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ABSTRACT

This teaching guide provides basic information on training outdoor leaders for a wilderness course at the National Outdoor Leadership School (NOLS) in Lander, Wyoming. The first chapter, "Teaching at NOLS," overviews teaching fundamentals and describes teaching techniques such as the use of demonstrations, modeling, formal classes, inquiry, teachable moments, debriefing, story telling, and games. The remaining chapters include: (2) Outdoor Living Skills, which covers backpacking, campsite selection, tent and fly pitching, sanitation, stove use and care, nutrition, fire building, fishing, and other skills relevant to outdoor education (3) Mountain Travel, focusing on travel and hazard evaluation skills such as trail techniques, map reading, hazard evaluation, risk management, route finding, compass navigation, and river crossings; (4) Leadership and Teamwork, which outlines information for teaching outdoor leadership and judgment skills related to expedition behavior, student teaching experiences, and expedition planning; (5) Environmental Studies, covering topics related to land management practices, natural sciences, physical sciences, and environmental ethics; and (6) First Aid, covering basic skills such as patient assessment, soft tissue injuries, cold injury, dehydration, shock, altitude illness, and emergency procedures. Each instructional topic includes a general statement related to the relevance of the subject, educational goals, specific course information related to educational goals, effective teaching methods, and a list of resources for locating additional information on a topic's key points. Appendices include tips for student leader exercises, a list of effective leadership habits and skills, and strategies for fostering initiative among student leaders. (LP)

NOLS

A Guide To The NOLS Wilderness Course Curriculum

"Our teaching method is demonstrated under realistic conditions and followed by action. To teach mountaineering, we climb mountains. [illegible] [illegible] conservation, we practice conservation."

Paul Petzoldt

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Every NOLS instructor who ever wrote a Newsletter article or submitted a curriculum file helped write this book: my apologies to them for presenting their collective ideas without footnoting, but the WEN has had so many contributors, this would have been impossible.

A special tribute should go to Del Smith, John Gookin, and Tod Schimelpfening for their continuous support and editorial insight in sorting out the direction and content of this document.

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Happy Trails,
Craig Stebbins

INTRODUCTION

Paul Petzoldt established the National Outdoor Leadership School to train outdoor leaders. He taught his students the skills required to take others safely into the mountains while they traveled through mountains. He summarized his educational theory with the following explanation: "Our teaching method is demonstrated under realistic conditions (and) followed by action. To teach mountaineering, we climb mountains; to teach fishing, we catch trout; to teach conservation, we practice conservation." Since 1965, the school has continued to follow this model and our instruction still takes place on extended expeditions.

In the past the curriculum covered on these expeditions was privy only to those directly involved in the "experience"—the instructors and students. Written material was limited to instructional checklists and catalog descriptions. Despite this lack of an officially documented curriculum, the school has produced qualified outdoor leaders for years. Most of the credit for this success comes from the strong oral tradition instilled during instructors courses and developed while field staff apprentice as instructors and patrol leaders.

The Wilderness Education Notebook is an attempt to write some of the oral tradition down. Designed to be a resource for our Outdoor Educator (OEC) and Summer Instructor Courses (SIC), the WEN is intended to help meet the student outcomes for the most typical NOLS course, the Wind River Wilderness Course (WRW).

The notebook does not contain everything you need to know to be a NOLS Instructor. We have not included specific lesson plans, rules or guidelines, and we assume that the reader has prior field experience. What the WEN does contain are some commonly agreed upon educational goals and basic content suggestions. Additionally, it identifies key points of instruction, provides some popular teaching techniques, and suggests some helpful resources.

The WEN should be viewed as a springboard from which NOLS instructors and other outdoor educators can further develop their teaching effectiveness. By consciously thinking about what information we want our students to gain and by examining ways to accomplish these objectives, we can become more effective educators.

Eventually new instructors will master many of the techniques and much of the information in this book, but this is not the end of the process. Mastery of the basics is what allows a professional to do the creative work that moves the profession forward. Experienced instructors must continue fine-tuning the curriculum and look for exciting new ways to teach it.

WHAT YOU CAN EXPECT TO FIND IN *THE WILDERNESS EDUCATION NOTEBOOK*

The *Wilderness Education Notebook* organizes the WRW curriculum into six major chapter headings: Teaching at NOLS, Outdoor Living Skills, Mountain Travel Techniques, Leadership and Teamwork, First Aid, and Environmental Studies. The chapters on teaching and outdoor living skills provide content suggestions and tips on ways to convey that information effectively. The environmental studies chapter includes simple overviews of common natural history topics. The first aid chapter offers suggestions for class content and teaching progression, but details are best found in *NOLS Wilderness First Aid*. Likewise, the most thorough sources for teaching our climbing curriculum are *NOLS Wilderness Mountaineering* and the *Climbing Instructor Notebook*, while for covering land management issues, refer to *An Introduction to Wildland Ethics and Management*.

Each instructional topic begins with a general statement that suggests the importance and relevance of the subject. This is followed by an **Educational Goals** section that sets the school's basic expectations for what a student should know or be able to do by the end of the course. Circumstances may prevent us from reaching these goals, but they represent what we should accomplish on a successful course.

Key Points outlines important information to help you attain the desired educational goals. Instructors should feel free to reorganize the basic material and make additions as they see fit. Carefully consider how much material you will present in any one setting. A common misunderstanding of early WEN users was to teach everything about a topic at the first instructional opportunity. Determine your content based on your students' immediate needs. Maybe you'll have the opportunity to teach the rest of the information by the end of your course, but surely not the first day.

The **Teaching Considerations** section briefly describes teaching methods instructors have found successful. This section also looks at how, when and where the topic fits into the course experience. **Resources** offers sources for locating information on a topic's key points.

There are risks and hazards inherent in any wilderness activity. This book does not claim to minimize these risks or to alert you to all the hazards of the mountains. It is a learning tool and should be read and studied as a supplemental source only. Reading the WEN does not qualify someone to be an outdoor educator or a NOLS instructor. It is not a substitute for professional instruction, an experienced mentor, or actual experience in the backcountry where one learns solid outdoors skills, responsible habits, and sound judgment. If you decide to participate in activities described in this book, the risk and responsibilities for the outcomes are yours. No one associated with the publication of the WEN, including NOLS and Craig Stebbins, accepts responsibility for any injury or property damage that may result from participation in such activities.

CHAPTER ONE

TEACHING AT NOLS

BACKGROUND

Wind River Wilderness courses are physically and mentally challenging educational experiences. They take you into an environment where even the simplest tasks require planning, communication and teamwork—where the mere act of living and working with 15 strangers can stimulate growth and change. In addition, everything from weather to terrain and group makeup provide opportunities for learning that an instructor should be prepared to incorporate into the educational process.

Experiential education—the stuff we 'do' at NOLS—depends upon firsthand experience. Regardless of the style or format of our teaching, we try to support instruction with activities. Ultimately, our teaching is intended not only to prepare students to meet wilderness challenges on their own, but to lead others as well.

Before you leave for the field with your course, students must be aware of your expectations and goals. Once away from town, select challenges that are appropriate for the group, and balance teaching and activities with free time for students to process their experiences.

EXPECTATIONS

High standards of performance reward our students, NOLS and ourselves. The curriculum guidelines for our Wind River Wilderness course state: "As a result of the course, we expect our students to be safe, competent and responsible wilderness travelers and leaders." These expectations must be made clear during course orientation and then followed up on in the field. You can let students know that having fun and enjoying each other is a goal, but their primary focus should be on learning.

Tell your students you expect them to take personal responsibility for their education. We can help them by taking time to explain our actions and decisions, and by creating an atmosphere in which questions can be asked. It is up to the students, however, to let us know when they do not understand instructions or are not picking up a skill. This is more responsibility than many students are used to, so expect to have to do some coaching to help them develop this habit.

CHALLENGE

To get the most out of a course, students must succeed. John Gookin, the NOLS curriculum manager, says, "Too much challenge and our students miss the sweet taste of success. Too little challenge and we dishonor them with low standards." Overcoming natural obstacles and solving real problems in the backcountry brings out the best in our students, but calculating what is "enough" challenge can be difficult.

BALANCE

Do not let your enthusiasm and educational agenda overshadow your students' needs. Modern educational theory states that people retain information best when it is attached to an emotional experience. Private time gives students the opportunity to address their emotional needs, reflect upon the course, and absorb new data. A break from instruction also allows them to develop sound outdoor habits and appreciate the wilderness.

FUNDAMENTALS OF TEACHING AT NOLS

Advice for new instructors: focus on teaching a few things well. Get off to a good start by being yourself, displaying a relaxed manner, conveying a positive attitude, being prepared, sticking to a basic formula, and using time wisely. Hone your teaching abilities by watching other instructors and borrowing what works. Ask for timely feedback and make an effort to evaluate your effectiveness. Successful wilderness educators utilize a variety of techniques and vary their styles with the changing needs of their students and the environment, so be flexible and creative.

Petzoldt recommended using a factual, dignified manner coupled with a sense of humor when addressing a group of students, but you need to develop your own style. A dramatic voice and vibrant presence may catch the students' attention, but if this isn't you, they will know. People are more likely to listen to a person being herself than they are to a mimic.

Make eye contact to establish a relationship with students. By addressing your students, rather than the sky or the horizon, you will notice if the group is asleep, awake, or squirming with full bladders. In addition, direct eye contact makes the students feel as if you are addressing them individually. Personalized attention often draws them into the subject being discussed. Transfer your enthusiasm to the audience by using a relaxed, alert and natural tone. Sitting like a sack of potatoes, fidgeting, or lecturing with your hands in your pockets conveys nervousness or disinterest.

PREPARATION

Do your homework. Only under exceptional circumstances should an instructor try to teach a skill or subject he has not physically done or personally experienced. Expanding our knowledge base allows us to connect topics and explain key points. A professional is up-to-date and knows where to refer a student with questions he can not answer.

SETTING

Constant evaluation of your classroom is essential in the outdoors. Be aware of conditions that may jeopardize safety and comfort. Ask yourself, "Can I manage my students in this environment safely?" If the answer is "no" or "maybe not" then modify the activity or change the location. By explaining your decision, you will further your students' education. In addition, an instructor must assess whether the students' physical comfort is affecting their ability to learn. Difficult weather, loud noise, intense sunlight, wind, and exposure are distracting and should be minimized in order to maximize the educational benefits of your teaching.

PROGRESSION

Pick the brain of every course leader you work with. The conscious sequencing of instruction is a learned art. For example, when teaching how to build a tyrolean traverse, students are able to focus best when they have been instructed about pulleys, rope throwing, and basic anchor techniques beforehand.

In order to develop an effective teaching progression, ask yourself, "What do the students need to know next in order to face the challenges ahead?" Choosing activities and instruction that match the abilities and interests of your group can be challenging, but your students will learn more quickly and with less unnecessary stress if you do not overwhelm them with information too early in the course. You can learn a great deal about when and where to teach different topics by watching other instructors.

THEMES AND "NOLS PRIORITIES"

Instructional themes provide a lattice that can be applied to a variety of discussions, activities or instructional settings. When you mention the NOLS priorities—safety of the individual, safety of the environment, and care of the equipment—in both your basic stove class and your warm and dry discussion, you are teaching with themes. Themes can be used to bring out similarities between subjects and to unify seemingly unrelated topics. Don't let yourself be intimidated by the 65 topics on the instructional checklist; look for themes to help present them in manageable chunks. Everything from low-impact camping to safety, judgment, and ecological concepts lend themselves to this approach.

Themes can also be used to integrate information, emotion, and a variety of teaching techniques into a powerful educational experi-

ence. An astro bivy provides a great opportunity to marvel at the immensity of the universe while sharing an experience that helps a student group bond. Combining first aid instruction with emergency procedures during a simulated accident gets students thinking on their feet and prepares them for traveling on their own. Including the importance of hydration and proper nutrition in a class on how to stay warm and dry helps reinforce critical themes.

BREVITY

Petzoldt advocated brevity and exactness for effective outdoor teaching. Keep this in mind when preparing your lectures. Formal classes work best when they are short and to the point. Time saved with precise instruction can be put towards activities, socializing, or enjoying the wilderness—all important components of a NOLS education.

FEEDBACK

Constructive feedback enables people to learn from their mistakes and acknowledge their accomplishments. Feedback is essential to the learning process and is most effective when it is immediate, specific, growth-oriented, tactful, and shows a cause-and-effect relationship.

LEARNING STYLES

Modern educational theory suggests that we learn best through the coordinated use of our senses—by seeing, hearing and doing. Some students learn best through verbal instruction. Others prefer to watch someone demonstrate a skill or activity once and then try it themselves. Still others need time to reflect on the experience before they will feel comfortable attempting it.

Age, physical ability, education, personality, and motivation all must be considered before determining the most appropriate teaching method for any given group. In a group composed of individuals with many different learning styles, an effective instructor may incorporate everything from visual aids and activities to lectures and discussions in order to accommodate all the students' needs.

ASSESSMENT

Our goal is not to teach our curriculum, it is for our students to learn it. We need to assess where our students are in their education constantly, so we can decide how much latitude to give them, and how much past material needs further enhancement. Quizzes and wilderness jeopardy are easy ways to check people, but the ultimate test is to observe our students' habits. Their spontaneous reactions to real situations are good predictions of what they'll do as outdoor leaders after the course. This reality based assessment and coaching can only be done on extended expeditions, and, according to WEA board members, William Forgey M.D. and Paul Petzoldt, is what sets NOLS apart as the ultimate model of an outdoor leadership program.

TEACHING TECHNIQUES

DEMONSTRATIONS

Demonstrations should create lasting images of major points. Actually getting on a snow slope and doing a self-arrest is much more effective then describing the technique in a meadow back at camp. But it is irresponsible to demonstrate what is easy, instead of what is important. For instance, consider the implications of someone teaching her students how to pull traction on a broken bone, but then neglecting to demonstrate how to maintain it.

The expression "Keep it simple, stupid" (KISS) is intended to remind us that effective instruction does not require complex explanations and fancy demonstrations. Basic teaching relies on a discuss-demonstrate-do formula. With experiential education, the emphasis should be on the demonstrate and do.

ACTIVITIES

Activities are the "do" aspect of learning. At NOLS, we believe they are the core of outdoor education. Unlike a traditional classroom setting, the wilderness provides unlimited firsthand learning opportunities. Here you can have the students go out and observe the characteristics of trout habitat instead of studying it in a book. **A typical WRW course probably spends two to four hours in activities for every hour spent in class.**

Activities are most effective when they are pertinent. Examples of some you can use to enhance your teaching include natural history games, astro bivies, river crossings, climbing, fishing, solos, accident scenarios, animal tracking, ecology walks, and campsite cleanups.

NOLS instructors do not commonly practice more symbolic activities such as ropes courses and new games. It is a challenge to avoid overcrowding a 30-day course, and we accomplish many of the goals of these activities through normal wilderness ones. More importantly, we need to emphasize activities that will help our students be effective outdoor leaders after the course.

MODELLING

"At NOLS, as an instructor... you are the message...you are the course; you are NOLS. Your students don't have to hear a message, they can see it." This quotation by educator Ed Porthan at a NOLS Conference illustrates how instructors model the school's values and expectations to their students. Students learn from watching us be good campers, safe climbers, effective leaders, positive expedition members, and skilled problem-solvers. But they also pick up bad habits from us. It is important, therefore to be aware of the impact of your actions. An instructor who denounces fishing as cruel, influences his students' decisions about picking up a fly rod. Try to present all sides of issues and avoid imposing your opinions on your students.

FORMAL CLASSES

Formal lectures can range from a five-minute talk about beaver dams to an involved class on altitude illness. The shorter classes are designed to spark interest, while longer lectures provide a more thorough working knowledge of a subject. Formal classes are the fastest way to pass on concentrated information, but it takes hard work to make them really effective.

Sticking to the basics is essential to the success of formal classes. If you get bogged down in mundane details, you will loose your audience. Follow the saying: "Tell them what you're about to tell, tell them, then tell them what you told them." The initial outline helps students mentally organize themselves. The concluding one reinforces key points.

INQUIRY

Since most people have a limit on how long they can sit through formal presentations, try to avoid relying too heavily on lectures. Vary your technique by employing the inquiry method of teaching. This style has students apply their knowledge directly to new situations. For example: follow up your introduction to alpine ecology by having your students look at the tree line and then try to explain why it varies from one slope to another. Or, after students have been introduced to protection placement, have them evaluate several pre-placed anchors and explain any changes they might make.

Instead of replying to a student question with, "Well, what do you think?" Try asking "What do you think and why?" For example: when a student comes up to you a week into the course and asks you "How tight should I lace my boots for today's hike?" Ask her what she believes is important when lacing boots and suggest she follow her own advice. Be sincere. Ask questions that review what the students have learned. Help them to trust their instincts.

This "Socratic" or inquiry method is a way of helping students recognize that they have the answers to many of their questions, but it takes time and may cause frustration, particularly when they lack prior experience. The technique is most effective, therefore, several days into the course after students have had time to accumulate enough knowledge to help find the solutions to their questions. Remember, if you don't ask your students to explain the reasoning behind their answers, you do not challenge them to develop their judgment.

TEACHABLE MOMENTS

The best instructors have learned to exploit the teachable moment. Petzoldt advocated doing this by pointing things out along the trail. He budgeted half his travel time to hiking and the other half to teaching, resting, photography, and attending to personal needs.

Hiking past a creek teaming with fish or through a meadow full of tracks provides great opportunities to learn about animal habitat and behavior. Stopping to brew up a hot drink while on a cold wet hike is a perfect time to get in a discussion on comfort control. But choosing the right moment is critical. If clouds have socked in the view, you may have to give up trying to teach map reading from what was a perfect ridgetop. Part of the effectiveness of the teachable moment is that it is not contrived. Be flexible and seize opportunities as they come up during your course.

When only part of the group is exposed to a teachable moment, share what was learned with the rest of the course at the next gathering. This displays that it is normal on an expedition for

people to share the uniqueness of their personal experiences.

DEBRIEFING

A focused debriefing seeks to identify and reinforce the lessons gleaned from an event or activity experienced by a student or the group. They can be used to diffuse tensions, raise issues, and to encourage students to learn from their own experiences. The power of an intense learning experience often fades if the students neglect to process their emotions—debriefings are designed to assist in that process. As the debriefer, do not pass judgment on a student's feelings. Focus the discussion on specific aspects of the experience such as communication, leadership and decision making. Use debriefings to enhance the learning process.

Avoid over using debriefings. Sometimes it is fine just to have a fun hike, then move on. Don't force feedback if there is nothing to discuss. Can you imagine if they did that when they were camping with their friends? On the other hand, if deep-seated issues arise, make sure you aren't discussing them when everyone is dog-tired. Break for a meal and reconvene. The NOLS Expedition Behavior (EB) standard is that issues should either be genuinely set aside, or dealt with, but never left to fester.

One valuable tool you can give your students is a model of how to conduct a debriefing in a casual sociable manner they can use with their peers.

VISUAL AIDS

Visual aids can be drawn on a sand bar, on your body, or on a sleeping pad. They can also be a natural feature such as an alpine cirque that helps to illustrate a glaciology class. A good visual aid leaves a strong image and reinforces the topic of discussion. A bad one is boring or distracting. In order to ensure that your prop enhances rather than detracts from your class, make sure it is visible to everyone and use simple, precise illustrations. Artistic ability helps, but it is not as important as clarity. If your presentation lacks substance even the best visual aid is not going to save it.

Some examples of effective visual aids include using blowup globes to teach weather, or a climbing rope that can be transformed into a geologic timeline. A 25-point outline written on your sleeping pad is probably not going to have the same kind of impact. If you want to give a strong presentation try to weave the visuals in with the rest of the material rather than give out all the eye-opening props at once.

STORY TELLING

An active imagination can produce a story for any situation. Students enjoy hearing about an instructor's experiences, but your stories need to be in good taste. The teller must be aware of the sensitivities of his audience. Stories illustrating a former student's mistakes should be educational, not demeaning, since negative descriptions of former students may make the present group apprehensive about making their own mistakes.

Readings also make a fine addition to anecdotal teaching. The reading can be during the class, or if you bring a few copies, have tentgroups read them aloud at bedtime. Your selections should contain something you want the students to think about. A discussion following the reading can clarify the reason behind your choice of material.

GAMES

Games can make learning situations fun, memorable and active. They can be organized activities, exercises or explorations of the senses that are used to focus the group on a single concept or idea. A simple approach is to have the game be the primary lesson with a brief follow-up to make sure the students learned the concepts you planned. Games can also be used at the conclusion of a class as a wrap-up activity, but they must never compromise safety, the environment, or the equipment. It's perfectly acceptable to play a game just to have fun too!

GUEST SPEAKERS

Have an outside expert talk to your course. In the backcountry this is often a backcountry ranger, a horsepacker, or a costumed instructor. Ask the guest to speak on a subject of interest to the students and pertinent to the course. Most students appreciate hearing a new perspective. They also tend to enjoy hearing about other outdoor professions, local history, and land management issues. If the speaker is unfamiliar with NOLS, prepare them by explaining who we are and what the course has been doing.

JOURNALS

Personal and group journals provide an excellent way to record the information, events and reflections of one's time in the mountains. They can also be used as a tool for studying the natu-

ral environment. The success of journals depends on how they are presented and how well the instructors follow their progress. Suggested entries include class notes, sketches, species lists, poems, course songs, or natural history observations.

TURNING AN OUTLINE INTO INSTRUCTION

The following considerations and questions are designed to help you determine the what, how much and when of instructing at NOLS.

1) **Read over your class topic.**
2) **Determine what is important for your students to learn and how the subject applies to the course.**
3) **Figure out the minimum amount of time you need to teach the subject effectively. If you could only teach for 15 minutes what would you convey? How would you do it? What three key points would you want these people to remember a year from now? Can you enhance the learning with an activity, a teachable moment or a game? Have you allowed enough time to scout the site, to do repeated demonstrations, and to answer questions?**
4) **Gather information that will give your class depth. Examine your own experience for anecdotes that illustrate important points. Ask yourself, "Do I have enough experience, knowledge and skill to teach this topic adequately?"**
5) **Try to simplify the instructional organization so that you can teach it off the top of your head or by casually referring to a simple written outline.**
6) **Ask your co-workers to look at your outline and comment on your progression.**
7) **Present the material. Evaluate your effectiveness and get feedback from the other instructors and students. Note what you will improve upon for next time, and write this down while the experience is fresh in your mind.**

RESOURCES:

Absolon, Molly. "Leadership and the Wilderness Experience" *1991 NOLS Staff Conference Proceedings.* pp.15-16

Dewey, John. *Experience and Education* Collier Books: New York, 1983. pp. 17-24, 73-88

Gookin, John. "Teaching at NOLS: Master Teachers or Just Getting By?" *NOLS Newsletter.* May '84

Gookin, John. "Educating at NOLS," *NOLS Newsletter.* Aug. '89

Gookin, John. "Failing Fairley," *NOLS Newsletter.* Dec. '91

Gookin, John. "Training, Teaching, Educating: What's the Difference?" *NOLS Newsletter:* Oct.'91

Gookin, John. "Too Much To Do," *NOLS Newsletter.* Aug. '91

Guillion, Laurie. *Canoe and Kayaking Instructor Manual*, American Canoe Assoc., 1987. pp.7-11

Kesselheim, Donn. "Transference: Debriefing," *1989 NOLS Staff Conference Proceedings.* pp. 39-40

Maughlin, Mike. "Teachable Moments in Ecology," *1990 NOLS Staff Conference Proceedings.* pp.10-11

Porthan, Ed. "Fine-Tuning Teaching Technique," 1989 *NOLS Staff Conference Proceedings.* pp. 34-35

Ibid. "Coaching for Growth: Providing Effective Feedback," pp. 36-37

Porthan, Ed. "Transformational Leadership," *1990 NOLS Staff Conference Proceedings.* pp.14-16

Petzoldt, Paul and NOLS Staff. *Unpublished Manuscript, "NOLS Instruction: Subjects and Priorities*, 1971

Petzoldt, Paul. *Wilderness Handbook.* pp. 265-275

Posel, Dan. "Ecology We Bump Into: Teachable Moments," *1989 NOLS Staff Conference Proceedings.* pp. 24-27

Snow Sawyer, Marit. "Natural History Games," *1990 NOLS Staff Conference Proceedings.* pp. 12-13

Schimelpfenig, Tod. "Motivation and Student Expectations," *NOLS Newsletter.* Feb. '84

Schimelpfenig, Tod. "Teaching Tips," *NOLS Newsletter.* May '84

Timmons, Maria. "Leadership is Our Middle Name," *1989 NOLS Staff Conference Proceedings.* pp.13-14

Timmons, Maria. "Fostering Initiative," *1990 NOLS Staff Conference Proceedings* pp.16-17

Timmons, Maria and John Gookin. *NOLS Wilderness Education: 1991*

Williams, Willie. "Wilderness Education: From Definition to Taxonomy" *NOLS Newsletter.* June '90

CHAPTER TWO

OUTDOOR LIVING SKILLS

Being comfortable in the outdoors is the core of the NOLS curriculum. Our students must be able to stay hydrated, well fed, and warm regardless of the conditions. As outdoor leaders, they are expected to return home and supervise the safety and ethics of their peers. This means they not only need to have stellar habits, but also to understand the rationale behind those habits. Instructor Patrick Clark says he tries to get all students to the "one-why" level of understanding—by this he means that they all know at least one good reason to do the things they do.

PACK PACKING

For the first week of a course, your students' enjoyment of their NOLS experience may be directly related to how their packs feel during hiking days. To enhance their experience, they need to know how to load 55-pounds of gear into their pack so it is balanced and comfortable.

EDUCATIONAL GOALS:

Students should be proficient at packing and organizing their equipment. Show them how to take off and put on a pack safely and efficiently. Give them ideas on ways they can adjust their packs for different terrain. Emphasize staying organized both in and away from camp.

KEY POINTS:

PARTS OF A BACKPACK

Understanding how backpacks are designed can help your students use them with comfort. Every pack has a frame that provides structure and transfers weight onto the hips. The frame may consist of internal stays that bend to conform to your body, or it may be an external support made from aluminum. The shoulder straps, waist belt, and sternum strap comprise the pack's suspension system. Some packs have additional straps for pulling weight forward. These straps can be adjusted as you hike to shift the weight from one muscle group to another for maximum comfort.

CARE OF A BACKPACK

Broken packs are difficult to repair in the field and uncomfortable to carry. Basic care prolongs pack life and ensures you will not be forced to hike with a pack that jolts you with every step.

Look at your pack. Check for wear points, particularly where the materials are stressed, such as shoulder strap attachments. Clean dirt off shoulder straps and waist belts to avoid skin chafes. Operate zippers and cord locks with both hands to reduce stress on these parts. Fix small problems promptly.

In the field, store your pack away from salt-starved animals that may chew waist bands or shoulder straps. Lean your pack against a tree or rock to avoid damaging the frame. Never drop your pack. If you must lay down an external frame pack, it should be laid frame side up to prevent stress on the welds. Do not lift a frame pack solely by the shoulder straps.

PACK PACKING

Think about what you are going to need during the day. Food, water, an extra layer, rain gear, sun protection, maps, and a first aid kit should be easily accessible while extra clothes, shelters, and gear you won't need until camp can be packed deep inside in the pack.

Weight distribution is critical to comfort and ease of travel. Pack heavier items high and towards the frame to help with balance while traveling on trail. For terrain that involves boulder walk-

ing, bushwhacking, or lots of twisting, ducking, and large steps, pack the heavy items down around the kidneys.

Avoid fuel contamination by packing your gas upright and away from food. Often vertical side pockets are the best place for fuel bottles; stoves can go at the bottom of the main pack bag. To help with organization, use stuff sacks and pockets. Fill empty cook pots and helmets with food or equipment to prevent wasted space. Secure anything attached to the outside tightly. Avoid having items dangling off your pack; tie excess straps and cords so they do not snag on branches. A well-packed backpack is closed and tight before traveling.

PUTTING ON AND TAKING OFF A PACK

Demonstrate one good technique for getting a pack on. Encourage your students to limber up before they load up. Make it socially acceptable to ask others for help.

If you choose to lift the pack by yourself, first loosen up the shoulder straps and waist belt. With a straight back, raise the pack onto your thigh. With an external frame, make sure you hold onto the frame for lifting; on internal frames you can lift with the shoulder straps. Lift primarily with your legs to minimize strain on your arms and back.

Once the pack is on your thigh, slip one shoulder into the strap, and swing the pack around onto your back. Slip your other shoulder in and fasten the waist belt. Tighten the straps so the majority of the weight rides on your hips.

To remove your pack, reverse the process. Packs should never be dropped. At the best, this can cause ruptured food bags; at the worst, you may crack a weld on your frame. During rest breaks, look around for logs or rocks where you can park your pack and get in and out of it without lifting.

TEACHING CONSIDERATIONS:

Pack packing is typically taught on issue day. Consider a thorough gear check to make sure everyone has everything they need for the course. Make your class concise and to the point. For most students issue day is overwhelming and much of what you have to say will not sink in. Give them essential information to get started. You can reiterate points and expand on them in the field.

Themes such as security, balance, organization, and accessibility are easier for students to remember than specific packing locations for individual items. Pack packing is the perfect time to introduce the importance of personal organization in the wilderness. Make it clear that we expect them to keep track of their gear at all times, and that not everyone's pack weight is the same.

RESOURCES:

Petzoldt, Paul, *The Wilderness Handbook*, 1974, pp. 115-140.
Simer, Peter and John Sullivan, *The NOLS Wilderness Guide*, 1983, pp.60-61, 86-8.9

CAMPSITE SELECTION

Campsites concentrate impact. Our students should learn to consider safety and impact when choosing a site to spend the night. Indeed, this methodology of examining safety and ethics while learning skills, is the hallmark of a NOLS education.

EDUCATIONAL GOALS:

Students should be able to choose a campsite that is safe, durable, out-of-the-way, and comfortable. They should recognize how vegetation, terrain, previous use, and duration of stay must be considered every time they stop for the night. They should develop habits that show that "good campsites are found, not made."

KEY POINTS:

SAFETY

Check your campsites for hazards such as:

- Dead trees or widow-makers that could fall in a wind.
- Thick woods with low branches that can poke you in the eye at night.
- Avalanche paths or areas of rock and ice fall.
- Potential lightning attractants.
- Animal trails.

DURABILITY

Identify the difference between a fragile and a resilient site. Avoid camping on delicate or moist broad-leaved plants that will not recover quickly.

Try to find spots with bare soil or thick duff. Dry meadows are also quite resilient. Find a large rock or spot of gravel for your kitchen. In heavily traveled areas, use established sites rather than create additional impact by camping in a pristine place.

COMFORT

Look for a site that is sheltered from the wind and has water nearby. Try to find a flat location for sleeping. Avoid low spots where cold air collects. In hot weather look for shade; in cold weather, southeastern exposures offer solar heat in the morning when you need it most. A view never hurts either.

LIMITING IMPACT

Try not to camp in a site that shows early signs of prior use. Left alone, such sites are likely to regenerate; used again, they can become sacrifice spots. In heavily traveled areas, camp in well-established campsites and stick to developed trails. In pristine areas, spread out and choose durable spots. Try to stay out of view of other backcountry users. Alter the way you travel to your kitchen or to visit other tent groups so you don't create social trails. Do not change the site by digging trenches or excavating a place to sleep. When you leave, replace any rocks or branches you may have moved so you disguise the site and minimize the chance it will be used again.

TEACHING CONSIDERATIONS:

Try teaching campsite selection on your first night. The sooner students are aware of what goes into selecting a good spot to camp, the sooner they will be able to exercise their own judgment. Make sure they understand and are using the how's and why's of choosing a site, rather than following a prescribed set of rules.

Use camp checks to enhance your students' grasp of site selection. If you come upon a poorly selected site, give your students a chance to explain their reasoning. Discuss their thought process, review the key points of site selection, and have them choose a better location. Encourage your students to take time to find a good spot. Have them leave their packs, put on extra layers, and explore the area for a location that is durable, safe, comfortable, and, when possible, aesthetic.

RESOURCES:

Freedom of the Hills, 5th Edition, 1992 pp. 36-38, 320

Petzoldt, Paul. *The Wilderness Handbook*, 1974, pp. 110-111

Simer, Peter and John Sullivan. *The NOLS Wilderness Guide*, 1983, pp. 19-27

Hampton, Bruce and David Cole, *Soft Paths*, 1988, pp. 35-48, 117-120

Leave No Trace, *Outdoor Skills and Ethics* . Contact the Outreach and Training Department at NOLS for minimum-impact camping materials, 1-800-332-4100.

TENT AND FLY PITCHING

EDUCATIONAL GOALS:

Students must learn how to erect their shelters efficiently and securely. As the course's experience broadens, so must the students' ability to make a safe and organized camp in exposed terrain and foul weather. All students must be able to erect a fly or tent above and below tree line with minimal assistance. They should recognize that taking good care of their equipment is not only a matter of personal responsibility, but also a question of safety.

KEY POINTS:

SHELTER PARTS

Know the parts of your shelter. Develop the habit of conducting a careful inventory every time you pack up.

SETTING UP A TENT OR FLY

After you choose a location, demonstrate setting up a shelter. Show your students how to tie a slippery taut-line or trucker's hitch. (Start with just one knot, you can always show them the other one later.) Discuss the attributes of a well-pitched shelter: tight guy lines, good knots, and a roof pitch that will shed rain or snow if you anticipate inclement weather. The long axis of the shelter should be facing into the wind. The corners and ridge line should be pulled so the shelter is smooth and secure. Nylon fabric may abrade or puncture when in contact with another object, so watch for branches or rocks rubbing the shelter. Flies should be low and have a steep

roof when they need to be stormproof; they should be high and flat when you want more air to move under them.

CAMP ORGANIZATION

Food, climbing gear, fishing equipment, and packs do not need to be in the shelter. Items that must be kept dry, such as clothing, books, and binoculars can be brought in. Everything left out must be secured against wind. Tie your laundry to branches or guy lines, put a rock on your sleeping pad, and place food bags over your pots

COOKING IN SHELTERS

Stoves and lanterns produce toxic fumes, which in a poorly ventilated space can at best give you a headache, at worst be fatal. Cooking inside a tent is unwise. Stoves can flare up unexpectedly and burn both you and your shelter. Spilled boiling water can be catastrophic. Cooking in the front door of a tent or at the edge of a fly is convenient in foul weather, but is still risky.

TENT CARE

Care of equipment is a high priority at NOLS, because it parallels our concerns for safety and ethics. Zippers are often the weakest part of your tent. Open and close them carefully by holding the tent as you zip. Assemble your poles carefully. Do not force or twist the sections in and out of joints. Do not use excessive force when putting stakes into the ground. Look for another placement rather than trying to penetrate underlying rocks or hard ground by pounding harder—force only breaks stakes. If possible, dry your tent out before packing. Definitely dry it before storing.

TEACHING CONSIDERATIONS:

The first day's instruction typically includes setting up tents or flies. If you are pressed for time, stick to the must-know information. All you need to do is make sure your students are warm and dry. Alternate techniques and situational judgment can be introduced later.

Students rarely master knot tying the first day, but be sure everyone can tie the knot successfully when coached. Use camp visits to give feedback on specific fly or tent pitching skills, to monitor campsite impact, and to offer suggestions on ways to improve your students' outdoor living skills.

RESOURCES:

Mountaineers, *Mountaineering: Freedom of the Hills*, 5th Edition, 1992, pp.38-41, 377-378
Simer, Peter and John Sullivan. *The NOLS Wilderness Guide*, 1983, pp.147-151

SANITATION

For many students, their NOLS course is the first time they have had to deal with getting rid of their own waste. Proper disposal is critical to protect both themselves and the environment from human contamination.

EDUCATIONAL GOALS:

Within a day of getting dropped-off, students should have both an understanding of how decomposition works and of how to dispose of human waste in the wilderness. As the course progresses, students must demonstrate the skills and judgment to manage human and kitchen wastes in all environments encountered.

KEY POINTS:

EFFECTS OF IMPROPER WASTE DISPOSAL

Improperly buried or spread waste can contaminate water and infect humans with protozoans such as giardia, bacteria such as camphlobacter, and viruses such as hepatitis. Health concerns aside, waste that has been dealt with improperly can have a negative impact on the experience of other backcountry visitors and on the environment. Seeing and smelling unburied feces and toilet paper is offensive. Animals may dig up soil and damage plants in search of our waste.

DECOMPOSITION

Organic material can be decomposed by sunlight and bacteria. When spread thinly at high altitude, feces can be sterilized by direct ultraviolet radiation. They can also be broken down by bacteria in humus soil if there is adequate oxygen, moisture and heat.

PROPER WASTE DISPOSAL

Explain and demonstrate proper waste disposal. Your general guidelines should indicate which

technique is appropriate for your current location. As you change locations, add new information. In general, choose a site that is at least 200 feet from water and away from areas of human interest, such as campsites, trails or climbing routes. Take care to avoid places that collect or drain water after a storm.

Catholes are the technique of choice in areas of high visitation and thick organic soil. Dig a hole approximately six-to-eight inches deep and six inches wide to serve as a personal latrine. After you make your deposit, use a stick to mix your feces with soil, then fill in the hole, and disguise the spot thoroughly. Spread catholes over a wide area and encourage folks to stroll far away from camp (don't wait until you're desperate!)

Feces smeared thinly across rocks decompose faster than when buried, but are more accessible to wildlife and can cause social impacts. This technique is recommended in less traveled areas and is particularly well-suited for areas above tree line or in the desert. Use the smear technique where you find limited organic soil, little moisture, cool temperatures, few visitors, and plenty of ultraviolet radiation. Many boulder fields and moraines are perfect spots for this method of disposal.

When available, use outhouses. Their use may be required by law in some areas.

NATURAL TOILET PAPER

At NOLS, we have employed natural toilet paper for years and we advocate its use in most situations. When done correctly, this method is as sanitary as regular toilet paper, but without the impact problems. Popular types of natural toilet paper include smooth stones, leaves, spruce cones, sticks, and snow. Inform students that some leaves are irritating, such as heart leaf arnica (*Arnica cordifolia*).

Hands should be washed vigorously after going to the bathroom to avoid the spread of disease.

WASH WATER

Leftover food and waste water need to be disposed of carefully to avoid contaminating water sources and feeding wildlife. Animals that habitually eat human food scraps often become nuisances or even hazards. Pack out solid food scraps. Scatter dish water away from camps, lakes or streams.

If you choose to bathe with soap, you should get wet, and then move at least 200 feet from water before lathering up. Use water carried in a pot to rinse off. This procedure allows biodegradable soap to break down and filter through the soil before reaching any body of water.

URINATION

Urinate away from camp on surfaces that will not be damaged by animals digging in search of salt. Be sensitive to the group's comfort when it comes to urinating around camp or other people.

TEACHING CONSIDERATIONS:

To put apprehensive students at ease, you should use a relaxed, matter-of-fact tone and sense of humor when teaching this material. Show them a sample disposal site, dig a model cat hole, and exhibit samples of readily available natural toilet paper. This instruction needs to take place on the first day in the field. Your introduction does not have to be comprehensive, but should be complete enough to establish sound waste disposal habits immediately. Smearing and alpine waste disposal can be introduced later when the course travels into these areas. As in any class, start with the norm, not the exception.

Proper hygiene, particularly the need for adequate hand washing, must be included in the first class. Explain that changes in regularity and stool characteristics are normal and expected because of the NOLS diet, physical activity, and hydration. Encourage students to heed nature's call and not hold it in. Humorous demonstrations and illuminating anecdotes may help relax first time users of a wilderness toilet, but be aware that profanity and graphic explanations may offend.

RESOURCES:

Hampton, Cole. *Soft Paths, pp.* 63-75
Leave No Trace, *Outdoor Skills and Ethics*, contact the Outreach and Training Office at NOLS. 1-800-332-4100.

STOVE USE AND CARE

The ability to use a stove safely and efficiently is a skill every expedition member must master. Burns from spilled hot water, stoves and hot frying pans are a common—in fact too common—type of injury on NOLS courses.

EDUCATIONAL GOALS:

Students must know immediately how to operate a stove safely and properly. As the course progresses, they need to learn how to trouble shoot and to perform basic maintenance procedures. Advanced stove repair can be taught to interested students.

KEY POINTS:

STOVE PARTS

Knowing the function and care of stove parts helps people operate stoves properly. The fuel tank stores fuel and can be pressurized with the use of the pump. The air "cushion" in the top of the tank helps store pressure that pushes fuel to the generator smoothly. Pumps need to be kept clean and well-oiled. The generator converts liquid fuel into a warm, fine mist that burns efficiently. Show how to control the flame and how to clean the fuel orifice.

Some stoves include pot racks for cooking and reflectors for more efficient heat distribution. Wind screens are useful for conserving fuel. Keep these parts clean and avoid needless folding to prolong their life. Brass and plastic stove parts are fragile and should not be overtightened. Protect stoves from rain and snow when not in use.

STOVE OPERATION

Start cooking each meal with a full fuel tank. Leave some air space in the tank. An overfilled tank will display erratic pressures that can damage the stove or make it run poorly. Fill the fuel tank away from the kitchen and allow any spilled fuel to evaporate before lighting. To avoid accidental ignition, cool stoves before refueling.

Choose a flat, protected area to operate your stove. Avoid sites near combustible material like dry grass, duff, nylon tents, or low branches. Make sure all valves are closed and pump the stove to build pressure in the fuel tank. Do not over-pressurize. An over-pressurized stove will burn with a yellow or pulsing flame. On an average, pump a Whisperlite™ 15-20 times and an Optimus 111™ 10 times.

After the stove is pumped, open the fuel orifice, and release enough fuel to wet the generator and fill the spirit cup. Turn the stove off and light the liquid fuel. Make sure you turn your face away from the flame. When the fuel is burned down, turn the stove on, and relight. The stove should burn with a steady blue flame. After the meal is completed, let the stove cool down, slowly open the fuel tank to depressurize, then refill the fuel tank.

TROUBLESHOOTING AND MAINTENANCE

To prevent problems with your stove, keep it clean and dry, oil the pump leather every few days, clean the jet after each meal, and pack it properly.

When problems occur, check simple things first. If fuel is not coming out, there may not be any in the tank—something that occurs surprisingly often with new students—or you may have a clogged orifice, a clogged fuel line, or lack of pressure in the tank. Low tank pressure can stem from a bad pressure cap, a dry pump leather, a bad one-way valve in the pump mechanism, or occasionally, from a cracked tank or generator.

A poorly running stove can be caused by dirt or water in the fuel, by an offset flame spreader, or by a partial obstruction in the fuel system. You may also have a pressure leak, or the stove may have been over- or under-pressurized, or over- or under-primed.

SAFETY AND CONSERVATION

If you get a fuel fire, let it burn out. Carefully set the lid on any burning fuel container. Choose a good, inflammable spot for filling stoves and cooking to prevent wildfires. Handle hot food and equipment with care. Don't pass boiling water over humans and do not lean over a stove when lighting it. Watch loose hair or clothes around flames. Smother flaming body parts immediately. STOP, DROP, and ROLL! Apply cold water to burns instantly, or the hot skin will burn even deeper.

Conserving fuel saves weight. Furthermore, it is an integral part of our minimum-impact philosophy. Save gas by cooking when your tent

group is around to eat or drink. Make hot drinks when the water is at the "fish eyes" stage. Turn your stove off when the food is finished. Cook out of the wind using a wind screen and reflector. Keep your stove well-maintained and at peak performance. If you have a fire, use it to cook too.

STOVES VS. FIRES

Stoves help minimize our impact in the backcountry because they allow us more freedom in selecting campsites and require no wood gathering. Stoves are faster than fires in wet weather and allow us to camp above treeline. When used properly, they lessen the chance of accidental wildfires. Stoves cause less air pollution and are legal in places where fires are not. But they burn fossil fuel that is pumped out of the ground in places like Alaska or Iraq, while wood fires burn a renewable fuel.

TEACHING CONSIDERATIONS:

Start with a simple class on lighting, operating, cleaning, and refueling stoves. Address repair and troubleshooting later. Reserve advanced stove repair for the mechanically inclined and motivated. Let folks know that to be truly self-sufficient, they need to know how to maintain and repair any of their gear, including stoves.

Model impeccable stove use to establish good habits in your students. Stoves are potentially dangerous. Demonstrate a precise, yet relaxed manner when teaching stove skills. Be familiar with the course's specific stove type prior to going into the field. The issue room staff can help train you to be an expert stove mechanic.

RESOURCES:

Simer, Peter and John Sullivan. *The NOLS Wilderness Guide*, 1983, pp.155-162
Hampton, Bruce and David Cole. *Soft Paths*, 1988, pp. 49-61
MSR and Optimus manufacturers literature included with the product.

STAYING WARM AND DRY

Many students come to NOLS thinking that being damp and cold is normal when you are living in the wilderness. Early in the course, show them they can stay comfortable in the most challenging weather conditions simply by dressing and eating properly. A student who is warm and dry is going to be a safer expedition member, a more attentive learner, and a more enjoyable companion.

EDUCATIONAL GOALS:

By the end of a five-week course, students must demonstrate the ability to stay healthy and comfortable while living and traveling in the wilderness. This requires a practical understanding of the effects of nutrition, hydration and physical activity on personal comfort. Outdoor leaders must be able to take care of themselves under stressful conditions and still have enough energy left to look after others.

KEY POINTS:

HEAT PRODUCTION

Under normal conditions, our body produces heat through muscular activity and basic metabolism. A healthy body that is well-nourished, hydrated and reasonably insulated maintains its temperature at approximately 99° F. When we get chilled, we start shivering. Shivering is an involuntary response intended to generate heat quickly through muscular twitching.

HEAT LOSS

Heat flows from warm objects to cold via radiation, convection, conduction, and evaporation. **Radiation** is the movement of heat in the form of particles or waves, similar to light or a radio wave. All objects radiate heat. Warmer objects radiate more than cooler ones. Since we are often the warmest object in an area, we have a net heat loss to the environment. Head, hands and feet have many blood vessels close to the skin which increases their potential for radiant heat exchange. When our bodies are cooler than the surrounding objects, they pick up radiant heat through the same mechanisms.

Convection occurs when a moving medium, such as water or wind, sweeps away an object's pocket of radiant heat. This is how you lose heat when you stand in a cold stream or a cool breeze.

Conduction is the direct transfer of heat from a warm object to a cool one. A warm butt sitting on a cold rock experiences conduction. Some objects, such as metal, conduct heat better than others, like ensolite.

Evaporation is the process of changing a liquid into vapor. It takes heat for this transformation to occur, so evaporating sweat cools your body. This is why a wet bandanna on your head, or dipping your hands or feet into water feels so good on a hot day. Dry climates help evaporation occur quickly; wet climates hinder evaporation.

NUTRITION AND HYDRATION

Nutrition and hydration play essential roles in keeping us warm. The calories our bodies burn come from the food we eat. Carbohydrates burn quickly. Fats, on the other hand, take up to three hours to kick in, but they provide twice as much energy per gram as carbohydrates. When staying warm is a struggle, eating a balance of the two will provide you with the energy you need.

WHEN DID COTTON BECOME "COOL"?

According to Thelma Young, the Rocky Mountain Branch seamstress, we first allowed students to wear cotton shirts to the mountains in 1971 when the school moved its issue facility from Sinks Canyon to Lander. Up until that point, students dressed for the field first thing on issue day. Since the canyon was cooler than town, issue day was at least tolerable in wool pants and sweaters. Upon moving down to Lincoln Street, it became clear to Thelma that no one would survive the day if they were dressed in wool from head-to-toe. She told Paul to let the students wear cotton until they got to the mountains. Paul was unaware this was a problem because he always dressed for the field just before the course departed. Once Thelma pointed out the situation, he agreed to let the students wear cotton in town, but those t-shirts came off and stayed off as soon as they got to the roadhead.

In cold weather, breakfast is critical to maintaining energy and warmth over the course of the day. Eat a power breakfast containing lots of carbohydrates. Eat fats at bedtime to have fuel early in the morning when the carbohydrates have metabolized. When the conditions are harsh, a proven strategy is to snack all day long and throughout the night.

Hydration is integral to heat production. A well-hydrated body utilizes its food more efficiently and has better circulation. Cold temperatures increase urinary output, thus accelerating dehydration. Drink 3-4 qts. per day normally, 5-6 qts. in the cold or at altitude Your urine will be clear and copious if you are well hydrated.

DRESSING FOR THE COLD

Cotton clothing works well in hot climates because it holds moisture against the skin, promotes evaporation, and accelerates heat loss. For these same reasons, you should not wear cotton on cold or wet days.

Modern fibers and layering systems provide lightweight, functional clothing that can keep you warm and dry if used properly. Layering clothes creates dead air spaces which trap warm air and provide insulation. Clothes made from wool, pile or polarfleece have hollow fibers that create spaces where air is trapped. Breathable wind gear prevents heat loss from convection. Polypropylene underwear wicks moisture away from your skin before any cooling evaporation takes place. Hats and gloves also provide a great deal of warmth by minimizing radiant heat loss.

Rain gear helps keep other layers dry, but since it is non-breathable, you get soaked with sweat if you exercise in it. When temperatures are mild, you will often be more comfortable hiking in polypro and wind gear on rainy days. When it is cold and rainy, go ahead and hike in rain clothes with a light layer of polypro underneath to minimize sweating. In either case, once you get to camp, change into dry clothes before you cool down.

STAYING WARM

Staying warm takes work, but getting rewarmed takes a LOT of work. When the wind is howling through your tent, it is difficult to drag yourself outside to start the stove and cook a meal or melt snow for water, but staying properly hydrated and nourished is critical to staying warm. Staying warm and healthy takes a little bit of knowledge and a lot of self discipline.

Avoid excess sweating in cold weather. Change your clothes quickly if you get wet. Keep spare clothing dry, particularly spare socks. Watch out for the safety of others in cold, wet or windy conditions.

DRYING CLOTHES

If you are warm and healthy, you can use your body as a drier, especially while you are exercising. Your radiant heat will drive moisture out of wet material, but there is a limit to the amount of clothing you should attempt to dry at one time. Two pairs of socks is the maximum for most people. Good drying techniques include wearing damp clothing over a layer of polypro when you go to bed, hanging socks or gloves over your shoulders and under your outer layers while working around camp, and sleeping with damp gear underneath your abdomen. Clothes do not dry out if you stuff them down at the foot of your sleeping bag. In extreme conditions, clothes can be carefully dried near a fire. Remember to be cautious about melting synthetic fabrics, singeing wool, damaging leather, or burning holes with sparks.

TEACHING CONSIDERATIONS:

Often conditions dictate that you cover this topic on the first day of the course. Start with simple facts, then expand on them until all expedition members are able to take care of their personal comfort. You can integrate the topic into lessons on cooking, hydration, trail technique, cold injury awareness, and leadership.

Students learn a great deal by watching their instructors manage their own personal climate control. An inappropriately dressed instructor should not be surprised when his students follow his example. Model impeccable standards. Put on an extra layer the minute you stop for a break on the trail. Carry a hot drink with you when you make camp visits. Take off your cotton t-shirt when it starts to rain. Your students learn best by mimicking your actions.

RESOURCES

Peters, E. *Mountaineering: The Freedom of the Hills.* 5th ed, Mountaineers, 1992, pp. 65-78

Forgey, Wm. *Death by Exposure, Hypothermia,* 1985, ICS Books, pp.8-11, 33-35, 90-91

Simer, P and Sullivan, J, *NOLS Wilderness Guide,* 1983, pp.46-73

Schimelpfenig, T. and Lindsey, L. *NOLS Wilderness First Aid, 2nd edition,* 1991.

Wilkerson, J. et al, *Hypothermia, Frostbite and other Cold Injuries,* Mountaineers, 1986, Ch 1-2

BASIC COOKING AND FOOD IDENTIFICATION

Good cooking has a positive effect on health, safety and enjoyment of the wilderness. Being able to prepare an edible and nutritious meal allows students to keep pace with the mental and physical challenges of a 30-day wilderness expedition.

EDUCATIONAL GOALS:

The goal of early cooking instruction is to make tasty and nutritious meals quickly and efficiently. Later in the course, your instruction can address baking and more involved meal preparation. All students must be able to prepare simple meals by themselves by the end of the first ration period.

KEY POINTS:

ORGANIZATION

An organized kitchen simplifies cooking and makes preparing a meal enjoyable. Place the ingredients, utensils and cooking equipment you will need within reach. Put them away when you're done. Clean up as soon as meals end.

HYGIENE

Good hygiene helps prevent food-borne illness. Washing your hands before handling food is critical. Do not share personal utensils or allow them to come into contact with communal foods. Utensils should be sterilized routinely with boiling water.

Clean pots and dishes after every meal to eliminate food-borne illnesses. Bacteria and their toxic by-products grow quickly on food residue. Scrub the pot with hot water and a natural abrasive like sand or pine needles. Starches dissolve best in cold water. Strain wash water away from camp and pack any remnants from the strainer into a garbage bag. Rinse with hot water. Do not scrub Teflon coated fry pans with sand or gravel. These items can be cleaned by scraping the pan with a spatula and using hot water to cut the grease. Let clean pots dry in the sun; a blast of UV helps keep viral and bacterial populations down.

FOOD IDENTIFICATION

Basic food identification classes include preparation guidelines for all the items in our food bags. Most of our dinner and breakfast foods are simply boiled, but students may need help determining proportions, water amounts, and cooking times.

Cheese and margarine enhance the taste, texture and caloric value of a meal. Both items must be stored in the shade to slow down spoilage. To avoid bacterial contamination, do not touch cheese with your hands.

White powders are the most confusing item found in our food bags. Show your students how to tell the difference between them: milk squeaks, cheese cake has two different grain sizes, flour is quiet and smooth, baking powder is fizzy to the tongue, and potato pearls are yellowish and granular. The bulk of the other powders found in our ration are drink mixes or desserts.

Soup bases are concentrated and salty. They can be used to flavor sauces, make a broth, and provide flavoring. Spicing is personal: respect the tastes of others when flavoring a meal. Conserve spices by cooking them into the food. Dried vegetables add flavor, color and vitamins to food. They need to be soaked in boiling water prior to cooking to re-hydrate.

Save trail foods for the trail when it is not practical to stop and cook.

BASIC COOKING

Water boils at 212°F at sea level. Giardia and most other water-borne pathogens are killed at 140° F, so when small bubbles—or what we call "fish eyes"—appear, the water is safe to drink. In the Winds, the effect of altitude on boiling point is not significant enough to require a rolling bubble for disinfection.

HELPFUL HINTS FOR NEW COOKS:

- Keep heat low and make sure there's plenty of grease or water in the pot to avoid burning food.
- Make sure you start cooking pasta in boiling water, rice can be thrown into cold.
- Add milk products after food is cooked and stir constantly to prevent burning.
- Mix powders with liquids separately to avoid lumps.
- Melt cheese by adding a few drops of water and covering the pan to create steam.

KNIFE WOUNDS

Knife cuts can be a common camp injury. Cuts to the fingers and hands often take a long time to heal and are difficult to keep clean during an active course. Demonstrate and model cutting away from the body and not towards or against body parts.

TEACHING CONSIDERATIONS:

Introduce a relaxed attitude toward food on the first day of the course to minimize the potential for food stress. Encourage all students to try their hand in the kitchen. Instructor eating preferences should be kept to oneself.

Cooking and food identification can be taught to the whole course or to smaller groups. If you decide to work with individual tent groups, get the instructors together and agree on key points before splitting up, or gather together as a group after the meal and have everyone share tricks they learned about outdoor cooking. Inviting tent groups over to the instructors' kitchen or having an instructor eat out are other ways to provide cooking tutorials.

Emphasize fuel conservation and hygiene throughout the course. Course banquets are enjoyable when everyone is committed to preparing food hygienically, but they have a reputation for sending food-borne illnesses raging through camp. Wait until students have demonstrated good habits before introducing the idea of a banquet. Use the *NOLS Cookery*; most courses issue one per tent group.

RESOURCES:

The NOLS Cookery. pp. 30-45
Petzoldt, Paul. *The Wilderness Handbook*. pp. 68-83, 112-118
Simer, Peter and John Sullivan. *The NOLS Wilderness Guide*, pp. 165-186

BAKING

Baking provides creative and nutritious alternatives to the one-pot "spooze" meal. This skill allows our students to buy cheap staples such as flour and live like kings; plus it can earn them social points when they return home and camp with their friends.

EDUCATIONAL GOALS:

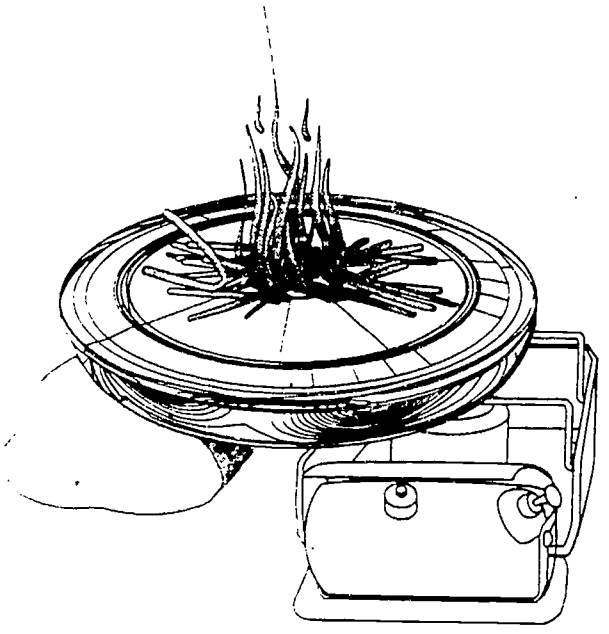
The ability to produce quick bread biscuits and pizzas should be in each student's cooking repertoire. The more ambitious ones can learn to make yeast bread or calzones later. Good hygiene must be an integral part of their baking experience.

KEY POINTS:

BASIC BAKING

Start with a simple, quick-rising dough. Explain the difference between yeast and baking powder, and point out different properties of whole wheat flour, white flour, corn meal, and baking mix. Make sure you have both clean utensils and clean hands. Demonstrate how to mix a basic dough. Explain how moisture determines the bread type: pancake batter pours easily, cake batter is thicker but still pours, cookie dough falls in wet glops from a spoon, and bread dough is dry and can be handled without sticking. Pie and pastry crusts have margarine cut into the flour first, then a trace of water is added.

Yeast baking includes some further considerations. You will get the best results on a warm, sunny day when the dough can sit outside to rise, but when it is cloudy, you can use a sleeping bag or warm belly to provide heat. Often it is helpful to activate your yeast separately from the dry ingredients to make sure it is alive and producing carbon dioxide. The yeast is working when it foams after being placed in warm sugar water. Once your dough is made, grease and flour the frying pan to avoid sticking. The dough should only fill the pan halfway, since it will rise as it cooks.



A twiggy fire on the frying pan lid provides heat for baking.

THE OUTDOOR OVEN

Baking requires low, even heat on all sides. In the wilderness, you can create such an oven using either your stove or a fire.

With your stove on simmer, light a twig fire on the frying pan lid to provide heat from above. Burn pencil-sized sticks. Put your dough on to cook in your pre-greased pan. Rotate the pan every few minutes to ensure even heat. Baking will be most controlled if your rotations are systematic. Demonstrate how to use the around-the-clock method for ideal heat distribution. Once the baked good is finished, let the twig fire burn down to ash and cool before you spread the remains.

The principles of baking are the same with a campfire, but you use coals as your heat source. Build a fire and let the wood burn down to hot coals. Spread a layer of coals off to one side of the main flame, and place your frying pan on top. With a shovel or pot lid, pile more coals on the frying pan lid. If your coals are even, you do not need to rotate using this method. Check to make sure your dough is not burning. If it gets too hot, cool the pan in snow or a shallow puddle. If you are cooking many dishes on one fire, have a coal generation fire on one side, and a cooking area on the other.

For some breads, particularly those with a stiff dough, you can bake with only bottom heat by using the flip technique. To do this, grease and flour the lid. When the dough is brown on the bottom, flip the entire pan onto its lid and finish baking.

TEACHING CONSIDERATIONS:

Get students baking as soon as they show a basic aptitude for cooking. For some inexperienced outdoor cooks, the idea of baking is intimidating; for others, they may need no instructions once they master the stoves. Ease natural fears by showing them how to create tasty items with a minimum of fuss. Model impeccable hygiene throughout your demonstration to establish better habits in your students.

Teach basic fire building skills if baking class is their first exposure to fires. The instructional area needs to be uncramped and durable. Allow plenty of time for preparation and cleanup. Consider presenting other topics or having a discussion to fill in the slow times in the baking process.

RESOURCES:

The NOLS Cookery. pp. 83-95

Booney, Bruce and Jack Drury. *The Backcountry Classroom: Lesson plans for teaching in the wild outdoors*. 1992, pp. 39-51

NUTRITION

The NOLS ration is designed to satisfy our nutritional needs, provide adequate caloric intake, pack easily, and be inexpensive. Using the limited items in our food bags, we must learn to keep ourselves energized and nourished for the duration of the course. It is beyond the scope of our instruction to dictate a strict dietary regime for our students; instead, you should show them how basic nutrition can affect their performance in the wilderness. Good nutrition provides energy to perform physical activities and to produce heat, so we can work, play and sleep warmly in a cold environment. In addition, good nutrition facilitates the repair of body tissues and provides building blocks for our immune system.

EDUCATIONAL GOALS:

The focus of your instruction should be on a nutritious and intelligent use of what is in the food bag. Students need to understand why good nutrition is an important aspect of safe expeditioning. They should also know the functions of the basic food groups and where to find them in the ration.

KEY POINTS:

NUTRIENTS

Nutrients include carbohydrates, proteins, fats, vitamins, and minerals. They are found in a variety of foods and serve different functions in our bodies.

Carbohydrates provide the most efficient source of energy to the body. When you are hydrated, they are easy to break down and go to work quickly. Our most common sources of carbohydrates are the sugars and starches found in grains, pastas, drink mixes, cracker mixes, candy, dried potatoes, cereals, and cocoa. Simple carbos (sugars) break down quickly, like kindling in a fire; complex carbos (starches) break down slowly, like a big log in a fire. Sugars give us quick bursts of energy; starches provide energy for hours.

Proteins are used to build muscle tissue, hormones, enzymes, and antibodies. They can serve as an energy source once carbohydrate sources are exhausted. Our protein comes from dairy products, grains, legumes, fish, nuts, and seeds.

Fat provides the body with additional calories for energy and gives us the feeling of being full. It is the most calorically dense food type. We get our fat from nuts, cheese, oils, peanut butter, fried trail foods, and margarine.

Vitamins and minerals serve a variety of functions in our bodies. Some help release energy from food while others maintain bodily functions. For example, vitamin A helps with night vision, while sodium provides electrolyte balance. We get vitamins and minerals from foraged salads and by eating a wide range of food types each day. Some instructors use vitamin supplements as well.

Water is an integral part of healthy nutrition. In the mountains, our requirements are greater than in town because of the dry, thin air and the amount of exercise we do each day. Drink enough to remain healthy and energized, usually at least four quarts a day, regardless of weather. Drink enough that you urinate clearly and copiously.

EATING WELL AT NOLS

Since carbohydrates are easy to break down and provide quick energy, they should be the bulk of your daily diet. It is not necessary to avoid fat at any meal or to eat it only at certain times of the day, although cheese makes a poor trail food since fat takes a long time to digest. The old "N" of nutrition called for combining foods at each meal to make a complete protein. Today's nutritionists say this is not necessary. What is more critical, is that we eat a variety of foods and adjust our intake according to our changing needs.

TEACHING CONSIDERATIONS:

Emphasize nutritional awareness and practical applications. Students do not need to be burdened with calorie counting or the details of quantitative nutrition. They do need to relate how they feel to what they ate during the day.

This information should get passed along early in the course; a concise presentation shouldn't take more than 15 minutes. Later in the course, have students describe how diet should be adjusted according to activities or conditions. This may be an easy way to affirm their understanding of nutrition, and to help them turn this simple knowledge into habits.

Some courses experience food stress. This can be caused by genuine food shortages, perceived food shortages, poor cooking, or bad expedition behavior in the kitchen. Keep an eye out for students who show chronic low energy or motivation. They may not be getting enough to eat or their kitchen practices may be preventing them from eating well.

RESOURCES:

Bering, Jackie and Suzzane Nelson Steen, *Sports Nutrition for the 90's.*

Cox, Carrie, "A Basic, Easy To Teach, Ten Minute Nutrition Class," *NOLS Newsletter,* Dec. 1992.

NOLS Cookery, pp. 12 – 13.

NUTRITIONAL SELF-ANALYSIS

PERSONAL CONDITION AND POSSIBLE NUTRITIONAL SOLUTION

Low motivation (chronic tiredness):
- Eat more of everything.
- Examine other possible causes (hydration, illness, poor physical conditioning, nutrient deficiency).

Low energy on the trail:
- Eat a larger breakfast, or one with a balance of carb
- Eat less fats and more carbs during trail breaks
- Drink more water with the trail snacks.

Muscular soreness at the end of day:
- Eat extra protein with the evening meal.

Sleeping cold at night:
- Eat more fats along with adequate carbs at dinner

Slightly tired upon arrival at camp:
- Eat simple carbs and drink a quart of water

Finished a long day on the trail with another one to
- Have a "good dinner" and a "good breakfast" balanced and adequate fats.
- Power hydrate.

Muscle cramps after exercise and sweating:
- Consume fluids and salts, drink cup-o-soup, eat from

Urine dark and smelly; dizziness when standing up:
- Drink at least two quarts of water, eat some carbohydrates

FIRE BUILDING

Although on most NOLS courses cooking is done exclusively on stoves and the most common type of fire is a little twig fire used for baking, fire building is a fundamental outdoor skill nonetheless.

EDUCATIONAL GOALS:

When our students leave the course they must be able to build and dismantle an environmentally sound fire. They must recognize when a fire is appropriate or necessary, and they should understand the legal and safety considerations involved in making that decision. Students should be set up to supervise fire building when they camp with their friends at home. Conditions permitting, students can also learn how to cook and bake on a fire.

KEY POINTS:

PROS AND CONS OF CAMPFIRES

Fires are a good source of heat for cooking food, warming people, and drying clothes. Adeptness at fire building offers students one more "survival technique" that may bail them out of tough situations. Fires provide a focus for social gatherings. But when used inappropriately, campfires create long-term scarring, nutrient depletion, disruption of local habitats, and soil sterilization. In some areas, regulations prohibit fires.

SELECTING A FIRESITE

Before you consider building a fire, you must know if there are any legal restrictions. Choose a durable site, free of flammable material and high winds. Stay away from low branches, nylon shelters, food bags, dry grass, and duff. The area adjacent to the fire site must be able to endure human traffic. A good location could be a large flat rock or an area of mineral soil free of shrubs and perennial plants.

In heavily-used places, you can usually find an existing fire ring. Choose the largest and most prominent one for your fire, and dismantle any surrounding satellite rings to concentrate use. Where no fire rings exist, find or make a site on bare mineral soil. Mineral soil is sandy and contains no organic material. You can use dry stream beds or sandy beaches, or you can collect mineral soil from under the roots of an overturned tree to build a mound. If you build a mound, make sure the soil pad is at least four inches thick and a foot larger in diameter then the proposed fire. If you have transported soil, consider using a fire blanket under the mound to facilitate cleanup.

COLLECTING WOOD

Gather wood far away from camp to dilute impact: select pieces no thicker than the diameter of your wrist. Do not break branches from dead or living trees. Firewood should be dead and down before you pick it up. Walk around when collecting so you don't deplete the wood supply in one area.

BUILDING A FIRE

Start by lighting a small fire with tinder and kindling. Tinder includes dry grass, wood shavings, and pine needles. This material ignites instantly with a match and will help the kindling—toothpick or pencil-sized wood—catch. Slowly add to the fire, but take care: too much large wood too soon will smother the flame. Avoid breaking sticks into fire-sized pieces until you are ready to put them in the flames. This retains the natural appearance of the wood and makes scattering leftover pieces easier.

In wet weather look for dry tinder and kindling under rocks and trees. Whittle dry shavings off larger sticks. In an emergency, use your fuel for ignition, break branches off trees—do what you must—but remember, this is a poor example to show students in any but the most dire circumstances.

Burn all the wood in the fire down to white ash or small pieces of charcoal. Douse the site with water, then place your hand in the slurry of drowned ashes to make sure the fire is extinguished. If it is cool, scatter the ashes over a broad area and return the mineral soil to its original location. Rinse any spilled soil off the rocks and camouflage the site.

SAFETY

Be ready with a shovel and water to extinguish the fire if conditions change and it becomes unmanageable. If the day is windy or dry, use your stove. Never leave a fire unattended.

TEACHING CONSIDERATIONS:

Some students are surprised at the infrequency of fires on NOLS courses; others are surprised we use them at all. Building, burning, and cleaning up a fire properly is time consuming. Your students must be aware of this commitment before they blithely start in on one. Explain why you choose a specific location. Discuss alternatives. Collect wood as a group and talk about the pieces you select. Have students dismantle the mound and spread the remaining ashes. Getting them actively involved in the entire fire building and dismantling process helps them to absorb the habits and understand the principles of backcountry fires.

RESOURCES

Hampton, Bruce and David Cole. *Soft Paths*, 1988, pp. 49-61

Petzoldt, Paul. *Wilderness Handbook*. 1974, pp. 24, 67, 112-118

Weller, Rob, "How about a little campfire, scarecrow?" *NOLS Newsletter*, Dec '93

MINIMUM-IMPACT STYLE

EDUCATIONAL GOAL:

We expect our students to finish their course with a thorough understanding of the philosophical principles and technical skills involved in leaving a minimal impact on the environment.

KEY POINTS:

HISTORY

Give your students some historical perspective on the development of NOLS' minimum-impact techniques. Discuss how in the early days at the school, minimum-impact meant burying your garbage rather than leaving it where it lay. Talk about Petzoldt's early experiments to decrease the effect courses had on the Wind Rivers. This tradition of trial-and-error continues at the school and specific techniques are still evolving. Mention the research NOLS is sponsoring to help quantify both impact and the ways to minimize it. Tell your students about NOLS' involvement in Leave No Trace.

MINIMUM-IMPACT CAMPING

Our goal is to travel through the mountains without leaving any sign of our passing. To do this, we need to take particular care around camp where impact is most pronounced. Look for durable sites to spend the night and dispose of waste properly. Move camp frequently. Research indicates that groups of four or more should spend a maximum of two nights in one place. Group meetings need to occur in especially durable sites. Depending on the environment you are in, camp in either a completely undisturbed site or a sacrifice area. Spread the group out to disperse impact.

Solitude is an important part of the wilderness experience. Respect the needs of other backcountry visitors. Make camps out of sight of trails, lakes and other campers. Camp in small groups and limit intrusive and boisterous behavior. Choose earth-toned equipment to be less noticeable and go out of your way to avoid walking through someone else's campsite.

When you are hiking, travel in small, quiet groups. Take rest breaks well off the trail and, when possible, move out of sight. In heavily traveled areas, stick to established trails. In remote areas, you can travel off trail, but spread out. Pick up litter as you go.

In town, try to minimize your course's physical and social impact on the community. Avoid unnecessary waste by using only the resources you need. Use courtesy and respect toward the townspeople. Interact in small, quiet groups. Be polite and try to leave a positive impression.

TEACHING CONSIDERATIONS:

Strive to see that your students do not leave the course believing minimum-impact camping is just something they have to do at NOLS. Discuss how the philosophy of minimum-impact is applicable not only to wilderness travel, but also to in-town living. Students are more receptive to this subject after they've had a chance to use the techniques and to visit both pristine and impacted areas. Trash removal, campsite inventories, and trampling studies are all valuable ways to illustrate the need for minimum impact. But, make sure your students aren't overly zealous. They need to be practical in their approach when they return home if they are to pass these ethics on to others.

RESOURCES:

Hampton, Bruce and David Cole. *Soft Paths.* 1988, (the whole book!)
Petzoldt, Paul. *Wilderness Handbook,* 1974, pp. 107-126
Royte, Elizabeth. "She Knows if You've Been Bad or Good," *Outside Magazine,* April '92
Simer, Peter and John Sullivan. *The NOLS Wilderness Guide.* 1983, pp. 19-45
Leave No Trace, *Outdoor Skills and Ethics Materials.* Contact the Outreach and Training Office at NOLS. 1-800-332-4100.

FISHING

Fishing may be a NOLS student's first exposure to catching, killing and eating an animal. The experience can be an exciting introduction to a lifelong outdoor sport, and it may stimulate reflections on the implications of being an omnivore. Fishing can provide enjoyment, relaxation and an opportunity to observe, study and interpret the aquatic habitat. It also allows for "quiet time" when students can reflect on their wilderness experience.

EDUCATIONAL GOALS:

At the end of their NOLS course, students should be able to use and care for fly and spinning equipment, should understand basic fish behavior and habitat, and should have been introduced to the ethical, legal and culinary aspects of fishing in the wilderness.

KEY POINTS:

EQUIPMENT

A fishing *rod* acts as an extension of the arm and allows the angler to throw the fly or lure great distances across the water. The *reel* stores and retrieves line, while metal *guides* along the rod keep it running straight. *Ferrules* are the joints where sections of the rod fit together. A *leader* attaches a fly to the fly line: it tapers down to a thin strand of monofilament that is practically invisible to the fish. Spin reels only contain monofilament line. NOLS fishing kits also include nail clippers, assorted flies or lures, and floatant to keep your fly on top of the water.

Fishing equipment is fragile. As with all camping gear, your options are to carry heavy stuff you can't break, or light gear that requires care. Lean the rod against a tree so it does not get stepped on. Assemble and disassemble your rod carefully without twisting or prying the sections. Grease metal ferrules with skin or hair oil. Carry your assembled rod around with the tip pointing behind you and the hook on the hook holder. Inspect your equipment regularly for loose or damaged parts.

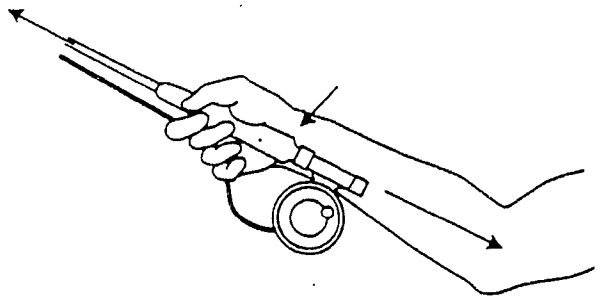
SPIN FISHING

Spin fishing relies on lures designed to attract fish by imitating either its food or its competitors. Choose a lure that looks like a small fish. Find a casting area with deep water, no submerged logs or grass, and clear of low overhanging branches. Imagine the rod as the hour hand of a clock. The motion of the cast is from the two-o'clock position to the ten-o'clock position. As the cast moves forward, release the line at the ten-o'clock position. When the line reaches maximum distance, engage the reel to close the bail. Allow the line to sink for a few seconds, then reel it in with an irregular jerking pattern. This imitates the erratic swimming patterns of the fish's prey.

When you feel a strike, set the hook by quickly lifting the rod tip up and tightening the line. The flex of an elevated rod absorbs shocks caused by the fighting fish and keeps the line taut.

FLY FISHING

Fly rods are assembled and cared for in the same way as spin rods. On combination rods the fly reel seat is screwed down toward the handle's end. Unlike spin fishing, the fly reel is primarily intended to store line. Rather than reeling fly line in, you pull it in by hand.

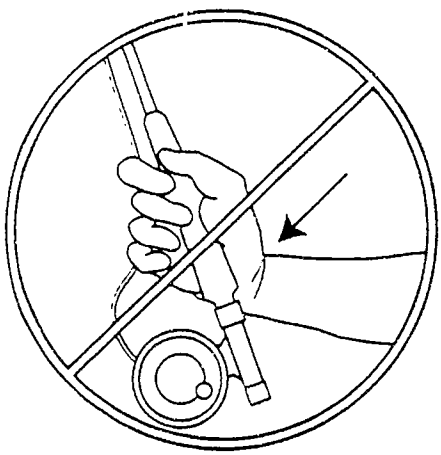


When fly fishing, grip the rod above the reel, keeping your thumb on top.

Attach a leader to your fly line using a *surgeon's knot*, and then tie your fly to the leader with an *improved clinch knot*.

Fly casting is more difficult for novices than spin casting. Practice in an open field first. The weight of the fly line propels the fly out to the fish. Wear glasses and a hat to protect against hooking an eye or an ear. Make sure no one is behind you when casting.

Grip the rod in front of the reel. Keep your thumb on top. Make sure the butt of the reel seat presses against the forearm. Cast with your elbow and shoulder, rather than wrist. Find a stable and comfortable stance and use an active upper body to power the cast. The rod moves in a plane 30–45 degrees off vertical. Start with 15' of line fed out the tip of the rod.



Fly casting is accomplished with the elbow and shoulder, rather than the wrist.

Now picture a clock face. Your cast should take place between ten-o'clock and one-o'clock. The rhythm of the cast should be a quick push between the ten and one- o'clock position, with a pause at each end of the cast. The pauses are essential to allow the line to roll out completely in both front and back. Watch the line to gauge when to move in the opposite direction. Once a rhythm is established, pull out more line on the back cast and throw it out with the momentum of the forward cast. False casts allow time for more line to be cast and to dry the fly.

Once you have enough line out, let the fly drop softly on the water. Keep the rod tip low and pointing towards the fly while waiting for a strike. Slowly pull the excess slack out of the line between the fly and the rod tip. As with spin fishing, when the fish hits the fly, set the hook by tightening the line. Keep the rod tip up and the line tight while playing and landing the fish. A slack line may allow the fish to wiggle off the hook.

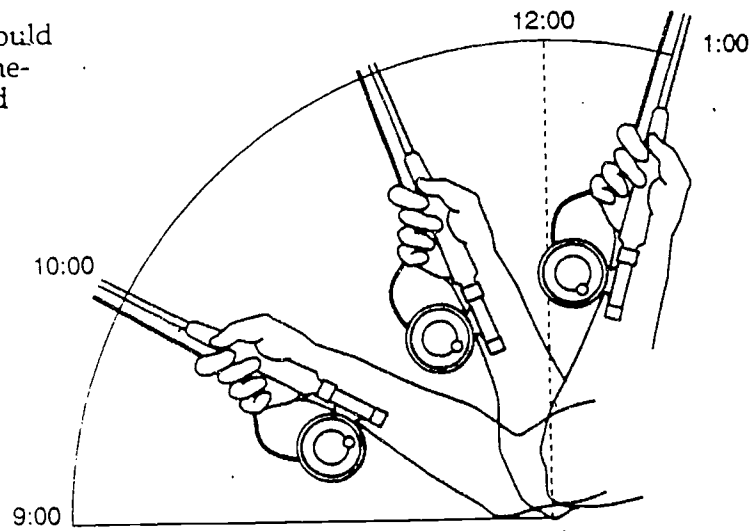
In close quarters, where an overhead cast is impractical, try a dapping technique. This involves flicking line out and letting the stream carry your fly to the fish.

Fly fishing requires stealth to trick the fish into thinking your fly is alive. Sneak up on the stream or lake. Avoid making noises, casting shadows, or creating vibrations which frighten fish into hiding. Stay low near the water.

KILLING AND CLEANING A FISH

Once you have the fish near shore, hold the line tight with one hand and reach into the water to grab the fish with the other. Remove the hook and kill the fish as quickly and humanely as possible. One method for doing this is to stick your thumb into the fish's mouth and bend the head back until its neck breaks. Another technique is to hit the fish on a rock, but because of their slippery skin, it can be hard to kill the fish quickly this way. You can also cut off their head with a knife.

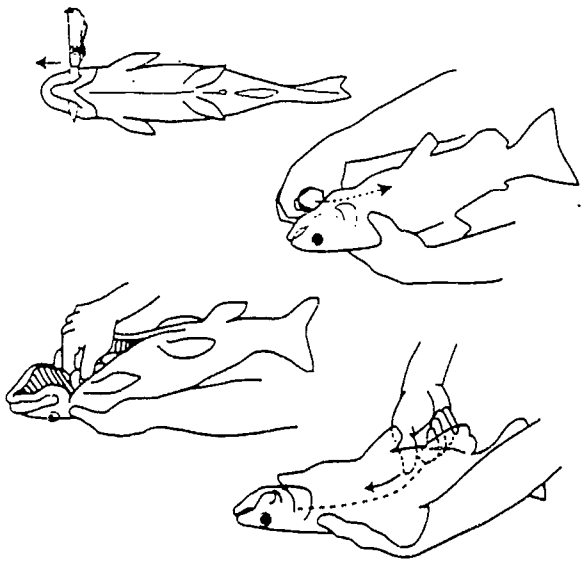
To clean the fish, make an incision from the anus to a line just behind the gill junction. Cut the gular membrane under the trout's chin. Grasp



When fly casting, picture a clock face with your head at twelve o'clock and your feet at six. Try to keep the rod between ten o'clock and one o'clock.

the membrane and pull back toward the tail in one motion. The gills, guts and pectoral fins should follow. Clean the kidney tissue along the spine. Rinse the carcass thoroughly before cooking.

Disposal of fish guts depends on your location. Biologists recommend leaving them in the water, but cold temperatures and reduced bacterial action slow decomposition. In areas of high use, this method contributes to visual impact. Guts thrown into trees are eaten by birds and pine martens, but if you choose this technique, do it well away from camp to keep animals out of course food. In bear country, clean and dispose of fish guts in fast moving water at least several hundred yards downstream of camp.

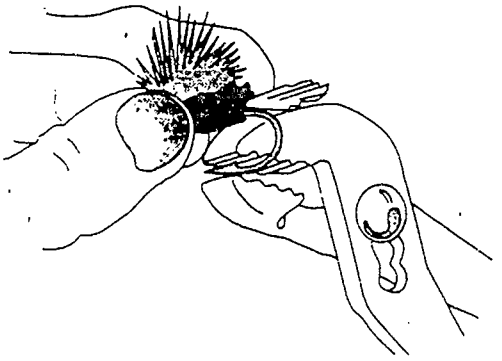


Steps for cleaning a fish.

FISHING ETHICS AND LAWS

Catch only enough fish to feed yourself and your cook group. Kill your fish quickly. Tie knots correctly so that fish won't escape with lures or flies stuck in their mouths.

Wyoming licenses are required while fishing or when in possession of rigged fishing gear along bodies of water. Local regulations governing allowable species, size and quantity of fish taken must be followed strictly, so know and follow the regulations in your course area.



For catch and release. flatten the barb on your lures or flies with a pair of pliers to avoid injuring the fish.

Some students may be repulsed by the thought of killing a fish. It is their decision whether to learn this outdoor skill. This issue can be a catalyst for students to either commit to participating in "the dirty work" of omnivorism, or change their lifelong eating habits.

CATCH AND RELEASE

If you plan to catch and release, use a barbless hook. Avoid playing the fish to exhaustion. Land the fish quickly and remove the hook with small pliers. Try not to touch the fish, but if handling cannot be avoided, do it gently in the water, trying not to disturb the protective slime on the fish's skin. Monitor the fish after releasing it. See that it swims away; if it doesn't, put it out of its misery and eat it.

TEACHING CONSIDERATIONS:

Get your students fishing as quickly as possible. Students have more fun and learn faster when they are motivated by the chance of success. Consider teaching spin fishing first since it requires less coordination and is more likely to produce quick results.

Remind students to have their licenses at all times when fishing. Do not underestimate the difficulty students have killing a fish.

RESOURCES:

Anderson, Sheridan. *Curtis Creek Manifesto*. 1986 (The whole thing)
Cairns, Bill. *Basic Trout Fishing*. Stone Wall Press. 1990 pp. 45-78
Hughes, Dave. *Reading the Water*, Stackpole Books. 1988
1992-1993 Fishing Regulations, Wyoming Game and Fish Commission
Kreager, Mel *The Essence of Flycasting* (video), 1987.

TROUT HABITAT AND BEHAVIOR

A little knowledge about trout feeding habits and lifestyles can aid your students in successful angling. The study of aquatic ecology can be as simple or as involved as the group desires. Keep in mind, the goal is to get them out there catching fish as soon as possible.

EDUCATIONAL GOALS:

Students should be able to choose a lure or fly that will attract a trout, and a fishing spot that is likely to yield a strike. With these basics in hand, novice anglers can have fun while broadening their knowledge of trout habitat and behavior.

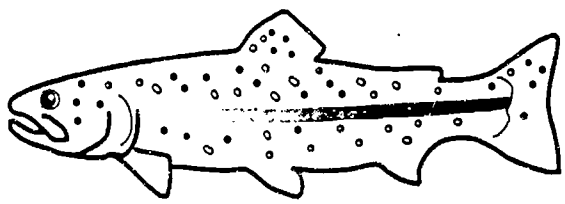
KEY POINTS

FISH FOOD

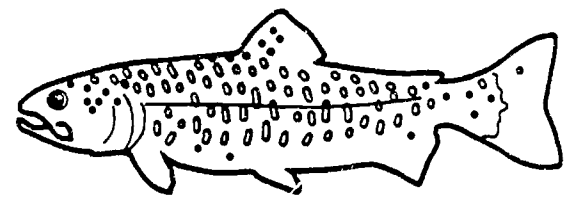
Trout meals include small fish, insects, leeches, and crustaceans. In most cases, anglers use either flies that imitate various stages of an insect's life, or lures that mimic small minnows to catch fish. At NOLS we carry fishing tackle to accommodate fish feeding at the surface, below the surface, and near the bottom of streams and lakes.

PICKING A LURE

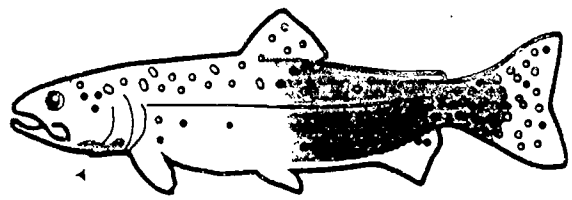
On NOLS courses, you have two choices of lures: spinners and spoons. By design, spinners work better in shallow water—they can be retrieved at a slow rate with less chance of snagging than a spoon. To avoid dragging the bottom, spinners with small blades require faster retrieval than large-bladed ones. A spinner is a good choice if you suspect the trout are feeding near the surface of a shallow lake or pond.



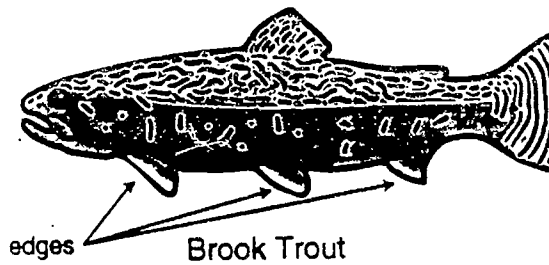
Rainbow Trout



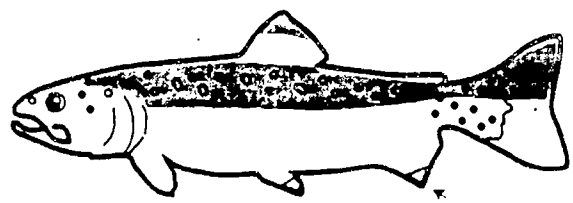
Brown Trout



Cutthroat Trout

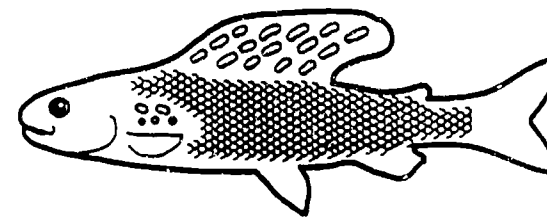


Brook Trout



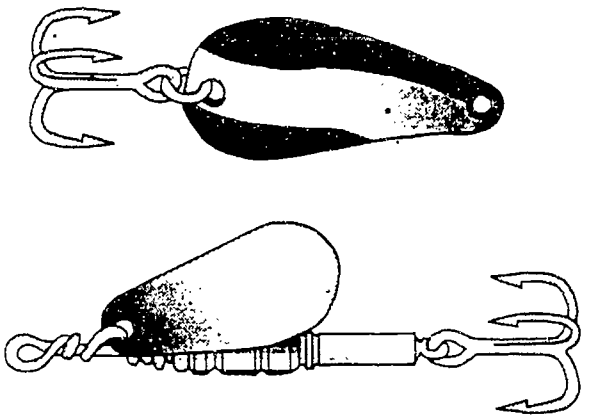
Golden Trout

White tips



Arctic Grayling

Species of fish found in the Wind Rivers



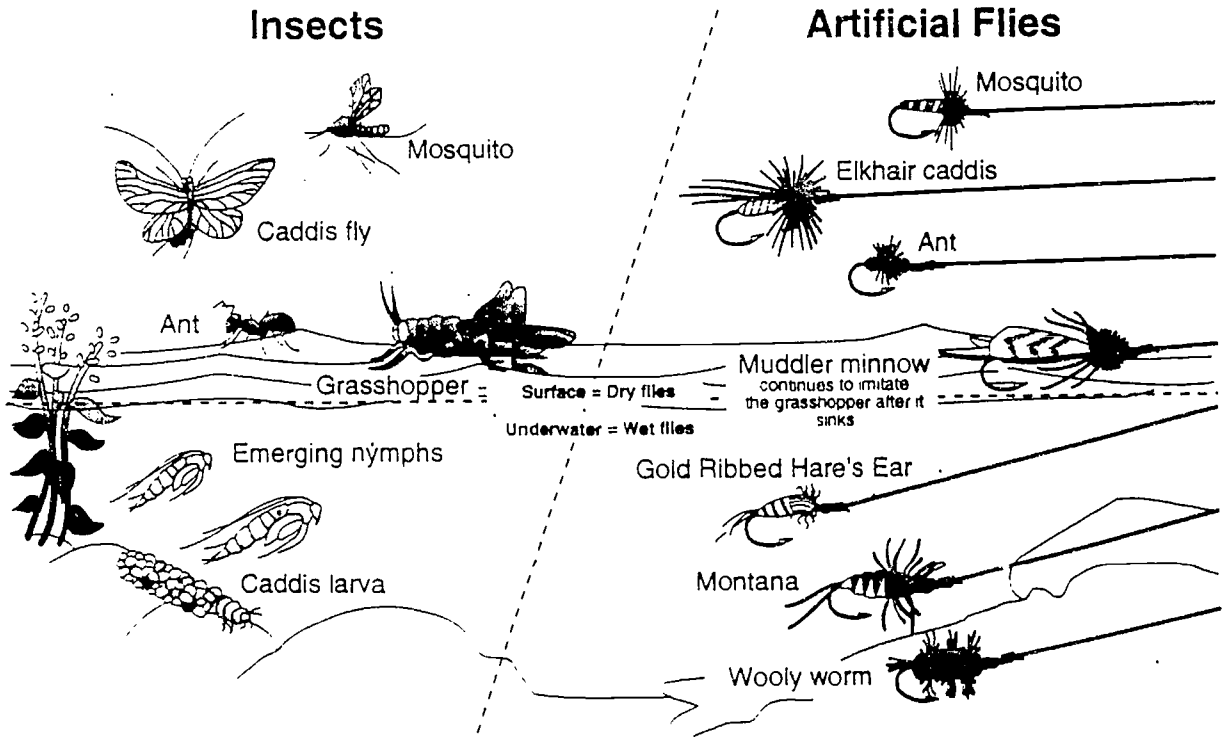
NOLS courses carry a variety of lures for spin fishing. Here are examples of a spoon (top) and a spinner (bottom).

Spoons work better than spinners in big water. A large spoon will ride higher in the water than a small dense one of the same weight. These light spoons are most effective early in the season when trout are feeding close to the surface or in the shallows. As the summer progresses, trout will feed at various depths in lakes and ponds. Therefore, a denser spoon that sinks below the surface works better at this time of year. Heavy spoons are easier to cast in windy conditions, sink faster, and stay lower in the water as they're reeled in.

MATCHING THE HATCH

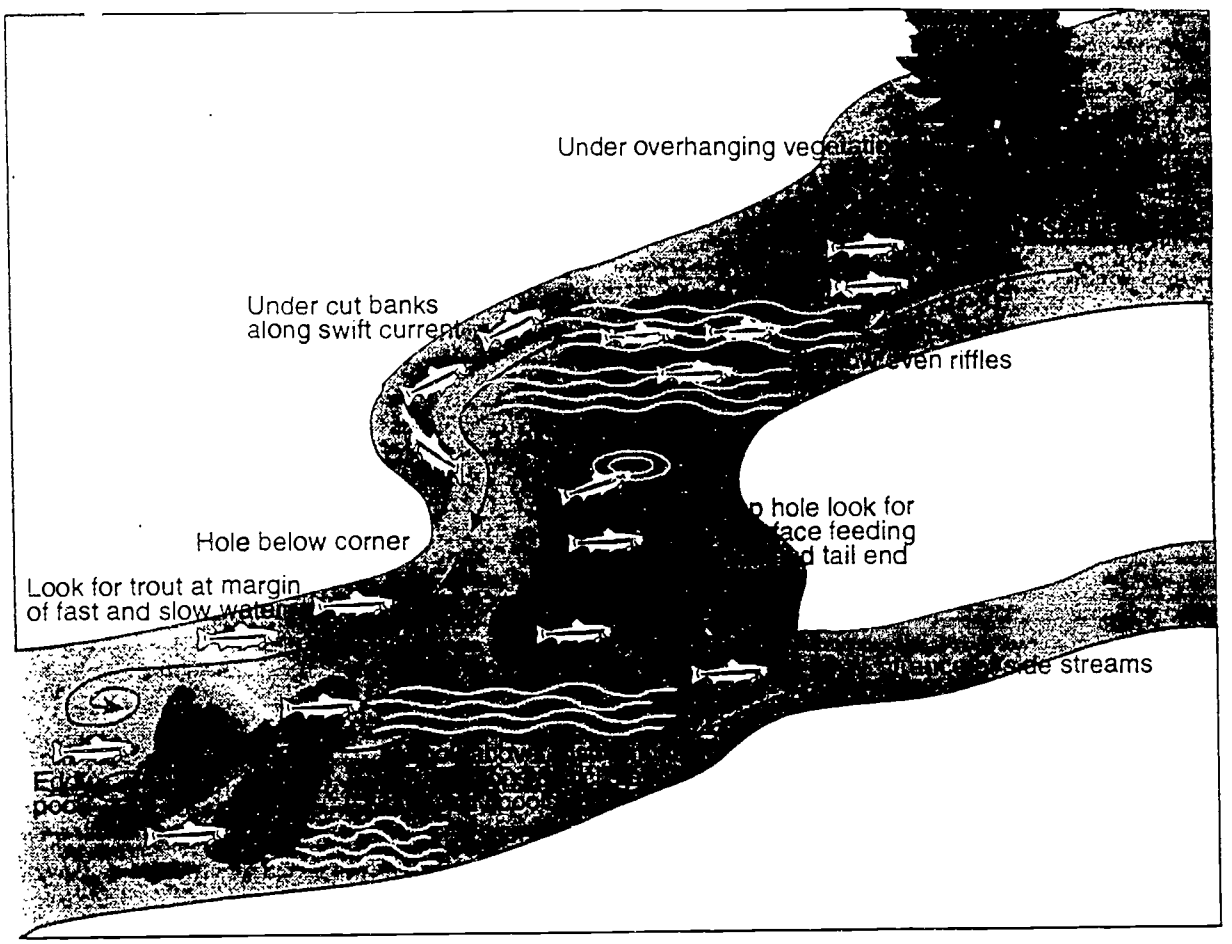
Fly fishing in the Winds often relies on presenting the trout with some sort of insect imitation. NOLS issues trout flies that imitate terrestrial bugs and aquatic insects in different phases. Terrestrial flies include grasshoppers, ants, inchworms, or crickets that may have fallen or jumped into the water. Aquatic insect flies are more varied. Depending on the genus, aquatic insects go through three to four life phases from egg to adulthood. Mayflies, stone flies and caddis flies start out as eggs, then crawl or swim along the bottom in a larval stage, before floating to the surface and sprouting wings. The mature adults mate, then die. Wet flies include those that approximate the nymph or larval stage. Dry flies resemble emerging or mature adults.

Trouts eat insects in all their phases. Try to determine what the trout are feeding on and match this food source with a fly. This is called "matching the hatch." Look for insects landing on the water and fish rising to eat them. This would be a dry fly situation. The lack of rises may indicate that nymphs, larvae or baby trout are on the menu. Many aquatic insect species rise to the surface and transform into the adult phase when it is almost dark out. This is called a hatch. Such an event can send the trout into a feeding frenzy.



Part of the art of fly fishing lies in "matching the hatch." Here are some examples of insects and the artificial flies designed to mimic them.

Finding Trout in Moving Water



FISH SENSE

Trout have evolved to be good hunters and successful evaders of predation. Their sense organs are especially keen to vibrations, dark silhouettes, and smells. Water transmits sound at a rate of a mile per second, so walking softly on the bank or in the water is essential to avoid alarming the fish. A trout's eyesight is also good. They notice the shape, size and tonal characteristics of insects. The color of the fly does not need to match the hatch exactly, but if the bugs are light-colored, use a light-colored fly.

Light refracts as it hits the water. This allows trout to detect a predator's approach from 48 degrees or more above the water surface. If you can see the trout, you should approach them in a low, crouched position. The smell of insect repellent, human skin, or petroleum products can also frighten fish. Trout have external taste buds that let them taste their prey just by bumping into it. Tie your flies with clean hands.

HOLDING WATERS

The angler reads the stream to look for places of shelter and easy feeding. You know from your river crossing experience that water velocity is different from place to place throughout the stream. Moving water brings a continuous supply of food, but constant exposure to a strong current tires a trout. Trout pick places that permit them to feed with minimal effort and that conceal them from predators. Undercut banks provide just such a sanctuary, but are difficult to fish. Trout also like to hang out at the bottom of deep runs where the light is diffuse and the water slower. You can often find them in pools just below the riffles, usually at the head of the pool where the water is deep and slow.

Most trout are territorial. This means the biggest, most aggressive fish get the best pools. Eddies behind boulders or submerged logs are also favorite trout hangouts because they tend to harbor delectable insect populations. Watch for trout darting into swifter currents for food

and back to slower water to rest. Trout prefer cool water because it is rich in oxygen. If the stream is unusually warm, look for trout in rapid water or where springs feed the stream.

The food producing areas of a lake are limited to the depth that sunlight penetrates. The best combination for trout is a shallow area next to a deep drop-off. This provides good feeding opportunities and a quick escape route. Many lakes in the alpine and subalpine areas of the Winds have this characteristic. Outlets and inlets create currents that bring food to expectant trout. Lake fish cruise when they feed. Watch for the direction of the rises and cast ahead of them. On windy days, look for current lines holding floating debris. Trout often investigate these lines looking for drowned insects. Peninsulas and land that juts out into lakes are good fishing spots because cruising trout must swim around the obstacles. On these points, try casting parallel to the shore to get your fly or lure into the main traffic pattern.

TEACHING CONSIDERATIONS:

As with fishing skills, trout habitat needs to be taught on the water, where students can observe and interpret the fish in their habitat. Take your students out and show them rising fish. Explain what the trout might be eating and where the nearest concealment is. Cruise the shorelines and banks while your students are fishing, and quiz them as to where they think the fish are and why.

Don't pass up teachable moments on the trail. If the fish are rising, consider dropping packs and sneaking up on the fish with binos to identify them and see what they are eating.

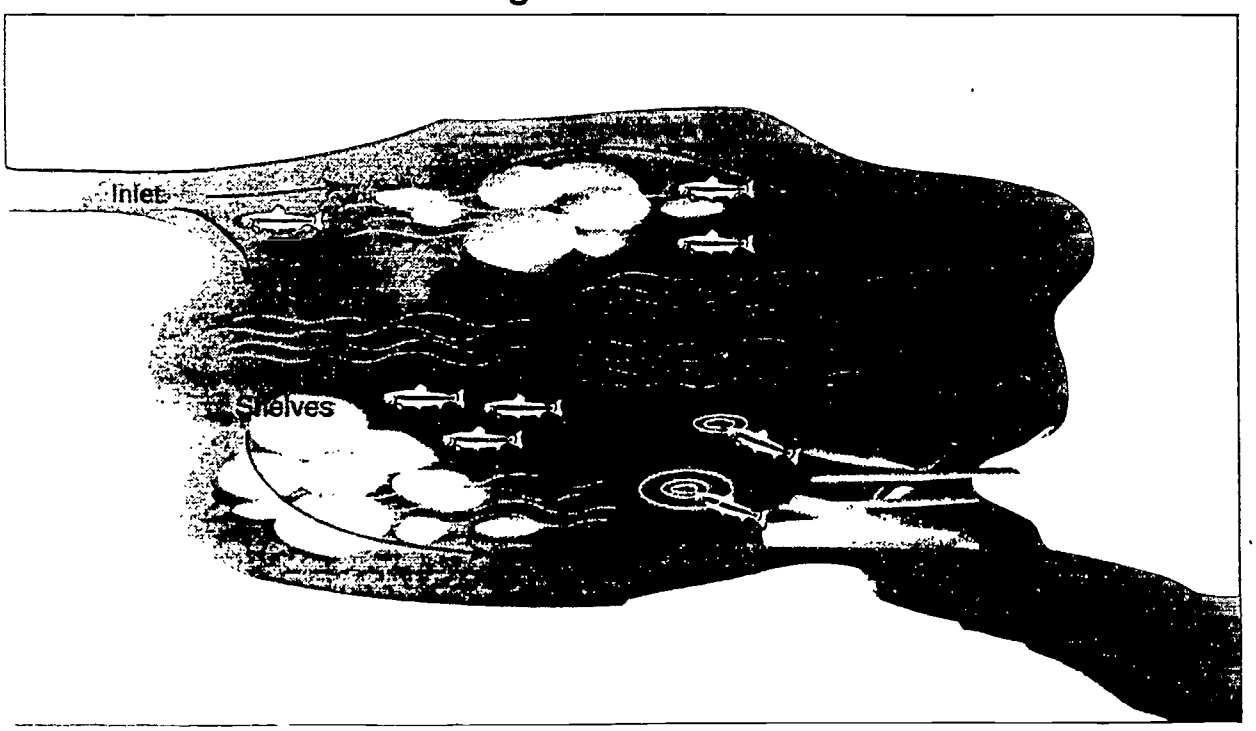
Introduce your students to aquatic insects by wading into the water and capturing live specimens. Examine them under a hand lens. The results are educational and fascinating.

Fly-tying can be another way to get students more deeply involved in trout behavior and habitat. The issue room has fly-tying kits available to take out into the field.

RESOURCES:

Anderson, Sheridan, *Curtis Creek Manifesto*. 1986
Cairns, Bill, Basic *Trout Fishing*. Stone Wall Press, 1990.
Hughes, Dave, *Reading the Water*, Stackpole Books, 1988.

Finding Trout in Lakes



BEAR HABITAT PRECAUTIONS

The rare privilege of observing a bear in the wild must be tempered with backcountry practices that protect both humans and bears. Native Americans had few, if any, problems with bears. Anthropologist Dick Nelson says if the Koyukon Indians wrote a book about bear safety, it would focus on keeping yourself in a state of respect towards the animal. We too can learn to respect and live among bears.

EDUCATIONAL GOALS:

Our primary concern as instructors should be avoiding dangerous bear encounters. Clean camping practices and an understanding of bear behavior and habitat are essential. Travel instructions must teach students how to avoid bears, and what to do if they run into one.

KEY POINTS:

BEAR BEHAVIOR

Bears are long-lived, intelligent and opportunistic. Once they have exploited human food, they continue to seek it out. Most bear attacks occur when the animal is surprised or threatened. Understanding this and recognizing that all bears—whether black or grizzly—are unpredictable is critical to living and traveling safely in their habitat.

1. Black bears evolved in a mountain/woodland environment and learned to respond to threatening situations by running away or climbing trees.
2. Grizzly bears evolved in the plains and tundra with no place to hide, so aggressive behavior became a key survival trait. As a result, they are very unpredictable.

BEAR AVOIDANCE

Before you leave the roadhead, do your homework. Make sure you know if your area has a history of human-bear conflicts. The more frequently your destination has had bear encounters, the more important it is to practice avoidance techniques. Bears are mobile creatures, however, and you can't always predict where the next problem one will be—so if there is a possibility that you are in bear country, practice impeccable bear camping techniques. In some areas, these techniques are required by local regulations.

AVOIDING BEARS ON THE TRAIL

- Make noise to avoid surprising a bear. Clap, sing, talk. This is especially important if visibility is less than 150 yards. Bears often bed down in dense, dark timber during the day and can be surprised easily.
- Hike in groups of four or more. Statistics show this group size minimizes the party's chance of eliciting an aggressive response from a bear suddenly encountered inside its critical distance.
- Do not attract bears. Food odors, fragrant toiletries, injured-animal imitations, and bear attack jokes may attract bears..
- Watch for fresh signs of bear activity. Scat, tracks, clawed trees, dug-up roots, torn-up logs, food caches (partially buried carcasses or places smelling of decayed flesh), or overturned rocks all indicate the presence of a bear. Remain alert, find a wide detour, and make more noise because the bear may be sleeping off its last meal nearby.
- Give wide berth to feeding areas. Spawning fish streams, berry patches, lush meadows in the spring, alpine zones in early fall, and white bark pine stands in late fall are popular feeding areas for bears.
- Know your "critical" distances. Bears have a hypothetical area around them within which an intruder often triggers a threatening or aggressive response from a bear. These distances vary according to the bear's sex, species, and its activity.

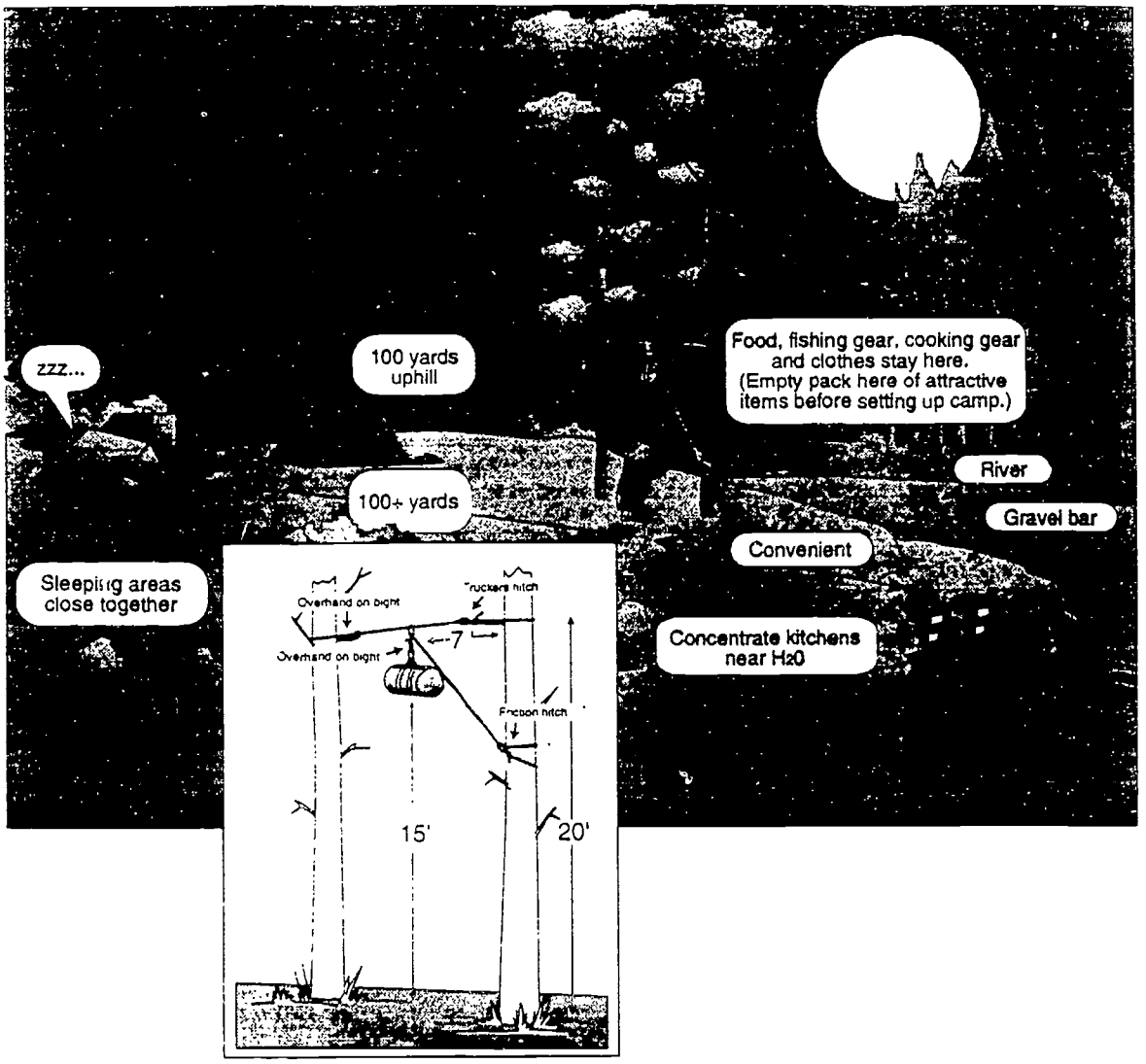
Based on a sprinting speed of 40 mph, an angry male grizzly can cover his critical distance in under two seconds. A sow with cubs can reach you from 300 yards away in ten seconds; that's faster than you can read these two sentences.

AVOIDING BEARS IN CAMP

Sleeping areas should be uphill and upwind of the kitchen to prevent evening, down-valley breezes from carrying food odors through the tent sites.

- No food or eating in the sleeping area! Leave trail food and toothpaste in the kitchen.
- Travel in pairs when walking out of camp.
- Remain alert for bears while in camp.
- Avoid camping near game and human trails; bears use them also.

Camping and cooking in bear country



Kitchen Sites should be clustered together, at least 100 yards downwind and downhill of your tent sites and along large streams whenever possible. This concentrates the impact on the gravel bar and keeps food smells out of the sleeping area. Your site should have good visibility (150 yards) in all directions.

- Cook groups should be close enough for a quick gathering if a bear is sighted.
- Take care cooking: avoid food spills, don't wipe hands on clothing, and minimize leftovers.
- Cook in your wind gear to keep food odors limited to one set of clothes. These items can then be stored with the food.
- Wash your hands and face after eating.
- Eat food immediately after preparation.
- Waste water should be dumped into a large stream or into a sump hole.

Food Storage

Hang food at least 15 feet off the ground and four feet away from the trunk of a tree; the site should be 100 yards from camps and kitchens. Hang bear attractants: this includes food, fish cleaning knives, cook gear, fishing equipment, fragrant toiletries, and used tampons.

Fishing in Bear Country

Look for bear sign along streams before fishing. Such sign include partially eaten fish and bear trails. Bear trails can be identified by alternating oval-shaped depressions worn into the grass, or by two, narrow lanes the width of a bear's shoulders.

Clean your catch far away from camp. Consider cleaning your fish underwater and leaving the guts in the water. Fish smells can be removed

from yours hands by rubbing them with evergreen needles. Don't fish alone.

BEAR ENCOUNTERS

Don't run, stay cool. Running triggers pursuit.

Maximize your presence. When your group size is four or more stand together (shoulder to shoulder) to emphasize your group's dominance and size. Stand your ground and speak to the bear in assured, audible tones. Raise your arms to emphasize your dominance and size. Try to appear as a multi-headed animal.

Adjust your actions to the bear's response. If the bear holds its ground, it is inviting you to leave.

Minimize your presence. Back up slowly without turning your back on the bear, speak in a low, calm tone, avoid eye contact, and turn sideways. These actions make you look smaller and less threatening.

Face a charging bear. Continue to speak to it in a low tone and stand still. The bear may make repeated false charges and veer off at the last minute before leaving.

Play dead if attacked. Curl up in a cannonball position and clasp your hands behind your neck to protect it. Do not resist the bear. It may lose interest once it believes you are dead. Do not get up until you are sure it is gone.

Climb a tree if attacked. Make sure you can get at least 15 feet up a stout tree before the bear reaches you.

TEACHING CONSIDERATIONS:

Begin your bear safety orientation by having the students read the posted information at the trailhead regarding the bear status in your area. Bear safety practices often begin on the first hike with a "What do we do if we see a bear?" discussion.

This can be followed by a demonstration of a "bear raid" drill. One person points and says "I see a bear." The group should then gather together, stand shoulder-to-shoulder, and face the direction the bear spotter is pointing. Get the students into the habit of assembling in this formation immediately. Make sure it is perfectly clear when you are doing a drill and when you aren't.

Impeccable kitchen habits, introduced with the initial cooking instruction, are as important for protecting the bear from habituation to human foods, as they are for our own safety.

Students may have a difficult time perceiving the threat of a grizzly bear when they have not seen one. It is worth taking the time to show students any bear sign you come across at the beginning of the course. Tell them your own stories about encounters or read them out of Herrero's book, so they can learn from other people's misfortunes instead of their own.

Bear camping takes time and attention to detail. Schedules should allow adequate time for kitchen setup, cooking and food hanging before dark. Having students climb trees is one of the more hair-raising activities you'll do on a course. Consider having a team of instructor-approved tree climbers do all the high tree work.

RESOURCES:

Herrero, Stephen, *Bear Attacks*, 1985.
USDI & USDA, Grizzly Country, 1987.
Hampton and Cole, *Soft Paths*. 1988.
NOLS Bear Camping Practices

CHAPTER THREE
MOUNTAIN TRAVEL

This chapter focuses on the travel and hazard evaluation skills neeeded to move safely and efficiently through the Wind Rivers. For information on mountaineering and technical climbing systems see NOLS Wilderness Mountaineering and its companion teaching notebook.

TRAIL TECHNIQUE

Hiking with a pack in the mountains is an athletic activity. Efficient hiking techniques are essential for enjoyable mountain travel. Completing a challenging travel day can enhance a student's self-esteem.

EDUCATIONAL GOALS:

Our goal is to develop careful, cautious, efficient and environmentally sound hikers—hikers who are familiar with techniques for traveling across boulders, scree, thick bushes, side hills, and even crowded trails.

KEY POINTS:

SAFETY

To reduce injury, warm-up and stretch muscles prior to starting out in the morning or after a long rest break. Pay attention to hot spots and attend to them promptly. (See the First Aid Chapter for blister care and prevention.) Gaiters keep socks cleaner, which is important for maintaining healthy feet. Wear boots with heavy packs or on uneven or unstable terrain.

Walk with smooth deliberate movements to avoid injury. Jumping, running and twisting with a heavy pack on can cause back and lower leg injuries. On steep downhills, avoid long steps and locked knees to minimize stress on your knees.

Ideally, hike in a party size of four or more. This way, if someone gets hurt one person can stay with the patient while two go for help. A hiking party should be close enough together to stay within sight of each other.

TRAVELING EFFICIENTLY

The rest step is a hiking technique designed to conserve energy when moving up steep hills. It works best with a shorter than normal walking gait. Place your feet flat, and transfer weight from one straight leg to the other in a slow, smooth motion. Avoid snapping the knee into the locked position. The goal is to move slowly and efficiently.

Take rest breaks out of sight of the trail. Rest long enough to give everyone time to eat, drink, and read maps, but not so long that muscles cool and stiffen. Rest breaks should occur often enough to accommodate the needs of the hiking group members, but avoid frequent stops that prohibit developing a regular hiking rhythm. Try resting for five minutes every hour early in a course, then adapt your pattern to terrain, weather, route, and group as experience and fitness change.

A good hiking pace allows efficient movement throughout the day. Ideally the pace should give you time to observe landmarks and terrain, to maintain an efficient breathing rate, and to arrive in camp with enough energy to choose a good campsite and prepare a hearty meal.

Efficient travel entails redistributing weight when people are having difficulty carrying their load. It requires that hikers are well-hydrated, nourished, comfortably dressed, and carrying packs that are tight and well-balanced. Efficiency also involves making sure nothing is left behind. Check before leaving camp or rest break sites.

MOUNTAIN WALKING TECHNIQUES

Hiking in the mountains is different from walking on a sidewalk. Your normal heel-to-toe stride should be replaced by a flatfooted technique which minimizes foot motion and reduces the chance of blisters. Strides need to be short to walk with flat feet. Lace boots loosely, and step around or over objects rather than on and off. Unnecessary up and down steps waste energy.

Allow enough space between hikers to prevent being snapped in the face by branches. Walk with your eyes. Watch the ground ahead, and consciously pick each foot placement. Consider hiking with a stout stick or ski poles. This will improve your balance and lessen the strain on your knees. Splay your feet when climbing steep slopes in order to shift some of the work from your calves to your thigh muscles. Often sidestepping on steep terrain improves balance and footing.

Use the "rest step" while walking uphill. Lock your knees briefly with each step, so you rest on your bones, not on your muscles.

If you can, find a way around thick brush. If you have no choice, you can try backing through bushes or using a stick to push vegetation out of the way. Tod Schimelpfenig says he once lay flat over brush and had students walk carefully across his back!

SCREE SLOPES AND BOULDER FIELDS

Walking on boulder fields requires practice and confidence. Step on the uphill side of rocks and boulders so if they roll, you'll be tumbled into the hill and out of the path of the moving rock.

Maintain motion and avoid stopping when unbalanced. Move from rest spot to rest spot. Do not travel over loose terrain with someone directly above or below you. If you have to go through areas that channel rockfall, move one at a time, and wait for an "all clear" signal before heading into this zone. Make sure everyone knows where you are at all times. Another way to travel through dangerous areas is to bunch together, so if a rock gets loose, it won't have time to accelerate between hikers. This technique only works if the group stays in its tight configuration.

If a rock comes loose and someone is below you, warn them by screaming "ROCK!" Use this call for any dangerous projectile.

Handholds can be useful in difficult terrain, but make sure they are secure. Test each hold, be it a tree branch or a rock, before committing your full weight to it. When you are using vegetation, pull on it along the long axis of the branch or vine, and always be suspicious of dead branches.

When descending the fall line, keep your weight over your feet and face downhill. Place your heel first and make sure it has bitten into the surface (scree, loose dirt or snow) before your weight goes onto it. Bent knees help absorb the shock and place you in an "athletic position"—ready to react. Consider helmets, handlines or belays if the consequences of a fall are serious. Be willing to call halt on an inappropriate descent line.

STRIVE TO PASS UNNOTICED

Use a trail whenever one is available—even if it is muddy. This prevents the creation of the multilanes often found in popular areas. Hike single file on the trail to keep from widening its margins. Do not cut switch backs. Off-trail, try to spread out to minimize impact. Walk abreast in meadows.

Take rest breaks well off the trail and out of sight of other hikers. Be quiet and avoid rowdy behavior. Loud noises spook horses and game, and can have a negative impact on the wilderness experience of other users.

MEETING STOCK ON TRAIL

Yield the right of way to horses and pack animals. Move at least 20 feet off the trail and stay still, but in sight. Talk to the riders as they approach so the horses recognize that you are a person and not something to be afraid of. Move to the downhill side of the trail—spooked horses are easier to control if they run uphill.

TEACHING CONSIDERATIONS:

Mountain travel habits begin developing on the first hiking day. Correct breathing and "hot spot" awareness should be emphasized, modeled and demonstrated. Blister care can be explained in a teachable moment. Consider having the students examine their feet carefully before they

begin hiking. Explain to them what healthy feet look like and how to maintain that status.

Some instructors have their students hike with loose boots (loose enough to get stuck in the mud) on the first few days of hiking. This method forces people to walk slowly, flatfooted, and with their eyes on the ground. Loose boots also cause fewer blisters, because while there is movement inside the boot, there is no pressure to cause friction and rubbing (movement + pressure = friction and blisters).

Students having difficulty walking off trail can learn by following behind instructors and observing their techniques. Before heading into their first boulder field have students practice boulder walking without their packs. Consider helmets for uncoordinated students. To do this tactfully, be honest with the student. Remind them that their health and well-being comes before fashion or esteem.

Hiking with ski poles allows you to transfer some of your weight onto your arms. The poles provide another point of contact when moving over steep or slippery terrain and can make up for the decreased lateral stability found in some students with knee problems.

Instructors must feel confident about student abilities before turning them loose in challenging trailless country. They should be able to navigate, stay warm and dry, function as a group efficiently, and know some first aid (see Chapter 5) and emergency procedures. Consider rendezvousing at technical or hazardous obstacles when they are first learning to travel cross-country.

RESOURCES:

Mountaineers, *Mountaineering: Freedom of the Hills*, 5th edition, 1992
Petzoldt, Paul, *Wilderness Handbook*, 1974, pp. 85-105
Powers, Phil, "Rockfall," *NOLS Newsletter*, Oct. '91
Simer, Peter and John Sullivan, *NOLS Wilderness Guide.*, 1983, pp. 215-223

MAP READING

Map reading skills are essential for traveling and leading groups into remote wilderness areas.

EDUCATIONAL GOALS:

Students must be able to navigate accurately on- and off-trail using a topographic map. They should be able to interpret basic map symbols (colors, contour lines, scale, grid coordinates and information found along the margins), and plan a route using this information.

KEY POINTS:

GENERAL CONCEPTS

A topographic map is a two dimensional representation of our three dimensional world. They are developed from aerial photographs by the United States Geological Survey (USGS). The United States is divided into 7.5, 15 or 30 minute quadrangles for mapping. These sizes refer to how many minutes of latitude and longitude the map covers.

The earth is divided into degrees, minutes and seconds of latitude and longitude. There are 360° (degrees) in a circle, 60' (minutes) in a degree, and 60" (seconds) in a minute.

INFORMATION IN MAP MARGINS

Map name: corresponds to a prominent feature on the quadrangle.

Date: indicates when the map was made. Remember, some features on older maps are likely to have changed due to natural and man-made forces (trails are rerouted, forests get burned or clear cut, and ponds dry up.) Dates and markings in purple indicate revisions.

Scale: measures distance.

Declination diagram: indicates the angular difference between MN (Magnetic North) and TN (True North). GN refers to Grid North and tells us the orientation of the Universal Transverse Mercator

(UTM) grid system. UTM marks off square kilometers. Most maps have UTM marks on the margins and newer maps actually have the grid squares drawn in.

Coordinates: are found at the corners of a map and indicate which lines of latitude and longitude the quadrangle borders.

- Lines of latitude (also known as parallels) run east-west but measure degrees north or south from the equator.
- Lines of longitude (meridians) run north-south but measure degrees east-west of Greenwich, England.

Contour interval tells the vertical distance between contour lines.

MAP COLORS

White shows non-forested areas.

Green indicates a woodland that is dense enough to conceal a platoon—approximately 40 people—in one acre.

Blue symbolizes any area covered with water, such as lakes, streams, rivers, ponds. A dashed blue line enclosing a white area indicates a permanent snow field or glacier.

Red is used to indicate more prominent man-made landmarks, such as surveys and major roads.

Purple shows recent corrections or additions to the map.

Brown marks contour lines.

Black marks man-made features, such as trails, cabins, bridges, roads, or mines.

ORIENTING THE MAP

Before you can navigate using a topographic map, you must be able to orient it to the land around you. One way to do this is through terrain association.

1. Locate a nearby terrain feature, preferably a linear one (ridge, trail or drainage) and rotate your map until the picture on the paper matches the terrain in view. You must be able to identify the feature on the map accurately for this to work! Your map is now oriented.

MEASURING DISTANCES ON THE MAP

Scale: This is the reduction ratio used when the map was made.

- A map with a scale of 1: 24,000 represents 24,000 inches of the earth's surface for every inch portrayed on the map. The scale will indicate how many miles or kilometers are contained in an inch on the map.
- On a 15' map (1: 62,500 scale), one inch = one mile.
- On a 7.5' map (1: 24,000 scale), 2 5/8 inches = one mile.
- 1° of latitude = 69 miles, 1' of latitude = 1.15 miles

MEASURING WITH THE SCALE

1. Draw the line of travel between the starting and ending points.
2. Use a thin piece of cord or grass to mark the length of the line.
3. Lay this on the appropriate scale and calculate the distance.

RELIEF FEATURES ON THE MAP

Contour lines connect points of equal elevation. They are used to indicate the elevation and shape of terrain features. They are represented by brown lines. Contour lines are separated by the contour interval, which is the vertical distance between the two actual lines. Typically this is 40 or 80 feet depending on the scale. The interval is the same between each line, so they are closer together where the land is steep, and farther apart where it is flat.

Index contours are the heavier brown lines that include elevation numbers. Every fifth line is an index contour.

Intermediate contours, found between the index contours and represented by lighter brown lines, do not have their elevation printed on the map.

Converging contour lines often appear as one thick brown line. These represent overhanging, vertical or near vertical relief.

Supplementary contours are dotted lines that display half of the interval in relatively flat terrain.

Contour lines indicate the kind and shape of land forms

- **Hills** and mountains are shown by closed lines that circle back to connect with themselves.
- **Valleys** are indicated by V-or U-shaped contours that point towards higher elevation. Often you'll find streams running down the apex of the V or U.
- **Ridges** are also shown by V-or U-shaped contours, but these point towards lower elevations. Remember, creeks never run along ridges.

STEPS TO SIMPLIFY MAP NAVIGATION

- Always start with the map oriented.
- Hike with the map in your hand and stay focused on the passing terrain and landmarks.
- Know your starting point, look around, and check to see how it is represented on the map. Then using your map, visualize the terrain ahead.
- Watch the terrain you pass through. Take mental notes.
- Fix your position on the map as often as is necessary.
- Check off features in your mind as you pass them, and remember what time that was.
- Locate your position on the map by:
  1. Identifying five characteristics (proximity to water, slope, tree cover, man-made features, aspect, major landmarks, etc.) which describe your location accurately.
  2. Then finding the place on the map which shares these five characteristics.

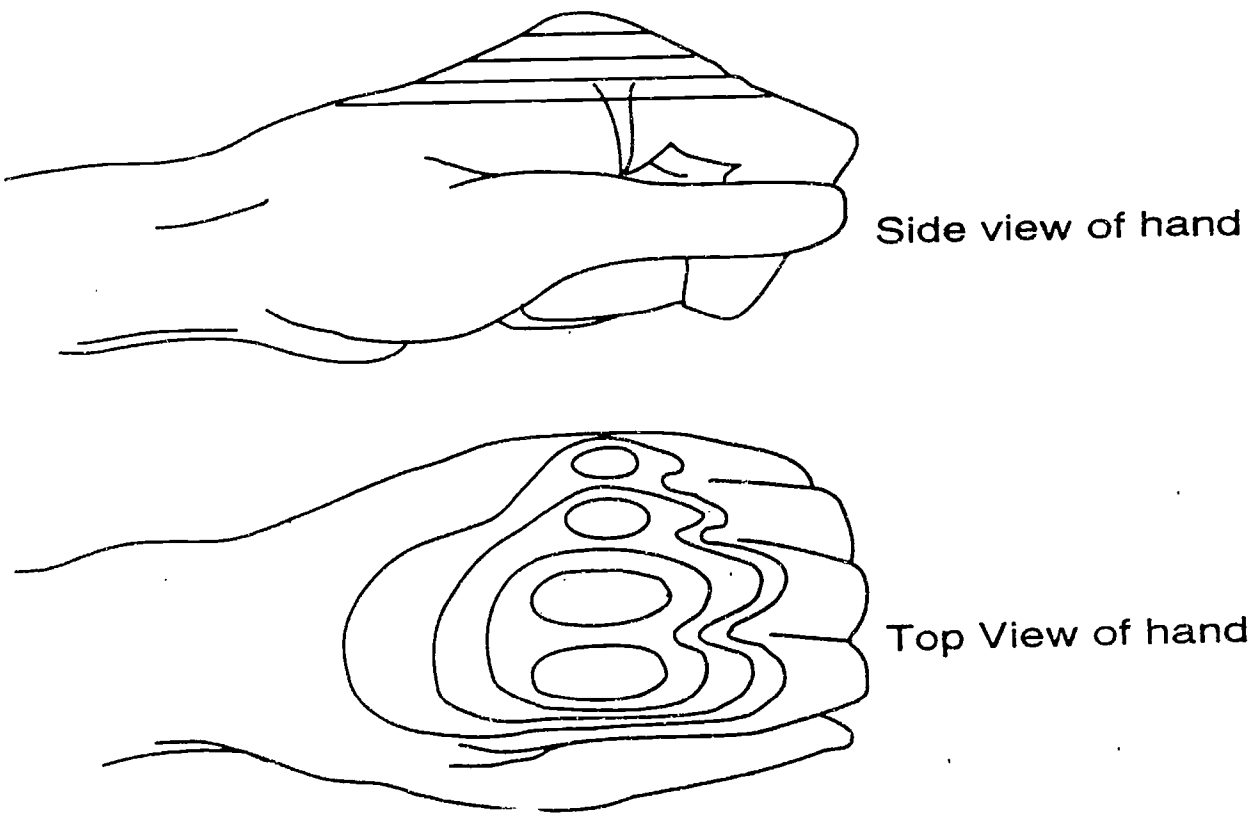
Remember, observe first, then read the map.

COMMON MAP READING MISTAKES

Some of the most common map reading errors occur when you:

- Believe you have traveled farther than you have, especially uphill or off-trail.
- Choose a place on the map where you want to be, and then make it fit your actual location through wishful thinking.
- Confuse a treed open area with a woodland and vice versa.
- Forgot what time you were at a known point.

KNUCKLE MOUNTAIN



Drawing contour lines on your knuckles is a good way to introduce the concept.

TEACHING CONSIDERATIONS:

This subject is challenging to teach because of differing spatial abilities of our students—three-dimensional visual aids often help. Individuals who appear to be uninterested or have continued difficulty with map reading may have a learning problem. These students often need more attention.

Teach the "must knows" first and add the less important details later. For example, teach the important map colors—white, green, blue, and black—before you introduce red and purple. Introduce the information in the margins as needed. Avoid any extraneous details that will distract students or be hard to grasp with limited experience.

Initial instruction should focus on navigation using map colors alone. Orient the map for your students until they become proficient with the greens, whites and blues. Consider leaving out contour lines until your students need this information. Try to start with a map for every student; they will learn faster if they have one in their hands.

Introduce contour lines with a three-dimensional model. For example, draw contour lines around your knuckles or knee to make a mountain that can be transformed from three dimensions to two by straightening the limb out. Sand models with parachute cord contour lines also work well.

Time Control Plans are a key part of practical map reading. They also provide a way to monitor student progress and help them develop good planning habits. Map quizzes are another effective way to check your students' progress. These can be TCP exercises that require individual students to plan a route or they can be exercises requiring students to draw their own map. Having students build terrain models out of snow is a fun way both to practice map reading, and to get a good look at your route.

Learning from one's mistakes is an important part of map reading. After initial coaching, constant instructor intervention can create false confidence or dependence in our student map readers. They often learn more after they have walked a couple of unnecessary miles.

RESOURCES:

Mountaineering: Freedom of the Hills, 5th Ed. Mountaineers, 1992, pp. 71-78

Kals, W.S. *Land Navigation Handbook*, 1983, pp. 1-80

Simer, Peter and John Sullivan, *The NOLS Wilderness Guide*. pp. 187-193

HAZARD EVALUATION

Students need to develop understanding, experience, and respect for hazards.

EDUCATION GOALS:

Each student must be able to identify and mitigate common mountain hazards. They also need to understand their own technical, physical, and psychological limitations when traveling through hazardous terrain. They should understand how subjective and objective dangers interact to lessen a group's safety margin.

KEY POINTS:

GENERAL CONCEPTS

Mountain hazards can be categorized in two ways. Objective hazards are part of a natural process. They include darkness, weather changes, rockfall and moving water. Subjective hazards are caused by the human attributes of a mountain traveler. These hazards include ignorance, overconfidence and fatigue.

To lessen the chances of an accident in the mountains, learn to recognize and manage hazards. Forethought and an understanding of personal and group limitations help to minimize hazard exposure.

OBJECTIVE HAZARDS

LIGHTNING

For information on how to avoid lightning or minimize your chance of being struck, see Meteorology in the Environmental Studies section of this notebook.

ROCKFALL

Learn to recognize signs of rockfall activity. Look at the base of gullies or cliffs for streaked snow, and freshly fractured or lichen-free boulders. Do not travel directly above or below others on loose

terrain, and try to limit exposure to rockfall paths by passing through them quickly and one at a time. Helmets may be necessary to minimize danger. Beware passing through active areas mid-morning or late afternoon when natural rockfall is more likely due to freeze-thaw activity.

Choose routes that minimize danger, and camps that are well out of the way of rockfall. Look and listen to see what times of day rockfall is most frequent and expect it during rainstorms.

SNOW

Snow can be dangerous without proper gear or experience. To assess the hazard, examine the slope for protruding rocks, check the slope angle, and consider the consequences of a fall.

Soft snow may cause post-holing and partially melted-out rocks can create elephant traps. Test snow security on steep terrain with a belay, and try to travel at the appropriate time of day to take advantage of harder or softer snow conditions. On steep slopes, look for an adequate run-out, which means checking to see if there is enough low angle snow for a fallen climber to come to a stop naturally without hitting any obstacles.

Probe snow bridges for adequate thickness, and make an effort to cross them early in the day while the snow is still frozen and strong. Consider the consequences of falling through the bridge. Will you be in danger of long falls, cold water immersion, or entrapment? Be more suspect as temperature rises, especially mid to late season when overnight freezing stops.

Expect cornices on the lee side of passes and ridges. Stay back from the edge, behind the apex of the ridge, for the safest travel path.

Frozen lakes can make for easy travel when they are solid, but walk around them if the ice is changing colors or showing signs of thinness such as melted water around the edges.

SWIFT WATER

(See river crossing and tyrolean traverse in this chapter.) Don't underestimate the power of moving water. River crossings are often the most hazardous obstacle encountered in the mountains. Consider a technical crossing for any moving water deeper than mid-thigh level on the smallest group member and be prepared to alter the route if the river crossing is dangerous. You may find a more suitable crossing if you hike to the divided headwaters of the river, or if you cross early in the day. Rivers rise in the late afternoon and evening as snow melt enters the stream. They subside in the morning after overnight cooling slows melting.

WET SURFACES

Be careful of wet slabs, boulders and scree slopes, and watch out for wet lichen. Steep wet grass should be viewed as fourth class terrain, especially when exposed or with poor runouts. When traversing wet, slippery slopes, move slowly, keep your weight low, use solid hand holds, and consider the use of handlines or belays in treacherous places. Keep your hands empty.

WEATHER

(See Meteorology in the *Environmental Studies* chapter.) When bad weather rolls in, stop hiking early to avoid getting caught in areas with poor camping. Be aware of rapidly rising water before and after storms, and consider waiting to move until the storm passes. Travel in bad weather only if you are certain you can stay safe and navigate accurately.

FOREST HAZARDS

It is easy to get turned around and lost in a dark forest. It may be embarrassing for you, but to avoid wandering off in the wrong direction and spending a cold night out without your sleeping bag, call out to others if you get disoriented after dark.

Watch for eye level branches when wandering around camp at night. Bring a flashlight, and avoid thick undergrowth in the dark. Walk with your hand in front of your face to protect your eyes.

"Widowmakers" or standing dead trees have fallen on camps during wind storms. When choosing a campsite, check for potential widowmakers and camp out of their range. Test questionable trees.

SUBJECTIVE HAZARDS AND RISK MANAGEMENT

By: Tod Schimelpfenig, Risk Management Director

Every activity contains some degree of risk. It is our responsibility, as wilderness educators, to manage the risks we encounter and to help our students learn to do the same.

With the responsibility to manage risk comes the temptation to ensure safety, an impossible task if we adhere to the dictionary definition of safety: freedom from harm. Nonetheless, in pursuit of this Quixotic windmill, we expand the depth of our knowledge, develop innovations in technique and equipment, and devise guidelines, procedures and laws that guide or restrict behavior in the interest of managing risk. We set performance expectations: "No cutting your feet." We provide education to accomplish the expectations: "So and so had to be littered over the divide because he cut his toe on a rock." When all else fails we restrict behavior: "No barefoot swimming."

These are sensible means to make our wilderness activities healthier, more enjoyable, and less likely to cause us harm. They pale, however, as tools to manage risk when compared to developing awareness of the human factor in accidents. In wilderness education we probe this topic when we discuss leadership, judgment and expedition behavior, but our tendency is to back away and focus on objective hazards—those tangible, measurable dangers.

Wilderness educators conveniently group hazards into objective and subjective. The former, while not necessarily predictable, are visible and understandable. We can see and understand rockfall, avalanches, moving water, cold water, deep water, weather, animals, and flashfloods. Subjective hazards are harder to get our hands around. They express our human frailty, our state of mind. Phil Powers says that we carry subjective hazards with us into the wilderness as unseen baggage—like that smelly lost sock that lurks in the bottom of a sleeping bag—and bring them to every decision-making session.

A complete list of subjective hazards would be as long as human history. It might include: errors in planning such as inadequate food, improper equipment, or unrealistic schedules; lack of knowledge or misinformation; unrealistic goals, preconceptions and expectations; inflexibility or resistance to change; lack of communication and leadership within a group; inability to manage stress; dishonesty about abilities; and peer pressure, complacency, or indecision.

In the interests of time (and because I'm not foolish enough to think I fully understand human behavior) I'm going to focus on only a few of these: complacency, risk perceptions, overconfidence, goals, schedules and impatience, peer pressure, immortal staff, and distractions. I hope this article stimulates conversations on this topic among staff and with students.

COMPLACENCY

Complacency is a product of boredom, distraction, lack of awareness, or failure to question old habits. We blunt the sharpness of our leadership edge because the uncommon has become routine or the environment appears benign. Wilderness is anything but routine—that is one of its attractions. The route may be the same, but the interaction of weather, student abilities, staff experience, equipment, and a host of other factors can make the once in a century event happen today. The complacent leader may suddenly enter what safety engineers call the recognition phase, the point where you realize that this is more than a bad day at work. The recognition phase is usually accompanied by plummeting self-esteem, thoughts such as "I'm an idiot," and "How could I have done this?" Consider climber Lynn Hill's unfinished figure-8 knot which resulted in a 70 foot fall, or the recent failure of an instructor to clip into an anchor, which resulted in a 20 foot fall for both himself and the student being belayed. These are just two examples of competent people erring in highly practiced tasks.

RISK PERCEPTIONS

The more routine and familiar an activity becomes the safer it appears. Mountaineering is expected to be more controllable simply because we have more experience with it, but have the changes in technique and equipment over the years really lowered the risk? Have the consequences of extreme weather, random avalanche, rockfall, or human error changed?

If a situation is voluntary, familiar, controllable, routine, pleasant, predictable, and avoidable it is perceived as having less risk. If we have no control, if it is dramatic, dreadful, catastrophic, or difficult to mitigate, we perceive more risk. For example, our executive director and finance manager will ride their motorcycles but wouldn't think of drinking apple juice that might be tainted with Alar.

Each of us has a unique perception of the risk and dangers of an activity. An activity that may cause you only concern can be frightening for others. A task that is difficult for one person can be dangerous for another. Fear and anxiety from perceived high risk can interfere with our ability to perform. Conversely, the perception of low risk can engender complacency, the "I've done this before" syndrome. When the terrain allows you to move safely unroped it can be hard, yet crucial if you're the leader, to understand another's need for a rope.

OVERCONFIDENCE

A close relative of complacency, overconfidence is acting with an inaccurate perception of where the outside of the envelope is. I worry about this in the age where skills fast out-distance experience. Many sport climbers climb 5.10, but can they climb a mountain? Consider the rock climbing camp graduate deciding on the wisdom of scrambling on steep slick canyon sandstone with a recent memory of the rough grip of Split Rock granite.

We once had a student who, after a rough time on the mountain hiking section, found she was good at caving. Her desire to excel on this program, and her perception that she was proficient with the intellectual process of memorizing cave passage, motivated her to excel on the mock search, to crawl away from her partner to search an extra passage, and then when she became lost, to try to find herself before the searchers did. Thirty-six hours and $50,000 later the efforts of more than 100 people found her.

GOALS

We are goal-oriented people in a goal-oriented society. Unrealistic goals (planning errors), inconsistent goals among group members, un-articulated goals, and the inability to review goals as the situation changes, all affect safety.

Well-understood and articulated goals are essential for an expedition, but the power of a goal can drive us to perform actions we would reconsider in other circumstances. As Abraham Lincoln said in reference to the Civil War era, "The dogmas of the quiet past are inadequate for the stormy present." Effective leaders are constantly checking in, clarifying and focusing goals. Many of us would agree that objectives such as summits, routes or timetables can be changed, while goals such as safety, friendship and learning are timeless.

IMPATIENCE AND SCHEDULES

If I've learned anything living in the wilderness it is that nature is very patient. The time limits we have outside the wilderness are often inappropriate and irrelevant while in it. A NOLS vehicle accident a couple of years ago (minor injuries, bashed truck) was a classic example of schedule pressures causing us to drive faster than we should. As it has often been said, is it worth haste for beer, sex or a plane schedule?

PEER PRESSURE

On a NOLS course, after retreating from a peak climb, a fellow instructor, in front of the students, called me a wimp. The remark was in jest, but its pressure was strong. My obscene retort clarified the issue for all present. Don't underestimate the pressure our peers, our students, and adventurers outside the wilderness education community, can place on our actions.

We're familiar with the concept of peer pressure. Now let's consider its subtle relative—position behavior. Position behavior has to do with the expectations placed upon you by virtue of your position in a group. This is the person with medical training who is suddenly looked upon as an expert, regardless of their ability or experience. Or the instructor, who simply because he/she has been hired by NOLS and wears the uniform of an outdoor educator, is deemed infallible by the students, and assumes the expectations of that mantle. The desire to gain approval by living up to other's expectations is powerful. Resistance requires brutal honesty in self-evaluation, and the courage to articulate your limits.

I should also say a few words about competition. We've all heard the mantra "Competition has no place in outdoor education" but let's be honest, it rears its ugly head every day. We compete against ourselves, against fellow staff, and against the achievements of people outside the wilderness. Challenge is an essential ingredient of growth and education, except when the competition becomes the end and we lose sight of the process.

IMMORTAL STAFF

In the role of the instructor we are often perceived by our students as pillars of strength, vitality and competence. We are, however, human and mortal, capable of error and susceptible to illness and injury. Instructors have fallen off routine rappel ledges, nearly died from cerebral edema, and disappeared down steep snow slopes leaving their students alone in technical terrain. We move casually along edges, perhaps not clipping in as often as we should. Accidents to staff on personal trips remind us of our limits and of a reality of our occupation.

An injured instructor wrote "Instructors who have spent time on technically demanding courses will recognize the phenomena of the 'casual day.' I have often been guilty of rigorously instilling safety awareness in my students, while telling myself that experience and surefootedness excused me from excessive caution. Casual day or not, exposure is exposure, and instructors, though we often forget it, are always human. I realize that I have been given a valuable lesson for a remarkably light fee."

"When I worked with juvenile delinquents I believed that displaying ease, unroped at the top of a rappel cliff, helped them to relax. Having never fallen off a cliff, I didn't know exactly where the line was that determined how far things could be pushed. I assumed I was well on the safe side of it; that nothing that felt stable and doable to me would be truly dangerous. Now, having fallen, I can see that the line is erratic, moving nearer and farther in the same way the canyon rim did as we contoured along, but not so visible and predictable. The line that marks what we are allowed to get away with is determined by many factors, and it isn't hard to overlook one."

INCORRECT INFORMATION

On a medical level, it is hazardous to act on incorrect information—to misdiagnosis. This can confuse a medical transport situation with a medical emergency, and place everyone involved at unnecessary risk.

Acting on incorrect guidebook information, or on any erroneous assumption, is also hazardous. Develop a habit of accepting nothing at face value, and question the assumptions underlying your decisions. Assess the situation at hand. I'm an advocate of access to other's experience through off-trail guides, safety incident accounts, and the tales of those who have gone before us, however, the conditions at hand may be more relevant than yesterday's advice. Relying on assumptions based on past practices rather than what we see in front of us was a factor in a flash flood near-miss in Baja.

DISTRACTIONS

In the confusion of sorting through expedition objectives, personal issues and physical needs, howling wind, and trip participants clamoring for attention, we can lose sight of what is important. The questions about radar failure, single versus double-hulled tankers, crew fatigue and alcohol in the grounding of the Exxon Valdez and the oiling of Prince William Sound are intriguing, but miss the point. "The ship's captain was given the best training, paid well with five months annual vacation and generous fringe benefits for the sole purpose of ensuring that the ship would be safely operated. Any other duty was minor."

Evaluating distraction is crucial to understanding and predicting the "human component" at play in our students. Their comfort level and focus with an activity or an objective hazard determines how they will be able to function.

Evaluating distraction among coworkers is also difficult and important. Our distractions—either short-term issues that develop during a course or larger issues and baggage that an instructor may bring into the field from home—need to be communicated to fellow staff to help keep the distraction from affecting our ability to manage risk.

PEOPLE ASSESSMENT

How can we be alert to people who may be involved in accidents? Randy Udall at the Colorado Outward Bound School suggests we look at a person's health: assess stamina, grace, strength and agility. Do they get sick easily in the field? Mentally are they alert, able to problem solve actively? Emotionally look for their ability to cope, to persist, to help others. Look for survivors. Look for people who are comfortable with the unknown. Seek out your student leaders early and cultivate them. You may need them.

Look out for abdicators, immortals or the disembodied. I had a student once, who after a river crossing class, casually waded a stream I thought warranted more caution. His response to my query about the consequences of swimming in rocky cold mountain rivers was "I'm not wor-

ried. It's your job to take care of me." He immediately rose to the top of my "needs supervision" list.

People who need a lot of support are high maintenance; those who get by on their own are low. These are the people who handle things themselves and don't mind being wet, cold or hungry occasionally. Another asset of such survivors is their ability to make up their mind, right or wrong. A wrong decision at least gives us new information, often quick information, and the solace of action.

High maintenance individuals or those who need your constant support can't see the end of the activity when things get tough. They are focused on the moment, hang their heads, move slowly and say "I'm cold, I'm wet, this course sucks." These people do not seek comfort in the present situation, they seek comfort elsewhere. They look meek and fearful, and fidget over small details. Peter Goth of the Wilderness Medical Associates says these folks have the umbles: they grumble, mumble, fumble, stumble, tumble, and bumble.

You can help high maintenance people by interjecting your vitality, your caution, by role modeling specific behaviors you want emulated, and by sharing your perceptions, decisions and emotions. Extending someone's survival skills with your vitality and energy works for awhile, but when the person finally gives up .....oh my! Be careful, the strongest and most capable people have their limits. When fatigued, or compromised by cold, uncertainty, or schedule changes, we all can falter and suddenly become the dreaded high maintenance person.

REAL INCIDENT ACCOUNTS

We don't like to hear about accidents, although we occasionally read them vicariously in *Reader's Digest* or secretly watch Rescue 911. What we can strive to do better is to discuss our decisions and accidents with others honestly, and build an oral and written tradition that gives us the benefit of each other's experience.

Regular incident accounts are available in *Accidents In North American Mountaineering, American Caving Accidents*, and *The River Safety Newsletter*. A consistent theme in all these publications is human attitudes in accidents. Jed Williamson, editor of *Accidents In North American Mountaineering*, lists a number of errors in judgment as contributing to accidents: desire to please others, sticking to a schedule, inability to cope with the unexpected, misperceptions, fatigue and distraction.

LEADERSHIP

I began this article by commenting that subjective hazards are errors in planning and leadership. Venturing into the wilderness with inadequate food or equipment, or an unrealistic schedule is a planning mistake. Inappropriate or poorly understood goals and expectations, lack of flexibility, communication difficulties, inability to manage stress, distraction, indecision, and inaccurate estimation of abilities are errors in leadership and expedition behavior.

NOLS instructor Peter Chance, in an often quoted essay on sea kayaking, says how leadership is crucial to safety. When he reminds us to be watchful, decisive, flexible, patient, and humble, yet not to be over cautious, he's telling us how to lead.

We already have a vocabulary with which to have conversations about leadership. We can enhance our risk management by consciously considering the impact of our leadership—the goals we communicate, the behavior we model, the habits we practice and instill in our students—has on safety.

As we develop leadership in our students and ourselves, consider the human factors inevitably intertwined into any accident. When we question decisions we should be acknowledging the reality of our attitudes, preconceptions and flexibility on our judgments, and speak of them as easily as we speak of frost generated rockfall, river crossing sites, and rattlesnakes.

Thanks to Phil Powers, Reb Gregg, Jim Ratz and Mark Cole for their editorial comments.

TEACHING CONSIDERATIONS

Make it an expectation that watching for hazards is everyone's responsibility. An outdoor leader understands that careless, thoughtless or dangerous behavior affects personal, as well as group well being.

The examples instructors set are critical. Students emulate positive as well as negative role modeling. Often they lack the experience to recognize the latter. Students should observe us staying in control, practicing sound techniques, articulating thought processes, and demonstrating consistent hazard awareness.

Include a hazard update as part of hiking group briefing. Periodic review of hazards keeps students aware of dangers they haven't observed recently. An informal weather log documenting the time and severity of the thunderstorms can also help develop student awareness by instilling in them a sense of local patterns and a habit of watching for meteorological changes.

RESOURCES:

Lightning and Mountain Weather, Nat'l Weather Service. Denver (Available at the NOAA office at the Lander Airport.)
Mountaineering: Freedom of the Hills, 5th Ed., Mountaineers, 1992
Powers, Phil, *NOLS Wilderness Mountaineering*, 1993, pp. 14 -47.
Powers, Phil, "Avoiding and reducing rockfall on a course," *NOLS Newsletter*, Oct. 1991.

TIME CONTROL PLANS

Besides their planning and communication function, TCP's are a valuable method for enhancing your students' map reading and navigation skills. A well-developed time control plan not only gets the students to camp on time, but also provides them with a useful tool for executing their own post-course adventures responsibly.

EDUCATIONAL GOALS:

A principal aim of this instruction is to use TCP's to promote student planning and navigation skills and to develop confidence in their abilities to travel on their own. All students should leave their course understanding the importance of making accurate time/distance calculations, and recognizing how this practice relates to efficient wilderness travel.

KEY POINTS:

USES FOR TIME CONTROL PLANS

A. As a planning tool which allows you to calculate the energy and time required to travel and surmount obstacles along a chosen route.
B. As a navigational learning tool.
C. As a means to track overdue parties.

TCP FORMAT

A written TCP should include:
A. The names of the participants (duties and equipment)
B. Travel plans
- Origins, destinations, dates
- Route descriptions (using named map features and cardinal directions)

C. Time-distances calculations
D. Contingency plans
- Alternate campsites/rendezvous points
- Anticipated obstacles/hazards
- Causes for delay

ESTIMATING TRAVEL TIME

The final part of the TCP is a multistep calculation to determine the total time required to travel a given route.

1. Start by measuring the *linear distance* or the mileage measured on the map from point A to point B.
2. Next determine the *adjusted distance*. This equals the linear distance + elevation gain adjustment (see conversion table below).
3. *Travel time* (hours) equals the adjusted mileage (miles) divided by the rate of travel, measured in miles per hour.
4. *Total time of travel* equals travel time + delays
5. *ETA* = ETD + total time of travel

TIME/EFFORT CONVERSION TABLE

- 1,000 feet of elevation gain approximately equals the effort needed to walk one mile on a flat trail.
- Two miles on a flat trail w/heavy pack takes approximately one hour
- One mile off trail takes about one hour

TEACHING CONSIDERATIONS:

Students do not need to be expert map readers prior to this class, but they should be able to recognize obvious map symbols, count contour lines, and make distance calculations using the map's scale. Having a long travel day under their belts can help them realize the importance of having a travel plan.

TCP instruction should be geared towards successful navigation, rudimentary time/energy management, and the development of an anticipatory mind set towards route-finding hazards and obstacles.

Varied math backgrounds and visual learning habits of some students can influence their ability to assimilate elaborate ETA calculations. Keep it simple. If in doubt try your explanation on your coworkers the evening before. Involve the students in the instruction by providing them with simple calculations that help you complete your sample TCP.

Subsequent TCP assignments must be followed up and critiqued. Students tend to devalue the utility of these plans if they do not receive timely feedback. Plan enough time so all the students can do one on their own. Consider having students navigate solely by a well-written TCP. This exercise helps them focus on navigating within "the big picture" and sharpens their ability to judge distances and elevation changes more accurately. The exercise works best when terrain features are easy to see.

RESOURCES:

Kale, W.S. *Land Navigation Handbook,* Sierra Club. 1983 pp.47-52
Petzoldt, Paul. *The Wilderness Handbook.* pp. 29, 30, 90, 95, 127, 130, 150, 151, 219
Simer, Peter and John Sullivan. *The NOLS Wilderness Guide* , pp. 228-229

ROUTE FINDING

Traveling off the beaten path is part of any NOLS course. Successful cross-country navigation requires sound route-finding skills.

EDUCATIONAL GOALS:

Teach your students to anticipate hazards and obstacles from their maps, and to avoid them as they are encountered during a hike both on and off trail. The goal of this instruction is to pick energy efficient routes.

KEY POINTS:

ROUTE FINDING

Good route finding conserves energy and minimizes exposure to dangerous terrain. It begins with a study of the terrain features on the map and continues as you find your way across the land in front of you. Good route finding matches the difficulty of the route to the abilities of the party.

COMPONENTS OF A WELL-PLANNED HIKE

A well-planned route is efficient and enjoyable. Avoid unnecessary exposure to lightning, rockfall, steep, loose or wet rock, moving water, technical terrain, steep vegetated slopes, ice fall, and crevasses. Conserve energy by contouring to avoid unnecessary elevation gain or loss. Small elevation changes may help you avoid extensive sidehilling, however. Minimize the time spent on boulder fields and scree slopes, or in deadfall and thick bush. Often the most efficient route sticks to open terrain. To make the route fun, provide opportunities for impromptu teaching and photography, and take time to observe.

USING THE MAP

Maps are a good place to start planning your route. Begin by identifying your starting and ending points. The shortest line between two points may not be the safest, fastest or most enjoyable option, however. Consider all the possible route variations when determining how to get from point A to point B.

Pick out terrain features that will indicate if you are straying off track. For instance, your route may have you keeping a river on your left and a ridge on the right. These features serve as boundaries and will channel your route.

USING TERRAIN FEATURES

Field observations, combined with a topographic map can help you predict the conditions you can expect to encounter during a day's travel. Some things are obvious: steep slopes will be physically demanding and may be slippery, while gradual ascents and descents are less taxing. Subtle factors, such as slope stability, can also be gauged by checking the map for features such as the presence or absence of vegetation. (The more trees, the more stable the slope.)

Aspect, elevation, and knowledge of ecosystems and habitats provide further clues to travel conditions. North-facing slopes tend to be more

thickly vegetated, and to hold snow and cornices longer than south-facing aspects. Boulder fields are common close to the crest of the Wind River Range. Lightning is more frequent at certain elevations and at certain hours of the day. Snow line, tree line and tundra zones can be expected at roughly the same elevation throughout a given range.

Ridges often have less vegetation and water than valleys. They are also less likely to be choked with deadfall and to have better vantage points. As a result, ridges are often the route of choice in the mountains.

Moving water may be the most dangerous hazard encountered on a route. (See the river crossings section for more information on this topic.) Weather can also cause unexpected obstacles. Prolonged rains will increase stream levels, promote rockfall, and contribute to flash flooding. Winds are stronger on exposed ridges and passes. But team efficiency is probably one of the greatest factors affecting actual arrival time. Given the unpredictability of many of these factors, alternative sheltered campsites should be planned for in the event of impassable conditions.

Maps can clue you in to many of these potential hazards, but remember, they have their shortcomings. For example, a 39-foot cliff might not show up on a map with 40-foot contour intervals. Therefore, expect the unexpected and allow time for contingency plans.

FINDING THE ROUTE

Be flexible. The map will only provide the most basic information. Readjust your route or travel plan as more information is gathered. Don't try to determine the entire route at once. Instead, visualize it in stages. One technique you can try is the "**see method.**"

A "see" is the distance you can see from where you are standing. Look ahead and choose the easiest route. If you notice a better 'see' enroute, take it. The second hiker in line is called the 'smoother-upper' and should be looking for a way to improve upon the first person's route. When the end of a 'see' is reached, the process is repeated. The object of this is to keep the group moving as a whole though individuals may stop briefly. Simply go where it looks best, keeping overall travel considerations in mind.

Don't force a route if it becomes dangerous, entails unnecessary impact, or frightens a group member. Be willing to backtrack until a viable alternative can be found.

Ideally, the whole party should know where they are at all times. Pay attention and update the group's position as you pass key landmarks. Look back often in order to make retracing the route easier. If in doubt, **stop and scout.** If the party suspects they've made a navigational error, stop and figure out where the error occurred. Seek higher ground or a place with a better view, and send members out with maps to gather more information. Regroup and evaluate the scout's findings.

Hiking groups should be self sufficient so they can relax with the knowledge that if they can't find the way, they can look more the next day.

TEACHING CONSIDERATIONS:

Route-finding instruction begins with sharing your thoughts and navigational decisions with the group. Once students are hiking on their own, route finding should be the subject of hiking debriefings, especially if it did not go smoothly.

Map-reading skills need to be solid before students will succeed at planning a route from the map. Sophisticated route finding incorporates a knowledge of local weather, geology and ecosystems. Have the students extrapolate where moraines and bushwhacks might be by looking at their map. Student route finding can begin before students are honed map readers. The "see method" is an easy way to get them started.

RESOURCES:

Bonney, Bruce and Jack Drury, *The Backcountry Classroom*, WEA. 1991. pp. 165-167
Mountaineering: Freedom of the Hills, 4th Ed. Mountaineers, pp.111-117
Petzoldt, Paul. *The Wilderness Handbook*, 1974, pp. 98-105
Simer, Peter and John Sullivan, *The NOLS Wilderness Guide*, 1983, pp. 215-229

COMPASS NAVIGATION

Although most navigation in the Wind Rivers can be done with a map only, being able to use a compass is useful when visibility is limited or terrain features subtle. Compass navigation skills should be seen as a complement to sound map-reading skills.

EDUCATION GOALS:

Students should know how to orient their map using a compass, be able to take and follow a compass bearing, and understand how to triangulate their position.

GENERAL CONCEPTS

A compass provides us with a consistent reference point and allows us to navigate without landmarks. The compass points to the earth's magnetic force which emanates from the magnetic north pole around Hudson Bay. These lines of force are caused by the flow of the earth's molten metal core. True north is the top of the planet towards the center of spin. Declination is the angular difference between true north and magnetic north at your location. The declination in the Wind Rivers is approximately 14° east.

BASIC COMPASS PARTS

Base Plate: This contains the Direction-of-Travel Arrow.

Bezel or Housing: the movable plastic circle with both the degrees and a north-indicating arrow printed on it.

North-Seeking Needle: This floats on a pivot inside the housing. The **red end of this needle points to magnetic north** ("Santa is red and lives up North").

BOXING THE NEEDLE

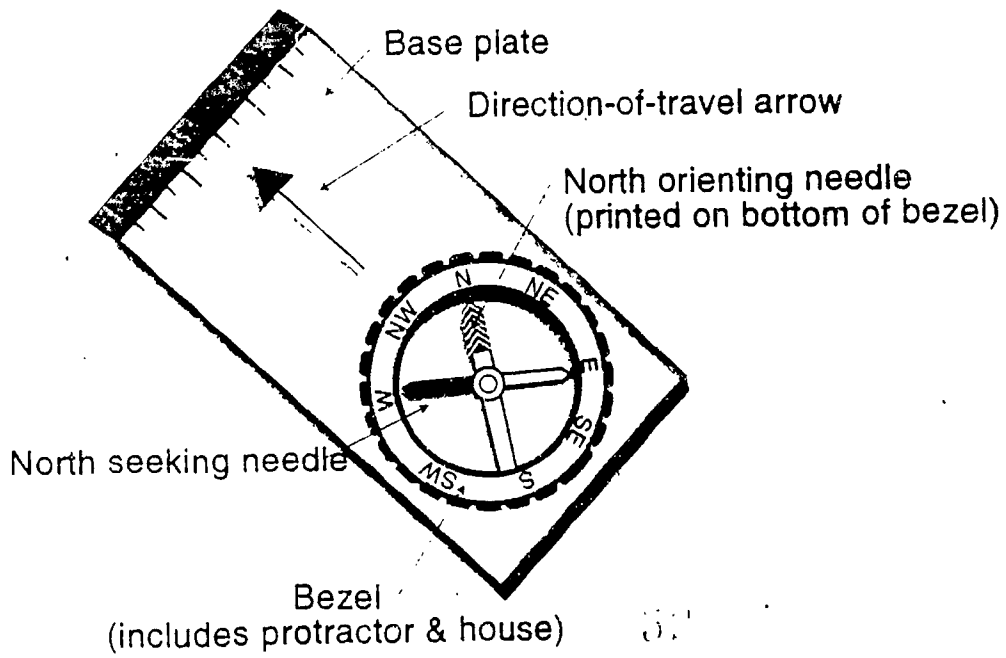
Boxing the needle is the first step in compass navigation. To do this, hold the compass flat in your hand at mid-chest level. Rotate the housing until the direction of travel arrow lines up with north on the bezel. Now rotate the compass by moving your palm until the north-seeking arrow lines up with—or is "boxed in"—the north-indicating arrow printed on the housing. The needle is now boxed and pointing toward magnetic north.

ORIENTING THE MAP

A compass can be helpful in orienting a map when, due to low clouds, thick vegetation, darkness, or featureless terrain, there are no real landmarks to use. The technique for orienting your map using a compass follows these steps:

1. Lay the map on a level surface.
2. Locate the declination diagram in the lower left corner of the map.
3. Lay the compass on top of the diagram and "box the needle."

Parts of the Compass



4. Without disturbing the compass, rotate the map until the MN vector (the line that points to magnetic north in the diagram) lines up along the edge of the compass (the edge parallel to the red needle). You have now aligned the magnetic north line on the map with the magnetic needle and your map is oriented to true north.

TAKING AND FOLLOWING A BEARING

To take a bearing, orient your map and then draw a straight line from your present location to your destination. Without disturbing the map, lay the compass edge along the intended line of travel. Rotate the housing or bezel to box the needle. The direction of travel arrow is now pointing in the direction you want to travel. The number on the housing dial is your bearing.

Now, keeping the needle boxed, lift the compass up to eye level. Sight along the direction of travel arrow and pick out a landmark which lines up with it. To follow the bearing, walk to your landmark and repeat the process of sighting along the direction of travel arrow with needle boxed. Keep doing this until you reach your destination. Fewer sightings result in fewer errors, so it helps to choose distant landmarks

To take a field bearing without the map, choose a landmark and point the direction of travel arrow at it. Rotate the housing to box the needle and follow the bearing in the manner described above.

TRIANGULATION

Triangulation is used to determine one's position using two or more known points. Again, you start by orienting your map. Then choose two known and visible landmarks.

Take a bearing on one of the landmarks. Place the edge of the compass (keep the needle boxed) on the map, so that it runs through the center of the landmark you just sighted. Double check to see that the needle remains boxed and that the map's orientation has not changed.

Draw a line along the edge of the compass through the landmark. Extend the line in each direction. You are on that line somewhere. You can even draw this line without a compass if you are careful. Now repeat this procedure on a second and for more precision, a third, landmark. It is helpful to pick landmarks that are at least 60° apart in order to improve the accuracy of the triangulation.

The intersection of all three lines is your position. Given human error, however, all three lines rarely intersect. Often they form a triangle, but your location should be somewhere in that triangle. Notice that triangulation with a compass is just a more refined way of orienting yourself using terrain association.

Triangulation is easier when you are traveling along a defined linear feature (ridge, trail, drainage, or river). Once again, start by orienting your map. Then trace a line along the linear feature you are following. Take a bearing on a landmark and transfer the line to the map. The intersection of the bearing line and your travel feature is your position.

TEACHING CONSIDERATIONS:

Introduce this instruction once the students are comfortable with their map reading skills, but do not wait until it is too late in the course for them to practice with your help. Compass use can be a distraction which impedes students' map-reading development, and the topic can be confusing if the instructor is unable to teach compass use in a simple manner. As with any topic, avoid teaching it if you have a weak personal experience base.

The "key points" mentioned above avoid adding and subtracting declination. This method is suggested because it is simple and easy to teach. Defer questions about declination calculations until after the class. These often confuse less experienced students, disrupt the flow of instruction, and cloud a simple method with useless complications. Unfortunately, most compass books are riddled with this unnecessary math.

Compass use should be taught in a step-by-step progression that builds upon previous skills. For ease of understanding, teach it in at least three to four installments. Here's a sample progression: 1) General Concepts: boxing the needle, orienting the map; 2) Measuring a bearing off the map and following it; 3) Triangulating a position; 4) Triangulating with range lines.

Students either seem to understand compass navigation easily or they struggle with it. Tailor your instruction to bring people along as they are ready. Organize a hiking group with students ready for more instruction and make that a focus of the day's trail education. Compass instruction is most effective in a setting that has clear, easy to identify landmarks. A simple

orienteering exercise can be a fun way for students to practice their skills. Make sure the distance of the legs are long enough to require accurate techniques. Instructor accuracy in setting the points is often the crux of a successful orienteering game.

In many cases this instruction is not vital for students to complete the SGE, but it can be useful. Students rarely need this skill in the Winds, but most will want it on future ventures.

RESOURCES:

Kals W.S. *Land Navigation Handbook*, 1983, pp. 81-148, 202-222
Kjellstrom, Bjiorn. *Be an expert with Map and Compass* (a good source for those who want the added challenge of adding and subtracting declination.)
Simer, Peter and John Sullivan. *The NOLS Wilderness Guide*. pp. 187-198
The directions that come with Silva compasses are simple and useful.

RIVER CROSSINGS

Early season travel in the Wind Rivers is often challenging due to the high volumes of rivers and streams caused by melting snow. Mountain travel requires the ability to judge moving water hazards and execute safe crossings.

EDUCATIONAL GOALS:

Students need the judgment and skills necessary to cross moving water without supervision. They should be able to recognize and assess river hazards, know when dry crossings are appropriate, and know when it is better to wade.

KEY POINTS

RIVER FEATURES

Study the river. Current—or the speed of the river—is determined by its volume, depth, and width. As a river widens, the current lessens. As the river gradient lessens, the current eases off. Narrow channels have faster water.

An eddy is a slow spot in the current formed behind obstructions. It is possible to eddy hop—or move from one eddy to another—to avoid having to tackle the main current for extended periods of time.

The deeper the water, the slower the current must be to wade. Visibility can also help you determine how deep a crossing will be. In general, visibility declines with depth. If you cannot see the bottom, chances are it is going to be too deep to wade.

Springtime often raises the river to flood levels and increases the chance of logs and debris washing downstream. The likelihood of coming upon strainers—or trees and logs lying partially on the bank and partially in water—also increases in flood stage. Strainers trap objects which wash down with the current. A swimmer who gets caught in a strainer can be pulled under and held against the branches which extend down into the water.

In the mountains, water levels rise as the day gets warmer and snow melts, and then drop back to their diurnal low between sundown and sunrise when melting slows. You can expect a mountain river fed by snowmelt to come up quickly when the weather gets warmer. Temperature increases also weaken snow bridges across rivers.

Surface texture is another clue to water depth. Deep water is glassy and masks the river bottom. Foaming rapids occur where the water is shallow, the gradient steep, or there are boulders and other obstacles along the river bottom.

The river bottom plays an important part in deciding where to cross. The chance of getting a foot trapped or having a wader trip increases with the size of the rocks on the bottom. Sand often covers rocks and logs in slow moving water and makes crossing easier.

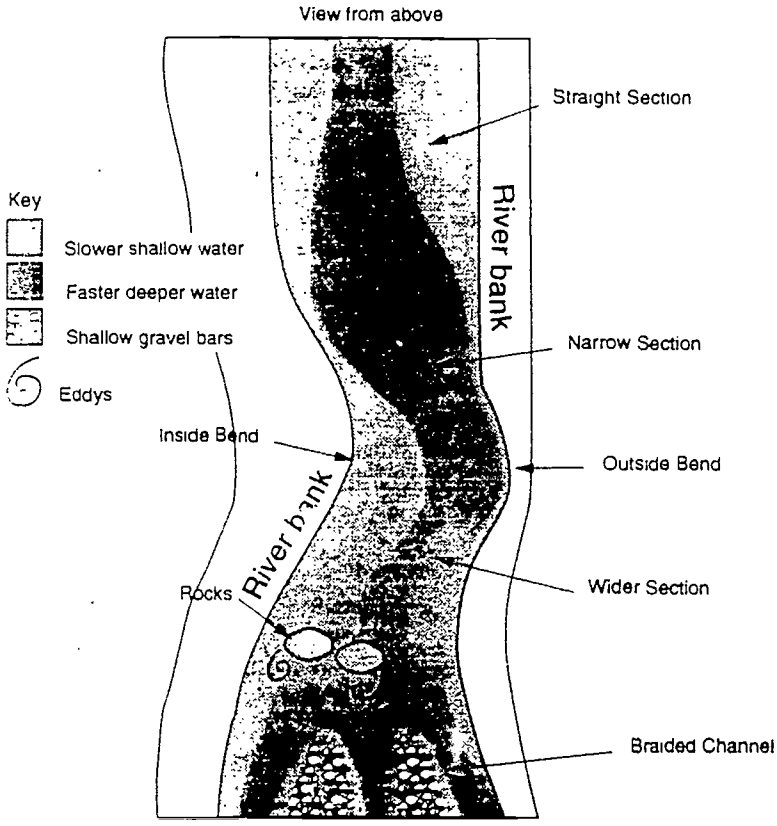
Water plunging down a steep gradient is likely to be fast and tumble rocks along the bottom. Listen for these potential ankle breakers washing down before stepping in to cross.

For entrances and exits, look for river banks without undercuts, overhanging vegetation, or steep slopes. Consider what would happen if you fell and got swept downstream. Bad washout zones include waterfalls, strainers, rapids, and low-hung snow bridges.

SCOUTING

Take time to find a good place to wade. Examine the map to see how large or steep an area the river is draining. A river draining a south-facing alpine basin or glacier may have more flow than a shaded north-facing one. Maps can also give you clues about gradient, river width, tributary locations, and wooded areas. Use high ground to survey large sections of the river.

RELATIVE CURRENT SPEEDS ON A FLAT RIVER



You may need to scout a long way up or downstream in search of a shallow, wide place where the current is manageable. Consider crossing the river's tributaries or feeder streams where the water volume will be less.

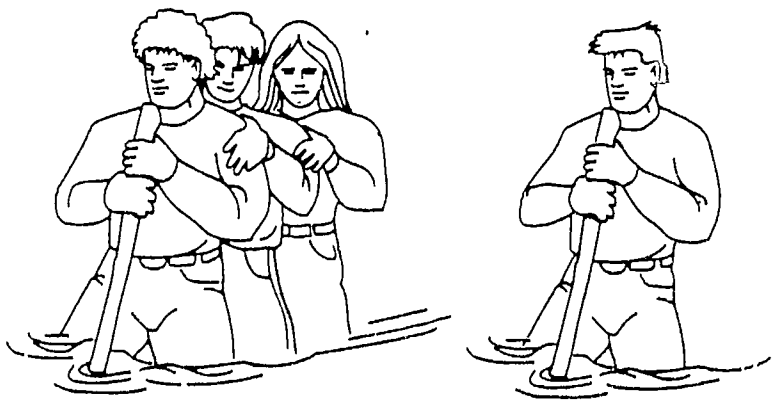
CROSSING TECHNIQUES

Your students need to understand the consequences of a slip. Can it result in a wet foot, lost equipment, a broken bone, or drowning? Ask your students what would happen if they fall. Less able group members may need help with their loads. Consider using the stronger people to shuttle packs across.

Crossing on logs, rocks, or using the high step technique preserves dry feet, but often requires balance, agility, and luck. Failure to execute these maneuvers properly is more likely to cause injuries than a carefully thought-out and executed wade.

Fallen trees and log jams can be used as bridges. Choose logs that are stable, broad and dry. Avoid crossing on thin, slippery, or inclined trees. Consider setting up a hand line to aid balance. Place the line at shoulder height and off to the side so that it does not interfere with packs or walking. Examine the consequences of falling off the log on the upstream side. The log may be a strainer.

Log jams are tempting foot bridges, but unless they consist of large, well-anchored logs which span the entire river, view them with suspicion. The entire lumber pile may be held in place by one or two key logs that may shift or release if someone walks on it. These are especially dangerous when they are in the main current. If the jam shifts or moves, find another place to cross. A hiker who falls through these floaters can be pinned on the underlying structure by the current.



A stick, friend, or both can provide stability in a stream crossing.

Before crossing a creek by rock hopping, rehearse your sequence of hops and steps in your mind. Try to connect dry, flat and closely-spaced rocks. Have your students imagine the rocks are coated with ice, so they place their foot on them delicately. Smooth, continual movement often facilitates balance. We do not encourage boulder jumping and hopping

with heavy packs on dry land, therefore, we should not promote leaps onto the slippery and rounded surfaces found on river boulders.

If you fall when rock hopping, you can bash yourself on rocks or even drown. Knee injuries may occur when the leading foot slips and the momentum of the leap continues to carry the knee forward onto the rock. Use a stick or a long fly rod case to provide balance while stepping from one stone to the next. This often reduces the need to leap, allowing more secure and balanced movements.

High stepping is when people walk rapidly through the river without getting water in their gaiters. If you use this method, the river bottom should be smooth and the distance short, since it is easy to trip.

WET CROSSINGS

Practice and familiarity with challenging wading conditions is important. Consider providing yourself additional points of contact, like a stout stick or the arm of another group member. Cross with your waist belt undone, to escape the pack faster if you fall. Redistribute loads to avoid top heaviness. Face upstream to lean into the current. Avoid staring at the river; moving water can mesmerize you and interfere with your balance. Choose a line that angles downstream if you want to fight the current less.

RIVER SWIMMING FOR SURVIVAL

If you find yourself in the river and at the mercy of the current, ditch your pack immediately and start floating. Lay on your back with your feet out in front of you. This position allows you to see where you're going and lets your legs absorb shock. Avoid standing up in swift currents; foot entrapment can occur in as little as one to two feet of water. Wait until you are in a slow, shallow area next to the bank before standing .

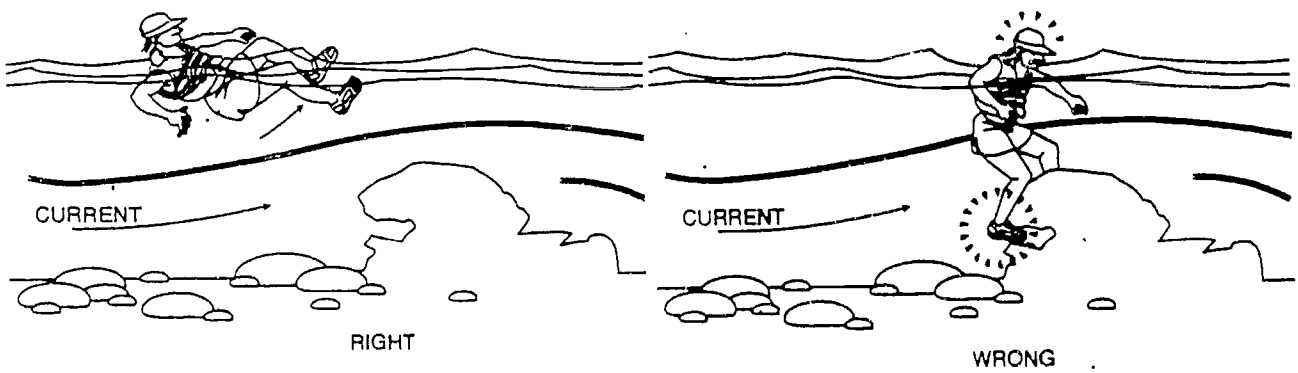
Wade in boots to provide adequate ankle support. Remove your socks, insoles and gaiters, then lace the boots up tightly for support and security. For deep crossings, remove wind pants and long underwear so there is less drag against your legs. Clothing tends to balloon up with water, making it difficult to move.

Make sure your pack is tight with all loose items secured inside. Keep your hands free and avoid dangling things around your neck. Loose items will be the first to disappear if you fall in.

Consider practicing your crossing technique on dry land or in shallow, slow water. Keep your feet shoulder-width apart and avoid crossing them when you walk. Use your foot to feel for solid footing before weighting it and commit carefully to each step.

Have the largest, most experienced person or team test the current prior to committing the entire group. Test it without packs on. If the test group encounters trouble, consider wading elsewhere. Post spotters downstream during the test and the actual crossings to help swimmers out of the water. Place them along the river's edge in eddies, where the swimmers are likely to be carried.

If you are wearing plastic boots and plan to wade in just the shells, you'll need to keep your gaiters on. Gaiters help prevent the boot shells from washing off your feet. Sometimes it is helpful to wear socks to pad your feet and make the boots fit more securely.



If you get washed downstream, keep your feet out in front of you, not down low where they can get snagged.

HOW DEEP CAN YOU WADE SAFELY?

- Ankle to mid-calf depths usually can be waded by yourself with a stick or with one other person for support.
- Mid-calf to mid-thigh depths should be waded with two others for support. Crossings become noticeably harder in water above the knees.
- Mid-thigh to waist deep wading becomes even more difficult because any current tends to buoy up the waders, especially if the current hits backpacks. Seriously consider finding a better place to wade.
- Avoid moving water above waist deep. Find or build a dry crossing.

WADING TECHNIQUES

When crossing on your own, face the current and use a stick as the third point of a tripod.

- Move perpendicularly or diagonally across the current.
- Move one point at a time.
- Use the stick to probe for holes.
- Shuffle across in small steps. Keep the stick in front of you.
- Keep moving. Hanging out in the hard parts wastes energy and increases risks.

The team method uses two or three people to cross the river together in a line parallel to the current.

- Face the current. The first person wades with a stick. The other two grasp the person in front of them.
- The first person creates an eddy in which the second and third stand. While the first person breaks the current, the others keep it from pushing her over.
- Take small steps, move together. The group works as a tight unit until out of the river.

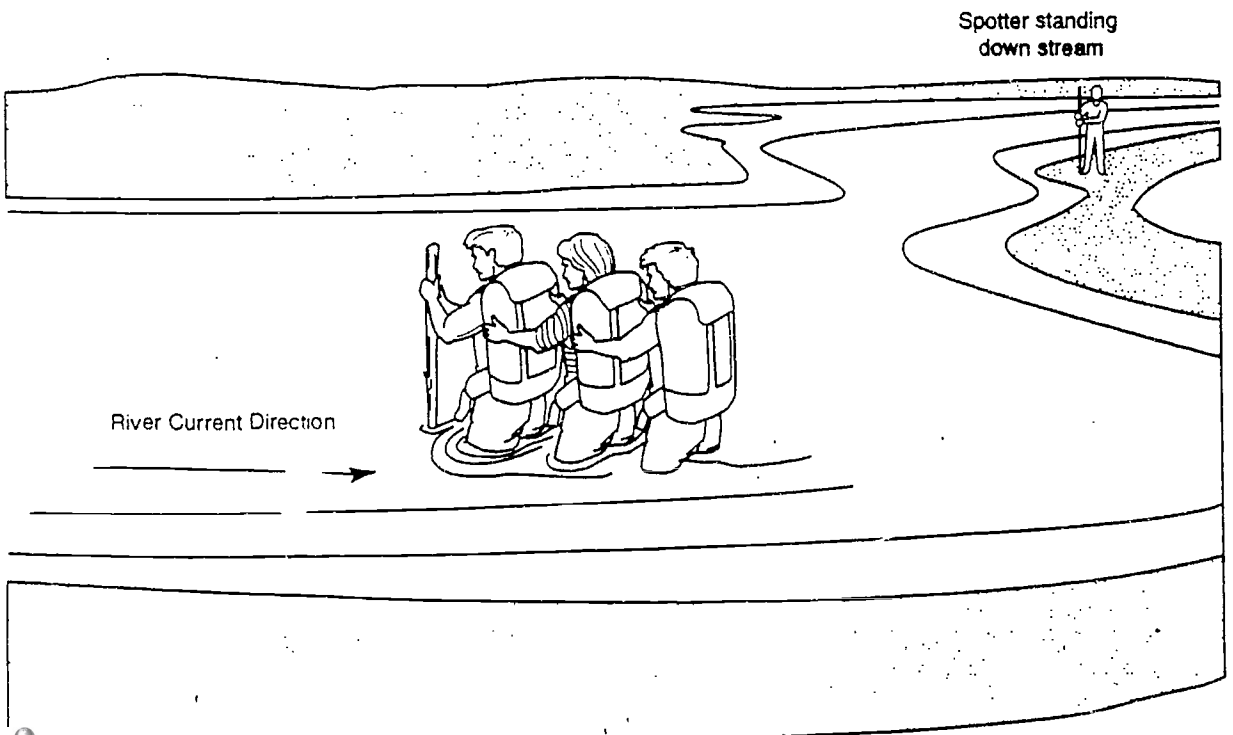
Another team method involves having two to four people cross together in a line across the current.

- Face upstream. Hold hands or grab the packs on either side of you.
- Take small steps, but try to maintain a steady speed.
- This method is not as stable as the team method described above, but it is fast in moderate conditions.

TEACHING CONSIDERATIONS:

River crossings are one of the most hazardous activities in wilderness. It can be hard to instill a respect for the forces involved when a person has not felt the impact of water pushing against his legs while wearing a heavy pack. Make sure you know everyone's swimming ability before teaching river crossings.

River crossing using the team method



Even though this subject is strongly governed by common sense, do not assume your students automatically understand the seriousness of moving water. Start talking about river crossings as soon as you encounter a fordable stream. Get them used to having wet boots. John Gookin provides his students with lots of practice in less tame water. He finds that people improve their skills and confidence after spending time crossing water that challenges their abilities. Alert spotters, as well as a safe washout zone, are mandatory for this activity.

Teach river scouting and crossing organization at the same time. Give your students the criteria for choosing a crossing, send them off to find an appropriate spot, and finish by discussing the merits of their recommendations. This is an appropriate time for the instructors to share their judgment with the group. Make it clear why a particular crossing and method are used or not used.

Model safe crossing techniques, especially for rocks and log crossings and remember what may be easy for you is often difficult for novices.

Let students know that the whole group must be comfortable with a crossing. Strict time schedules may lead students to rush, pressure them into a bad crossing, or prevent them from doing adequate scouting. Communicate expectations which promote wise student decisions.

In a low water year or late in the season, courses may not get a chance to wade rivers that are exciting and educational. Instructors have been able to teach crossing techniques and water safety by practicing wading at the outlets and inlets of lakes. Consider practice wades without packs if you believe the group needs more experience.

RESOURCES:

Bechdel, Les and Slim Ray. *River Rescue*, pp 55-60
Mountaineering: Freedom of the Hills. 5th edition, 1992, pp. 85-86

TYROLEAN TRAVERSE

A tyrolean traverse can be a thrilling event on a NOLS course. Some course routes routinely use the technique to cross rivers, especially in June. The skills learned building a tyrolean traverse can be applied to boating, mountaineering, rescue, caving, river crossings, and many other situations.

EDUCATIONAL GOALS:

Different goals are appropriate for different situations. Instructors must determine whether the students need to master the skills required to erect a tyrolean traverse, or just experience the thrill of crossing a river on a rope. If you want your students able to build tyrolean traverses on their own, they should understand basic rope handling, pulley systems, tensionless anchors, and force vectors before you begin instruction on a traverse system.

KEY POINTS:

A classic tyrolean traverse is a double taut line across a river that allows you to cross the obstacle on ropes rather than in the water. The lines are tightened using a 3:1 pulley system. Rarely are any two tyroleans the same. Success with the system comes from being able to adapt the basic concepts to any appropriate site.

EQUIPMENT NEEDS:

1.) Four ropes
   - Two long (anchor to anchor)
   - Two short (bank to bank)
2.) Two cordelettes
3.) Ten locking carabiners
4.) Twenty non-locking carabiners
5.) Fifteen double slings
6.) Ten single slings

SITE SELECTION

Selecting a safe site often involves extensive scouting. The ideal spot is a narrow portion of the river where a single rope can easily reach from shore to shore. You will need two large, healthy anchor trees at least ten feet back from the river's edge, and high banks so the ropes

are well above the water to prevent the people crossing from dragging through the river. The site should also have safe spots for easy loading and unloading.

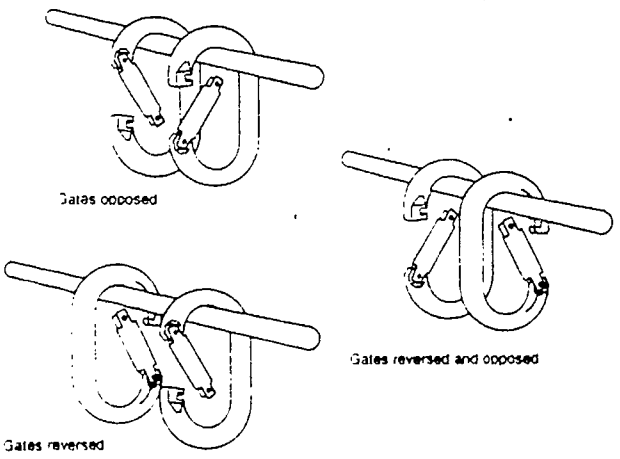
GETTING THE ROPES TO THE OTHER SIDE

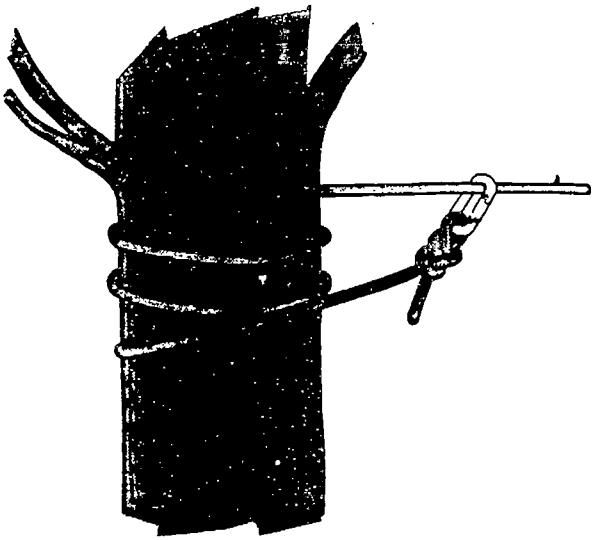
One of the main reasons for making a tyrolean traverse is that only one person has to swim the river. Ensure the swimmer's safety by choosing a short crossing site with minimal objective hazards. Station spotters downstream. Have dry clothes and a hot drink ready to send with the first person across the ropes when the tyrolean is complete.

Throw the ropes across the river. Make sure a poor toss will not get the rope caught in the river. Consider throwing it across upstream, and then walking it down to the crossing site. For long tosses, you may want to tie a rock to a section of parachute cord. You can then use the p-cord to pull the rope across. Once over, keep the rope out of the water to prevent snags. Use prearranged hand signals to communicate above the roar of the river.

BASIC CONSTRUCTION

Use two or three wraps of rope around a large tree trunk to create a tensionless anchor strong enough to hold the force exerted by people crossing the traverse. The end of the rope is tied in a figure-eight on a bight and clipped to itself. Two ropes should be attached in this manner on one side of the river. On the opposite shore, the ropes pass through a pair of guide biners clipped into a sling attached to the guide tree. The ropes then go to independent anchor trees where they are pulled tight with a 3:1 pulley system. Two additional ropes, attached shower curtain style to the taut line, are used to make a hauling system.





A tensionless anchor is made by wrapping the rope two to three times around a tree and clipping it back on itself using a figure-eight on a bight and a carabiner.

SYSTEM SAFETY

Tighten the system enough to keep people dry, secure, and able to move without undue effort, but do not remove all the slack from the ropes. According to vector physics, the force on the anchors increases as the angle of sag in the system decreases. In other words, the tighter the system, the greater the force on the anchors when the system is loaded in the middle.

Bouncing puts unnecessary stress on the anchors. Consider using a haul line to help people across. Watch out for injuries during tyrolean construction and use. If people are careless, they may get fingers caught when tying off the pulley system, or pinched between support lines and in carabiners when loading and unloading. Rope burns from dragging arms and legs along the rope as you cross are also possible.

Use two supporting ropes in two independent systems so everything is backed-up. Use two carabiners for pulleys. This creates a redundant system and results in less friction by providing a better bending angle than one or three carabiners. Use the improved prussik knot to create your 3:1, but tie the system off so the prussik is no longer in the system (see diagram on page 24.). Have no more than four people tighten the pulley system to avoid rope damage. Avoid breaking branches and friction burns on the trees used.

CROSSING TIPS

Clip into both support ropes with two oval carabiners. The gates should be reversed but not opposed in order to make unloading easier. If an individual's harness does not hold the carabiners so the supporting rope goes through straight, add two more to twist the orientation 90 degrees.

RETRIEVING THE SYSTEM

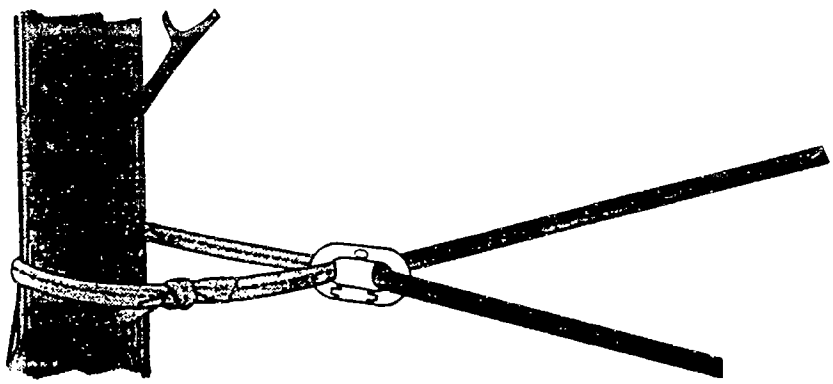
When half of your group has crossed the river, reverse the entire system to make it retrievable. The old guide tree now becomes the new anchor tree and vice versa. New pulley systems are set on the far bank. Keep the rope out of the current during this transition.

When there is only one person remaining, release the system, undo your tensionless anchor, and join the ends of the support ropes with a Flemish bend. The tyrolean is now one system without a backup. Make sure the knot is clear of the trunk on the upstream side, then retighten and have your last person cross. Pull the rope from the upstream side to keep the tail from being washed around the front of the tree and creating excessive friction. Pull the rope as quickly as possible to limit its time in the current and reduce the chance of it getting snagged in the river.

TEACHING CONSIDERATIONS:

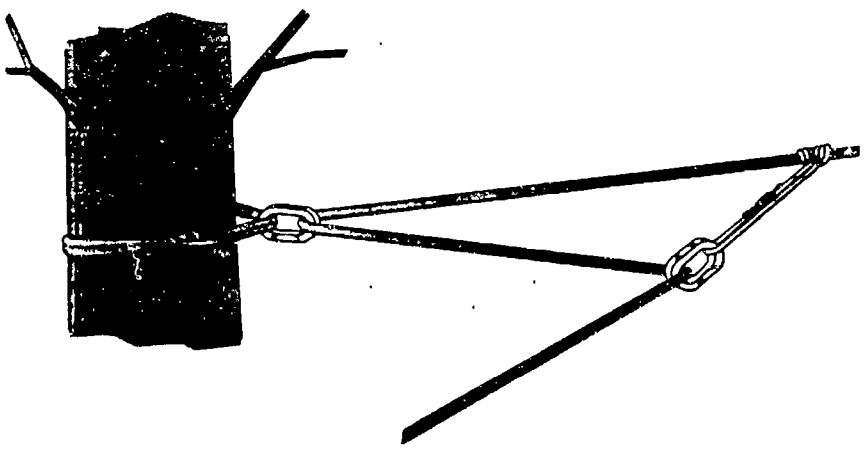
If you want your students to know how to do a tyrolean on their own, start by teaching them

A. 1:1 PULLEY



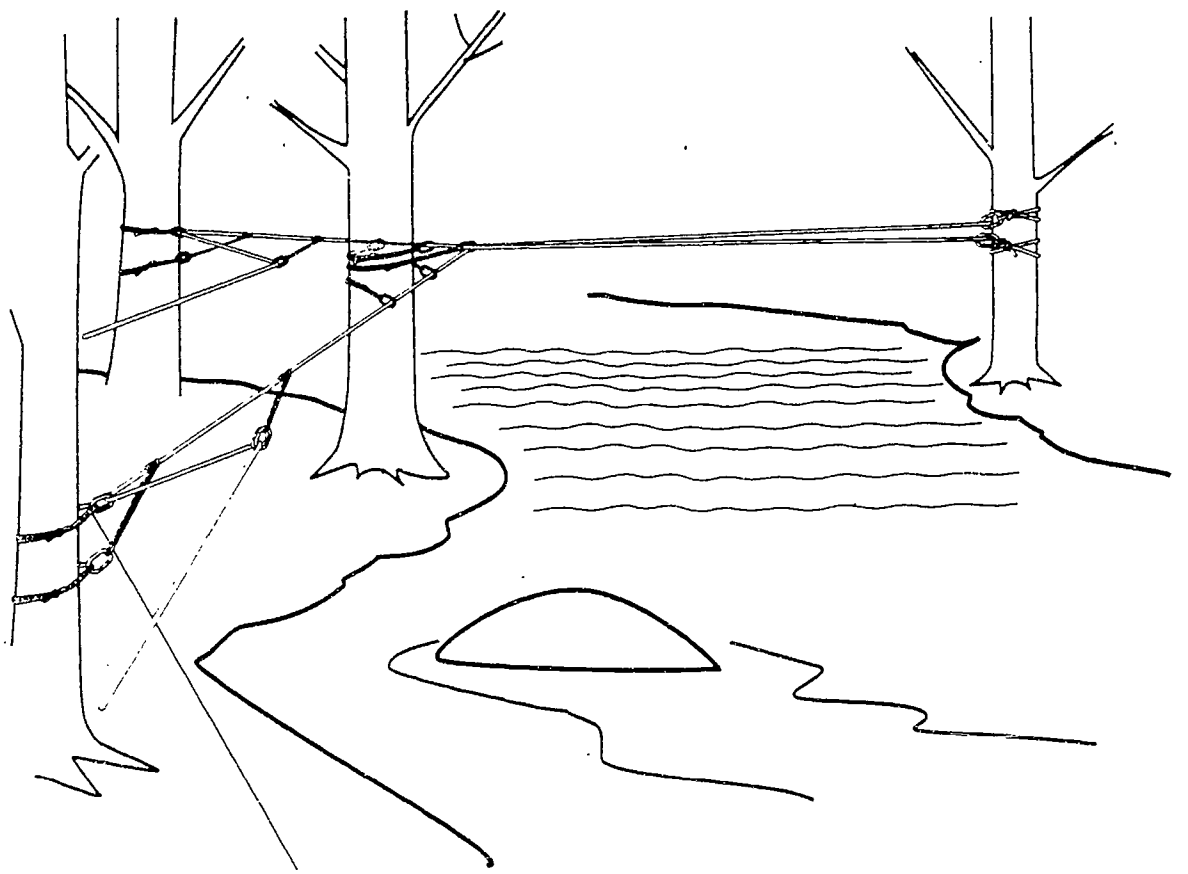
A 1:1 pulley system is simply a change of direction in the hauling rope. It does not provide any mechanical advantage.

B. 3:1 PULLEY



A 3:1 pulley system, also known as a Z-drag, has two changes of direction and results in a mechanical advantage that makes tightening the crossing rope in a tyrolean easier. Use an improved prussik hitch for creating the second change of direction. A Z-drag can also be use in tightening shelter guy lines (a trucker's hitch is really a 3:1), bear hangs, and for hauling people out of crevasses.

Tyrolean Traverse



Tie off here so prussik hitches are out of the system.

the preparatory skills. Once they understand the basics of knot tying, anchoring, and 3:1 pulleys, demonstrate a simple dry land tyrolean and have them practice. Avoid trying to jam all the preparatory instruction into the morning before your tyrolean demonstration. Build these skills through a series of experiences that reinforce the techniques.

Discuss how judgment must accompany safe use of this skill. Students need to know that other methods for crossing a river have been considered before putting in the time to build a tyrolean. Equally important is their ability to choose a safe site. If students have the opportunity to practice the system before an actual crossing, instructors can then focus their riverside instruction on site selection, site safety, retrieval, and adapting the theoretical system to the actual location.

Self-sufficiency with this skill requires practice in different settings. Besides learning the construction skills, students must know how to adapt the system to less than ideal locations. Other areas of the curriculum may get less attention if these skills are necessary to complete travel independent of the instructors, but students get a tremendous sense of achievement when they can overcome obstacles with their own skills. Once again, this technical skill is a fantastic medium for nurturing judgment, decision-making and leadership.

RESOURCES:

Hess, Rob "Anchors Away," *NOLS Newsletter*, Oct. 1992

May, H.G. *Mountain Search and Rescue* , Rocky Mountain Rescue Group, Inc. Boulder 1973 pp. 231-237

CHAPTER FOUR
LEADERSHIP AND TEAMWORK

OUTDOOR LEADERSHIP AND JUDGMENT

The primary goal of NOLS is to develop "safe, competent, responsible wilderness travelers and leaders." While a background in theory is helpful in leadership development, at NOLS we pride ourselves on practical leadership education. Outdoor leadership is the ability to make decisions, to keep tentmates laughing, or to cook a tasty meal at the end of a long day. It is well-timed appropriate action, not a theoretical attitude or behavior. NOLS believes that outdoor leaders exercising good judgment based on common sense, knowledge and experience, provide the best protection to people and the environment. This chapter provides basic outlines for teaching leadership. For more information, see Appendices One through Four at the end of the notebook.

EDUCATIONAL GOALS:

At the end of a 30-day WRW we expect successful students to:

- Work effectively as a member of a team.
- Communicate ideas and concerns on an individual and group level appropriately.
- Identify personal strengths, skills and areas for growth in developing outdoor leadership styles accurately.
- Take responsibility for learning through setting and attaining personal goals.
- Plan and carry out safe and environmentally sound expeditions.
- Use abilities and initiative in a leadership role with peers.
- Respond to problems using decision-making and planning skills.
- Display an awareness of group strengths and limitations.
- Use experience and judgment to implement sound decisions and follow them through to completion.

KEY POINTS:

Focus on tangible elements of outdoor leadership, such as judgment, technical skills, communication skills, teaching ability, and attitude.

JUDGMENT OR DECISION MAKING

Leaders make decisions, or facilitate groups making decisions. Developing the process of decision making is a crucial component of leadership education. While at times it is wise to follow standards or procedures developed by others, rarely is this possible in the complex environment of outdoor leadership, and it should not happen without a conscious decision-making process. A NOLS course develops leaders with outdoor experience, skills and knowledge, and presents an opportunity to develop judgment and decision-making abilities.

Fostering the development of judgment in students is challenging, but it should be a focus of your curriculum. Things you can do in the field include:

- Giving your students a decision-making model.
- Discussing your decisions with students.
- Giving students the opportunity to make real decisions, and to experience their consequences.
- Identifying and processing leadership situations.

There are many published decision-making models but they all include the ability to:

- Recognize, define and evaluate a situation.
- Understand priorities.
- Consider options.
- Evaluate consequences.
- Choose alternatives.
- Implement a decision.

Students (and their parents) know we will be placing them in unsupervised situations, and that our curriculum includes small group experiences away from instructors. The decision to allow students to make independent decisions with real consequences can be difficult for an instructor, but people recognize contrived exercises and rarely grow from them.

Before you send students off on their own, consider how well they are equipped. What are their technical, leadership and communication skills? How much experience do they have? Are they prepared for an emergency? What level of supervision does this group require, and what are the consequences of an error in judgment? You must balance risks with the anticipated benefits of an activity.

COMMUNICATION

Leaders must be effective communicators. Articulating group goals, engaging in feedback, and teaching require communication ability.

TECHNICAL SKILLS

Competence and experience in technical skills underlies a successful leader and is a focus of our curriculum. The skills need to be balanced with judgment, decision-making ability, and communication skills, however.

DEVELOPING LEADERSHIP

Opportunities for leadership development abound on a NOLS course. Leader of the day, Bearmeister, and small group leader are common opportunities. Simpler demonstrations of personal leadership include everything from keeping yourself healthy and organized in camp, to staying focused on a climb.

TEACHING CONSIDERATIONS:

- Role model what you hope to see in your students.
- Offer simple models and clear expectations early in the course.
- Coach for growth. Give immediate specific feedback when you see something you do or don't like in your students or colleagues.
- As the course progresses, be sure to teach more finely tuned situational leadership skills.

REFERENCES:

NOLS Leadership Binder, 1994, available at any NOLS branch
The NOLS Newsletter has articles about teaching leadership in most issues.
Petzoldt, Paul, *The Wilderness Handbook*, 1974
Bonney, Bruce *The Backcountry Classroom*, WEA, 1992 (good academic info)

EXPEDITION BEHAVIOR

Many an expedition has failed because of conflict among its members. The expedition lifestyle, which involves living and working together in close quarters and under harsh conditions 24-hours a day, is new for most people. On a mountain, a river or an ocean, there is often no private time for an individual feeling stressed or needing personal space. The combination of interpersonal skills and appropriate communication required for a team to be successful under such conditions comprises what we call Expedition Behavior or EB.

EDUCATIONAL GOALS:

Students must be able to work together and respect each other. They should understand how conflict arises, recognize good EB, know how to resolve problems, and be willing and able to give appropriate feedback. The goal of good EB is for people to work as an effective team, not for them to become best friends.

KEY POINTS:

Recognizing sources of conflict, modifying destructive behavior patterns, and developing effective communication skills can help build teamwork and improve the chance of an expedition's success. By discussing these topics early in the course, you can establish which behaviors are desirable in your students and which are destructive to the team and, therefore, unacceptable.

SOURCES OF CONFLICT

Given the nature of an expedition, conflict between team members is normal. The cause of tension can be as trivial as different tastes in food, or as fundamental as conflicting personal and group goals. Other potential sources of disagreement include: ill-defined objectives, differences in personal energy and skills, different expectations and attitudes, and egos that get in the way of the team's focus.

Individual behavior patterns can also cripple an expedition. Putting off confronting the person you have a problem with, talking behind someone's back, failing to respect other expedition members, avoiding work, hoarding food, and having an excuse for everything without ever getting anything done can all cause a team to founder.

DEFINING GOOD EB

Good EB is essentially being a nice, helpful person. The skills it takes to be such an individual seem intuitive, but it is surprising how often you will run into students who have no idea how to function on an expedition; therefore, you may find it helpful to define just what characteristics comprise the quality we call good EB.

Doing your share of work around camp is an integral part of exhibiting good EB. Paul Petzoldt used to say that if you were doing 110 percent of the chores, you were doing enough. In addition to helping get things done, having a positive attitude plays a big part in good expedition behavior. Being honest, straightforward, and tactful is essential. Having a sense of humor and not complaining is helpful. Letting people know when you need assistance and talking to them when you have a problem is also critical. Finally, showing respect by being on time to meetings and listening to your colleagues will help build rapport and enhance the group's sense of camaraderie.

CONFLICT RESOLUTION

When a conflict occurs, prompt resolution is important to avoid having the problem escalate. You will need to be diplomatic in dealing with the situation, but there are a variety of tricks you can use to help ease tension. To begin with, select a space where everyone is comfortable, safe, warm, and dry. Establish ground rules. Only one person speaks at a time and people should use "I" rather than "we" statements during the discussion. Encourage everyone to listen to each other rather than to plan their responses while someone else speaks. Make eye contact.

Once the problem is out in the open, identify needs in yourself and in others. Brainstorm constructive ways to remedy the situation. Try to be creative and respect conflicting values. Finally, as a group, make a plan and commit to it. Check in later to see how things are going. Be flexible. If the first plan is not working, renegotiate the contract.

Feedback is another way to encourage the development of good EB. Often people honestly do not recognize the effect of their behavior on the group and need to be told before they can make a change. In order for feedback to be effective, however, it must be immediate and specific. Take care to preserve an individual's dignity by offering solutions and sandwiching negative comments with positive ones. If you establish a system of regular feedback early in the course, people are less likely to get defensive about anything they can construe as criticism, and more likely to benefit from your efforts.

TRANSFERENCE

Good EB doesn't end at the roadhead. Encourage your students to continue the habits they have developed during the course. Point out the importance of being responsible for personal actions and looking out for other people. Remind them that their community is like an expedition and should be treated with the same respect.

TEACHING CONSIDERATIONS:

Instructors set the EB standard primarily by role modeling, although classes are useful for clarifying specific points and elaborating important details. Students have many insights on what good EB is based on their experiences at camp or in school. Usually they enjoy discussing them.

One common way to introduce EB is to make a brief formal presentation and follow it up with an informal discussion. Humorous stories around the fire or during an astro bivy can complement the class and display less academic teaching methods that your students may be more comfortable using later on their own friends.

There is no perfect time to give an EB class. One taught too early in a course is often lost on students still overwhelmed by basic camping issues. If you wait until EB problems occur, however, it may be too late. The ideal window of opportunity is not only difficult to identify, but may not exist at all on some courses.

One solution is not to wait for formal class to begin talking about EB. The first meeting of the course is a good time to introduce the concept. Later—say during the first week—you can teach an actual class on the subject. In another week or so, follow-up your original presentation with a discussion designed to refine the group's understanding of the topic.

Some courses have constant EB problems that eat up much of the students' and instructors' time, other courses do not. The EB class may be the last time you discuss the subject, or you may constantly be mediating between poorly communicating people, advising despairing students, and calling unpleasant group meetings.

If you do have sensitive issues to deal with on a course, try using a talking staff to structure your discussion. The talking staff comes from Native American culture and entails having the group sit in a circle and speak one at a time while the others focus on listening. A sacred object is passed from one speaker to the next, and only those holding the object can talk. The format is intended to create an atmosphere where students can speak without fear of challenge or commentary.

Another trick is to use Petzoldt's form of group therapy. When an EB problem came up, Petzoldt used to gather the group together and ask them to take a minute and think about what behaviors they saw in others that annoyed them. He then repeated the process and asked the students to identify the behaviors in themselves that irritated their colleagues. Finally, he asked each student to identify group behaviors that dis-ased them. The students were not required to share this information, only to reflect, and then act upon their insights.

Initiative games can be used before, during, or after an EB class. To be useful, however, the instructors should have some experience debriefing them. It is more common at NOLS to use some kind of course activity, rather than an initiative game, to explore EB with your students. For example, you can transform a challenging stream crossing into an initiative by discussing with your students how decisions were made, how people performed under pressure, and how individual behavior either contributed or detracted from the process.

Most NOLS students prefer to avoid confrontation. Many, having never seen a personal conflict resolved successfully, find the idea of confrontation threatening. As an instructor you may find yourself encouraging students to try this new, unfamiliar, and risky behavior. Needless to say, this can be one life skill that will serve them long after NOLS, whether they are in the backcountry or not.

RESOURCES:

Petzoldt, Paul, *The Wilderness Handbook*, 1974, pp. 127-143.

Ratz, Jim, *Unpublished Manuscript of a tape-recorded interview with Paul Petzoldt in Chicago in 1989.*

STUDENT TEACHING

Successful teachers and effective leaders share many of the same traits: clear communication skills, organizational abilities, enthusiasm, and a sincere desire to share information. Student teaching can be, therefore, a way to help further a student's leadership skills. To enhance the effectiveness of the experience for your students, help them prepare their material, offer them hints for effective presentation, and provide prompt feedback after the class has taken place.

EDUCATION GOALS:

The primary goal of student teaching is the successful presentation of information to a group of peers. The material presented should be rel-

evant and appreciated by the audience. The activity should be voluntary.

KEY POINTS:

TOPICS

Help your students choose a topic that interests them and fits into the group's goals. Once a subject is decided upon, encourage them to focus on the aspect that intrigues them most. Ask them what the group would want to know about their topic. Defining the subject and narrowing the focus helps new teachers avoid getting lost in a maze of material.

PREPARATION

With the student teacher, determine whether additional research is necessary prior to presentation. Discuss the resources available to supplement your student's knowledge; these can include everything from the course library to instructor notes and other expedition members' personal experience.

Have student teachers clarify their goals. Ask them what they want their audience to know. Are they teaching a skill? Or is their objective to have the audience develop a basic understanding of an issue or object? Encourage your students to focus on fostering curiosity rather than creating experts. Too much information can be overwhelming or boring.

Figure what teaching format will be most effective. A class on junipers works best as a teachable moment. Predator-prey relationships can be taught effectively with a game. Knot tying lends itself to the basic demonstrate-and-do formula. If the student decides to do a lecture, help develop some visual aids to illustrate the topic and enhance the presentation.

PRESENTATION

Have students come up with an outline for their class. Make sure their progression is logical, easy to follow, and covers the major points. Have them include a review or wrap-up at the end. One of the most common pitfalls for new teachers is the failure to include any kind of closure in their class. Such an oversight leaves the audience hanging and can be avoided by simply reviewing the material covered and inviting questions.

Most students benefit from rehearsing their presentation. Have them make a practice run through the class with you. Ask them questions. Give them feedback on everything from their posture and tone to the specific information conveyed. Remember, even a well-researched class can be painfully boring if presented in a droning, monotone voice.

Timing can be critical to the success of a class. Student classes, like instructor classes, need to be integrated into the overall course progression. Choosing appropriate locations and making sure that conditions are optimal will increase the likelihood that your student will have a successful experience. Student teachers should not be expected to motivate and inspire the unmotivated or the uncomfortable. Make sure the group is in a frame of mind to be courteous to and supportive of their peer.

FEEDBACK

After a student class, take time to evaluate how things went. You may choose to debrief the student privately, or to have the entire course offer constructive criticism after the presentation. Make sure you point out the positive aspects of the class, as well as the things that could be improved upon. Consider everything from the visual aids to organization and the group's reaction. Commend the student for their effort and encourage them to build upon the experience.

TEACHING CONSIDERATIONS

A student teacher's experience should be positive. If the material needs to be taught again, then the instructors have failed. A successful presentation results from close work between a motivated student and an instructor familiar with the material. The instructor must be involved with everything from choosing the subject, to coaching the student, timing the presentation, and providing feedback afterwards.

Such close involvement requires a significant investment of time. This investment must be weighed against the potential benefits of the student taught class. Would the student's leadership development be better served by an instructor-student feedback session or another chance to lead a hiking group? Poorly done student classes can erode self-confidence, waste time, and scare off other would-be teachers in the group.

For the first-time teacher, consider limiting the length, scope, audience size, and exactness required by the subject matter. A simple formula might be to have a student prepare a mini-class about something commonly found along the trail. Let the student choose the appropriate

moment during a moving day to present the information. This small, informal group setting is often less intimidating than teaching to the whole group. An instructor should be present in order to critique the student. That evening the information can be shared at a group meeting by one of the hiking group members.

EXPEDITION PLANNING

In most cases, students already have a sense of an expedition by the time you present a class on expedition planning. They understand the skills and relationships necessary to live in the mountains for extended periods of time. Your presentation, therefore, should be aimed at inspiring them to use this knowledge to plan personal trips in the backcountry after they finish their NOLS course.

EDUCATIONAL GOALS:

The goal of an expedition planning class is to provide your students with guidelines that enable them to plan, organize, and carry out an extended trip in the wilderness. These guidelines should cover logistical requirements, personnel and fiscal considerations, and equipment needs.

KEY POINTS:

CHOOSING AN EXPEDITION GOAL

It is important to select an objective for your expedition. The goal you come up with may be as simple as catching fish or identifying birds, or as complex as summiting K2 or kayaking the Colorado River. The critical thing is that all team members have the same basic mission in mind. Consider having a backup objective in case certain factors, such as weather or group motivation, force a change. These alternative plans ensure that the trip is not a total loss if the original goal is not attained.

CHOOSING YOUR TEAM

Select a team of people who work well together and enjoy each other's company. Make sure that you have people with the skills and experience necessary to attain your objective. All team members should be aware of the expedition goals and willing to share in the trip's expenses.

COORDINATING YOUR LOGISTICS

Do your homework before you get to the trailhead to avoid logistical nightmares in the field. Your research should include looking into routes, knowing regulations, and planning for emergencies. Logistics also include planning for food, finances, transportation, and fuel.

PLANNING YOUR ROUTE

A. Information sources:
- guide books, trail guides, outdoor magazines, mountaineering journals,
- outdoor retailers,
- Park rangers and public land managers at both the regional and local offices,
- local residents who have been to the place before at the same time of year.

B. Map sources:
- U.S. Geologic Survey, Denver, CO,
- retail map dealers, outdoor stores,
- local, public and university libraries.

C. Permits and backcountry regulations:
- check with local land agencies for specific regulations.

D. Emergencies resources:
- plan how to handle any emergency encountered during your expedition,
- know the nearest hospital to your roadhead,
- find out who handles rescues and helicopters in your trip area. Check to see if there are any specific requirements or limitations for this kind of assistance.

GETTING TO THE ROADHEAD

A. Travel plans
- figure out exactly where you are going and how you will get there,
- take care of any airline tickets, bus transportation, or car expenses required,
- find out if there are luggage requirements or restrictions,
- make sure you have all the necessary visas, shots and papers.

B. Money
- finances are more easily dealt with before the excursion begins,
- consider requiring a deposit to cement members' commitment during the planning stages,
- approach equipment manufacturers and food producers for donations. Offer to do product testing or provide testimonials and photographs in return for their support.

TAKING THE RIGHT AMOUNT OF GAS

(Estimated fuel needs for a three-person cook group per day:)

	Summer	Winter–melting snow	not melting snow
MSR Whisperlite	1/3 quart	1 quart	2/3 quart
Optimus	1/2 quart	1 quart	3/4 quart

EQUIPMENT

- Choose clothing, equipment and shelters that are able to accommodate the weather found in the region you will be traveling,
- Leave with gear in good order. Pick items that do not require special equipment to fix. Bring a basic repair kit that includes: stove parts, duct tape, wire, needles, thread, and ripstop nylon.
- Prior to leaving discuss who will pay for any personal gear used by the group that is either damaged or lost.
- Pack a first aid kit. Stock it with supplies that have multiple uses, such as tape, 4X4 gauze pads, and disinfectant. Keep this kit small and practical.

FOOD AND FUEL

- Poor food planning or insufficient fuel supplies can transform a nice trip in a beautiful place into a bad experience.
- Keep in mind personal tastes, caloric requirements, weight, cost, packaging, and ease of preparation when creating the menu.
- Cheap bulk food can be obtained in the bulk food sections in some super market chains, at food co-ops, ethnic grocers, and from restaurant supply distributors.

THE AFTERMATH

- Make sure you put the gear away clean, dry and repaired.
- Arrange for a slide show.
- Make notes on what worked well and what you would do differently next time.

TEACHING CONSIDERATIONS:

This class works well towards the latter part of the course when the students have experienced expedition life and have started thinking about where they are going to use their NOLS skills next. Often instructors preface the class by reading a story or telling humorous anecdotes from a personal experience that demonstrates the pitfalls of poor expedition planning. Remind your students that they have the skills to do their own trips and that all they need is some organization, and a group of friends, full food bags, and a ride to-and-from the roadhead.

If you have not showed them the first aid or repair kits, this is a good time to do so. Talk about why each item is included. Provide them with guidelines for making their own kits. Show them the ration planning sections of the NOLS Cookery, and encourage them to go for it.

RESOURCES:

Petzoldt, Paul, *The New Wilderness Handbook*. 1974.
Mountaineers, *Mountaineering: Freedom of the Hills*, 5th edition, 1992, pp. 6-88, 397-388.
NOLS Cookery.

CHAPTER FIVE

ENVIRONMENTAL STUDIES

INTRODUCTION

Environmental studies includes natural sciences, physical sciences, environmental ethics, and land management practices. Basic knowledge of these topics help students develop an understanding of how the natural world functions and how people influence that functioning. The ultimate goal is to foster respect. This ethical development can result in behavioral changes in students that are as simple as recycling household waste or as involved as informed political activity.

DEVELOPING AN ENVIRONMENTAL ETHIC

The creation of an environmental ethic can begin with an enjoyable wilderness experience. Teach your students how to fish, observe wildlife, harvest local salads, and travel using their natural history knowledge. Have fun, play. But at the same time, a tone should be set that encourages students to observe their outdoor neighborhood and understand that there they are visitors in someone else's home.

Our desired outcome—that students embrace the idea of wilderness preservation—is more likely to be obtained if they enjoyed their experience and developed a connection with the land. Try to get your students thinking about the "wild" aspect of their course. Help them recognize the ways their experience depends on the pristine and unique habitats they share with other plant and animal species. Inform them of the land management agencies and conservation practices that shaped their course area. Explain any management or commercial threats to the region. Do a service project or talk to a local land manager.

Near the course end, discuss the transference of NOLS behavior to everyday life. Explain to your students how the course instruction and challenges have prepared the students for personal and societal challenges elsewhere. Discuss any course experiences that either directly or metaphorically illustrate worldwide environmental problems or solutions.

This may sound like a highly orchestrated teaching schedule but it is not. Keep your expectations realistic. You probably will not get to all of the previously mentioned activities, nor will you have all of your students ready to canvas for Green Peace, but do not despair. The crux of teaching environmental studies is to keep it fun and applicable, and to follow it up with time to put the experience into a larger perspective.

U.S. PUBLIC LAND MANAGEMENT

Although students arrive inspired to travel into wild lands, many of them are unaware of the political process and principles which guide their management. Taking care of the land only begins with teaching minimum-impact camping techniques; it is a natural extension to place the land in its broader political context that enables students to protect wild lands after they have returned home. This core curriculum topic can seem overwhelming at first, but the basic objectives are simple—you do not have to be an expert on the environmental issues affecting the area—and can be taught informally along the trail or floating down a river. If you have a special interest and time allows, more in-depth classes can be taught.

EDUCATIONAL GOALS:

There are two basic goals of this curriculum topic.

1. Provide the students with some land management information regarding the area where they are traveling, such as the name of the national forest, national park etc.

This is intended to provide the students a sense of place. It may include a history and description of the managing agency, a comparison to other agencies, a discussion of the Wilderness Act or other pertinent legislation, or a discussion of the particular characteristics and history of the actual area you are visiting.

2. Provide the students with ideas on how to participate in issues that concern them.

Students can leave the course with some ideas on how to participate in the public process by which wild lands are managed. Just the fact that they can be involved can be a new idea. Some tools for active participation can be discussed, such as joining "watchdog" organizations, getting on federal agency mailing lists, writing letters to elected officials, and submitting public comment.

BACKGROUND:

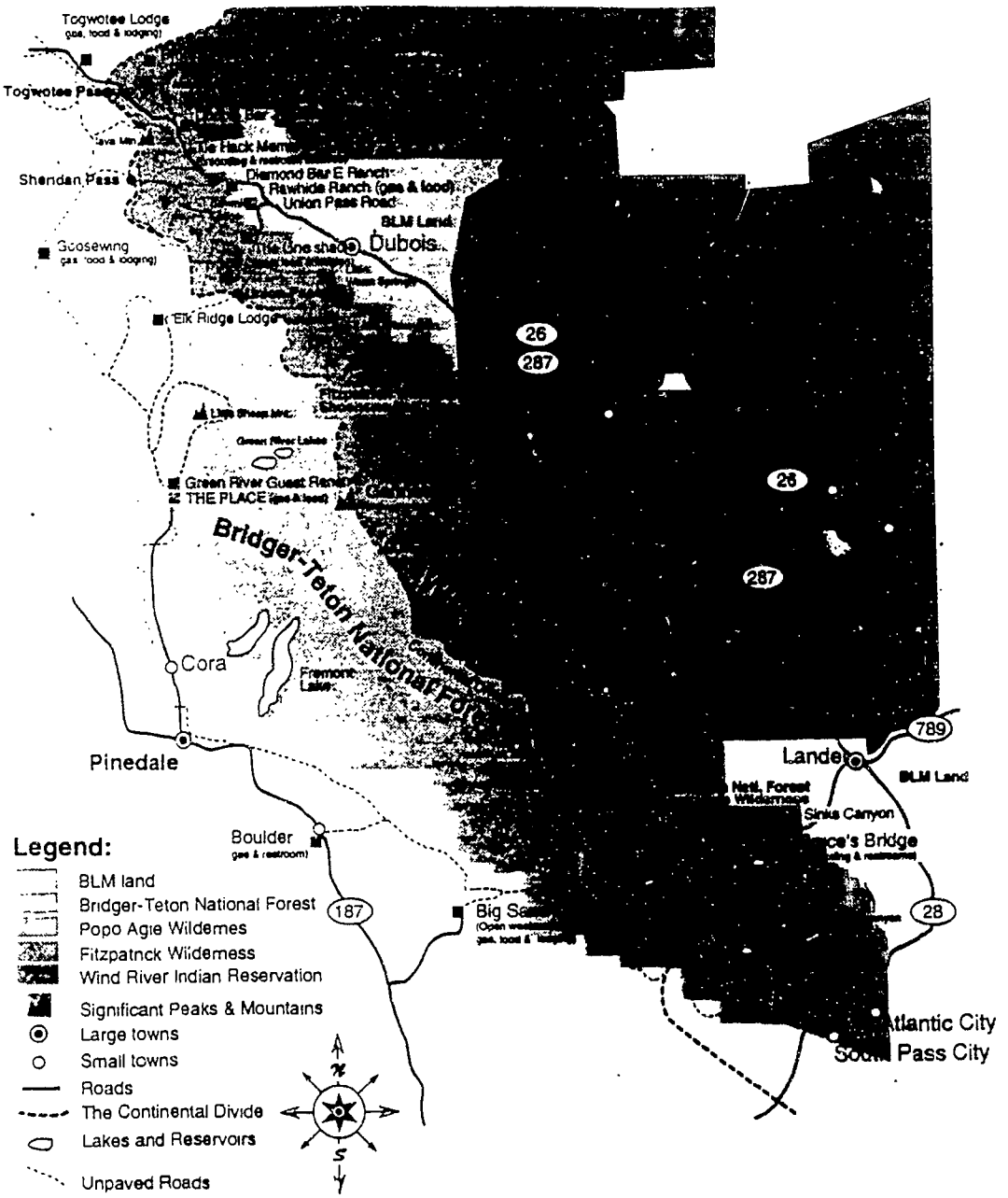
Classes can be much more interesting than a dry recitation of acreage and mission statements. However, the following points are dry facts and figures. Therefore, use these with caution—intersperse them into stories of the area or of your personal experiences.

Please refer to the NOLS textbook, *An Introduction to Wildland Ethics and Management*, for information regarding the agencies, their missions and history. It is not possible to convey all of the points you may want to make, so here are some sample ones related to the Wind Rivers:

- NOLS first Wind River course in 1965—Paul Petzoldt receives letter of congratulations from the U.S. Forest Service.
- There are approximately 375,000 recreation visitor days in non-developed areas of the Winds annually. Our permits allow approximately 16,000 service days in the Wind Rivers annually (service days count only students, not instructors)–or approximately 4 percent of total recreation use in the Winds.
- Bridger-Teton National Forest (west of continental divide; 807,000 acres in the Winds).
- Shoshone National Forest (east of continental divide; 547,000 acres in the Winds). The Shoshone National Forest was the nation's first national forest when the land was set aside as part of the Yellowstone Timberland Reserve in 1891.
- Bridger Wilderness Area: This wilderness was one of the original areas designated with passage of the Wilderness Act in 1964.
- Popo Agie Wilderness Area: Originally set aside as the Popo Agie Primitive Area in 1929. It was designated wilderness in the 1984 Wyoming Wilderness Act.
- Fitzpatrick Wilderness Area: Designated wilderness in 1976 with additional acreage added in 1984.

The following are generic points that may be used in a discussion on agencies and legislation. They are by no means inclusive of all key points nor do they necessarily represent points that must be taught on each class. The "why's" and "how's" have not been explained here.

- Federal agencies administer roughly 727 million acres or 32 percent of the total U.S. land area—2.2 billion acres.
- U.S. Forest Service (Department of Agriculture; est. 1905). Multiple-use management of national forests and national grasslands.



- Bureau of Land Management (Department of the Interior; est. 1946, organic act 1976). Multiple-use management of federal public lands.
- National Park Service (Department of the Interior; est. 1916). Preservation and enjoyment of national parks and monuments.
- U.S. Fish and Wildlife Service (Department of the Interior; est. 1956). Conservation, protection and enhancement of fish and wildlife and their habitats.
- The Wilderness Act of 1964 created the National Wilderness Preservation System. There are currently 95.6 million acres designated as wilderness in 565 areas nationwide.
- The National Environmental Policy Act of 1969 provides the legal basis for public involvement in decisions made by the federal government that affect the environment. Environmental impact statements (EIS) and environmental assessments (EA) accompany land management documents. The public can comment on these assessments.

TEACHING CONSIDERATIONS:

Land management curriculum does not have to be taught in a "traditional" one-hour sit-down type of class—although if you have the time, especially on semester courses, then this type of class can be appropriate. Teachable moments and other informal opportunities can be power-

ful learning experiences that leave a more lasting impression on students. Basic information can be integrated informally and quickly, and more information shared if time and interest allows. Teachable moments can include: A few minutes at the trailhead register to discuss the fact that there are rules and regulations to follow and that NOLS receives and pays for permits to access public land; a few minutes at the wilderness boundary sign to discuss how management changes from one side to the next; or a few minutes looking at snowmobile or mountain bike tracks inside of wilderness to discuss legal and illegal wilderness activities.

Discussion of federal land management agencies inevitably begins early on a course as students notice Forest Service signs or hear they're going to a "National Park." A common question asked is "How does a National Park differ from a National Forest?" Because this material is so broad, it is often useful to explain these distinctions informally as the teachable moments come up. Consequently your actual class on land management is more recap and expansion, as well as a time when students can ask questions that have arisen out of previous discussions.

Frequently students arrive at NOLS with negative preconceptions about federal land agencies. They will already be referring to the "Bureau of Livestock and Mining," or the "Forest Circus." They may think it is "cool" to slam the government. It is important to stress that while the actions of these agencies in the past may not have fully pleased us, all of them are influenced by public participation and ultimately their management will be a reflection of our participation in the democratic process. Criticism should generally be coupled with a willingness to implement a better plan. If you state your own opinions about an issue, please make sure the students know that it is your personal opinion.

RESOURCES:

NOLS has a textbook that covers wild land ethics and land management topics. The book is called *An Introduction to Wildland Ethics and Management*, by Susan Brame and Chad Henderson (NOLS, 1992). The book is available at branches and at the NOLS Public Policy office. It has easily digestible sections on each agency, wilderness management, and citizen action, as well as graphs, charts and tables presenting land management information. It is intended to be used as a reference book for this curriculum and thus the Wilderness Educators Notebook will not delve into details.

Each branch has a selection of land management fact sheets that are updated periodically. These fact sheets are not meant to be the content of your land management class, but they should provide you with some specific information by which to increase your own knowledge or to enhance a class. Eventually, these fact sheets will cover every operating area, at least domestically. In the meantime, check out the land management curriculum file at the branch's library or ask your briefer if fact sheets are available for your course area.

The NOLS Public Policy Program has additional resources on land management. For further information talk to Chad Henderson in the NOLS Education and Special Programs department.

ECOLOGY AND WIND RIVER HABITATS

The Wind Rivers provide an excellent backdrop for teaching basic ecological concepts and exploring a variety of western mountain habitats. Knowledge of the immediate natural environment can lessen physical impact, enhance recreational enjoyment, and develop a broader understanding of the forces shaping global ecology.

> *"The science of relationships is ecology, but what we call it matters nothing. The question is, does the citizen know that he is a cog in an ecological mechanism? That if he will work with that mechanism, his mental wealth and physical wealth can expand indefinitely? But that if he refuses to work with it, it will ultimately grind him to dust? If education does not teach us these things, then what is education for?"*
>
> *-Aldo Leopold,*

EDUCATIONAL GOALS:

The goal of the environmental studies curriculum is to teach our students observation skills that aid in the interpretation and enjoyment of the mountains, and in the development of an understanding of how they interact with the natural world. The curriculum provides tools they can use to examine the ecosystems they travel through, and to explore the changes these places undergo as a result of both time and human interaction.

KEY POINTS:

ECOLOGICAL CONCEPTS

Ecology is the study of the earth, its organisms, and their relationship to the environment and to each other. An understanding of regional ecology helped Native Americans and early white settlers survive.

A *Biome* is a regional ecosystem distinguished by its communities. The location of a biome is determined by climate. The Wind Rivers contain two: a mountain biome surrounded by a temperate grassland biome. An *ecosystem* is a self-contained unit of organisms and environments in a single location. Multiple ecosystems can be found in a biome. Wind River ecosystems can be as small as an individual lake, or as large as the entire range.

A group of populations interacting with each other in a common locality is a *community*. Abiotic factors such as soil type, elevation, latitude, wind, slope, and aspect affect which populations will form communities. One example of a community—the riparian community—is the plants and animals that live along streams and lakes.

A group of organisms that can produce fertile offspring are said to be a *species*. Brookies and Cutthroats are different species of trout. A *population* is a group of the same species that live in the same community. The home address of a species is its *habitat*. Common Wind River habitats include a mountain stream, an alpine meadow, or a lodgepole pine forest. Ecosystems typically include multiple habitats. A *niche* is an organism's "profession."

Species interact in the following roles: predator, prey, competitors, dependents, producers, consumers, symbiosis, and parasitism. For example, algae and fungi interact in a symbiotic relationship to form the lichens we see throughout the range. Within these relationships there is a pattern of birth and death that results in a flow of energy and a recycling of material.

Survival and reproduction are the primary objectives of all species. Evolution and adaptation have produced two reproductive strategies. One strategy is common among many critters low on the food chain. These animals produce lots of offspring each of which require minimal energy output. The goal of such mass production is the survival of a few. The other reproductive strategy occurs higher on the food chain among mammals such as humans and bears. These animals produce only a few, energy intensive offspring; the species depends upon the survival of the majority of them to succeed.

There are two basic types of organisms: *autotrophs* and *heterotrophs*. Autotrophs are the producers which use energy from sunlight to "fix" atmospheric carbon and other simple compounds via photosynthesis. "Fixed" carbon compounds, such as sugar, can then be used as building blocks and energy supplies by plants and animals alike. Heterotrophs are consumers and include carnivores, omnivores and herbivores. These organisms cannot make their own food and must live by eating others.

With autotrophs as the primary link, all species together form the food chain. Each level of consumption, from autotroph, to herbivore, to carnivore, is a *trophic level*. As one moves from level to level up a food chain in any ecosystem, only 5 to 17 percent of the stored energy is transferred. Roughly 90 percent is lost. Due to this energy loss, a maximum of seven trophic levels exist—often there are fewer. This is exactly "why big fierce animals are rare." (See the book by this title by Paul Colinvaux.)

Evolution and adaptation are the biotic factors that contribute to a species' place in the environment. Each species has taken thousands of generations to evolve the individual genetic traits that allow it to fulfill a highly specialized function in the ecosystem. Local populations take another several hundred generations to fine tune their traits specifically for a chosen community.

Succession is the natural process communities go through over time as they adapt to local conditions. As changes occur, the populations come and go according to their individual habitat

needs. If the community stabilizes, we refer to it as a *climax community*. Climax tree communities are identified by saplings and mature trees of the same species growing together. They can be seen in the upper lodgepole forests or in subalpine areas where mixed stands of spruce and fir grow. Stability does not imply stasis, however; one lightning strike can start the succession over again.

Human alteration of habitat typically proceeds at a rate faster than that of natural change. In areas affected by either type of change, sensitive species that have no place to move may experience local extinction, or overcrowding.

Extinction is a natural process where one species is gradually replaced by one or more better suited to take over its job. Extinction becomes a threat to our planet when the rate of removal exceeds the rate of replacement, and the key roles of the vanished organisms are no longer being filled. It is estimated that only two percent of the world's species are known to us for their medicinal, agricultural and pest control attributes. Due to human-induced changes in habitat, a species per day vanishes worldwide at this time. This rate exceeds nature's ability to keep up. The grizzly bear and gray wolf populations are locally extinct in the Wind Rivers due to hunting, grazing, and human encroachment.

LOCAL HABITATS

This section briefly describes the habitats that make up the ecological neighborhoods you'll be camping in or near in the Wind Rivers. Each description lists a few of the common species and discusses their interactions within their habitat. In this section the focus is on specific habitat study—as opposed to an altitude-zonation approach—because when learning the complexities and frailties of an area, specific habitats are easier to observe, explore and interpret than altitudinal zones. A natural historian might argue there are more habitats in the Winds than we present here, but the following are the most obvious ones.

SAGEBRUSH GRASSLANDS

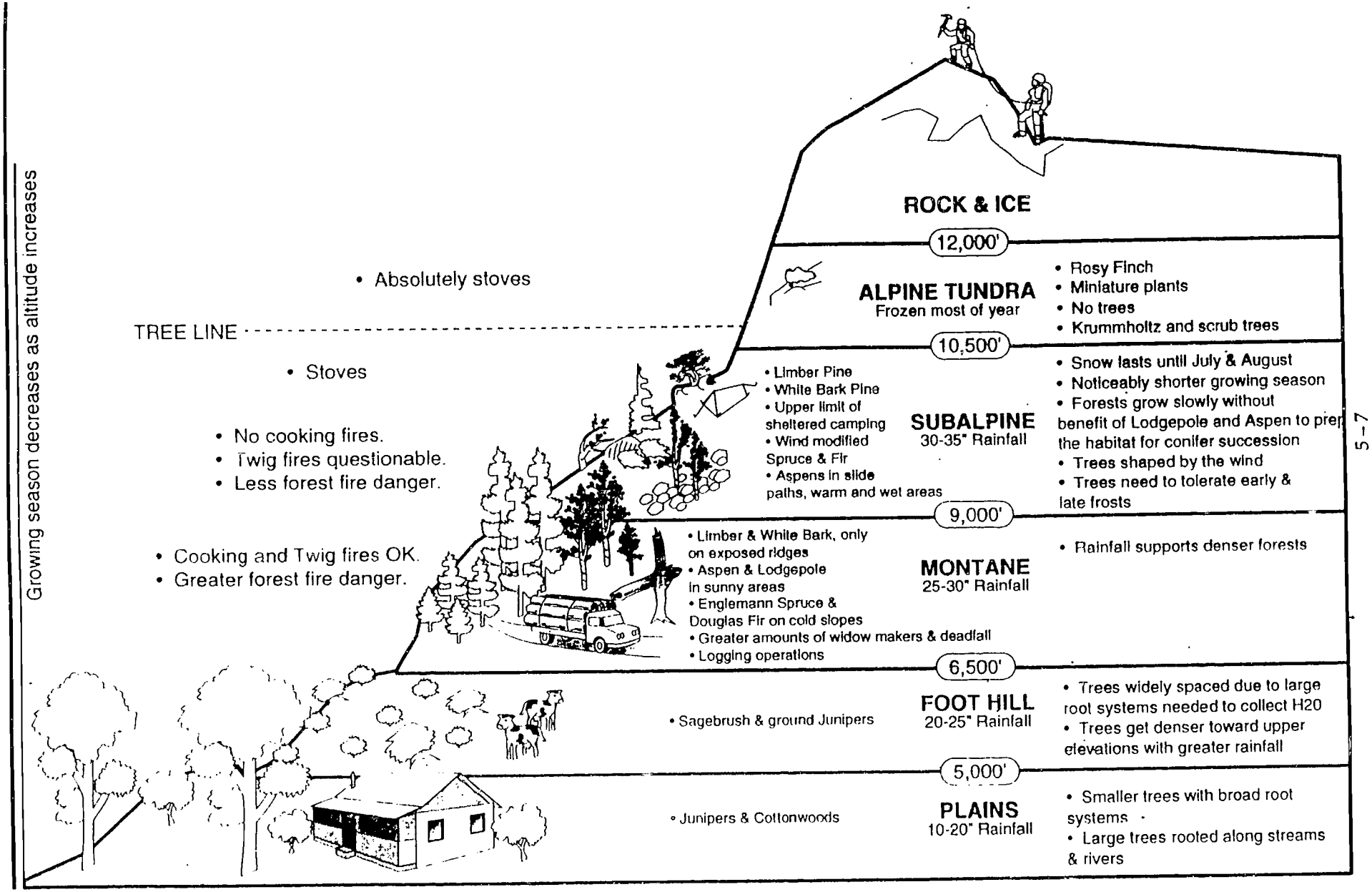
Sagebrush grasslands mark the zone where the temperate grassland biome adjoins the mountains. The foothills where these grasslands occur are dominated by low scrubby vegetation capable of living in semiarid conditions. Sagebrush succeeds here because it is highly adapted to this specialized niche. In most areas surrounding the Winds, the density of sage and the distribution of grass and forbs (broadleaf herbs) are directly related to the livestock grazing history of the area.

The balance between sage and other plants is critical to the wildlife that occupy the habitat. During the summer months sage grouse, pronghorn antelope, and mule deer depend on grasses and forbs; in the winter they rely on sagebrush. The introduction of cattle and sheep has changed this equation, however. Overgrazing can exhaust grass populations and allow sagebrush to spread, rendering the range unfit for livestock or wildlife grazing.

The BLM, the Forest Service, and the Wyoming Game and Fish Department practice range rehabilitation in and near the foothills of the Winds. The most common method used is to burn an area, fence it off, and let native grasses reestablish themselves without the pressure of livestock. The young sagebrush that rise from the ashes produce a higher quality forage than their stagnant predecessors.

In addition to its forage value, sagebrush also provides important thermal cover and concealment for animals. Least chipmunks, sagebrush voles, chukars, western terrestrial garter snakes, sagebrush lizards, and prairie rattlers use this canopy to avoid predation from American kestrels, great horned owls, golden eagles and ferruginous hawks. Uinta ground squirrels and prairie dogs, on the other hand, choose to burrow in open areas where they can see threats approaching. Badgers, with their well-adapted digging feet, help control the burrowing mammal population. After summer rain showers, shallow catch basins found in this environment become mating and nursery ponds for the Great Plains toad and Plains spade-foot toad. To succeed, these amphibians' embryos must mature into mobile juveniles before the puddles dry up.

Human structures place challenges on game populations. Pronghorn antelope can be skilled jumpers, but unlike deer, they prefer to wiggle un-


Growing season decreases as altitude increases
ROCK & ICE
12,000'
ALPINE TUNDRA
Frozen most of year
• Rosy Finch
• Miniature plants
• No trees
• Krummholtz and scrub trees
10,500'
• Absolutely stoves
TREE LINE
• Stoves
• No cooking fires.
• Twig fires questionable.
• Less forest fire danger.
• Limber Pine
• White Bark Pine
• Upper limit of sheltered camping
• Wind modified Spruce & Fir
• Aspens in slide paths, warm and wet areas
SUBALPINE
30-35" Rainfall
• Snow lasts until July & August
• Noticeably shorter growing season
• Forests grow slowly without benefit of Lodgepole and Aspen to prep the habitat for conifer succession
• Trees shaped by the wind
• Trees need to tolerate early & late frosts
9,000'
• Cooking and Twig fires OK.
• Greater forest fire danger.
• Limber & White Bark, only on exposed ridges
• Aspen & Lodgepole in sunny areas
• Englemann Spruce & Douglas Fir on cold slopes
• Greater amounts of widow makers & deadfall
• Logging operations
MONTANE
25-30" Rainfall
• Rainfall supports denser forests
6,500'
• Sagebrush & ground Junipers
FOOT HILL
20-25" Rainfall
• Trees widely spaced due to large root systems needed to collect H20
• Trees get denser toward upper elevations with greater rainfall
5,000'
• Junipers & Cottonwoods
PLAINS
10-20" Rainfall
• Smaller trees with broad root systems
• Large trees rooted along streams & rivers

der or through fences. These barriers can become lethal when snow fall makes them difficult to crawl under and pronghorns are blocked from open forage.

The elk have also been affected by human encroachment. Today most of the elks' winter foraging grounds are blocked or occupied by ranches. In six locations on the west side of the Winds, Wyoming Game and Fish operates feeding stations to keep the animals from raiding local hay supplies.

ASPEN FORESTS

Although the majority of the large aspen forests occur in the foothills of the Winds, examples of this habitat can be found up to subalpine areas. Able to prosper in rocky, wet or poor soil, aspens are specially adapted for a fire changed ecosystem. The roots of these trees send up suckers as soon as there is an opening in the canopy—an opening that often results from fire. These suckers are genetically identical to the parent tree and quickly repopulate an area disrupted by fire, wind storms, or old age.

Sunlight penetrates the aspen canopy, allowing for lush ground cover. However, the type of flora on the forest floor will vary according to adjacent habitats and elevations. Lower forests commonly include snow berry, Oregon grape, wild rose, yarrow, elegant aster, and lodgepole lupine. Areas that have been grazed have more bearberry and mountain juniper.

Many wildlife species live or forage in aspen forests. Animals eat everything from the leaves to the cambium layer of the trees. Young aspen suckers are a favorite food of elk and moose.

LODGEPOLE PINE FOREST

Lodgepole pine dominates 80 percent of the forested land in the central and Northern Rockies. Its habitat spans from the upper limit of the sage brush to the lower limit of subalpine areas. Lodgepole often make up the largest and thickest forests in the Winds. "Dog hair stands" of densely packed, small trees are common in this habitat. At first glance this forest appears to be mono-speciated. A closer look will often show that Engelmann spruce, Douglas fir, and subalpine fir seedlings are being nursed by the shade and carpet of needles the lodgepole provides. If no fires come through, these climax species will eventually succeed the lodgepole.

Wildfires are a key part of the ecology of the lodgepole forest. Fires burn away litter and diseased trees, open up the canopy, and recycle nutrients. However, 80 years of fire suppression in the Winds has allowed the lodgepole to grow older and less healthy, resulting in an increase in the mountain pine beetle population. The beetle's larvae kill both weak trees and young healthy ones, resulting in a buildup of dead fuel—a key ingredient for a catastrophic wildfire. On the west side of the central Winds, the destruction left by 1988 Fayette Lake fire clearly shows how devastating a fire can be once fuel accumulates.

The lodgepole is the basis of the food chain in this habitat. Black-backed woodpeckers eat the beetles that live in the trees. Standing snags house owls, chickadees and squirrels, while also providing perches for goshawks and redtails. Lodgepole seeds feed Clark's nutcrackers, Cassin's finches, and red squirrels. The majority of the other birds in the forest feed on insects. Toads, salamanders, red-voles, and garter snakes are found in downed logs. In the winter, deer feed on the lichen attached to the bark. Further up the tree one can see patches of bark gnawed away by porcupines going after the cambium layer. The blue grouse is able to live here in the winter because it can digest pine needles.

The forest floor provides shade and cover for deer and elk. Common understory plants include grouse whortleberry, lodgepole lupine, milk vetch, yarrow, pale agoseris, kinnikinnik, and blue grass. Populations of these plants extend into adjacent habitats. Buffalo berry, huckleberry, columbine, and golden rod are also commonly found in lodgepole forests.

LAKES

On a geologic scale, lakes are only an intermediate step in the erosion process. They collect water until they silt in and are overgrown by succeeding plant communities. Wind River lakes have several origins. During a particularly wet year, a river may jump its channel and cut off an adjacent bend leaving behind an oxbow lake. Alternatively, glacial moraines may have bulldozed debris across the valley, damming streams in their way. Other lakes in the Winds were carved out by glaciers, and filled up when the ice melted.

Unlike lakes, ponds are often shallow enough for rooted plants to extend from the surface to the bottom all the way across. Deeper water doesn't allow this. Below a certain depth, lakes have a layer of water never heated by the sun. This strata supports less life due to its lower tem-

perature and lower oxygen content. A process known as "overturn" mixes the nutritious bottom sediments with the oxygen rich surface. This phenomenon occurs in the fall when warm, surface water cools to the same temperature as the lower layers. The surface water then sinks and mixes with the bottom levels. The same process happens early in the summer. Wind—a persistent force in the mountains—speeds up overturn and allows for a more thorough mixing of nutrients. The renewal resulting from this process keeps the habitat from becoming stagnant.

If the body of water is big or deep enough, look for diving birds. Ospreys, common golden eyes, western grebes and ringneck ducks use specific adaptations to extract fish or plants from the water.

In high elevation lakes with barren shores, expect to see less biodiversity among residents. Lower lakes have more organic material washing into them, so they usually support more rooted aquatic plants along their edges. Some of these plants concentrate salt in their tissues making them a summer favorite for moose and deer, because salt—an essential nutrient—is not available in their winter forage. Shoreline flora also provide nesting opportunities and shelter. The plants attract insects and host algae that feed leopard frog tadpoles and small invertebrates—animals that in turn nourish trout fry. Great blue herons, willets, common snipes and American avocets come here to feed on both the aquatic juveniles and the plants.

Often the transition from meadow to lake isn't well defined. Marsh plants such as water cress, willow herbs, and water willow bridge this transition zone and provide nesting spots for the American sandpiper and common loons.

SUBALPINE FOREST

Subalpine species mingle with lodgepoles where the two forests meet. As one ascends, forests change from thick, tall stands, to scattered, isolated islands where trees resemble shrubs. This change is due to the harsh conditions, such as increased sunlight, lower temperatures, stronger and more frequent winds, and limited soil moisture found at higher elevations. The upper boundary of the subalpine forest is tree line.

Engelmann spruce and subalpine fir are the dominant species in subalpine forests, although on windy ridges at the upper limit of the habitat, whitebark and limber pines are more common During the Ice Ages, Wyoming's mountains were clad with glaciers, and the basins in between thick with conifers. When the glaciers receded and the high desert crept northward, the subalpine forests retreated from the drying basins and were left isolated in the mountains where they thrived on the abundant moisture.

Subalpine forests are characterized by islands of trees interspersed with meadows. These islands create microclimates which collect snow, slow down wind speeds, and modify temperatures. Coyotes, mule deer, elk, bighorn sheep, and red foxes use these places to seek shelter from storms.

The conifer seeds from these islands feed red squirrels, golden-mantled ground squirrels, Uinta chipmunks, Clark's nutcrackers, and black bears. Nutcrackers are key players in the reseeding of whitebark and limber pines. This bird can cache upward of 32,000 seeds during a harvest. The cache sites are typically placed on windswept, south facing slopes at the perfect depth for successful germination. The birds only recover and eat about 70 percent of the seeds they bury; the rest are left to grow.

Direct sunlight reaches portions of the forest floor and helps produce herbs, roots, fungi, and berries which attract many foraging species and their predators. Pine martens, short-tailed weasels and coyotes come looking for the herbivores—deer mice, least chipmunks, montane and long-tailed voles, red squirrels, northern pocket gophers, reptiles, and insects—attracted to the bountiful ground cover.

Although these forests are typically too remote for logging, recreational impacts can be significant. Repeated campfire use depletes the ecosystem of wood-based nutrients. Defoliation and soil compaction due to trampling by humans and stock are common in popular areas. Presently, NOLS sponsored research is studying the effects of human trampling on various types of subalpine and alpine vegetation. In 1993, this research showed alpine meadows to be more resistant than people previously believed.

RIPARIAN

In the subalpine forests, fir and spruce dominate the riparian zone, while bog willows, alders, monkey flowers, and aspen are common at lower elevations. The majority of the nutrients that support stream food chains come from the needles and leaves of the bank dwellers. Mountain streams serve as a corridor for elk, moose and deer traveling to seasonal ranges.

Overhanging bank vegetation moderates air temperatures and provides cover. In the Winds, you can expect to find the nests, beds or burrows of spotted sandpipers, moose, mule deer, heather voles, water shrews, and muskrats in such spots. Beavers build dams to create ponds for protection. The dam slows the water flow and causes flooding. The harvest of trees around the pond clears the canopy and promotes the growth of aspens and willows, the beaver's favorite food.

The characteristics of stream habitat varies according to the gradient of the stream. Fast, tumbling water removes fine sediments and exposes large rocks. The fastest growing algae are the ones which blacken these boulders. Snails and stone fly nymphs live in eddies or under rocks to avoid the swift water. Caddis fly larvae build funnel-shaped structures they dangle into the current to collect food. Some submerged plants rely on flexible stems to reduce their drag in the water. Others regenerate from their washed-away fragments.

Stream insects and animals attract many predators. Adult caddis flies, mayflies and stoneflies are easily picked off during a "hatch" by trout, sandpipers and warblers. Amphibians, crustaceans and mollusks feed great blue herons, merganser ducks and American dippers.

The integrity of the streambank is vital to the health of a riparian habit. Loss of streamside vegetation causes the water to silt up and exposes it to increased solar radiation. Excessive sediments smother bottom dwellers. Solar radiation warms the water and reduces the amount of oxygen available. Plants, insects and trout are the first species to feel the resulting collapse of the food chain. Livestock grazing and logging activities can accelerate stream bank erosion. Excessive cow manure in slow moving streams tends to flood the food chain with nutrients that help bacteria consume vast amounts of oxygen. Called cultural eutrophication, this process smothers other stream inhabitants.

MOUNTAIN MEADOW

Meadows are found at all elevations throughout the Winds. In these places, climatic conditions are such that grass communities are favored over woody plants. Meadows develop after a forest fire, a glacial scar, or from ancient lakes that filled with silt.

Most "wet" meadows are found in the subalpine areas. Here poor drainage or a shallow water table creates conditions which attract moisture-loving species such as willows, sedges and grasses. The soil in these meadows is often cold, soggy and low in oxygen—conditions unfavorable to trees.

Commonly seen on ridge tops and south facing slopes, dry meadows are usually larger than wet meadows. Here the soils are well-drained and only support lush vegetation early in the summer after the snows melt. The cycle of wet springs and dry summers keeps seedlings from gaining a foothold in these conditions.

In some meadows, sod out-competes nearby tree populations by dominating the nutrient, water and space resources. Look for saplings along the edges of meadows, indicating encroachment of the forest.

Meadows are good places to observe fauna because of the food and shelter they supply. Careful observation of the grasses and sedges will show a network of miniature trails used by the western jumping mouse, northern pocket gopher, and the meadow vole. As the plants dry up, these critters spend more time in their burrows, safe from attack by American kestrels, red-tailed hawks, and merlins. Sunset is a good time to see great horned owls and nighthawks hunting over the meadows. Expect to see these birds perching in nearby trees. The edges of communities (called ecotones) are good places to observe wildlife since they contain the resources of both communities.

As the snow thins over the meadow, mule deer, elk and moose return to graze on sedges and grass under the snow. These plants have adapted to cool temperatures and may start sprouting before the snow is gone.

Coyotes, foxes and long-tailed weasels cruise the margins of meadow, using the trees for cover while sizing up their next meal out in the clearing. If the meadow is wet and has a stream adjacent, frogs and salamanders may be found.

TIMBERLINE

Timberline is the area where trees become increasingly stunted and take on the form of shrubs. This belted strip of dwarfed and twisted conifers marks the end of the subalpine forests and the beginning of alpine tundra. In the Winds, the elevation of this strip varies between 9,500 and 10,500 feet. The interaction between wind, temperature, topography, and snow pack influences timberline's characteristics and determine where trees are found. Treeline is technically defined as "the upper limit of erect though stunted trees, at least 13 feet tall."

"Krummholtz"—a German word for crooked wood—is the name given to the stunted, shrub-like trees of any species that are found at the upper limits of their habitat. Common krummholtz species in the Winds include limber pines, whitebark pines, subalpine fir, and Engelmann spruce. These trees, also known as "elfin timber," tend to grow in small islands or clumps. The windward side of the islands consists of deadwood, while the live portion of the tree survives and reproduces in the lee. A krummholtz island reproduces by sending down roots from its live branches. These roots eventually become new trees. This strategy works because the dying portions of the tree protect the new growth as the islands creep downwind.

Timberline is determined primarily by water stress. There are low elevation timberlines where forests meet grasslands, and high elevation timberlines like that found in the Winds—both are dictated by the amount of water available to plants. Timberline roughly corresponds to the 10°C (50°F) isotherm (the average daily temperature) for the warmest month of the year. Winter temperatures are only significant when the krummholtz remains above the snow pack and exposed to the wind.

Krummholtz is most commonly found on the lee side of hills and boulders where the trees are protected. In the winter, these spots collect snow and bury the trees. A fully buried tree is protected from the mechanical and desiccating effects of winter wind and sun. When the tree is exposed, however, it becomes vulnerable. Air blown ice crystals abrade the branches and trunks that stick up above the snow and cause "flagging," which is the name given for trees with branches found only on the lee side.

Damage from desiccation occurs when exposed needles are warmed by the sun in the early spring. The warmed needles begin to conduct photosynthesis, but since the rest of the tree is still frozen, the needles are unable to replenish the water they lose in the reaction. The resulting desiccation kills the needles leaving orange-brown foliage on the tree tops.

A high snow pack, on the other hand, may not melt out in time for the summer growing season. As a result, south and southwest facing slopes should have a slightly higher timberline if all other factors are equal. The additional sunlight these slopes receive translates into warmer daily temperatures and a faster melting snow pack.

The stresses placed on the krummholtz cause it to produce few cones. Animals sighted in and around the trees are usually wayward visitors, taking advantage only of the trees' cover. Look for white-crowned sparrows nesting in these islands.

TEACHING CONSIDERATIONS:

When teaching ecology, avoid the abstract and limit your discussions to what can be seen in the immediate surroundings. Use teachable moments to teach about habitats. Use habitat information and awareness to emphasize the importance of sound minimum-impact skills.

RESOURCES:

Benyus, Janine. *The Field Guide to Wildlife Habitats of the Western United States.* 1989 Simon and Shuster Inc, New York. pp. 77-84, 93-104, 117-130, 163-176, 203-216, 273-298.

Brangonje, Rene, USFS, Pinedale District, telephone interview

Cole, David *Low-Impact Recreational Practices for Wilderness and Backcountry.* 1989, US Dept of Agriculture, Intermountain Research Station, General Technical Report INT-265, pp. 5-7, 51-55

Kelsey, Joe. *Wyoming's Wind River Range,* 1988, American Geographic Publishing, Helena, pp.46-61

Posel, Dan. "Ecology We Bump Into: Teachable Moments," *1989 NOLS Staff Conference Proceedings,* Lander pp. 23-25

Posel, Dan. " Alpine Timberline: Teachable Moments in Ecology," *NOLS Newsletter,* June 90, pp. 27-29

Snow Sawyer, Marit. Personal Wind River Field Notes 1992. Lander .

Snow Sawyer, Marit. "Natural History Games" *Second Annual NOLS Wilderness Education Conference*, 1990. Lander, pp.12-13
Shaw, Steve. BLM, Lander District, Range management
Stebbins, Robert C. *A Field Guide to Western Reptiles and Amphibians*. 1966, Houghton Mifflin Co. Boston. pp. 58, 63, 75, 109, 129, 192,

Wyoming Game and Fish Dept., Pinedale
Duke Early, Warden
Ron Remmick, Fish[illegible]ologist
Dan Stroud, Habitat Improvement

TREE IDENTIFICATION

Because there are only seven species to choose from, learning to identify trees in the Wind Rivers is relatively easy. Despite the limited diversity, trees are one of the most conspicuous indicator species used to identify different habitats in the Winds, and are, therefore, integral to understanding the natural history of the alpine environment. To recognize the significance of forest habitats, students need to know the ecological and economical importance of these species.

EDUCATIONAL GOALS:

Knowing the natural history of local trees allows our students to choose safe and durable campsites. Understanding the past and present human uses of trees, our students recognize the external factors affecting the future of this habitat in the Wind Rivers. Learning how plants and animals benefit humans also allows students to view the environment in a personal context and furthers their feeling of connectedness with the earth.

KEY POINTS

The seven dominant trees in the Wind Rivers are: aspen, Douglas fir, Engelmann spruce, limber pine, lodgepole pine, subalpine fir, and whitebark pine.

ASPEN, *POPULUS TREMULOIDES*

Early French trappers referred to aspens as "noisy leaf." They believed that the cross Jesus was crucified on was made of aspen wood, and that this was why the tree never stopped shaking or quaking. Aspens, which are in the same family as willows, create genetically identical groves by sprouting new trunks, or suckers, from a single root system. These trees, known as clones, change color at the same time each fall. This adaptation allows the tree to regenerate quickly after any disturbances. They can rise from the destruction of fire or avalanche without having to budget energy for seeding. Aspens are found along watercourses and at the edge of coniferous forests at low elevations. They grow on the better soils of post-burned areas, and are a source of food for beaver, cattle, elk and ruffed grouse.

Pioneers extracted quinine from aspen bark, and made an aspirin-like compound from the cambium layer of new growth. Today aspens are harvested to make chipboard and pulp.

DOUGLAS FIR, *PSEUDOTSUGA MENZIESII*

Douglas firs are often found taking over old lodgepole pine forests at middle elevations (between the lodgepoles and the subalpine firs in the Winds). Because they cannot tolerate shade, Douglas firs need fire to thin out competitors. The tree has a thick, fire-resistant bark that withstands the heat which destroys other species of trees.

In the Pacific Northwest, Douglas firs grow to 300 feet in height, but in the drier Rocky Mountains, the tree only reaches 130 feet. Douglas fir seeds are eaten by squirrels, meadow mice, shrews, wrens, and crossbills. Deer eat the new shoots, and bears have been known to eat the cambium layer. The tree is vulnerable to attacks by western budworm, tussock moths, and Douglas-fir beetles.

Douglas firs yield more timber for harvest than any other tree in North America. The wood is used for construction and plywood production.

ENGELMANN SPRUCE, *PICEA ENGELMANN*

Engelmann spruce needles are sharp and square, and smell like menthol when crushed. Like subalpine firs, Engelmann spruce have stiff branches and grow in a conical shape to shed heavy snow loads. They are found primarily in bottomlands along damp streambeds and in moist subalpine basins.

Old growth Engelmann spruce may be as much as three feet in diameter and 120 to 140 feet tall. The cones are harvested by squirrels, and the foliage provides cover for moose. Engelmann spruce is used by humans to produce wood pulp. Because of its clear, odorless properties, it is also used to make food containers. Native Americans chewed the gum of eastern spruce varieties after observing bears eating it. This eventually led to the development of chewing gum. Spruce needles are high in vitamin C and make a good herbal tea. Large spruces provide dry bivouac sites, and a place to find dry twigs on the ground.

LIMBER PINE, *PINUS FLEXILUS*

Limber pines are difficult to distinguish from whitebark pines. Both trees have five needles per fascicle. The primary distinguishing feature is the cone: Limber cones are green when young and become brown with age. They last for several years on the ground. Whitebark cones are purplish-red and disintegrate quickly.

The trunk of a limber pine tends to separate into multiple upward growing branches. These branches are flexible in order to shed snow before it accumulates and its weight breaks the branch. The trunks are generally twisted and gnarled by the elements, and the trees are often found growing out of what appears to be solid rock. Limbers are considered mature at 300 years, and have been known to live up to 1300 years.

LODGEPOLE PINE, *PINUS CONTORTA*

Lodgepoles have two needles per fascicle. The tree grows best in the poor soil and direct sun of recently burned areas. New growth is only frost resistant to 15°F. Some lodgepoles cones are covered with a resinous coating that needs the heat of forest fires to open. This feature allows for the immediate reseeding of a burned area. Often these serotinous cones cling to the tree for many years. The seeds remain viable for up to 150 years.

Porcupines eat the sap-producing cambium. If the porcupine girdles the tree while going after the cambium, the tree will die. In this manner, one porcupine can kill 100 trees in a winter. Lodgepoles provided a reliable source of straight teepee poles for local and plains Indian tribes, and are now harvested for log cabins and 2x4s. Native Americans also used the pitch on open sores or chewed it for sore throats.

SUBALPINE FIRS, *ABIES LASIOCARPA*

Subalpine firs can be identified by their "flat and friendly" needles. They tolerate broad moisture ranges from stream banks to hillsides, and have stiff branches. When found at low elevations, subalpine firs typically assume a conical shape similar to that of the Engelmann spruce. The shape helps them shed snow.

Subalpine firs need snow to survive. The snow protects the lower growth from the damaging effect of windblown ice crystals. These low branches tend to root and sprout additional trees around the base of the original growth, resulting in the formation of tree islands. The islands help conserve moisture and organic debris. The tree's resinous bark make it a poor fire survivor.

The subalpine fir, which is found growing with Engelmann spruce and whitebark pine, is the most widespread fir in western North America. It is often the climax species in the subalpine forests of the Wind Rivers, and provides deer and porcupine with protection from weather and predators. The trees are rarely logged because of the high elevation at which they are most commonly found.

NATURAL FIREWORKS

The Lewis and Clark expedition observed Indians deliberately setting single subalpine firs on fire. The resinous nature of the trees provided an amazing fireworks display as the tree ignited.

—*Northwest Trees*

WHITEBARK PINE, *PINUS ALBICAULIS*

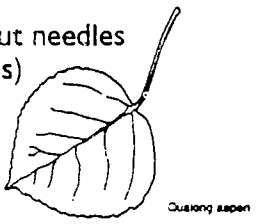
The whitebark pine is usually only seen by backcountry travelers since most roads in the western United States do not extend into its habitat. Whitebarks are found primarily in the upper fringes of Wind River forests. They prefer a dry climate, and are frequently seen in krummholtz shrub form around treeline. At lower elevations, the trees grow straighter and often reach 40-80 feet in height.

The needles of the whitebark, which grow in bundles of five, are the most frost-resistant of all Wind River trees. The whitebark's branches flex to shed snow, and its shallow roots offer anchorage and the ability to collect moisture in the thin, alpine soil where it grows.

Simplified Key For Major Wind River Trees

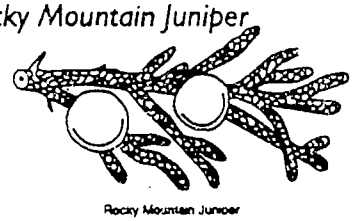
Trees with needles
Conifer Family: Spruces, firs, pines

Trees without needles
(broad leaves)
Aspen



Quaking aspen

Trees with scales
Rocky Mountain Juniper

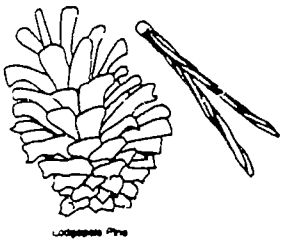


Rocky Mountain Juniper

Needles grow singularly from branch
Spruces and firs

Needles group in groups of two or more
Pines

Needles in groups of two
Small, paired cones
Lodgepole Pine



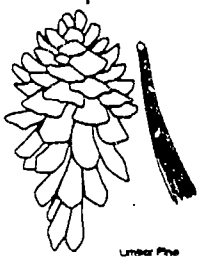
Lodgepole Pine

Needles sharp and
square in cross-section
Englemann Spruce

Needles in groups of five
Found on windy ridge,
flexible branches

Needles soft-tipped and flat in
cross section

Brown cones over 3.5" long
Found below subalpine
Limber Pine

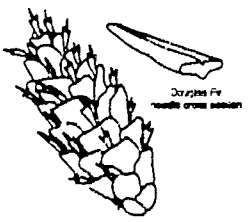


Limber Pine

Bark smooth and whitish
Found in the subalpine
zone, forms tree islands at
upper elevations.
Subalpine Fir

Sub-alpine Fir

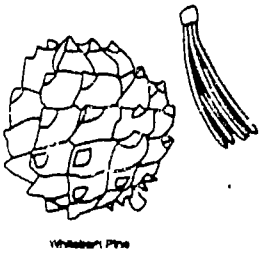
Bark furrowed and reddish.
Found in the montane zone,
often seen with aspen. Papery
cones with mousetails.
Douglas Fir



Douglas Fir needle cross section

Douglas Fir

Purple cones, resinous
Found in subalpine zone.
Whitebark Pine



Whitebark Pine

The whitebark's cone contain pine nuts which ripen in August and September and are an important food source for grizzlies, Clark's nutcrackers, red squirrels, golden-mantled ground squirrels, and deer mice. The tree also provides ruffed grouse with shelter from goshawks.

Due to the high elevation at which they are found, whitebarks have limited commercial value. At the end of the summer, however, they produce a delectable supply of pine nuts for mountain travelers.

John Muir never visited the Winds but claims to have found a whitebark pine that was 426 years old and only six inches in diameter. The 1/8 inch diameter branches were said to be 75 years old.

WIND RIVER FORESTS

Wind River woodlands are technically not true "old growth" forest because they are fire successional. *Old growth forests* are climax communities with mature trees dying of old age and decomposing on the forest floor. The climatic conditions which make the range attractive to recreationists make it difficult for trees to prosper: cool summers, deep snow, year-round sunshine at the lower elevations, and abundant warmth and water, but warmth and water that rarely occur at the same time.

TEACHING CONSIDERATIONS:

The major benefit of using trees as a topic for teaching natural history, ecology and land management issues is they are easy to see and identify. These species can be the focal point for explanations of mountain zonation, plant adaptation, and abiotic factors in mountain ecology. One way to teach about trees is to have them less than arm's length away, and to offer information as practical examples present themselves. Certain mnemonics help students remember specific species.

RESOURCES:

Rocky Mountain Tree Finder, 23,4, 5
Lanner, Ronald, Trees of the Great Basin, UNV Press, Reno, 1984
Northwest Trees 88,89-105,109, 38-39,35-451
Red Oaks 226-237

INDIVIDUAL SPECIES

Students are often curious about specific plants and animals they see during the course. Instead of providing a detailed natural history for each organism in the Winds, the following points are suggestions for ways to make your presentation fit into an overall understanding of the alpine ecosystem and the relation of humans to it.

EDUCATIONAL GOALS:

Students should know how to identify individual species and to recognize their habitats and niches within the local ecosystem. Students should also be aware of human impacts on the success or failure of specific species. Instruction can incorporate the themes of minimum-impact and wildland ethics into a discussion of ecosystem health.

KEY POINTS:

IDENTIFICATION

Show your students how to recognize specific plants and animals by their distinguishing characteristics. Clue them into using tracks, scat, flight patterns, and habitat for identifying birds and animals. When identifying plants, have them focus on flower and leaf arrangements, soil and slope aspect, elevation, and season.

Get your students using the reference books in the course library. Show them how to use a dichotomous key. Discuss pollination requirements, rutting behaviors, and mating habits in the species under consideration. Encourage observation and interpretation. Make tracking a common activity. Ask your students questions and help them figure out nature's patterns by themselves.

WILDLIFE OBSERVATION

Where animals are likely to be found depends on the season. In the spring some species are conspicuously attracting mates, waking up hungry, or just trying to warm up. The summer is often filled with rearing young, or bulking up for a fall rut. Fall behavior can include migrating, gorging, stockpiling food, mating, or moving into a frost-free winter home.

Wildlife observation succeeds when you use all of your senses and begins to think like an animal. Continually shift focus from the macro picture of your surroundings to the micro. Practice watching for movements out of the corner of your eye. Heighten your senses with binoculars or listen with your eyes closed. Pick high traffic areas to observe. These include carcass sites, game trail intersections, water borders, and scent markers (scat piles). The daylight hours are less productive for observing than dawn or dusk. Do not let darkness lessen your observations. Many mammals hunt or feed at night. Use your binos to extend your vision well into the twilight.

Stalking requires careful and well thought-out moves. Approach from downwind with the sun at your back. Pause as the animal stops to listen or tenses up. Move on them when they are occupied with feeding or grooming. Move from hiding place to hiding place. Follow the animal's trail; it is usually the quietest path.

Lessen your impact with good etiquette. Avoid causing the animal to flee repeatedly. This taxes their energy reserves. Recognize when the animal is disturbed and back away. Steer clear of nurseries. Your scent can lead other predators to them, as well as drive off the parents.

ANTHROPOLOGICAL USES

Students often enjoy learning about how specific plants and animals have been used by past and present populations. Talk about the medicinal and dietary uses of the species you identify. Try collecting and eating edibles. Discuss the present recreational and economic harvest of this species.

Identify how human interference has affected the size and well-being of a species. Discuss population fluctuations and how they relate to human activities such as recreational use, timber harvesting, and the introduction of exotic plants and animals.

MINIMIZING OUR IMPACT

Understanding the natural history of an area enables you to travel through it safely and with less impact on its native inhabitants. Knowing animal feeding habits, understanding their responses to threats or danger, and recognizing breeding cycles, helps you know the appropriate time and place to view wildlife. Distinguishing between edible and lethal plants allows you to supplement your diet with impunity, and understanding plant habitat and zonation benefits route and campsite selection.

TEACHING CONSIDERATIONS:

This instruction is designed to get students to appreciate and understand their surroundings. Good teaching incorporates natural props and visual aids—why draw a picture of a spruce cone when you can handle one? Make instruction fun, short and relevant. Mini-classes and teachable moments are most successful when they tie natural history information to other themes within the curriculum.

The pioneer naturalist approach is one method for giving your teaching a pragmatic twist. This method uses natural history knowledge to achieve a practical goal, much the way a Native American or early explorer would have utilized his knowledge of the local environment for everything from choosing an efficient travel route to harvesting a wild salad.

Early or late day game walks are a fun and non-academic activity which promote observation skills. Organize a scavenger hunt to explore the botanical resources of an area. Have your students explain the human uses of the plants they collect to the rest of the course. Obviously, this activity and the items collected should not cause any significant impact.

MAMMAL TRACKING

The opportunities for learning firsthand about wildlife while living in the field should not be ignored. Wildlife sightings, however, can be rare with a large group of noisy students. By becoming familiar with the tracks and sign of animals, students do not need to wait for actual sightings to learn about the behavior, habitat, and diet of wildlife.

EDUCATIONAL GOALS:

Students should be able to identify common tracks found in the course area, and to classify those they don't know into the families or orders presented below. Students should be able

to use gait patterns in identifying tracks, and understand the value of scat in studying animal diet. They should also be able to demonstrate an ability to "tell what happened here" from tracks.

KEY POINTS:

GAITS

Gaits are the way animals move. The most common gaits are: a diagonal walk, a trot or pace, and a gallop. You can also use tracks to determine if an animal is jumping, hopping, or bounding. Have your students practice each type of movement and examine the tracks they leave behind.

When analyzing tracks, there is some terminology worth knowing. The stride is the distance between two placements of the same foot and the *straddle* is the distance across between the tracks of the right and left feet.

FAMILIES AND ORDERS FOUND IN THE ROCKY MOUNTAINS

Most tracks can be classified according to the family or order. Typically tracks found in the Wind Rivers are from one of the following:

A. *Canidae* (Dog Family)
   1. four toes, non-retractile claws, oval shape overall.
   2. characteristically use diagonal walk, trot or gallop.
   3. local species include: coyote, wolf, fox (red and gray), and domestic dog.

B. *Felidae* (Cat Family)
   1. four toes, retractile claws, round shape overall.
   2. characteristically use diagonal walk, trot or gallop.
   3. local species include: bobcat and mountain lion.

C. *Ursidae* (Bear Family)
   1. five toes front and back, non-retractile claws, front and back tracks significantly different, little toes to the inside.
   2. characteristically use diagonal walk or gallop, sometimes bound.
   3. local species include: black bear, grizzly bear

D. *Mustelidae* (Weasel Family)
   1. five toes front and back, frequently in a 1-3-1 pattern, non-retractile claws
   2. characteristically bound or walk.
   3. local species include: least weasel, long- and short-tailed weasels, pine marten, river otter, mink, skunk, badger, wolverine

E. *Artiodactyla* (Even-toed Ungulate Sub-order)
   1. two toes front and back; dew claws can appear.
   2. characteristically use diagonal walk, trot or gallop.
   3. local species include: mule deer, elk, moose, pronghorn, and bighorn sheep.

F. *Lagomorpha* (Rabbit Order)
   1. four toes front and back.
   2. characteristically hops.
   3. local species include: cottontail, jackrabbit, snowshoe hare, and pika.

G. *Procyonidae* (Raccoon family)
   1. five thin, elongated toes, front and back
   2. characteristically walks or paces.[1]
   3. only local species is raccoon.

H. *Rodentia* (Rodent Order)
   1. four toes in front and five in back.
   2. characteristically walks or hops.
   3. local species include: marmot, muskrat, beaver, porcupine, squirrels, woodrat, voles, shrews, moles, and mice.

INTERPRETING TRACKS

Tracks often lead between homes and feeding areas, and well-used paths are usually distinguishable as trails. A more recent track will obliterate older tracks. Tracks in and around camp will weather at the same rate as animal tracks in the area and can be used in comparison for dating. Tracks of predators chasing prey are commonly seen in snow.

SCAT IDENTIFICATION[2]

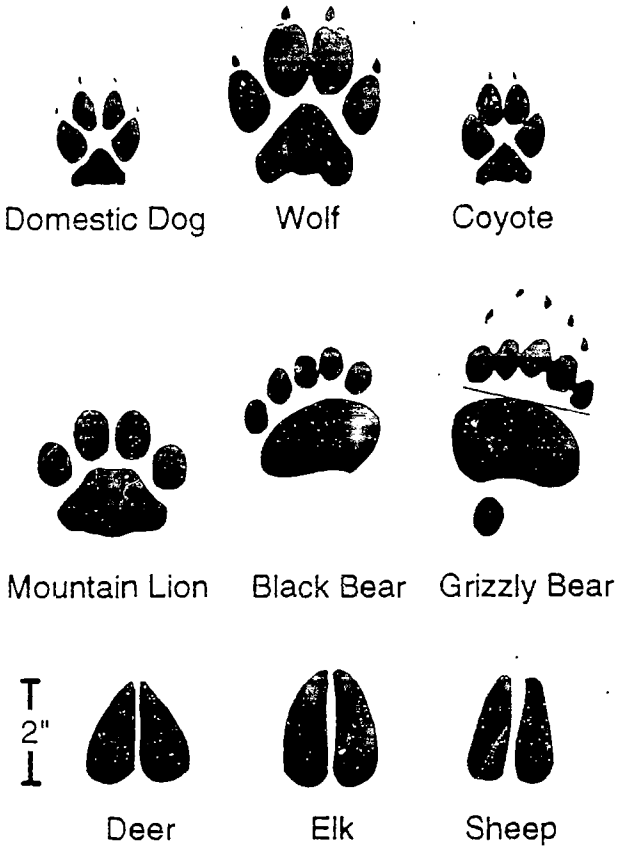
Scat can be picked apart to determine what an animal has been eating. (Don't forget to wash your hands afterwards!) The presence of fur, bones and feathers indicate carnivores: canines, felines and weasels. Grasses, berries and bark indicate herbivores: ungulates, lagomorphs, rodents etc. The consistency and color of the scat will vary with diet. Typically, summer elk scat is loose and forms piles, while in winter when feed is dry and sparse, elk scat forms hard, round pellets.

Canine and weasel scat are often found on trails or on top of rocks and logs. The scat of these animals, and of other carnivores, typically have a long cord-like appearance. Lagomorphs, on the other hand, leave flattened, disk-like pellets,

[1] Halfpenny argues that the raccoon uses an unusual offset walk pattern, while Brown says that the racoon, along with other small, wide-bodied animals such as the porcupine and badger, paces as its preferred form of locomotion.

[2] Halfpenny's chapter on scatology (pp.133-148) is useful in preparing a class on scat.

Common Mammal Tracks
(all front prints)



while ungulates (with the exception of moose) have nipple-dimples. You may also find owl pellets, grouse scat, and other non-mammal droppings.

OTHER ANIMAL SIGNS[3]

The presence of animals can also be determined by nibbled vegetation, bark stripped from trees, digging, scraping and tunneling in the ground, fur left on bushes and trees, gnawed bones, or food caches. You may also find beaver dams and squirrel middens.

TEACHING CONSIDERATIONS:

It is important to focus on the tracks students are actually likely to find in the course area. For example, in the Wind Rivers in the summer you would probably only discuss mule deer, elk, moose, bighorn sheep, coyote, bobcat, fox, pine marten, marmot, squirrel, weasel, and small rodents.

This class is difficult to teach effectively without drawing pictures of the tracks. Instructors who practice their drawings ahead of time will make better visual aids in the field.[4]

Demonstrating different gaits during a class is humorous and entertaining; getting students to attempt each gait is an effective way to show how they really work. Using two ski poles or sticks as front feet makes practicing gaits easier and more realistic. The diagonal walk, gallop, bound, and hop are the most important gaits to teach.

Ideally this class is taught on a day when the instructor has identified some tracks nearby that the class can be led to during the teaching session. Reinforcement of tracking knowledge can be done with some informal tracking in the first few days following the class.

The class can be ended by showing drawings of a number of different tracking scenes and asking students to interpret the story. Examples can be found in Halfpenny, pp. 106 - 128.

Tracking is a subcategory of the general class of Observation Skills. Students can often be compelled into making the detailed observations necessary for tracking by opening the class with an activity: "Everyone go and spend 60 seconds finding a sign that animals have been here." Students have to go no farther than the plants they stepped on coming to class, but most will walk away looking for a clear coyote print or a piece of scat. This serves as an effective demonstration that subtle animal signs are all around us, but we often ignore them in search of something large and obvious.

It is important to stress the difficulty of tracking when one's eyes are five feet away from the dirt. Instructors will find that getting down on their knees to look for animal sign and encouraging students to do the same is very effective. Students will soon be finding far more animal sign than they did before.

Instructors need to decide before teaching this class whether it is appropriate to use Latin or common names of animal families and orders. Common names are more readily understood by those new to the study of wildlife, but Latin names suggest the sophistication of taxonomy and prepare the student for further investigation in the biological sciences.

[3] Stokes has an excellent chapter on animal signs (pp.68-125)
[4] The drawings of Elizabeth Biesiot, the illustrator for Halfpenny's guide, are probably the easiest to learn from and copy.

RESOURCES:

Halfpenny, James, *Field Guide to Mammal Tracking in Western North America*, Johnson Books, Boulder, 1986.
Stokes, Donald, *Guide to Animal Tracking and Behavior, 1986.*

CONSTELLATIONS AND USEFUL ASTRONOMY

Although our ancestors were intimately familiar with the motions of the stars, moon and planets, modern urban and suburban dwellers may have only observed the night sky in detail on a few occasions. As a result, they are often thrilled by their first view of the stars in the mountains.

Students acquire a familiarity with stars and planets by learning some major landmarks in the sky and understanding the basic motions of the heavens. Practicing telling time and navigating by the stars may give students a sense of connection with historical wilderness travel practices, as well as an increased confidence in their ability to orient themselves and travel without maps.

EDUCATIONAL GOALS:

Students should have a basic understanding of the heavens and be able to: find the pole star, identify some constellations, understand how the apparent rising and setting of the stars results from the earth's rotation, and understand the progression of the phases of the moon and how they result from the relative positions of the earth, sun and moon. With more advanced students, you can determine the cardinal directions under a clear night sky; figure out how to tell the time to within a couple hours by the stars; and show them how to calculate their latitude and longitude within a few degrees using crude instruments.

KEY POINTS

POLARIS

The pole star, Polaris is invariantly over the Earth's North pole, deviating by less than one degree nightly.[1] If you hang a weighted string from your hand or from a tree limb and line Polaris up with it, you are directly south of the weight. A north-south line can thus be scribed on the ground and an east-west line drawn through it at right angles.

CELESTIAL LANDMARKS

Other key landmarks in the sky include: the Big Dipper, the Summer Triangle consisting of the stars Vega, Altair and Deneb, the Milky Way, and Orion. Some common summer constellations are: Cassiopeia, Bootes, Corona Borealis, Lyra, Cygnus, Aquilla, Delphinus, Sagittarius, and Scorpio.

APPARENT MOTION OF THE STARS

As the earth rotates under Polaris, stars appear to rise in the east and set in the west; moving across the sky at the same speed as the sun and moon. Constellations close to Polaris ("circumpolar") never set. The angle of Polaris above the horizon equals your latitude. Certain stars lying on the "celestial equator" are directly overhead for observers on the equator, and always rise due east and set due west. The most easily seen of these are the three stars that form the Belt of Orion. Others can be located using a Planisphere.

PHASES OF THE MOON

There is a "far side" of the moon, but no "dark side." Phases of the moon are determined by the portion that is illuminated and visible from earth. The moon orbits the earth in 29.5 days, giving roughly 7 days per phase (historical origin of the week). Different phases of the moon have characteristic rising and setting times (e.g. full moon rises at sunset, sets at dawn).[2] By understanding moon phases, a wilderness traveler can make good use of its light.

TELLING TIME WITH THE SUN

With the sun, a wristwatch, your shadow, and your hand, you can determine time and geographic directions. We know the sun rises in the east and sets in the west. At those times our shadow points in the opposite direction from the sun. At solar noon—1:00 p.m. daylight savings time—our shadow points north because the sun is slightly south of directly overhead at this

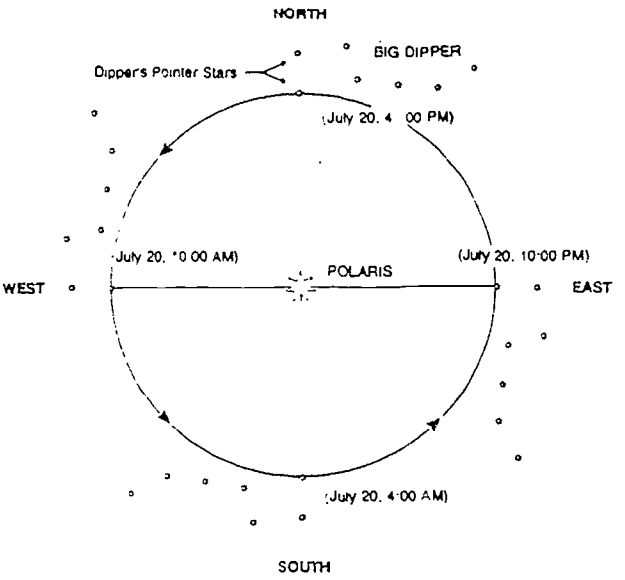
[1] Polaris is within one degree of the North Pole. It will be closest to due north in the year 2095, when it will be 0 degrees, 26 min. from the North Pole. (Norton's Star Atlas)
[2] The actual time between successive new moons varies from 29.25 to 29.75 days, with a mean of 29 days, 12 hours and 44 minutes. (Norton's Star Atlas).

latitude during the summer. At the beginning of the trip use a watch and compass to note the times and shadows for the cardinal and intercardinal points. The face of an analog watch can be used as a protractor to determine compass points. Point the hour hand at the sun. Halfway between the hour hand and 12:00 o'clock is due south.

Try using your hand as a measuring stick to count how many hands the sun is above the horizon. By corresponding this measurement to a given time of day, one can learn to estimate the daylight hour without a watch.

DETERMINING LATITUDE

The declination of a star is the latitude on earth where it passes directly overhead. The point overhead is called the *zenith*. Deneb, for example, in the Summer Triangle (constellation Cygnus), has a declination of 45 deg. 6 min. N, and passes almost due overhead in the Northern Wind River Mountains. With a good star chart you can determine your latitude by observing what stars pass directly overhead.



By lining up the Big Dipper's pointer stars with Polaris throughout the night, we can determine our cardinal directions.

TEACHING CONSIDERATIONS:

If this class is taught at night ("astro bivy"), it is unrealistic to assume that all students will stay awake unless you turn in early. If the class is taught during the day (with visual aids portraying constellations and stars), plan to reconvene at night to identify the stars you talked about. Time the presentation of star-oriented material for the nights when the moon is far from full. A full moon obscures all but the brightest stars.

This class can be improved by doing a little homework ahead of time. Look in one of the periodical resources listed at the end of this section to determine if any of the bright planets are currently visible in the night or morning sky (Venus, Mars, Jupiter, Saturn), to obtain a schedule for the phases of the Moon, and to see if any meteor showers or eclipses will be occurring during the course. These events all communicate that the sky is constantly changing and may help you time your astronomy class.

A diagram of the earth-moon system (with the sun out of the picture to the side) is useful in explaining phases of the moon. (For an example see *The Book of the Moon*, p.21.) An alternative visual aid is to have students act out the parts of the earth and moon, while the real sun (or a headlamp at night) illuminates them.

You can easily get bogged down by the diverse and vast amount of material available for astronomy classes. Subjects vary from the life histories of stars, to the mechanics of the solar system and black holes. Teach only what you know and avoid teaching more than a couple of constellations on any given night.

Students are invariably astonished by the clarity of the skies in the mountains, and will often sit out late just looking at the stars. These are good times to join them and pass on a few constellation names informally. Never pass up an interested student, but don't add so much information that you over-satiate their enthusiasm.

Using Polaris to find north is a fun and simple trick to teach everyone. Other celestial navigation and time telling techniques are for the more motivated student—and the more motivated instructor! The benefits lie in the sense of "solar system as clock" that the student may gain and a historical perspective on the usefulness of stars to expeditions.

RESOURCES:

The Planisphere
Hockey, Thomas, *The Book of the Moon*, 1986.
Rey, H.A. *The Stars*, 1962
"Celestial Events" column in *Natural History* magazine.
Stardate, bimonthly publication of the University of Texas MacDonald Observatory
Norton's Star Atlas, Arthur P. Norton

METEOROLOGY AND LIGHTNING

Prior to making an 8000 meter ascent, renowned alpinist Rienhold Messner travels to the mountain and spends weeks observing local weather patterns. We can do the same thing as we travel through the Winds. The daily pattern of afternoon buildup and the occasional cold front provide a convenient backdrop for introducing students to some basic meteorological observation and forecasting skills. Recognizing these patterns and then using them to plan peak climbs or moving days is a critical skill for mountain travelers.

EDUCATIONAL GOALS:

Most importantly, our students must learn to minimize hazards by being able to anticipate and respond prior to the onset of dangerous meteorological conditions such as lightning, adverse climbing weather, and out-of-season storms. This learning should occur early in the course. An additional aim is to instruct students in basic weather observation and interpretation. Students should be able to differentiate between a local weather phenomenon and a regional weather system.

KEY POINTS:

OBSERVATION

Record basic weather observations daily. After a few days or weeks of collecting information, amateur meteorologists will be able to identify trends and patterns in the local weather. Wind speed, air temperature, precipitation, wind direction, cloud type, cloud height, and cloud progression records allow us to make some good guesses about the weather even without precise instruments to record details. Make your weather observations at the same time each day, and include a prediction for the next day. When your forecasts are wrong, try to figure out where you went wrong and why.

Your observations on wind speed should include its comparative strength, quality and duration. Ask yourself, is it stronger today than yesterday? Did it come in a sudden gust? Were there ominous clouds preceding the wind, or is the cloud cover changing steadily? How long has it been blowing at this rate? Trends in wind strength are useful in gauging the arrival and passage of storm fronts.

Air temperature is often recorded on zipper-pull thermometers, but is best documented as a trend, e.g. "colder than yesterday." Some people like to note what they were comfortable wearing or doing at a given temperature. Temperature trends can also be key indicators for cloud and precipitation changes.

Precipitation records should indicate duration and amount. This, along with other concurring observations, will help students develop a frame of reference from which to judge the severity of future rain and snowstorms.

Wind direction is also important. The exact direction, however, is not as critical as its trends and shifts. Because topographic features distort ground level winds, wind direction should be observed in high-level clouds and measured with a compass. Shifts in wind direction can signal the beginning, ending, or middle of a front. When recording wind direction, note where the wind originates, not where it is going.

Clouds exist in three basic forms: cirro clouds, cumulus clouds and stratus clouds. Meteorologists attach prefixes to these cloud forms to describe their height. "Cirro" indicates the highest clouds in our atmosphere. A cirrostratus (stratus is the Greek word for layer) cloud is a high, flat, sheetlike cloud.

Cirrus clouds are high wispy clouds sometimes known as mares' tails. They are often the leading cloud form in a warm front.

Cumulus clouds are best described as puffy clouds. Cumulus clouds, by themselves, indicate fair weather. In certain conditions, they develop vertically into towering piles. The conditions causing this development—convective currents resulting from temperature differences in the atmosphere—often generate lightning strikes as well. The tops of towering cumulus can reach up to the cirrus layer. Here, high winds sheer off their tops leaving them with an "anvil" shape. Cumulus clouds occur at all atmospheric altitudes.

Stratus clouds appear as one or multiple layers and are named for the cloud forms that make

CLOUD NOMENCLATURE

Name	Description
CLOUD TYPE	
cirrus	high wispy clouds
cumulus	puffy clouds, clouds which tower up
stratus	horizontal cloud layer(s)
nimbo	rain (sometimes lightning) producing clouds
CLOUD FAMILY	
cirro	highest clouds: 40,000 to 20,000 feet
alto	middle elevation cloud: 20,000 to 6,500 feet
strato	lowest level clouds: 6,500 feet to near the surface

Example: A low altitude layer cloud is not a "stratostratus" but is just called a stratus cloud. If it produces rain, it would be called a nimbostratus.

up each layer. Recall our cirrostratus example. Other stratus clouds include stratocumulus and nimbostratus (a layer of rain producing clouds). With the exception of cirrostratus, stratus clouds tend to form in the middle and lower atmospheric altitudes.

Cap clouds form above peaks when high winds propel moisture-laden air rapidly over a cold summit. These caps are lens-like in shape (lenticular) and appear stationary, though in fact they move rapidly, forming as moist air rises on the windward side, and dissipating as it drops on the leeward side. Cap clouds indicate the presence of extremely high winds and freezing temperatures.

Recognizing cloud types is critical to record the order in which various forms pass overhead. Observing and interpreting this progression helps us calculate how much time is available before bad weather strikes and to predict the weather for the next few days.

Percentage of sky coverage (cloud cover) coincides with common cloud progressions. In this simple observation, note the trends in cloud and sky coverage rather then record a detailed description of cloud progression. For example, "Over the last two days the cloud ceiling has thickened and lowered."

METEOROLOGICAL CONCEPTS

The dynamics of mountain weather are easy to understand if you know a few simple concepts. Most of our weather comes from the west. This is the prevailing wind direction in North America. The exception to this is when storm fronts with clockwise or counter clockwise wind shifts interrupt the general pattern.

Two types of air masses influence all weather: cold-air masses and warm-air masses.

During the summer, the warm-air masses over Wyoming originate over the Pacific, due west of California. There they collect moisture from water evaporating off the ocean. Warm-air can hold more moisture than cold-air. They are also lighter and will rise over cold air. The cold air masses that move through Wyoming in the summer are pushed out of the Gulf of Alaska and sink toward the state with the help of the prevailing wind. Less capable of holding moisture and denser than warm air, cold air tends to wedge itself under masses of warm air.

Temperature differences affect the barometric pressure associated with each air mass. Since cold air is denser than warm air, these air masses have higher pressure. Warm air masses are low pressure areas. The temperature difference between these different air masses may only be slight to the ground observer.

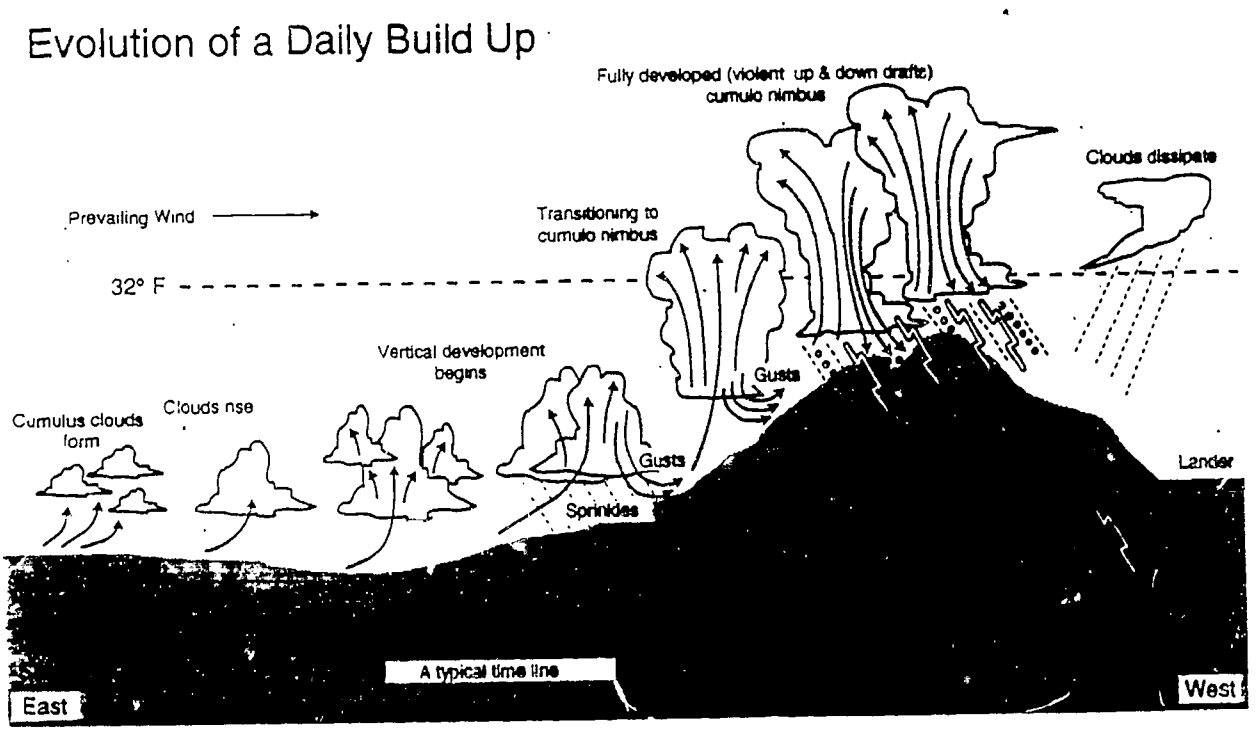
WIND RIVER WEATHER PHENOMENA

Weather effects can be broken into two categories: local or orographic, and regional. According to the staff at the National Weather Service station in Lander, 90 percent of the weather experienced in the Wind Rivers during the summer is local weather, influenced and created by the topography.

In the Winds, orographic weather can include slope winds, daily buildup, and the formation of fog. Hikers often notice a slight wind in the morning or afternoon during a day that is otherwise calm. These breezes tend to flow up or down the gradient of the terrain. In the morning, warm air will rise upslope or up-valley. In the late afternoon and throughout the evening, air cooled by low ground temperature will sink into depressions or drain down valleys. Hence a campsite off the valley floor will be a noticeably warmer place to sleep than the one down in the bottom. Look for similar effects when camping at the foot of a glacier or snowfield where thin layers (200 feet thick) of cold air slip off the glacier and roll down valley. The cooling effect of this air is noticeable until the ground temperature warms it up—usually a third of a mile or so from the glacier's toe.

Daily buildup is responsible for most of the lightning you experience in the Winds. It begins after sunrise each day with water vapor evaporating off the hot plains. This rising vapor forms harmless looking cumulus clouds that are blown toward the range by the prevailing winds. As these clouds ascend the western slopes, they increase in size and vertical development. The vertical movement grows increasingly violent within the rising cloud forming hail and building up an electrical charge. As the clouds cross the high peaks and passes, the electricity is discharged, although lightning strikes have occurred at all elevations in the range. When the day cools down again, the likelihood of a storm due to the daily buildup decreases. Published weather statistics say that in the Rockies you can expect thunder and lightning storms five to six days a week during the summer.

Fog forms when moist, warm air comes in contact with a cold surface. Expect to see occasional fog over snowfields, glaciers or ground that has not seen the sun in awhile.

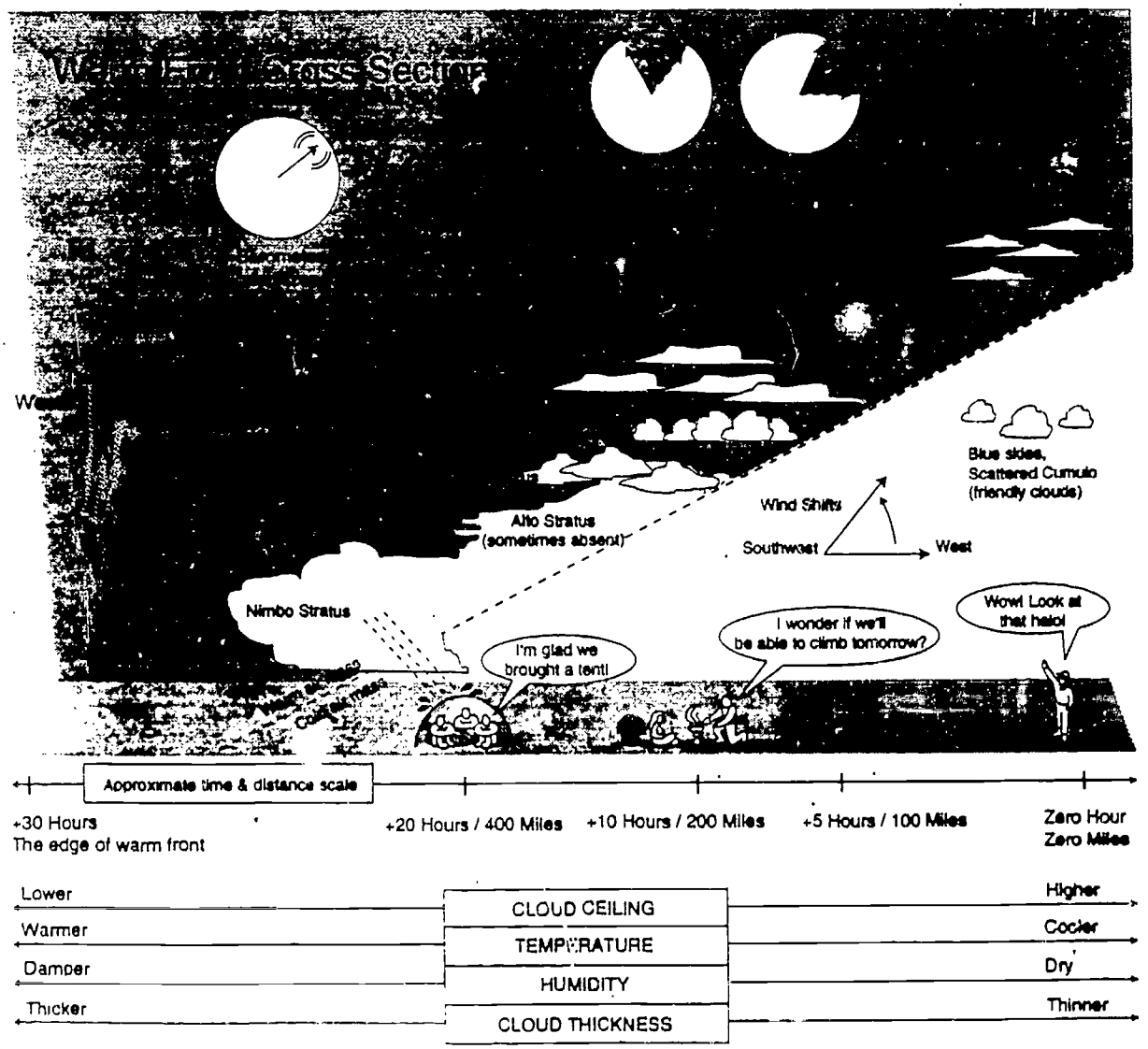


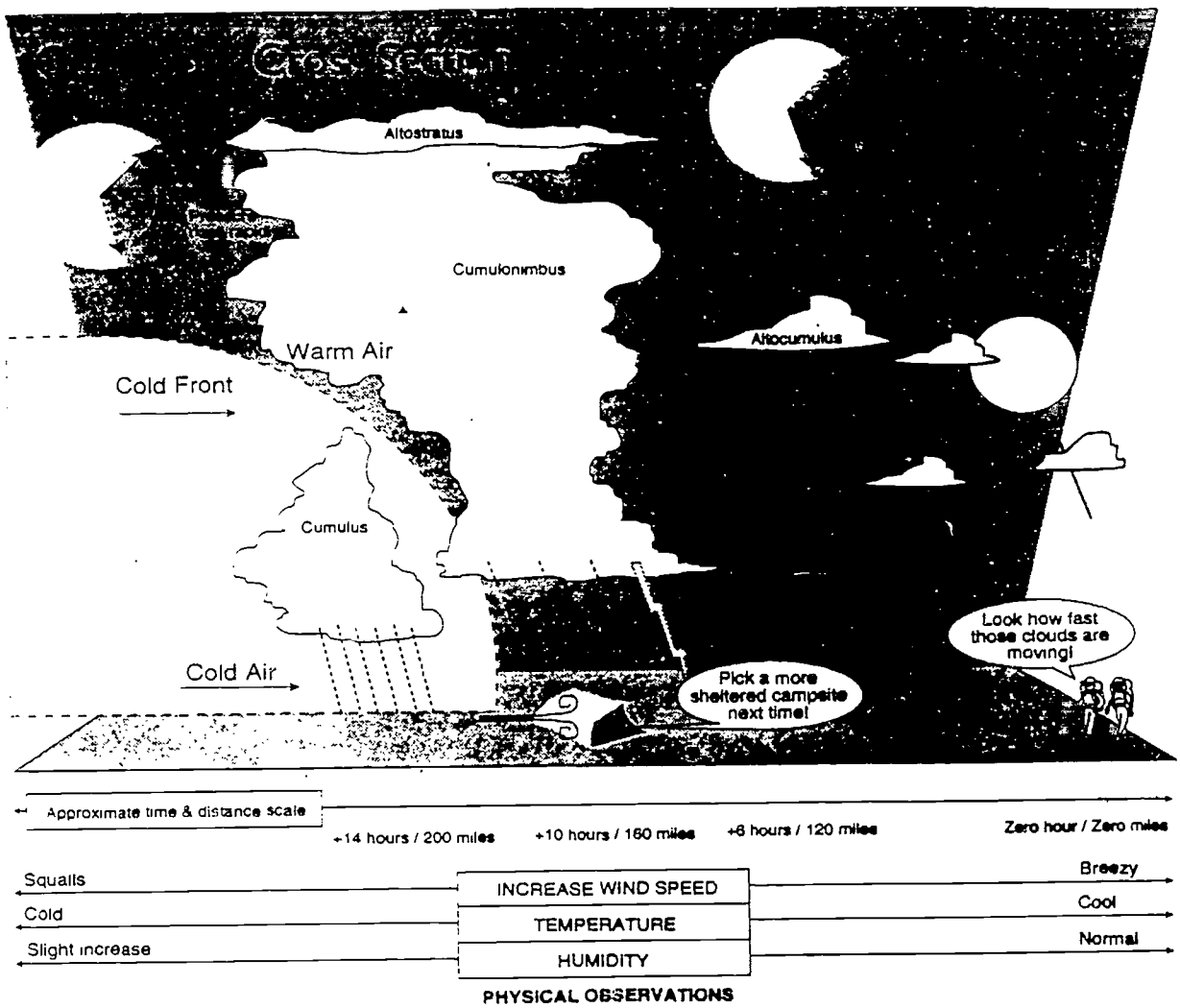
FRONTS

Fronts occur when warm and cold air masses come in contact with each other. The difference in each air mass's temperature, pressure, wind speed, and direction, creates a dynamic that yields predictable meteorological events. Cold fronts occur when a cold air mass bulldozes into a warm air mass. A warm front happens when warm air follows behind cold air and replaces the leading air mass as it advances. In North America, air masses and frontal systems trend west to east, pushed by the prevailing wind. The collisions of these air masses may take place over the state, or the fronts may have already formed when they arrive.

The size of the air masses, the area where they formed, and the preexisting weather conditions influence the severity and duration of a storm system. Since we cannot see the temperature or barometric pressure of these air masses, we must rely on visual signs to identify the approach and passage of fronts. An observer can often predict how big a "dump" the approaching weather will deliver based on past experience. Such anticipation allows trip leaders to adjust travel plans to avoid exposed travel and unsheltered campsites.

Unlike other parts of the continent, Wyoming experiences few warm fronts during the summer. The warm moist air, arriving from the Pacific, is often dried out and has insufficient water remaining to develop the normal cloud progression and rain by the time it reaches the state. Most of the moisture is deposited on the Sierra Nevadas and the intermediate ranges between Wyoming and the West Coast. This creates "weak" fronts that pass in one to three days without developing significant mid-level stratus clouds.





The classic cloud progression for a warm front is: cirrus, cirrostratus, cumulostratus, altocumulus, alto stratus, nimbo stratus. Basically, the cloud ceiling gets thicker and lower for one to three days before it rains or snows. Cumulonimbus may appear at the end of this sequence and indicate a clearing trend. If you have a barometer, you will see the pressure fall steadily, then plunge rapidly to a low point before it comes back up. Look for the wind to shift counter clockwise and come from the southwest, south and southeast. The shift should begin with the appearance of cirrostratus. Try to detect a slight rise in temperature and humidity. Warm fronts slide in quietly and build more slowly than rowdier cold fronts. Remember rarely does the weather overhead match the frontal models illustrated in the text; these drawings represent idealized fronts.

Cold fronts are the more common front encountered in the Winds during the summer. These fronts announce their arrival with increasing wind speeds, punctuated by strong gusts. Expect a similar, but more abrupt, wind shift than with a warm front. Look for a towering wall of cumulonimbus clouds off to the west. Scattered, mid-level cumulus and stratus clouds may precede the front. Often these clouds are seen racing across the sky. The cumulonimbus associated with the main front have the capability of producing thunder, lightning, heavy rain, and fierce winds throughout a 24 hour period. Observers will notice the temperature drop more than the humidity change during this type of storm. Watch for a plummeting barometer as this storm comes closer. The faster the rate of drop, the stronger the storm.

LIGHTNING

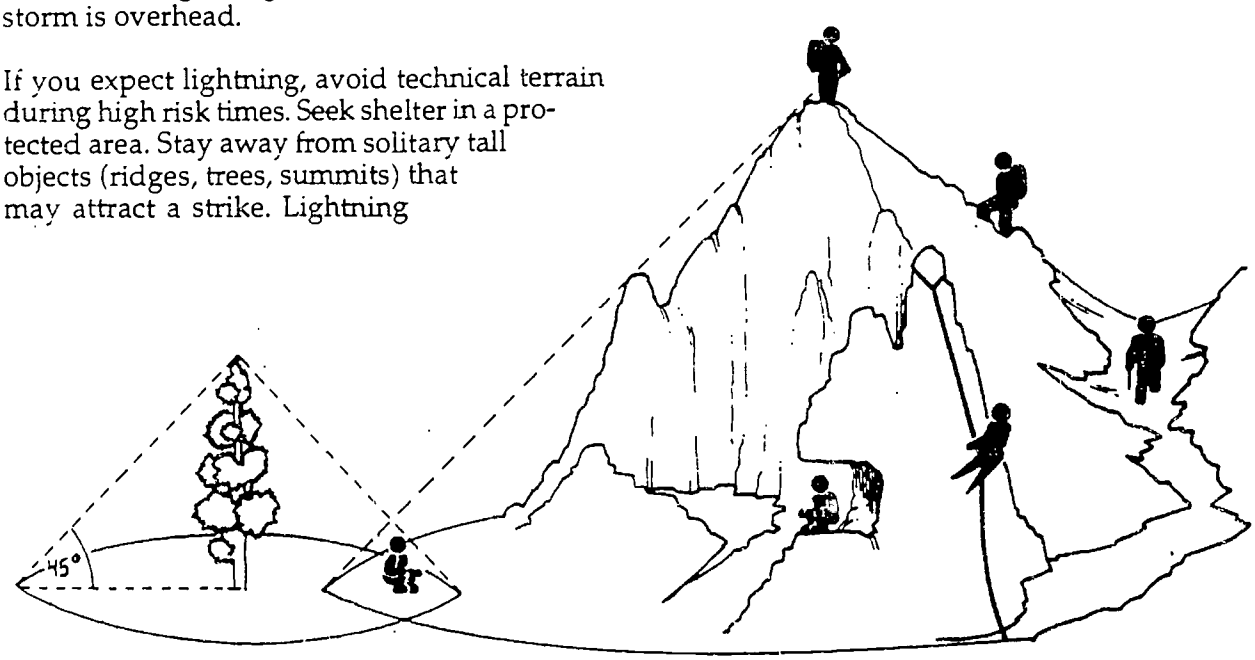
Lightning almost always occurs with thunderstorms and is the greatest weather threat to outdoor travelers in the Rockies, according to the National Weather Service in Denver. It is caused by the strong up and down drafts found

inside cumulonimbus clouds. These violent air currents create an intense electrical field which polarizes the cloud. The top of the cloud becomes positively charged, while the bottom gains a strong negative charge, along with some small positive charges. Normally the ground has a negative charge, but as the cumulonimbus passes overhead, it induces a positive charge in the ground. When the positive ground charges become strong enough, they travel up tall objects to seek their opposites in the clouds. The strike occurs when the air between the cloud and the ground can no longer insulate the charges from each other.

Saint Elmo's fire (a bluish glow about an object), humming metal objects (e.g. climbing gear), hair standing on end, the burnt odor of ozone, or a crackling sound on wet rocks are all signs that an area is in imminent danger of a lightning strike. Another indicator is the distance the storm is away from you. To determine this, count the seconds between a lightning flash and its thunder. (Light travels 186,000 miles per hour. Sound travels a fifth of a mile per second.) Divide the elapsed seconds by five. This will tell you how far away the lightning is in miles. Simultaneous lightning and thunder indicates the storm is overhead.

If you expect lightning, avoid technical terrain during high risk times. Seek shelter in a protected area. Stay away from solitary tall objects (ridges, trees, summits) that may attract a strike. Lightning kills people two ways: with direct hits and with ground currents. Direct hits are usually lethal. Grounds currents emanate from the lightning strikes and travel along the ground, shocking their victims until the currents dissipate.

Body position can reduce the hazard of ground currents. If you are caught out in the open assume the lightning safety position—squat as low as possible with your feet touching each other and hands off the ground. This position prevents a ground current from traveling up a limb into the body's core. Instead, the current enters one foot and passes out the other, causing less injury. Nonconducting insulation can also help shield you from ground currents. Crouch on an ensolite pad, on your pack (frame side down), or on a coiled rope. Make sure party members are spread at least 30 feet apart. Do not lean against rocks, or bridge small gaps or depressions. Ground currents take the shortest path, which may be your body if you provide the bridge between two points. Place metallic equipment away from you. Untie from ropes if possible. Avoid standing in water, which is another good conductor.



If lightning is imminent, do not be on the highest point in the area. Move off ridges and summits, and avoid drainages and shallow caves. If you choose to rappel, be sure your rope will not conduct current down to you from a high point. Remove metal objects that could burn you if they receive current. Crouch on both feet, facing downslope. If possible, insulate yourself from the ground with a foam pad. High points, illustrated by the tree above, offer a cone of protection from a direct strike. An individual squatting at the outer edges of that cone is unlikely to be struck—either directly or by strong ground current—and should be far enough away to avoid being hit by the tree if it falls.

Tall objects are believed to create a "cone of protection" from direct strikes. This may be true. However, the danger from ground strikes is still substantial inside the cone. For these cones to be effective, they need to be tall enough to have a base area large enough to dissipate ground currents. Some suggest that the base radius be at least 100 feet. Cones of protection provided by large topographic features seem to be best. They have enough height to attract strikes and are far enough away for ground currents to dissipate.

TEACHING CONSIDERATIONS:

At your first opportunity, point out some cumulonimbus clouds and discuss their potential danger. Students must know how to recognize when lightning is possible and be able to avoid it. Detailed explanations about the causes of lightning can be saved for later.

Remember that fun facts are only purposeful if they affect our judgement and decision-making. Keep the themes of judgement and decision-making thoroughly infused in this material, and help folks develop the strategy of anticipating possibilities, and planning accordingly.

Practice the lightning safety position ahead of time with your students. Demonstrate the position and then have your students practice. Critique their form.

Begin basic meteorology instruction by having your students look skyward and describe what they see. Encourage them to document their observations for several days. Show them how to keep a simple weather log. Follow this by teaching basic weather concepts. In the final installment, you can introduce weather patterns, and use their weather journals to interpret the previous days' events.

Include a horizontal time scale at the bottom of any front models you illustrate for the students. This scale helps make the information practical. Remember, no one can see those air masses, but cloud progression is visible and, therefore, a helpful observational tool worth stressing.

If your presentation includes the origins of continental weather patterns, consider using an inflatable globe and dry-erase markers to illustrate your material. Advanced weather knowledge should be reserved for the highly motivated. Instructor Patrick Clark sums it up simply, "There are only two kinds of clouds you need to be able to identify in the mountains: cumulonimbus and cap clouds. The first ones because they can kill us, and the second ones, because they show us it is too windy and cold to climb up there."

RESOURCES:

How to avoid Lightning Accidents, National Weather Service, Denver, CO

Keen, Richard. *Skywatch: The Western Weather Guide*, Fulcrom Inc, Golden CO, 1992, pp11-31

Powers, Phil, *NOLS Wilderness Mountaineering*, Stackpole Books, 1993. pp. 25-32.

Reifsnyder, William, *Weathering the Wilderness*, Sierra Club Books, San Francisco, 1980, pp.25-88

Uman, Martin, *Lightning*, Dover, NY 1984

WIND RIVER GEOLOGY

Wyoming topography blesses the geology student with huge expanses of exposed rock. Consequently, the Wind Rivers are an excellent place to observe faulting, glaciation, geomorphology, and mineralogy. Teaching geology on a NOLS course will depend entirely on the students' interest and the instructors' expertise. The breadth of this topic makes it difficult to manage in a single short presentation. Focus your instruction on phenomena and processes that the students can examine and interpret firsthand during their course.

EDUCATIONAL GOALS:

The goal of geology instruction on a NOLS course is to help students camp, climb and travel more efficiently in the mountains. But there is more to the topic than that. Like all natural history, the study of geology can help your students better understand the Earth and their connectedness to it.

KEY POINTS:

ROCKS AND MINERALS

The three basic rock types—sedimentary, igneous and metamorphic—are all found in the Wind Rivers. The distribution of minerals in these rocks determine their characteristics and properties.

Sedimentary rocks are composed of remnants of erosion that were deposited in beds or layers and cemented into rock. They are classified by their grain size, mineral composition, and type of cement. Local types include sandstone, limestone, shale, and dolomite. Sedimentary formations can be seen along the range's eastern foothills and canyons. Most were laid down when the western portion of the state was under an ancient sea.

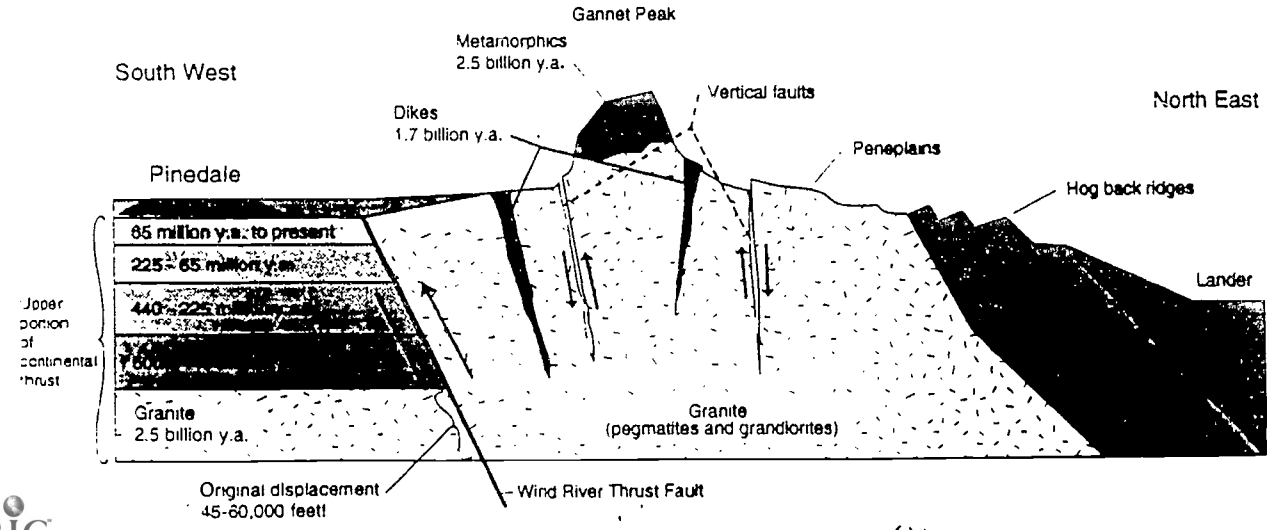
Igneous rocks crystallize from molten material. They are classified by mineral composition, grain size, and the location where they cooled. Rocks that cooled from lava above the surface are extrusive igneous rocks. Those that cooled from magma underground are intrusive igneous rocks. Slow cooling igneous rocks have large crystals, while quick cooling rocks have small ones. Most of the igneous rocks seen in the Winds are intrusive and include granite, granodiorite, pegmatite, rhyolite and andesite. You will also see basalt dikes scattered throughout the range. Examine one of these dikes—which are veins of rock formed from molten material being injected into a fissure in existing rock—to see clearly how crystal size is smaller at the edges where they cooled quickly than in the center where the cooling was slow. Although the Winds themselves are relatively young geologically, the igneous rocks found in the mountains were formed 2.5 billion years ago and are some of the oldest on Earth.

Metamorphic rocks form when sedimentary or igneous rocks are changed, but not melted, by heat and pressure. Metamorphic rocks are classified by mineral composition, grain size, and layering. Coarse metamorphic rocks that have alternating light and dark colored mineral bands are called gneiss. Schist is comprised of banded flaky minerals which cleave along parallel planes. Both rocks are common in the range, particularly along the continental divide. The metamorphic rocks found near the high peaks belong to the amphibolite or granulite groups. They were formed 12 miles under the surface at 500° centigrade and at a pressure 5000 times greater than our atmosphere.

ROCK CYCLE

The rock cycle represents the constant recycling of minerals from one rock type to another. For example, say you start with a reservoir of molten material buried deep within the earth. The magma cools slowly forming igneous rocks. Gradually, through uplift and erosion of the overlying rocks, the granite is exposed on the surface of the earth. Rain, freeze-thaw, and ice erode the rock away. The resulting cobbles, boulders, stones, and sand are carried by water down streams, into rivers, and finally to a lake or the ocean. Here, the sand forms a beach. Millions of years later that beach is buried and the sand cemented together to form sandstone—a sedimentary rock. The sandstone is buried even deeper, and heat and pressure transform it into quartzite—a metamorphic rock. The quartzite may be buried further where it melts, then cools into an igneous rock; or it may be uplifted and exposed above ground in the form of a cliff where climbers scramble. Rain, freeze-thaw, and ice then erode that rock away, and the cycle begins again.

Wind River Geologic Cross Section



GEOLOGIC AND HUMAN TIMELINE FOR THE WIND RIVER MOUNTAINS

4500 mya	Minimum age of the earth
3500 m	Sediments and lavas settle on the floor of an ancient sea. These were later metamorphosed into the schists and gneisses found on the high peaks.
2500 mya	Rocks that form the range's high peaks are metamorphosed within the continental block; igneous rock crystallizes into the granite and pegmatite batholiths in the southern range (Mt. Bonneville to South Pass)
1700 mya	Large basaltic (black, fine grained) dikes cut across the submerged range
1700 to 600 mya	First multicelled organisms arrive with the ancient sea that covers the range. Sediments deposited in the shallow sea and tidal flats. Wyoming was a land of gentle rolling hills draining into a western sea.
500 mya	First fish appear
440 mya	Terrestrial flora and fauna evolve
400 mya	Amphibians appear
300 mya	Beaches cover western WY, forests common
270 mya	Shallow restricted seas, reptiles and conifers prosper, sediments from this period contain silver and uranium
240 mya	Present North American continent drifts away from Pangea
225 mya	Wide tidal flats cover western WY, first mammals appear, begins a long period of alternating marine and continental environments.
180 mya	Broad flood plains cover region, dinosaurs climax
135 mya	Rockies begin to rise, dinosaurs die out
65 mya	1st Wind River uplift, mountain structure formed (Laramide Orogeny), surrounding seas retreat. Wind River Thrust fault pushes the ground up 45,000 feet above the surrounding surface.
65 to 5 mya	Initial range is eroded flat. The top of this flat still exists on the peneplains named Goat Flat, Horse Ridge and Ram Flat
5 mya	2nd Wind River Uplift, South Fork lake; Alpine Lakes and Mt Warren faults push current range to its ancestral height; nearby, sediment-filled basins erode to uncover ancient Laramide topography. River canyons begin carving deeper. Range still has rolling appearance.
250,000 ya	Ice Age begins. Continental ice sheet does not extend to Wyoming. Regional ice caps form to cover local mountains. The average temperature is believed to have dropped only a few degrees below normal.
200,000 ya	Buffalo Glaciation. This commenced a period of glacial retreats and surges that lasted until 5,000 ya. Glacial deposits and erosion begin at this time. This glacial period is what gives the Winds its current topographic character.
140,000- 50,000 ya	Bull Lake Glaciation
25,000-10,000 ya	Pinedale Glaciation. Fremont Lake carved out at this time.
15,000 to 12,000 ya	Continental glaciers recede. First humans cross Bering Strait land bridge into North America.
9,000-7,000 ya	Yuma style projectile points dated to this time found in the Winds and surrounding prairies.
7,500-5,000 ya	Altithermal period (warming trend). Glaciers may have completely disappeared from the range.
5,000-3,000 ya	Indian Basin Glaciation. Renewed glacial activity restricted to higher elevations.
100 AD to 1,000 AD	Minor glacial advances at above 11,000 feet.
1700-1900 AD	Minor advances in the Gannet Peak Area.
1806 AD	John Colter allegedly visits Wind Rivers.
1824-1840	Fur trapping era comes and goes in the Rocky Mountains.
1836	Oregon Trail crosses South Pass.
1868	South Pass Gold Rush fizzled after a few years.
1868-1878	Wind River Indian Reservation created and settled by Shoshone and Arapaho Tribes.
1903	Skirmishes fought on the Sheep Desert between cattlemen and sheep ranchers over range land. Raid and Ambush Peaks named for the raid which killed 1200 sheep.
1922	Gannett Peak climbed.
1924	Paul Petzoldt climbs the Grand Teton in blue jeans and cowboy boots.

LOCAL PLATE TECTONICS

Wyoming is part of the North American (continental) plate. The Wind Rivers rose from a thrust fault where compression forces cracked the upper layer of this plate. The eastern side of this fault was thrust up and over onto the western side. This rising eastern block is what gives the Winds their striking appearance when viewed from the west. Hogback ridges further clarify this uplift.

TEACHING TECHNIQUES:

You can begin by introducing basic mineralogy and rock types, eventually correlating local specimens to the earth's plate you are standing on. Some instructors start out with the big picture and then focus the instruction towards the immediate rocks nearby. Once the students have a basic handle on some geologic concepts, get them looking at the map and trying to determine the presence of boulder fields and other geologic features that could influence their route finding. Once again, this natural history topic should touch on the themes of judgment / decision-making, and our connectedness to the earth.

The significance of economic geology in the state should not be overlooked when discussing the region's human history or land management practices. For the last three or four years, Wyoming has been the top coal-producing state in the U.S., thanks in large part to its low-sulphur coal. In addition to coal, extractive industries—such as oil, natural gas and uranium—together with ranching, are the foundation of Wyoming's economy and have been for years. These industries have a strong influence on the state's culture, society and politics.

RESOURCES:

Kelsey, Joe. *Wyoming's Wind River Range*, 1988, American Geographic Publishing, Helena MT, pp. 24-37.

Link, Paul. Geology of the Wind *Rivers ar.' Absaroka Mountains*, NOLS Field Text, 1977, pp. 1-34

Geologic Field trip with David Love, summarized by Jack Frost, 1989 NOLS Conference Proceedings

Lageson, David, *Roadside Geology of Wyoming*, Missoula Mtn. Press, 1988

National Geographic Magazine Map, *Earth's Dynamic Crust*, August, 1985 National Geographic Society, Washington D.C.

CHAPTER SIX
FIRST AID

Students must develop habits which maintain health and avoid accidents during their course. Nonetheless, accidents, illness and injuries are always possible. Since there are times students travel without their instructors, they must be able to formulate emergency plans, and perform basic patient care until more qualified help arrives.

EDUCATIONAL GOALS:

Our students must be able to recognize and treat life-threatening medical conditions quickly. They need to know how to maintain an open airway, keep a patient warm and dry, take cervical spine precautions, stabilize major fractures, control bleeding, and treat for shock. Our instruction should be geared toward techniques that a novice first aider can use to care for a patient until instructors take over. The students' emergency procedure training should focus on getting a patient out of immediate danger, stabilizing any injuries, and contacting the instructors, rather than on specific evacuation techniques. People who plan wilderness trips after their NOLS course are advised to continue their first aid education. Outdoor leaders should have first aid certification.

KEY POINTS

A NOLS course is not a substitute for formal first aid training. The *NOLS Wilderness First Aid* book is designed to be carried in the field as a reference text and instructional resource. Consult that text for specific first aid curriculum issues and content.

FIRST AID CURRICULUM PROGRESSION

At the beginning of the course, students need to be introduced to basic hygiene, water disinfection, and sanitation techniques, as well as to know how to avoid and treat medical problems resulting from heat, cold, dehydration, and altitude. When students begin hiking on their own, they should be familiar with basic patient assessment, shock, bleeding control, soft tissue injuries, lightning, and basic emergency procedures. As students venture further from instructor supervision, they should know how to stabilize head, neck and back injuries, fractures and dislocations, and sprains and strains. Before small group expeditions, you should have covered poisons, bites and stings, altitude illness, litter building, and gender medical concerns.

The school's injury and illness data is published yearly in the NOLS Safety Report which you can find at all branch schools. In 1992 a summary of this data, covering the years 1984-89, was published in the *Annals of Emergency Medicine*. This article provided a snapshot of the medical problems most commonly encountered on NOLS courses. The data set covers five years, 358,210 person days of field time, 10,977 students and staff, and 1,479 injuries, illnesses or nonmedical incidents.

NOLS INJURY AND ILLNESS STATISTICS 1984-89

Injuries (839)	Illness(529)
•56% of field medical incidents •53% sprains, strains, tendon injuries •27% soft tissue injuries •4.6% fractures, dislocations	•44% of field medical incidents •60% non-specific viral syndromes or diarrhea

(•56% of all injuries occurred in lower extremities)

Forty-three percent of all these incidents resulted in evacuation. Basically this means if you work two summer courses you'll probably experience an evacuation. Evacs are often based on conservative assessment of a need for evaluation by a physician or projected inability to participate in the program. Only two percent of the evacuees from 84-89 (29 of 634) were not able to walk out under their own power.

On any course you can see an athletic or soft tissue injury, so knowing how to treat sprains and strains, and wound cleaning to prevent infection are important. Flu symptoms or diarrhea are also possible. Hand washing, food preparation hygiene, and water disinfection are essential in minimizing the likelihood of illness.

"To effect a substantial reduction in injury and illness rates for multi-week wilderness activities, prevention strategies must focus on hygiene, athletic injuries, and wound care."—Tod Schimelpfenig, *NOLS Risk Manager Director*

RESOURCES:

Gentile DA, Morris JA, Schimelpfenig T, Bass SM, Auerbach PS: "Wilderness Injuries and Illness" *Ann Emergency Med* July 1992; 21:853-861.

HYGIENE AND IMPURE WATER

Diarrhea and influenza are the most common illnesses on a NOLS course. The pristine character of the wilderness can lure students into believing the water is pure and good hygiene unnecessary. Students need to be aware that their health and the health of the group depends upon preventing the spread of disease through food and water.

EDUCATIONAL GOALS:

The development of sound hygiene habits should be our first priority. Students need to know the basic mechanisms of disease transfer and techniques for maintaining good health on an expedition. Various methods of water disinfection should be included in the instruction.

KEY POINTS:

PERSONAL HYGIENE

Hand washing must be a daily habit. Clean your hands after relieving yourself and before preparing or eating a meal. Use toilet paper or be proficient with natural TP. Keep nails trimmed and clean. Do not share lip balm, water bottles, eating utensils, food, or tooth brushes with anyone you wouldn't french kiss.

KITCHEN AND FOOD HYGIENE

The major carriers of food-borne illnesses are contaminated food and utensils. Have clean, healthy people prepare food. Use group cooking utensils rather than your personal spoon when making meals. Boil utensils regularly and plan food amounts carefully so you don't have to store leftovers. Pour food from the bag rather than reaching in with your hands.

"Keep food hot or keep it cold, but don't keep it long."

—Schimelpfenig

Bacteria grows best at temperatures between 45° and 140° F. It can reach dangerous levels quickly. Heat and cold usually destroy the bacteria, but will not necessarily kill the toxins they produce.

HEALTH, HYDRATION AND STRESS

Adequate hydration is a vital part of staying healthy. Drink 5-6 liters per day for optimal physical and mental performance. Be aware of stress and fatigue. Rest when you are tired and make sure you get enough sleep. Eat a balanced diet to ensure that you stay well nourished.

WATER DISINFECTION

All natural water sources may be contaminated. The protozoa giardia is present in many Wind River water drainages.

Giardia and amoebae are killed in 2-3 minutes at 140°F (60°C) while diarrhea-producing bacteria and viruses die at 131°F(55°C). Therefore, hot drink water does not have to reach a rolling boil (or 212°degrees F) to be safe to drink. The lower boiling point of water at the altitudes found in the Winds will not affect disinfection.

Filters remove protozoa (giardia, amoebas) but not viruses, and often need regular cleaning to be efficient.

Halogens, such as chlorine and iodine, work by bonding with organic materials. They function best with viruses, diarrhea-causing bacteria, and protozoan cysts. Clear water enhances the halogen's effectiveness, so it is helpful to prefilter murky water through a bandanna to eliminate organic particles and silt. In colder water, halogens need more contact time to kill pathogens.

Recent data in the medical literature indicates that very cold water requires even longer contact times than we thought to kill giardia cysts. The latest conservative recommendations for 1 potable aqua tablet in a liter of water (8ppm iodine concentration) at 5°C (41°F) are 60 minutes, at 15°C (59°F), 30 minutes, and at 30°C (86°F) 15 minutes.

TEACHING CONSIDERATIONS:

It must be made clear that proper hygiene is an expectation—not an option. Telling students about the "mung" isn't enough. The course needs to observe their instructors modeling hygienic habits at all times.

Hygiene tips should be included in your sanitation and food preparation instruction. For emphasis, give hygiene almost as much attention as food identification and basic cooking skills.

Tent groups and other instructors practicing lax hygiene habits should receive timely and specific feedback. Sharing personal eating utensils is a sign that good hygiene has not become a habit. It is our responsibility to continue to promote these habits and not become frustrated by a lack of compliance.

RESOURCES:

Fraker, L.D., Gentile, D.A., Krivoy, D., Condon. M. and Backer, H.D. Giardia cyst inactivation by iodine. *Journal of Wilderness Medicine*. Vol 3. Num 4. Nov 92.
Schimelpfenig, Tod. "Of Toilet Paper and Soap," *NOLS Newsletter*. May '91,
Ibid. "Water Disinfection."

FOOT CARE, BLISTER PREVENTION, TENDONITIS

The success and enjoyment of a course can ride on the well-being of the students' feet. Proper foot care is as important as sound hygiene to the welfare of the expedition. Without it our students can have a miserable, painful or abbreviated NOLS experience. To prevent this, students need to be motivated and disciplined about taking care of their feet.

EDUCATIONAL GOALS:

Students need to know how to wear their socks, boots, gaiters and camp shoes properly. They need to be able to identify and treat foot problems (hot spots, blisters, tendonitis) long before they become debilitating.

PERSONAL SAFETY CONCERNS

Be aware of your feet. Think about where you are stepping, how your feet feel, and what their recent history is. Have they been cold, wet or sore in the past day? Check them frequently during breaks and stop at the first sign of rubbing.

Avoid walking barefoot. Any cut or puncture on your feet has a high risk of infection. Keep your feet clean. Feet that are washed every day are less likely to develop skin irritations caused by

salt and dirt build up. Toe nails should also be trimmed. Dry your feet before going to bed to promote good circulation, sensation, skin integrity, and to avoid trench foot. Don't try to dry socks on your feet while you sleep.

PROPER FOOT GEAR

1. **Socks:** Two pairs of socks help provide cushioning and sweat absorption when hiking. Wrinkles should be smoothed out and the toe seam should run across the top of your toes. The sock's heel should ride on your heel, not above or below it. Bunched up socks cause more blisters.
2. **Boots:** Boots should fit tightly enough to provide adequate ankle support, but not so tightly that they cause soft tissue problems: hot spots, blisters or tendonitis. Loosen boots for going uphill to allow heel lift. Tighten boots for downhills to prevent numb toe.
3. **Gaiters, Galoshes and Camp Shoes:** Gaiters help prevent rocks, snow and dirt from getting into your boots, thereby keeping your socks cleaner and easier to wash. During early or late season courses when there is a lot of snow, galoshes worn over boots or camp shoes help keep your feet dry and can prevent immersion foot. Galoshes are also less damaging to vegetation in soggy soil. Camp shoes are another way to reduce soil erosion. They should be light and durable, should enclose your foot, and be comfortable with socks. In damp weather, dry feet in camp are a godsend: consider drying your camp shoes near a fire, or lining them with plastic bags to keep your socks dry.

> **Stuck in the mud**
>
> *"Petzoldt used to have students lace their boots loosely so that if they got stuck in the mud the boot would come off. His reasoning was that very loose boots require a very deliberate, well-placed, flatfooted walking technique, to avoid blisters and sprained ankles."*
>
> *-Steve Goryl*

HOT SPOTS AND BLISTERS

Excessive friction and pressure in a localized spot will cause a hot spot or blister. Factors which contribute to this include dirty and bunched socks, improperly laced boots, new boots, wet socks, and hot feet. Some people's feet are more prone to blisters and may require preventative taping and moleskin.

BRUISING

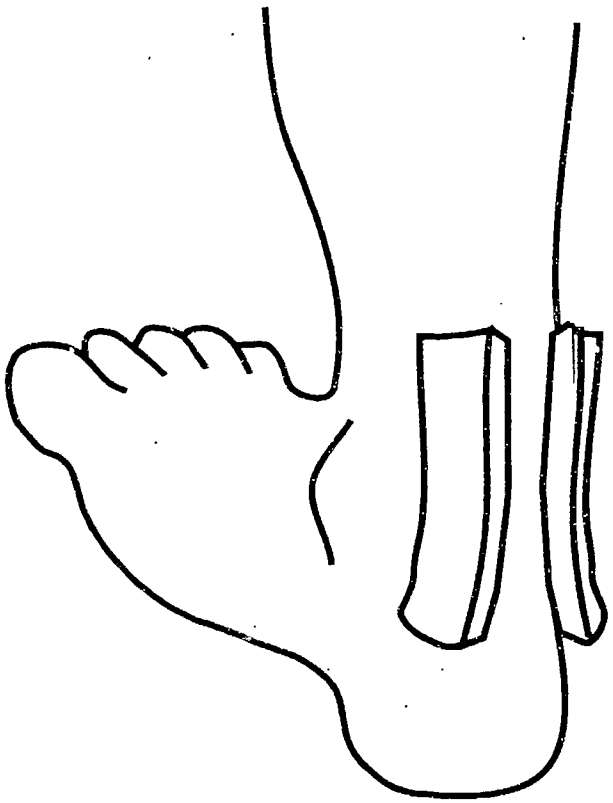
Though uncommon, bruising is caused by high mileage on trails, inadequate cushioning, and excessive weight while hiking in camp shoes

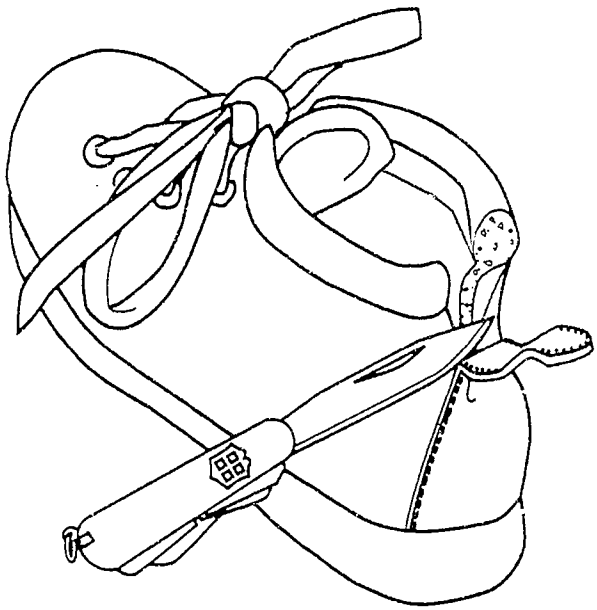
TENDONITIS (SQUEAK HEEL OR KOLFLACHIA)

The inflammation of the tendon or the tendon sheath is caused by tight fitting boots or excessive pressure on the tendon.

FOOT REPAIR

1. **Hot spots** should be covered with tape or moleskin to reduce the friction on the skin. Socks, boots and walking pattern can also be adjusted to reduce rubbing. Severe hot spots should get a molefoam donut.
2. **Closed blisters** should be kept from enlarging or popping. Often a molefoam or ensolite donut applied around the injury will pad the area and prevent further rubbing. Tape the donut in place. Adjust the boot lacing and hiking pace to accommodate the injury. Blisters bigger than the size of a nickel should be drained with a sterile needle, dressed, and then padded with a molefoam donut.
3. **Open/drained blisters** should be kept moist and clean. Moisture aids in the regeneration of skin, but will attract infection if you are not diligent about keeping the wound clean. Hot soaks in sterile water are soothing and aid healing.
4. **Sore feet** that do not have any skin breaks or tendon problems can be alleviated with rest in camp shoes, soaking in a cold stream, and foot massages. The key is getting out of the boots as soon as possible. Stiff or tight boots can be exchanged or stretched in the issue room prior to leaving for the field. Stretching and softening can also be achieved in the field by wetting the boots and having the student walk around in them until they dry.
5. **Tendonitis,** like blisters, needs to be caught early. Use the RICE method—Rest, Ice, Compression, and Elevation—and Ibuprofen to treat this problem. One can also try re-lacing the boot to relieve pressure, or padding each side of the tendon with ensolite rails (1" X 6"). If neither of these methods alleviate the pain, try making heel lifts from ensolite or molefoam. The lifts compress quickly so check them periodically to make sure they are still helping alleviate pressure on the tendon. Extreme methods of controlling tendonitis include cutting out the heel of the boot and/or evacuation.





Ensolite rails can help reduce some of the pain of tendonitis, most commonly caused by tight fitting boots. In extreme cases, cutting out the heel of the boot and/or evacuation are called for.

TEACHING CONSIDERATIONS:

Foot care begins on issue day. Right off the bat, encourage your students to wear shoes and see that they have the correct foot gear before departing for the field.

Prior to the first hike, students benefit from seeing exactly how to put on their socks, gaiters and boots. Some instructors like to joke that for students, the first few days of a course are like early childhood all over again. During this time, they learn how to dress, eat, walk, and poop. A quick lesson on how to walk with flat feet and a shorter, slower stride will help avoid many foot problems, as well as help your students develop good hiking habits. Encourage students to find walking patterns that work for their feet and boots. Do not forget to include the "whys" of these techniques. The less we make our instructions sound like rules, the more likely our students will heed our suggestions.

During the first few hikes, periodically ask the students how their feet feel. Check them at breaks. It is quite common for a novice hiker not to notice a hot spot or to downplay the severity of a blister in order to avoid inconveniencing the hiking group. A foot problem can provide a valuable teachable moment on how to adjust boots or make a molefoam donut. Make sure these foot repair sessions are educational and not embarrassing for the affected student. Students also benefit from watching instructors fix their own feet. This helps them pick up different tricks for tape and moleskin, but more importantly, it shows them that all feet are susceptible.

Students are empowered when they can take care of themselves, and they are empowered as leaders for future expeditions if they can take care of others as well. Show them how to fix their feet and get them doing it themselves as soon as possible. See that each student hiking group has its own foot repair kit.

PATIENT ASSESSMENT

EDUCATIONAL GOALS:
Students must know the ABCs of patient assessment: airway, breathing, circulation, cervical spine, hemorrhage, and shock. They should also be able to do a basic secondary survey which includes taking a simple patient history and vital signs, as well as conducting a head-to-toe physical exam.

KEY POINTS:
Safety of the rescuer is a priority. After determining that the scene is secure, conduct a primary survey to determine if there are any immediate threats to life: airway, breathing, circulation, or bleeding. Knowing how to handle these emergencies quickly may save a patient's life. Once the injured party is stabilized, conduct a secondary survey on the patient to determine the nature of the problem. Students must have the skills to protect a patient from the weather, stabilize—not necessarily splint—fractures and spinal injuries, maintain airway, control bleeding, and treat for shock

TEACHING CONSIDERATIONS:
This class is best kept simple and practical. Students should perform assessments on each other that include taking vital signs. Periodic reviews when students search each other for hidden wounds or take a partner's vitals are important to reinforce the techniques involved in patient assessment.

SOFT TISSUE INJURIES

EDUCATIONAL GOALS:
Students should be able to describe the basic anatomy and function of the skin. They should recognize the various wound types and be able to describe the specific problems and treatment techniques associated with each. They must be able to control bleeding through pressure, elevation, and pressure points. They should be capable of explaining the importance of and techniques for wound care in the wilderness. Students should recognize and be able to treat infection and burns.

Discuss the common causes of soft tissue injuries around camp with your students. Demonstrate how to take precautions against blood-borne diseases like HIV.

KEY POINTS :
1. How does the skin function and what is its anatomy?
2. How do you control bleeding (with disease precautions)?
3. What are open soft tissue injuries?
4. What are closed soft tissue injuries?
5. How do you clean and dress wounds?
6. What are the signs of infection?
7. What type of burns are there and how do you treat them?

TEACHING CONSIDERATIONS:
Early in the course, encourage the prevention and prompt treatment of common camp injuries such as cooking burns, cut and cracked fingers, localized infections, bruises, and abrasions. It is especially important that students know how to control severe bleeding. Separate instruction can be devoted to infection and burns. Model infectious disease precautions by using gloves and have students treat their own minor wounds.

SHOCK

EDUCATIONAL GOALS:
Students must be able to explain what shock is, summarize how it progresses, describe its signs and symptoms, and know how to treat it.

KEY POINTS:
1. What is shock?
2. What are the causes of shock?
3. What are the signs and symptoms of shock?
4. How do you treat for shock?

TEACHING CONSIDERATIONS:

Students often get hung up on complex explanations of shock physiology. Keep the conceptual descriptions simple and focus their attention on anticipation and treatment. Treat for shock automatically with all serious injuries, with the exception of those to the head.

FRACTURES AND DISLOCATIONS

EDUCATIONAL GOALS:

Students should know the basic structure and function of the skeletal system and be able to identify all major bones. They should be able to perform an assessment for fractures and dislocations, and describe the management techniques for both. Students should be proficient at the following splinting techniques: sling and swathe for the clavicle, scapula, ribs, shoulder, humerus, and elbow; sling and swathe with board or Foamlite™ stabilizer for the forearm, hand and wrist; immobilization on a sleeping pad with additional padding for the pelvis; full leg Foamlite™ splint for the hip, femur and lower leg.

KEY POINTS:

1. What is an open fracture? A closed fracture?
2. What is a dislocation?
3. What are the signs and symptoms of a fracture or a dislocation?
4. How do you assess the injury?
5. What is the treatment for fractures and dislocations?

TEACHING CONSIDERATIONS:

Instruction on fractures and dislocations should be geared toward individuals with limited skills and knowledge: keep it simple. Patient transport is not a high priority. Instead, students need to be able to monitor the injury, make the patient comfortable, and prevent further damage until instructors arrive. Splinting techniques taught should emphasize the various applications of the sling and swathe, and Foamlite™ tube.

HEAD/NECK/BACK

EDUCATIONAL GOALS:

Students should be able to describe the basic structure and function of the brain and the spinal cord. They should also be able to recognize both the common mechanisms and the signs and symptoms of injuries to these parts of the body. They should have the ability to assess and treat a head, neck or back injury, and know how to move a person with a suspected spinal cord disorder.

KEY POINTS:

1. What is a head injury?
2. What are the signs and symptoms of a head injury?
3. How do you treat a head injury?
4. What are the signs and symptoms of a spinal cord injury?
5. How do you treat a spinal cord injury?

TEACHING CONSIDERATIONS:

Students need to recognize common mechanisms of injury as well as symptoms of head, neck and back injuries. Their treatment should emphasize monitoring and stabilization. Patient transport skills should focus on the techniques for moving patients in immediate danger.

COLD INJURY

EDUCATIONAL GOALS:

Students need to learn how the body regulates temperature in a cold environment. They should be able to describe the causes, signs and symptoms, assessment, and treatment of the following cold injuries: hypothermia, frostbite, and immersion foot.

KEY POINTS:
1. What are the mechanisms of heat production and loss?
2. What are the signs and symptoms of hypothermia?
3. How do you treat mild and severe hypothermia?
4. What are the best ways to rewarm patients in the backcountry?
5. What causes frostbite and immersion foot?
6. How do you treat frostbite?
7. How do you treat immersion foot?

TEACHING CONSIDERATIONS:
Instruction should emphasize awareness and prevention of these problems. Properly equipped and educated individuals should be able to avoid cold injuries in the field. For Wyoming summer students, the recognition of mild hypothermia symptoms is going to be more important than understanding severe hypothermia and frostbite. They also need to be familiar with how to dress for inclement weather and how to dry clothes when they become wet.

During periods of bad weather, instructors must model how to stay warm and dry effectively. Inexperienced students often need close monitoring when conditions deteriorate. Foot inspections and dry sock inventories should be conducted regularly with those students exhibiting lax personal care. Storing wet clothes in packs should not be tolerated.

HEAT INJURY/ DEHYDRATION

EDUCATIONAL GOALS:
Students should be able to describe the physiology of temperature regulation in a hot environment. They need to know the cause, the signs and symptoms, and the treatment for heat cramps, heat exhaustion, and heat stroke. Students must understand the importance of hydration and recognize the signs of dehydration. They should know how to prevent snow blindness and sunburn.

KEY POINTS:
1. What is proper hydration?
2. What are the signs and symptoms of dehydration?
3. How can you avoid sun-related illness?
4. How do you assess heat exhaustion and heat stroke?
5. What is the treatment of heat exhaustion and heat stroke?

TEACHING CONSIDERATIONS:
Good hydration habits begin in town on issue day. Proper dressing techniques should be discussed as soon as the group starts hiking. Teaching students to stay cool is as important as showing them how to stay warm, especially midsummer in the Wind Rivers. Sunburn and snow blindness are avoidable with adequate instruction and student monitoring.

STINGS, BITES, POISONS

EDUCATIONAL GOALS:
Students should be able to describe the signs and symptoms, as well as the assessment and management of poisoning. Instructional emphasis should be on poisonings that can occur on a course: insect envenomization, rattlesnake bites, carbon monoxide poisoning, poisonous plant ingestion, and food poisoning. Students should also understand the signs and symptoms, assessment, and treatment of anaphylactic shock.

KEY POINTS:

1. How do you treat ingested, injected, or inhaled poisons?
2. What do you do for tick bites?
3. How do you treat rattlesnake bites?

TEACHING CONSIDERATIONS:
Emphasize prevention. Teach your students how to avoid snakebites, hornet nests, or carbon monoxide poisoning. A student prone to anaphylactic reactions should carry their own Anakit™. Make sure the students have a clear understanding of snakebite treatment if their small group expedition roadhead is in snake country.

ALTITUDE ILLNESS

EDUCATIONAL GOALS:

Students should understand how altitude affects humans. They should be able to describe the basic physiology of acclimatization and list techniques which aid in the process. They should recognize the signs and symptoms of altitude illness and know how to treat acute mountain sickness, high altitude pulmonary edema, and high altitude cerebral edema.

KEY POINTS:

1. How do you acclimatize to altitude?
2. What are some ways to aid acclimatization?
3. What factors affect the severity of altitude illness?
4. What are the signs and symptoms of AMS, HAPE, HACE?
5. How do you treat AMS, HAPE, HACE?

TEACHING CONSIDERATIONS:

Often this instruction occurs as a technical lecture. Spice the class up with some stories. Point out cases and examples of acclimatization problems that have occurred on courses in the Wind Rivers. Keep in mind that the students need a practical understanding of this topic, more than a clinical or pharmacological one. The subtle relation between AMS, nutrition, hydration, and staying warm should be well understood before small groups.

ATHLETIC INJURY

EDUCATIONAL GOALS:

Students should understand mechanisms of injury and preventative techniques for athletic injuries in the wilderness. They should recognize factors contributing to injuries, such as fatigue, hydration, nutrition, stretching, and proper walking technique. They should be able to distinguish between sprains and strains, and understand RICE.

KEY POINTS :

1. How do you prevent athletic injuries on courses?
2. What are the signs and symptoms of athletic injuries?
3. How do you treat athletic injuries?

TEACHING CONSIDERATIONS:

Many of these problems occur when students use improper walking and boot lacing techniques. Instructors need to ensure that students understand both how to walk with a pack, and how to lace their boots during the first week of hiking.

GENDER MEDICAL CONCERNS

EDUCATIONAL GOALS:

The primary goal of this instruction should be on preventative hygiene and early recognition of symptoms. Students should know the cause, the signs and symptoms, and the treatment of urinary tract infections, vaginal infections, and testicular torsion. They should also be aware of the effects of activity and the outdoors on the menstrual cycle

KEY POINTS:

1. What are special hygiene considerations for men and women?
2. What is testicular torsion and how do you treat it?
3. How do you prevent vaginal infections?
4. What are the signs, symptoms, and treatment for vaginal infections?
5. What are the signs and symptoms of urinary tract infections?
6. How do you treat urinary tract infections in the field?

TEACHING CONSIDERATIONS:

There is no substitute for knowledge when it comes to presenting this topic professionally. The personal hygiene component of this class should be taught at the beginning of the course. Specific medical problems can be introduced later. Treat the subject sensitively and in a balanced manner. Emphasize the practicality of this information for leading coed groups. Consult Linda Lindsey's handout titled, "Health Concerns for Women."

RESOURCES (GENERAL):

Auerbach, Paul, and Edward Geehr, *Management of Wilderness and Environmental Emergencies*. 2nd ed. St. Louis: Moseby, 1988.
Schimelpfenig, Tod, and Linda Lindsey, *NOLS Wilderness First Aid*. Lander: NOLS, 1990
Tilton B., and F. Hubbell. *Medicine for the Backcountry*. Merrilville: *ICS*, 1990
Wilkerson, J. *Medicine for Mountaineering*. Seattle: The Mountaineers, 1986

IMPROVISED LITTERS

With the increased use of high-tech resources like helicopters and radios, the skill of litter building may seem archaic. However, common sense tells us not to be overly dependent on complex technology. Furthermore, most of our students will not be traveling with radios after their course, so they benefit from knowing how to build a simple litter.

EDUCATIONAL GOALS:

Students should be able to construct both a pack frame and a rope litter. They need to understand the limitations and advantages of both types of litters, as well as the procedures for transporting a patient safely.

KEY POINTS :

CONSTRUCTION

Construction takes time for pack frame litters. On a recent course, it took two instructors, experienced in litter construction, three and half hours to build a sturdy pack frame-pole litter that was capable of surviving a six-day evacuation. Rope litters are less involved. If you intend to have students build their own litter, prepare materials beforehand in order to shorten the class.

Pack frame litters need to be rigid. Frames must overlap at least 40 percent for adequate strength and rigidity. Additional stiffness can be gained by lashing stout poles to the assembled frame. If the litter is not reinforced properly, it can flex and crack the frames at the welds.

Without sufficient padding, either type of litter will be very uncomfortable. Use plenty of clothes, sleeping pads, and bags for padding. Before you load the patient, test the litter out for comfort and function with a similar-sized healthy person.

Build the litter right the first time. Each knot and lashing should be extremely tight in order to prevent loosening when the litter is moved. Consider how much of an interruption it would be to have to stop, unload the patient, and disassemble the padding and carrying sticks to retighten the lashings.

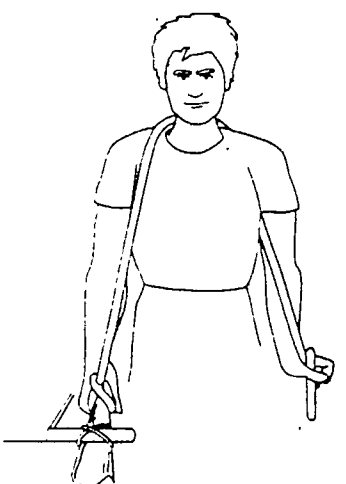
PACK FRAME OR PACK FRAME-POLE LITTER

Pack frame—or pack frame and pole—litters are most efficient for long carries over moderate terrain. They are relatively comfortable and are good for patients with lower extremity injuries. They provide a rigid platform that protects the patient from accidental bumps and are easier to pass over or around obstacles.

The disadvantage of a pack frame litter is that it requires more materials and time to construct; it is difficult to maneuver in tight spots; and it requires a large group to build and handle. Also, a growing percentage of backpackers carry internal frame packs that cannot be used for this type of litter.

ROPE LITTER

Rope litters are quick and easy to construct with minimal materials. They are a good option when you are facing a quick move with a patient whose injury will not be compromised by lack of rigidity in the litter. Rope litters are more maneuverable than pack frame litters because of their flexibility.



Bracing the litter with a sling over the shoulder is a good method for carrying.

The disadvantage of the rope litter is that it can be uncomfortable and confining during long periods of travel, and is often more fatiguing to carry. The lack of rigidity in a rope litter limits the type of injury for which it is appropriate.

PACK FRAME-POLE LITTER: INGREDIENTS

1 ..... Swiss Army knife with saw blade
2 ..... strong poles (10 ft. long, at least 4 inches in diameter)
7 ..... packframes(5 for the platform + 2 uprights)
3 ..... 10-21 ft. slings
1 ..... 30-8 ft. pieces of parachute cord
10 ..... lash straps
4 ..... prussiks
8-10 .... hardy individuals

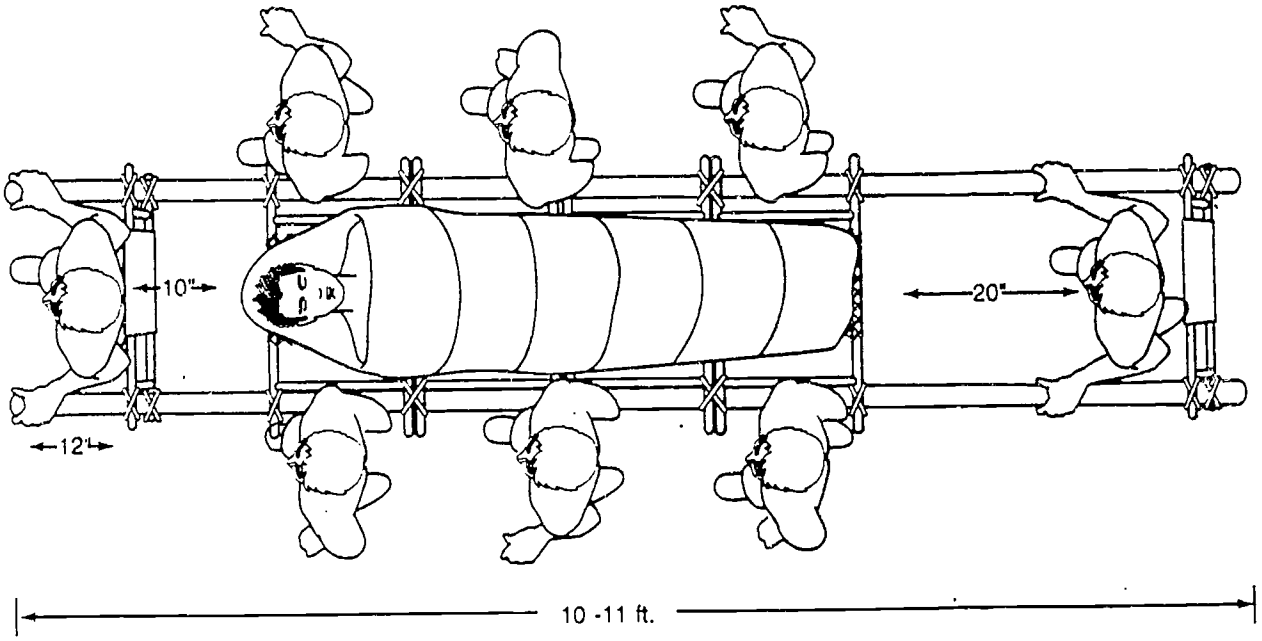
CARRYING THE PATIENT

Safety of the patient and litter bearers is the main criterion in how and where a litter will be carried. Unless they request otherwise, carry the patient so they face forward. Have one person guide the lifting and lowering of the litter. Warn the patient about what is ahead. Brief the team and patient about the carry before you begin and then debrief at the end of the move. Warm-up as needed. Expect to need more people to lift and lower the litter then are required to carry it.

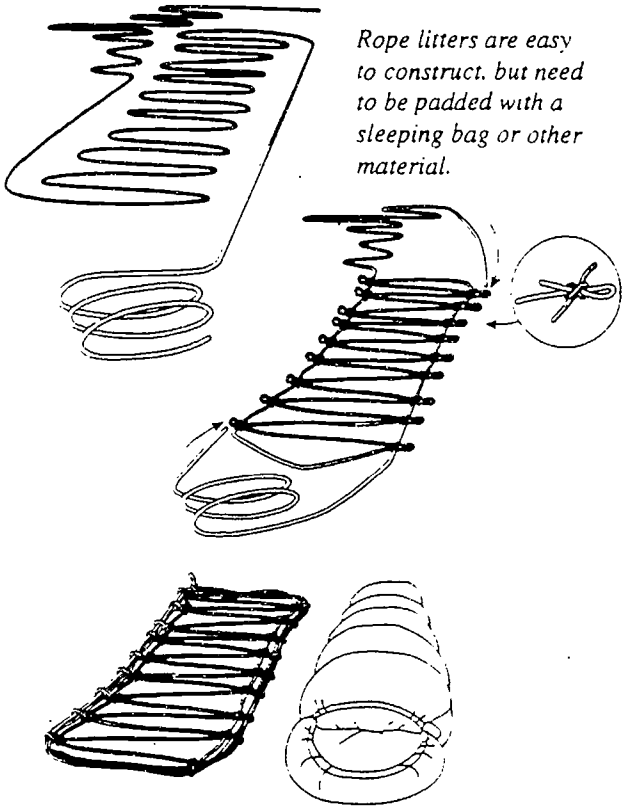
MAKING A LITTER MOVE

On a six-day litter evacuation from the San Pedro Matirs, I found the following scheme efficient and useful for carrying a 180 pound patient over a difficult trail and through thick brush. The team consisted of ten litter bearers, one litter boss, and a person carrying a pack. The litter boss directed the litter around obstacles along the trail and coordinated the rotation of the folks carrying it. He also called the rest breaks. We had four people on each side of the litter. They supported the weight using webbing straps that ran over their shoulders (see drawing). In addition, there was a person at each end in an upright pack frame. Carrying in the upright was most taxing, so we rotated these people every ten minutes. The folks that came out of the uprights would either go to sides of the litter, or switch with the boss or the pack carrier. Positions were changed without setting the litter down. Approximately every 30 to 40 minutes we'd set the litter down and take a ten minute break. The boss was on the lookout for any member who was getting tired and replaced them before the litter crashed. Efficient travel was achieved when a precise path for the litter was scouted and marked ahead of time. Members of the team carried all day with their essentials in a daypack while the balance of the course shuttled loads to a rendezvous point. In tricky terrain the gear shuttlers would drop their loads and help support or spot the litter carriers. The course was of average size and everyone was able to carry in all positions on the litter. We averaged five to six hours of carrying each day.

-Craig Stebbins



Pack frame or pack frame and pole litters are most efficient for long evacuations over moderate terrain. But, they take a long time to build.



Rope litters are easy to construct, but need to be padded with a sleeping bag or other material.

TEACHING CONSIDERATIONS:

Litter building is time consuming, but it is a great subject to teach when the group wants to be active and the weather restricts your options. Real litter evacuations require a great deal of preparation and thought, but these situations can provide excellent opportunities for students to learn more about emergency procedures, long-term patient care, teamwork, and leadership.

In an actual litter evacuation, an open discussion prior to the carry can be beneficial to all the students and staff involved. Encourage the students to express their concerns and apprehensions about the carry before it starts. Instructors should address these concerns and detail any expectations they have of the students during the evacuation. Explain that for efficiency, leadership styles may need to become more directive during an evacuation. The patient should participate in the discussion if they are well enough.

It is easy for students to get caught up in the macho aspect of carrying an injured friend out of the mountains. Instructors need to be ready to park the litter when the team first shows signs of getting tired. On multiple day evacuations, it helps group morale to have a quick briefing each morning prior to the carry.

RESOURCES:

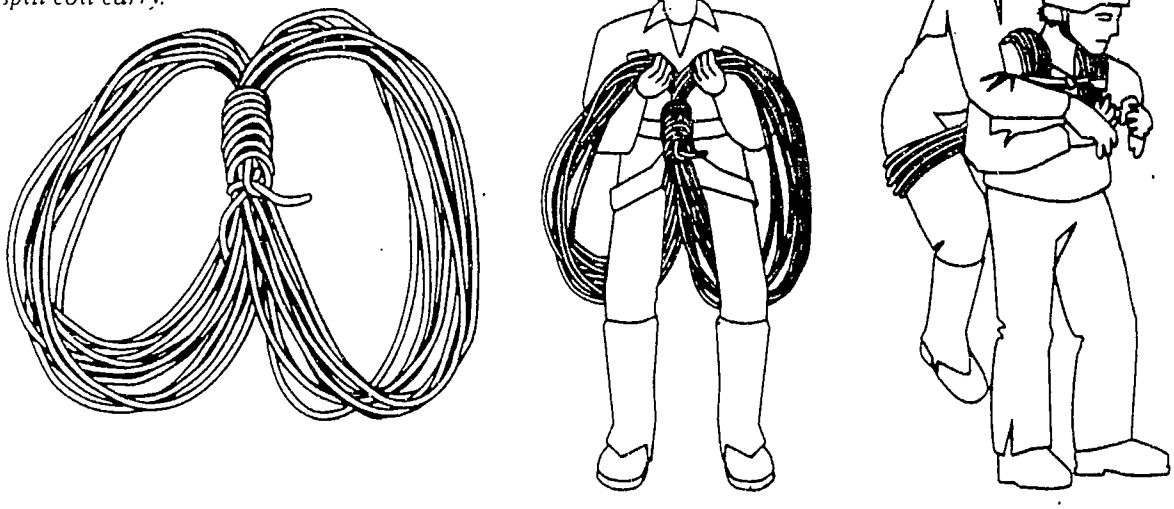
Mountaineering: Freedom of the Hills, 5th edition. 1992.

May, M.G. *Mountain Search And Rescue Techniques*, Rocky Mountain Rescue Group Inc, Boulder, CO 1973. pp. 257-276

Setnika, Tim. *Wilderness Search and Rescue*, Appalachian Mountain Club, Boston 1980. pp.339-346

Schimelpfenig, Lindsey. *NOLS Wilderness First Aid*, 2nd Edition, p 315

Another method of evacuating an injured party is the split coil carry.



EMERGENCY PROCEDURES

NOLS prides itself on its ability to run self-sufficient expeditions with minimal outside assistance for its field evacuations. This spirit of self-sufficiency should be conveyed to our students when we discuss how to handle backcountry emergencies. Before students can travel safely on their own, the basic procedures for handling an emergency should be understood. This instruction should also prepare students to handle emergencies that may arise on their future trips. A calm head, the ability to stay organized, and a well-thought out plan are more important than advanced medical training and a repertoire of technical rescue skills.

EDUCATIONAL GOALS:

Initially, students should be given a simple set of guidelines to follow in the event of an emergency while away from their instructors. This instruction should focus on the "front end" of the situation, which means keeping the patient and party safe, warm, dry, and well-fed until the instructors arrive to administer any additional first aid, and carry out the evacuation.

KEY POINTS:

THE FUNDAMENTALS

1. Stop and think:
   - Survey the scene and make sure it is safe.
   - Think all plans through thoroughly. Neglected details can become time wasting snafus since errors tend to multiply over time.
2. Administer first aid to the patient. This includes:
   - ABC's, patient assessment, shelter, and treatment.
   - TLC and attention to patient's psychological needs.
   - Keeping a written medical record: mechanism of injury, chief complaint, vitals, and care given.
   - Making provisions for the patient to relieve themselves.
   - Getting the patient involved in their own care if possible.
3. Assume leadership and organize the group:
   - Designate others to see that food, shelter and hot drinks are available.
   - Assign a scribe to keep medical records.
4. Make a plan to find the instructors:
   - Designate two runners; the rest of the group will stay with the patient.
   - Have written instructions for the runners, and send them with marked maps.
   - Make sure runners are well-fed, properly equipped, and know where they are going.
5. If hiking is not feasible, students should consider staying put and waiting for the instructors to find them; but they must realize that this could take days.

ADDITIONAL CONSIDERATIONS

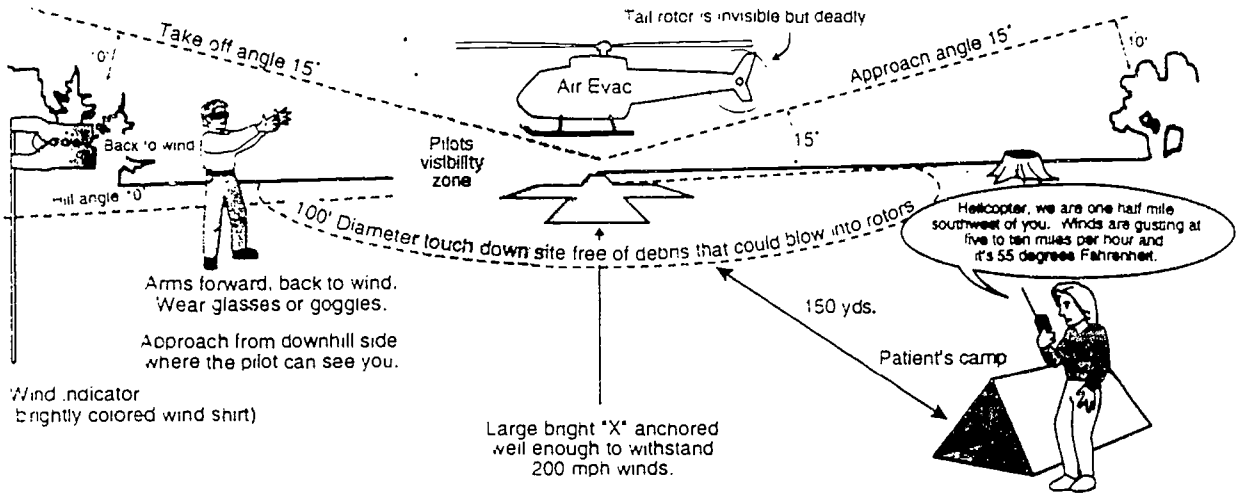
1. Know the first aid training of your group and the qualifications and experience of any outside assistance available in the area (rescue groups, etc.).
2. Keep your party occupied (scouting and preparing a landing site, preparing the evacuees equipment, etc).
3. Consider the severity of the injury, the distance to the roadhead, the difficulty of terrain, your party's strength, and the weather when making preparations for an evacuation.
4. Determine the best type of evacuation and have a backup plan. The options include walking out, riding a horse, carrying a litter, or flying out by helicopter.

A. Helicopters have limitations:
   - They are used by NOLS for life or limb threatening injuries, or when no other evacuation method is feasible.
   - They only fly in good weather: days with high cloud ceilings and winds less than 20 mph.
   - Pilots do not like to wait on the ground for extended periods of time in case the weather changes. Have the patient at the site before the helicopter arrives.
   - Know the helicopter rescue specifics for your area prior to your trip.
   - Helicopters can crash; don't use them lightly.

HELICOPTER SITE SPECIFICS

Landing zone

- Provide a secure and bright colored wind direction indicator.
- Select site that is at least 40 paces in diameter, and long enough for the aircraft to approach and take off on a 15 degree approach angle which includes clearance of all obstacles by at least 10 feet (see diagram).



- Choose a site with less than a 10 degree slope, preferably make it flat.
- Have the site's long axis point into the wind.
- Try to have a downhill takeoff path that is free of tall or dry grass, or marshy areas.

Touchdown site

- Select a 20 ft x 20 ft. hard surface, one that will not let the helicopter settle.
- Mark the site. A royal blue marker is easy to see against all backdrops (use NOLS sleeping bags filled with hundreds of pounds of rocks to keep them from getting sucked into the rotors). Mirrors and geometric shapes work better yet.
- Remove all loose debris within a 100 foot radius of the touchdown site. Loose objects sucked into the rotors could cause a crash or will at least force a mandatory grounding of the aircraft until it can be checked out.
- Approach the aircraft only after the pilot has motioned you to do so. Keep your head down.
- Remove yourself to the edge of the landing zone before the aircraft takes off.

Radios are not a panacea for wilderness emergencies; they are not always reliable, and most have limited capacity in mountainous terrain. Do not be surprised by delayed stress symptoms in yourself and in others involved in an emergency.

The best defense is a good offense! Avoid emergency situations before they occur.

TEACHING CONSIDERATIONS:

Teaching prevention is an important component of this instruction. Make students aware of hazards as you encounter them on the course. Without being morose, share a few evacuation stories that illustrate valuable lessons. Model the safe behavior you expect from your students. As part of this instruction, review key hazard evaluation points you want your students to remember prior to hiking on their own.

Evacuations involving the entire course should be discussed with the students—including the patient if possible—beforehand so they understand what is expected of them, and what they can expect from their instructors. Encourage them to ask questions and express their feelings regarding the upcoming challenge. It pays to have everyone oriented prior to making a litter carry, or sending a group member out by helicopter.

RESOURCES:

Stoffel, Robert and Patrick Lavalla, *Personal Safety in Helicopter Operations, Helirescue Manual*, The Emergency Response Institute, Inc. Olympia WA. pp.42-60

Schimelpfenig and Lindsey, *NOLS Wilderness First Aid*, pp. 301-315

LEADERSHIP APPENDIX 1

LEADERS OF THE DAY

summarized by John Gookin and Eric Sawyer

The following are notes from a staff forum where 14 instructors came up with a checklist of tips for student leader exercises. Folks had differences of opinions, but many more commonalities. In general, the forum participants felt that student leadership practicals were worthwhile, but they needed careful attention and had to be flexibile to meet the changing needs of the students.

BEFORE THE EXERCISE

Assign the task the night before (or even days before, with a briefing the night before) so students can do prep work. Instructors need to have role modeled behaviors before they should expect students to do them on their own.

MAKE EXPECTATIONS VERY CLEAR:

- Info handouts, calendar worksheets, etc., can be very helpful if you are delegating multiple days of leadership.
- Make your briefing very specific. Have the students explain back to you what they are going to do.
- Clarify their authority and the instructor role (if you'll be present). Discuss how far off track you'll let them get.
- Forewarn leaders r.e. topics to be debriefed so they don't think they're in trouble when you start a critique.
- Set them up for success in a way we'd want to be treated.

IMPORTANT TIPS

- Lots of route info. so they are empowered (consider having students get all the off-trail guide info that's relevant)
- Help them develop a super-thorough TCP.
- Train all students as routefinders rather than letting them learn too slowly by experience.
- Teach students to use contingency plans and emergency procedures.

CLARIFY EXPECTATIONS OF FOLLOWERS

- Teach leadership and EB skills before you expect them to be demonstrated.
- When teaching leadership, be sure to point out various differences, situational advantages, and disadvantages of such leadership styles as directive, democratic, consensus, facilitated, delegated, etc.
- Give appropriate challenges r.e. terrain, student concerns, mileage, and weather.
- Show that one person can have a repertoire of styles.
- Get other folks to help novice leaders.
- Give plenty of help to more challenged leaders.

DURING THE EXERCISE

Leaders should delegate and coordinate as much as they are comfortable with. Instructors generally should only step in for safety issues, and sometimes efficiency's sake, but stepping in at all grossly diminishes student responsibility from then on.

- Give them leadership opportunities with and without instructors.
- Consider a mid-hike check in with either the leader, or the whole group.
- Instructors should take on an educational role other than organizer: natural history interpreter, storyteller. But be careful not to get too carried away with these roles. You can spend so much time storytelling, etc., that the students pay more attention to you than the student leader and the tasks at hand.

AFTER THE EXERCISE

GROUP DEBRIEF

Consider doing this during the last bit of hiking unless alertness is waning. Use both reinforcement and constructive criticism.

LEADER DEBRIEF:

- This should be thought of as setting them up for their next leadership role. Mentor or coach for better success.
- If it seems warranted, consider letting ex-student leaders run a meeting where they point out to the other students what could make student leadership work better.
- Be sure to point out that using "lessons learned" from our own experiences is how we best develop our own judgment.

MORE TIPS

- Consider not having a leader some days if that's what the students want to do.
- Avoid lame challenges.
- Nix the idea that aggressive charismatic leadership is the primary model.
- Give all instructors opportunities to demonstrate their styles.
- Model instructor discussions where styles clash, but get worked out.
- Get students to balance efficiency with inclusion.
- Be sure you increase student responsibility as the course progresses. These folks will all need to lead their peers when they go home. Good small group expeditions, short and long, should set them up for success.

LEADERSHIP APPENDIX 2

LEADERSHIP HABITS: THINGS WE SEE STUDENTS DO THAT DISPLAY LEADERSHIP

by John Gookin

Pitch in. If someone else initiates a worthwhile team project that helps the group move towards its goals, lend a hand.

Don't pitch in. Some jobs, like tying your shoe, are one person jobs where good teamwork means doing them alone.

Take initiative. Be the one who initiates an action that helps your group move towards a goal. Timing is everything.

Don't take initiative. If you're always the one who takes the lead in making group events happen, be sure to let others take the lead too. Sometimes this means standing back and letting others figure things out.

Help others get organized. Folks who aren't organized sometimes improve if you help them establish a system that betters their habits.

Be on time. Get up early. Organize your gear. Take care of essential tasks. Plan time after the morning's chores to sit back, relax, sip tea, and look at the map.

Keep an eye on the map. By keeping careful watch on the map and the terrain you pass, you can be invaluable to any hiking group, possibly trimming miles off the route.

Remind people to take care of business at the start of hiking breaks. This includes drinking water, using the bathroom, putting on moleskin etc.

Unobtrusively remind people of what to do next. You can help people learn to think for themselves by subtly steering them towards things. Eventually they should develop habits and do things on their own.

Let folks have a bad day. Sometimes we all need a break and others can pick up the slack so the group still functions well enough.

Don't let folks have a bad day. When things get "real," the group needs full effort from everyone. Get people psyched. Stir up the adrenaline. Help everyone focus.

Have higher standards for yourself than for the group. If you expect others to be on time and pitch in, you'd better be more reliable than they are.

Let folks know what you like about them. If people are helping the group, let them know it's

appreciated so they'll keep doing it. This nurtures a relationship that will make it easier when and if you ever have any constructive criticism for them.

Don't tolerate moral compromise. If you see a clique pushing someone into the role of course scapegoat, quickly let your students know that this behavior is destructive and intolerable.

Carry some extra group gear without anyone knowing it. Put some extra fuel or food in your pack so everyone else gets a slight break and you get extra training.

Keep an eye on others. If folks get cold, tired, hot, or hungry, they can get tunnel vision and not realize what they're doing. Converse with folks to assess their level of consciousness. If they're fading, fix the situation long before it spirals downward.

If you know the group is **making an error,** do something about it. This can include navigation, route finding, socializing, hiking too hard, being lazy, eating too much, not drinking enough, or anything else that affects the group.

Prepare for hikes the night before. See how folks are feeling. Review the map. Repair gear. By the time a hike begins, leaders should feel like their job is half over.

Encourage flexibility. Be the one in the group who leads the way in letting changes roll off your shoulder. Point out how flexibility allows for good things to happen.

Share your food. At a rest break, take out your bag of trail food and share it. Take some dinner that came out especially well, over to your neighbors to sample.

Be both self critical and self respectful. At a debrief, mention things you could have done better and things you did well, first, before you critique anyone else

LEADERSHIP APPENDIX #3

WHAT IS LEADERSHIP?: SOMETIMES OUR INTUITION IS RIGHT

Moderated by John Gookin

Fourteen field staff made this list of what "leadership" meant on courses. We bypassed the formal model of "leader of the day" and focused on spontaneous actions by students that could earn them a spot in the course journal under "student leaders." To qualify, **these skills and habits had to help the group achieve its goals and they had to be virtuous** (they couldn't be at someone else's expense). We were trying to get a better grasp on verbalizing what it was that intuitively told us that some students were excelling at leadership, even when they didn't have a formal leadership role.

Modeling good skills can help others become higher achievers, and help the whole group to achieve more en masse.

Appropriate **initiative** can help the group function more efficiently, and it can make it more "normal" for others to apply initiative later.

Enthusiasm can help people get psyched about a group goal.

Attitudes are contagious and can make the same tasks humorous or drudgerous.

Emotion, displayed with just enough spontaneity and style, can help the group deal with events and sometimes move beyond them.

Discipline is something that all groups need to achieve difficult tasks. Helping the group deal with lapses in discipline can help it achieve higher goals.

Followers pitch in appropriately, reward the initiative of others, and help a group flow. Demonstrations of followership make it more "normal" for others to be appropriate followers later.

Having a **shared vision** means helping the group verbalize things it intuitively appreciates.

Many theorists think this is the greatest thing a leader can do.

A model **communicator** speaks clearly to groups, listens and is assertive with style. This wasn't seen as an end in itself, rather as an essential tool to effective leadership.

An **organizer** helps group efficiency, buying time to rest, play, or do more activities.

Energy can be added to a group by any individual; this could include running around doing tasks, or just adding to the collective spirit of the group.

Perceptive and sensitive people can help individuals or the group be more aware of how folks feel about what's going on.

Anticipatory people help the group see the consequences of their actions. Like a good chess player, the better ones see what's coming far in advance and help the group prepare for it or avoid it.

Group mediators help resolve conflicts and help individuals focus on group goals.

Servants are folks who lead in such a benevolent way that the group knows the leader is serving their needs. These folks may prepare group equipment, or they may just put planning time in that saves the group vast amounts of coordination time later.

EB is the foundation that buys credibility for the above habits. These social skills are paramount to being able to help a group "click." Many modern theorists think that these "social skills" are the key to effective leadership in any setting.

Inclusion is drawing in everyone's opinions to create more ownership in group decisions. This could involve getting a nod of the head or verbalized opinions. We assumed that inclusion could also involve getting more voicey folks to back off a little to let others chime in.

The above habits could be good or bad for a group, but key factors we continually came up with were:

Benevolence
Modeling for others
Significantly helping the group achieve its goals
Spontaneity (indicates genuine personal habit rather than parroted behavior)
Good style.

LEADERSHIP APPENDIX 4

FOSTERING INITIATIVE

by Maria Timmons

Initiative is an internally motivated quality involving independent thinking and leadership. To "teach" initiative then seems paradoxical, but we can encourage initiative in our students by creating an environment and a teaching progression that promotes the desire to take initiative. Following are a series of steps to foster initiative in our students.

Clear expectations: set a tone in the orientation that promotes ownership in the student. Tell students they will be expected to take responsibility for their own learning, and that they will be expected to take more initiative as the course progresses. Define initiative, and identify it as a desirable trait in developing their leadership abilities.

Example: Students learn directly from the example set for them. Instructors should openly model good decision making and initiative. If an instructor stands back to defer to a course leader, expect students to model this.

Recognition: Positive feedback is essential in developing any leadership quality. Give credit to either the individual or the group whenever it applies. Give specific examples so students can develop a picture of positive behaviors. Every one deserves credit for what they have done well, and hearing appreciation encourages repetition.

Delegation: In the early stages of a course, students need more direction. Tasks, such as rerations, give students an opportunity to take initiative within a structure. Outline the task, assign a student to be responsible for each portion of the work, then turn it over to them. The next ration they have a model of organization they can use. Other tasks which provide this opportunity include leader of the day, planning part of the course, and equipment management. These are plainly organizational tasks, not just "chores."

Set up: An extension of delegation is "setting up" an individual who is able and willing to take a higher profile. Outline a task and give responsibility to one student. For example "Jeff, your group should be first in camp today. Go ahead and choose camp and kitchen sites using what you know about bear camping."

Being human: there are certain human fallibilities that can be an asset in developing initiative in your students. I encourage students to ask clarifying questions or "what next" questions because due to my poor memory, I may leave out vital information. An instructor team of two once apologized for their tardiness and lack of efficiency, only to find at day's end their students (in teams of four) helping them to unload their sea kayaks. Finally, when you don't know the name of a flower or are uncertain of a route, say "I don't know, but let's figure it out." All of these acts are conscious techniques which decrease the perceived distance between student and instructor competencies and all of them promote student initiative.

Backing off: An essential part of developing initiative is knowing when to back off. This frequently happens simply in the nature of a course; ever notice how well students perform during an evacuation? Sometimes when a student makes a request, it is better to claim you are busy and send them to another student. It is a disservice to do something for a student when they could do it themselves. Even when students are struggling, unless it's a safety issue, don't rescue them.

The question raised by educators at this point was "How do we know when to set students free?" While there are many situational variables, here are some factors to consider to determine when to back off.

Self awareness: We all need a high degree of self awareness to avoid creating an unnecessary dependence. We need to be aware of our own needs for maintaining control. How willing are we to give students power, if it means they might come up with a different solution than we were hoping for? We can only offer students control that we are willing to give up.

Assessing student abilities: Two considerations that help in assessing individuals is their ability and willingness to take leadership. Also, in peer leadership, there is a collective competence and group strength. Weigh the power of individuals, both positive and negative, in the context of the group.

Safety: Our decisions to set students free are situational and the penalty for failure is an important factor. In safety issues, we must err on the side of caution and encourage this attitude in students. Make students aware that their decisions are based on limited experience. Early on give students decision making power, but tell them you will step in if a decision is unsafe or you have information to help them make a safer decision. This veto power is one tool of risk management.

Conclusion: This paper outlines a method for developing initiative in our students. In a more general way, it outlines a process for becoming better educators. Life continues to offer new material to learn from, the plan is to continue raising questions, testing theories, sharing ideas, and being creative.