suggests that the prevailing winds are from the west and from the right in the photograph.

Celestial Navigation – *Celestial navigation* can provide orientation and navigation (Figure 13.9). Polaris is the North Star. Since it is located over the North Pole, the North Star provides orientation. The North Star is the last star in the handle of the small dipper and the big dipper points to it. Orion's belt provides an east/west axis and orientation. The planets move from east to west in the night sky. Find a tree or other object which can be used for sighting to determine the movement of the planets.

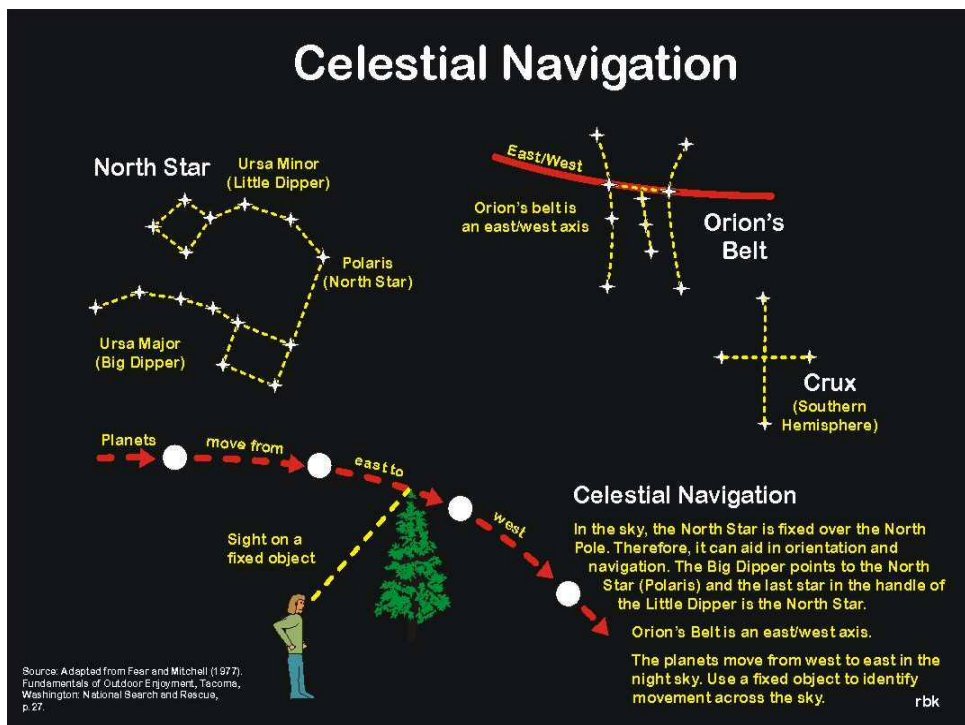


Figure 13.9: Celestial Navigation

Watch Methods – The *watch method* of determining the north/south axis is included in this section also. It is included because it can be used even if you don't have a watch. The sun rises in the east and sets in the west. In a mechanical sense, it moves across the sky. Its movement correlates with the time of day. The watch method utilizes the mechanical movement of the sun across the sky with the time of day (Figure 13.10). Simply point the hour hand of a traditional watch toward the sun. Bisect the angle made by the hour hand and 12:00. This is the north/south axis. South is between the hour hand and 12:00. North faces the other direction.

Cell Phone Watch Method – A *cell phone* doesn't have a clock face (Figure 13.11). If you have the appropriate app, you can picture time as a traditional clock face. You don't need it because you can mentally superimpose the clock face on the cell phone. The critical component is the knowing the time. Once you know the time, estimate the hour hand and superimpose it and the clock face on the cell phone so that the hour hand is pointing toward the sun. Then follow the previous directions.

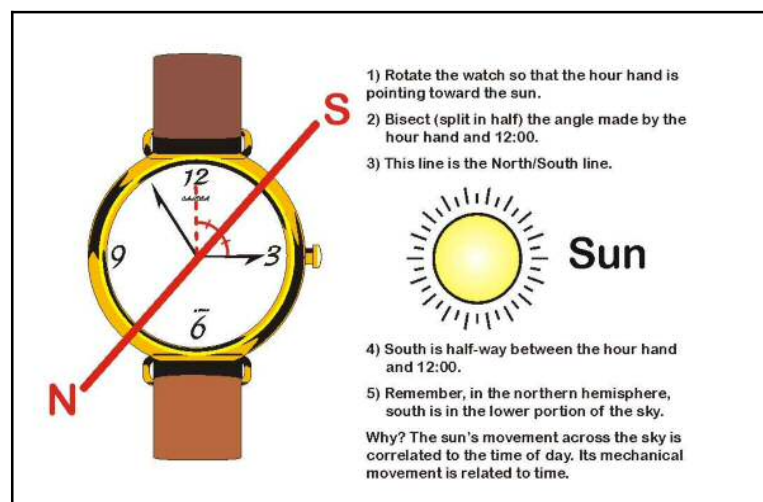


Figure 13.10: Watch Method – to determine north

Watch Method without a Watch – The last version of the watch method is using the watch method without a watch (Figure 13.12). It requires estimating the time of day. Again, once you have the time of day, you create a hypothetical clock and point your arms toward the sun and 12:00. Again, you will need to work backwards to estimate where 12:00 is located. Look up bisecting the angle created by your two arms. Your line of vision is south. North is directly behind you. Yes, this is imprecise but it will orient you and if you want to go in a general direction you can do so.

Watch Method Using a Shadow – The bollard in the snow demonstrates differential heating and melting of the snow (Figure 13.13 and see Figure 13.5). The same bollard casts a shadow that can be used to determine north and to provide direction. In addition, the time of day needs to be known, even if it is an approximation.

The shadow is related to the time of day line. When the photograph was taken, the time was approximately 2:00 pm. Next, the 12:00 noon position needs to be calculated. The 12:00 position line will move counter clockwise as the time increases. As with the watch face method, the angle between 12:00 and 2:00 is bisected. This line forms the North/South line.

Using the shadow, the north and south positions are reversed with the previously described method. Rather than north pointing away from the angle made by the 12:00 and 2:00 lines, north is on the same side of the angle made by the two lines. This makes sense because the shadow is pointing away from the sun. The watch face method points the time line toward the sun. The watch face method is superimposed on the photo in Figure 13.13.

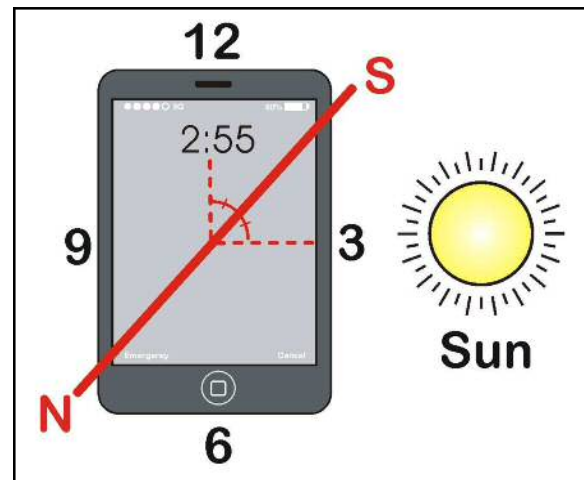


Figure 13.11: Cell Phone Method

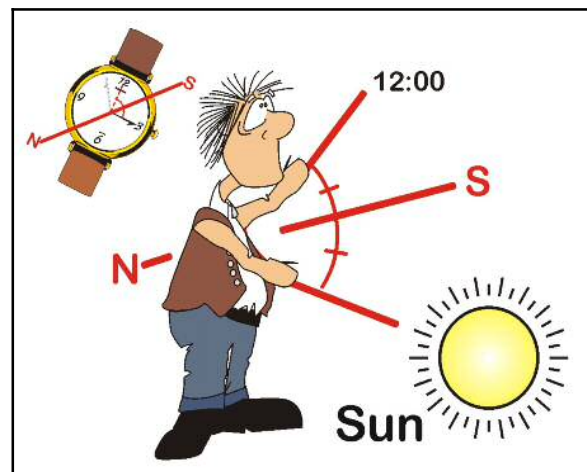


Figure 13.12: Using the Watch Method without a Watch

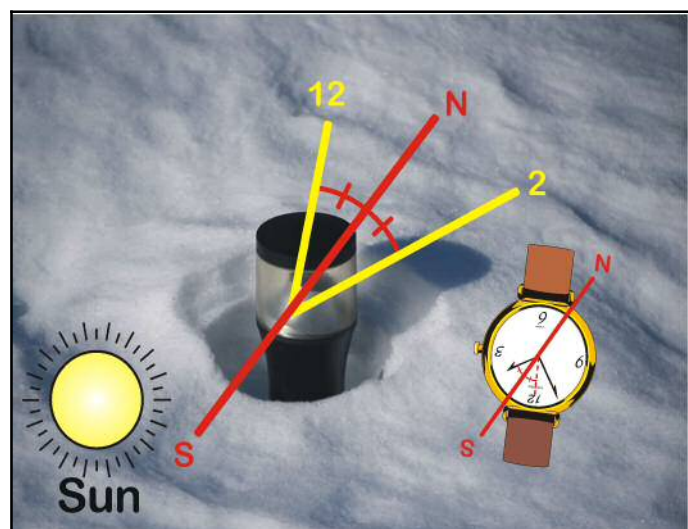


Figure 13.13: The Shadow Knows – Using the shadow and modified watch method to determine north.

Navigational Techniques

Orientation focuses more on orienting the person with their surroundings. Navigation focuses more on moving within the landscape. It utilizes the concept of orientation for its foundation. However, it is people on the move. Regarding basic movement of people, a great deal can be learned from the search and rescue literature and their focus on the behavior of lost victims. In addition, a great deal can be learned from trackers who also focus on people's movements.

Lost Person's Behavior – Gleaned from the search and rescue literature, lost person's behavior is useful in determining unfettered travel in the backcountry (Koester, 2008). In terms of this discussion, the importance of this material is that the unfettered travel of people without the use of navigational aids to orient themselves is not random. It is predictable.

Walking in Circles – People walking without navigational or orientation aids will tend to walk in circles. According to Gatty (1983), it has nothing to do with being right or left handed. He notes that the symmetrical human body is not truly symmetrical. In this case, one leg is normally bigger and stronger than the other leg. Roughly 55% of the population will veer to the right and 45% will veer to the left.

Lost Person's Behavior – To a degree, people's behavior when lost is predictable. As might be expected, people will tend to walk downhill rather than uphill (Koester, 2008). For example, 45% of lost people will walk downhill and 21% will stay at the same level. In contrast, only 34% will walk uphill. Behaviorally by activity, only 7% of hikers and hunters will move uphill. Fifty percent of the hikers will descend. Roughly 67% of children will move downhill or remain at the same level.

Also, as might be expected, rivers and streams form barriers. Most people will tend to avoid crossing them. If there is a trail, road, or abandoned railroad right-of-way, people will tend to use them because of their ease of travel, unless of course, the person is purposely not seeking to be found.

Mental Maps – The mind makes mental maps all the time. You drive to the grocery store. You turn right onto the boulevard. You identify a street sign, building or other landmark and know where this is where you turn. You have made a mental map. A useful trick is to turn around and make a mental picture of the trail just traveled (Figure 13.14). You should do this as a matter of course. This is particularly helpful if you come to a fork in the trail. If you have to retrace your route, you will have made a mental picture of the fork in the trail and you will better remember which fork to take. This technique is also useful when driving down the highway. As you pass an exit on the return side of road, look in your rear view mirror and make a mental picture of the exit.

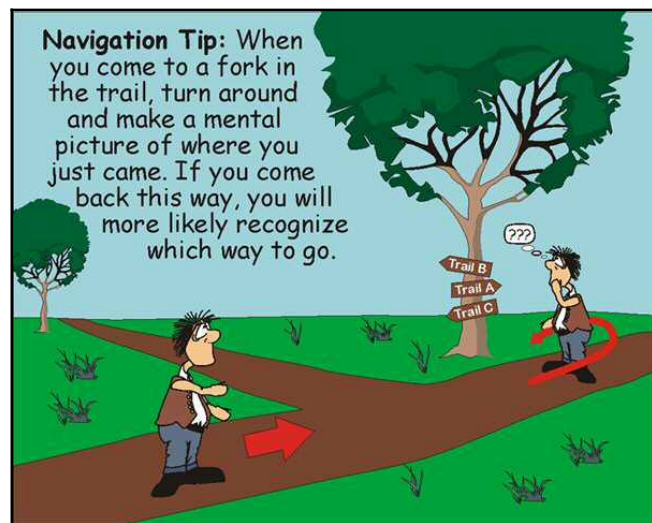


Figure 13.14: Turn Around, Look and Make a Mental Map of the Trail Just Traveled.

Speed of Travel – Speed of travel is often overlooked as an aid in navigation. Although it is an imprecise measure of distance traveled, it complements the other travel aids and provides a sense of where you are.

Speed of travel tells you how far you have gone and how far you should have gone. The range of speeds for a hiker or backpacker range from 1.5 to 3 mph. This is with a 30" pace. Altitude, terrain, group or individual travel, and motivation will significantly influence speed of travel. Groups tend to travel more slowly than individuals. Measure your speed of travel over known distances and you will have an accurate predictor of your speed of travel for you or your group.

A canoe can travel from 2.5 to 4 mph. Currents, headwinds, tail-winds, group or individual travel, and motivation will significantly influence speed of travel. A headwind will slow travel and a tailwind will increase the speed of travel.

The best method to determine your speed of travel is to measure it over a known distance. As you start your trip purposely measure your time and distance using a map as you progress. Calculate your rate of travel for your group. This technique provides an actual metric.

If you are traveling at roughly two miles an hour, after three hours you would expect to have traveled six miles. You look at a map. You notice that for the first six miles, the trail or waterway moves in an easterly direction. Then it turns and moves in a southerly direction. You determine your general sense of direction using the watch method or even a compass. It doesn't matter. If after six hours of travel, you are not traveling in a southerly direction, you might begin to wonder if you took a wrong turn. Or, you simply could be behind schedule and adjust your average speed of travel by lowering your speed. In this example, the speed of travel, time spent traveling, orientation using the watch method and a map complement each other in navigation and in providing you a sense of orientation of where you are or should be.

When traveling in the backcountry, this author uses speed of travel and congruence to acclimatize himself into backcountry travel. We go from sitting behind a desk to traveling in a canoe with map and compass. Mentally, we need to re-acclimatize ourselves to backcountry travel and this new environment. We need to tune our senses and reorient ourselves. Speed of travel coupled with the other methods discussed here greatly aid with this acclimatization.

The speed of and distance traveled technique are frequently used by automobile drivers. Traveling at 60 mph on an interstate, most travelers realize they are traveling a mile a minute. Thirty minutes equals 30 miles. Sixty minutes equals sixty miles. There is an intuitive relationship between time and distance and each can be used to help determine the other.

Aiming-off – Aiming-off is an orienteering technique that is useful in general navigation. Rather than aiming directly for a small object that could easily be missed, the traveler uses a “collector” and then aims-off to the target. A collector is a large or continuous object such as river, lake, road, power line, or similar object that can easily be targeted. In a very real sense, it creates a boundary to one’s travel.

Two examples of aiming-off are provided. In Figure 13.15, a lake is used as the collector. Aiming for it is relatively easy. It is a simple matter of intersecting with it and bearing left to find the house.

In the second example, a river is used as the collector (Figure 13.16). The strategy is to aim to the left of the object and the bend in the river. The bend is easily found and the building is right around the corner.

Estimating Distance with Shape, Form, and Color of Objects

Shape, form and color are affected by viewing distance. Scenes can be divided into three general zones: foreground, middle ground, and background. The U.S. Forest Service has done considerable research on this topic as it relates to visual management of forest landscapes (U.S. Forest Service, 1974). The changes in shape, form and color (hews) of the landscape can be used in estimating distances and in navigation.

The U.S. Forest Service (1974) identified three zones. The foreground ranges up to 1/4 to 1/2 mile from the viewer. Middle ground ranges from 1/4 to 1/2 mile to three to five miles from the viewer. The background extends beyond three to five miles from the viewer. Each of these zones has different characters and the exact same object(s) in one zone will have a different shape, color or color when viewed in another zone.

The zones and the changes that occur in viewing similar objects in each zone are illustrated in the overlook on the Kangamangus highway near Conway, New Hampshire (Figure 13.17). It is the same forest in the foreground, middle-ground and background. However, the changes in form, shape and color are readily identifiable in each of the three zones. In fact, the changes can be used in reverse to predict general distances. This application is useful in backcountry navigation to determine relative distances.

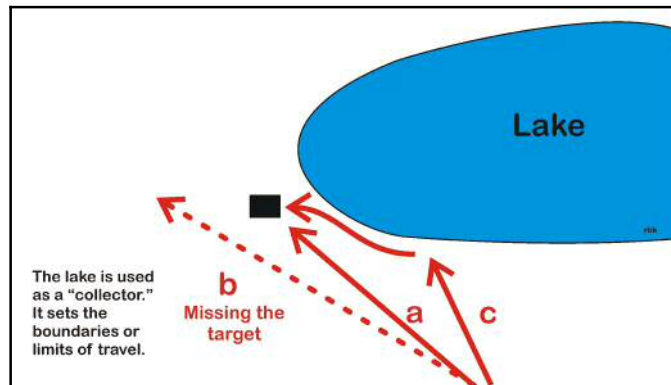


Figure 13.15 – Aiming-off Using a Lake – Source: author – [file:\NA-AimOffLake4[144].jpg]

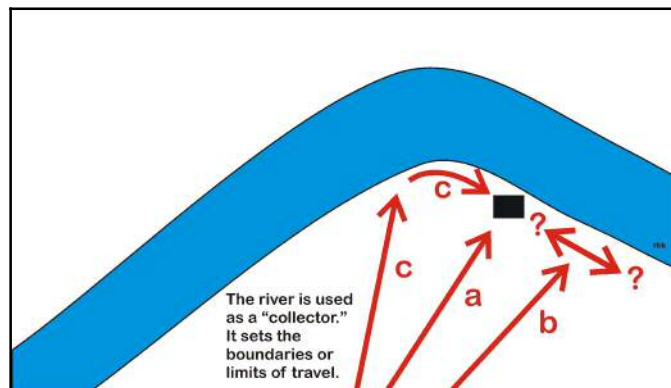


Figure 13.16 – Aiming-off Using a River – Source: author – [file:\NA-AimOffLake4[144].jpg]



Figure 13.17 – Kangamangus Overlook – Caption: This scenic overlook on the Kangamangus Highway demonstrates the effects of distance on the visual landscape. It demonstrates the differences in the foreground (sign and first hill in middle of the scene), middle ground (second hill on left), and the background (third hill on the right). Near Conway, New Hampshire. Source: author – [file:\SLIDES-VIS\DSC_0024.JPG]

The following is a zone by zone analysis of the scene viewed from the Kangamangus overlook (Figure 13.17). In the foreground, the tree limbs and leaves on the trees are easily distinguishable. The first hill in the center of the picture is still part of the foreground. The individual limbs on the trees are still easily distinguishable and the scene is most likely less than $\frac{1}{2}$ a mile away. The hill on the left is in the middle-ground and is most likely over half-a-mile away. Note that the individual trees have begun to merge together and there is a color shift noticeable even on a black and white version of the photo. Over three to five miles away, the mountains on the right are clearly visible in the background. The same species of trees now appear as a solid plane and even the shadow of the cloud presents itself as a single object on the hillside. Again, note the color shift that is evident even in the black and white version of this photograph.

In backcountry navigation, a boater crossing a bay can easily determine the relative distances from shore or to destinations by using these visual principles. The closer the traveler gets to shore or the destination, the background characteristics will give way to the middle ground characteristics and then to those of the foreground. In the background, trees will merge together into one plane or mass. As the traveler merges into the middle ground, those same trees will emerge as individual trees but the limb structure won't be pronounced. Also, the hues will change toward looking more natural. As the traveler enters the foreground, the limbs of individual trees will become pronounced. The traveler can conclude the relative distance and that he/she is getting closer rather than further away from the shore.

A more sophisticated application of this principle is that gaps in the color transition may indicate bays or similar features that can correspond with features on a map. The changes in hue, size of objects and their shape occurs continuously with distance. Therefore, two ridge lines will create a gap in hue, object sizes, and their shapes because the distance between the two ridges is blocked by the ridge in the foreground. This feature is evident in Figure 13.17 with the ridge lines between the hill in the foreground blocking

the hill in the middle ground.

Summary

Even if you go high tech for your navigation, your first line of defense should still be the use of natural features with which to orient yourself and to aid in navigation. The use of natural features to orient yourself provides a useful backup to the high tech approaches. More importantly, it provides the link between the high tech approaches and features within the local environment. Intuitively, most people use a variation of the local reference system to orient themselves with features within their environment. The better able you are to make this connection, the less likely you will become disoriented and lost when the high tech method fail or are unavailable. The bottom line is that you always have your knowledge with you to help orient yourself in time of need.

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Chapter 13.2: Topographic Maps ¹

A **map** is a model or representation of objects and terrain in the actual environment. There are numerous types of maps. Some of the types of maps include mental, planimetric, topographic, and even treasure maps. The concept of mapping was introduced in the section using natural features. Maps are created for numerous purposes. A treasure map is used to find the buried treasure. Topographic maps were originally used for military purposes. Today, they have been used for planning and recreational purposes. Although other types of maps are mentioned, the primary focus of this section is on topographic maps.

Types of Maps

Mental Maps – The mind makes mental maps all the time. You drive to the grocery store. You turn right onto the boulevard. You identify a street sign, building or other landmark and know where this is where you turn. You have made a mental map. This was discussed under using natural features.

Planimetric Maps – A planimetric map is a two dimensional representation of objects in the environment. Generally, planimetric maps do not include topographic representation. Road maps, Rand McNally ® and GoogleMaps ® (not GoogleEarth) are examples of planimetric maps.

Topographic Maps – Topographic maps show elevation or three-dimensional topography two dimensionally. Topographic maps use contour lines to show elevation. A **chart** refers to a nautical chart. Nautical charts are topographic maps in reverse. Rather than giving elevation, they provide equal levels of water depth.

Topographic Maps

Topographic maps show elevation or three-dimensional topography two dimensionally. Topographic maps use contour lines to show elevation. Originally, topographic maps were developed by the Army Corps of Engineers for military use. This is most evident in that green on the map indicates areas where troops can hide. Generally, these are forested areas and more specifically, areas where the vegetation is over six feet tall. Today, topographic maps are being used in numerous civilian applications including recreation. The following sections address the different components of a typical topographic map.

Color Coding – Most features on a topographic map are color coded. **Black** represents cultural elements including boundaries, building and the names of features. **Brown** indicates contour lines. Contour lines are point of equal elevation connected together. **Blue** indicates water and includes rivers, lakes, streams and wetlands. Most people consider **green** as forest. This is partially true. Originally, topographic maps were made by the Army Corps of Engineers for military purposes. Green areas are areas where the vegetation is over six feet tall. Six feet is the height of a soldier and green indicates areas where troops can hide. **Purple** indicates recent revisions without revising the topography. The new revisions are simply superimposed on the landscape without changing the contour lines.

¹ This section was written by Robert B. Kauffman who is solely responsible for its content. This section is copyrighted © Robert B. Kauffman, 2015. Robert B. Kauffman, Professor of Recreation and Parks Management, Frostburg State University, Frostburg, MD 21532. e: rkauffman@frostburg.edu.

North – Generally, there are three norths (Figure 13.18). These are found in the lower left hand corner of the topographic map. The first is **True North** (★) or the North Pole. This is represented by the star. The second north is **Grid North** (GN). Grid north is where the lines of longitude converge. Unlike the lines of latitude which circle the earth horizontally and which are parallel to each other, the lines of longitude are not parallel to each other. The third north is **Magnetic North** (MN). Magnetic north is the place to where the magnetic compass needle points. The location of magnetic north is not fixed and moves. The date when magnetic north was read is provided (1960) and the movement is noted also.

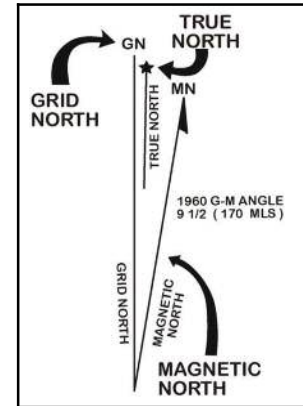


Figure 13.18: North.

Declination – The angle created by the difference between the lines of longitude pointing to grid north and magnetic north is **declination** (Figure 13.19). It differs with location. Figure 13.19 provides the relative correction for the error between magnetic north and grid north. Declination becomes important when finding the bearing of travel on the map and then finding the same bearing of travel in reality. The difference in declination needs to be corrected since the bearing to grid north and magnetic north are different.

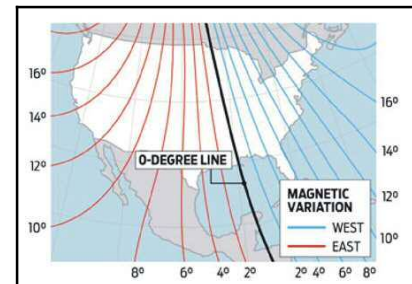


Figure 13.19: Declination.

Scale – The scale is located in the bottom center of the topographic map (Figure 13.20). On a 7.5 minute topographic quadrangle map, one inch on the map equals 24,000 inches or 2,000 feet in the real world (24,000"/12" per 1 ft). Another way of thinking about scale is that objects on the map have been reduced to 1/24,000th of their original size. Beneath the scale, distance in miles, feet and kilometers are also provided. These are generally more useful since they provide a measure of usable distances. The the contour interval of 20 feet on this map is also listed. Last, the information or data on the map was originally determined in 1929.

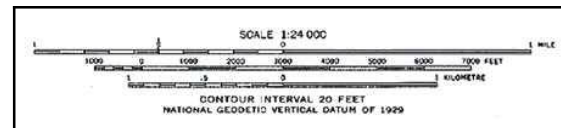


Figure 13.20: Scale.

Contour Lines – Contour lines are lines of equal elevation (Figure 13.21). They provide a method of representing three-dimensional space or topography two-dimensionally. By definition, contour lines cannot intersect each other. The closer the contour lines are together, the steeper the slope. The further apart the contour lines, the more gentle the slope. Contour lines are brown in color. The intervals can vary based on the purpose of the map and on the surrounding topography. Generally, the contour line are in 20 foot intervals. In mountainous terrain they can be 50 foot or 100 foot intervals. In site planning, the planners normally use one or two foot intervals.

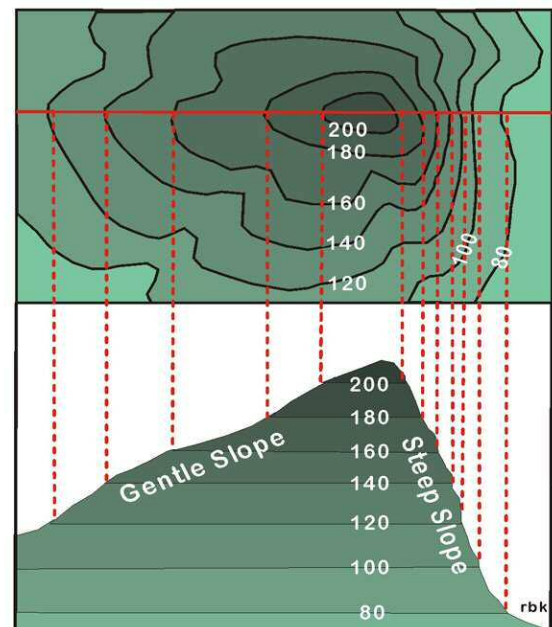


Figure 13.21: Contour Lines.

With nautical charts, the depth of the water is represented by contour lines also. Again, they are lines of equal depth and their color is blue.

Stream Flow – The contour lines are necessary to determine which way a stream flows (Figure 13.22). As noted, contour lines are points of equal elevation. Contour lines tend to create “Vs.” The rule is that the stream flows out of the “V.” A “V” without a stream is a ridge extending outward (not shown).

Symbols – Generally, most symbols are cultural and colored black on a topographic map. A sampling of symbols used on topographic maps is presented in Figure 13.23. These include building, roads, water features, railroads, and benchmarks. A benchmark is a small monument placed by the USGS indicating a documented or known elevation at this point. Benchmarks are usually affixed to permanent objects such as rock out croppings, bridge abutments, concrete slaps, etc.

Summary:

A **map** is a model or representation of objects and terrain in the actual environment. There are numerous types of maps. Some of the types of maps include mental, planimetric, topographic, and even treasure maps. Topographic maps show elevation. Although they were originally used for military purposes, they have been used for planning and recreational purposes. The basic principles involved with topographic maps were presented and will be utilized in the next section.

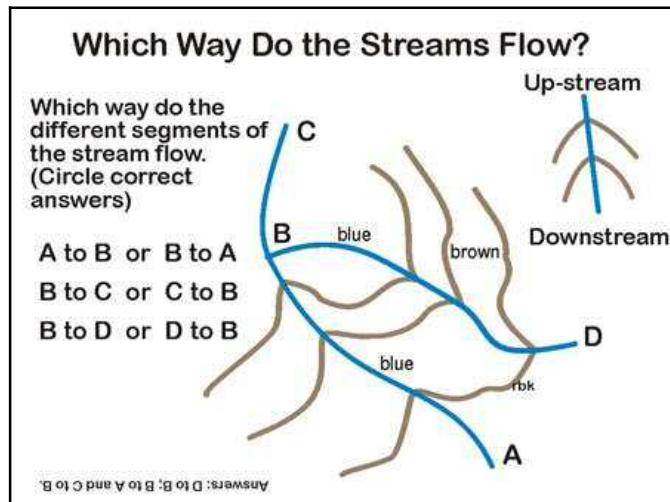


Figure 13.22: Which way do the streams flow?

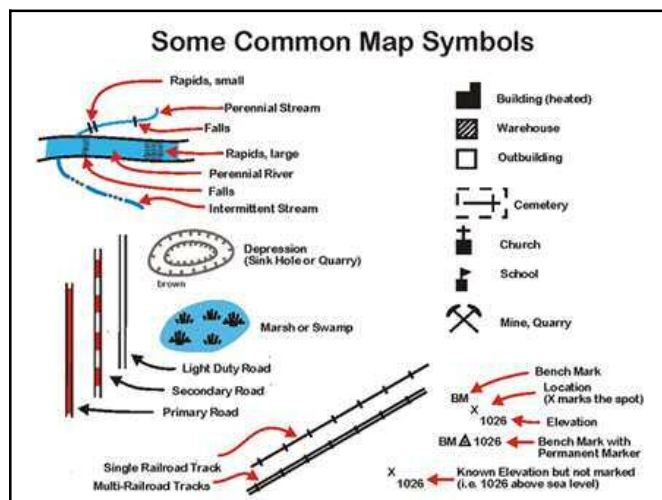


Figure 13.23: Some common map symbols.

Chapter 13.3: Compass

This section focuses on the use of a compass for navigation and orientation. The purpose of this section is to cover the traditional use of a compass in navigation. It complements the use of topographic maps in the next section (i.e. Map and Compass).

Essentially, there are two ways to use a traditional compass. The first is given a bearing, find an object on that bearing and travel to it. The second is given an object in the real world environment, determine the bearing to the object. These are the only two ways to use a compass.

Compass

The traditional compass is pictured in Figure 13.24. The parts of the compass include the transparent base, direction of travel arrow, compass housing, orientating arrow and compass needle (magnetic needle). The mm (millimeter) and inch marks are used with reading distance on maps. There are many other types of compasses. The primary difference between different types of compasses is the sighting mechanism used to determine the bearing or direction of travel. The common element of all compasses is that they contain a magnetic compass needle and the magnetic needle points to magnetic north.

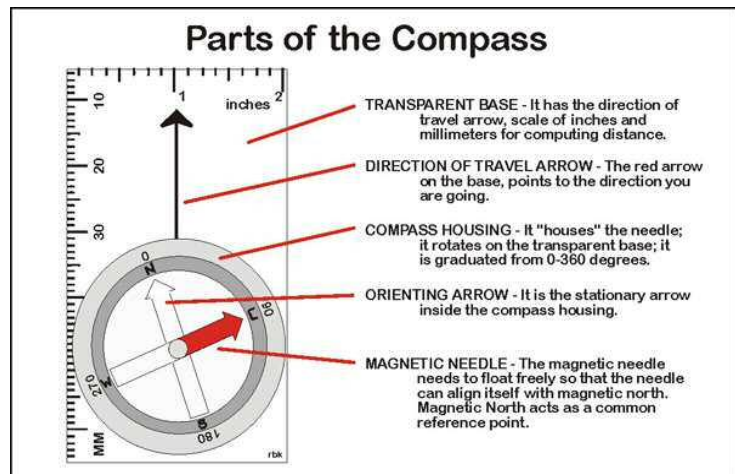


Figure 13.24: Parts of a Compass.

If you want to determine north, this can be done two ways. First, let the magnetic needle float freely within the compass housing. It will point magnetic north. Magnetic north is a reference point. It is a reference point that enables you to orient everything else in the environment. Second, rotate the direction of travel arrow to north or zero degrees. Rotate everything including yourself until the magnetic needle is superimposed over the orienting arrow in the compass housing. The direction of travel will be pointing to magnetic north.

Finding a Bearing to an Object – There are two ways to use a compass. The first is to find the bearing to an object in the environment and is covered in this section. The object can be a tree, building, mountain peak, river cut, or any prominent object. Remember that objects will change in terms of their relative size, color and relationship to their surrounding the closer that you get to the object. A typical use of this method is to triangulate two or three objects to determine your specific location on a map. You determine the bearings to two or more known objects in the environment and where the bearing lines intersect on the map is your location. The following steps are used to find a bearing to an object in the real environment.

Step #1 – The first step is to point the direction of travel arrow toward the object in the real environment (Figure 13.25). During this phase, the magnetic needle and orientation arrow in the compass housing will normally not be aligned.

Step #2 – Next, rotate the compass housing until the orientation arrow in the compass housing is aligned underneath the magnetic needle (Figure 13.26). Be sure that the red portion of both arrows are aligned. Also, be sure that the direction of travel arrow is still pointing to the object in the environment. Read the bearing off the compass housing. This bearing is your direction of travel to the object. It is also the bearing to an object even if you aren't going to travel to that object.

Given a Bearing, Find an Object – The second way to use a compass is given a bearing, find an object in the environment (Figure 13.27). A typical use of this method is to determine the bearing from a topographic map or nautical chart and then travel on that bearing. However, more on this in the Map and Compass section. The following are the steps on how to find an object in the real environment when given a bearing. The following steps are used to find an object in the environment given a bearing.

Step #1 – Given a bearing, rotate the compass housing until the bearing on the compass housing aligns with the direction of travel arrow.

Step #2 – Rotate both you and the compass until north on the magnetic needle (red portion) is aligned on top the compass housing north. Often many people find this to be difficult because they want to remain stationary. However, it is important to rotate both the compass and yourself.

Step #3 – With your line of sight, follow the direction of travel arrow, look up and find an object in the environment that the arrow is pointing at. If you travel toward that object, you will be traveling on the bearing.

Summary:

Magnetic north is a global reference point. The magnetic needle in a compass points to this location pretty much anywhere. Since it is a global reference point, magnetic north aids in orientation and navigation. A compass can be used two way. First to find the bearing to an object in the real world and second, given an object in the real world to find a bearing to it. The trick is to integrate the use of the compass with topographic maps or nautical charts which is a topic in the next section.

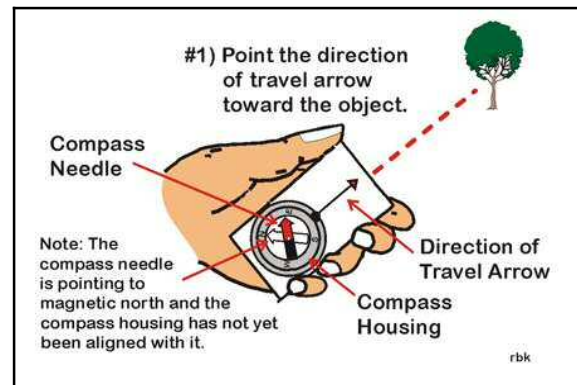


Figure 13.25: Finding a bearing to an object (Part 1).

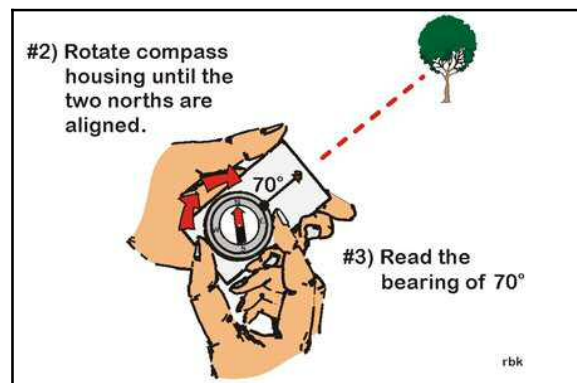


Figure 13.26: Finding a bearing to an object (Part 2).

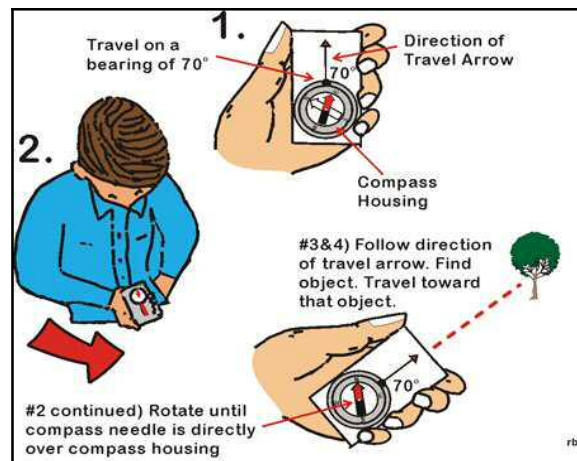


Figure 13.27: Given an object, find an object in the environment.

Chapter 13.4: Map and Compass

The purpose of this section is to combine map and compass to navigate or orient yourself. It combines and integrates the previous sections (i.e. compass and topographic maps). As with the compass, there are two ways to use a map and compass. The first is given a bearing, find an object in the real world on that bearing. The second is given an object in the real world, find the bearing to it. Integrating topographic maps, the first approach is to find the direction to an object on the map and then find that direction or bearing to the same object in the real world. The second approach is to find the direction in the real world and then determine it on the map.

Map and Compass (from map to compass bearing)

The first scenario is to determine the direction from point A on the map to point B and then find the direction in the real world to point B. The purpose of this exercise is to determine the bearing or angle of travel on the map and then to convert the bearing into an actual bearing of travel in the real world. The following directions are used to accomplish this task.

Step #1: Determine the direction of travel on the map

– For the purposes of this exercise, lines are drawn on the map to illustrate the different steps used to find the bearing. The first step is to determine where you are on the map and where you want to go (Figure 13.28).

Steps:

- 1) You want to travel from the Bobcat Stadium to Old Main.
- 2) Using the compass base, draw a line from the Bobcat Stadium to Old Main.
- 3) This line is the direction of travel on the map.

Step #2: Extend the MN and direction of travel lines until they intersect

– The second step is to extend the magnetic north arrow and direction of travel lines until they intersect (Figure 13.29). Use the base of the compass or a ruler to accomplish this task. Because you are extending the magnetic north arrow on the map, there is no need to correct for declination (i.e. the angle between

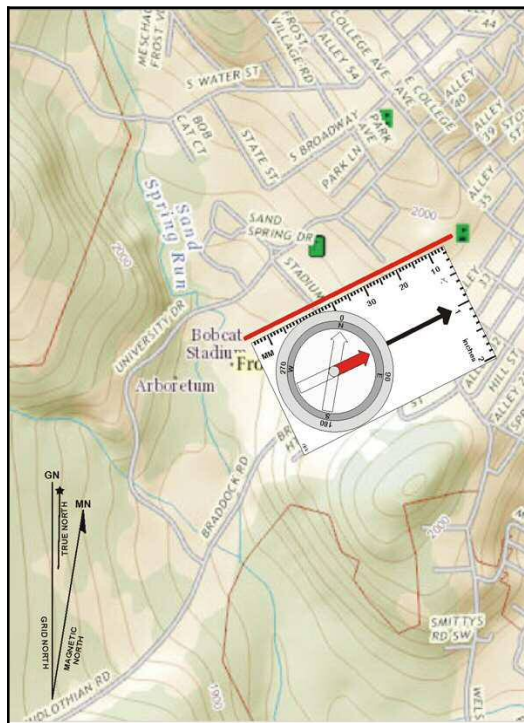


Figure 13.28: Determining the direction of travel on the map.

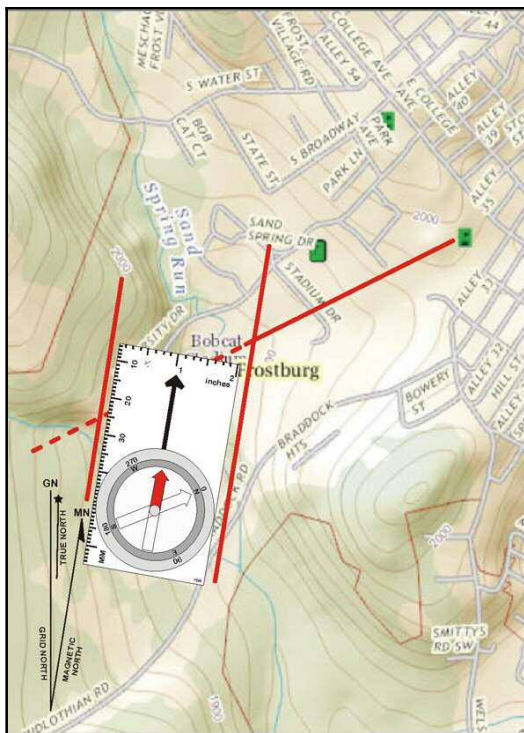


Figure 13.29: Extend MN and direction of travel lines until they intersect.

MN and GN).

Steps:

- 1) Using the compass base, extend the line from the Bobcat Stadium to Old Main (dotted line) and extend the MN upward until the two lines intersect.
- 2) Note: As shown, both sides of the compass base can be used to extend the lines.
- 3) The intersection of the two lines creates an angle. This angle is the bearing.

Step #3: Determine the angle (bearing) – The third step determines the angle in degrees between the magnetic north line and the direction of travel line (Figure 13.30). Place the compass base on the direction of travel and rotate the compass housing until the orientation arrow in the compass housing is parallel with the magnetic north line on the map. Read the bearing off the compass housing where the direction of travel arrow intersects the compass housing. This is the bearing of travel. If you find it easier, you can place the direction of travel arrow directly over the line of travel on the map. The base of the compass housing and the direction of travel are parallel and create a parallelogram.

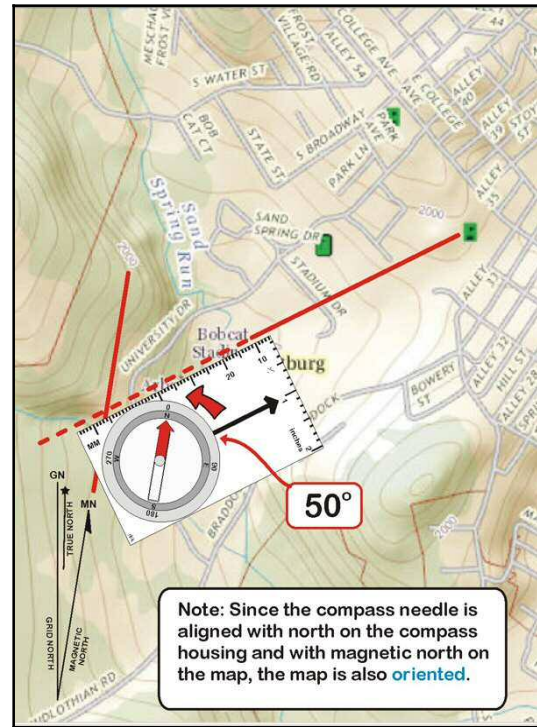


Figure 13.30: Determine the angle (bearing).

At this time ignore the magnetic compass needle in the compass housing. You are using the compass as a protractor at this point and not as a compass. If you line up the magnetic compass needle with the orientation arrow in the compass housing the map will be **oriented** also. This means that all the elements on the map are in the same general location as they are in the real world.

Steps:

- 1) Place the compass base parallel to the direction of travel. (Note: The direction of travel can be placed directly over the line also)
- 2) Rotate the compass housing until the orientation arrow in the compass housing is aligned or parallel with the MN line.
- 3) Read the bearing off the compass housing. This is where the direction of travel intersects the compass housing.
- 4) The direction travel is 50° East.

Step #4: Travel on a bearing – Now that you have a bearing of travel from the Bobcat Stadium to Old Main on the map, you can use that bearing to travel to Old Main in the real world (Figure 13.31). Hold the compass in your hand. Rotate the compass and yourself until the compass housing orientation angle lies directly underneath the magnetic north needle. Be sure the magnetic needle is floating freely. Do not move the compass housing. Rotate everything. Pick an object and travel to it. Repeat the process until that object is Old Main. You can hold both the map and compass together or hold just the compass. Either way will work.

Steps:

- 1) This is the same process as described under using a compass – “given a bearing, find an object in the real world.”
- 2) You are standing at the Bobcat Stadium. You will travel on a 50° East bearing (from Step #3). Find an object in the real world and travel to that object.
- 3) Be sure that the magnetic needle and the north arrow in the compass housing remain aligned.

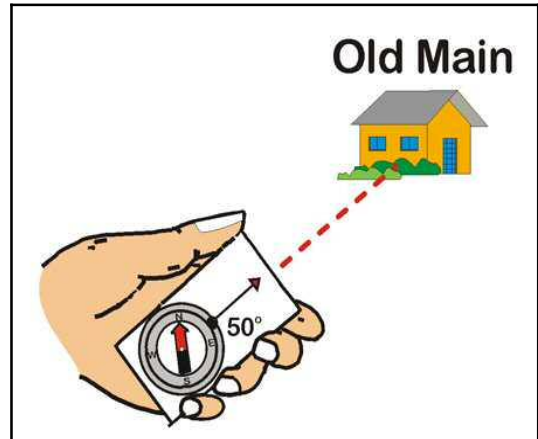


Figure 13.31: Travel on a bearing.

Map and Compass (Triangulation)

The second scenario works in reverse. This is where you find your location on the map based on bearings to known objects in the real world. In the example below, a bearing will be found to two objects in the real world (Old Main and the intersection of Loop and Braddock Roads). Using these bearing, lines will be drawn on the map on these bearings. Your location is the intersection of the two lines. Triangulation is the process of taking the bearing to two or more objects in the real world and then working in reverse to find your location on the map.

Step #1: Determine a bearing to two or more objects – In the triangulation process, the first step is to take a bearing to two or more known or identifiable locations (Figure 13.32). Generally, the wider the angle between the two objects the more accurate the determination of your location.

Step #1:

- 1) You think you are at the Bobcat Stadium but you are not sure?
- 2) Take a bearing to Old Main. It is a 50° East bearing.
- 3) Take a second bearing to the intersection of Loop Road and Braddock Road. It is a 180° South bearing.
- 4) Next, you will determine your location on the map from these two bearings.

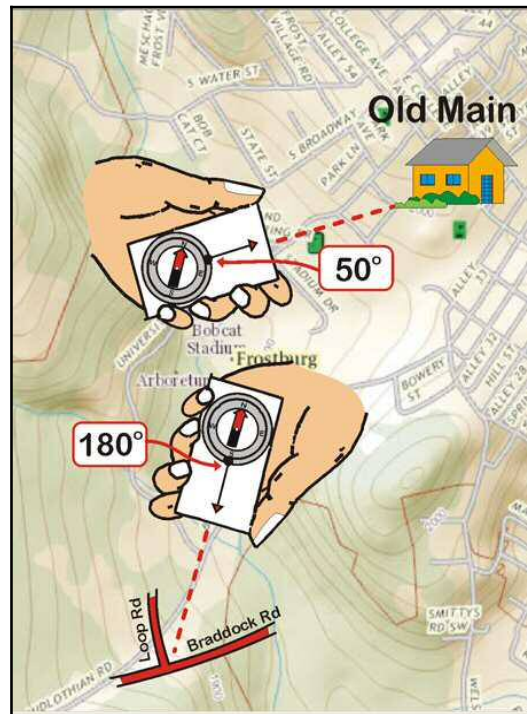


Figure 15.32: Determine a bearing to two or more objects.

Step #2: Transfer the first bearing to the map – In the second step, you are going to transfer the bearing from the real world to the map (Figure 13.33). You will need to identify both Old Main and the intersection of Loop and Braddock Roads on the map. You will be working backward. Place the direction of travel pointing to Old Main and using the compass as a protractor, rotate the compass until north in the compass housing is aligned (parallel) with magnetic north on the map. Be sure to keep the direction of travel pointing toward Old Main. Draw a line on the map from Old Main. You are located somewhere on this line. Step #3 will provide an intersecting line and an exact location.

Step #2:

- 1) Place the compass base or direction of travel arrow on the map so that it is pointing to Old Main.
- 2) Rotate the entire compass until the orientation arrow in the compass housing is aligned or parallel with the MN line. **DO NOT ROTATE THE COMPASS HOUSING.**
- 3) Draw a line on the map westward from Old Main. This is the bearing of 50° East on the map.
- 4) You are located somewhere on this line. The second bearing will tell you exactly where.

Step #3: Transfer the second bearing to the map – This step is identical to Step #2 except it is the transfer of the bearing to the intersection of Loop and Braddock Roads to the map (Figure 13.34). This is tricky because there is a temptation to readjust the compass. **AGAIN, DO NOT ROTATE THE COMPASS HOUSING.**

Step #3:

- 1) You know the actual compass bearing to the intersection is 180° South.
- 2) Place the compass base or direction of travel arrow on the map so that it is pointing to the intersection and rotate the entire compass until the orientation arrow in the compass housing is aligned or parallel with the MN line. **DO NOT ROTATE THE COMPASS HOUSING.**
- 3) Draw a line on the map northward from the road intersection. This is on a bearing of 180 degrees north.

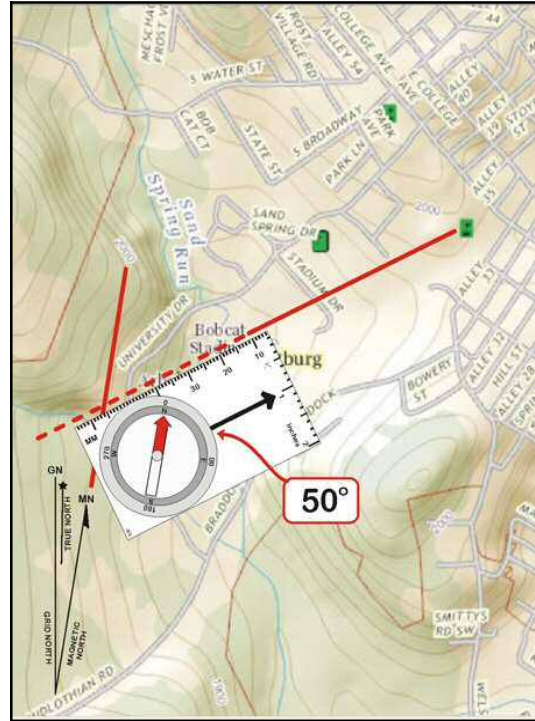


Figure 13.33: Transfer the first bearing to the map.

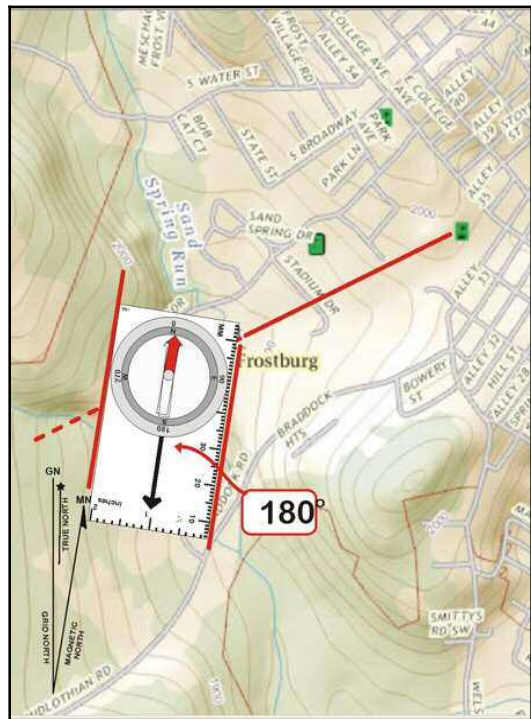


Figure 13.34: Transfer the second bearing to the map.

Step #4: Your location is the intersection of the two lines

– Your location is the intersection of the two bearing lines (Figure 13.35). In the real world you will know that you are at the Bobcat Stadium because you will be standing next to the stadium. In this case, it provides a check of your work. In most places on the East Coast, there are sufficient buildings and features that the map can be oriented by simply rotating the map until the known objects on the map are aligned with their relative position in the real world (Figure 13.36).

Step #4:

- 1) Line #1 is the bearing of 50° east from Old Main (a known location).
- 2) Line #2 is the 180° south from the intersection of Loop and Braddock Roads (a second known location).
- 3) You have determined your location. It is the intersection of the two bearings. And, yes, it is Bobcat Stadium.
- 4) Triangulation suggests three bearings. Actually, only two bearing are needed to find your location.

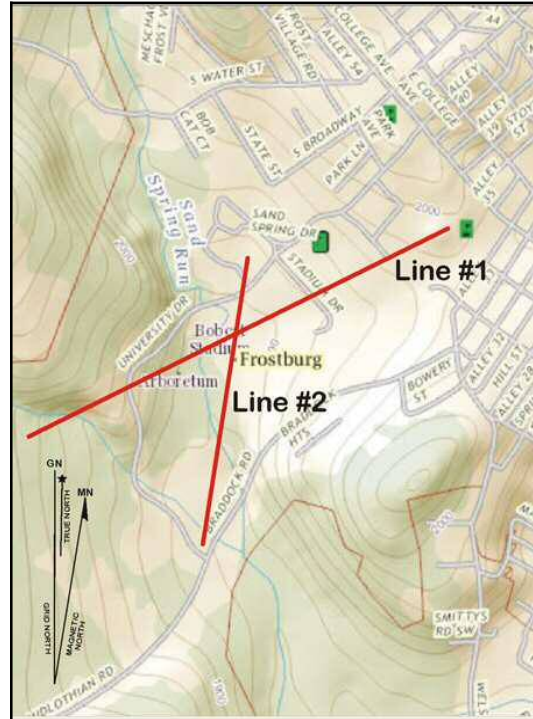


Figure 13.35: Your location is the intersection of the two lines.

Summary

The purpose of this section is to combine map and compass to navigate or orient yourself. It combines and integrates the previous sections (i.e. compass and topographic maps). As with the compass, there are two ways to use a map and compass. The first is given a bearing, find an object in the real world on that bearing. The second is given an object in the real world, find the bearing to it. Integrating topographic maps, the first approach is to find the direction to an object on the map and then find that direction or bearing to the same object in the real world. The second approach is a triangulation approach where you find the direction in the real world and then determine it on the map.

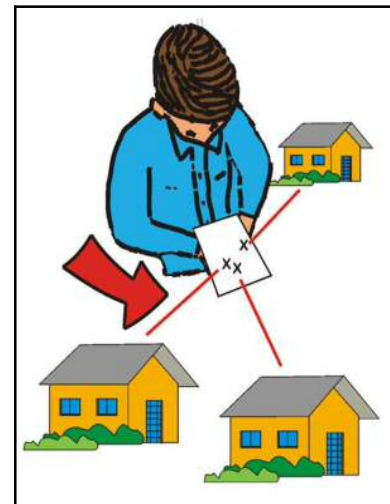


Figure 13.36: Orientating the map.

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Chapter 13.5: – Electronic Navigation ¹

With the advent of GPS, navigation has entered the electronic age. For most people it has moved from the map and compass phase to GPS navigation systems and Google Maps ®. That is if they were ever in the map and compass phase in the first place. The center piece of electronic navigation is GPS and the navigational systems that rely upon it.

GPS Navigation – GPS stands for global positioning satellites (Figure 13.37). The primary function of GPS is to determine the location of objects on the ground. Coupled with navigation programs it has become a sophisticated and articulate navigation system. Many people rely on it for the automotive navigation. In this respect, it is extremely valuable. However, there are stories of people being misdirected by GPS. One is provide in the next section on Google Maps.

Regarding emergency situations, GPS may not always be available. If there is a major war, the next major battlefield is said to be on outer space where the objective is to knock satellites out of service. Major solar flares from the sun could affect satellites and GPS services. In contrast, GPS will most likely be unaffected by natural disasters on the ground such as hurricanes, floods, and tornadoes.

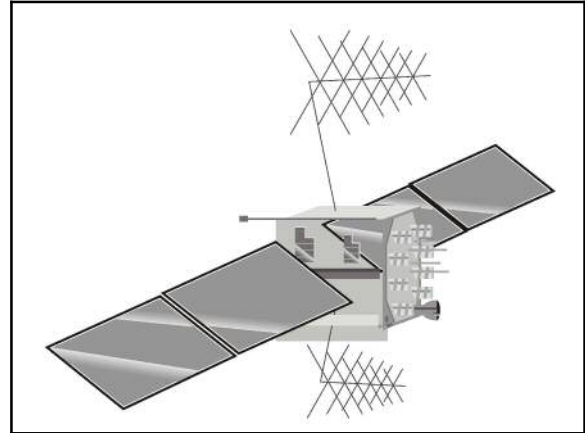


Figure 13.37: GPS Satellite

People blindly plug the destination into their navigation system and off they go to their destination. When the computer tells them to turn left, they do so. When it tells them to turn right, they do so. In doing so, they abandon all other types of navigation including natural signs. In the hustle and bustle of today's fast paced society, it is convenient. However, in time of emergency you may not have it rely upon. You may need to familiarize yourself with more traditional forms of navigation.

Google Maps ® – Google Maps and similar internet services provide mapping opportunities that were unavailable several years ago. This author uses Google Maps to identify unique recreation and park features in a location and then print out a series of maps that enable finding the location easily when arriving in the new city.

In determining your “bug-out” route, a series of Google Map print outs can outline your route using primary and secondary roads. The maps allow you to home in on critical junctions and avoid errors. This author participates in a yearly event near Belvidere, New Jersey (Figure 13.38). It has an interesting twist in that the GPS will take you 20 minutes off course to the destination. In plotting the course from Martin's Creek, Pennsylvania to Belvidere, New Jersey, Route 611 takes a sharp left turn. For the past three years, this author has made the correct turn onto the Belvidere-Martins Creek Highway. Actually, it

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is really going straight onto the road. Traveling separately and relying on his GPS for navigation, a friend missed the turn for two successive years. He turned left and missed the correct route. His GPS took him twenty-minutes out of his way to the final destination. This year with map in hand and considerable prepping, he made the correct turn onto the Belvidere-Martins Creek Highway.



Figure 13.38: Martin's Creek – Rt 611 takes a sharp left turn. The Belvidere Martins Creek Highway, the desired route, goes straight. The GPS keeps you on Rt 611 and 20 minutes out of your way. – file: \MAP-MartinsCreekIntersection[20].jpg

It is this type of mapping that can greatly aid you in reaching a “bug-out”

destination in time of crisis, even if you are familiar with the route. It can show you alternative routes in case your usual route becomes blocked. Also, it never hurts in case someone unfamiliar with the route is along in the vehicle.

One last suggestion. Print out your maps prior to the emergency. If there is a power outage, you may not have the opportunity to print your maps.

Rand McNally ® – Rand McNally maps were the old standby. The old version of the maps have been mostly replaced by electronic mapping. Regardless, these maps still serve a useful purpose in navigation, particularly if you need to seek alternative routes. For the most part, this author has replaced his Rand McNally with a series of Google Maps. Regardless, it is still a staple that fills a niche.

Map Quest ® – For many, Map Quest and its similar variations have provided specific directions to a destination. This author doesn't particularly care for Map Quest. It is too anal retentive in how it provides its directions. The main problem that this author has with the map quest approach is that if for any reason you get off course, you are lost and the directions are virtually useless until you get back on track. In summary, the directions assume that you are remaining on course.

Summary – GPS and the navigation systems associated with it have significantly changed navigation for most people. Regardless, in times of surviving an unexpected emergency, these tools may not be available to you. For this reason, an understanding of more primitive versions of navigation such as maps and compass may be needed.

Chapter 14: Bugging-Out ¹

Contrary to much of the literature, the order of preparation for bugging-out starts with identifying the types of disasters most likely encountered, and the bug-out site or destination. Without first identifying these two factors, constructing a bug-out bag has little or no utility regarding its contents. Its contents are determined by what you need to successfully get you to your bug-out site or destination. Intuitively, once the bug-out site has been identified, it determines the logistics including the bug-out bag, vehicle and other logistical needs.

In terms of the Surviving the Unexpected Emergency Model, bugging-out is influenced by the type of disaster, magnitude, duration, and whether it is man-made or natural. Hurricanes in the east, forest fires in the west, mud slides in California, tornadoes in the mid-west are fairly predictable time of year events. They occur during the same time of the year and usually there is advanced forecast of their coming. For example, bugging-out of the flood plain may involve simply moving to higher ground. For those bugging-out from a major hurricane like Katrina or Sandy, it may require traveling several hundred miles inland. Or, in the case of a storm that hit Washington, DC, this author had relatives bugging-out to his home 125 miles away.

As indicated in the previous paragraph, the first step in bugging-out is to identify the most likely bug-out situations. It determines the destination or bug-out site. The destination or bug-out site determines logistics including the travel vehicle, bug-out bag, and what will be needed at the destination. When reading this section, it might be helpful to select a likely scenario that you will be facing and then tailor the material in this section to your needs. It will help focus your thoughts and actions. A sample bug-out checklist of items is provided at the end of this section (see Appendix A).

Definition

Stewart (2012, p.7) defines bugging out as “the decision to abandon your home due to an unexpected emergency situation – whether a natural disaster or one caused by man.” Abandon is a good choice of words since you are assuming that your home and contents may not be there upon your return. Hence, good planning includes documenting personal records and documents that might perish. Second, it is an unexpected emergency. Most often emergencies do give forewarning although it may not be much time. Third, although not stated in his definition but implied is that you need somewhere to go. Fourth, you need to travel or be in transit to the bug-out location. This author would add to the Stewart (2012) definition “.... – *and traveling to a safer location.*” Unfortunately, sometimes the bug-out location is not safe but only a better location than where you are at.

Bugging-out is the decision to abandon your home due to an unexpected emergency situation – whether a natural disaster or one caused by man – and traveling to a safer location.”

¹ This chapter was written by Robert B. Kauffman who is solely responsible for its content. This chapter is copyrighted © Robert B. Kauffman, 2016.

Developing a Bug-out Plan

As noted in the introduction think in reverse order. The following is a five step process for developing a bug-out plan. It corresponds with the handout titled: **Developing a Bug-out Plan** (see Appendix B). Also, the topics are discussed in further depth in the remaining sections.

Step 1: Identify Potential Disasters – The first step is to determine the types of disasters which will require your to bug-out to somewhere else. Familiarize yourself with the *Surviving the Unexpected Emergency Model*. Review the internet for major natural or man-made disasters that have hit your area within the last ten years. Which of these could have led you to evacuate the area? An important consideration is to develop your stay/go decision criteria. For each of the disasters, what are the circumstances which will cause you to bug-out? Identifying these criteria reduces hesitation and indecision when the pending disaster approaches. The following illustrates a possible “go” decision. “*If we are in the direct path of a Type III or greater hurricane as reported by the Weather Service 12 hours prior to its arrival, we will bug-out.*”

Step 2: Select Bug-out Sites – For each of the potential disasters, review potential bug-out sites that are in safe areas or that lie outside the impacted area. Most likely one site will service several disasters. Once the site is identified, the logistics can be determined to travel from your home to the bug-out site. Regarding bug-out sites, an important sidebar is that for everyone bugging-out there needs to be a host or bug-out site. Depending on where a person lives, they could easily become the destination and the host at a bug-out site.

Step 3: Determine Bug-out Route – Once disasters and potential bug-out sites have been identified, the next step is to determine the best route(s) to the bug-out site.

Step 4: Bug-out Vehicle (BOV) – A bug-out vehicle is necessary to transport you to the bug-out site. Most people will simply use their cars. Determine any modifications that you need to make to your vehicle such as a trailer hitch and small trailer.

Step 5: Bug-out Bag (BOB) – Think *checklist* and *packing for a trip*. The checkoff list is a refresher of what you need to take with you. Tailor the checkoff list to where you are going and how you are getting there. The bug-out bag is what you take with you. It can be a backpack, suitcase or what you pack in your car. Prepack your bug-out bag and store your checkoff list with it. As the disaster approaches, top-off the bug-out-bag and bug-out at the appropriate time. The bug-out bag is what you take with you. An important topic is what you leave behind or abandoning your home.

Identify Potential Disasters

The first step is to determine the types of disasters which will require your to bug-out to somewhere else. The purpose of this exercise is two-fold. You need to determine for which disasters you will need to bug out and which disasters you most likely will host others bugging out. In this section, you will identify the types of disasters for which you choose to plan. Your task is to determine the “decision criteria” which determine whether you stay or go.

The *Surviving the Unexpected Emergency Model* is used as the basic frame for planning (Figure 1). On the right side of the model are listed both natural and man-made disasters. The model is about making planning decisions. Review the internet for major natural or man-made disasters that have hit your area within the last ten years. Which of these could have led you to evacuate the area? Conversely, for which of the disasters will friends and family most likely use your home as their bug-out site.

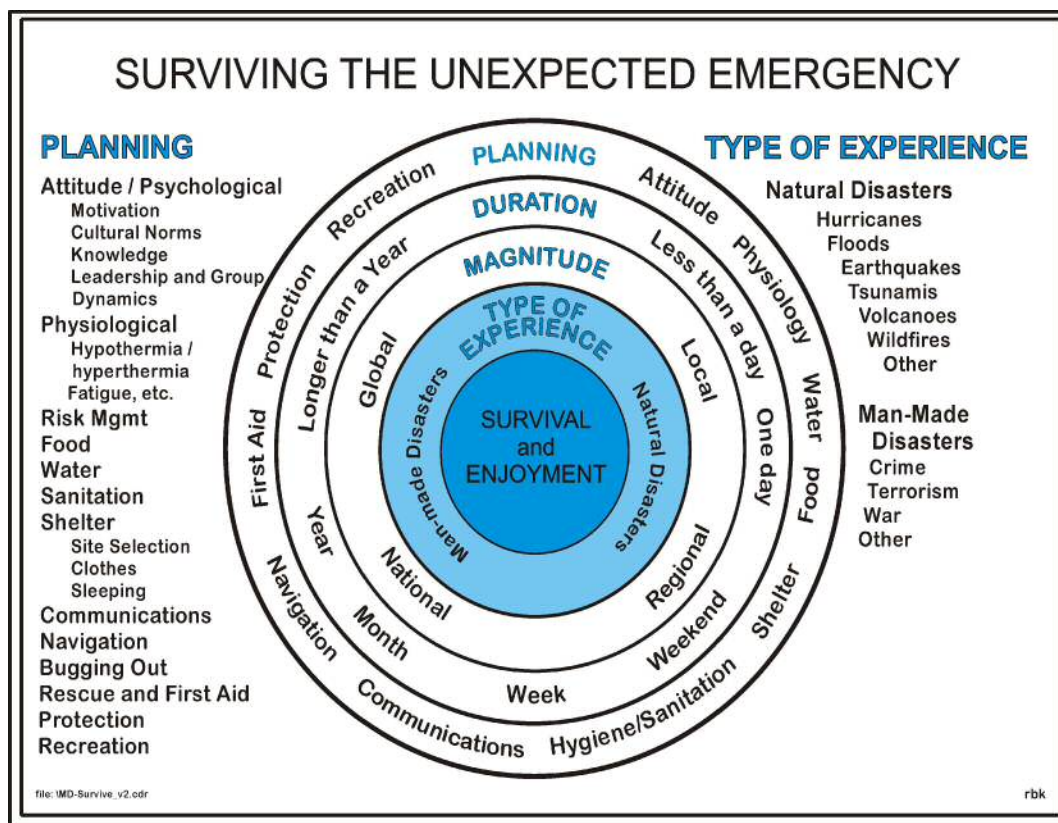


Figure 1: Surviving the Unexpected Emergency – Source: Author.

Examine the disasters to which you are susceptible in terms of the magnitude and duration. You are seeking to determine the criteria which you will use to determine whether you stay put or bug-out. The internet will provide a good source of information with which to examine previous disasters.

On the left side of the model is the planning process. It lists the major categories involved in the planning process. Bugging out is treated as a separate item. However, the other planning topics cut across the bugging out topics.

Develop your stay/go decision criteria. For each of the disasters, what are the circumstances which will cause you to bug-out? Identifying these criteria reduces hesitation and indecision when the pending disaster approaches.

Developing the decision criteria for each disaster is not a complicated process. Essentially, it is a statement of **who** will do **what when** certain events occur. The east and gulf coasts of the United States are prone to hurricanes. The west coast is prone to wildfires. Consider the following decision criteria statement. *“If we are in the direct path of a Type III or greater hurricane as reported by the Weather Service 12 hours prior to the arrival of the storm, we will bug-out.”* The “**who**” is the “we” or our family. The “**what**” is the decision to bug-out or stay put. The “**when certain events occur**” is the approaching hurricane. It is further defined as a Type III or greater hurricane as reported by the Weather Service. Also, the criteria of time is identified as 12 hours prior to the arrival of the storm.

The decision criteria can easily be expanded to include the preparation to bug-out. Consider the following decision criteria statement. *“If we are in the direct path of a Type III or greater hurricane as reported by the Weather Service 24 hours prior to the arrival of the storm, we will prepare the house for abandonment and make preparations to bug-out.”*

Selecting a Bug-Out Site

Most of the literature focuses on what you should include in your bug-out bag. Of equal or greater importance is the selection of the bug-out site. Think in reverse, to a large extent, the bug-out destination site determines your pre-planning efforts and what you take with you in your vehicle.

For most bug-outs, the travel portion is several hundred miles at most. The proposition could be advanced that shorter is better, and the longer the bug-out, the more problematic the bug-out can become. Under normal travel conditions, two hundred miles are four hours or a day’s travel at slower speeds. By design, the bug-out bag is prepared for 72 hours or three days of supplies. In contrast and depending on the crisis, the time spent at the bug-out site could be several days and in a bigger crisis several weeks or even months.

Second, the facilities and services available at the bug-out site will greatly affect your planning and preparation. Although FrFrog (2008) doesn’t indicate his location, it can be inferred that his bug-out site was still in the zone of destruction created by Katrina. From his blog, he didn’t have the full repertoire of utilities and services normally available to residents. In contrast, this author had six relatives descend upon his household during June of 2012. However, since my bug-out site was outside the area affected by the storm, everyone had full use of normal utilities and services. In contrast, in Stewart’s (2012) book, he considers his bug-out site primitive camping in the woods at an undisclosed site.



Figure 2: Superdome and Katrina – Sleeping arrangements inside the Superdome during Katrina. – Source: Jim Reed Photography.

Government Run Shelters – One of the bug-out sites that you can select is a government-run shelter. In terms of the Rescue Curve, a government run shelter is equivalent to rescue by others outside your group. It is your last choice. In the end, it may be your only choice. Conceptually, most people would prefer self-rescue (i.e. bugging-out), or rescue by others in your group (i.e. bugging-out to a site with family or friends). Regarding safety and prevention, the knowledge and practices that you will take will better prepare you for an eventual emergency.



Figure 3: Superdome – The role of the National Guard is to maintain order. – Source: National Guard.

Government-run shelters warehouse people (figure 2 and figure 3). They seek to maintain control and order. With limited personnel and resources, their ability to warehouse people and keep people fed can be a daunting task in itself. This is not to diminish what they do. It only raises the question whether this is what you want for you and your family. Obviously, FrFrog (2008) is not enthralled with government-run shelters in his passage below.

13) **Don't rely on government-run shelters if at all possible.** Your weapons WILL be confiscated (yes, including pocket-knives, kitchen knives, and Leatherman-type tools); you will be crowded into close proximity with anyone and everyone (including some nice folks, but also including drug addicts, released convicts, gang types, and so on); you will be under the authority of the people running the shelter, who WILL call on law enforcement and military personnel to keep order (including stopping you leaving if you want to); and so on. Much, much better to have a place to go to, a plan to get there, and the supplies you need to do so on your own. (Source: FrFrog, 2008).

When You Are the Bug-Out Site (i.e. Host)

Everyone discusses bugging-out to a bug-out site. For every person bugging-out, there has to be someone hosting the bug-out person. Depending on where you live, you could easily become one of those hosts. If you are one of those host sites, you too need to plan for the bug-out crisis. This section focuses on some of your needs.

Plan for More People than You Anticipate – The simple truth is that people will bring their friends, even if they are told not to do so. Prudent planning should anticipate this.

FrFrog (2008) provides this reflection on his experience as a bug-out site in Katrina. There are several points worthy to comment upon in his third item. If you are a bug-out site, plan for more people arriving at your door than planned. People bring friends. Second, if you are a bug-out site, you need to communicate to those bugging-out to your site what they can bring as well as rules and regulation onsite. These are noted in the following FrFrog (2008) comment below.

3) **Plan on needing a LOT more supplies than you think.** I found myself with over 30 people on hand, many of whom were not well supplied and the stores were swamped with literally thousands of refugees, buying up everything in sight. I had enough supplies to keep myself going for 30 days. Guess what? Those supplies ended up keeping 30-odd people going for two days. I now know that I must plan on providing for not just myself, but others in need. I could have been selfish and said "No, these are mine" - but what good would that do in a real disaster? Someone would just try to take them, and then we'd have all the resulting unpleasantness. Far better to have extra supplies to share with others, whilst keeping your own core reserve intact (and, preferably, hidden from prying eyes!). (Source: FrFrog, 2008).

Being a Bug-Out Site Requires Planning – Think about it. Everyone focuses on what are the needs of the people bugging-out, but no one focuses on the hosts at the destination sites. The simple fact of the matter is that the host needs to consider planning for all of the topics previously discussed in this section. Planning includes food (i.e. You can't count on what people bring with them.), water, sanitation (i.e. You are now running a hotel and taxing the sanitation facilities), shelter (i.e. You need to house these people somewhere.), first aid (i.e. More people and changed routines means more accidents), protection (i.e. You don't know the proficiency in firearms of those visiting you and you don't want anyone getting hurt either.), and recreation (i.e. You need to entertain everyone including children.).

FrFrog (2008) must have had a real circus in his backyard. His property became a RV park. If you are a bug-out site, you will need to consider most of the functions discussed elsewhere including food, water, shelter, sewage, and recreation. Also, it reinforces establishing rules and protocols for those coming from distant locations before they depart for your location. In addition, consider pets and their accommodation.

7) **Make sure you have a bug-out place handy.** I was fortunate in having enough ground (about 1.8 acres) to provide parking for all these RV's and trailers, and to accommodate 11 small children in my living-room so that the adults could get some sleep on Sunday night, after many hours on the road in very heavy, slow-moving traffic. However, if I hadn't had space, I would have unhesitatingly told the extra families to find somewhere else - and there wasn't anywhere else here, that night. Even shops like Wal-Mart and K-Mart had trailers and RV's backed up in their parking lots (which annoyed the heck out of shoppers trying to make last-minute purchases). Even on my property, I had no trailer sewage connections, so I had to tell the occupants that if they used their onboard toilets and showers, they had to drive their RV's and trailers somewhere else to empty their waste tanks. If they hadn't left this morning, they would have joined long, long lines to do this at local trailer parks (some of which were so overloaded by visiting trailers and RV's that they refused to allow passers-by to use their dumping facilities). (Source: FrFrog, 2008).

In contrast, June 29-30, 2012, a derecho (i.e. a severe line of thunderstorms) moved east and hit the Washington, DC area. It was not a major storm on the magnitude of Katrina or Sandy. Over 68,000 people lost their electricity in Washington, DC and 1.6 million people lost their electricity in Maryland for up to ten days (Wikipedia, 2012). There were water restrictions. The temperature and humidity made the area inhospitable. Without electricity, people were without air conditioning, cooking, and the workplace was inactive. It was an emergency situation and this author had six relatives descend upon his home in western Maryland, 125 miles away. Our house can accommodate close to this amount of people easily, but never-the-less it quickly became a cramped living experience.

We were taken by surprise. We had no reason to expect that we would become a bug-out site. In addition, we had full services available to us including electricity, cable, sewage, etc. Also, the local grocery chain store was relatively unaffected by the situation in Washington. Had we had the same outages as in Washington, our living conditions would have been considerably different.

Recreation – If you are a bug-out site, consider providing recreation and entertainment needs. You will have a group of people in a confined area for an extended period of time. You will need to provide them with recreation. It can be inferred from FrFrog's (2008) comments that this was problematic after Katrina.

8) **Provide entertainment for younger children.** Some of these families had young children (ranging from 3 months to 11 years). They had DVD's, video games, etc. - but no power available in their trailers to show them! They had no coloring books, toys, etc. to keep the kids occupied. This was a bad mistake. (Source: FrFrog, 2008).

Abandoning Your House

Abandoning your house may seem like a simple task. Most people would think that you lock the doors and leave. In a minor crisis, this may be sufficient. However, there are things that you may need to do prior to leaving your home. In a major crisis, assume that your house will be ransacked or totally destroyed upon your return. Some tasks that you will need to do prior to leaving include:

- Turn off the water and other utilities – Note: *The house will be without heat.*
- Turn off the main circuit breaker in the circuit breaker box
- Plug the drains – Note: *This is necessary only if there is a possibility of a flood which can force sewage back into the house.*
- Turn off the gas line.
- Place valuables in a safe deposit box – Note: *Assume that your house will be ransacked or totally destroyed before your return.*
- Secure and lock the doors – Note: *Don't leave the key under the door mat or in the planter.*
- Secure windows – Note: *This needs to be appropriate for the pending crisis (e.g. hurricane)*
- Drain water pipes and place antifreeze in drain traps – Note: *This is only necessary in winter and if there is no heat in the house.*

Upon return, if your house was ransacked, you will feel violated. If it is destroyed, you cannot expect to retrieve anything that remains in it. Neither of these are pleasant thoughts. It helps to explain why many people refuse to leave their homes in times of crisis. Regardless, it should guide your planning processes and you should be prepared for the eventuality upon return.

Selecting a Route

Once disasters and potential bug-out sites have been identified, the next step is to determine the best route(s) to the bug-out site.

Depending on the type of crisis, GPS may or may not be functioning. Many experts recommend not relying on GPS for two reasons. It may not be available and you can't count on it. Second, you may prefer using primary and secondary roads for travel. GPS tends to direct you on the most direct route, and usually, the route includes interstates.

It is recommended that you have a hard copy (e.g. Rand McNally, or printed maps) of the maps to your bug-out destination (Figure 4). It increases self-reliance and decreases reliance on others. As an

alternative, print overlapping printouts of Google Maps ® of your route.

Consider traveling the bug-out route prior to actually having to bug-out. Preplanning and practice increased familiarity with the designated route, and reduces the likelihood of hesitation, indecision, or panic during an actual emergency.

Bug-Out Vehicle

Under the philosophy of what you have in your pocket is what you will have in an emergency situation, the vehicle that you own will most likely also be your bug-out vehicle. Most people are going to adapt their current vehicle to the task of becoming a bug-out vehicle. Few are going to buy a vehicle base solely on their bug-out needs. Assess your likely evacuation scenarios and determine if your vehicle is suitable for your needs. Sometimes a simple upgrade will benefit your needs. An all-wheel drive vehicle may be a simple upgrade over a front wheel drive vehicle.

Range of Travel – The range of travel of your vehicle should correspond with your anticipated bug-out site. If your bug-out site is 125 miles away and your vehicle gets 25 mpg, you will need a minimum of five gallons of fuel to reach your destination. If your fuel tank holds 17 gallons, you might have a rule not to let your fuel tank go below a third of a tank.

There are a lot of “rules of thumb” regarding filling your gas tank. Some suggest that you never let your gas tank go below half-full. Most likely it is not bad advice, particularly in time of a pending crisis. That dictum could be amended to keep your fuel tank topped off during periods of pending crisis. Even if you only have 125 miles to travel, a full tank leaves you with additional options after you arrive at your bug-out destination. One of those options is that you could drive home without refueling.

Do a Trial Packing of Your Vehicle – You have a list of items in your bug-out or “go-pack.” As part of the previously mentioned checklist, it should include a list of items to include in your vehicle. An often overlooked suggestion in the literature is to do a trial packing of your vehicle to see if everything fits. If there is a problem readjust your list of items or add a roof carrier. A trailer may create additional problems during an evacuation. During the trial pack, you can determine the best placement of items within your vehicle. Determine what can be put in the trunk and what items do you need to have immediate access?

Your Vehicle Determines Capacity – In backcountry planning there is a saying: “*Backpackers count ounces. Canoe campers count pounds, Rafters count tons.*” Your mode of transportation dictates what you can take with you and whether you count ounces, pounds or tons. If you are bugging out on foot or bicycle, what you can carry will be similar to what a backpacker can carry. The same rules of planning apply. In this respect, Stewart’s (2013) book on building the perfect bug-out bag is essentially a backpacking manual utilizing both old school and modern camping techniques. As a backpacker on foot, he is counting ounces.

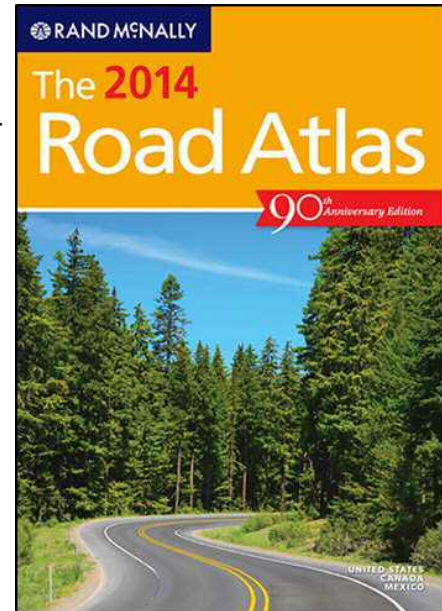


Figure 4 – Rand McNally – In time of emergency, you may not be able to use GPS. Also, Rand McNally shows all the back roads of travel. Source: author – [file:\BUG-RandMcNally[48].jpg]

A car can carry considerable weight. However, depending on its size and type, it is easy to overload the vehicle. However, it usually becomes a space or volume issue rather than a weight issue. Most people will fill-up their vehicle before reaching its weight carrying limits. The previous planning dictum could be modified to say: *“People bugging-out on foot count ounces. People bugging-out in cars fill space.”*

Big Vehicles Can Be a Disadvantage – In time of a mass evacuation, large vehicles and RVs can be a hindrance. FrFrog (2008) summarizes the disadvantage of large vehicles below. As a footnote, point 10 mentioned in the paragraph refers to starting the bug-out trip with a full tank of gas because you will most likely have difficulty buying gas along the way.

6) **A big bug-out vehicle can be a handicap**. Some of the folks arrived here with big pick-ups or SUV's, towing equally large travel trailers. Guess what? - on some evacuation routes, these huge combinations could not navigate corners very well, and/or were so difficult to turn that they ran into things (including other vehicles, which were NOT about to make way in the stress of an evacuation!). This led to hard feelings, harsh words, and at least one fist-fight. It's not a bad idea to have smaller, more maneuverable vehicles, and a smaller travel trailer, so that one can "squeeze through" in a tight traffic situation. Another point a big SUV or pickup burns a lot of fuel. This is bad news when there's no fuel available! (See point 10 below.) (Source: FrFrog, 2008).

Counter Viewpoint – As a counterpoint to using your existing vehicle as a bug-out vehicle, Google® “bug-out vehicle images.” The plethora of examples of bug-out vehicles (BOV) includes every conceivable variation of a bug-out vehicle imaginable. Stewart (2013, pp.164-167) provides a series of guidelines for a BOV. These are listed below. Other than being a 4x4 vehicle, most of the criteria could be applied to a regular vehicle also (Figure 5).

- Guideline 1: In good Working Order/Low Maintenance
- Guideline 2: Off-Road Capabilities – 4x4
- Guideline 3: Fuel Range/Efficiency
- Guideline 4: Cargo Space
- Guideline 5: Additional Supplies

Stewart's (2013) preference for a bug-out vehicle is a 1972 Bronco. He notes that the big reason for this is that it is pre-computer. This is actually a very good point. The 1972 Bronco has fewer sophisticated parts, and it is easy to fix. His points are well taken, particularly with it being pre-computer. Return to the internet images of bug-out vehicles. How many of those vehicles have sophisticated computer operated systems? The owners of these vehicles would argue otherwise, but one good EMP (Electro-Magnetic Pulse) would render most of these vehicles inoperative. Regardless, they will have arguments that defend their designs. The point is that there is a divergence of opinions and designs regarding BOVs.

Return to the basic premise advanced in this section. Most people are going to select a vehicle for their normal every day needs. They might briefly consider



Figure 5 – Bug-out Vehicle – Stewart (2013) suggest as his idea BOV a 1972 Ford Bronco. It is pre-computer. It is not susceptible to EMP. It is four wheel drive. It is easy to repair. He has a point. Source: Internet – [file:\BUG-72Bronco[58].jpg]

how it would serve as their BOV, if they consider it at all. Unless you have identified specialized needs and unless you are wealthy, this is the reality facing most people.

Bug-Out Bag

A “bug-out bag,” “go-bag” or “bug-out kit” is “a self-contained kit designed to get you through at least 72 hours of independent survival while on the journey to your destination, often called a Bug Out Location (BOL).” (Stewart, 2012, p.8). His definition is typical of the literature. Along with your vehicle which was discussed in a previous section, your bug-out bag is designed to travel light and fast to your destination. It is designed to be self-contained and self-sufficient. Usually, it is a backpack. However, it can just as easily be a travel suitcase on wheels.

The potential contents of your bug-out bag are reflected in the major headings used this chapter (Figure 6 and Figure 7).

Overview – As might be expected, authorities suggest having a fully prepared bug-out bag fully packed and ready to go at all times. This author suggests more of a hybrid approach. It is one that he uses for camping and travel trips. It starts out as a partially packed bag. As the trip approaches, the pack becomes more complete. Second and key to this approach is a printed checklist of all the items included in the pack. This list is critical to the success of this approach. In addition, the checklist is critical to anyone who is maintaining a fully packed pack approach also. You can always decide not to bring an item on the checklist. But the checklist is just that, a checklist not to forget anything.

In his first two points on his blog, FrFrog provides some insights regarding a bug-out kit. He suggests having a bug-out kit ready at all times and this of course requires renewing supplies in your bug-out kit on a regular basis. In part, this is a self-defeating strategy for most people because it requires constant maintenance. Only the truly dedicated preppers will maintain their bug-out bag on a regular basis. However, if there is a pending crisis looming in the near future, most people will begin to pay attention to their bug-out bag and its contents.



Figure 6 – Typical Bug-out Bag (BOB) and Contents: Contents of a typical BOB. If you are bugging out to a relative's house, do you really need a hatchet, large knife, or shovel? Source: author – [file:\BUG-BOBcontents[80].jpg]



Figure 7 – BOB Suitcase – A travel suitcase can make an excellent BOB. Approach bugging-out as if taking a trip. Source: author – [file:\BUG-Suitcase[47].jpg]

1) **Have a bug-out kit ready at all times.** Many of these folks packed at the last minute, grabbing whatever they thought they'd need. Needless to say, they forgot some important things (prescription medications, important documents, baby formula, diapers, etc.). Some of these things (e.g. prescriptions) obviously can't be stocked up against possible emergency need, but you can at least have a list in your bug-out kit of what to grab at the last minute before you leave! (Source: FrFrog, 2008).

2) **Renew supplies in your bug-out kit on a regular basis.** Batteries lose their charge. Foods have an expiration date. So do common medications. Clothes can get moldy or dirty unless properly stored. All of these problems were found with the folks who kept backup or bug-out supplies on hand, and caused difficulties for them. (Source: FrFrog, 2008).

As noted, this author suggests a hybrid approach which he uses for camping and travel. It focuses on the use of a check-off list of the contents of your bug-out bag. FrFrog first point really underscores the importance of the checkoff list and his second point underscores the hybrid approach of packing in stages as the pending disaster approaches.

First, pack your bug-out bag with stable and non-perishable items such as clothing, sleeping bag, freeze-dried food, and money. Next, develop a list of the contents for your bug-out kit. Print it out and keep it with your bug-out kit. It is your check-list of what you need to take with you. List items by location such as bug-out bag, car, etc. Third, as a pending crisis approaches, review the list and begin packing your bags. Since some level of advanced notice is given for most pending crises, this allows for the packing of perishable such as medications. Fourth, if you live in an area where there is period during the year where there is likely to be a bug-out situation, it might be wise to pre-pack the majority of your bug-out bag as suggested by FrFrog and others. This may be a hurricane season in the east or wildfires in the west.

Food – A review of the literature suggests that a bug-out pack should have an arbitrary three days of food supplies. Usually, these food supplies are freeze-dried or MREs. This approach is not really practical for several reasons. First, your destination and the travel time to the destination determine the amount food needed in-transit. Second, most freeze-dried food requires hot water which requires a stove and stopping the vehicle. Stopping to cook increases travel time and can be unsafe. Third, and particularly in temperate climates there is no reason why you can't use perishable foods in-transit. Last, there may be different food requirements in-transit and once you are onsite. For purposes of this discussion, food is divided into two phases, in-transit and onsite.

When bugging out, in-transit is simply the time in-transit from when you leave your house to when you arrive at your bug-out site. Onsite is defined as everything that occurs once you reach the bug-out site. In-transit food and onsite food requirements may differ greatly depending on circumstances.

In-transit Food – In-transit food selection focuses on expeditiously keeping the vehicle moving toward the bug-out site. Emphasize foods that do not require cooking. Cooking requires stopping and your task is to reach the bug-out site.

Depending on travel and forewarning, food can include a mix of perishable and non-perishable foods. Sandwiches can be made in-route. Most deli products will survive a day or more in temperate climates. Peanut butter and jelly sandwiches are always an



Figure 8 – Peanut Butter and Jelly Sandwiches – When bugging out, you are on the move. Avoid meals where you need to stop and cook. Source: Internet – [file:\BUG-PP&J[47].jpg]

alternative (Figure 8). Remember, the purpose is to arrive at your bug-out destination expediently.

Even if you use perishable food, consider having backup of non-perishable food. This can include MREs, dehydrated food, or freeze-dried food. Again, emphasize foods that do not require cooking. The backup food can also included items such as Cliff Bars ®. Cliff Bars ® which are energy bars. However, unlike most of the sugar laden versions, these bars contain more complex carbohydrates that digest more slowly in the digestive system (Figure 9).



Figure 9 – Prepackaged Foods – The Cliff Bars ® store well and provide good energy. Source: Internet – [file:\BUG-CliffBars[33].jpg]

When bugging-out, emphasize foods that do not require cooking. This author disagrees with the advice of others (e.g. Stewart, 2012 and Carr, 2012). As a general rule, the purpose of a bug-out bag is to facilitate moving quickly to your destination. With this in mind, travel should de-emphasize items that require cooking since cooking requires a stove and stopping the vehicle. For example, Ramen noodles ® store well and make a quick meal. They are the staple of many college students and campers. However, they require a stove to boil water. If you are traveling in your car, this requires you to stop and cook your noodles. A stop of half-an-hour for lunch is the loss of being thirty miles further down the highway.

Most people will have a small cooler. Try freezing two to three two-liter bottles of water. When bugging out, the frozen bottles are placed in the bottom of the cooler. If the bottles remain intact from freezing, they can provide another gallon of drinking water. The cooler can carry perishables used in-transit or later when onsite.

Onsite Food – Determining onsite food needs generally requires some pre-planning even if it is a quick phone call prior to bugging out. The type of onsite food taken will depend on the duration of onsite experience, the magnitude of the disaster, utilities provided onsite, and storage capabilities onsite. Often one or two days of onsite food supplies is good for transitional purposes with the host bug-out site or for short term stays.

Water – The rule of thumb is to plan for one gallon of water per person per day. Three days would be three gallons. Two people would require six gallons. Reusing two liter soda bottles is a convenient way to store water. Since a liter is very close in volume to a quart, two two-liter bottles equates to a gallon (Figure 10).

As with food, consider in-transit and onsite water considerations. Preplanning is useful here in determining amounts. An extra day of water is not a bad idea in case there is a delay in-transit due to traffic or a vehicle breakdown.

While in transit, you shouldn't have need to purify water unless your mode of travel is by foot or bicycle where you don't have

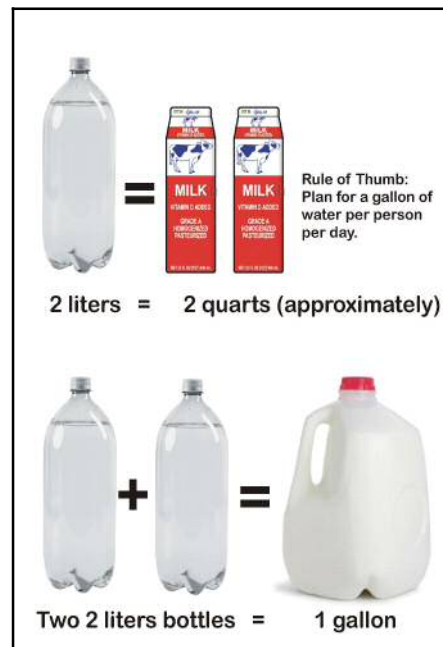


Figure 10: Conversion of two liter bottles to gallons.

the capacity to carry water. Then the same procedures for water purification in the backcountry are used. These methods would include filtration (e.g. pumps), chemical (e.g. iodine or chlorine), or boiling water. Boiling water can be cumbersome.

Sanitation – Toilets are more of an issue at the bug-out destination site than while in transit. For the most part chemical toilets are impractical for use in automobiles. In time of a major evacuation, expect rest stops to be unusable. Assume other toilet facilities in commercial settings to not be available either.

In time of emergency, most people will simply pull the car off the road and urinate along side the road. Be sure that you are safely off the road and not in danger of being hit by a passing vehicle. On interstates, this can be a potentially dangerous situation. Consider using an exit that has an easy exit and reentry to the highway.



Figure 11: WAG Bag – Poop in it. Zip it and dispose it. Source: Internet advertisement.

Regarding excrement, WAG (Waste Alleviation and Gelling) bags provide a viable alternative to pooping along side the road. A WAG bag is a one unit disposal bag for wastes (Figure 11). Simply put the poop in it, seal it, and dispose it in the normal trash. Some bags come with a hand sanitizer and toilet paper.

Whether you choose to use WAG bags or not, remember to pack toilet paper and sanitizer.

Shelter – Generally, shelter is more of an issue at the destination than during travel. Hopefully, most bug-out sites are sufficiently close that they do not require overnight sleeping. Avoid sleeping along the highway where other vehicles could plow into your vehicle. Use rest areas or entrance and exit ramps. As a rule sleep in an area where others are doing the same.

If traveling in a car, the car can usually provide ample shelter. Sleeping in it may be less than comfortable, but adequate. This author always has a sleeping bag in his car in case there is an overnight stop in a rest area. The sleeping bag is rated down to 20°F. Remember to lock the doors for security and to keep a window cracked. There were many mornings that the ice had to be scraped off the inside of the windshield. The ice resulted from the condensing moisture from normal respiration while asleep.

Clothes – You need to dress appropriately for the time of year and location. Review the clothing section under shelter. Don't forget rain gear. A 20-gallon trash bag can serve in a pinch for a rain coat. In the bug-out bag, one change of clothes is probably adequate. You may want to include an extra set of underwear. Remember, most of your clothing needs will be for the onsite experience.

Communications – Most automobiles are equipped with an AM/FM radio and increasingly many cars have satellite radio. In time of pending crisis, AM radio can be a good source of information. Even so, it may be advisable to have a portable radio which provides continuous updates on the pending weather.

In time of a crisis, assume cell phone and other communications will not be available. In part, this will depend on the type of disaster present. If they are available, consider it an added benefit.

First Aid – Include the same first aid kit that you would have at your bug-out site. You need not include anything that is different for the trip (Figure 12).

Having adequate medications for the duration of the crisis is important. This includes both in-transit and onsite experiences. Again, this is in part related to the type of disaster, its duration, and magnitude. Having adequate medications eliminates another worry once onsite at the bug-out site.

Protection – Weapons are always a sensitive subject. Review the section on weapons. In time of crisis, be sure to carry weapons in accordance with your state laws. If you cross state lines in route to your bug-out destination, familiarize yourself with the new state's laws. Consider pepper spray for close-up situations if needed. Check with the bug-out site host regarding what their policy is toward weapons.

Money – Cash is king. Plan for at least two weeks where you pay for everything with cash. Consider small denomination bills in the ten and twenty dollar denominations rather than large denomination bills in the fifty or one hundred dollar denominations. Some even suggest an abundance of ones and five dollar bills. In a crisis situation, people may not be able to or want to give you change for purchases. If all you have is a hundred dollar bill, a moderate purchase could quickly become a very expensive purchase because no change will be provided (Figure 13).

In calculating your cash needs, include the purchase of items for which you normally use plastic. Assuming that you can purchase gas in route, the gas station's electronic credit card device may be inoperative. Most stations don't even have the manual credit card devices any more to manually process credit cards. Assume that ATMs and other banking services will be inoperative. By all means, bring your plastic credit cards and checkbook. If they are operative, fine. Just don't assume that they will be functional and preplan that they won't be functional.

FrFrog (2008) notes the importance of cash being king in his blog. Also, he notes some of the problems that he had with seemingly well intentioned people during an emergency situation. Forewarned is forearmed.

11) **Have enough money with you for at least two weeks.** Many of those who arrived here had very little in cash, relying on check-books and credit cards to fund their purchases. Guess what? Their small banks down in South Louisiana were all off-line, and their balances, credit authorizations, etc. could not be checked - so many shops refused to accept their checks, and insisted on electronic verification before accepting their credit cards. Local banks also refused (initially) to cash checks for them, since they couldn't check the status of their accounts on-line. Eventually (and very grudgingly) local banks began allowing them to cash checks for not more than \$50-\$100, depending on the bank.



Figure 12 – First Aid Kit – Consider taking the first aid kit that you will use onsite with you in your BOB vehicle. Source: Internet – [file:\BUG-FirstAid.jpg]



Figure 13 – Cash is King – Caption: Assume there will be no electronic services. Cash is king. Use small bills since you may not get change. Source: author – [file:\BUG-Money[144].jpg]

Fortunately, I have a reasonable amount of cash available at all times, so I was able to help some of them. I'm now going to increase my cash on hand, I think... Another thing - don't bring only large bills. Many gas stations, convenience stores, etc. won't accept anything larger than a \$20 bill. Some of my guests had plenty of \$100 bills, but couldn't buy anything. (Source: FrFrog, 2008).

Tools – You might want to add to your bug-out bag a Leatherman ® or similar multi-tool device and a LED flashlight. A pliers, scissors, screw driver, bottle opener, and knife can be useful in time of a crisis. The same is true of a small tactical flashlight. However, some may prefer the five D-cell version of the Maglite ® which can also serve as a weapon if needed.

Summary

When thinking about bugging-out, people are really abandoning their homes and possessions. This is not an easy thing for people to do. Normally, leaving one's home is the last option. It doesn't matter what the pending disaster is. Upon returning to one's home after a disaster, a resident can assume their home was ransacked or destroyed. Neither is a comforting option. Bugging-out is a stressful situation.

Contrary to most of the bug-out literature, start with the end product or your destination. First, determine the situations for which you will most likely need to bug-out. Use the model to determine natural and man-made disasters. This “frames” your planning. Second, determine your destination or bug-out site. This requires preplanning. Third, once you know where you are going, the issue becomes how to get there and fourth, what to take with you. This requires a vehicle, most likely the one you normally use and a bug-out bag (suitcase) in the back seat. Pack for a bug-out situation much the same as packing for a normal trip.

There are two keys in the planning process. First, think of bugging-out as how you would normally plan for a trip. Most disasters give some pre-warning. Pack staples and as the event approaches, pack perishables and everyday items. The second key to planning is the checklist. As a practical matter for most people in their daily lives, planning for a bug-out situation is not normally a high priority item. It only becomes important in time of pending crisis. The check list is an instant refresher of what is needed, particularly when you are in a hurry and under pressure to pack and move. It reduces error and helps prevent omission.

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Appendix A: Bug-Out Checklist ^{1,2}

House, Bedroom and Bathroom

- _____ Tent, fly, trailer, shelter
- _____ Ground cloth
- _____ Air mattress
- _____ Ensolite or sleeping pad
- _____ Sleeping bag
- _____ Pillow
- _____ Toiletry bag (tooth brush, toothpaste, biodegradable soap, dental floss, shaver, etc.)

Clothes Closet

- _____ Sneakers
- _____ Socks
- _____ Sandals
- _____ Underpants
- _____ Undershirts
- _____ Poly underwear - pants
- _____ Poly underwear - top
- _____ Sweater
- _____ Shorts
- _____ Long pants
- _____ Belt
- _____ Jacket
- _____ Rain gear (rain pants, jacket, parka, poncho, paddling top & bottom, etc.)
- _____ Hat
- _____ Gloves
- _____ Bandanna(s)
- _____ Swimsuit
- _____ Towel

Kitchen (Food and Water)

- _____ Food (think meals if possible)
- _____ Condiments (salt, pepper, etc.)
- _____ Water purification tablets
- _____ Water pump or purifier
- _____ Canteen, water bottles
- _____ 2 liter or larger water containers for multi-day storage (1 gallon/day)
- _____ Mesh laundry bag for 2 liter bottles
- _____ Cooking pots and pans
- _____ Spatula, cooking spoon, etc.
- _____ Cup
- _____ Plates (Rubbermaid™ or Tupperware™ container)
- _____ Knife, fork, spoons
- _____ Large Knife
- _____ Matches
- _____ Waterproof matches

- _____ Fire starters
- _____ Can opener (or pocket knife)
- _____ Stove
- _____ Gas bottles
- _____ Funnel for gas
- _____ Stove windscreen
- _____ Packpacker oven
- _____ Dining fly

Sanitation

- _____ WAG bags
- _____ Pea bottle
- _____ Toilet gear (shovel or trowel, toilet paper, Purell™ hand cleaner, etc.)
- _____ _____
- _____ _____

Communications and Electronics

- _____ Cell phone
- _____ Satellite phone
- _____ CB radio (optional)
- _____ Walkie Talkies (good if traveling with more than one vehicle)
- _____ Portable radio (with emergency bands)
- _____ Signaling mirror
- _____ Whistle
- _____ Computer
- _____ Camera (computer cord, battery charger, storage card, case, tripod, etc.)
- _____ _____
- _____ _____

Navigation

- _____ Rand McNally™ maps
- _____ GPS
- _____ Google Maps
- _____ Compass
- _____ _____
- _____ _____

First Aid and Medications

- _____ First Aid Kit
- _____ Prescription medicine(s)
- _____ Lip salve
- _____ _____
- _____ _____

Protection

- _____ Guns (optional)
- _____ Ammunition
- _____ Pepper spray
- _____
- _____
- _____

Tools

- _____ Leatherman and/or pocket knife
- _____ Folding saw (or axe)
- _____ Duct tape
- _____ Watch
- _____ Thermometer
- _____ Shovel
- _____ Scissors
- _____ Can opener (included in kitchen also)

Accessories

- _____ Backpack(s)
- _____ Dry packs (Watersheds)
- _____ Flashlight
- _____ Spare batteries
- _____ Spare bulb for flashlight
- _____ Candle lantern (matches in Kitchen)
- _____ Candles
- _____ Sunglasses
- _____ Spare prescription glasses
- _____ Binoculars
- _____ Sun block or suntan lotion
- _____ Insect repellent
- _____ Fishing tackle (rod, reel, lures)
- _____ Rope(s)
- _____ Nylon twine
- _____ Nylon cord
- _____ Sewing Kit – Needle and Thread
- _____ Rubber bands
- _____ Spare plastic bags (Ziploc™)
- _____ Car keys
- _____ Vices (booze, smoking items, etc.) ⁴

Money and Valuables

- _____ Money (two weeks - small bills)
- _____ Credit cards
- _____ Check book
- _____ Copies of insurance policies
- _____ Valuable documents (assuming home is ransacked or destroyed)
- _____ Wallet
- _____
- _____

Recreation

- _____ Recreation (think creative activities)
- _____ Reading materials
- _____ Cards
- _____ Books (think creative recreation)
- _____ Notebook or journal
- _____ Pencils, pens, refills
- _____
- _____
- _____

Transportation⁴ - Bug-out Vehicle

- _____ vehicle manual
- _____ vehicle registration
- _____ vehicle insurance
- _____ spare tire
- _____ jumper cables
- _____ tool kit
- _____ flares or signaling devices
- _____ spare 5 gallon gas cans (depends on travel distance)
- _____ GPS
- _____ roof carrier (optional)
- _____ trailer hitch with ball
- _____ NRS straps (for tying roof rack items)
- _____ first aid kit (stays in car)
- _____ flashlight (stays in car)
- _____ shovel
- _____ fire extinguisher (stays in car)
- _____ paper maps of journey
- _____ sleeping bag (stays in car)
- _____ toilet kit (stays in car – razor, shaving cream, toothbrush, toothpaste (2-oz, toothpicks, etc.)
- _____
- _____
- _____
- _____

Notes:

¹. This checklist is much more comprehensive than most people need. It started as an eleven day Everglades camping trip checklist developed by the author for his personal and professional use. You will note some of the recreational items listed. It is recommended that you develop your own abbreviated list from this list and/or other sources.

Generally, it is easy to delete items that are not relevant to your situation than it is to think of items to add. Feel free to make your own list, shorten it, and adapt it to your bug-out situation.

². From an organizational perspective, the original checklist used the classification system used by Colin Fletcher's *The Complete Walker* (e.g. kitchen, close closet). It looks at different functions (e.g. house (i.e. bed and bathroom), clothes closet, kitchen; bedroom, accessories, etc.). It has been morphed to include many of the topic headings in the text.

³. This is not the time to ignore your vices. Bugging-out has sufficient stress in and of itself. This is not a good time to go "cold turkey" on what might be considered vices such as smoking or alcohol.

⁴. Normally, transportation is not included as part of the bug-out bag. It is included here as a matter of convenience and inclusion.

Appendix B: Developing a Bug-Out Plan ²

The purpose of this inventory is to assist you in developing a bug-out plan. It asks basic questions in helping you determine potential bug-out sites. These questions address the potential need to bug-out and historically which situations have resulted to evacuations in the past. Next, it helps you determine potential sites, potential routes, and limitations associated with your vehicle.

Step 1: Review Disasters (i.e. natural and man-made) – The first step is to identify the disasters, both natural and man-made that I am likely to face where I am living.

- 1) Review the internet for major natural disasters that have hit your area within the last ten years. Which of these led to or could have led you to evacuate the area?

[Enter your response in the table following Question #2.]

- 2) Review the internet to determine if your area is area is prone to attack by terrorists, nuclear war or other man-made disaster.

List Natural/Man-made Disasters	Natural or Man-made Disaster	People Evacuated (Yes/No)
1)		
2)		
3)		
4)		
5)		
6)		

- 3) **Stay/Go Decision Criteria** – Determine the stay/go decision criteria for each of the disasters for which you are planning. It reduces hesitation and indecision when the moment to stay or go approaches (e.g. Go: If Weather Service reports a Type III or greater hurricane in direct path 12 hours prior to arrival, bug-out). List those criteria here.

² This instrument was developed by Robert B. Kauffman who is solely responsible for its content. This article is copyrighted © Robert B. Kauffman, 2015. Robert B. Kauffman, Professor of Recreation and Parks Management, Frostburg State University, Frostburg, MD 21532. e: rkauffman@frostburg.edu.

Step 2: Review Potential Bug-Out Sites – The second step is to identify potential bug-out sites.

- 1) For the major natural and man-made disasters in the previous question, what is the minimum safe distance that you would need to bug-out to be outside the sphere of its impact? _____

- 2) Identify friends relatives who live outside of the sphere of impact identified in the previous question. In your estimation, which of these people would you comfortable with at a bug-out site? In terms of facilities and services, which of these sites would serve as a good bug-out site?

Identify Potential Friends and Relatives Who Could be a Bug-Out Site	Personally Comfortable (Yes/No)	Good Bug-Out Site (Yes/No)
1)		
2)		
3)		
4)		
5)		
6)		

- 3) Rank in order your preference of potential bug-out sites.

Rank In Order Your Preference of Potential Bug-Out Sites	(Yes/No)	Contacted (Yes/No)
1)		
2)		
3)		
4)		
5)		
6)		

- 4) Have you contacted any of the above people and discussed the possibility of using them as a bug-out site?

Step 3: Bug-Out Routes – Examine the routes to the bug-out sites.

- 1) For your most likely bug-out site, how far is it from your home? _____
- 2) For your most likely bug-out site, how long would it take to drive (i.e. assuming you are driving) to that site under normal conditions? _____
- 3) Is there anything that might prevent you from reaching this destination? This might be a ferry that stops running, a large bridge that is closed, a tunnel that is closed, etc.

3) Identify alternative routes to the bug-out destination.

Step 4: Bug-Out Vehicle (BOV) – Examine your vehicle to determine if it is suitable for your bug-out.

- 1) Are there any special road or travel conditions that are required of your vehicle? (e.g. 4x4 terrain, etc.) If there are, identify modification to your vehicle that are needed.

_____ okay _____ need – Specify: _____

- 2) Are there any modifications that you need to make to your existing vehicle such as adding a trailer hitch and a small travel trailer?

_____ okay _____ need – Specify: _____

- 3) For your bug-out vehicle, can you drive to the bug-out site on one tank of gas? Will you need to carry gas with you to reach the bug-out site?

_____ okay _____ need – Specify: _____

Step 5: Bug-Out Bag (BOB) – Think *checklist* and *packing for a trip*. Tailor the checkoff list to your specific needs. Prepack your bug-out bag and store your checkoff list with it. As the disaster approaches, top-off the bug-out-bag and bug-out.

The purpose of this inventory was to self-identify the components that you need to address in developing a bug-out plan for yourself and your family. Its questions will provide you with a good start.

rbk

First Aid ¹

First aid procedures are amply covered in Chapter 11 of Bradley (2011) and others. This section is short. It has two foci. First is the difference between frontcountry and backcountry protocols. Second is the addition of a first-aid manual to your first-aid kit.

Front-country versus Backcountry Protocols – In a time of disaster or major crisis, medical services may not be readily available. By definition, their triage protocols may change significantly so that only life threatening victims are treated. In this respect, the backcountry protocols may be more applicable. Essentially, if you are over three hours from a hospital or similar care, use the backcountry protocols. As you read Bradley (2011), he straddles the issue between frontcountry and backcountry protocols and emphasizes traditional frontcountry protocols. As you read his first aid section note how many of the treatments require doctor or hospital care. It may not be available.

First-Aid Manual – It is suggested that the half-life of first-aid training is six months. This means that you will forget half of what you learned after six months if you don't constantly train and update your skills. This is not a criticism but a simple statement that *if you don't use it, you will lose it*. For this reason, the most valuable addition to your first aid kit is a manual on first aid where you can quickly review the symptoms and treatments in time of crisis. One manual is Buck Tilton's *Backcountry First Aid and Extended Care*. It is small and designed to fit in your first aid kit. It could easily be the most valuable addition to your first-aid kit.

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Arriving on the Scene¹

Note that this is assessing the scene and not the victim. First, you need to find the victim (*search*). Then you need to extricate the victim from the MOI or mechanism of injury (*rescue*). Only then can you render *first aid*. Once the victim is stabilized, you can *transport* them. The main “take away” from this handout is to survey the scene before rushing in to help the victim and be sure to take care of those are participating in the rescue and operation.



Stop! Think! Observe! Plan! [*Why? Adrenaline*]



Stop Survey the site for MOI (Method of Injury) and other hazards. [*Why? You don't want two victims.*]



Stop Talk with the victim. They can provide you with valuable information. Also, if the victim responds, it indicates they are alive and their level of alertness. [*Why? They may provide you with valuable information about what happen, the MOI, and their status.*]



Stop When accessing the victim, do not put others in danger. [*Why? Again, you don't want two victims.*]



Stop Rescue the victim (i.e. remove them from the MOI) [*Why? The victim and rescuer need to be safe themselves before rendering first aid.*]



Stop Assess whether the victim is stable where they are or whether they are in immediate danger and need to be moved to a safe location. [*Why? This relates back to the MOI.*]



Stop Examine the patient [**Note:** *The number of steps that occurred before examining the patient.*]

- 1) Primary survey
- 2) Secondary survey
- 3) SOAP Notes



Stop Be sure to monitor and take care of everyone else in your group.



Stop Stabilize the patient and prepare to transport [*Why? The basic tenant in first aid is to stabilize the victim and then transport them to a hospital where they can receive medical help.*]



Stop Transport and evacuate victim [*Why? The victim needs trained medical help.*]

¹ This handout was developed by Dr. Robert B. Kauffman who is responsible for its content. This handout is adapted from materials in Hubbell, F., (2005). Wilderness First Aid. Conway, NH: TMC Books, pp 12-13.

A Primer on Knots, Hitches, and Bends ¹

The term knot is used generically to cover knots, hitches, and bends. It was done so here. Technically, knots, hitches and bends are structurally different and serve different purposes. In addition, the three types of knots indicate three basic knot tying situations. The rope is fasten to another object (i.e. hitch). It is fasten to another rope (i.e. bend). Or it is a self-supporting knot in the rope that creates a loop or serves some other function. Along with principles and definitions, the three types of knots are used as the organizational structure and headings in this section.

Principles and Definitions

Knot – The critical element in determining a knot is that when tied, it is self-contained and self-supporting. A simple overhand knot or figure-8 knot is self-supporting in that the configuration of the knot and how it is tied supports itself as a knot. Unlike a hitch, a knot does not need another rope or object to maintain the integrity of its configuration. Unlike a bend, a knot doesn't need another rope to maintain the integrity of its configuration when two ropes are tied together.

Also, it should be noted that the term knot is often the generic term used for hitches and bends much like Xerox ® is synonymous with copying and used interchangeably with all copying. Similarly, Kleenex is synonymous with tissue paper and used interchangeably with it. So generic is the use of knot as part of the nomenclature, obvious hitches such as the water knot, grapevine knot, or barrel knot are actually called knots. This section recognizes the difference between knots, hitches, and bends. It is structured along these distinctions. However, the term knot is used generically and interchangeably with hitch and bends.

Hitch – Without another rope or object to assist in maintaining its integrity and configuration, a hitch will fall apart. In this respect, a hitch is not self-contained nor is it self-supporting. Without a peg or object, a clove hitch will fall apart. The same is true for a Prusik which is listed under the hitches. It needs another rope to tie and to maintain its integrity and configuration.

Bends – Bends are used to tie two ropes together. The water knot is used to tie two the two ends of webbing together to create a sling. Also, the water knot is labeled as a knot rather than a bend indicating the confusion often associated with the terms used.

Families – Examination of knots reveals that their internal structure tends to repeat themselves in other knots. This suggests that knots can be grouped into families. Also, this helps when examining knots because the configurations are the same. The figure eight family of knots is probably the largest family of knots. The bowline and sheetbend have identical configurations. Two half-hitches and the clove hitch are the configurations.

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Families can be extended to include similar configurations but where the number of loops or other element is varied in the knot. The single, double, and triple fishermen knots (hitches) have the same configuration except for the number of loops. The double sheetbend is similar to the sheetbend, except that it has a second internal loop. The figure nine knot has one more turn than a figure eight knot. An overhand knot has one less turn than a figure eight knot.

The conclusion is that many knots have much in common with each other. There are only so many ways to tie them.

Parts of a Rope (Figure 15.1) – The following are some commonly used rope terms. It is useful in orientating and describing the parts of a rope as well as working with a rope. Some of the terminology seemingly overlaps with other terms, such as the difference between a bight and loop.

Bight – A bight is a loop where the line doesn't cross over itself. The rope forming the loop remain essentially parallel to each other. It is usually taken out of the center of the rope.

Loop – In contrast with a bight, a loop is a turn in the rope where the lines cross over each other. When tying a bowline, the first step is to make a loop.

Working End – The working end is attached to item being rigged or hauled. Think of it as the end of the rope working or currently occupied.

Standing End – The standing part of a rope includes all the rope excluding the working end.

Running End – The running end is the free end of the rope. It is part of the standing end of the rope and it is the section of the running end of the rope used to tie a knot or hitch to something else.

Tying Considerations – Some knots are selected because of their strength (e.g. figure-8). Some are chosen because a life might depend on the knot being “bombproof” (e.g. figure-8 on a bight). Some knots are selected because they can be tied and untied quickly (e.g. bowline). Others have a specific purpose or functions (e.g. double fisherman, Prusik).

Function – Many knots are designed for specific uses and functions. A sheetbend and double fisherman are designed to tie two ropes together. A water knot is designed to tie two pieces of webbing together but not two ropes. A bowline is designed to tie a loop in the rope. A clove hitch is designed to tie a rope to a branch or peg.

Strength (Figure 15.2) – Tie a knot in a rope and it will immediately lose 1/4 to 1/2 of its strength. The knot creates a stress point where the fibers on the outside of the bend in the knot are stressed more than those on the inside of the bend. This creates a stress point and leads to rope failure at this point.

Ease to Tie/Untie – A knot should be relatively easy to tie. When tying a line around a post or object, the bowline is easier and quicker to tie than a figure-8 follow-through.

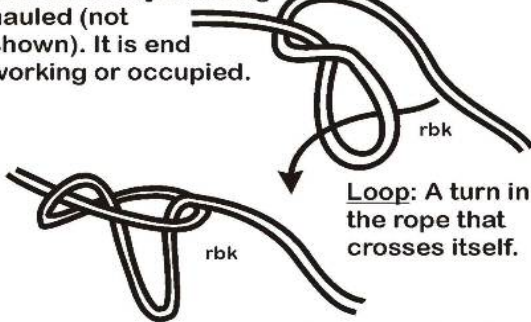
Often overlooked is the ability to easily untie a knot. A bowline is easy to untie even after heavy loading. Just bend the “horse collar” section of the knot over the working end of the rope and the knot will fall apart. In contrast, considerable labor and time can be extended trying to untie a double fisherman.

Parts of a Rope

Figure 15.1

Working End: The end tied off to object being hauled (not shown). It is end working or occupied.

Standing End: All the rope not fasten to the object being hauled.



Bight: A loop that does not cross over itself, usually taken from the center of the rope.

Loop: A turn in the rope that crosses itself.

Running End: The end of the rope not tied off and free to use.

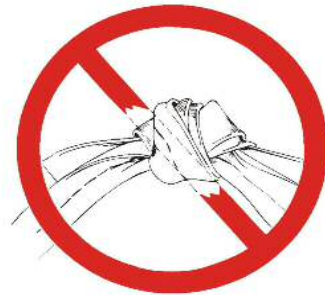
Setting and Dressed

Figure 15.3

As the hands pull the ends the loosely tied knot will "set" properly.



This knot is not "dressed" properly. Note the kink or unwanted twist in the webbing.



Relative Strength of Knots

Figure 15.2

100% No Knot
75%-80% Figure 8
70%-80% Bowline

65%-70% Double Fisherman's
60%-70% Water Knot

60%-65% Fisherman's
60%-65% Clove Hitch
60%-65% Overhand Knot
60%-65% Two Half-hitches

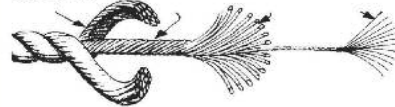
43%-47% Square Knot

Types of Rope

Figure 15.5

Laid Rope

Strand



Strand

Yarns

Fibers



Solid Braid



Dynamic Kernmantle

A braided sheath is woven over the twisted-core which acts as a shock absorber.



Static Kernmantle

A protective sheath is woven tightly over the load-bearing parallel-fibers in the core.

Patterns and Running Ends

Figure 15.4

Square Knot



"Killer" Square

Under even a small amount of tension, the "killer" square will come undone.

Source: rbk



Source: Smith, B., and Padgett, A., (1996). *On Rope - North American Vertical Rope Techniques*. Huntsville, AL: National Speleological Society, Inc.

Setting and Dressed (Figure 15.3) – In tying a knot, the knot is tied loosely. *Setting* is the process of tightening the knot so that it becomes dressed. A knot is *dressed* when it is configured properly. All the parts of the knot are in their proper location and the knot looks as it pictured in the textbook. This is important because, a properly dressed knot makes for easier inspection. An improperly dressed knot can lose up to 50% of its strength.

Inspection – It is important to determine that a knot is tied properly and safe. A properly dressed knot is the first consideration. A second consideration is the pattern or configuration of the knot. A figure-8 knot has a unique and distinct configuration. In a figure-8 follow-through the second rope runs parallel to the first rope within the knot. This creates a distinctive pattern. Also, it relates to the knot being properly dressed. Third, there may be a key element of the knot that needs to be checked. In the square knot, the two running ends are on the same side of the knot (Figure 15.4). In the “killer square” the running ends are on opposite sides of the knot. Except for this feature, both knots look identical. Unfortunately, the killer square knot will literally fall apart under tension.

Amount of Rope Used – Some knots consume more rope than others. With its three loops, a triple fisherman’s knot consumes more rope than a double fisherman or a single fisherman. A figure eight on a bight consumes more rope than a bowline. At some point, the amount of rope consumed in tying the knot can influence its use. Not much is gained in strength of the triple fisherman over the double fisherman. However, the double fisherman does save some rope.

Types of a Rope (Figure 15.5) – Several of the common rope types are presented in Figure 15.5. These are laid, braided and kernmantle.

Kernmantle is comprised of the *kern* and the *mantle*. The mantle is a woven outer sheathing that protects the kern. Kernmantle ropes are either *dynamic* or *static*. The kern in a dynamic rope consists of twisted strands of fibers. Dynamic ropes are used in climbing and are designed to stretch. Specifically, they are designed to absorb the fall of a climber. The kern in a static rope consists of parallel unidirectional strands of fibers. The design minimizes stretch. They are not used in lead climbing or in situations designed to absorb falls.

Ropes are constructed out of nylon, spectra, and polypropylene as well as natural and other materials. Nylon is one of the more common materials. It is strong, flexible, and doesn’t float in water. Spectra is much stronger than nylon which is reflected in its cost. Polypropylene has less strength than nylon. It is inexpensive and it floats in water.

Knots

When tied, a knot is self-contained and self-supporting. It doesn't need an object or another rope to maintain its integrity. This may be a fine distinction, but a distinction non-the-less. Traditionally, the term knot is used to include hitches and bends. It is used as a generic term for hitches and bends. Historically, many hitches and bends actually incorporate the term knot in their name when they are really hitches. Two families of knots are included in this section, the figure eight and bowline.

Figure Eight Family (Figure 15.6) – Consider the figure eight knot as a base knot. By itself, it is a stopper knot that is tied at the end of a rope to stop someone who is rappelling from rappelling off the line at the bottom of the rope. Other than this, the figure eight by itself has little utility. Other than demonstrating how to tie the knot, this author can't remember ever using the figure eight by itself. Having said this, the figure eight knot is foundational or a base knot for a whole family of knots. The figure eight on a bight, follow through, or in-line figure eight have great utility and great usage along with other derivations not noted here. These knots have been used extensively.

Figure -8 – Figure-eight on a Bight (Figure 15.7) – The figure eight on a bight provides a loop in the end of the rope. The running end of the rope is made into a bight and the bight is tied as if were a simple figure eight. If the person is creating a loop and then clipping it (i.e. carabiner) into something else, this knot is quick and efficient. Simply, if trying to tie a loop around a person or some other fixed object, the figure eight on a bight won't work.

Figure-eight Follow-through (Figure 15.8) – For climbers, this is the knot used to tie into the harness. It is "bullet proof" in that it won't come undone and it provides maximum protection. It is designed to create a loop in the rope connected to the harness or around the person or other object that is secure and provides maximum protection. It is a staple of climbers. The disadvantage of this knot is that it does take time to tie. Under normal circumstances this is not a problem. In an emergency situation and when time is of the essence, this can become more problematic.

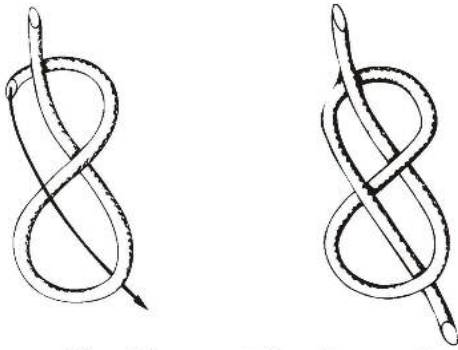
In-line Figure Eight (Figure 15.9) – The in-line figure eight is a figure eight tied onto the main line rather than as part of the main line. This enables the running end to do something else. It could be to tie a loop in the middle of the line or to create a self-equalizing anchor (see next item).

Directional Figure Eight Follow-through (Figure 15.10) – The running end of the in-line figure eight is worked back through the loop and then retraced the knot as diagramed. The setup is a self-equalizing anchor system where the pull on each anchor is the same. The system can easily incorporate multiple anchor points with the addition of another loop. If there is an abundance of carabiners, they can be used to clip the loops around the anchors to the loop at the bottom of the figure eight.

The system has been used in river rescue and to a lesser extent in climbing. The system can be hooked to multiple D-rings on a raft to extricate it from a pinning. Or it could be used to anchor a hauling line to multiple trees used as anchors where no one tree would serve as a suitable anchor. Actually, it should be used more in climbing since it is truly self-equalizing, particularly when used with carabiners.

Figure eight

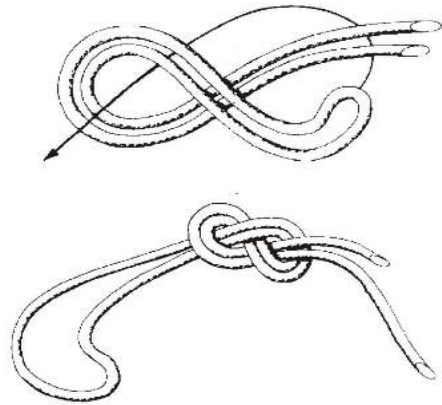
Figure 15.6



The Figure 8 knot is one of the strongest knots. It can be used as a stopper knot, to tie two ropes together, or to tie a loop in the end of a rope.

Figure eight on a bight

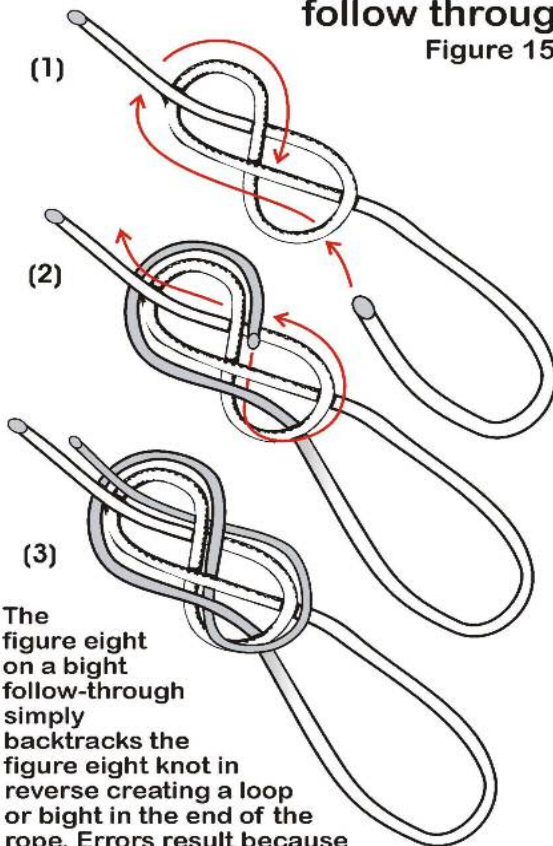
Figure 15.7



Fold the rope back on itself. Tie a Figure 8 knot with the two strands as you would the Figure 8 pictured above.

Figure eight on a bight follow through

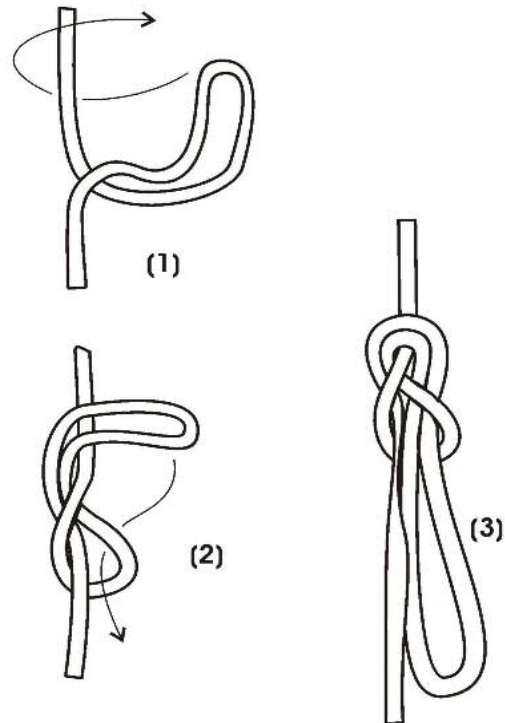
Figure 15.8



The figure eight on a bight follow-through simply backtracks the figure eight knot in reverse creating a loop or bight in the end of the rope. Errors result because the backtrack is not parallel to the original configuration.

In-line figure eight

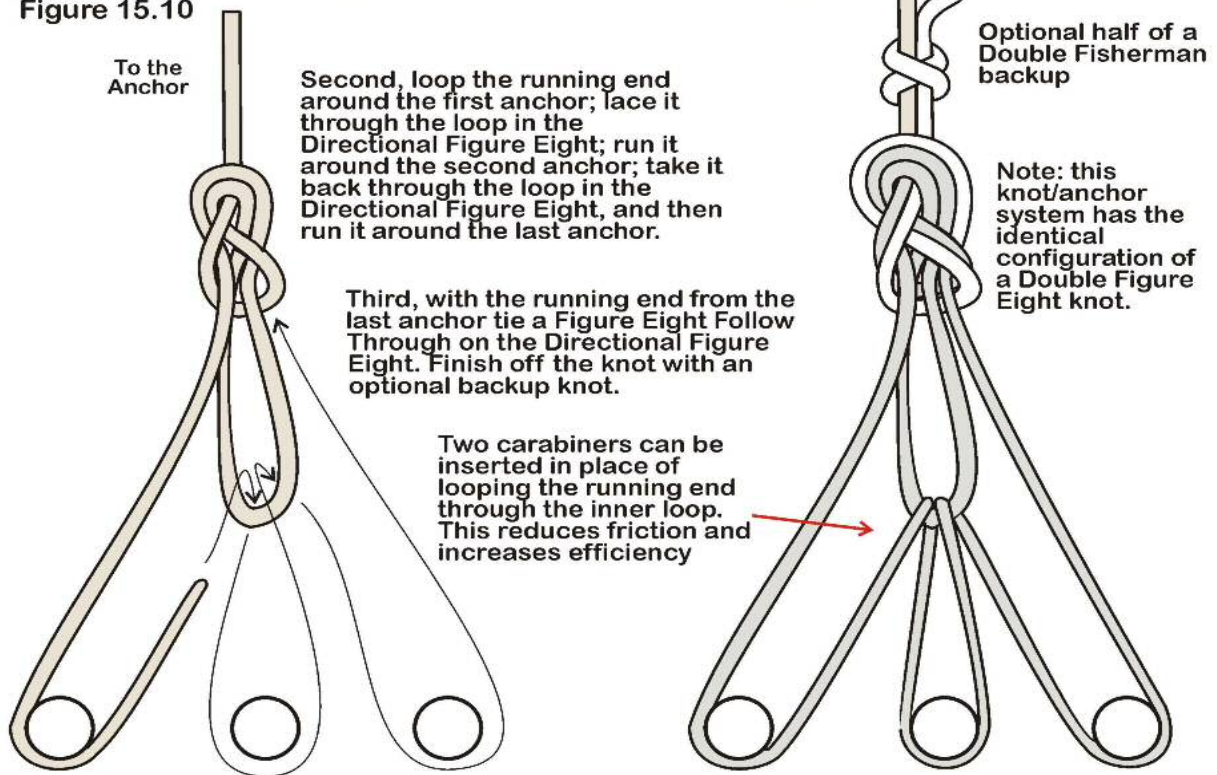
Figure 15.9



Make an overhand loop on the rope (1). Go around the back of the rope, and through the loop (2). Seat Knot (3).

Self-Equalizing Anchor Using a In-line figure eight follow-through

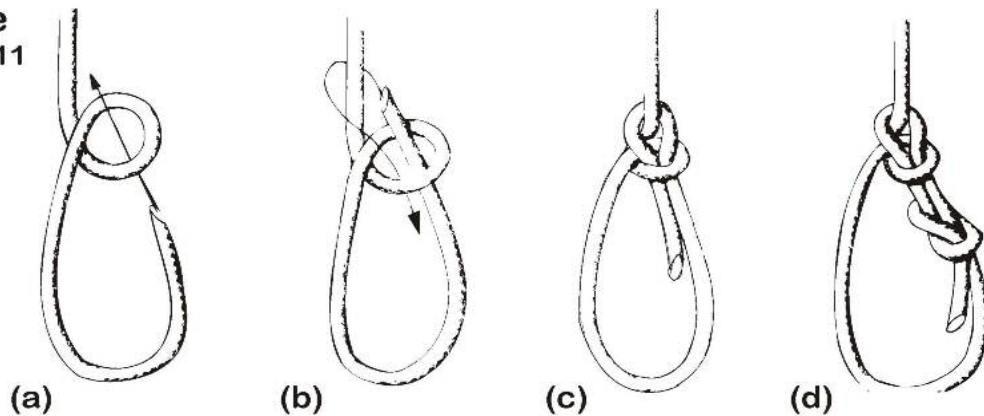
Figure 15.10



Source: Kauffman, R. (2015). *Swiftwater Rescue Packet*. McHenry, Maryland: Garrett College. Unpublished packet.

Bowline

Figure 15.11



The rabbit comes out of his hole (a); goes around the tree and seeing the fox goes back down into his hole (b). The rabbit grabs his tail and the fox grabs the tree (don't ask me why, but you need to do so to make the knot work). They both pull (c) Then they both go bowling (pun intended).

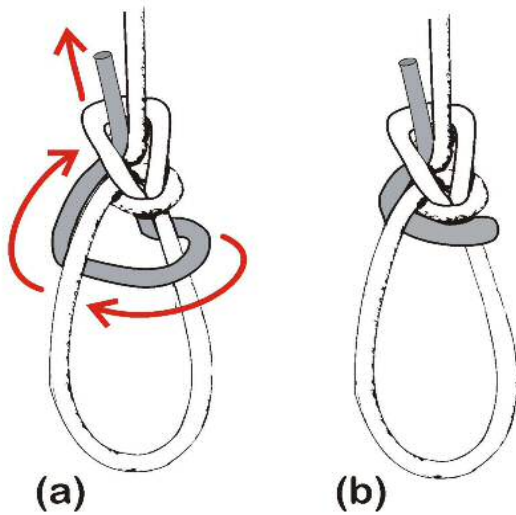
Source: Smith, B., and Padgett, A., (1996). *On Rope - North American Vertical Rope Techniques*. Huntsville, AL: National Speleological Society,



Note: Some believe the knot is weakened with the end on the outside. It is more prone to snagging and inverting into a slip knot.

Yosemite tie off on the bowline

Figure 15.12



The bowline tends to be a loose knot and under a tension/release situations, it can easily become loose and undone. (a) Take the running end, bring it around, through the loop, and up through the "horse collar" as shown. It is parallel to the working end. (b) Set and dress the knot. It is now backed up.

Bowline (Figure 15.11) – The bowline is used to tie a loop in the end of a rope. The advantage of using the bowline is that it can be tied quickly and easily. Also, it consumes less rope to tie than a figure eight follow-through. The knot maintains its integrity under tension. However, it can loosen when placed in continuous tension and compression situations. In the climbing community the bowline has fallen into disfavor for this reason. When a climber falls, they tend to bounce which can loosen the knot. If there is any doubt that the bowline could be placed in a tension and compression situation, back it up.

Yosemite Tie-off (Figure 15.12) – If there is a need for a secure bowline, back it off. The Yosemite tie-off is one of several acceptable methods. Often half of a double fisherman's knot is used. Half a single fisherman can be used in a pinch, but it tends to be a loose knot and it may fall apart under compression and tension situations which defeats its purpose as a backup.

Hitches

A hitch requires an object or another rope to maintain its integrity and structure. Several hitches are covered in this section, two half-hitches, clove hitch, Prusik, trucker's hitch, double fisherman's, tensionless anchors, and munter hitch.

Two Half-hitches (Figure 15.13) – Two half-hitches is a commonly used to tie a loop around an object or another line. It is useful in tying off the running end in a trucker's knot.

Clove Hitch (Figure 15.14) – The clove hitch is used to tie a line to a post or tent peg. The knot has the same configuration as two half-hitches. The difference is that the clove hitch fastens the running end around a fixed object (e.g. peg, posts), and two half-hitches fasten the line around another line. The clove hitch is a loose knot and in tension and compression situations, it tends to become loose and undone. This author usually backs up the clove hitch with two half-hitches to maintain its internal integrity.

Prusik (Figure 15.15) – The Prusik is a multi-purpose hitch. It is used in climbing as an ascender and in rescue on hauling systems. In many circles, it is preferred over mechanical devices because it slips at around 900 lbs of tension. This protects the system from fatiguing elsewhere. The Prusik is a hitch because without the main line to maintain its integrity, the knot will fall apart.

The Prusik is designed to cinch down on the rope and to kink the rope at an angle to increase its hold. In theory, the Prusik works best when the diameter of the Prusik is significantly smaller than the main line. In rescue work, this author has used Prusiks with diameters that are close to the main line with little adverse effect.

The first step in making a Prusik is to make a sling. Tie the two ends of the rope together using a double fisherman's knot. Next loop the Prusik around the main line and through itself as pictured in Figure 15.15.

Third, is the issue of where the double fisherman is located in the final knot. There are three options. First, the double fisherman can be positioned over the Prusick as pictured in Figure 15.15. In theory, this minimizes the loss of tensile strength due to a knot in the system and in theory, the tensile strength of the Prusik approaches that of the rope without a knot. In practice, it may not make any difference. The Prusik has two supporting lines. If the rope has a tensile strength of 900 lbs, it has an effective tensile strength of 1,800 lbs. It should be noted that some people find it easier to tie the Prusik by positioning the double fisherman over the knot.

The second option is to have the double fisherman located on the side of the sling. Practically, this approach is satisfactory. The third option is to locate the double fisherman where the carabiner fastens into the Prusik. This should be avoided since it places undue stress on the system. Often, when tying the knot, the double fisherman is grasped and looped through and around the main line. It is convenient. This approach will tend to line up the knot where the carabiner clips into the sling.

For a Prusik to be effective, it needs to be loosened easily and readjusted along the main line. This is a three-step process of loosening the knot, moving it and re-cinching it. It is important to loosen the knot first or it will be difficult to move a cinched Prusik. To loosen or untie the Prusik, pull the “horse collar” over itself. Usually, this is the double fisherman. Conceptually, this process is similar to loosening the bowline. Prusiks can easily cinch down on the main line making them difficult to move and readjust.

Trucker’s (Rigger’s) Hitch (Figure 15.16) – The trucker’s hitch is used to fasten boats, construction materials, and other items to roof racks on a car, or to fasten lines to tent pegs that are easily adjustable. Close inspection of the rig reveals that the hitch is the same configuration as a Z-rig and offers a theoretical 3:1 mechanical advantage. This mechanical advantage makes the trucker’s hitch an attractive rig for when the line needs to be taught or when the tension on the line needs to be adjusted. The adjustable lines to the tent pegs are an example of this re-adjustment. The other feature of the trucker’s hitch is that it is easy to untie and when untied, the hitch simply falls apart.

In situations where the tension needs to be monitored or adjusted, or where there needs to be micro adjustments made in hauling line, the trucker’s hitch is ideal for these situations. The author uses it as a staple tool to set up and adjust lines in river rescue.

Two half-hitches are used to finish off and lock the trucker’s hitch into place. If there is any doubt regarding the two half-hitches, use three half-hitches. The half-hitches need to be snug or it will slide down the line. If it is anticipated that the system will be readjusted, tie the half-hitches using a bight in the rope. Pulling on the one side of the bight unties the half-hitches.

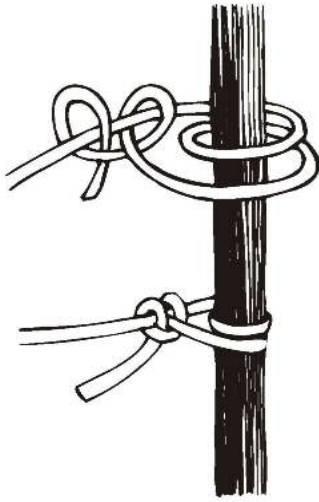
Double Fisherman (Figure 15.17) – The double fisherman is used to fasten two ends of a rope together to form a loop or sling. It is also called the grapevine knot. It is an integral component in tying the Prusik. Half of the knot is often used as a backup knot for other knots. The knot cinches on itself making it extremely difficult if virtually impossible to untie after being loaded. For this reason, it is used in situations where it won’t be untied and other knots are preferred in situations where the knot is to be untied. Since it uses the other end of rope to maintain its structure, the double fisherman is a hitch.

The configuration of the single, double, and triple fisherman are essentially the same except for the number of wraps around the rope. The configuration of the single fisherman is that of an overhand knot with the other end of the rope passing through the center of the overhand knot. It tends to be a loose knot and in backup situations, half a double fisherman is generally preferred. In terms of strength, there is not much difference between it and the triple fisherman. The triple fisherman is also called the barrel knot. If consuming more rope in the knot is not an issue, the double fisherman is more than adequate.

Tensionless Anchor (Figure 15.18) – Traditionally, the tensionless anchor has been used to anchor ropes around trees. This author has used the tensionless anchor to fasten boats, construction items and other items to be hauled to the roof racks on his car. It has replaced the trucker’s hitch in this use. It works by the rope creating friction around the anchor. It is a hitch because it uses the tree or roof rack to maintain its integrity and structure.

Two half-hitches

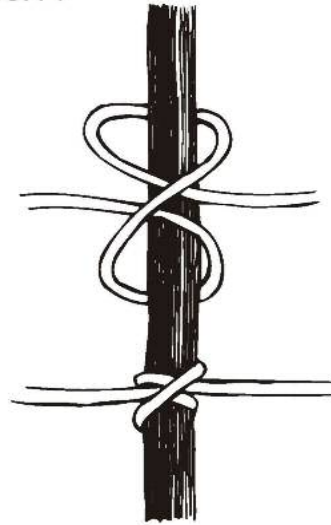
Figure 15.13



To be tied correctly, it should look like a clove hitch.

Clove hitch

Figure 15.14

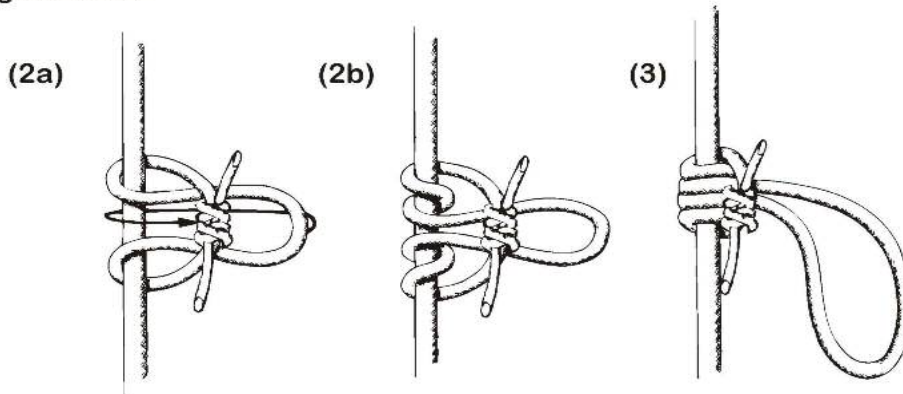


Careful inspection reveals that the clove hitch and two half-hitches are identical knot configurations.

Usually, the author ties the clove hitch off with two half-hitches since the clove hitch tends to easily fall apart.

Prusik

Figure 15.15



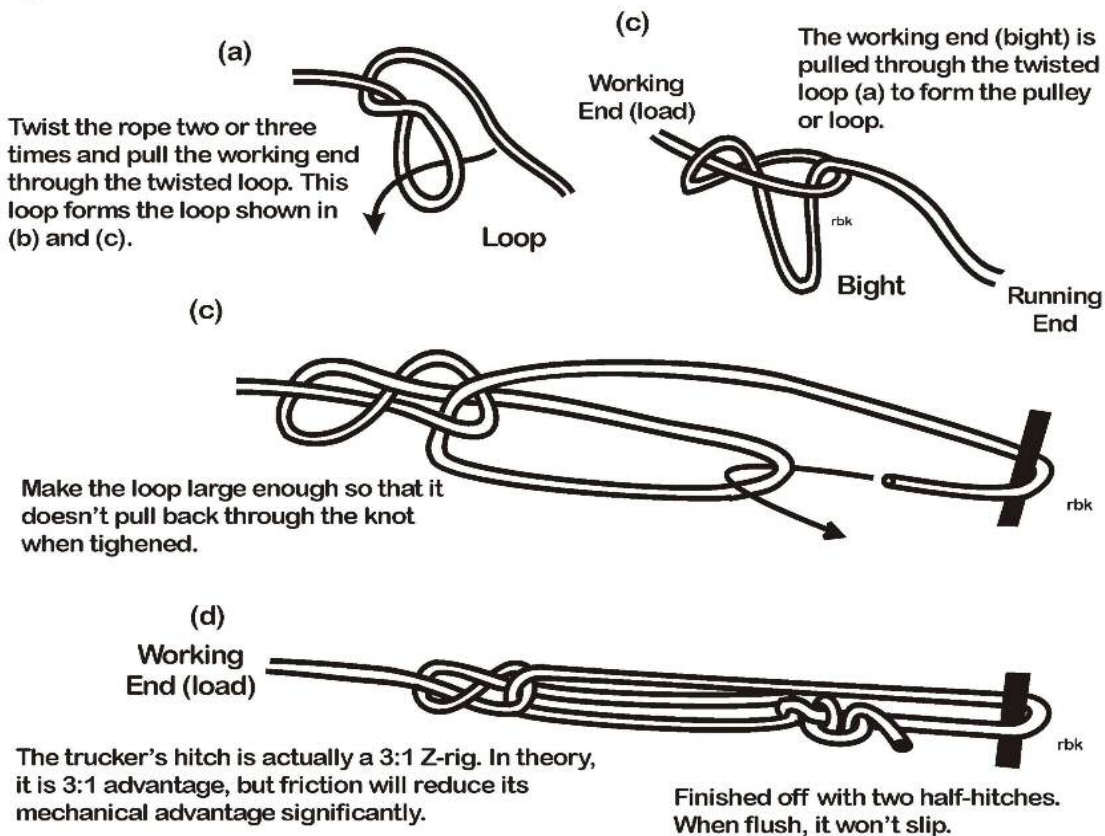
1) Tie two ends of the rope using a double fisherman's knot (not shown).

2a and 2b) Hold the double fisherman's knot in the one hand and loop two to three times around the main rope. Another loop can be added for extra bight. Make sure the loops are parallel with each other.

3) To untie a tight prusik, flip the double fisherman's knot back over the loop and push the loop through the knot. This will loosen the knot.

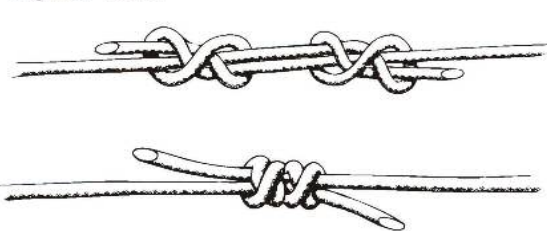
Trucker's (Rigger's) Hitch

Figure 15.16



Double Fisherman's Knot

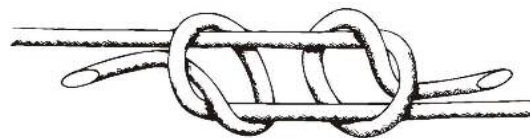
Figure 15.17



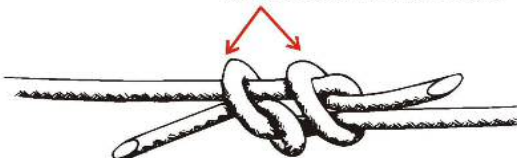
The single fisherman, double fisherman, and barrel knot belong to the same family of knots. They are really hitches. The double fisherman is the most commonly used in the group because it holds better than the single fisherman and uses less rope than a barrel knot (i.e. tripple fisherman).

The single fisherman's knot (right) shows the basic configuration of the hitch. Close inspection reveals that it is an overhand knot with the working end of the line passing through the center of the overhand knot.

Single Fisherman's Knot



Note: Overhand knots



In Figure 15.18, the tensionless anchor is drawn with the rope neatly coiled around the anchor. This need not be the case. Only the first two coils should be neatly looped around the anchor and free of crossovers. This aids when finishing off the knot. Feel free to coil the remainder of the rope around the anchor with numerous crossovers.

The literature shows several ways to finish off the tensionless anchor. The first is to let the running end hang loose (not pictured). This is not recommended. If the tensionless anchor is only under tension, it will tend to maintain its integrity and not loosen. If the system is under repeated tension and compression, it will tend to loosen and begin to fall apart.

The second method of finishing off the tensionless anchor is tie a figure eight on a bight and fasten the knot to the main line with a carabiner (not shown). This approach is slightly better than using no tie off. It does provide fail safe protection where if the system loosens and begins to unwind, it will eventually lock down on itself.

The third approach brings the loose running end around the main line on the first coil and cinching it off as shown in Figure 15.18. This is why it is important to neatly coil the first two coils. After the first two coils, the rope can be wrapped in any fashion and it can cross over itself.

The author has used this version of the tensionless anchor for years to fasten boats and other items to the roof racks on his car. It replaced the use of the trucker's hitch for tying down boats on roof racks. It is easy to tie and untie. It works equally well on metal roof racks. Also, the system tends to maintain its integrity when experiencing repeated tension and compression situations. However, if there are known situations with extreme repeated tension and compression situations, the author will normally revert to the trucker's hitch.

Munter Hitch (Figure 15.19) – The munter hitch is a friction device that can be used in place of a rappelling device. The author uses it in place of a tied off clove hitch on a carabiner.

Bends

Bends tie two ropes together. Two bends are covered, the sheetbend and water knot. A figure eight follow through is not included. However, it can easily be inferred (see Figure 15.8 and Figure 15.10). The second running end retraces the loosely tied figure eight knot in the other running end.

Sheetbend (Figure 15.20) – The sheetbend is used to tie two ropes together. Careful inspection of the knot reveals that it has the same configuration as a bowline (see figure 15.11). Hence, the sheetbend has the same attributes as a bowline. It tends to be a loose knot. Under stress and compression, it will tend to become loose and come apart. Like the bowline, it is easy to untie. Simply, break the “horse collar” and the knot falls apart. For additional strength, consider a double sheetbend with its two loops (not shown).

The alternative is a figure eight follow through (not shown). It consumes more rope in tying the knot than a sheetbend. Also, it tends to be a tighter knot in that it maintains its integrity under stress. However, a big advantage of the sheetbend over the figure eight follow through is that it can be quickly tied and quickly untied.

Tensionless Anchor

Figure 15.18

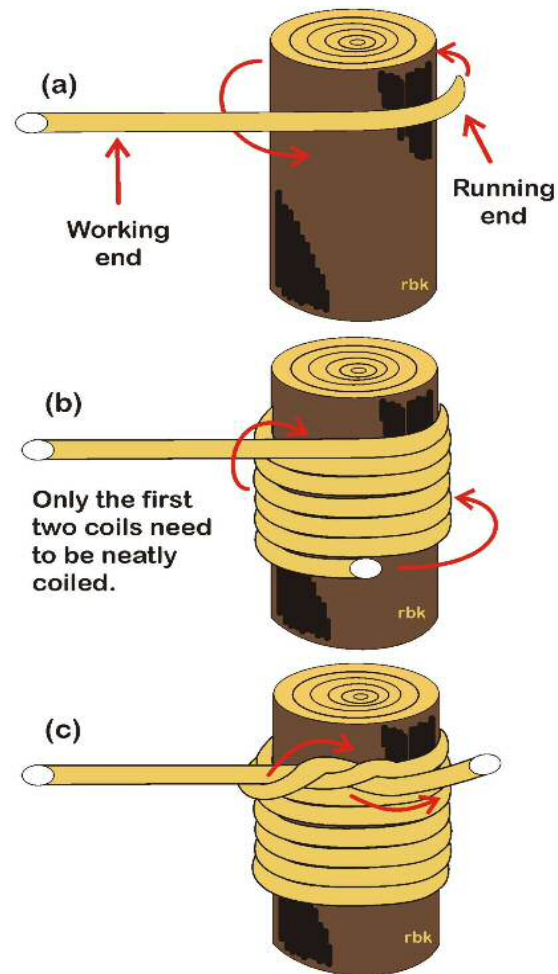
A tensionless anchor utilizes the friction created by the rope wrapped around a tree, car roof rack, or other object to prevent slippage of the standing end of the rope.

Many texts depict a tensionless anchor with the working end not tied off or just hanging (b). The problem is that the system will tend to loosen and begin to unwind.

A good way to tie off the anchor is shown in (c). The working end is looped around the standing end and pulled taught. It locks the rope and maintains the integrity of the system. This author has used this system to fasten boats to a car roof rack for years. It is quick and easy to tie and untie.

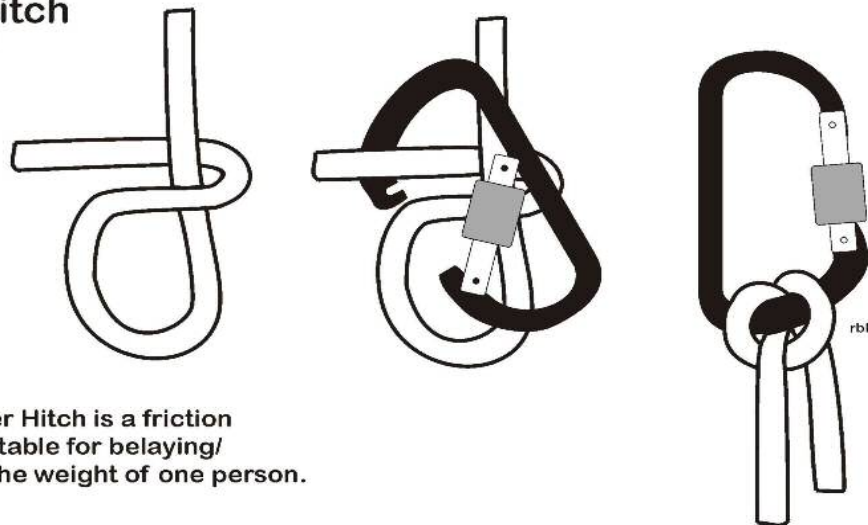
Some people will tie the working end to the standing end using two half-hitches (not shown). It works, but in the estimation of this author, it is not as efficient as (c).

The diagrams show the rope neatly coiled around the tree, roof rack, etc. Only the first two loops should be neatly coiled. The remaining coils can be wrapped crossing over each other without ill effect.



Munter Hitch

Figure 15.19

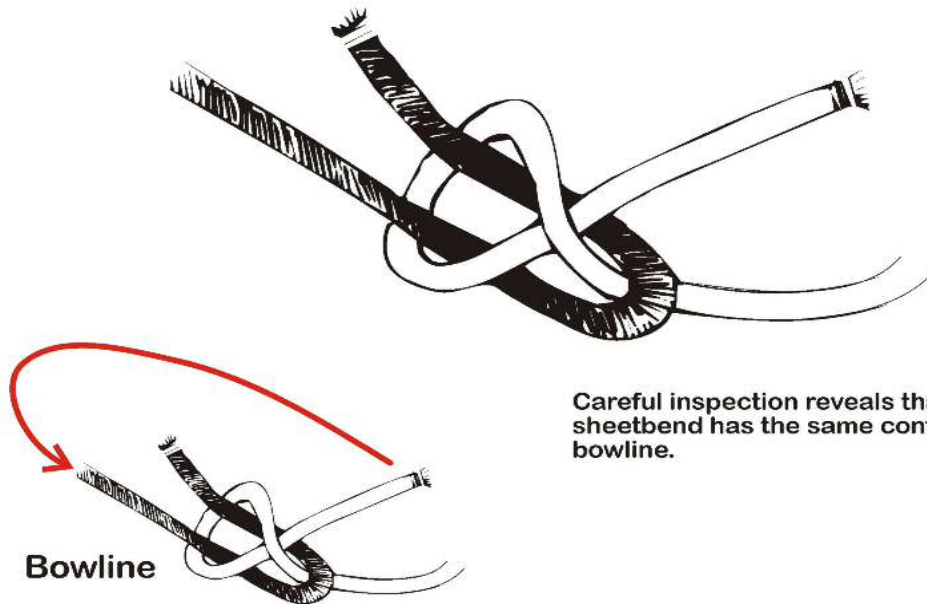


The Munter Hitch is a friction device suitable for belaying/ lowering the weight of one person.

Sheetbend

Figure 15.20

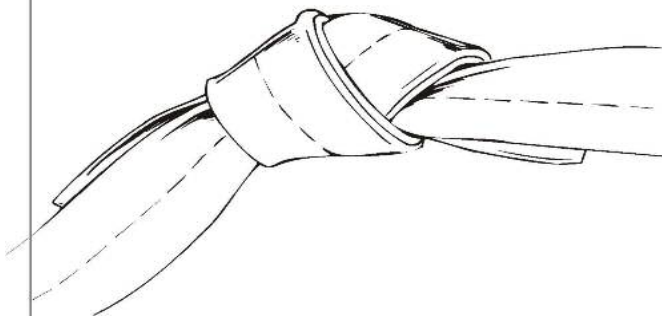
Use the sheetbend for tying two ropes together even if they are of different diameters. A double sheetbend (not shown) is better.



Careful inspection reveals that the sheetbend has the same configuration as a bowline.

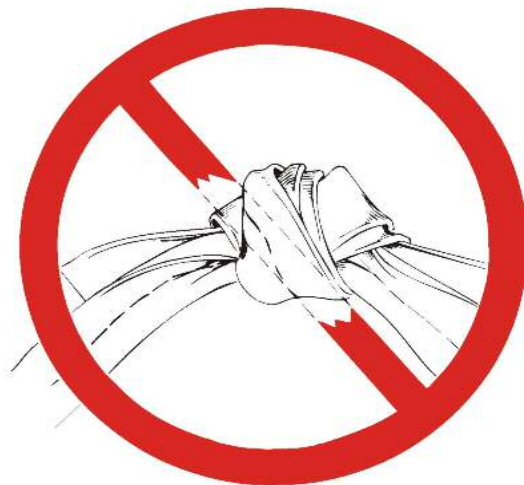
Water Knot (Bend)

Figure 15.21



ABOVE: The water knot is a follow-through overhand knot. It is the preferred knot for tying two pieces of webbing together. Tie an overhand knot in the one piece of webbing. With the other piece of webbing, trace it back through the original overhand knot following every bend. It creates a parallel knot that mirrors the original knot.

BELOW: This knot is not “seated” properly. There is a kink or unwanted twist in the webbing.



Water Knot (Figure 15.21) – The water knot is used to tie two pieces of webbing together to form a sling. This is the primary purpose of the knot and no other knot excels like the water knot in this capacity. Normally, it is not used to tie two ropes together. A sheetbend or figure eight follow through would be used. The configuration of the knot is that of an overhand knot.

The knot is tied as an overhand knot follow-through. Tie an overhand knot loosely in the webbing. With the other end, follow through the knot in reverse. Seat and dress the knot. Avoid kinks. The follow through webbing should parallel the original knot. No backup is needed. The knot maintains its tightness under stress and compression and remains tight.

Summary

Technically, knots, hitches and bends are structurally different. Regardless, the term knot is used generically to cover knots, hitches, and bends. It was done so here. In addition, the three types of knots indicate three basic knot tying situations. The rope is fasten to another object (i.e. hitch). It is fasten to another rope (i.e. bend). Or it is a self-supporting knot in the rope that creates a loop or serves some other function.

Consider knowing how to tie one knot in each of these three situations. The corollary is that sometimes less is more. Consider being able to tie these three knots blindfolded, backwards, or forwards. The point is that knowing how to tie a few knots well is better than trying to tie multiple knots with overlapping functions.

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A Primer on Pulley Systems ¹

Pulley systems utilize mechanical advantage to pull weighted loads. In swiftwater rescue, hauling systems may be used to extricate a raft or canoe. Or they may be used as an integral part of a rescue system (e.g. Tefler lower). In climbing, hauling systems are used to haul gear on multi-pitched climbs and in rescue to raise or lower a litter. The major advantage of the rescue pulley systems described in this section over traditional pulley systems is that they are adjustable meaning that they can be moved along the length of the haul line.

Principles and Definitions

There are three types of basic pulley systems. They are the 2:1, the Z-rig, and block and tackle (Figure 1; see also Figure 7, Figure 8, and Figure 12). Most systems described in this section are configurations that use combinations of the 2:1 or 3:1 Z-drag. Principles and definitions included in this section include mechanical advantage, compound pulley systems, the concept of throw, self-adjusting brakes, range of system, throw, internal versus external pulling systems, and the 120° rule.

Mechanical Advantage – The primary purpose of a hauling system is to gain mechanical advantage. There are several ways to calculate mechanical advantage. A scale can be attached to the effort and the load. Divide the weight of the load by the weight on the effort line provides the mechanical advantage. Second, measure how far the effort line moves in terms of how far the load moves. If the effort line moves nine feet for a corresponding movement of one foot on the load, there is a nine to one mechanical advantage. Some people will count the number of lines support the load. This method may work, but with many of the complex systems it is inaccurate. For example, the double Z-rig has five supporting lines and a mechanical advantage of 9:1 (see Figure 11).

Compound Pulley Systems – These are pulley systems where one pulley system is pulling on the effort of another system. The 4:1 piggy-back is a 2:1 pulling on a 2:1 system (see Figure 9). The 5:1 is a 3:1 Z-drag and 2:1 system hooked together in parallel (see Figure 10). The double Z-rig is a 3:1 Z-rig pulling on another 3:1 Z-rig. (see Figure 11) are examples of compound systems. One technique for determining mechanical advantage is to count the supporting lines. As noted, this doesn't necessarily work for complex systems. The 9:1 double Z-rig has five supporting lines, not nine (see Figure 11).

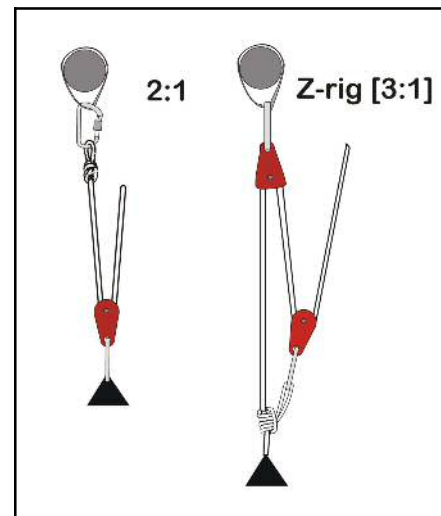


Figure 1: 2:1 and 3:1 Z-rig. Source rbk

¹ This section was written by Robert B. Kauffman who is solely responsible for its content. This section is copyrighted © Robert B. Kauffman, 2016.

Self-adjusting Brake (Figure 2)

– The self-adjusting brake is a prusik knot fastened to the haul line that maintains tension on the haul line as the hauling system is readjusted for a new pull. In addition, the brake provides a safety on the haul line in case for some unknown reason someone lets go of the rope.

In general, the use of a prusik is preferred over mechanical devices (e.g. ascenders).

In contrast to mechanical devices which tend to dig into the rope, the use of a prusik will begin to slip at around 900 lbs of pressure releasing tension on the haul line well before the braking point of the haul line. In tests where the system was pulled until it fatigued, the pressure of nylon on nylon burnt through the mantle (i.e. the braided protective sheath) and the prusik would slide down the kern (i.e. center core of kernmantle rope). This occurred at around 900 lbs of pressure. Often the prusik would slide on the haul line before the rope breaks creating a built in safety factor.

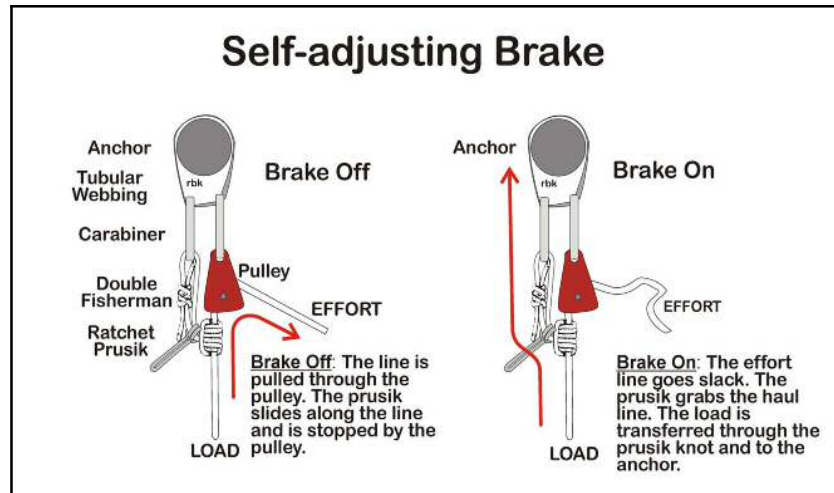


Figure 2: Self-adjusting Brake. Source: rbk

Range of System (Figure 3) – The *range of the system* is defined as the length of the hauling system. It can be as long as desired. However, there are practical limitations. As a general rule, the longer the hauling system becomes, the more cumbersome the hauling system becomes to manage. Often the range is limited by obstacles or features in the landscape.

Also, the longer the hauling system becomes, it tends to multiply the amount of rope needed to configure the system. Increase the range of a 5:1 system by one foot, and an additional five feet of rope is consumed within the hauling system to gain that one foot increase in range.

For the purposes of discussion, the range of the system is held constant in the discussion and in the drawings.

Throw (Figure 3) – *Throw* is defined as the distance the hauling system moves before it needs readjustment. Throw and range of the system are interrelated. The concept of throw

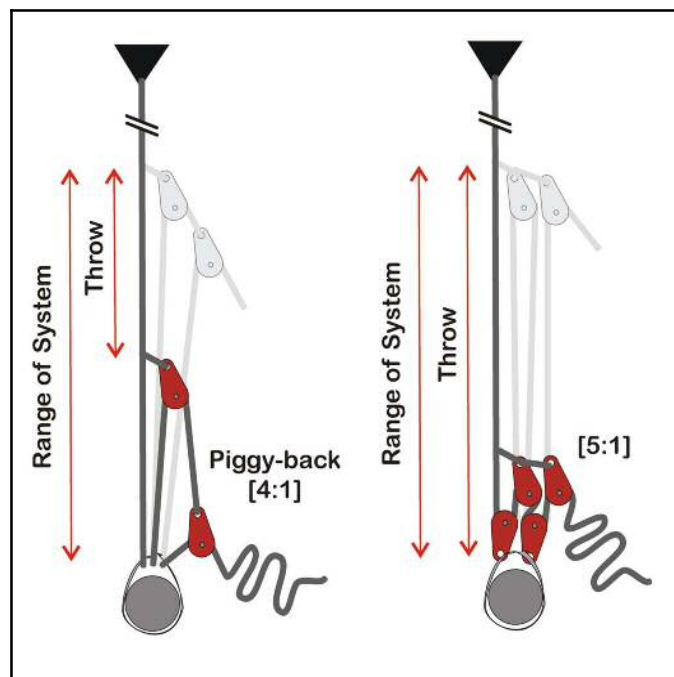


Figure 3: Range of System and Throw for Piggy-back and 5:1 Systems – The throw for the piggy-back is half that of the 5:1 system. It needs to be readjusted twice as much as the 5:1.

is demonstrated with the piggy-back [4:1] and 5:1 systems in Figure 3. The piggy-back is a 2:1 system pulling on another 2:1 system. When the system is exhausted or pulled to its limit at the anchor, the second or top pulley moves half the distance of the “range of the system.” This distance is “throw.” This requires the piggy-back system to be adjusted twice as often as the 3:1 Z-rig or 5:1 system which have a throw equal to the range of the system. Lack of throw makes the piggy-back more cumbersome to use.

An advantage of the 5:1 system is that it has both good mechanical advantage (5:1) and the same throw as a 2:1 system or a 3:1 Z-rig (Figure 4). This means that the 5:1 system moves the same distance as the 2:1 or 3:1 systems before it needs to be readjusted. In contrast, a 4:1 piggy-back system has half the throw as the 5:1 system. The throw for the different pulley systems discussed in this section are summarized in Figure 4.

Figure 4: Summary Table of Throw for Pulley Systems				
Pulley System and Mechanical Advantage	Range of System ¹ [feet]	Throw ² [feet]	Throw as a % of Range of System ³	Notes:
2:1	10	10	100%	Figure 7
3:1 Z-Rig	10	10	100%	Figure 8
4:1 Piggy-back	10	5	50%	Figure 9
5:1	10	10	100%	Figure 10
8:1 Double Piggy-back	10	2	20%	Not diagramed
9:1 Double Z-rig	10	3.3	33%	Figure 11
Block and Tackle ⁴	10	10	100%	Figure 12
¹ Range of the system – The <i>range of the system</i> is the length of the hauling system. See discussion within the text. For purposes of this table, the range of the system is held constant at ten feet. ² “Throw” – Throw is defined as how far the hauling system moves before it needs to be readjusted. The greater the throw the less times the system needs to be readjusted. Note: The length of the pulleys and prusicks were not included in the calculation of throw. ³ Calculation: [Throw] / [Range of System] x 100 = [% Throw is of Range of System] The length of the pulleys and prusicks were not included in the calculations. ⁴ Mechanical advantage is determined by the number of pulleys used in the block and tackle. Since the pulleys are all located next to each other, throw is unaffected and is the same as the range of the system.				

Internal Versus External Hauling Systems

– In an *internal system*, the hauling system and hauling line are one and the same. The Z-rig is a classic example of the internal hauling system (see Figure 8). In the *external system*, the hauling system acts independently of the haul line. The Piggy-back is a classic example of an external system (see Figure 9). The piggy-back system is designed to be rigged as an external system. However, the Z-rig can be rigged as either an internal or external system.

120° Rule and Directional Pulleys (Figure 5

and Figure 6) – Derived from the climbing literature, when the angle between two anchors is roughly 120 degrees, the force on each anchor equals the weight of the load on the anchor (Figure 5). In pulley systems, when the angle between the anchor and effort is 120 degrees, the force on the anchor, effort and load are all the same (Figure 5). The result is that no mechanical advantage is obtained.

Intuitively, when using a 2:1 pulley system, the effort should be half of the load. A 20 lb effort should exert a 40 lb effort on the load or twice the effort (Figure 6). However, this is not the case when the angle is 120 degrees. It is a 1:1:1 ratio between the load, anchor and effort. Any potential mechanical advantage is lost. As the angle between the anchor and effort decreases, the mechanical advantage approaches the theoretical 2:1 ratio. A directional pulley minimizes the angle (i.e. zero angle) and maximizes the mechanical advantage (i.e. 2:1). In addition, the use of a directional pulley provides safety for the haulers since it allows them to safely stand off to the side of the hauling system in case the system fails.

Types of Systems

There are three basic pulley configurations: 2:1 Pulley System, the 3:1 Z-rig and the block and tackle. Although the block and tackle receives a minor role, it should be given more consideration as an external hauling system, particularly in search and rescue situations. For the purposes of this discussion, all of the pulley systems are a combination of the 2:1 and Z-rig systems. The block and tackle system is treated separately.

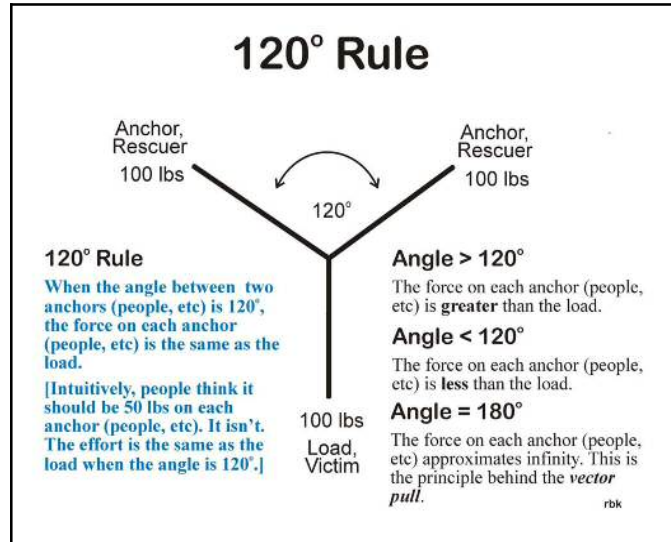


Figure 5: 120 degree Rule. Source rbk

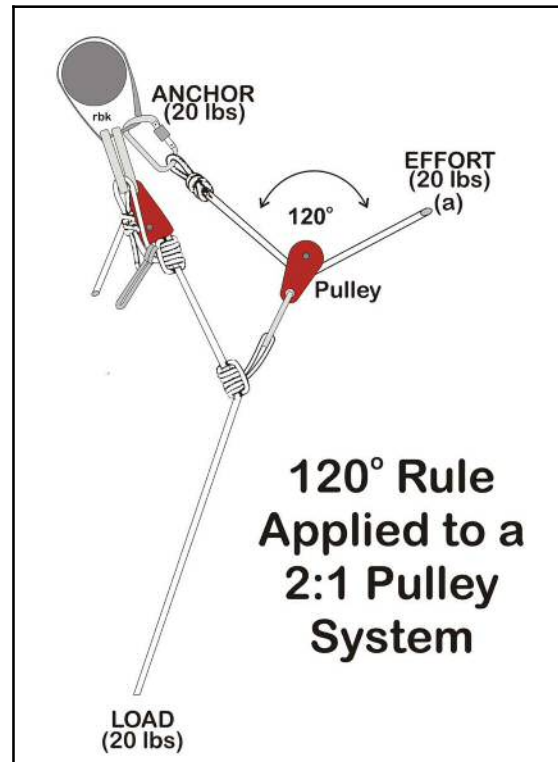


Figure 6: 120 degree Rule. Source: rbk.

2:1 Pulley System – The 2:1 pulley system is one of the two basic systems (Figure 7). Normally, it is configured as an external hauling system. It doesn't lend itself as an internal hauling system because it can't be readjusted. Not including a directional pulley, the system can be constructed with one pulley and a prusik. The self-adjusting brake adds another prusik and pulley to the system. Throw is the same as the range of the system. As a practical matter and because of its low mechanical advantage, there is little benefit of using a 2:1 pulley system by itself. It is usually used in combination with itself in the piggy-back (4:1) and in concert with other systems such as in the 5:1 system.

Z-rig (3:1) – The 3:1 Z-rig is the second basic system (Figure 8). Not including a directional

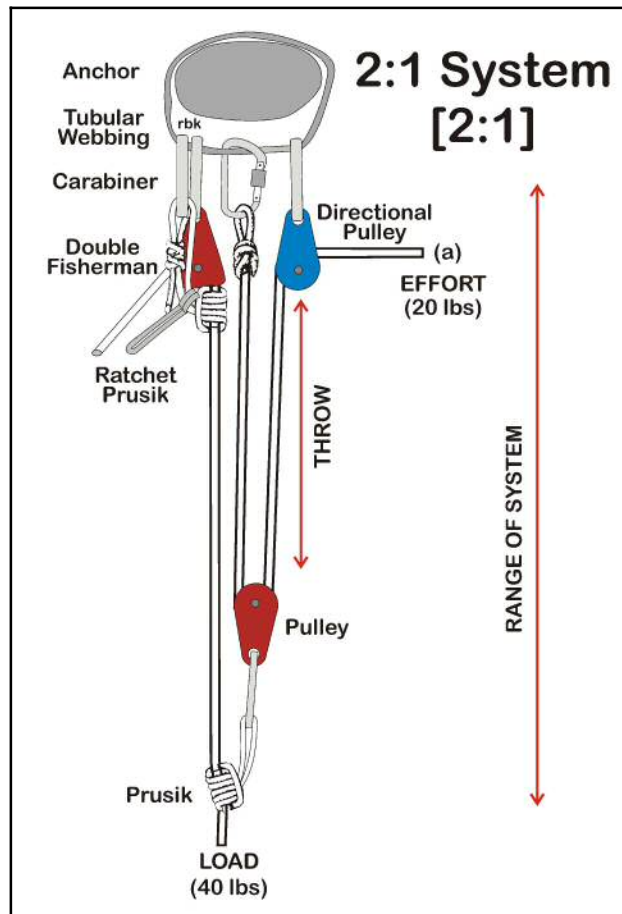


Figure 7

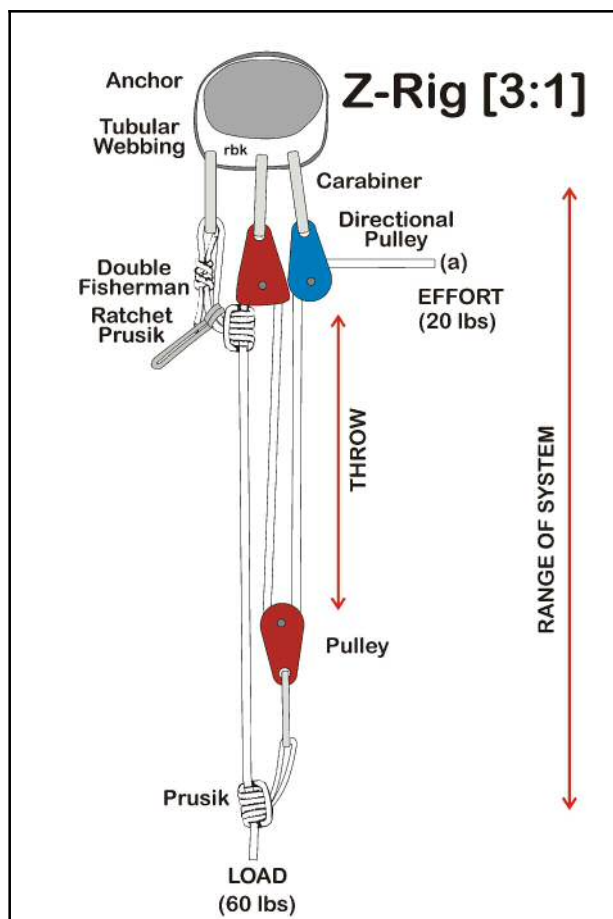


Figure 8

pulley, the system can be constructed with two pulleys and a prusik. The self-adjusting brake adds another prusik to the system. However, another pulley is not necessary. Normally, the Z-rig is used as an internal system where the haul line is used as part of the hauling system. The Z-rig has a throw equal to the range of the system. The Z-rig can also be configured as an external hauling system. It can be used in more complex systems like the 5:1 pulley system or the double Z-rig. In some circles, the Z-rig has fallen into disfavor because with the inherent inefficiencies and friction found in any of these system, the system is closer to a 2:1 mechanical advantage in actuality. For this reason, if mechanical advantage is needed, consider the 5:1 system.

Piggy-back (4:1) – The 4:1 piggy-back system is literally a 2:1 pulley system pulling on another 2:1 pulley system (Figure 9). Not including a directional pulley, it requires two pulleys and a separate haul line. Obtaining a 4:1 mechanical advantage with only two pulleys can be considered an advantage of the system. The self-adjusting brake adds another prusik and pulley to the system. As a practical matter, most 4:1 systems utilize three pulleys. Although two separate lines are shown in Figure 9, a Figure 8 on a bight is often tied in the middle of a rope and the two running ends of the rope become the two haul lines. As demonstrated in Figure 3 and Figure 4, the system has poor throw or half the range of the system. Often users tend to compensate for the lack of throw by increasing the range of the system.

Consider several of the following notes regarding the use of a piggy-back system. Figure 9 shows two separate systems. A figure-eight on a bight can be tied on the effort line of the first pulley and used as the hauling system for the second pulley system.

Building on a theme of maximizing mechanical advantage using a minimum of pulleys, multiple piggy-backs begin to come into their own. In multiple piggy-back systems, mechanical advantage increases exponentially. Add another 2:1 pulley and the 4:1 piggy-back has a mechanical advantage of 8:1. Add a fourth pulley to create a double piggy-back, and a mechanical advantage of 16:1 is obtained. A disadvantage of multiple piggy-back systems is that the systems require multiple lines to construct and throw is sacrificed forcing constant readjustment of the hauling system. Comparatively, a double Z-rig requires a minimum of four pulleys for a 9:1 mechanical advantage. With an 8:1 mechanical advantage, a multiple piggy-back system requires three pulleys, one less pulley than the double Z-rig. In terms of mechanical advantage, a double piggy-back system comes into its own using four pulleys to provide a 16:1 mechanical advantage. However, the mechanical advantage is obtained at the expense of throw and there is a tendency to extend the range of the system in order to obtain a reasonable throw.

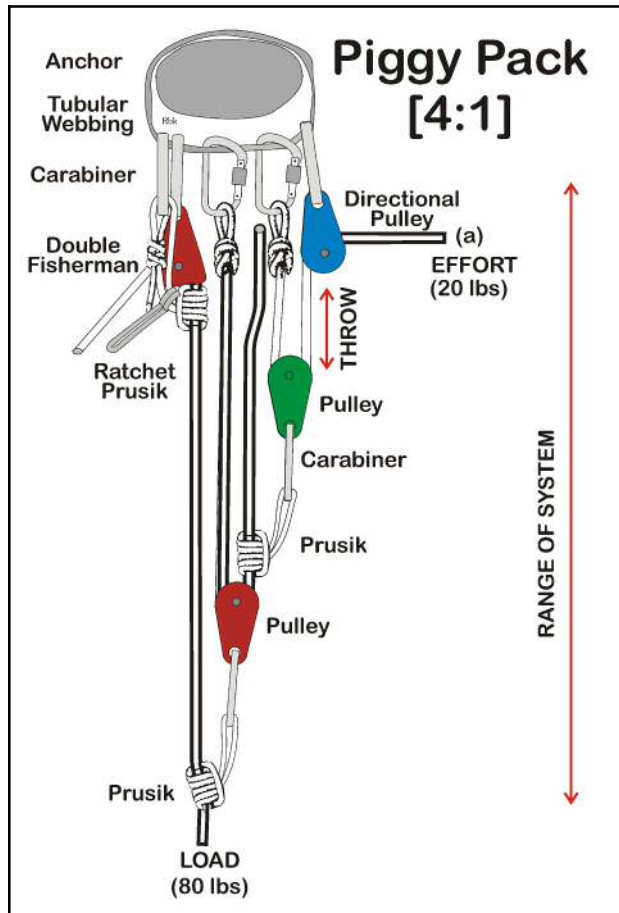


Figure 9

5:1 System – The 5:1 system is a 2:1 pulley system pulling on 3:1 Z-rig (Figure 10). Not including a directional pulley, it requires four pulleys. The self-adjusting brake adds another prusik to the system, but not another pulley. Since the base system is a 3:1 Z-rig, the 5:1 system is usually configured as an internal system. However, it can be configured as an external system also. A significant advantage of the 5:1 system is that it has a throw equal to the range of the system. It has the same throw as a 2:1 system or Z-rig, yet it has a mechanical advantage of 5:1. The 5:1 system has sufficient mechanical advantage to more than compensate for the practical losses of mechanical advantage resulting from the inefficiencies and friction associated with a simple 2:1 or Z-rig. This makes it an excellent alternative to these and the piggy-back systems.

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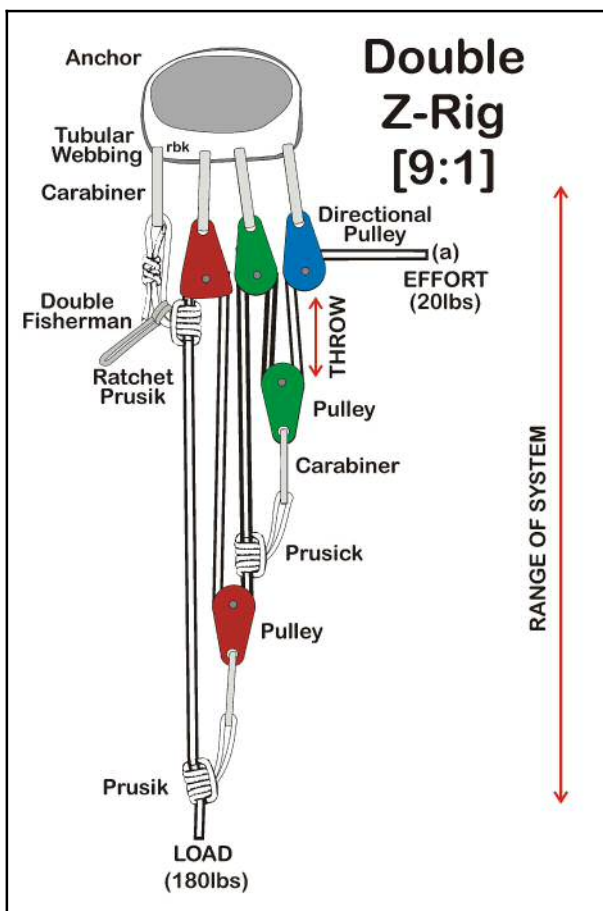


Figure 11

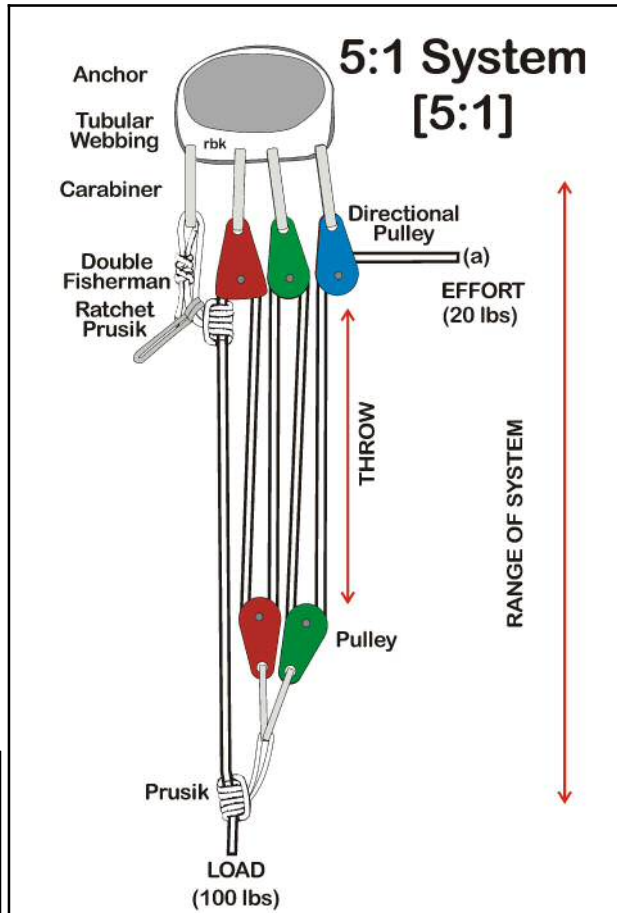


Figure 10

If needed, the 5:1 system can easily be converted into a double Z-rig, and conversely, the double Z-rig can easily be converted into a 5:1 system. To create a double Z-rig, simply unhook the 2:1 system (green pulleys) and fasten it with a prusik to the effort line of the Z-rig.

Double Z-rig (9:1) – The 9:1 double Z-rig system is a 3:1 Z-rig pulling on another 3:1 Z-rig (Figure 11). Not including a directional pulley, it requires four pulleys or the same number of pulleys as in the 5:1 system. The self-adjusting brake adds another prusik to the system. Although it is usually used as an internal system, it can be configured as an external system also. In contrast to the 5:1 system, the double Z-rig maximizes mechanical advantage at the expense of throw (see Figure 4). Comparatively, it has poor throw, equivalent to that of the piggy-back system.

The 5:1 system can easily be converted into a double Z-rig and the double Z-rig can easily be converted into a 5:1 system. To create a 5:1 system, simply unhook the green Z-rig and fasten it to the prusik on the main haul line with a carabiner.

A benefit of using a double Z-rig system is that it is an internal system. This means that the main haul line is used to configure the pulley system and no additional lines are necessary to configure the hauling system. In contrast, the piggy-back (4:1) and the multiple piggy-back systems (8:1) require additional ropes in roughly 20 to 30 foot lengths to create the haul system. This can be inconvenient.

The piggy-back is an external system. Although the double Z-rig is normally used as an internal system, it too can be configured as an external haul system if desired.

Block and Tackle – A block and tackle system consists of two or more pulleys pulling in opposition to each other (Figure 12). Usually, there are two or more pulleys housed within each of the two blocks or housings. When configured as an internal system, lifting is finished when the two pulleys are drawn together. The system cannot be readjusted. As an internal system, the block and tackle system is relatively impractical except for lifting heavy loads short distances.

When configured as an external system, a block and tackle system becomes a practical and efficient hauling system. In this configuration, it has a similar configuration to a piggy-back except the block and tackle is substituted for the two 2:1 pulleys. The system can have a self-adjusting brake and it can easily be repositioned along the haul line. Throw is the same as the range of the system. Also, because the pulleys are positioned next to each other, the system has better practical throw of systems where pulleys are pulling on other pulleys (e.g. double Z-rig). As pictured in Figure 11, the system provides a theoretical 4:1 mechanical advantage. Additional pulleys can be added increasing the mechanical advantage without sacrificing throw. This makes this system particularly advantageous in rescue situations. The biggest disadvantage of this system is bulk and weight making it more suitable for search and rescue teams than general recreation users. Regardless, the use of a block and tackle system as an external system has numerous advantages and in SAR situations, it can supercede most of the systems discussed on this section.

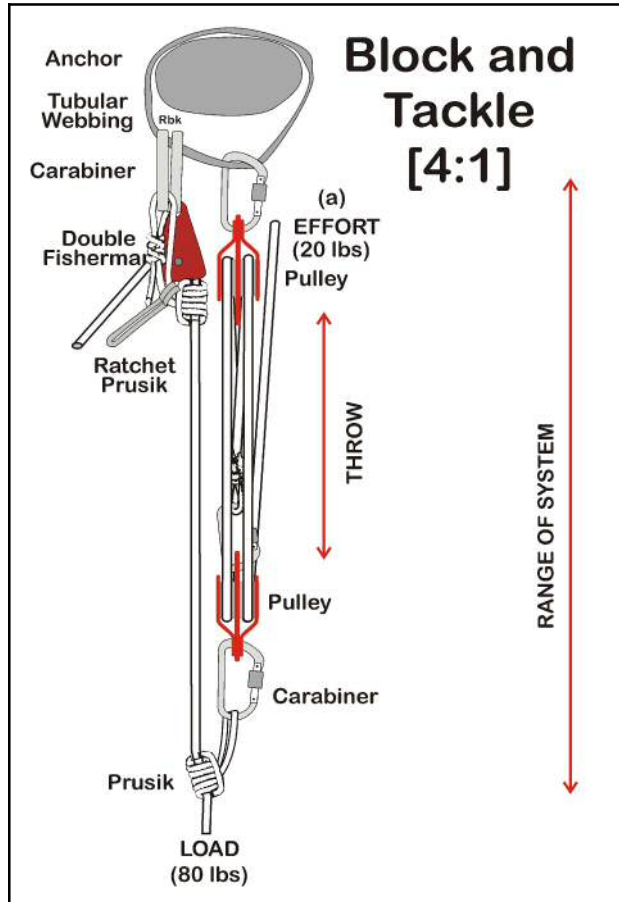


Figure 12

Summary

The pulley systems presented in this section are used by outdoor rescue personnel in creating rescue systems. All of the systems can be condensed into three basic systems, a 2:1, 3:1 Z-rig, and block and tackle systems. All compound systems are composed from the 2:1 and 3:1 Z-rig. The 5:1 system is literally composed of the 3:1 Z-rig and 2:1 system hooked in parallel. The purpose of the pulley systems is to increase mechanical advantage. An often overlooked factor is “throw” or how far the hauling system can operate before it needs to be readjusted. Throw makes the 5:1 system a good practical system. Figure 4 is a summary table of the different systems described in this section. It juxtaposes throw, mechanical advantage and the number of pulleys required to operate the system. The 5:1 has almost twice the mechanical advantage as the 3:1 Z-rig with an identical throw.

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Chapter 16: Protection ¹

Usually, the discussion of protection for preppers quickly gravitates to guns, the Second Amendment and gun control. It is a sign of the times. However, protection is more than guns and weapons. Protection can include finances, insurance and other forms of protection. This chapter is delimited and doesn't address these topics.

This chapter addresses guns and weapons. It simplifies protection into three groups and focuses on one of those groups, the defenders. It introduces some basic defense tactics and approaches to defense. And yes, it does discuss guns as well as less-than-lethal weapons.

Three Groups of Players

If a time comes where you are surviving an unexpected emergency for an extended period, there are three groups of players. This is true for the riot or extended snow storm scenarios as it is for the Yellowstone Caldera eruption or Katrina or Sandy. There are *defenders*, *aggressors*, and *peace keepers* (i.e. military/police). Conceptually, it is like playing the game of rock, paper and scissors where each group can trump the other group depending on the circumstances. The strategy used and developed is determined, in part, by the magnitude, duration, and type of experience.

Peace Keepers (Military/police) (Figure 16.1)– For this discussion, the peace keepers include the military, police and other rescue personnel. The primary purpose of the military/police is to maintain law and order. They will do so even if it steps on your second amendment rights. It is illustrative to review FrFrog's "Thoughts on Survival," particularly the second and third posts (FrFrog, 2008). In discussing post Katrina survival, he emphasizes this point several times. For the purposes of this discussion, it is worth reemphasizing several of his points.

First, the military including rescue personnel seek to maintain order. This includes relief agencies such as the Red Cross. This means confiscation of anything that might be considered a weapon including pocket knives and Leatherman tools. It means confiscation of medications. Think airline check in requirements. These groups seek control and to maintain order. This is their mission. It is not unexpected either.



Figure 16.1: Peace Keepers – The National Guard after Hurricane Sandy. They have more and bigger toys than aggressors or defenders. To think otherwise is foolish. Source: US Government – [file:\NationalGuardSandy[89].jpg]

¹ This section was written by Robert B. Kauffman who is solely responsible for its content. This article is copyrighted © Robert B. Kauffman, 2017.

Second, FrFrog (2008) discusses the attitude of rescuers toward victims. Think of it as role playing where they are the rescuer and you are the victim. This is this perception on their part. If you are self-sufficient and not seeking to be rescued, you are not playing the game correctly. You are not playing your role. Your roll is to play the part of someone who needs to be rescued. It can lead to conflict. Complicating this situation, FrFrog (2008) notes that many of the rescuers have an attitude where because you are prepared and self-sufficient, you somehow gained “unfair advantage” over your neighbors (see point #2 on his third post). For the purposes of this discussion, it reinforces a defensive posture of avoidance which is discussed in the next section.

Third, it is axiomatic that the military and police will be more powerful than defenders or aggressors. They will have bigger and better weapons. They have more personnel. And their mission is to maintain order (period). In the game of rock, paper and scissor, the military/police beat the other two options. This is not a criticism of the peace keepers. It is reality and if you think otherwise, you are mistaken in your perception of their role. Again, for those maintaining a defensive mode, it becomes a strategy emphasizing avoidance.

 Defenders – When surviving an unexpected emergency, most people will seek a defensive strategy. Normally, most people think of defense in terms of a home invasion. This is a good paradigm with which to start. By definition, it is a defensive position. You have your home and in it your possessions. You are protecting them from aggressors. In non-disaster times, the aggressor could be a lone intruder or burglar, and in a post-disaster situation, it could be your unprepared neighbors. Your strategy is one of avoidance and maintaining a personal “gag rule” of secrecy. Avoidance includes avoiding the military/police. Avoidance includes avoiding unwanted neighbors. What others don’t know about your possessions and protection measures can’t hurt you. Secrecy is a good strategy.

 Aggressors – Bradley’s (2011) classification suffices for identifying potential aggressors. He suggests three different situations that a person or family will encounter. In addition, the peace keepers (i.e. military/police) might be included in this classification also. The last group to consider is a zombie attack even though it is fictitious.

<c> **Good People Driven to Violence** – The first classification is where otherwise good people can be driven to violence by desperation. This group includes neighbors who are less prepared than you and covetous of your preparedness. In time of desperation, they may become violent. Bradley (2011, 328) suggests that “*The best way to avoid this potential confrontation is to be discreet and not broadcast that you have stockpiles of supplies.*” Essentially, this is implementing a “gag order” and maintaining secrecy.

<c> **Criminals** – According to Bradley (2011), the second group is criminals who are either traditional career offenders or they are exploiting the chaos created by the situation. These groups could be either small or large in size. Also, their impact and dominance depends on the magnitude of the disaster and the ability of the military/police to maintain some semblance of law and order. They could be good people driven to violence or they can simply be gangs of bad people. Again, the best defense is one of avoidance. Don’t broadcast your preparations.

<c> **Terrorists** – The third group is made up of terrorists who have a political or religious agenda. There is no negotiating with this group. Actually, the probability of encountering this group is slight because normally they have little interest in invading your home.

<c> **Zombie Invasion** – The zombie invasion is totally fictitious, but it is funny how it begins to permeate one’s thinking through television and movies, never-the-less. The classic publication in this

area is Max Brooks, *The Zombie Survival Guide – Complete protection from the living dead*. It is a complete survival guide dealing with a zombie invasion. It is important to mention this because the depiction of fighting zombies has no relationship to reality. Yet the common rules used in fighting zombies can easily permeate our thinking and how we deal with aggressors including head shots and viewing aggressors as zombies who don't fight back.

 Being a Defender – This discussion assumes that the reader does not plan to be an aggressor or a member of the military/police. This means that most people will be defenders, protecting their house and property. It begins with a strategy of avoidance and having a “gag order.” If you don't want aggressors visiting you, don't advertise your position.

A new way of thinking about protecting your house and property is to develop a defensive posture where you think of your house as a castle or fort under siege. If interested, the reader can easily expand upon this thesis on their own. It is not just having powerful firearms. It is about the tactical advantage gained by devising defensive tactics and using them effectively to defend your home and property.

Defensive Measures for Defenders

The following section focuses on defensive strategies for defenders. Many of the strategies are borrowed from the animal kingdom and represent strategies employed by animals to survive. Typical strategies used in nature include avoiding detection, defensive structures, communal action and bugging-out.

 Avoiding Detection – In the animal kingdom there are primarily two ways animals avoid being detected. These are staying out of sight and camouflage. Staying out of sight includes moving underground and being nocturnal. For preppers, avoiding detection includes having a gag rule and secrecy and avoidance strategies.

<c> **Gag Rule and Secrecy** – Your first line of defense is to maintain a “gag rule” of secrecy. Don't talk about being a prepper and don't talk about your preparations. Discussing this topic may seemingly have tinges of paranoia associated with it. So be it. Simply put, if people know you are prepared with stores of food and supplies for surviving an unexpected emergency, where do you think they will go in times of disaster? They will go to your house. If you told everyone how much money you had stored in your house, would you not eventually expect a burglar to attempt to steal it? And people do talk. Who knows whom else they have talked to regarding your preparedness?

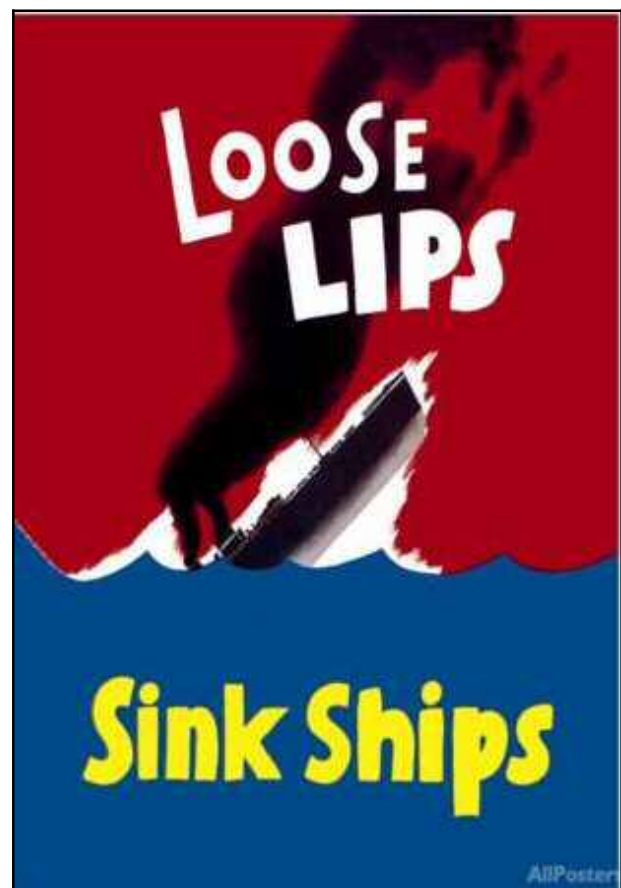


Figure 16.2: Loose Lips Sink Ships – In the theme of the WWII poster, preppers who don't want to be over run with visitors seeking refuge, keep their prepper preparation secrete and have a personal “gag order” not to discuss their preparations with others. Source: US Government – [file:\LooseLipsPoster.jpg]

Like the parlor game, the story can easily become magnified as it passes from person to person. The bottom line is to maintain secrecy and don't discuss your level of preparedness with anyone in your community. If they don't know you are prepared for surviving the unexpected emergency, they won't be knocking on your door in times of emergency. In WWII, one of the slogans was that "Loose lips sink ships." The slogan is equally applicable to preppers (Figure 16.2). Loose lips invites non-preppers.

You may be a "bug-out" site for relatives and friends. This is perfectly acceptable. As FrFrog (2008) notes, this can result in several unintentional consequences. First, you need make sure that this group understands your "gag rule." They won't adhere to it, but they need to know it regardless. In addition, they need to know that they are invited and their friends are not invited. Second, expect some of their friends to show up anyway. Expect people to talk regardless of your gag order. Third, specify what they should and should not bring. They may arrive in RVs and you may not have room in your driveway to accommodate them. In addition, parking these vehicles at your house is an invitation for others in your neighborhood to join the party at your house.

<c> **Avoidance Strategies** – Avoidance is seeking strategies of avoiding aggressors and peace keepers (i.e. military/police). Avoiding aggressors is obvious, but on first glance, avoiding peace keepers may seem questionable. The need to avoid the military/police and rescuers was described in the previous section. They are there to rescue victims. If you don't want to be rescued, avoid them and stay indoors.

Avoidance dovetails with maintaining secrecy. It is one of developing a mind set. It is one of thinking how others, including aggressors, could interpret your seemingly benign actions in ways that could harm you. In times of emergency, maintaining normal functions can have unintentional consequences. The RVs parked in your driveway is an advertisement for aggressors. A more benign unintentional consequence might result from the use of an electric generator at night. If your house is the only house in the neighborhood with lights on at night in an otherwise neighborhood with a black-out, your lights are like a bug lamp shining at night attracting every bug in the neighborhood (Figure 16.3).

 Defensive Structures – In the animal kingdom, typical defensive measures or ways of warding off an attacker include startling the predator, playing dead, creating a distraction, mimicry and defensive structures. For preppers, startling an intruder can provide temporary advantage. The bird playing injured can distract a predator. The same might work for a prepper. This section focuses on mimicry and defensive structures, including castles, forts, and star fortifications.

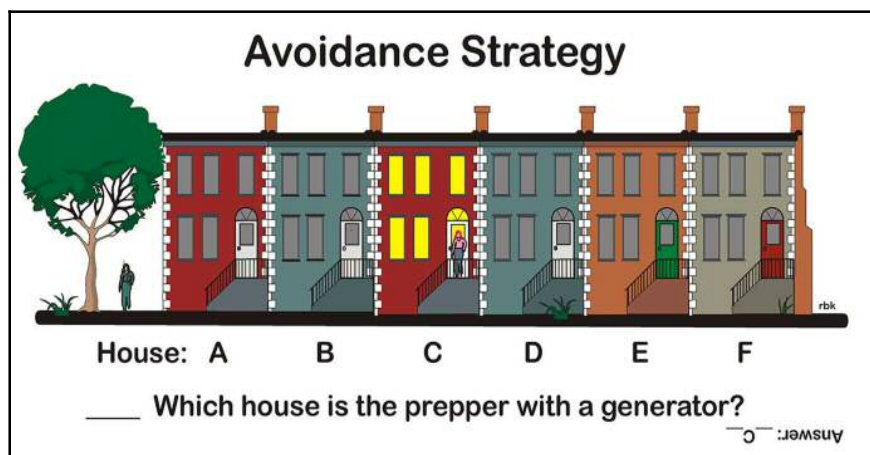


Figure 16.3: Lights On – Avoidance is often blending in with the surroundings. Lights and a generator are dead giveaways of prepper when all other houses are without lights. Source: author – [file:PR-LightsOn.cdr]

<c> **Mimicry** – In nature, mimicry occurs when an organism mimics its surroundings or other organisms in its environment. For preppers, mimicry has been discussed elsewhere. It is important for preppers to look like their surroundings. If your house is the only one with its lights on during what is an obvious black-out elsewhere, it might be prudent to keep your lights off at night to mimic your surroundings. If your house has three RVs parked in the driveway, it may be an indicator to others that your home is a fortification.

<c> **Castles and Star Forts** – Think of your home or bunker as a castle or fort. Avoidance involves making your home or bunker unattractive to aggressors. You have maintained a “gag rule” and secrecy. You have taken steps not to attract aggressors. Protecting your home could be as simple as standing at the front door banishing a shotgun to ward off aggressors. It may work unless the aggressors are your neighbors. Or, it may be a bullet proof door on a bunker that is used to deter aggressors. These actions may be sufficient to ward off aggressors. However, there may be some lessons learned from viewing your house or bunker as a castle or fort.

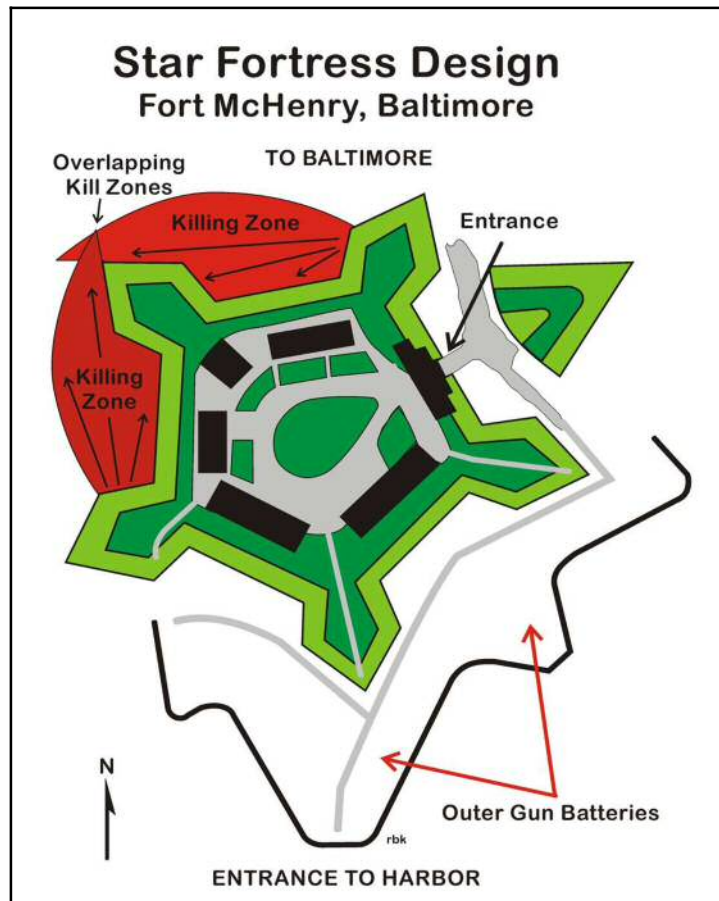


Figure 16.4: Star Fortress Design – Fort McHenry in Baltimore displays the classic principles of the star fortress design. Source: author. [file: \PR-McHenry.cdr]

In terms of defensive measures, it is conceptually sound to think of your home as a castle or fort under siege by potential aggressors. In military parlance, a strategy favoring the defender over the aggressor or the aggressor over the defender often reverses itself with the development of a new technology. With the introduction of gunpowder and exploding shells in Europe, the advantage transferred from the defender in the castle to the aggressor with gunpowder and exploding shells. Castles were no longer safe havens. The design of castles and forts represented the pinnacle of refinement for the defender.

It is worthy to mention that during a siege, those in the castle or fort don't travel far from the fort or castle. In addition, storage of food, water, and the other necessities of life becomes important and has been discussed elsewhere in the appropriate discussed elsewhere.

Built in 1789, Fort McHenry exemplifies the star fortress design (Figure 16.4). Its design typifies many of the principles in fort and castle design.

The fort was designed to protect Baltimore harbor and played a prominent role in the War of 1812. The fort held and stopped the advance of the British forces from capturing Baltimore. The event spurred Frances Scott Key to write the Stars and Bangle Banner.

From a design perspective, the fort was built in an era of exploding artillery shells. The movement was toward large earthen mounds for protection rather than steep walls which hindered scaling. In Figure 16.4, the emphasis is on earthen mounds to absorb the exploding shells. The fort still has vertical walls which require scaling, but they are more subdued.

The fort is a five sided pentagon with bastions or angular bulwarks extending outward at each of the corners (Figure 16.5). As diagramed, the bastions provide the defenders with several advantages. First, the bastions create flanks on each side of the main walls that are designed to create overlapping killing zones. Firing from the bastions create an “*enfilade*.” This is where the soldiers on the bastions are firing at right angle to the attacking troops. This increases their ability to kill attackers. Missing an attacker high or low is still likely to hit an advancing soldier.

The star fort design minimizes dead spots which are hard to defend. An enemy assailing the walls will look for a weak spot or a place which is difficult to defend. Older forts had round turrets which created a dead spot or a spot which was harder to defend. As shown in Figure 16.4, Fort McHenry is a typical star fort design that has overlapping killing zones.

The entrance is an obvious weak spot in the defense of any fort. Fort McHenry reflects the evolution of protecting the entrance. The first technique is to bend the entrance. This is accomplished by the bulwark in front of the entrance. Bending the entrance slows down the attackers and exposes them to additional fire power. Next, the front bulwark places the attackers in a crossfire. The narrow tunnel like entrance makes it difficult to advance to the inside of the fort if the entrance is breached.



Figure 16.5: Star Fortress Design – Looking north, the city and port of Baltimore are in the background. The scene shows the earthen mounding, the extending spears of the fort, and the overlapping killing zones. The outer gun batteries are pictured in the bottom right portion of the photo. Source: author. [file: \MCH1523.jpg]

There are several principles that can be applied to protecting the home. Building a moat around your house is probably not necessary. First, assess where aggressors are most likely to enter your home. Is it the front, rear, garage or basement doors? What can be done to fortify these entrances with locks and other barricades?

Second, think of maintaining the high ground or out-flanking the aggressors. As a rule, the opponent with the *high ground* has the military advantage. They have better command of the battlefield. *Out-flanking* your opponent means that you are on one or more of their sides. Perhaps there is a second floor porch which overlooks the entrance. This outflanks the invader at the door. Also, the defender has the high ground and tactical advantage.

Assume a small gang of aggressors are at your basement door. If you are on a porch overlooking the basement door, you may have both the high ground and out-flank them. If you have a cohort at a location on the opposite side, they may be deterred because they are out-flanked on both sides. Tactically, the

aggressors are at a disadvantage. Also, leave an exit for them to retreat. You want them to retreat. This may be a more affective strategy than waiting for the aggressors to come through the front door and then opening fire.

 Communal Action – Often, there is safety in numbers. A herd protects its individual members. This can occur through sheer numbers. Or it can occur by the stronger members creating a perimeter to protect weaker members and the young in the center. For preppers, one approach is to identify other preppers adjacent to you and develop a common support system for a time of crisis.

 Bugging Out – In the animal kingdom, escaping is a common defense mechanism. It is the flight portion of fight and flight. The prepper equivalent of escaping is bugging out. Bugging out is discussed in depth in Chapter 14.

Firearms for Defense

When discussing protection, the discussion usually gravitates quickly to firearms. In discussing protection, firearms are an important component in the discussion, but not the only element in the discussion. The discussion of firearms is controversial and with a myriad of tangential arguments. Illustrating and fueling these tangential arguments on an emotional level are two contrary signs that can be posted in the front yard to help ward off potential intruders (Figure 16.6). Which sign posted in your front yard offers you the most protection, either real and perceived?

As an unfortunate sidebar, gun free zones have become killing zones in many instances. In the 2012 Aurora, Colorado mass shooting, the perpetrator purposely drove past several other theaters because the Century 16 theater was advertised as a gun-free zone. In the 1999 Columbine shooting, the perpetrators choose the school because it was a gun-free zone. Unfortunately, there is considerable evidence that mass-shooters choose their sites because they are gun free zones where no one will shoot back at them. Hence, the adage “*Gun free zones are killing zones.*”

Firearms for defense are delimited to the defense of the person and home. Firearms for aggressors and military/police are not discussed since both are considered outside the scope of this discussion. Also, it is hoped that the reader does not seek to become an aggressor either. Regarding fighting zombies, hopefully they remain fictitious and there is no need to fight them either. The following are some considerations to consider in selecting firearms for defense for your home.



Figure 16.6: Which Sign Protects – For many, guns are an emotional issue. These two signs should help fuel this emotional response. Which of the two signs would you post in your front yard? Which of the two signs offers the most protection? Source: author. [file: \PR-Signs.cdr]

 Who is Responsible for Your Protection? – The issue is “*Who is responsibility for providing your protection?*” Is it the police or is it your responsibility? Let me take a different approach to this issue. If you answered the police, then answer the following question. If the police are responsible for protecting you from harm and if they don’t protect you from harm and if you are injured (e.g. robbed, raped, killed, etc.), can you sue the police for breach of duty? In other words, are they negligent? The answer is no. The police do not have a duty to protect you. There are other reasons for this, but for the most part the police are only able to act after a crime has been committed. This is a benefit of living in a free society.

If the police are not responsible for your protection, then who is? **You are!** You are responsible for your own protection. To do this you need the tools with which to do it. Hence, the second amendment. Essentially, as part of natural law, you have a God given right to protect yourself. The power to protect yourself is granted from God and not the government. Note the way the amendment is written. The amendment states that the government shall not infringe on your right. The government doesn’t have the right to deny you of a right which it doesn’t have the power to grant or take away.

A well regulated Militia, being necessary to the security of a free State, the right of the people to keep and bear Arms, shall not be infringed. [2nd Amendment to US Constitution]

One last recommendation. The second amendment and gun rights have come under fire (pun intended). State laws vary considerably from state to state. Check with your local authorities regarding the laws that affect you, your gun rights, and the use of your guns.

 Definitions – There is a lot of confusion regarding the terminology associated with firearms. The following definitions are provided to provide a better understanding of some of the terms associated with firearms.

<c> **automatic** – refers to guns that automatically reload the next shell into the chamber for firing. A typical mechanism uses some of the waste gases from the fired shell to eject the used shell and load the next shell into the chamber. Usually, a fully automatic will fire continuously once the trigger is pulled. A semi-automatic fires one round each time the trigger is pulled. [see fully-automatic and semi-automatic]

<c> **double action** – A double action gun means that when you pull the trigger, it both cocks the hammer and releases the hammer to fire the bullet. It is a double action because pulling the trigger completes the two actions at once (i.e. cocking the hammer and releasing the hammer). [see single action]

<c> **fully-automatic** – When the trigger is squeezed, the gun fires a continuous burst of bullets until the trigger is released. In some cases, the gun is configured to fire a burst of several bullets. This is in contrast to a semi-automatic where the trigger must be squeezed for each round to fire the bullet. [see semi-automatic]

<c> **revolver** (Figure 16.7) – A revolver has a rotating cylinder that stores the bullets. As the hammer is cocked, the cylinder advances

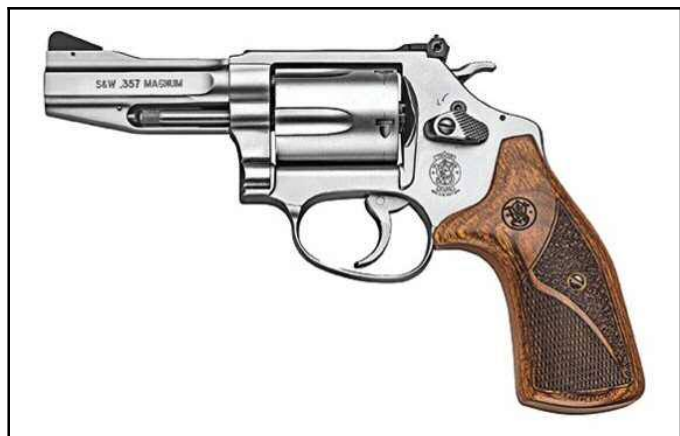


Figure 16.7: Revolver – The 357 Smith and Wesson is a typical example of a revolver. Source: Smith and Wesson – [file:\PR-Revolver[79].jpg]

the next chamber and bullet for firing. [see also single-action and double-action]

<c> **rifling** – Rifling is the spiral groves in the barrel of the gun that spin the bullet as it leaves the barrel. This results in a more accurate projectile. Rifling makes a rifle a rifle and not a shotgun. [see shotgun]

<c> **semi-automatic** (Figure 16.8) – When the trigger is squeezed, the gun fires one bullet and automatically reloads the next bullet into the chamber. The trigger must be squeezed again to fire this round. This cycle repeats itself each time after the bullet is fired. This is contrast to an automatic where the trigger fires continuously or fires a burst of bullets until the trigger is released. [see fully-automatic]



Figure 16.8: Semi-automatic – The waste gas from the bullet is used to eject and load the next bullet. The trigger must be pulled each time to fire the gun. The 45 caliber 1911 is a classic example of the semi-automatic. Source: Colt – [file:\SemiAutomatic1911[100].jpg]

<c> **shotgun** - a shotgun has a smooth bore barrel. It is not a rifle because the barrel does not have rifling or spiral groves which rotate the bullet as it travels down the barrel. It is akin to a cannon although some modern versions of cannons use rifling.

<c> **single action** (Figure 16.9) – A single action gun requires the user to cock the hammer manually. Pulling the trigger releases the hammer to fire the bullet. It is a single action because pulling the trigger releases the hammer which is a single action. [see double action]

 Selection Considerations for Defenders – As previously noted, firearms used for defense are delimited to the defense of the person and home. Firearms for aggressors and military/police are considered outside the scope of this discussion. Also, it is hoped that the reader does not seek to become an aggressor either. The following are some considerations when selecting firearms for defense of your home.

<c> **Collateral Damage** – If you use “double aught” buckshot (i.e. 00 buckshot), the seven to ten pellets in a 12-gauge shotgun have enough power to go through the invader, the wall behind it, and injure people behind the wall. Buckshot gets its name because it is designed to kill a buck (deer). You want a gun that does its job but doesn’t destroy everything else in sight. This important consideration is not to just think

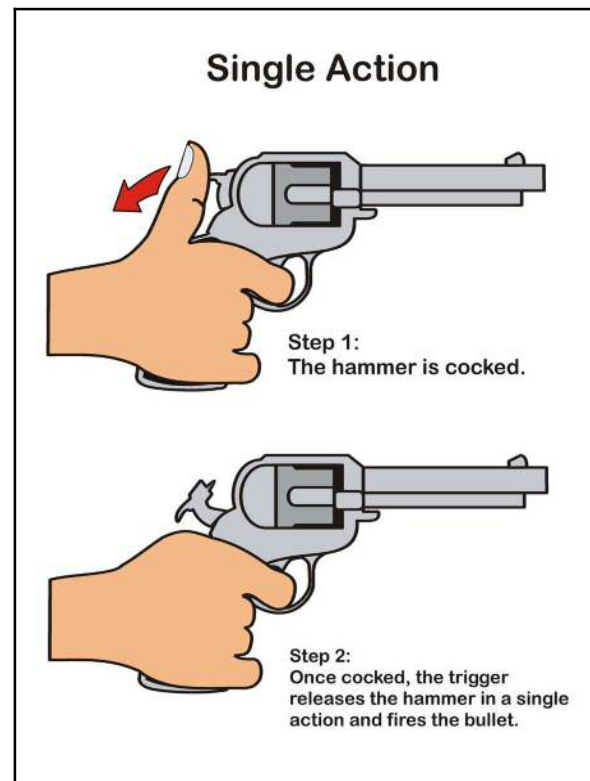


Figure 16.9: Single Action – The single action pistol requires the hammer to be manually cocked prior to firing. The trigger is released in a single action. Source: author – [file:\PR-SingleAction[144].cdr]

about the invader but to also think about potential collateral damage.

<c> **Maneuverability** – In a home, bunker or similar situation, the action usually occurs in a confined space. Hence, maneuverability becomes an issue. A large shotgun or rifle can be difficult to maneuver in a house or other confined space. A double barrel shotgun designed as a fowling piece can be awkward and difficult to maneuver in the confined space of a hallway or stairwell. The same is true for most hunting rifles. In contrast, a shotgun with a 30 inch barrel is more manageable. Also, handguns are maneuverable within confined spaces.

<c> **Ease of Use** – A weapon that is difficult to use is a weapon that is less likely to be fired. Consider ease of use. In times of stress such as in a home invasion, the simplicity of a revolver to use over an automatic may easily offset the other advantages of an automatic pistol. There is a certain simplicity in using a double barrel shotgun. Insert the shells. Close the breech. You are ready to go.

<c> **Safety** – A fourth consideration is safety. An automatic has the potential of a bullet remaining in the chamber when the clip is removed. This is virtually not a problem with a revolver. A double barrel shotgun with an open breech is proof positive that it is loaded or unloaded and when the breech is open, it can't be fired.

<c> **Psychological Considerations** – The sound of a pump action shotgun being loaded is universal and an unmistakable sound. The sound sends a message to any intruder. Its sound can be more of a deterrence than actually shooting the gun. A second message of the pump action is that it is a shotgun and that shotguns don't require great accuracy on the part of the shooter at close range to hit the target.

<c> **Use of Hunting Weapons** – Often, hunters have an array of weapons designed specifically for hunting will adapt the use of their hunting weapons for the protection of home and property. This group chooses its weaponry based on the type of hunting they perform. Or perhaps better stated, this group will adapt their hunting weapons to prepper situations. Birders have fowling pieces. Deer hunters have high-powered rifles capable of killing a deer at 100 yards or greater distance. In times of an unexpected emergency, this group uses its weaponry two ways. First, they believe that they will be able to hunt with their weaponry. In this respect, many have an attitude that they can live off the land. Second, they will adapt their existing weaponry to defending their homes. Their weapons tend to be long barrel shotguns or high-powered rifles. It is not that this isn't a viable approach. It is. However, in terms of many of the previously discussed selection considerations, the use of hunting weapons is less than optimum (e.g. see maneuverability and collateral damage).

 Revolver Versus Semi-automatic (Figure 16.10) – One of the standard debates is the debate between using a revolver or semi-automatic. The discussion here will not solve the debate either. In discussing what weapon to carry in a bug-out bag Stewart



Figure 16.10: Revolver Versus Semi-automatic – One of the standard debates is the debate between using a revolver or semi-automatic. The discussion here will not solve the debate either. Source: author – [file:\PR-GlockVRevolver.cdr]

(2013) advances the following argument for carrying a revolver over an automatic. His discussion is included here because it is a good summary for what to carry in your bug-out bag as well as addressing the general debate. In general, this author agrees with his analysis. Unless you are constantly using your gun, the revolver is easy to use, fairly foolproof, safe, and it will do the job.

Revolver vs. Automatic

I am certain to ruffle some feathers with my opinions about whether you should pack a revolver or a semi-automatic pistol. First, let me say that there are excellent revolvers and excellent semi-auto pistols. I would be happy to carry either one in a Bug Out. However, I choose to pack a revolver in my BOB for two main reasons:

Reason 1: Simplicity. I like how simple a revolver is. There's a barrel, a bullet, and a hammer. It's pretty hard for something to go wrong or jam. They are also very easy to load and unload. Semi-auto pistols have several moving and sliding parts. And, as much as hard-core semi-auto die-hards don't want to admit it, these guns occasionally jam. I've shot thousands of rounds through both revolvers and semi-autos. I've never had a revolver jam on me. I have had semi-autos jam on several occasions, I remember one instant vividly.

Reason 2: Caliber Flexibility. When it comes to choosing a caliber, I want something with knock-down power. If the situation has called for me to aim and fire my weapon at an attacker, I don't want to just injure him. I want to **stop** him – period. For this reason, I have chosen to carry a .357 Magnum 5-shot revolver in my BOB. .357 caliber revolvers will also fire .38 caliber rounds, which gives you some flexibility in sourcing ammo. If you're in a pinch, trying to find two popular calibers is easier than trying to find one. (Source: Stewart, 2013, pp.136-137)

This brief discussion won't solve the debate between carrying a revolver or semi-automatic in your bug-out bag or in general. However, if you consider yourself an occasional user of guns, you should probably consider a revolver for its simplicity, ease of use, safety, and being relatively foolproof.

 Gun Safety – Much like the discussion of gun ownership, gun safety is a loaded topic (pun intended). Storing guns in the house is another issue that is not going to be solved here. However, one word of advice or suggestion regarding having guns in the house. If you own guns, determine the “common practices” regarding what people and organizations in your state recommend. What does the gun store owner recommend? What does the National Rifle Association (NRA) and other organizations recommend? Things change. By knowing what the common practices are for having guns in your house, you protect yourself because you won't be too far from the norm or common practices. It is not a right or wrong answer, only what other experts consider is appropriate.

<c> **Training** – Most training focuses on handling, storing and transporting weapons. This is important. Additional training may include target shooting. In addition, readers should consider “situational training.” Situational training focuses on tactical situations a shooter may encounter through interactive simulation. Training should include situations which preppers may encounter. Remember the chapter on psychology and the effects of adrenalin. Adrenalin narrows a person's focus and takes away cognitive thinking ability. This is why training becomes important. With the loss of cognitive ability, training kicks in and assists people in doing the right thing.

<c> **Appreciation** – There are a lot of public service ads about locking up guns to protect children, etc. Learning about the dangers of guns is no different for children than learning that the stove is hot or any other hazard is hazardous. When I was young, my father took me to my uncle's farm where we shot the 25 caliber Favorite. He took a bar of soap and I shot at it. One of the bullets penetrated the bar of soap.

My father noted that the bar of soap has the same consistency as the human body. Guns can injure and kill. Lesson learned. My take away was an appreciation of the dangers of what guns can do. It was more than cognitive learning. It was on an experiential level.

The corollary is that if there are guns in the house, hiding them from the children only makes them more curious. They need to be made aware of the dangers. It was a lesson learned at the appreciation level.

Less-Than-Lethal Weapons

Usually, the discussion of protection gravitates quickly to guns. However, protection includes other types of weapons also. Bradley (2013, p.457) discusses several types of less than lethal weapons that can be used for self-protection. This author divides less-than-lethal weapons into two groups. The first group is specifically designed as less-than-lethal weapons and items that can serve in a dual role as a weapon.

 Less-Than-Lethal Weapons – These are weapons used strictly for defense or that are designed to disable but not kill the aggressor. These include Tasers, pepper spray, large knives, and the martial arts.

<c> **Taser** (Figure 16.11)– The Taser fires two electrodes that are connected to an electrical supply by wires to deliver a disabling electroshock to the victim. The shock is a high voltage, low amperage current. Taser devices are considered firearm and are held to the same standards. They can be carried either concealed or open in 45 states. Check your state regarding specific regulations. Note, if the cartridge is removed, the Taser becomes a stun gun.

<c> **Stun Gun** (Figure 16.12)– Also an electroshock devise, the stun gun applies an electric shock directly to the victim. It is a high voltage, low amperage current. Check with your state regarding laws and regulations involving its use.

<c> **Pepper Spray** – Pepper spray is an irritant that can cause pain, temporary blindness, and tears. Many of the sprays contain refined hot peppers. Some states have age limitations. Again, check with your state regarding specific regulations. Tear gas and other chemical spray can create the same effect.



Figure 16.11: Taser ® – The Taser is an electroshock device. Two electrodes are shot toward the victim and the high voltage low amperage current immobilizes the victim. Source: Taser – [file:\Taser[138].jpg]

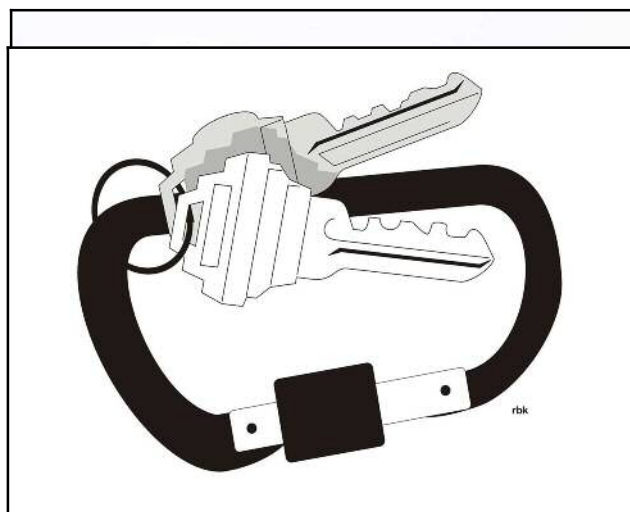


Figure 16.13: Brass Knuckles – Used as a key chain, the locking carabiner can be used as brass knuckles. The keys can be placed between the fingers to create a weapon. Source: author – [file:\PR-Carabiner&Keys.cdr]

<c> **Large Knives** – Referred to here, knives refer to large knives including hunting, Bowie, switch blades, gravity and a host of other knives. Most states have laws limiting the size of blade that can be carried. Again, check with your state regarding specific regulations.

<c> **Martial Arts** – Judo, karate, and the other martial arts can be used in defense. They require skill and training. However, the ability to perform them is always with the defender.

 Dual Role Weapons – Often tools and other artifacts can be used as a weapon. An advantage of these items is that they are not normally perceived as a weapon or if carried, they are with you as the tool. It is only if needed that they are used as a weapon. The carabiner is fairly benign, yet it can be used as a set of brass knuckles. The Maglite is an excellent light that can also serve as a club.

<c> **Carabiner** (Figure 16.13) – This author uses a locking carabiner to hold his car keys. It looks perfectly harmless and normal. However, the keys can be slipped off the carabiner and this author has a set of brass knuckles when the carabiner is slipped over the fingers if needed.

<c> **Key Chain** (see Figure 16.13) – The keys can be positioned between the fingers and they make an effective weapon when punching.

<c> **Maglite**® (Figure 16.14) – A Maglite with four D-cell batteries delivers quite an impact. The C-cell version can be used also. Although not as intimidating as a baseball bat, it has both the weight and length to be make it an effective weapon. Also, it can be used in time of emergency as a flashlight. This author carries a Maglite in his car in case of emergency.

<c> **Baseball Bat** – This is an old standby. When swung, a baseball bat can yield deadly results. In the movies, it is a favorite instrument used to bludgeon people, particularly by the villain.

<c> **Knife** (Figure 16.15) – Although it is included here, a pocket knife is not really designed as a weapon for defense. The Swiss Army knife carried by this author is mainly used for odd jobs and to open letters.



Figure 16.14: Maglite® – The four D-Cell Maglite® is a good flashlight that can easily be used as a weapon if needed. Source: author – [file:\PR-Maglite.cdr]

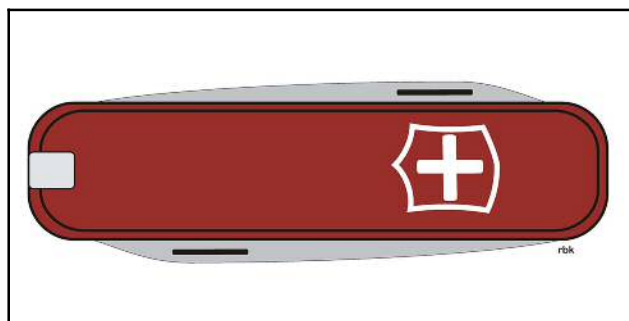


Figure 16.15: Swiss Army Knife – In a pinch, the normally benign Swiss Army knife can serve as a weapon. Source: author – [file:\SwissArmyKnife[144].cdr].

Summary

Usually, the discussion of protection gravitates quickly to guns. However, protection includes other types of weapons and defenses also. Three groups of players were identified. These were the defenders, aggressors, and military/police. In a game of rock, paper, and scissor, each of the groups can trump the other, if only temporarily. Preppers are defenders and invariably, their strategy is one of avoiding aggressors and often, it is avoiding the military/police also.

For defenders, the issue is how to defend one's home and family. Basic defense tactics were discussed including the star fort design and out-flanking the aggressors. In addition, this chapter provides a primer on weapons, both guns and less-than-lethal weapons. Protection is more than having guns. This returns the discussion to the strategy of avoidance. Without conflict or confrontation, a defender survives another day. This is the objective of prepping, surviving another day. Unfortunately, there may be occasions when avoidance is not possible and the defender needs to be prepared for these situations.

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Recreation for Preppers ¹

It was suggested that being a prepper was in essence taking a camping trip. Although there is considerable truth in this statement, there is at least one big difference. On most camping trips the recreation is the travel. It is the activity that fills the day. Essentially, the wilderness camper gets up in the morning has breakfast, travels most of the day, arrives at the campsite, eats dinner, has an hour or two in the evening, goes to bed and repeats the ritual again the next day. Travel is the activity. For the prepper confined to a bunker or basement for an extended period of time, there is no travel. There is a lot of time to fill with activities that avert boredom. In essence, the prepper has the same issues facing prisoners or POWs in confinement except their confinement is due to the unexpected emergency. None-the-less, it is still confinement. Maintaining sanity and how others have achieved it is an issue similar to the one faced by preppers in a bunker, shelter or basement. Actually, it can be a daunting task.

Lessons from Prisoners in Solitary Confinement – Cells in solitary are roughly eight feet wide and ten feet long. A cell is smaller than most bunkers or basements but the physical and mental impacts are the similar. They wear the person down. For example, wrongly convicted inmate Shujaa Graham found solace in routine while he was in solitary.

"I kept myself occupied," he said. "I programmed myself." He woke up at 5 a.m. every day and did exercises like jumping jacks and push-ups. Then he'd sponge himself off in his sink. Later in the day Graham went into a deep meditative state, pretending to visit his mom and other family members. (Fuchs, 2013)

A common theme among prisoners and POWs is that they noted they were "slippy." Initially, it is physical and then mental. Graham, who spent three years in solitary on death row and later found to be innocent noted that "You have nothing but four walls and a steel door ... You end up slowly slipping," (Fuchs, 2013). He was referring to the loss of mental acuity.

Another common theme among prisoners in solitary confinement is sensory deprivation. It is sensory deprivation of all five human senses including sight, sound, smell, touch and taste. There is little difference between a bunker, shelter or basement and a prison cell. Both separate the occupants for the outside world and both can lead to sensory deprivation. In one of the letters from a prisoner describing solitary in the *Survivors Manual: Survival in Solitary*, the writer touches on the impact of sensory deprivation.

I never seen the sky, or felt the warmth of the sun, or a breeze pass me by, the trees and grass or a rain drop. I never knew how painful it could be to be denied nature itself. I had a small narrow window which does not open, but all I could see was brick walls and nothing more. I remember from those brick walls was a small plant growing from within the cracks of the brick; that was my only part of nature that gave me hope. As the wind would blow against the leaves of this plant, I would actually close my eyes and pretend this very wind was blowing against my face. I know it sounds crazy, but it was the only part of nature I had. (Kerness, 2012, p.19)

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Regarding survival, the letters from prisoners tend to reflect the Stockdale Paradox covered in the next section. They discuss how writing letters reinforces your “inner consciousness.” It provides the connection with the outside. However, for prisoners who don’t have many artifacts and possessions, it becomes a method engaging the mind, being creative, and being connected to the outside world.

Lessons from POWs – POWs are another variation of prisoners. This conversation dovetails with the discussion under the motivation section and the 3Cs. The Stockdale Paradox provides insight regarding how to survive confinement in a bunker, shelter or basement.

Tom Moe was shot down in North Vietnam and was a POW for five years. There was physical and mental torture. Obviously, the physical and mental torture would not be present in a bunker and hopefully the duration would be considerably less than five years. Regardless, a significant key to his survival was to keep his mind active. He had to be creative and mentally active. This is evident in his account below.

I based my mental retreats not on fantasy but on real things. I designed and built homes, about 10 of them — some dream houses, others more practical. First I made a floor plan, then the exterior, and then I would build them in my mind nail by nail, down to the most minute detail. I’d design it, lay the cement, put up the two-by-fours, drive each nail, and even saw each board — slowly. If it progressed too fast, I would envision a bad cut on a board and resaw it.

I made lists. I made a list of every country I could think of, then every capital. I even made a list of all the candy bars I could think of. I tried to think of everything I had ever learned; once I reviewed everything I’d learned about trees. Sometimes I’d derive mathematical formulas, spending hours in the process. I could get completely wrapped up in this, completely escaping into my mind. With mental exercise came resolve — if I could help it, this was not going to be the place where I cashed it in. (Moe, 1996)

Vice Admiral James Stockdale was a prisoner of war in Vietnam for seven years. His coping mechanism led to the Stockdale Paradox. The paradox is embodied in three lessons. The second lesson is to “Take realistic stock of your situation.” (Swaner, 2012). This is a realistic assessment of your situation. It is not blind optimism which only leads to disappointment. It is confronting the reality of your situation. On the other hand, there must be faith that you will succeed. This leads to control over your situation. You will accept the challenge and as noted below in the lesson quote “prevail in the end.”

Lesson #1: Blind optimism is not the path. – Stockdale makes it clear that you must never confuse faith that you will prevail in the end—which you can never afford to lose—with the discipline to confront the most brutal facts of your current reality, whatever those facts might be.... (Swaner, 2012)

The third lesson was to seek social support. Stockdale developed a communication system with his fellow prisoners. People are social and need contact with others. For the prepper, communication with the outside world may become very important. It may be listening to the radio or communication with a short-wave radio.

Summary of POW and Prisoner Confinement – For preppers who may be confined in a bunker, shelter or basement, several lessons or conclusions may be taken away from this review. First, confinement affects individuals physically and then mentally. It leads to people mentally “slipping.” This suggests the need for people to be creative and engaged. Dovetailing with this point, it is the role of recreation to provide a creative experience. This is addressed in this section. Another lesson that can be gleaned from those confined is the need for social interaction. This interaction is with others outside of

the bunker or basement. Also, this interaction can involve sensory interaction with the environment outside of bunker or basement.

It should be noted that POWs and prisoners in solitary confinement represent the extremes of confinement in terms of both isolation and length of confinement. In addition, there is the element of torture for POWs. Depending on your political orientation, solitary confinement for prisoners may be viewed as torture also. Although a bunker, shelter or basement is confinement, they don't have the element of torture.

In addition, the amount of confinement in a bunker or basement will depend on the type of emergency present. A nuclear incident with radiation will most likely have the most confinement. A three-day snowstorm may limit mobility but it wouldn't confine occupants to their bunker or basement. Even most natural or man-made disaster will significantly limit mobility but not lead to total confinement.

Regardless, the longer the confinement becomes and the more mobility is limited, the more impact the confinement will have on the psychic of those confined.

In the movie *Blast from the Past*, a family is locked in an underground bomb shelter for over twenty-years (Figure 1). Although the movie is a spoof, it does accurately depict the depression and lack of creative stimulation on the part of the mother. Not surprisingly, she turns to alcoholism. The movie does accurately reflect the need to stimulate the mind. The father did this through the education process with the Brendan Fraser character.



Figure 1: Blast from the Past – The movie depicts life in a bomb shelter for thirty years. The mother pictured here, became depressed and an alcoholic. – Source: *Blast from the Past*.

Nash's Model of Leisure – Jay B. Nash created a model of leisure that is applicable to meeting the recreational needs in a bunker or basement (Nash, 1953, p.89). The original model was modified by this author to more accurately represent sub-zero behavior (Figure 2). Excesses, delinquency, and crime are depicted as an inverted pyramid rather than as a rectangle in the original model. The rationale is that there are fewer crimes than excesses and a pyramid spatially reflects this difference.

The model depicts leisure as hierarchical. There are four levels. These are 1) entertainment, amusement, escape from monotony and killing time, 2) emotional participation, 3) active participation, and 4) creative participation. As a rule creative leisure is better than entertainment, amusement, escape from monotony and killing time. This is not to negate the role of entertainment, amusement, escape from monotony and killing time. Entertainment and amusement have their purpose and place in a person's leisure.

Entertainment, amusement, escape from monotony and killing time are antidotes to boredom. In a three day snowstorm, games, playing cards, watching video and the like will probably get you through the experience with little wear or tear. However, as the time of confinement increases, amusements as an

antidote becomes less effective in maintaining mental integrity.

The next two levels on the scale are *emotional* and *active participation*. In both of these, the participant participates in the activity. Emotional participation is more passive and active participation involves the more active involvement of the participant.

At the peak of the pyramid is *creative participation*. For those who were confined in prison or as POWs, writing letters, mentally designing houses, and deriving mathematical formulas are examples of creative participation. These activities are necessary to keep the mind active and sharp when in long term confinement whether it is prison or a bunker, shelter or basement. For preppers who face long-term confinement, activities which are creative become even more important to the health and survival of the individual.

Corollary #1: *As the time of confinement of a prepper in a bunker or basement increases, the more important it becomes to address “creative participation” in order to keep the mind active, sharp and healthy.*

Corollary #2: *The more that confinement is required because of the disaster or emergency, the more a prepper needs to address “creative participation” activities.*

Creative Recreation – The emphasis so far has been on the impact of long-term confinement of preppers in a bunker or basement. As previously noted, amusement and games to kill time will see most preppers through a three-day snow storm.

For a moment, consider other examples where there is recreation in a confined situation. The first example that comes to mind is a cruise ship. It is a one week to ten day cruise. The ship is its own little island. Attention is paid to food and sufficient entertainment and recreational activities are present to fill the time on board. Also, there are ample social experiences to meet other passengers and there are ample places to visit onboard before passengers begin to feel confined on a ship.

The cruise ship example can easily be expanded to resorts and casinos. They are self-contained and operate pretty much like a cruise ship. Most casinos are without windows and any connection to the outside. Another example is assisted living facilities where the residents are for the most part confined to the facility.

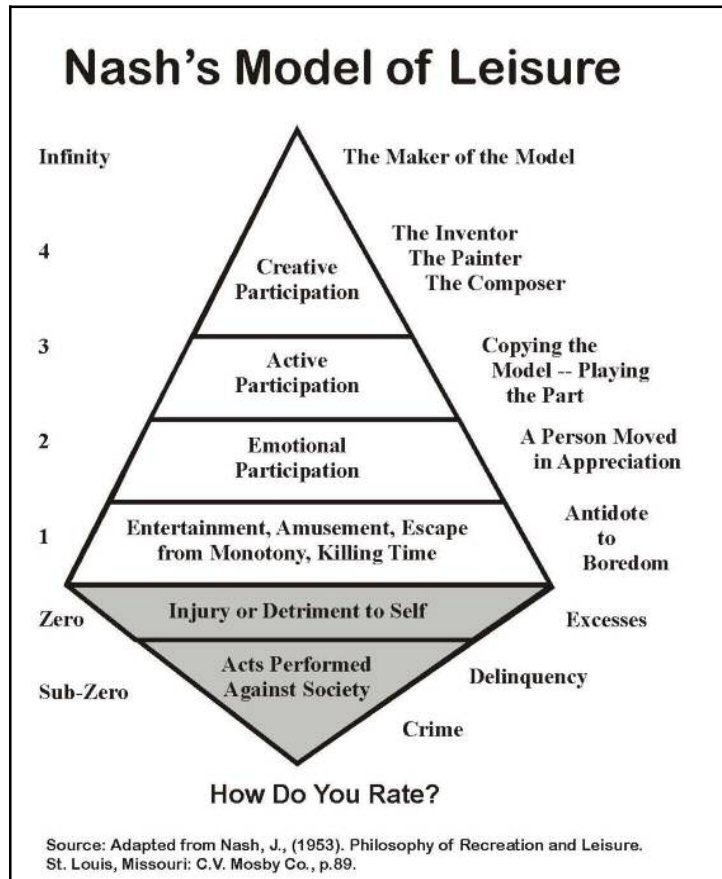


Figure 2: Nash's Model of Leisure – Important for preppers in long term confinement is to provide creative activities that stimulate the mind. – Source: Adapted by the author from Nash, 1953.

Reconsider the camping trip analogy discussed in the first paragraph as it relates to confinement in a bunker, shelter or basement. In time of an unexpected emergency, most preppers will have large amounts of leisure time. Most preppers will “hunker down.” Unless they are bugging-out, there is little travel. If they are bugging-out, they will hunker down once they reach the bug-out site. Most preppers will have stored food supplies and other necessities. If there is no destruction of the home or personal property, a prepper’s life is one with a lot of leisure time in times of emergency. Consider the following suggestions.

First, create a schedule of daily activities. Include as part of this schedule amusement oriented activities designed to relieve boredom as well as creative oriented activities. Think of your situation as a cruise ship and you are the activity’s coordinator. Remember, the schedule provides structure in a situation without much defined structure.

As part of your store of supplies, include the usual games and activities. As a rule, games that don’t require electricity are better than those that do require electricity. Include games that are individual as well as group. As a twist, include the directions and rules of games in your supplies that are new to everyone. This works particularly well with card games. If you don’t know how to play bridge, pinochle or hearts, the time together provides the opportunity to learn these new games. Also, it can be a form of active or creative participation. Although the games would be considered amusements, learning them is a higher form of leisure.

Third, be sure to structure time for creative activities. Creative activities can be as simple as writing a journal. Remember the diary of Anne Frank was written in an attic in the Netherlands during WWII. Or, it could be carving wood figures out of spare pieces of wood.

Next, there may be some merit in providing time to communicate with the outside world. This need will depend, in part, on the type of disaster or emergency. A television and the weather channel will probably suffice for a three-day snowstorm blanketing the region. A short-wave radio might be more applicable for a nuclear incident or a major natural disaster such as the eruption of the Yellowstone caldera.

Summary – Unless you are facing personal property losses and are digging out from the destruction, most preppers abound with large amounts of leisure or free time. Most people “hunker down” in their bunker, shelter or basement. This is in contrast to most people’s normal schedule where they have little free time. This section spent some time discussing the problems of confinement and its effect on the psychic. It suggested that the longer the confinement or the more absolute the confinement, the more people will need to include “creative participation” as part of their recreational activities. Much can be learned from prisoners and POWs.

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