COTI Guide to Crew Leadership for Trails

Colorado Outdoor Training Initiative

PLANNING DESIGN CONSTRUCTION MAINTENANCE
Colorado State Parks
TRAIL GRANTS

Produced by Colorado Outdoor Training Initiative (COTI)
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About COTI Guide to Crew Leadership for Trails

PURPOSE

This training course was developed to teach trail crew leadership consistently throughout the state. Local, state and federal land management agencies will benefit because all participants will gain basic skills that are uniform across Colorado. Land managers will know what to expect when groups trained with these materials work on projects.

Local groups and organizations will benefit because they can insert the standardized training into their programming. The standardized materials may strengthen the base of their training program which may shape relationships with land managers.

Another benefit is that all groups that use the standardized training materials will have a common point of reference when discussing trail maintenance and construction, safety, tool use and crew leadership.

As a result of the training, Crew Leader Trainees will learn trail terminology, methodology and fundamentals of the functionality of a trail. Instructors will teach Trainees about trail maintenance and construction, tools and tool safety – including tool identification, carrying, use and storage. Crew Leaders will learn how to assess risks to avoid injury.

Crew Leader Trainees will learn individual learning styles, listening skills as well as conflict and dispute resolution. A successful Crew Leader will be able to assess the individuals that make up the crew, understand motivational types and be able to effectively acknowledge efforts of individuals and the team.

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By the time the course concludes, Crew Leader Trainees will know how to motivate individuals to produce the desired end result in a safe manner while utilizing the varied skills offered by Trail Crew Members.

Crew Leadership for Trails is a basic course for crew leadership. Time limitations and the amount of material covered in the course do no allow Crew Leader Trainees the opportunity to practice being a Crew Leader. COTI recommends that in addition to this course, Crew Leaders work under an experienced Crew Leader or arrange for mentoring to gain confidence prior to leading a crew. In addition, many organizations and agencies have established protocols and programs for their Crew Leaders. Trainees need to check with these entities to get any additional training that is specific to that group.

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Summary of COTI Training Program

PURPOSE

COTI Instructor's Guide to Teaching Crew Leadership for Trails was developed for any organization or land management agency that is interested in crew leadership training. This *Guide* has been designed to teach basic trail maintenance and construction, safety, tool use and crew leadership principles. The intent of COTI is to offer training resources that can be inserted into existing programming.

HISTORY

The content of the *COTI Instructor's Guide to Teaching Crew Leadership for Trails* is a direct reflection on survey results and focus group feedback. Prior to the development of the materials, a comprehensive statewide survey titled: *The Blueprint for Outdoor Stewardship* confirmed the need for consistent, standardized crew leadership training. Training content was specified at statewide focus group meetings with organization and agency representatives. Multi-organizational committees collected curricula to match the focus group specifications. A statewide curricula content review period, followed by testing the materials at pilot workshops completed the development process. The *Guide* was refined one more time using feedback from the pilot workshop participants and instructors who taught the materials.

BENEFITS

COTI Instructor's Guide to Teaching Crew Leadership for Trails and its companion pieces will offer a standardized training package to agencies and organizations. Local, state and federal land management agencies will benefit because all participants will gain basic skills that are uniform across Colorado. Land managers will know what to expect when groups trained with these materials work on projects.

Local groups and organizations will benefit because they can insert the standardized training into their programming. The standardized materials may strengthen the base of their training program which may shape relationships with land managers.

Another benefit is that all groups that use the standardized training materials will have a common point of reference when discussing trail maintenance and construction, safety, tool use and crew leadership.

SPONSORSHIP

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Course Objectives

By the time the course concludes, Crew Leader Trainees will:

- Know how to motivate individuals to produce the desired end result in a safe manner.
- Understand practical trail construction and maintenance techniques.
- Know about tools and tool safety – including tool identification, carrying, use and storage.
- Know how to assess risks to avoid injury.
- Understand individual learning styles, listening skills as well as conflict and dispute resolution.
- Experience a mix of in- and out-of-the-classroom discussions and activities that facilitate learning.

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Trails Overview

THE IMPORTANCE OF PLANNING

It is essential that Crew Leaders have a basic understanding of trail development and planning. Knowing how trails are planned for sustainability, understanding the objectives of the trail, and understanding the impacts of a trail will enhance a Crew Leader's ability to effectively communicate trail concepts to the crew. It is important for a Crew Leader to involve their crew in identifying existing problems and brainstorming solutions as a team.

Planning is an important first step in the development of a trail for a land management agency or organization. During the planning process, agencies will consider various environmental factors as well as establish goals and objectives for trail development. Trails vary considerably by area management objectives, intended user groups, environmental conditions, location, and past use patterns.

Developing sustainable trails is a planning objective for most agencies. Characteristics of a sustainable trail include:

- Supports current and future intended use with minimal impact to the area's natural systems.
- Produces negligible soil loss or movement with minimal impact to vegetation and fauna that inhabit the area.
- Pruning or removal of certain plants may be necessary over time.
- Accommodates existing use while allowing only appropriate future use.
- Requires little rerouting and minimal long-term maintenance.

Good planning begins by establishing objectives. It is important to understand the objectives for a trail system or work section before beginning any trail work. Why are we doing what we are proposing to do? What are we trying to accomplish with this particular trail? Is it to provide access for visitors to a special

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attraction, provide an escape and rescue route, create an interpretive opportunity, reduce impacts to other trails by providing alternatives, or rebuild an existing trail that has deteriorated? All steps in the trail design, construction, and maintenance process are grounded in the objectives set out during the planning process.

Objectives can be compromised or changed unintentionally through new construction, reroutes, or maintenance activities. For example, if a trail is designed as a universally accessible trail to an overlook but, during maintenance work a step or drainage dip is installed, the trail objectives have been compromised. Similarly, if a trail is intended for mountain bike and equestrian use and steps are installed, trail objectives will be compromised.

Horse and rider on a trail in the Rawah Wilderness area.

Examples of trail objectives:

- Provide high quality recreation experiences for families
- Provide access for physically challenged individuals or groups
- Provide high quality recreation experiences for mountain bikers
- Provide high quality recreation experiences for motorized recreation
- Provide opportunities for interpretation and environmental education
- Provide access to an area for camping or hunting
- Provide for multiple-use opportunities
- Provide access to scenic or cultural opportunities
- Reduce resource impacts from unplanned trails and establish manageable use patterns
- Manage conflict among existing users
- Localize use to minimize impact on other areas

Some examples of different trail users and user groups:

- Experienced trekkers, hikers and backpackers
- Bird watchers and other wildlife viewers

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- Casual weekend users
- Families
- School children
- Foreign tourists of varying abilities
- Scientists and researchers
- Physically challenged or other special needs populations
- Local communities
- Park management and ranger patrols
- Mountain bikers
- Horseback riders
- Motorized vehicle users
- Fisherman and hunters
- Winter recreationists (snowmobile, ski, snowshoe)

Both motorized users and non-motorized users have legitimate rights and responsibilities regarding ethical trail use. As is the case with all user groups, they also have different needs and motivations. Understanding and tolerance of all trail users can promote a positive share-the-trail ethic and may help with conflict resolution.

TRAIL IMPACTS

Trails can have impacts, both desirable and undesirable. Undesirable impacts can be environmental such as erosion, stream sedimentation and contamination, and habitat fragmentation or social such as conflict among trail users, attracting undesired users, etc. Desirable impacts include new and expanded recreation opportunities, increased understanding of conservation issues, and increased tourism revenues.

Examples of trail impacts include:

- New recreation opportunities
- Education/interpretive opportunities
- Social benefits
- Economic boost to community
- Health benefits

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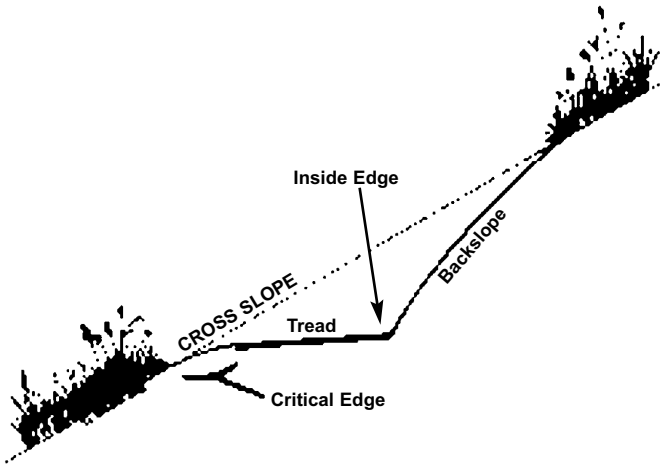
- Reduction in resource impacts by directing and channeling visitor use
- Stress on human sensitive wildlife species
- Loss or degradation of vegetation
- Visual degradation
- Increased use
- Increased demands upon maintenance and patrol resources

TRAIL ANATOMY AND TERMINOLOGY

Understanding trail terminology will assist Crew Leaders in understanding trail issues while also increasing confidence in communicating trail concepts to crew members.

Figure 1.
Trail structure anatomy



Tread: The tread is the surface of the trail on which users walk or ride. The tread may be either built as a “partial” or “full bench” trail. Partial bench trail is essentially cut-and-fill, where all or part of the trail is composed of excavated (loose) soil, which can be prone to erosion. Full bench construction means the trail is built entirely on native mineral soil, and is less likely

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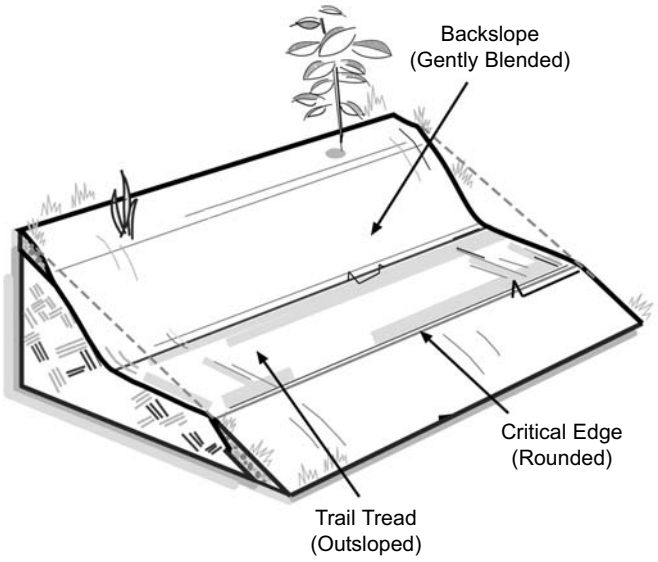
to erode. Full bench trails are cut into the hillside, and are generally more sustainable than partial bench trails. COTI training will emphasize full bench construction as the most sustainable trail construction technique.

The width of the tread will vary from agency to agency and from trail to trail. Hiking and biking trails will be narrower than trails built to accommodate horses or all terrain vehicles (ATV's). The land management agency will establish the width of the tread in their construction or maintenance standards for trails under their jurisdiction.

Figure 2.
Full bench trail



Outslope: Notice in the illustration that the tread is not level perpendicular to the direction of travel. Like the hillside, the tread slopes downward. Outsloping a trail is one technique to get water to flow across the tread rather than follow it or stay on the trail causing puddles. Water flowing down the hillside simply crosses the trail and continues down the hill. Trails that

are insloped or have no outslope will tend to allow water to flow down the trail, causing erosion or a puddle on the trail which causes users to walk around the puddle, widening the trail. The trail tread is usually outsloped by 1" to 2" for every 12" in width of the trail tread. Hence, a 24" wide trail would have an outside edge 2" to 4" lower than the inside edge. In general, when dealing with basic trail: outslope is good, inslope is bad, with some exceptions.

Cross Slope: The slope or gradient of the undisturbed hillside is called cross slope. It is generally referred to in percent, not degrees. A good analogy is to alpine skiing terminology – fall line, or the line or path water follows down hill.

Backslope: The excavated slope rising above the inside edge of the tread is called the backslope. The slope is cut back to mimic the original hillside. The backslope is a merger or transi-

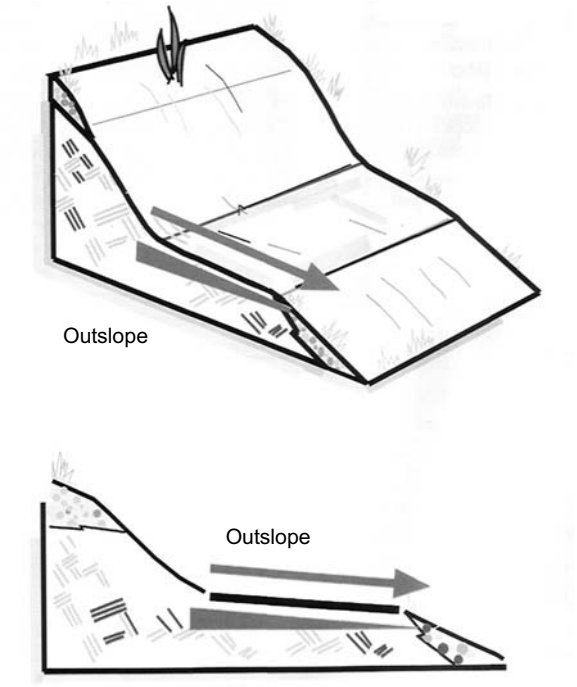


Figure 3.
Outslope

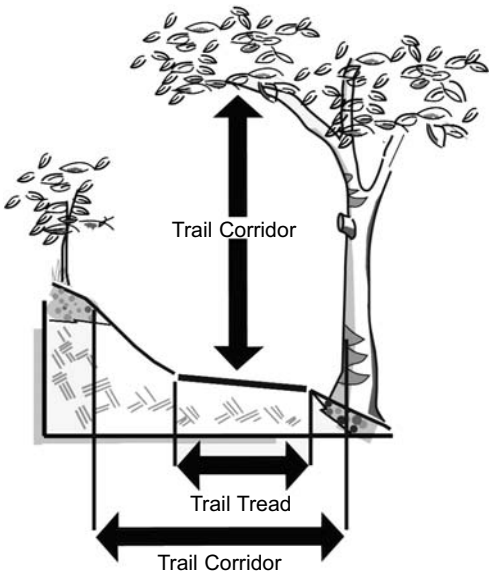
Backslope work on a trail.

tion of the natural hillside cross slope with that of the tread. It is "laid back" or reclining into the native hillside. When vegetation returns, the backslope will blend into the hillside and the trail will seem like it has always been there.

Critical Edge: The rounded outside edge of the trail is called the "critical edge" because this is where critical trail maintenance problems usually begin. Rounding the outside edge helps water to flow off of the trail.

Centerline: The middle of the trail is called the centerline. Trails are sometimes marked for construction by placing a row of pin flags along this centerline.

Figure 4.
Trail corridor



Trail Corridor: The area of passage of the trail, including all cleared and managed parts above, below and adjacent to the tread. This trail corridor is wider than the tread surface itself and is as high as necessary for the trail users. Trail corridors that blend in with the landscape and accommodate traffic will encourage appropriate trail use. When the trail corridor is not

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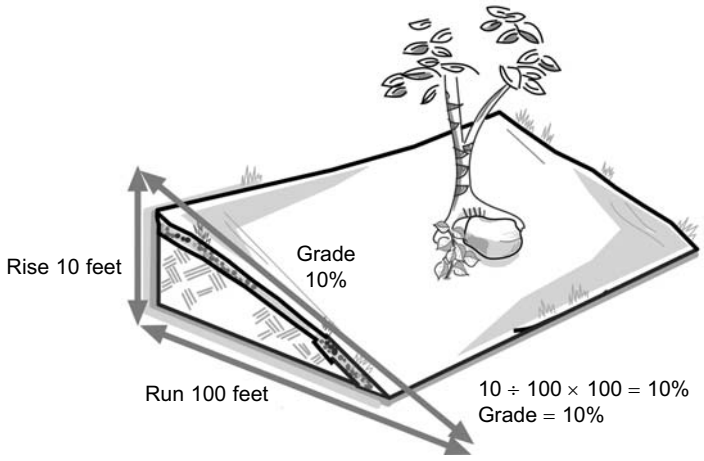
maintained, trail users will leave the trail tread and cause unnecessary trailside impacts.

Figure 5.
Grade of cross slope



Grade: The trail grade is the amount of change in elevation of the trail from one point to another. The USFS defines grade as "the vertical distance of ascent or descent of the trail expressed as percentage of the horizontal distance, commonly measured as a ratio of rise to length or as a percent." Grade may be measured for the entire trail but more commonly is measured by trail segment. In simplest terms, grade is the distance the trail rises (rise) over the horizontal distance of the segment (run) and is usually expressed in percent.

TRAIL CONSTRUCTION OR MAINTENANCE STANDARDS

Land management agencies have guidelines that relate to their physical characteristics, users, location, and environmental factors. The trail corridor height, tread width, grades, and surface will vary, depending upon the intended user groups, location, the projected usage level, and environmental factors such as soil type and drainage patterns. Agency guidelines promote trail objectives, sustainability, uniformity, minimal maintenance, and cost effective trails.

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Trail surfaces can be concrete, asphalt, natural, crusher fines, or other materials (boardwalk, gravel, paved cobblestone, wood chips, etc.). The potential user groups as well as environmental factors will help to determine surface standards.

Agency guidelines vary by recreation zone and management objectives creating a range from basic primitive trails in wilderness settings to 10-foot wide paved trails in urban or front country areas. The US Forest Service, the National Park Service, Bureau of Land Management and Colorado State Parks may have very different construction or maintenance standards that are dependent upon zoning and conservation objectives as well as user and social preferences. Usually, an agency representative or trail designer will communicate agency guidelines to the Crew Leader before initiation of the project. The Crew Leader must know the agency standards before beginning work.

Equally important, agency guidelines vary by the type of experience and the motivations of the visitor. Examples of user motivations:

- Solitude
- Be with others / family
- Challenge
- Education
- Excitement / thrill
- Skill improvement
- Fitness / health
- Enjoy outdoor environment

Environmental factors are also taken into consideration when establishing agency guidelines for trails. Topography, water features, drainage patterns, soils, wildlife, and vegetation can have an influence on land management agency guidelines.

TRAIL DESIGN

Crew Leaders are not usually called upon or expected to design new trails. Designing, staking and layout of trails requires special training, knowledge, experience, and skill and is usually accomplished by a land management agency representative or qualified trail designer.

The role of topography is well recognized in trail design and construction literature. Drainage patterns and the erosive force of water are directly related to topographic forms. Steeper topographic areas are more susceptible to erosion than more gently sloped areas due to the higher velocity of water flow. Topography also has a social aspect. When topography dictates steeper trail grades (for example, trails on Colorado's 14,000-foot peaks) certain user groups may be excluded, including the physically challenged, the aged, or some family groups and impacts may be greater. It is necessary to balance both environmental impacts and the visitor experience when determining trail standards and final trail grades.

Topography is the trail designer's best friend. The construction and maintenance of trails in flat areas is generally more difficult and requires more maintenance than trails in areas with some topographic relief or cross slope. This is because areas with cross slope allow natural water flow that doesn't usually impact trail corridors. However, cross slope conditions can also present a difficult challenge to the designer when grades are exceedingly steep, rainfall amounts are significant and/or intense, and soils are erosive. A trail designer must have a thorough understanding of how to use topography efficiently and effectively in order to minimize resource damage.

Trail Designers study the area to find natural features that add to user enjoyment while avoiding sensitive areas. They must strive to balance both anticipated environmental impacts and the intended visitor experience when designing trails, while also

meeting agency objectives. A significant amount of time goes into the planning, design, staking, and layout of a trail. A trail is not built in one day.

Grade

The maximum sustainable profile grade is the steepest acceptable grade for a trail segment that meets agency guidelines with minimal impacts to natural or cultural resources. It is established based upon a variety of conditions such as:

- Soil types (susceptibility to erosion)
- Rainfall amounts (seasonality and rainfall event intensity)
- Vegetation
- User group characteristics

Soil type, in combination with flow patterns, grade, and user group characteristics are often the determining factor in establishing the maximum sustainable profile grade for the trail, but there is no magic formula for establishing maximum sustainable grade. It requires experience and an understanding of the local conditions as well as intended present and future user groups.

Curvilinear Design Principles

Curvilinear design is an approach to trail design that utilizes the natural land contours as the desired location for a trail corridor. Using this approach, the trail corridor is located to rise or

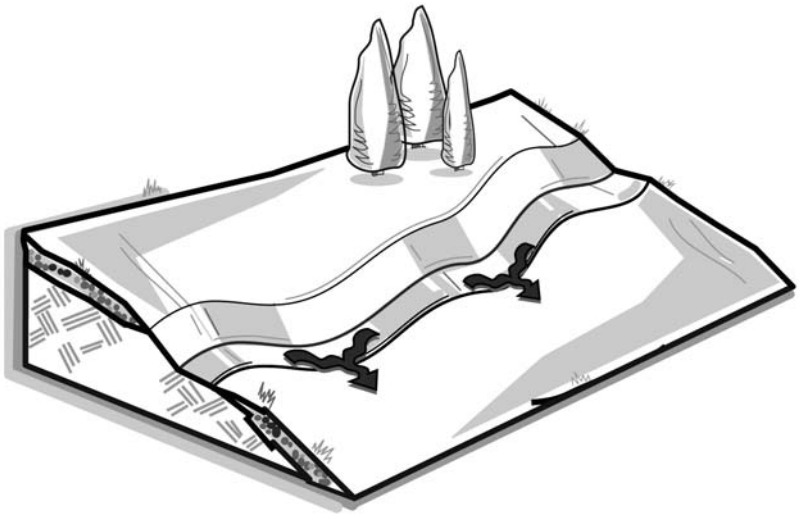

Figure 6.
Curvilinear trail

descend gradually along natural contours crossing the contours at an angle so that natural drainage patterns can be reestablished during the trail construction process. Maintaining trail profile grades that gradually rise or fall across contours will most appropriately ensure sustainable trail construction. It is recommended that trails never climb directly up an existing hillside or fall line. Where necessary, special structures such as dips, switchbacks, steps, and bridges may be needed when a sustainable grade cannot be achieved.

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ACCESSIBLE TRAIL

Some trails advertised as “accessible” do not necessarily meet the government standards or guidelines for accessibility. Accessibility is a regulatory requirement (set forth in the Americans with Disabilities Act or other legislation). Constructing a trail that is advertised as “accessible” is usually done as a preference on the part of the agency. Chances are slim that volunteers or trail crews would be used to build a trail to meet government accessibility requirements. Contractors usually construct these hard-surface (concrete or asphalt) trails.

Other terms used to describe the concept of accessible services and facilities are “universal design” and “universal access.”

When constructing partially accessible trail, consider the following points:

- The firmness and stability of the trail surface. Firmness is the resistance to vertical movement; stability refers to resistance to lateral movement.
- Trail sections that have relatively excessive grade and cross slope.
- Any item or material that causes an obstruction. An acceptable obstruction could range from ¼-inch in height above the trail surface to 4 inches in height or more, depending upon the trail standards.
- The minimum clearance width of the trail corridor. Are there any large features (boulders, drop-offs, large trees, and buildings) that restrict or limit the width of the trail corridor?
- Ruts, roots, grooves, or other similar objects in or near the tread that run parallel to the trail tread. These types of objects can force a wheelchair to go where the user does not wish to go.
- Watch for places where two or more critical elements are found together. These critical elements include lack of firmness; lack of stability; steep grade; excessive cross slope; obstructions or rough surface; and overhead hazards. Areas with numerous critical elements can be especially difficult for people with mobility limitations. If a combination of any of these factors exist on a section of trail, try to get rid of at least one of them.

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Trail Construction

Example of a good basic trail. American Lakes Trail, State Forest State Park.

Introduction

The Trail Construction section will cover the basics of trail construction. Crew Leaders construct trails using the specifications and standards provided by the land management agency representative. Crew Leaders must adhere to the agency specifications in the construction of new trail. Do not change the design or layout of a trail unless given permission to do so by agency representative or the trail designer. If a Crew Leader has questions regarding the location and construction of a proposed trail, talk to the agency representative or trail designer.

Trail Staking and Layout

More often than not, trail construction is associated with a trail re-route. An agency representative or trail designer will mark a new trail route with flagging, stakes, or pin flags or a combination of them. The flagging, stakes, and pin flags serve as a guide for the Crew Leader as to where to construct a trail or a related improvement such as a rock wall or drainage dip. Flagging will also mark special features for a Crew Leader to be aware of such as large rocks to remove. Not all designers or agencies use the same methodology in the layout of a trail. A Crew Leader needs to know what methodology the trail designer or agency representative used before starting construction of a new trail. Find out what the markings mean.

Types of trail staking and layout marking:

- Starting point of trail construction will be marked at either the centerline, inside edge or critical edge of a trail, or marked with plastic flagging in trees.

- A new trail may be broken down into sections marked with stakes or flags.

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- A trail may be measured and different points will be marked denoting distance from a starting point. (For example, 1+00 would be 100 feet from the starting point according to standard civil engineering notation).

Construction Notes

A land management agency representative or trail designer may provide detailed construction notes to explain their markings and how they would like the trail built. These notes usually give information based upon linear footage or station from a starting point of the trail. Crew Leaders must then read these notes to know what to do. In other cases, Crew Leaders may pre-walk the trail section with the trail designer or agency representative to discuss the work to be done. Construction notes will sometimes give details on safety issues for a project site, objectives for the project, and standards for trail construction. The Crew Leader needs to be aware of the safety issues, objectives and standards so the finished product matches the anticipated vision described in the construction notes. In circumstances where trail construction notes are minimal or not provided, it is important for the Crew Leader to either request notes from the agency or schedule a time to walk the new trail route with an agency representative to be clear on construction expectations.

The trail designer will communicate the construction standards and expectations for the trail. Trail construction standards will include trail corridor height and width, tread width, grades, and type of surface materials. In some cases, specifications will also be provided for unique improvements such as boardwalks. Trail standards may vary by agency. Know the agency standards before beginning work.

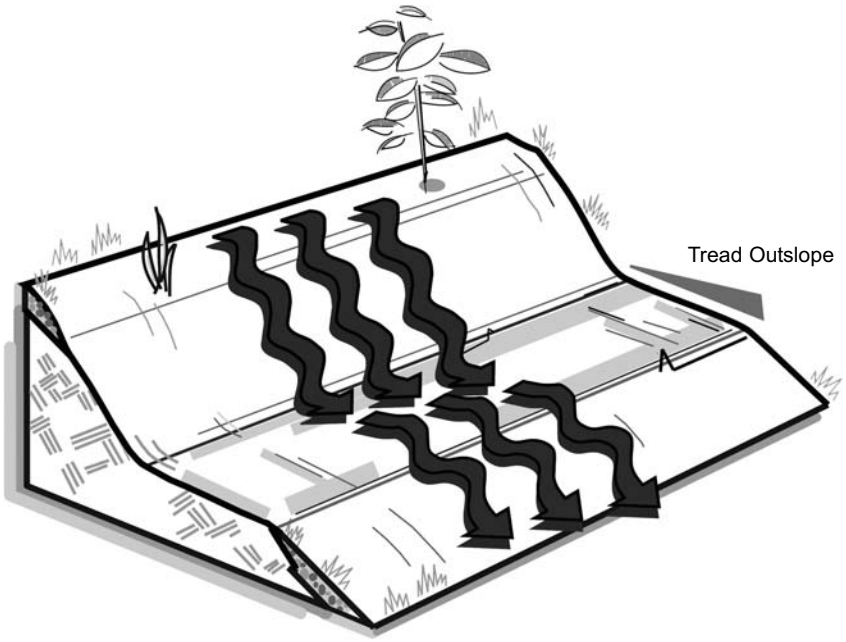
Water Control Structures: Drainage & Erosion

Erosion is the single biggest threat to trails and is a primary concern when constructing a new trail. Erosion occurs when water is allowed to flow at forces greater than the ability of the land to resist erosion. Concentrated flows of water strip soils and move them down hill.

Trail grade and outsloping are designed to let water move across the trail following natural flow patterns. “Sheeting” describes a very thin layer of water gradually moving across the trail. Encourage water to sheet across the trail. Do not let it collect and run down the tread.

Water control structures are used to supplement natural drainage in difficult portions of a trail. They are also used in maintenance projects to correct drainage problems. Further training is required to learn the skill of constructing drainage structures.

Figure 7.
Sheet flow
An outsloped trail tread allows water to drain in a gentle, non-erosive manner called “sheet flow.”



- Outslope of a trail is the primary drainage control method.

- Grade reversal dips are used as an erosion prevention measure. They make sure water cannot continue down a trail by providing a short section of uphill trail. Water doesn’t flow up hill. These also add interest to the trail by providing undulation.

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- In-sloping the trail is occasionally used in special circumstances like switchbacks or banked turns. Water sheets back, toward the hill, and is then diverted away from the trail. A grade reversal dip is nearly always installed above a section of in-sloped trail.

- Basic drainage dips and swales encourage surplus water to move off the trail. Swales are short sections of trail where extra outslope is used to move any surplus water off the trail. Drainage dips refer to larger structures where the lower portion of trail is gently and smoothly built up to create an "earthen dam."

- Reinforced drainage dips and waterbars, rarely specified in new trail construction, are occasionally used to fix erosion problems on existing trails. New trail construction usually relies on integrated natural drainage, not drainage structures.

TRAIL CONSTRUCTION: STEP-BY-STEP

Only full bench construction techniques are described below. Prior to starting trail construction, a Crew Leader will walk their section with their crew and discuss the work needed using the construction notes.

STEP 1: Clear the Corridor

Every trail needs an opening or corridor through the complex "enviroscape" of trees, shrubs, grassland, rocks, and water. This corridor needs to be wider than the tread itself, but should look as natural as possible. The height and width of the corridor vary according to the users, the site, and the dominant vegetation. Trail standards of height and width are established by the land management agency.

- Remove rocks and vegetation to create an opening and establish the corridor.
- While pruning and removing plants, emulate the vegetation patterns as best you can.
- If over half of a plant needs to be pruned, it is better to remove it.
- Cut trees and other vegetation at ground level. Use duff or dirt to hide the ground level stump of a tree.

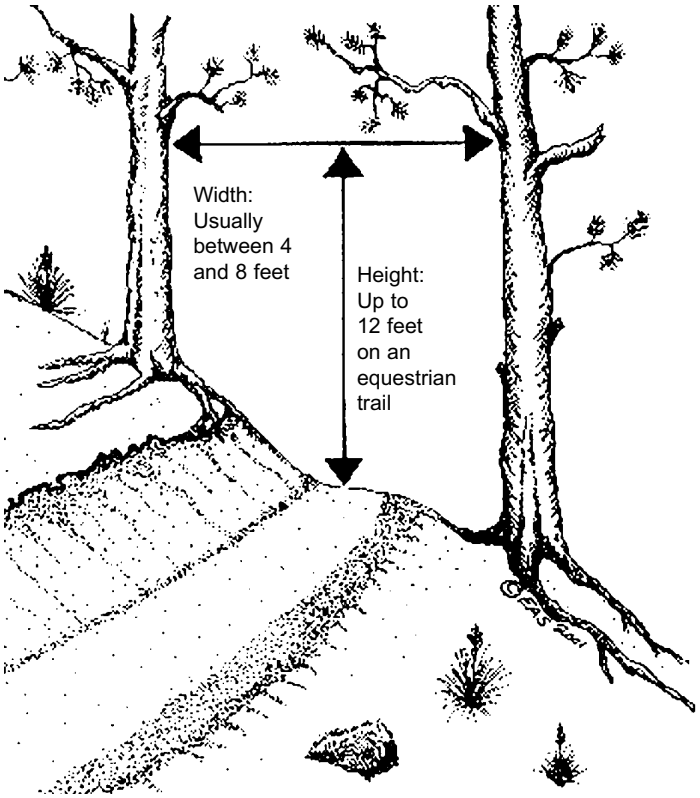

Figure 8.
Trail corridor
The trail corridor varies depending upon the intended user.

- Prune branches of trees to within no more than ½ inch of the bark collar. When using loppers, always place the sharp blade rather than the wedge to the living side of branch.
- Use the three cut method when removing large limbs of 2 inches or more in diameter. (Please see a more thorough explanation on page 31 in the Trail Maintenance section or in the *VOC Crew Leader Manual,* Fifth Edition, page 8-10 through 8-12).
- Never rub soil or duff into a cut on a live tree or shrub.

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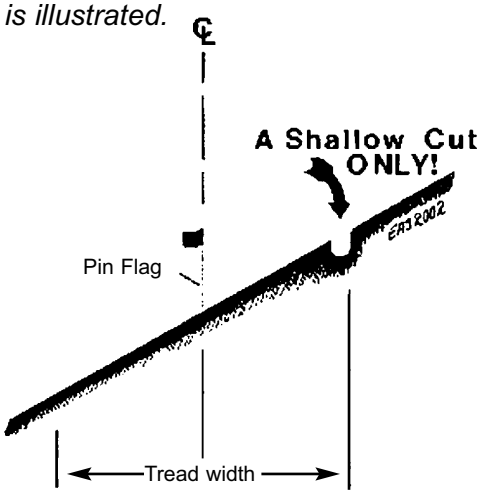
- Discard and scatter cuttings out of sight, off the trail with cut ends facing away from the trail.

- Try to blend all cuttings into the natural surroundings.

STEP 2: Establish Starting Point of Construction

There are several methods that trail designers will use to mark or flag a new trail so that Crew Leaders will know where to begin construction. This training will discuss four different methods used by trail designers. Tread width is established by the land management agency.

Figure 9.
Establish the starting point of trail construction. Center Line method is illustrated.



Pin flags are used to mark the center line of the planned trail tread.

1. Center Line Method.

In this method, the center line of the trail tread is usually marked with a line of pin flags or stakes placed at intervals of 5 to 10 feet along the length of the trail route.

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- Cut a shallow line along the uphill edge of the tread at half of the tread width measuring from the centerline flag for the entire section of work.

- Check location of flag line frequently as you cut this line so as to stay on course.

- You can mark this upper line with more flags to make it easier for your crew.

2. Inside Edge Method.

The inside edge (where the tread meets the backslope) is marked with a line of pin flags or stakes.

- Cut a shallow line along the lower edge of the tread for the full tread width measured from the inside edge flag for the entire section of work.

- Check location of flag line frequently as you cut this line so as to stay on course.

- You can mark this lower line with more flags to make it easier for your crew.

3. Critical Edge Method.

- The critical edge is marked with a line of pin flags or stakes.

- Cut a shallow line along the uphill edge of the tread for the full tread width measured from the critical edge flag for the entire section of work.

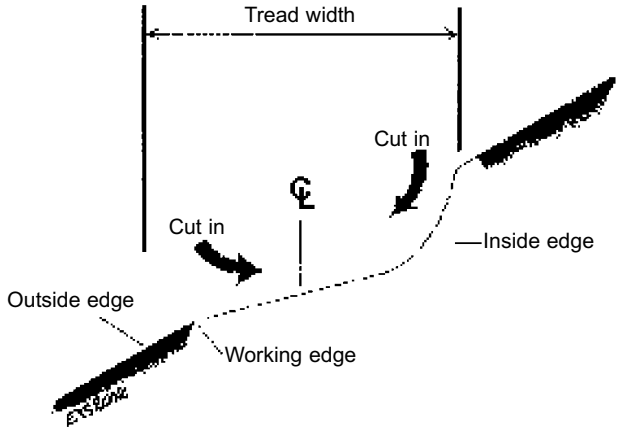
- Check location of flag line frequently as you cut this line so as to stay on course.

• You can mark this upper line with more flags to make it easier for your crew.

4. Flagging Method.
This method is not recommended for inexperienced Crew Leaders. Flagging is placed at intervals in trees and shrubs above the ground. The Crew Leader must decide where to start construction of the trail on the ground based on where the flags are placed in vegetation.

STEP 3: Establish the Initial Tread Surface
After cutting a shallow line, start digging and grubbing to establish a rough trail bench and tread. While working on the tread, it is important that the crew not walk on the critical edge or below it in order to protect the integrity of the trail surface and prevent unnecessary resource damage.

Figure 10.
Establish the initial tread surface. Center Line method is illustrated.



• Clear organic matter (duff) from the surface.

• Save duff for later restoration work if needed, otherwise disperse and scatter according to agency specifications.

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- Cut flat or slightly outsloped tread with nearly vertical backslope

1. Excavate less than you think you need to in terms of both width and depth of the tread. Better to excavate more later than try to re-pack soil in holes left because of too much excavation.

2. Save mineral soil for sections of trail that need fill or else broadcast material as per agency guidelines.

3. Rocks are often designed to be left as part of the trail. Make sure a rock should be removed before doing so. It is easier to leave it in than take it out and put it back.

4. Remove stumps, roots, rocks as appropriate. Details below.

5. Keep all duff and dirt within the tread area. Rake into piles on the tread, shovel into buckets and disperse or scatter according to agency specifications. (It is recommended to disperse well off the trail and not in big piles, unless filling up a depression out-of-sight from the trail.)

Tread surface assessment – what to remove or leave (usually specified by trail designer)

- Based on user: For more challenging trails leave natural obstacles such as roots and rocks that do not pose a safety hazard, cause damage to vegetation, or contribute to erosion. Obstacles on the inside of a trail will force users to the outside of the tread which will cause the edge to break down, resulting in tread creep. Conversely, obstacles left on the outside edge will guide users back onto the designated route. Remove any object that will act as a dam or gutter to collect and hold water on the trail.

• Rocks: Large round or rectangular rocks tend to make a good, durable trail surface and should generally be left in place. Jagged, pointy, sharp rocks force users off the trail and should be removed if reasonable. Keep in mind, when these rocks occur near, but not in, the tread, they will keep the user on the trail. Remove any rocks that will work loose and leave holes. If a rock is too large to remove, consider chipping with a hammer and chisel to remove jagged portion.

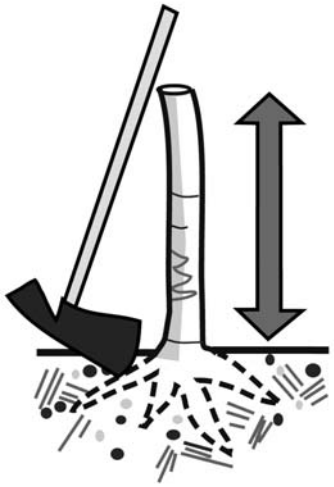

Figure 11.
Digging out roots.

• Roots: The same principles regarding "traffic control" apply to roots as well as rocks. Leave most roots that are not in the tread itself. Deciding which roots to remove requires discussion and should consider roots holding soil, trail users and safety, health of vegetation, and alternatives to removal such as ramping up and over a root. Remove most roots that lay parallel to the tread. Parallel roots channel water and are a hazard to users. Removing, or even cutting, large feeder roots on the downhill side of a tree may damage the tree (that is why trails are often routed above large trees).

DO NOT REMOVE IF:

• There is any uncertainty it should be removed (ask land management agency personnel for instruction).

• It poses a hazard to your crew.

• You don't know how.

• Proper tools/resources/fill materials are lacking.

• It would make the trail worse than leaving it.

Dealing with tread obstacles – rocks, roots, stumps

• Techniques for removal will be demonstrated by instructor.

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- Fill and compact all holes left after removing objects. Techniques for filling will be demonstrated or discussed by instructor.

- Getting creative: often an object is in the way but removing it is not practical or desirable. Rocks may also be placed in gaps between roots/other rocks. Mineral soil and/or aggregate is then used to fill any remaining voids and then vigorously compacted. On some occasions, a small rock wall may hold fill soil to cover important roots that are in the way but should not be removed.

STEP 4: Establish Backslope

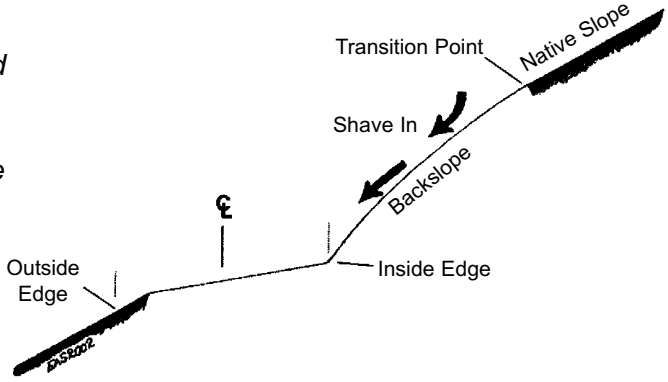
The backslope is important as an interface between the trail and the slope above the tread. The backslope controls how water enters the tread area from above. It is also a distinct and recognizable boundary of the tread on the hinge point or inside edge. The backslope should be a merger or transition of the slope of hillside with that of the tread.

Blend backslope into hill:

1. Taper back from vertical.

2. Develop to prevent water from undercutting and causing sloughing into the trail.

Figure 12.
Cut the backslope by shaving down and in towards the tread center line. Notice that the inside edge now merges the outsloped tread with the backslope. The top of the backslope also serves as a transition point with the native slope.



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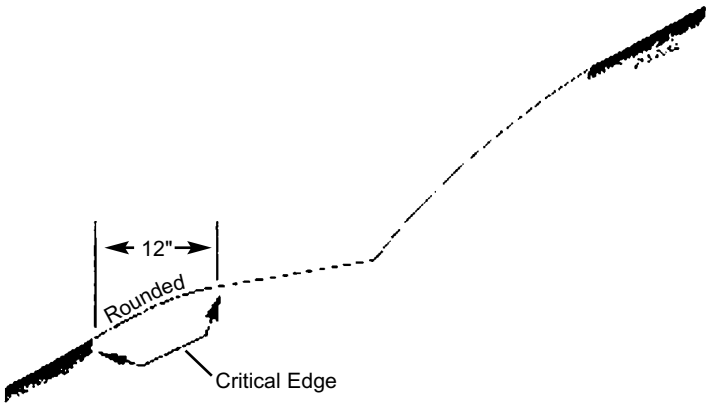
STEP 5: Establish Outslope

Now that the trail tread has been cut and the backslope created, it is time to establish the critical edge and refine the outslope of the tread.

Figure 13.
Shave-in to establish the critical edge of the trail. The edge should be rounded over to blend in with the native hill slope below the trail. This improves drainage across the tread, and ultimately the sustainability of the trail.



- The trail should be well compacted and fairly smooth with no place for water to puddle.

- Critical edge (outside edge) should have no loose fill, duff, or debris.

- Avoid creating berms.

- Methods to check for appropriate outslope:
  Techniques will be demonstrated by Crew Leader Instructor.
  1. Tool lean

  2. Water-bottle used as a level

  3. Roll a ball

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STEP 6: Reclamation & Finish Work

When finished with a section of new trail it should appear as if it's always been there.

- Repair any scars to area surrounding trail.
- Do not leave rocks that are clearly "out of place".
- Scatter saved organic material over disturbed soil and rocks off trail being careful not to impede drainage or block the outslope.
- Make sure no tools or trash are left behind.
- Flags should be left in place unless instructed otherwise. The trail will usually be inspected after the project and the flags serve as markers.

Suggested Tools Per Crew

The following table outlines the suggested range of tools needed for equipping crews for various types of work. Evaluate the tool needs for each crew as it relates to the work project and adjust the list accordingly. This table is based on a crew size of seven workers.

SOME BASIC TIPS:

- Two tools can be carried per worker (one in each hand)
- Smaller tools can be carried in packs or buckets
- Carry tools with protective sheaths on.
- Tools can be carried in a wheelbarrow to the work site

Tool	New Trail Construction	Easy Trail Construction	Trail Maintenance	Trail Closure	Crusher Fines	Tree Planting	Habitat Restor
Adze Hoe		1	1		1		
Bow Saw	1	1	2				1
Br. Blanket	1	1		2		3	2
Buckets	4	4	4	6		6	2
Canvas Bag				1			
Lopper	1	1	2				
McLeod	3	3	3	4	5	2	3
Pick Mattock	2	1	2			1	2
Pulaski	2	2	2	1	1	2	1
Rake					2		1
Rock Bar	2	1	1	1	1	2	1*
Shovel	3	3	3	4	5	4	2
Wheelbarrow		2		2	4		1

New Trail Construction – rocky, forested slopes

Easy Trail Construction – grassy meadows

Trail Maintenance – corridor clearing, tread maintenance, drainage structure maintenance

Trail Closure – other tools may be needed such as small trowels

Crusher Fines – assumes trenching has been completed by machinery. Crew does finishing work on trench and transports and spreads fines material

Tree Planting – other tools will be needed such as wire cutters & hammers

Habitat Restoration – closing old trail or road; prepping the soil, seeding, and transplanting some native plants. Installing erosion matting if needed on slopes would require additional tools such as 1 scissors, landscape staples, and 2 small sledgehammers per crew.

*1 rock bar every other crew to be shared if possible

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Trail Maintenance

Land management agencies usually have maintenance plans with established maintenance standards and priorities for each trail. Agency personnel and/or trail adopters will regularly inspect trails to locate and identify problems such as safety concerns, areas of excessive erosion, vandalism and potential segments of trail for re-routing. The maintenance trail crew's task is to correct those problems according to the established maintenance standards and priorities.

WHY DO TRAIL MAINTENANCE?

- To repair trails damaged by flood, avalanche, fire, user abuse, or heavy use.
- To restore tread to a safe, usable condition.
- It is cost effective to keep trails in good shape. Failing to care for trails can lead to extensive maintenance, closure, or complete loss of trails.
- To increase visitor safety and reduce liability risk.
- To protect the resource by reducing unwanted impacts.

Trail maintenance is a critical activity to ensure the success of a trail program. Finding solutions for erosion problems, boggy areas, loose soils, and widening or braiding of trails requires experience and skill. If a trail re-route is needed, knowledge of trail design, staking and layout is required. Trail designers may be consulted for assistance in determining reroute potential. Trails built without conformance to sustainability concepts will require more maintenance and cause more resource damage.

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PRIORITIES IN TRAIL MAINTENANCE

Lacking a specific land management agency maintenance plan, the following three priorities can be used to determine which tasks to complete and in which order:

1. Correct unsafe situations. This could mean repairing impassable washouts along a cliff or removing blowdown from a steep section of an equestrian trail.

2. Correct natural resource damage – erosion, sedimentation and off-site trampling, for instance.

3. Restore the trail to the planned design standard. This means that the ease of finding and traveling the trail matches the construction standard for the recreational setting and anticipated user group. Actions may range from simply adding signs to reconstruction of eroded tread or failed structures.

KNOW THE AGENCY STANDARDS BEFORE BEGINNING MAINTENANCE WORK ON ANY TRAIL

At the work site, determine what projects can be accomplished as basic maintenance, what projects can be deferred, and what projects will need major work. Always inform the land management agency of any work not completed.

BASIC TRAIL MAINTENANCE

Only basic trail maintenance will be included in this training module. Techniques such as construction of drainage structures, drainage crossings, turnpikes, rock walls, rock steps, and culverts will be covered in future COTI training modules. Only hand tools will be used in performing maintenance techniques.

The topics covered in detail are:

1. Trail Corridor Maintenance
   - Plant removal
   - Pruning

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2. Tread Maintenance
   - Re-establishing alignment
   - Removing obstacles
   - Removing sloughs and berms
   - Improving backslope

3. Drainage Structure Maintenance
   - Surface water control
   - Maintaining a swale, dip or waterbar

1. TRAIL CORRIDOR MAINTENANCE

Plant removal

Plants growing into a trail corridor or trees falling across a tread surface are a threat to user safety and trail integrity.

Encroaching plants such as thistles or dense willows may make travel unpleasant or even completely hide the trail. If people have trouble traveling through the trail corridor, they will likely impact surrounding areas by traveling off of the established tread. It doesn't take a full obstruction of the tread to push users to one side or the other. Anything that impinges on the user's visual perception of how clear the trail is will push them to one side or the other. For example, a low branch that comes to within a foot of the tread, when it is about at eye level, will subconsciously push the user to the other side of the trail.

Most trail corridors are cleared an equal distance on either side of the tread centerline. Construction or maintenance standards established for that trail determine the height and width of a trail corridor. A Crew Leader needs to know the trail standards. Within the trail corridor, plant material and debris are cleared all the way to the ground. Large trees and boulders within this corridor are obvious exceptions and shall remain. The critical corridor dimension is the safe, unhindered passage of the user (hikers, stock, OHV, etc., fully packed and with a rider, if applicable.)

If you are uncomfortable with your ability to safely cut a tree due to the hazards or your lack of experience, walk away from it!

A trail corridor with persistent straight edges is not pleasing to the eye. Work with natural vegetation patterns to “feather” or meander the edges of your clearing work so they don’t have a severe appearance.

Some trail corridors may need to be cleared several times a year while other trail corridors may only need corridor maintenance once every few years depending on the type of vegetation near the trail. For example, a trail in a scrub oak area requires more frequent corridor clearing than a trail in a lodgepole pine forest. Trail corridor maintenance can also be accomplished at the same time a volunteer or staff person is performing a monitor and evaluation of trail conditions.

Only remove trees or shrubs that are 6-inches in diameter or less and can be cut with loppers or a bow saw.

- Walk away from trees that are larger than 6-inches in diameter. Felling standing trees (including snags) or large branches are statistically one of the most dangerous activities in which a trail worker can engage. Do not consider felling trees unless you have been trained and certified.

- Mark any hazardous trees that you are unable to safely remove and inform the land management agency representative.

- If you find a fallen tree lying parallel with the trail and the trunk of the tree is not within the clearing limits, you can leave it in place and prune the limbs flush with the trunk.

Pruning of the trail corridor provides an unimpeded passage for trail users.

- For a clean pruning cut, use the three-cut method where the first step is to make a shallow undercut with a bow saw, then follow with the top cut. This allows for a clean cut and pre-

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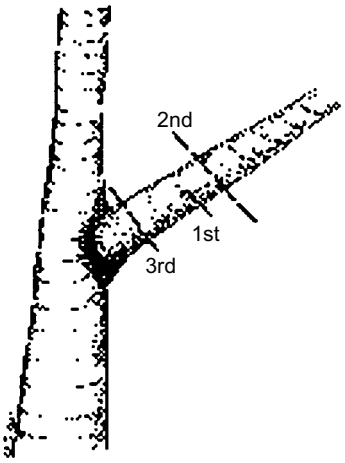

Figure 14.
The "three-cut" method of trimming large branches prevents bark from "banana peeling" off the main trunk of the tree.

vents the limb from peeling bark off the tree as it falls. Use the three-cut method to remove large limbs (2 inches or more in diameter). Make the first cut about 8 to 12 inches up the branch from the collar on the underside of the branch. Make the second cut on the top side opposite the first cut, and the third cut to remove the stub flush with the limb collar. Do not use an ax for pruning. Loppers and bow saws are best for pruning as using an ax above knee height can be very hazardous.

- Trim back all limbs to the trunk (or ground for brush) leaving nothing that could impale or grab trail users, their stock or their equipment.

- If over half of a tree or any other large plant needs pruning; it is usually better to cut it down instead. Otherwise, prune trail facing branches to within ½ inch of the collar on the main trunk of the tree.

- If a limb is too high or too large to cut at its base, try to cut it at a "fork" of the branch as close as possible to the trunk.

- Never rub dirt or duff into the cut on a live tree or shrub. Microorganisms (pathogens) in the soil can be introduced through the exposed cut.

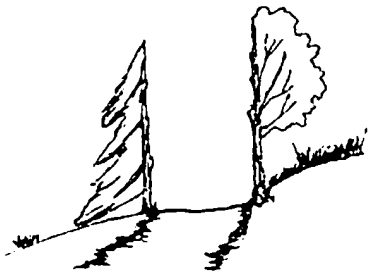

Figure 15.
These trees should have been removed rather than pruned.

- Dispose of cuttings and vegetation in an acceptable manner. Whenever possible, branches, limbs, and especially small trees should be moved out of sight of the hiker or rider on the trail. Often a small clearing behind a tree or shrub will suffice to deposit cut limbs.

- Young trees that have been cut should be dragged into the surrounding forest and/or hidden behind rock outcroppings, out of sight. Take special care that the cut, butt-end of a tree is not visible from the trail.

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- Cut intruding brush back at the base of the plant rather than in midair at the clearing limit boundary. Cut all plant stems close to the ground.

- Some land management agencies may want cuttings piled up for wildlife habitat. In addition, some agencies may have concerns relating to wildfire that direct how the slash is to be disposed. Other agencies may require that vegetation be spread below the trail to impede runoff.

2. TREAD MAINTENANCE

Tread maintenance ensures a solid, obstacle-free tread is established and enough protection is provided to keep it in place. Multiple use trails, primarily those that include bicycle traffic, will sometimes leave obstacles to provide additional challenge to bicycle riders or limit bicycle speeds, as long as these clearly do not present a hazard to foot traffic.

Tread work requires maintaining tread to its desired width. This means removing slough and berm and filling ruts, holes, and low spots. It includes removing obstacles such as protruding roots and rocks. Do not leave any exposed roots or root stubs, as exposed roots usually die. It also means repairing any sections that have been damaged by landslides, uprooted trees, washouts, or boggy conditions.

Tread maintenance aims for a solid, outsloped surface. Remove all the debris that has fallen on the tread including the sticks, stones and candy wrappers. Some land management agencies advocate pulling the lower edge berm back onto the tread surface and using it to restore the outslope as well as using any slough material in the same fashion. Only do so if the material can be firmly packed, not creating another berm. Remove and widely scatter organic debris well beyond the clearing limits, preferably out of sight.

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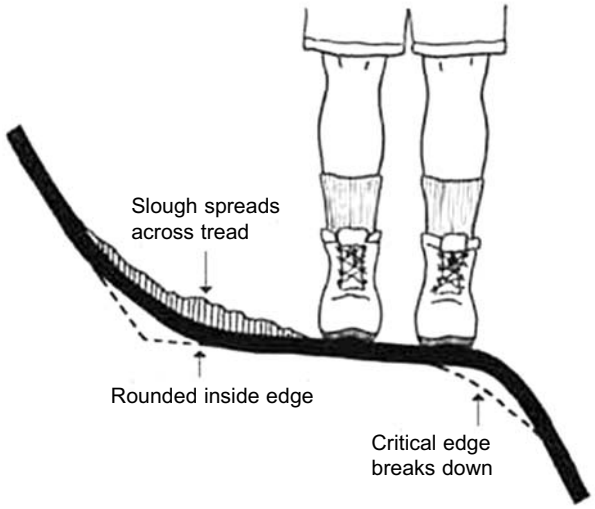
Figure 16.
Tread creep at work.



Reestablish the tread alignment:
Most livestock, bicycle and ATV use, and some people have a natural tendency to follow the outside edges of trails. Additionally, sloughing will make the trail edge the flattest place to walk. As the tread moves downhill, it also narrows, causing trail users to travel closer to the outer edge. The result is tread creep, in which the trail actually moves from its intended location within the established corridor. Other causes of tread creep are constructing a trail that is too narrow or with backslopes that are too steep. The trail crew's job is to bring the trail back uphill to its original location.

- Trees, log ends, rocks, and stumps left close to the downhill edge of the trail will keep animals and people to the middle of the tread. Good places for off-trail objects like this are at the crest of a hill, adjacent to a dip, steps or other structures, or along the inside edge of a turn in a trail. These "guide structures" should not impede the natural drainage pattern across the tread surface.

Remove roots and stumps within the tread surface:

- A sharpened pick mattock or Pulaski is most often used to chop away at roots.

- Not all roots and stumps are problems. A stump may have been left during trail construction to help keep the trail from creeping downhill.

Figure 17.
A "daylighted" tree root.

- Leave roots that are perpendicular and flush to the tread and that are not a tripping hazard. Remove roots that are parallel to the tread. They cause erosion and create slipping hazards. Look for the reason the roots were exposed and fix that problem. (For example, a drainage dip may be needed above root exposure.)

- Some large, exposed roots may require ramping the trail over them using rocks and fill dirt.

- Remove rocks within the tread surface. Rock removal ranges from shoveling cobble to moving large rock off the tread.

- When moving large rock, think first. Plan where the rock should go, and anticipate how it might roll. Communicate with the entire crew about how the task is progressing and what move should occur next.

- The two most common injuries in rockwork are pinched (or smashed) fingers and tweaked (or blown out) backs. Work safely when removing large rock!

- Do not throw or kick rock off the trail. Always place or roll a rock to a safe location. An out-of-control rock might hit someone below.

- Always keep your back straight and lift rock with the strong muscles of your legs.

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- Rockbars work great for moving medium and large size rocks. Use small rocks or logs as a fulcrum for better leverage.

- Not all rock within a tread surface needs to be removed. If it is not a tripping hazard, you can leave them.

- Some large, exposed rock can be crushed or chipped with rock bars and sledgehammers to create a flatter surface. Use eye protection when chipping rock.

Remove slough and berm that has formed on the tread. On hillside trails, slough is soil, rock, and debris that have moved downhill to the inside of the tread, narrowing it. Slough needs to be removed. Leaving slough will cause the trail to "creep" downhill.

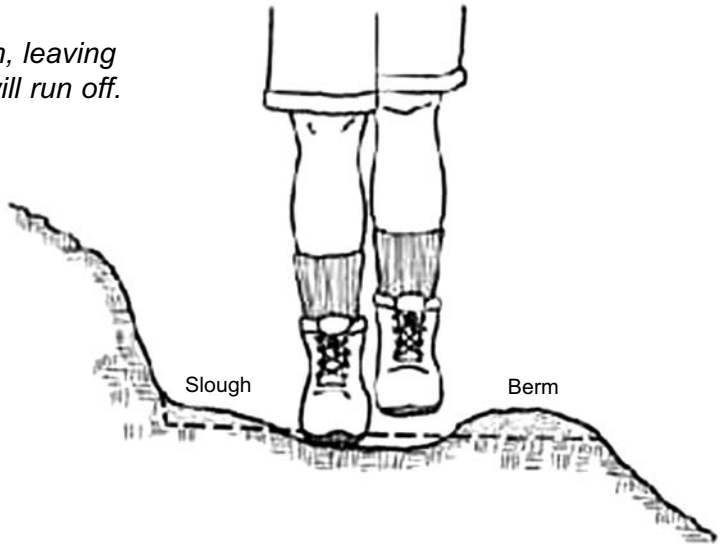
- Loosen compacted slough with a pick mattock or Pulaski, then remove the soil with a shovel or McLeod. Use excess soil to fill holes in the tread or on the downhill side of waterbars and drainage dips.

- Blend the slope of the tread into the backslope area.

Berm formation is the single largest contributor to erosion of the tread surface and its removal is the most important task for trail maintenance. Berms may form a false edge. Berm is soil that has built up on the critical edge of the tread, forming a barrier that prevents water from running off the trail. Berms are a natural consequence of tread surface erosion and redeposition or inadequate compaction during construction.

A false edge is unconsolidated, unstable material, often including significant amounts of organic material that has almost no ability to bear weight. This is probably the least stable trail feature and a major contributor to accidents.

Figure 18.
Remove the slough and berm, leaving the trail outsloped so water will run off.



- The outside berm along the trail tread must be periodically removed. Some management agencies recommend shoveling the berm material back into the center of the trail to avoid trenching which can cause more erosion issues. Removing berms also promotes natural drainage and runoff patterns. Remove any organic material and pack the soil firmly.

Improve the backslope of the trail.

The backslope is an important interface between the trail and the slope above the tread. The backslope controls how water enters the tread area and it is a distinct and recognizable boundary of the tread on the inside edge.

- The backslope, where at all possible, should not be steeper than the native hillside slope, also known as the angle of repose or cross slope. It may not be practical to bring the backslope to the angle of repose on a steep hillside where a full bench trail is cut into the hill. This can be acceptable as long as hillside materials are solid enough to stand on their own. A vertical backslope eventually causes slumping of the soil onto the trail causing the trail to again “creep” downhill.

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- The backslope imitates the cross slope above.

- Cut the backslope by shaving down and in towards the tread center line. The inside edge now merges the outsloped tread with the backslope.

3. DRAINAGE STRUCTURES

The erosive force of water is usually the most destructive element acting upon a trail. A properly outsloped trail will allow water to flow across the tread rather than straight down the trail. However, a poorly laid out trail, maintenance problems, or local site conditions (such as steep trail profile grade) may allow water to be captured and the result will be water flowing down the tread. Proper maintenance of trails includes correcting drainage problems.

Trail Crew Leaders must be able to analyze various trail drainage problems and develop appropriate solutions. The more fluent a Crew Leader is in understanding the causes of a trail drainage problem, the better they can communicate to the crew members the corrective work required for the situation. Always try to identify the source of the trail drainage problem. Often just looking uphill will help locate the source of a problem. Frequently, the solution to a drainage problem may be in a less obvious location away from where the problem is manifesting itself.

To effectively analyze a drainage problem, a Crew Leader must understand the physics of water. Water erodes soil surfaces by picking up soil particles and carrying them. Water builds soil surfaces by slowing down and dropping soil particles. Water in the erosion mode will strip tread surface, undercut support structures, and blast apart fill on its way downhill. How much damage is done depends on the amount of water involved and how fast it is flowing.

Water has “deposit” ability. If you slow water down, it loses its ability to carry soil. If you abruptly turn or block water, it slows. This has some advantages if you are restoring eroded tread and use check dams to capture waterborne soil.

Water can also affect soil strength. Generally, drier soils are stronger (more cohesive) than saturated soils, but it is also true that fine, dry soils blow away. More experienced trail workers can identify basic soils in their areas and know their wet, dry, and wear properties.

Surface Water Control

Running water erodes tread and support structures and can even lead to loss of the trail itself. Diverting surface water off the trail is part of an effective maintenance program.

The most effective drainage structures are those designed and installed during the original trail construction. A properly out-sloped trail will allow water to flow across the tread rather than straight down the trail. A good drainage structure is self maintaining, requiring minimal care, but there will be times when more work is needed to promote effective drainage.

Types of drainage control structures:

- Grade reversal dip or rolling grade dip. These drainage control structures use a reversal in grade to force water off the trail without the need for any other structures. This type of dip works best when designed and built during the original trail layout and construction. Water collected from the hillside is not intercepted and carried by the tread. Grade reversal dips are the most unobtrusive of all drainage structures if constructed with smooth grade transitions. Grade dip channels can be armored.

- Swales. Shaved-down sections of trail with an exaggerated outslope. Used to shed water off a trail and is a useful remedy for wet spots on relatively flat trails.

- Drainage dip. A depression constructed in the trail to catch water running down the trail and to divert the water off the trail. Usually constructed in a trail after the original trail layout and construction has been completed.

- Reinforced drainage dip. A reinforced drainage dip is a drainage structure which has a water bar buried under a layer of compacted soil.

- Water bar. A drainage dip combined with an exposed stone or timber barrier set diagonally into the trail. The drainage dip diverts water from the trail and the hardened barrier deflects water in case of major water flow. This type of drainage structure is no longer recommended for construction or use on trails, but previously constructed water bars need to be maintained or replaced.

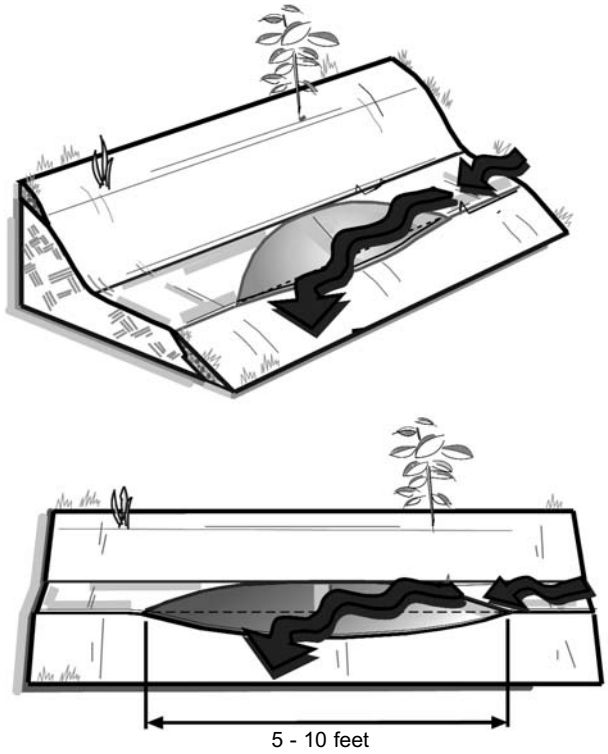
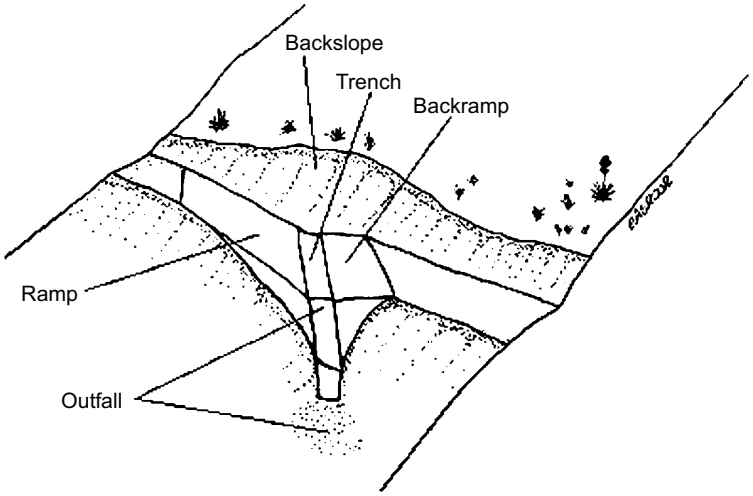


Figure 19.
Swale.

Figure 20.
Anatomy of a drainage dip.



Maintaining a swale, dip, or waterbar:
The biggest maintenance issue for drainage structures is sediment build up. If a drainage structure clogs, water will find its way down the tread, creating erosion channels or puddling. The best drainage structures are self-cleaning, but realistically, most drains collect debris and sediment that must be removed.

Most problem drainage structures are water bars. If water is slowed by hitting the stone or timber barrier, sediment builds up. Inadequate outsloping or an outfall that is too narrow can compound this. An effective water bar allows for the “natural” flow of water on and off of the trail.

- When maintaining a water bar or dip, anticipate where the runoff goes and remove excess sediment where needed.

- Reestablish or locate the outfall or drain outlet to naturally turn the water off the trail before it reaches the water bar or the dirt barrier of a drainage dip.

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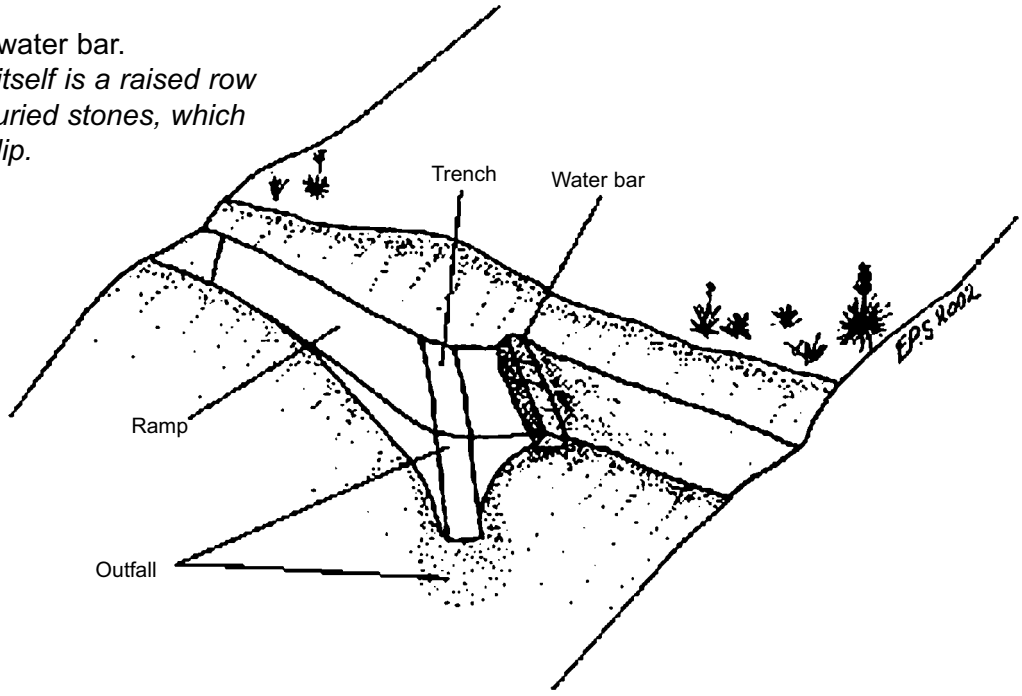
- Dig the outfall wide (up to two shovel widths) and graded so water does not slow before it exits the trail. Outfalls that allow water to return to the tread below the drainage structure need to be reconstructed.

- Clear the outfall of all logs, rocks, and other debris, and even consider cutting logs and roots if needed to preserve the natural flow of water off the trail. The exception is that some rocks, logs or other debris can be left to dissipate the energy of flowing water.

- Mineral soil removed from an outfall can be placed on the downhill side of the dip or waterbar on the trail and compacted. This will promote a smooth ramp up and over the dip or waterbar.

Figure 21.
Anatomy of a water bar.
The waterbar itself is a raised row of fitted and buried stones, which reinforce the dip.



- The outlet can dip down to 12 inches below trail level across the entire width of the trail.

- Dips and water bars are constructed at an angle to the trail, not perpendicular.

- The ramp or downhill approach to the drainage structure will usually begin at a minimum of five to six feet above (up to 10 to 20 feet for steeper trails) and will be a steady grade several degrees steeper than the trail and outsloped as much as possible..

- Below the drainage structure, the approach will extend about five feet below the drainage structure and will be a steady and consistent grade across the entire width of the trail.

Leadership

TOPIC: Understanding Motivational Types

Researchers David McClelland and John Atkinson suggest that there are three different motivating characteristics in human behavior. Although they acknowledge that most individuals have a mix of all three types, one tends to dominate.

The three characteristic types identified are:

The Achiever:
This person is committed to accomplishing goals, welcomes a new challenge and looks for opportunities to test out new skills and improve performance.

The Affiliator:
This person values relationships, enjoys working with others and seeks out opportunities to be helpful and supportive.

The Power Person:
This person seeks to influence people and events so that change is realized.

No one style is better than the other. In fact, most successful projects require a mix of styles to blend the work of a group. Teams that include a variety of styles benefit from the different perspectives people bring to the task. However, people with different styles prefer different kinds of supervision, recognition and job placement. It is helpful to determine the preferred style of a crew member in order to provide an effective match. The reference sheet describes characteristics of each motivational type and the kind of supervision that is the most effective.

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Motivational Characteristics: ACHIEVER

MOTIVATIONAL CHARACTERISTICS	DESCRIPTION	CONDITIONS OF SUPERVISION
Achiever		
Goal: Success in a situation which requires excellent or improved performance	**Positive Attributes:** Concern with excellence, personal best Sets moderate goals, takes risks Enjoys a level of moderate stress Restless/innovative Likes challenging work Likes to work alone Likes to overcome barriers **Negative Attributes:** Will sacrifice people to achieve goals May be insensitive Can be autocratic Gets bored quickly	Wants concrete feedback to improve performance Likes results-focused management Wants a boss who leaves him/her alone Likes to be challenged Enjoys time management and responds to goals, objectives and conceptual thinking Needs a well-delegated task Enjoys being consulted about decisions, planning

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Motivational Characteristics: POWER

MOTIVATIONAL CHARACTERISTICS	DESCRIPTION	CONDITIONS OF SUPERVISION
Power **Goal:** To have an impact or influence on others; to bring about change.	**Positive Attributes:** Concern for reputation, position, respect Tries to shape opinion Wants to change things (e.g. Provide opportunities for the physically challenged) Combative, fighting spirit Verbally forceful Uses social power: • Exercises power to benefit others • I win – you win – (we win!) • Charismatic • Creates confidence in group to realize achievable goals **Negative Attributes:** Uses personal power • I'm in charge • I win – you lose – (we lose) • Group is dependent, submissive • Treats people indifferently • Autocratic	Likes clear cut policies and procedures Likes to know limits of authority Likes strong leadership Needs lots of personal freedom and respect Works well alone Tends to operate outside standard rules and regulations Likes to associate with other "power brokers" Needs to be included in decision making and planning

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Motivational Characteristics: AFFILIATOR

MOTIVATIONAL CHARACTERISTICS	DESCRIPTION	CONDITIONS OF SUPERVISION
Affiliator **Goal:** To be with others, to enjoy mutual friendships	**Positive Attributes:** Seeks out relationships Likes to work with many people Likes social activity for its own sake Sensitive to feelings, needs and wants of others Supports others in the achievement of their goals Talks about feelings **Negative Attributes:** Will sacrifice project goals to keep people happy Concerned about personal popularity Hates to discipline Is crushed by criticism	Wants a concerned, caring supervisor Enjoys long chats Welcomes advice Likes to be part of a team, pair, group Needs help if situation is tense or unpleasant Avoids conflict May not report problems back to supervisor or may "dump" them back to supervisor

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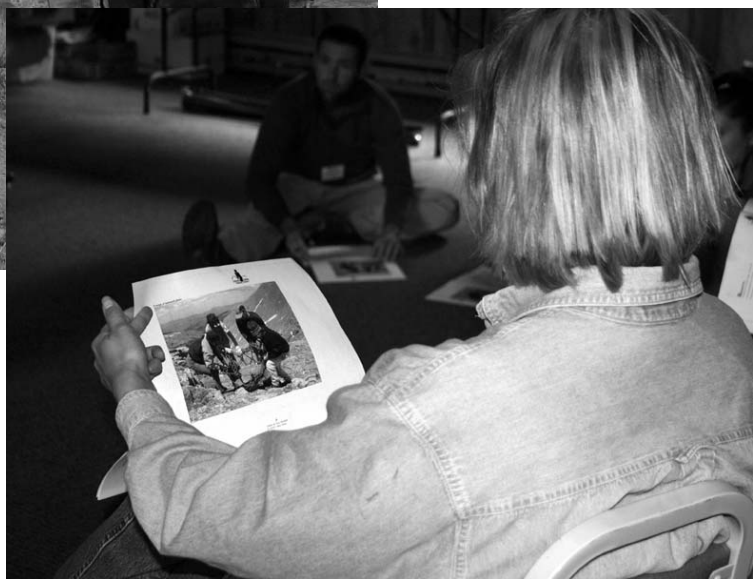
Leadership

TOPIC: How to Say Thank You

Crew Leaders represent the front line of any organization/ agency and they are key for the retention of individual Crew Members. A Crew Leader's interaction with each Crew Member will play a large role in the quality of a project experience. Effective crew recognition requires an understanding of why people participate. By determining a Crew Member's motivational type and reason for participation, you can provide an environment that meets the motivational needs of individual Crew Members.

This activity will focus on effective recognition tailored for each motivational type. It will provide the opportunity to practice developing and delivering verbal recognition to a crew based on a Crew Member's motivational type.



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Recognition Tips

Recognition:

- Give it frequently
- Give it using different methods
- Give it honestly
- Give it to the person, not to the work
- Give it to the achievement
- Give it consistently
- Give it on a timely basis
- Be as specific as possible

Day-to-Day Recognition

- Say “thank you”
- Tell them that they did a good job
- Ask for their opinions
- Greet them by name
- Show interest in their personal interests
- Smile when you see them
- Brag about them to others in their presence
- Say something positive about their personal qualities
- Provide food, snacks to acknowledge
- Demonstrate that you care about them and their well being
- Provide social opportunities on a project for a reward
- Provide educational opportunities
- Involve Crew Members in decisions
- Ask about the Crew Member’s outside life (family, other work, interests, etc.)
- Make sure that Crew Members receive treatment equal to that given to staff
- Send a note of appreciation to the Crew Member or the Crew Member’s family
- Recommend the Crew Member for promotion or a more responsible job
- Celebrate goals achieved, small triumphs

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Crew Member Recognition Strategy

Write a verbal recognition for the Crew Member for each motivational type indicated in the chart below based on the scenario on the front of this card.

MOTIVATIONAL TYPE	RECOGNITION
ACHIEVER	
AFFILIATOR	
POWER	

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Leadership

TOPIC: Teaching to Different Learning Styles

Leading a crew to accomplish a goal is one of the most challenging aspects of being a Crew Leader. Crew Leaders are challenged with creating a safe, positive work environment while addressing a wide variety of learning needs. Each Crew Member will interpret directions in a different way. Misunderstandings can lead to poor outcomes, an unsafe work environment, and frustration for all involved. The key to effective teaching lies in understanding different learning style preferences. Effective instructors can teach different ways to do one task. The Learning Styles handout defines examples of different learning styles and how to teach to each style. These learning styles are a simplification and are meant to be used to illustrate a point.

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Learning Styles

PROACTIVE LEARNERS (LET'S GET GOING AND DO IT!)

What they want:
- Examples of what others have done
- Minimal instruction and details
- Learn through trial and error

Successful Technique:
- Lecture
- ✗ Demonstration
- Mentor
- ✗ Learning-by-doing
- Hand-outs

REFLECTIVE LEARNERS (CLASSIC TEACHING AND REASSURANCE.)

What they want:
- Verbal step-by-step directions followed by a demonstration on how to follow the directions
- Mentoring during the project
- Questions answered during the project

Successful Technique:
- ✗ Lecture
- ✗ Demonstration
- ✗ Mentor
- Learning-by-doing
- ✗ Hand-outs

ACTIVE LEARNERS (TELL ME THE WHOLE THING, THEN LET ME DO IT.)

What they want:
- Simple directions/overview of what needs to be done
- Questions answered BEFORE work begins on the project
- Demonstration and mentoring at the beginning of a project with less oversight as time passes

Successful Technique:
- ✗ Lecture
- ✗ Demonstration
- Mentor
- Learning-by-doing
- Hand-outs

CONCRETE LEARNERS (I WANT TO KNOW THE ONE WAY IT IS TO BE DONE.)

What they want:
- Detailed and systematic directions
- Demonstration of detailed and systematic directions
- Instructional guides or hand-outs

Successful Technique:
- ✗ Lecture
- ✗ Demonstration
- Mentor
- Learning-by-doing
- ✗ Hand-outs

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Leadership

TOPIC: Keys to Effective Listening

Active listening facilitates many positive relationships.

Crew Leaders work with a large range of personalities and levels of acquaintance that makes active listening paramount. Active listening includes empathy, paraphrasing, probing, reflecting, summarizing, verbal prompts and silence. We listen at 125-250 words per minute, but think at 1000-3000 words per minute so our brains are usually way ahead of our ears. We usually recall only 50% of what we heard immediately after we listen to someone talk. The most helpful thing to remember when listening is to *stop talking.*

All too often, as listeners, we allow distractions (multi-tasking), attitude, or personal biases to interfere with our abilities to engage in a beneficial listening experience. Crew Leaders can be distracted by any number of activities that are happening around a discussion. It is vital that a Crew Leader focus, because how the other person feels could determine how that individual behaves during the project, or whether that person returns for future projects. This activity will demonstrate how multi-tasking and distractions can deter from active listening.

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Active Listening Tips

POSITIVE LISTENING TECHNIQUES:

• *STOP TALKING. YOU CAN'T LISTEN AND TALK AT THE SAME TIME.*
• Lean forward and make eye contact.
• Be patient, allow the speaker time and ignore distractions.
• Empathize with the Crew Member.
• Hold your temper – anger displays more than words.
• Focus on the problem, not on the personality.
• Be open – consider the speaker's feelings and opinions.
• Demonstrate equality, not superiority.
• Maintain a problem-solving attitude.
• Show tolerance for ambiguity.
• Be aware of others in the group.

NEGATIVE LISTENING TECHNIQUES:

• Criticize or argue.
• Interrupt or be obstructive.
• Distract, by drumming fingers, jingling keys or coins which signifies your impatience.
• Be confrontational.
• Be a "yes man".
• Act exasperated or walk away.

QUESTIONS AND PHRASES THAT PROMPT COMMUNICATION

• Can you expand on that?
• What are your major concerns?
• What solutions/choices do you see?
• How can I help?
• What needs to be done?
• What is the best way to work it out?
• How do you feel about that?
• What do you think?
• How important is that to you?
• How did you come to your decision?
• How do you plan to do it?
• That is important. What solutions do you see?
• I'm glad you brought that to my attention.

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Leadership

TOPIC: Conflict and Dispute Resolution Management

Conflict is inevitable in any group that is together for any length of time. People are unique and therefore will have differing viewpoints, ideas and opinions. Conflict occurs when there is no internal harmony within a person or whenever there is disagreement or a dispute between, or among, individuals. In other words, conflict may be intra-personal, interpersonal or intra-group.

There are many sources of conflict:

- Different values and beliefs
- Role pressure or clarification
- Perception differences
- Diverse goals or objectives
- Race, ethnicity, or gender differences
- Personality clash or conflict
- Competition for limited resources
- Disagreement on how things should be done
- Personal, self or group interest
- Tension and stress
- Power and influence

People generally may think of conflict in negative terms because conflicting issues that are avoided or handled poorly may divert attention from important issues, damage morale,

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cause polarization and reinforce differences in values. Outcomes may also include irresponsible and regrettable behaviors.

Conflict handled well can result in positive outcomes. It may promote change, increase cohesiveness, become a forum for problems to be heard, and provide a means for people to work together. Knowing how you handle conflict will help you to better interact with others who approach conflict in a different way.

Remember, when resolving conflicts:

- Real issues driving many conflicts are rarely obvious.
- Separate the people involved in the conflict from the rest of the group for privacy unless it is a group issue.
- Clarify issues and find common ground.
- You are in charge of how you respond.
- Avoid pre-formed judgments.
- Solutions lie in building trust and open dialogue.
- A vision of success is required.

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Leadership

TOPIC: Assessing Your Crew

Crew Leaders are expected to manage projects, people and safety. It is a Crew Leader's job to ensure a positive experience for all parties. Crew assessment is a tool that can be very helpful. Every Crew Leader needs to know about the people working on the project and be one step ahead. It is much more important for a Crew Leader to be proactive than reactive. A skilled Crew Leader is able to anticipate, to see things before they happen and institute a preventative measure.

There are five elements for a Crew Leader to be mindful of while leading a crew. The five elements are expectation, skill, personality, performance and safety.

The first element is **expectation**. Every member on the crew has a different reason for being there. The more expectations a Crew Leader can fulfill the better the experience each member will have. It is important to find out the member's reason or motivation for being there. If the member feels satisfied in their experience they tend to be more productive. Meeting member's expectations will also help increase retention levels. Clear expectations in the beginning will lead to fewer problems down the road.

Next, it is important to measure the team's **skill level**. By knowing the individual skill sets of members on the crew, the team can tackle projects more efficiently. Some members may have medical expertise, equipment certification or project experience, which can make the work go a lot smoother and safer. This information helps when pairing people together, deciding who will do which tasks, determining which member will need more assistance and/or training and ensures better quality of work.

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Personalities play a big role in project management. Not everyone will be a leader, an analytical thinker, a supporter, and a cheerleader or show exceptional determination. But the combination of these personalities is what makes a team

successful. Identifying the roles people play and strategically placing them will help the team be more efficient and productive.

Performance assessments need to be done on a continuous basis. It is easy to get off track when supervising multiple people. It is easier to correct mistakes as they happen than to correct them when a task has been finished. Trying to motivate a crew to redo a task because their leader was negligent is not easy.

Lastly and probably most important is assessing your crew's **safety**. Safety is a Crew Leader's first priority. A person's well-being can be measured in three different ways:

- **Personal safety** is the first consideration for a crew. Crew Leaders need to be sure their crew is healthy in order to take on the physical demands specific to their projects. Crew Members need to drink plenty of water, eat nourishing food, take enough breaks, stay warm (or cool as the case may be) and dry, and stretch their muscles throughout the day. It is the Crew Leader's job to provide a method that maintains each of these physical needs.

- **Mental well-being** must also be evaluated. Members need to be attentive and focused to help maintain their own safety. Members need to continue to learn and be challenged in order to grow and remain attentive and focused. When boredom and monotony set in, members lose their motivation and determination. This will cause a loss in productivity and may create an unsafe environment.

- **People want to fit in, accomplish goals and feel good about themselves.** Stress, feeling overwhelmed, and lack of support will keep a person from achieving their fullest potential. A Crew Leader needs to watch for external signals and be ready to offer additional support when needed.

Safety and Tools
TOPIC: Tools

Tools can make a crew leading experience either enjoyable or miserable, depending on whether the right tool is available at the right time and whether crew members know how to use tools safely. The information provided gives the basics for hand tools in a project setting. Only basic hand tools used on a project will be covered in this training.

There are many specialized tools available for work projects including rockwork tools, power tools, and motorized equipment. All of these specialized tools require training before using in the field and will not be covered in this component. It is essential to know what tools your agency or organization will allow on a work project.

TOOL TALK

The tools to be used during the day should be introduced in a logical order to allow an effective discussion of their use and safety with the crew. The order of tool presentation is up to the Crew Leader. However, certain subjects regarding tools must be covered. These subjects will be referred to as “CUSS”:

- **C**arrying tools
- **U**sing tools
- **S**toring tools
- **S**afety with tools

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"C" – Carrying Tools

There are basic safety requirements for carrying tools to and from the work site. Be alert and make sure the safety guidelines are enforced throughout the day:

- Always wear gloves while carrying tools.
- Safety sheaths should be properly in place on the tool.
- Pick up a tool and feel for the balance point. The balance point is the place where there is equal weight in front of and behind your hand. Carrying a tool at the balance point results in less strain on wrist and arms. Carrying a tool vertically requires tensing the wrist and provides minimal control over movement of the tool. The best possible control over motion of the tool is obtained when it is gripped at the balance point.
- Always carry tools in hands with arms at sides. The blade or most dangerous part of the tool should point downward.
- Never carry tools propped on your shoulder.
- Tools should be carried on the downhill side of the trail. This is so that the tool can be thrown clear in case of a stumble or fall.
- When it is necessary to carry tools in both hands, carry the heaviest or most dangerous tool on the downhill side.
- Maintain a safe distance between people when walking to the work site. Everyone should be an arm and a tool-length from the next person on the trail while walking.

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Crew Members need to be responsible for maintaining the correct distance from the person immediately preceding them down the trail.

- Watch where tools are pointed at all times.

- Let the slowest Crew Member set the pace for the group.

- Announce “Coming through” or “Bumping by” when approaching other crews working. Stop and wait for the Crew Members to cease work. The person who is working has the right of way and will cease work and yield when comfortable for them to do so. “Coming through” or “bumping by” is always a request for passage and never a demand.

“U” – Using Tools

Each tool has its proper and improper methods for use. Here are some of the general considerations when using tools:

- Before using any tool, make sure you know what it is used for and how to use it safely.

- Before using any tool, check to make sure the handle is not loose or split. Tag all damaged tools for repair. Any tool with flagging on the handle is not safe to use.

- Adopt the proper stance for using the tool. This will save strain on your back and make the tool more effective to use.

- Establish secure footing before using tools. Be especially careful when working in wet, slippery conditions.

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- Maintain a safe working distance between Crew Members at all times. Be sure someone else's space is not compromised while using a tool. Do not bunch up or crowd one another. Some organizations will maintain at least a 10-foot distance between workers as a safe operating distance when using tools.

- Full "roundhouse" swings with tools are not generally acceptable unless a Crew Member has extensive experience with this technique. Using a tool this way can be dangerous and may cause the user to quickly tire.

- In the rare occasion a roundhouse swing is necessary, check to make sure the work site is safe and advise those people nearby that you will be swinging. Before starting to work, clear away any brush or limbs that might unexpectedly catch a swinging tool. Yell "Swinging!" before lifting the tool to work.

- Use all tools in a motion parallel to the body rather than towards the body.

- Demonstrate to the crew how to lift with the legs instead of the back. "Head up, butt down" is the order of the day.

"S" – Storing Tools at the Worksite

Tools are dangerous when not stored properly at the worksite; any tool is a potential risk. Here are some things to remember about tool storage:

- Concentrate all tools not currently in use in one area if possible.

- Tool sheaths, due to their small size, are easily lost and should be gathered by the Crew Leader.

- Store all tools on the uphill side of the work section or trail so they are not a hazard, but can be reached easily. Store them with the handles pointed down towards the trail or work section, and the sharp or business end furthest uphill.

- Store shovels with the sharp edge towards the ground.

- Never sink axes, Pulaskis, picks, or similar edged tools into the ground or in stumps where they become dangerous obstacles, i.e., impalement and tripping hazards.

- The storage of rock bars requires special attention. Rock bars are heavy and have pointed tips that can severely injure someone if they slide or roll down a hillside. To store rock bars, place the tool on the ground, parallel with the contour, and preferably centered behind a tree or rock for security. They should never be stored in such a way that they can escape downslope and create a javelin-like hazard.

"S" – Safety With Tools

Carrying, using, and storing tools present different safety issues. It is important for Crew Leaders to emphasize tool safety at all times. Remember these tool safety tips:

- Dis-CUSS tools in the morning and re-emphasize "CUSS" all day long.

- Be careful how you carry, use, and store tools at all times. Set a good example for your crew by always being "tool safe".

- Always use proper personal protective equipment like hardhats, gloves, and safety glasses when using tools.

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Tools

- Use the right tool, the right way, for the job at hand.
- Avoid “roundhouse” swings. You could injure someone else and you increase the likelihood of a miss-stroke and hitting yourself. Roundhouse swings are very tiring and unsustainable over extended time periods.
- Tools come in a variety of sizes, shapes, and intended uses. They are all dangerous if not treated with respect.
- Misused tools can break and are a danger to future users. They also cost time and money to repair.
- Remove all broken tools from use immediately, and tag for repair before you forget and the tool is used again.
- Stay alert when others are using tools nearby.
- Do not set a tool down “just for a minute” in the wrong place. It will become a hazard.
- Safety with rock bars is very important; they are a hazard especially when stored improperly.
- Trade off on tools occasionally for relief from repetitive stresses. Repetitive stress may cause more injuries particularly towards the end of the day.
- Always “CUSS” your tools, even if you have a crew of veteran members. The refresher is helpful for everyone.
- Be thinking about the consequences of every move. When working with a rock or log, think ahead so as not to be standing in the wrong place when it moves. Be ready to toss the tool aside and jump free. Avoid cutting

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toward any part of your body, and watch out for your coworkers. Use skill, not brute force.

- Everyone has different levels of coordination. Some members of your crew may need to use a given tool several times before they are able to overcome their awkwardness. For others, new tools may come as second nature. Spend an appropriate amount of time training each individual to ensure safe and efficient work habits.


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Tool Descriptions and Uses Glossary

Knowing what a tool is designed for is important. The following tool descriptions contain usage and safety concerns for each tool.
Safe and proper tool usage cannot be overemphasized.

Always be on the lookout for Crew Members using tools improperly. If a Crew Member is using the wrong tool for the job, it can lead to overexertion and increase the potential for an accident or broken or damaged tools. You need to be sure that the right tool is being used for the job.

Common examples of tool misuse are:
- Using a shovel to pry rocks or to dig in hard, rocky soil instead of a rock bar or mattock
- Using the axe blade of a Pulaski to break up soil
- Using the grubbing end of a Pulaski to pry up big roots and rocks
- Using an Adze hoe to cut larger vegetation, such as tree roots
- Chipping or prying rocks with a McLeod
- Cutting into dirt or rock with a bow saw
- Chipping rock without safety glasses
- Throwing a tool

When you see these things happening, politely instruct the Crew Member how to use the tool safely. Always keep in mind – safety first!

Tools for Measuring

Altimeter: An instrument for measuring altitude.

Clinometers: A clinometer is a simple instrument for measuring grades. Most clinometers have two scales, one indicating percent of slope, the other showing degrees. Percent slope, the relationship between the amount of elevational rise or drop over a horizontal distance, is the most commonly used measure. Don't confuse percent and degree readings. It is easy to do! Expressed as an equation:

$$\text{Percent of Grade} = \frac{\text{Rise}}{\text{Run}} \times 100 \text{ percent}$$

A section of trail 30 m (100 ft) long with 3 m (10 ft) of elevation difference would be a 10 percent grade.

Levels: A device for establishing a true horizontal line or plane by means of an bubble in a liquid that shows adjustment to the horizontal by movement to the center of a slightly bowed glass tube. Carpentry and construction levels, line levels, and laser levels are different types of levels that can be used for construction of fencing, stone walls, boardwalks, and bridges. Levels also help to determine the slope of trail tread.

Abney Level: Hand-held instrument that is adjusted like a sextant and can be set to a fixed gradient. The user sights through the Abney to a fixed reference (usually a second person) until the crosshair bisects the bubble; this indicates the preset grade.

Global Positioning System (GPS) Receiver: A hand-held, battery powered device used to determine the location (latitude and longitude and/or meridian) and altitude using a network of global positioning satellites.

Measuring Wheel: A device that records the revolutions of a wheel and hence the distance traveled by rolling the wheel over a trail or land surface. (Cyclometer)

Other Measuring Devices: The tilt of the handle on an upright McLeod can be used to measure outslope of tread. A partially filled, clear water bottle can be used as a level. Pulaski's are useful as measuring gauges since the handles are exactly 3 feet long and most heads are 1 foot from end to end. Get a tape measure that has metric units. Another good idea is to mark off commonly used measurements on your tools. Know the length of your feet, arms, fingers, and other handy rulers as a ready reference on the trail. Get to know the length of your pace over a known course so you can easily estimate longer distances.

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Tools for Cutting, Sawing and Brushing

Bow Saws: Bow saws come in many sizes and consist of a tubular steel frame designed to hold a sharp and deeply toothed steel blade. Blade lengths can vary from 16 to 36 inches.

Bark Spud: A tool with a 1- to 4-foot long wood handle and a dished blade used to remove bark from logs by sliding between the bark and the wood.

Bush Hook: A long handle and either double- or single- edged curved blade gives the bush hook a powerful cut.

Chain Saw: A portable gas-operated saw with an endless chain carrying cutting teeth.

Cross Cut Saws: A crosscut saw is a large saw intended for cutting through downed timber. This type of saw should be used with wedges to hold the kerf (cut) open to prevent the log being cut from sagging and pinching the saw. The crosscut saw has two handles connected by a long steel saw blade. This saw requires two people to use it. Correctly pushing the saw in sync and at the same speed, while your partner pulls allows the saw to work to it's full potential. After a few pulls, a smooth rhythm may be obtained. Crosscut saws are another tool that takes practice and experience to use safely and effectively and may require certification.

Draw Knife: A tool with a sharp blade and handles at both ends used to strip bark from small diameter logs. (Raw Knife)

Froe: An old hand tool used originally for splitting shingles and shakes. It consists of a heavy, 12-inch-long, straight steel blade with a wooden handle. The cutting edge of the blade is placed against the wood to be cut and a club or mallet is used to hit the face.

Lopping and Pruning Shears: Lopping and pruning shears are similar in design and use. However, lopping shears have longer handles to improve reach and increase leverage for cutting thicker stems. Handles on lopping shears range from 26 to 36 inches long, and should be used on live limbs approximately 1 inch diameter or smaller. Pruning shears have shorter handles and should be used on small branches with diameter of approximately 3/8 of an inch. A good rule of thumb is not to cut anything bigger than your thumb. Use a bow saw for limbs larger than 1 inch in diameter.

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Machete: A large knife used to clear succulent vegetation.

Pole Saw: A pruning saw with a telescoping handle to trim branches that would otherwise be out of arm's reach. Some models have built-in loppers that can be operated from the ground with a rope. (Tree Pruner)

Pruning Saws: Single handled, straight bladed pruning saws are useful for limbing, some brushing, and removing small downfall; especially where space is limited and cutting is difficult. Folding pruning saws are handy.

Scissors: Heavy duty scissors or utility shears are used to cut erosion mat, straw wattles and twine used in erosion control.

Swedish Safety Brush Axe: A machete-like tool with a protected short, replaceable blade and a 28-inch handle used to cut through springy hardwood stems. (Sandvik)

Timber Carrier: A tool, with a long handle and hooks, which allows two people on each side of the carrier to transport logs or timber.

Weed Cutters: Weed cutters are used for cutting light growth like grasses and annual plants that grow along trails. They are lightweight and durable and usually swing like a golf club. Tool with a serrated blade at the end of a wooden handle. (Grass Whips, Weed Whip, Swizzle Stick, Swing Blade)

Wire Cutters: Various pliers-like tools, some with cutting blades only, some with cutting and gripping blades – such as needle-nose pliers or fencing pliers – are used for cutting wire and wire mesh in the construction of protective tree cages, barrier fences, etc.

Tools for Pounding and Hammering

Hammers: A variety of hammers may be used on projects. Sledgehammers or "double jacks" should be used carefully. They are used to drive spikes or to break rocks or concrete. Carry sledges by your side, by gripping the handle near the head. Nail or claw hammers have heads with heat-treated steel faces for driving nails, and claws on the other end for pulling nails. Three and four pound sledges ("single jacks") are used with a rock chisel for shaping stone. Carry the hammer by gripping it near the head, holding the tool away from your body as you walk. Protective glasses must be worn when using hammers, especially a sledge with a chisel. Claw hammers are for driving nails only and should never be used with a rock chisel.

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Rubber Mallet: A short handled hammer with a large diameter, hard rubber head used for driving the wire staples that hold erosion matting in place. Fist-sized rocks are a good substitute if they are available.

Single-Jack Hammer: A short handled hammer with a 3 to 4 pound head. Can be used alone to drive timber spikes, or with a star drill to punch holes in rock.

Sledgehammer: A long handled heavy hammer with a 6- to 8-pound head, usually held with both hands.

Star Drill: A foot-long tool, weighing about a pound, used with a single-jack hammer to punch holes in rock or open a seam/crack. Chisel end is star shaped.

Tools for Lifting and Hauling

Austin Rock Sling: An Austin rock sling is a carrying device made of steel chain configured in a web pattern with rope or steel ring handles. It is generally used to transport large rock for use in walls or other structures. Several Austins used together can be utilized to move large logs and beams for bridges or turnpikes.

Brewery Blanket: A brewery blanket is a heavy nylon blanket generally 6 to 8 feet square and originally used in the filtering process at a brewery. It is useful for transporting duff, soil, and rocks. For heavy loads, a brewery blanket can be knotted at the corners or a golf ball sized rock wrapped in each corner of the blanket to provide the volunteers with a better handhold.

Buckets: Usually a five-gallon plastic container with a heavy wire handle (bail) useful for transporting soil, duff, and small hand tools.

Cable, Wire: A thick, heavy rope, made of wire strands.

Cable Gripper: A device that clamps onto a cable when tension is applied to the attachment point.

Cable Rigging: Cable works and hoists used to lift and move large, heavy rock or logs.

Cable Strap: A pre-cut length of wire rope (that may have eyes on both ends), that is used in rigging applications.

Cant Hooks and Peaveys: Cant hooks and peaveys afford leverage for moving or rotating logs. To roll a heavy log, use a series of short bites with the hook and maintain your progress by quickly resetting it. Catch the log with the hook hanging on top of the log. Rotate the log using the leverage of the handle, working the tool like a ratchet. Moving large logs may require several hooks working together. Avoid taking large bites; a heavy log will roll back and pin the handle before the hook can be reset.

Canvas Bags: The canvas bag or coal sack is a large heavy canvas tote bag with two handles that can be used to carry large volumes of light material such as duff, needles, or leaves. It has the same capacity as about two full buckets.

Clevis: A U-shaped metal piece with holes in each end through which a pin or bolt is run. Used to attach two objects together. (Shackle)

Griphoist: A brand name for a manually operated hoist that pulls in a cable at one end and expels it from the other end; used to move rock or timber needed for trail structures.

Hay Hooks: Also called “bale hooks,” are sturdy steel hooks equipped with D-handles that are designed to be slammed into bales of hay or straw, providing a grip for dragging or lifting them. Hay hooks are also used to grip the mesh or handles of wire baskets enclosing the burlapped root balls of B&B trees to aid in moving and positioning them.

J-Straps: Nylon loop straps attached to a shoulder pad are used to carry rock bars comfortably by transferring the weight to a shoulder.

Log Carriers: Log carriers enable teams of workers to move logs. The tool hooks the log, allowing persons on either side of the handle to drag it. Several carriers could allow four or more persons to carry a large log.

Ratchet Winches or Come-Alongs: Hand operated winch. Ratchet winches (also called come-alongs) are useful for pulling stumps and for moving large rocks and logs. These winches offer mechanical advantage – the Grip Hoist is a specialized winching system that provides a mechanical advantage of 30:1 or more.

Rope: A large stout cord of strands of fibers or wire twisted or braided together.

- Working End: The end of the rope being used at the time to tie a knot.
- Standing Part: The part of the rope not being used at the moment.
- Bight: A curve or bend in the rope. This is usually a loop through which the working end is passed.

Skyline: Rigging system with a highline by which a load is moved via a pulley, pulled by a separate rope.

Slackline: Rigging system with a highline, which is lowered to pick up a load, then tightened to move the load.

Snatch Block: Pulley with hinged side plate allowing attachment anywhere along a fixed rope.

Sod Stretcher: A carrying device similar to a medical stretcher, consisting of a large rectangle of fabric (usually a brewery blanket) with sleeves sewn into its long sides to receive two rock bars or aluminum pipes which serve as stiffeners and carrying handles. The pipes are usually held apart by plywood spacers slipped over the pipes at the ends of the blanket. Sod stretchers are used to carry chunks of sod, plant plugs and small tree plugs that are being harvested or transplanted.

Tumpline: A strap slung over the forehead, to anchor a backpack.

Wheelbarrows: Wheeled tub used to transport loose materials.

Winch: Applicable to a broad array of devices that use a drum, driven by a handle and gears, around which a cable is wound, to provide mechanical advantage for moving heavy objects.

Wire Cable: A thick, heavy rope made of wire strands.

Zipline: Rigging system with a taut, stationary wire rope highline for moving loads on a movable pulley.

Tools for Chopping and Grubbing

Adze Hoe: The modern adze hoe has a forged steel head with a large, almost flat blade set at a 90-angle to a three foot wooden or fiberglass handle. The head is “friction fitted” to a bent “adze style” handle. You use an adze hoe to chip or break up clumps of soil when constructing new trail or outsloping an existing tread.

Axes: Axes are of two basic types – single or double bit. Single-bit axes have a cutting edge opposite a flat face. Double-bit axes have two symmetrically opposed cutting edges. One edge is maintained at razor sharpness and the other is usually somewhat duller as result of chopping around rocks or dirt.

Cutter Mattock: A cutter mattock has a broad mattock blade, but also a short stout axe or cutter blade in place of the pick point.

Fire Rake: A tool with triangular tines used to cut duff and debris from firebreaks or trail corridors.

McLeods: The McLeod combines a heavy-duty rake with a large, sturdy hoe. The hoe edge of the McLeod is about 9 ¾ inches wide and the head is 11 inches at its widest point. The head can be used for tamping soil or crusher fines. The McLeod is also useful as a slope gauge. When planted standing upright on a trail tread, the tilt of the handle will indicate the slope of the tread. You can clearly see whether the trail is insloped or outsloped.

Pick Mattock: A pick mattock has a broad adze or mattock blade instead of the clay point. The mattock blade is good for working in most soils and may be used to cut roots or chop clumps of grass.

Railroad Pick: The modern railroad pick is a heavy digging tool with a stout forged steel-head. The head has an “eye” or socket for a handle and two points. The “chisel” or “clay” point is flat and used to work hard packed clay soil. The point is tapered and is a good tool to use for general digging in rocky soil.

Pulaskis: The Pulaski combines an axe and an adze hoe in one multi-purpose tool. The tool is named for Edward Pulaski, circa 1910, a Forest Service Ranger and part-time blacksmith. He developed the tool especially for firefighting purposes.

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Rakes: Lightweight rakes are usually used for smoothing and leveling surfaces, for spreading and seeding.

Tools for Digging, Scooping and Planting

Auger, Soil Auger: T-shaped tool with a spiral tip for turning into soil to probe its content.

Auger, Power Auger: Consists of a vertical shaft with a spiral tip for digging into the soil, and a small motor mounted on the top of the shaft for turning it. These are used by some agencies to dig planting and fencepost holes in non-wilderness settings. Various models may be operated by one or by two or more people.

Dibble: Essentially a tapering, pointed stick used to open a hole for small plants (e.g. grass plugs) by thrusting the point into the soil and moving the handle with a circular motion to enlarge the diameter of the hole. Dibbles may be long or short, thin or thick, wood or metal, and may be equipped with a cross-piece to grip on the handle. They are frequently used in wetland restoration for planting plugs of grasses or sedges.

Digging-Tamping Bar: A long bar with a small blade at one end for loosening compacted or rocky soil and a flattened end for tamping.

Planting Bar: A heavy steel tool consisting of a three foot rod-steel handle tipped with a steel wedge that has a foot plate projecting from one side, near the ground. The wedge is stepped into the ground with foot pressure applied to the foot plate and the handle is pushed away from the user to open a hole to receive a small plant, such as a tree seedling or grass plug. Perhaps best used with one person opening holes and a partner installing the plants.

Posthole Digger: Consists of a hinged pair of clam-like blades attached to long handles. Spreading the handles apart causes the blades to close, making it possible to grip and remove pre-loosened soil from a narrow hole. Occasionally used to dig signpost, fencepost and small planting holes.

Rockbars: Mild steel bars, 6 feet long and designed with a chisel tip for loosening dirt or prying rocks and a pointed end for prying or a tamping end for compacting soil.

Sharpshooter: A short handled spade with a D-grip and a long, narrow, round-tipped blade which is useful for digging and lifting transplants and for cleaning soil out of trenches.

Shovels: Shovel blades are either square-edged for scooping (good for piles of loose material) or pointed for digging in soft or pre-loosened soil, with either a wooden or fiberglass handle that can vary from three feet to five feet long.

Trowel: A small planting tool, usually a foot or less in length, with a straight handle and shovel-like blade.

Tools for Personal Protection

Clothing: Long sleeved shirts and long pants are suggested clothing when working and may actually be required by some agencies. Shorts are not recommended.

Dust Masks: Dust masks can be used for some types of rockwork and in extremely dusty conditions.

Ear Protection: Ear protection is needed when working near most motorized equipment and working in any environment with loud, repetitive noises such as chipping rock with a manual jackhammer.

Footwear: Sturdy shoes or boots are preferred due to the rugged terrain associated with trail or outdoor work. They are necessary to protect the feet from glancing tools, loose rock, dense vegetation, and cactus and provide good footing when working.

Gaiters: Coverings that zip or snap around the ankles and lower legs to keep debris and water out of your boots. (Leggings, Puttees)

Gloves: Work gloves are necessary to protect the hands from blisters, thorny brush, poison ivy, or any other minor scratches associated with outdoor work. Gloves also help with gripping tools.

Hardhat: A hard shell worn on the head as protection during trail work. Hardhats are an agency requirement for many types of work, especially when working in timber or when there is a chance of being hit on the head and risk of head injury.

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Safety Goggles or Glasses: Eye protection is important for any type of work whether digging, cutting, sharpening, sawing, chipping rock or for when there is a chance of something getting into your eyes.

Safety Harness: A body belt or strap usually made of nylon, for use while working near steep drop-offs. Must be of approved construction and design, and in good repair, and attached to a secure anchor point with carabiners and approved climbing rope.

Sheath: Protective covering made of leather or plastic used to cover sharp blades of tools while in storage or when the tools are transported.

Suggested Tools Per Crew

The following table outlines the suggested range of tools needed for equipping crews for various types of work. Evaluate the tool needs for each crew as it relates to the work project and adjust the list accordingly. This table is based on a crew size of seven workers.

SOME BASIC TIPS:

- Two tools can be carried per worker (one in each hand)
- Smaller tools can be carried in packs or buckets
- Carry tools with protective sheaths on.
- Tools can be carried in a wheelbarrow to the work site

Tool	New Trail Construction	Easy Trail Construction	Trail Maintenance	Trail Closure	Crusher Fines	Tree Planting	Habitat Restor
Adze Hoe		1	1		1		
Bow Saw	1	1	2				1
Br. Blanket	1	1		2		3	2
Buckets	4	4	4	6		6	2
Canvas Bag				1			
Lopper	1	1	2				
McLeod	3	3	3	4	5	2	3
Pick Mattock	2	1	2			1	2
Pulaski	2	2	2	1	1	2	1
Rake					2		1
Rock Bar	2	1	1	1	1	2	1*
Shovel	3	3	3	4	5	4	2
Wheelbarrow		2		2	4		1

New Trail Construction – rocky, forested slopes

Easy Trail Construction – grassy meadows

Trail Maintenance – corridor clearing, tread maintenance, drainage structure maintenance

Trail Closure – other tools may be needed such as small trowels

Crusher Fines – assumes trenching has been completed by machinery. Crew does finishing work on trench and transports and spreads fines material

Tree Planting – other tools will be needed such as wire cutters & hammers

Habitat Restoration – closing old trail or road; prepping the soil, seeding, and transplanting some native plants. Installing erosion matting if needed on slopes would require additional tools such as 1 scissors, landscape staples, and 2 small sledgehammers per crew.

*1 rock bar every other crew to be shared if possible

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Safety and Tools

TOPIC: Tool & Safety Talk

Crew Leaders are responsible for the safety of their assigned crew and for anyone who passes through their work section. Project safety begins as soon as the Crew Leader meets their crew.

The Safety and Tool Talk will establish safety guidelines for the crew at the start of the day. The Safety presentation informs volunteers of safety issues such as dehydration, sunburn, over exertion, poison ivy, and other site-specific hazards. The Tool Talk establishes safe ways to carry, use, and store tools during the project. Wearing appropriate clothing at all times (boots, gloves, etc) sets a good example for the crew.

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If An Accident Occurs...

- The Crew Leader should stay with the accident victim.
- Only the Crew Leader (or his/her designee) should be in verbal communication with the next level in the chain of communication.
- Make sure you can give clear directions about your location to staff or medical personnel. Be prepared to send Crew Members to strategic locations as a flag, or to notify the appropriate staff or medical personnel as per the established chain of communication appropriate to the Project Safety Net.
- Do not talk to the media. Refer them to agency personnel.
- Do not attempt anything medically that you or your crew has not been trained to do.

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Crew Leader Safety Talk Checklist

___ Have Crew Members completed a liability waiver if required?

___ Make sure your crew has appropriate footwear, clothing, eye protection, and gloves.

___ Do Crew Members have lunch and enough water?

___ Do Crew Members have sun protection (hat, sunscreen, sunglasses, and lip balm?)

___ Discuss the project goals, specifications, and context.

___ Specify the length of hike and type of work.

___ Explain any site- or project-specific hazards.

___ Ask that persons with specific health concerns notify you about them in private. Some items you should know about include: back problems, allergies (insect, plant, and medication), diabetes, heart and lung problems, epilepsy, and other serious physical conditions.

___ Ask if any of your crew are certified Emergency Medical Services personnel (EMS) or other health care professionals. Ask if anyone is certified in CPR or Wilderness First Aid. Establish primary and secondary medical chain of command within crew.

___ Explain to your crew the Project Safety Net and the chain of communication for the project. (Refer to Know Your Agency and Organization Protocols). Select someone on you crew to act as an alternate leader to start the safety net process should you become incapacitated.

___ Explain “Coming Through!” or “Bumping By” and practice it at all times.

___ Demonstrate why safe working distances are important. Be sure that people working near a hazard (chipping stone, lumber cutting, etc) stay at a safe distance and are wearing eye and/or ear protection.

___ Hardhats should always be worn if there is any risk of head injury (on steep slopes or areas where rock or other materials may come down from above) or if required by the agency.

___ Demonstrate how to lift with the legs and not with the back. Get help and/or tools to move heavy objects.

___ Reiterate through the day the crew’s need to drink water, even when they may not be thirsty (drink water at least every 15 minutes). Remind them that by the time they feel thirsty, they are already dehydrated. Enforce water breaks by taking them as a crew throughout the day.

___ Stress the need to wear sunscreen. Watch for sunburn throughout the day.

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___ In areas where West Nile Virus may be a concern, stress the need to wear insect repellent.

___ Lead the Safety Warm Up and stretching exercises at some point before starting the work. Use the opportunity to provide further information on additional safety issues.


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Safety and Tools
TOPIC: Safety Warm-Up

This unit is designed to teach Crew Leader Trainees how to lead a simple warm-up stretching exercise in the field with a crew, while emphasizing safety concerns simultaneously.

The Safety Warm-up Exercise is an easy way to prepare a crew for project work, and a great way for a Crew Leader to facilitate leadership of a group in a fun, interactive way at the beginning of a day. Because stretching is more effective after 15 minutes of exercise, this exercise may be more productive after hiking to the work site.

This exercise can also be utilized as an “ice breaker” to introduce Crew Members to each other.

Safety is the most important component of a restoration project, therefore Crew Leaders must stress that Safety is the Number One Priority. A successful project is a safe project – getting the work done is secondary!

Examples of appropriate stretches:
- Arms over head and bend side to side
- Low back arch (numerous times)
- Bend forward to stretch back-touch toes (numerous times)
- Forward lunge-keep back leg straight and foot flat on ground
- Arch back and pull shoulder blades together

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Safety and Tools

TOPIC: Basic Risk Assessment

The Crew Leader is responsible for the safety of a crew and therefore needs to understand the basics of risk assessment. Crew Leaders will perform risk assessments constantly throughout the workday. Crew Leaders need to assess potential hazards while hiking to the work site, while working at the work site, and even during lunch!

The term “risk” includes three concepts: the hazard, the possible outcomes, and the likelihood. A hazard is a situation that can cause harm to a person. An outcome is the resulting injury due to a hazard. The likelihood describes the level of probability of the outcome.

For example, one of the possible risks of standing in front of the group to teach this course is that the instructor could step on a loose rock (hazard) and sprain his or her ankle. The instructor may experience pain, need to go to the doctor, and could even miss a paid work day (outcomes). However, the likelihood is low.

Once we understand the risks of any particular activity, we can think about how to mitigate, or lessen the likelihood of each. If the severity of the outcome and the likelihood are both low, we may choose to do nothing to mitigate the risk. But if the severity is high (even if the likelihood is low), we will probably choose to take some mitigation action. For example, when operating a vehicle on icy winter roads, an accident could cause death for the driver. Although the likelihood is relatively low, the severity is high: we will both adhere to safety standards already in place (following the rules of the road, wearing our seatbelts) and implement some new ones ourselves (driving slowly and cautiously.)

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Hazard-a-Guess Scenario

Potential Hazard	Potential Injury / Outcome	Likelihood (high/ med/low)	Need to mitigate? Y/N	What measures are already in place?	What should be done?

Safety and Tools

TOPIC: Know Agency and Organization Protocols

COTI-trained Crew Leaders may work with many different agencies and organizations. “Agency” refers to local, state, and federal land management organizations. “Organization” typically refers to non-governmental or non-profit groups.

Because every agency and organization has different communication protocols and a different safety net, this unit reviews what questions need to be asked before and during a project.

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Project & Safety Checklist

Use the checklist to complete the Project & Safety Information Form. It is ESSENTIAL that you know this information and do everything you can to collect details.

Before you arrive on the project:

1. ❑ Contact the sponsoring agency.

- a. ❑ Find out the Agency Staff Liaison's name, title, and contact information.
- b. ❑ Give the Agency Liaison YOUR contact information.

2. ❑ Contact the Agency Staff Liaison to make sure you have all the basic information:

- a. ❑ What are the dates of the project?
- b. ❑ Where is the project located?
- c. ❑ What type of project is it?
- d. ❑ What are the goals of the project?
  How much does the agency expect you to accomplish?
- e. ❑ What is the background or context for the project? Why are you doing it?
- f. ❑ Where do you get the tools for the project?
  Is any special equipment needed for the project?
- g. ❑ What are the specifications they want you to follow (for example, spacings for plantings)?
- h. ❑ Are there any special regulations for the area? What should the Crew Leader do if someone is violating a regulation?
- i. ❑ Will an agency person be at the project?

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3. ❑ Ask the Agency Staff Liaison some questions about the safety and communications network for the project:

a. ❑ Find out what the safety and communications net will be for the project, and if there is a project safety plan specific to the agency. In case of an emergency, what is the chain of communication?

b. ❑ Get the agency's safety and communication protocols in writing! If a serious accident occurs, (i.e., medical transport, airlift) you may not remember what to do.

c. ❑ Find out if there are any special safety concerns for the project.

d. ❑ Will there be an EMS personnel on site at the project?

e. ❑ Where is the nearest medical facility?

f. ❑ Find out what forms they will require you to use. These could include liability waiver forms, accident forms, incident forms, etc.

When you arrive at the project:

❑ 1. Park your vehicle facing toward the exit – make sure it won't be blocked in!

❑ 2. Check in with agency person when you arrive on site (if there is one on the project).

❑ 3. Learn about the specific evacuation plans.

❑ 4. Find out if the agency wants to be informed of all medical incidents, no matter how small.

❑ 5. Find out which Crew Member(s) have the highest level of medical training, and appoint a stand-in Crew Leader, in case you get hurt.

❑ 6. Obtain any agency communication devices, such as a radio. Learn to use it! Is the radio set on the proper channel?

❑ 7. Obtain maintenance, restoration or trail notes.

❑ 8. Ask that safety and communications protocols be provided in writing.

❑ 9. Review the project-specific safety protocols, and Job Hazard Analysis, if applicable, with your crew.

❑ 10. Do not let Crew Members avoid safety protocols.

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Project & Safety Information Form

	PROJECT NAME		
	SPONSORING AGENCY		
1a	AGENCY STAFF LIAISON'S NAME AND TITLE		
	OFFICE PHONE	CELL PHONE	EMAIL
2a	PROJECT DATES		
2b	PROJECT LOCATION		
2c	TYPE OF PROJECT		
2d	PROJECT DESCRIPTION, GOALS		
2e	PROJECT BACKGROUND		
2f	EQUIPMENT/TOOLS NEEDED & LOCATION		
2g	PROJECT SPECIFICATIONS AND STANDARDS		
2h	SPECIAL AREA REGULATIONS		
2i	AGENCY PERSON ON SITE OR AVAILABLE DURING PROJECT		
3a	COMMUNICATIONS / SAFETY NET		
3b	SAFETY / COMMUNICATIONS PROTOCOLS		
3c	SPECIFIC PROJECT SAFETY CONCERNS		
3d	WHAT TYPE OF EMS PERSONNEL WILL BE ON SITE AT PROJECT?		
3e	NEAREST MEDICAL FACILITY		
3f	NECESSARY FORMS REQUIRED (LIABILITY WAIVER, ACCIDENT, INCIDENT, ETC.)		
	IMPORTANT PHONE #'S / RADIO CHANNELS / SECONDARY EMERGENCY CONTACT AND NUMBERS		

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A Crew Leader's Daily Reminder

Start of Project

GREET crew members as they arrive
- Supply name tags for everyone (if you decide to use them)
- Ensure waivers are signed (if required)

INTRODUCE yourself and crew members

DISCUSS project expectations, work objectives and work site specifics
- How far/difficult is hike/travel to site
- What type of work will be done

LEAD Safety Stretch Exercise (may be done upon arrival at the worksite)

DEMONSTRATE/PROVIDE Safety/Tool Talk
- Discuss safety and first aid
  - Find out crew members health needs
  - Make sure everyone has water, food, clothing, boots, and gloves for the day
  - Ask if anyone has medical/first aid training
  - Explain your level of first aid training and where a first aid kit is located
  - Explain the safety net for the project
  - Explain the environmental and safety hazards for the project
- (CUSS) Carry, use, storage and safety of tools being used that day

HIKE/TRAVEL to the work site at a pace everyone can handle
- Put your slowest hikers/travelers in front
- Check tool carry and safety on the way to the site

Upon Arrival at the Worksite

EXPLORE work area and discuss with crew members
- Find out what talents, experience or expertise crew members have
- Utilize project notes (if provided) to explain tasks and standards for project

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DEMONSTRATE tasks to be performed during the day

- Provide a short talk on ecological restoration and terminology and tasks to be performed (seeding, planting, erosion control)

DELEGATE tasks to crew members accounting for individual preference, ability and skill

Ongoing/Throughout Project

PROMOTE a safe work environment

- Take breaks as needed
- CUSS for tools
- Encourage crew members to work at a comfortable pace.
- Continually assess for risks

PROVIDE a positive work environment through:

- Demonstration of appropriate leadership styles
- Praise and recognition of crew members
- Utilizing active listening techniques, giving appropriate feedback, and demonstrating tact and diplomacy in negotiations and confrontations with others
- Understanding motivational styles
- Understanding learning styles and using effective teaching techniques
- On-going assessment of crew members (expectations, skill level, personality, performance, and safety)
- Identifying problems in the field, creating a plan of action to resolve problems, communicating the plan to crew members, and motivating them to implement solution
- Using a group approach to solve problems
- Modeling appropriate behavior
- Having fun!

End of Project

WALK work site at end of project with crew members to assess work accomplished

- Gather tools, packs, clothing, trash, etc. so that nothing is left behind
- Give thanks to crew members for a job well done and encourage them to volunteer/work again
- Check tool carry and safety on the way out

ENCOURAGE crew members to provide feedback on project

Fill out evaluation form provided

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Conclusion

CONGRATULATIONS!

You have completed *Crew Leadership Training for Trails*. *Crew Leadership for Trails* is a basic course for crew leadership. Time limitations and the amount of material covered in the course have not allowed you the opportunity to practice being a Crew Leader. **COTI recommends that in addition to this course, you work under an experienced Crew Leader or arrange for mentoring to gain confidence prior to leading a crew.** In addition, many organizations and agencies have established protocols and programs for their Crew Leaders. **You need to check with these entities to get any additional training that is specific to that group.** The Daily Reminder summarizes all of the basic components from the training workshop and presents the information in a simple format that can be utilized in the field. Following the basic reminders will promote a better crew leading experience.

HAPPY TRAILS TO YOU!

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