SUGGESTED REVEGETATION PRACTICES

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Introduction

In the past ten years more and more of us have become increasingly aware of the impact of people on the backcountry of our wilderness areas and parks. This effect is certainly evident in the North Cascades, especially in the choice but scarce alpine and subalpine meadows. In 1970 we were asked to begin a revegetation project on Cascade Pass in the North Cascades National park. In the past this area had been heavily visited and used for camping by both backpackers and horse parties. Its beaten down meadows full of impacted trails, barren campsites, eroded gullies and assorted horrors stimulated us to study and conduct trials of revegetation methods.

Our backgrounds include years of gardening, degrees in biology and a long-time love of and experience in the mountains and wild areas of the West. Recently we have participated in seminars on wilderness management with the U.S. Forest Service and National Park Service. On numerous occasions we have had discussions with backcountry rangers, Youth Conservation Corps groups, Student Conservation Association groups and other volunteers on the techniques of replanting worn out campgrounds, old shelter sites and subalpine meadows.

It is hoped that this paper will help more of you than we will be able to meet personally to be successful in revegetating our beautiful mountain areas. We hope you will try some of our methods and will let us hear, in turn, your suggestions. All of us working together can help heal the scars of man's unthinking overuse of the mountains and backcountry. Thank you for your efforts.

If your aim is to try to restore the area to its original condition or merely to plant material that will cover the ground and prevent further degradation, then first you should spend some time really looking at the neighboring plant communities.

If it is a lowland forested area, what are the dominant trees? What shrubs are in the understory? What herbs are found with these woody plants? In order to understand the relationship of these various plants with each other, you should examine the microclimates and microhabitats. Notice what plants seem to pioneer on disturbed soil, where a tree has blown over, in an avalanche track or recent rock slide, or what plans creep out onto the trail. Find damp areas and compare the plants that live there with those on dry sites. Where the light is brightest, notice what vegetation occurs and how it differs from that found in dense shade. Pay attention to down logs and old stumps and what grows on them. Notice where seedlings and young plants are growing.

In a subalpine or alpine area notice the wind patterns. Often this is obvious from the branching habits on woody vegetation. Look for the plants that can withstand strong wind and those that shelter from the wind. Find the wet spots in the meadows and observe the plants that seem to prefer to grow near snow fields and snow melt water courses. Some plants have definite aspect preferences (north, south, east, west), especially around large rocks. Notice plants that appear to like to grow out on a boulder or crowd around its bottom or grow on rock screes.

You need not be a graduate taxonomist to observe carefully how plants live together in communities or note their preferred habitats. You can call them by their common names if Latin names bother you, or even name them yourself--Plant A, Plant B etc.--as long as you identify the

same plant consistently. See the list of suggested readings for helpful books on the identification of plants and how they live together.

All of this is to get you to see what plant habitat preferences you can find. After all, in revegetation you want to recreate a living community by putting a plant in a place where it will grow.

II. Soils

The soil patterns in the North Cascades are bewildering in their complexity, and little investigative work has been done with them. This need not bother you, however, as the things you will need to know about soils are simple, commonsense things.

Many denuded areas around old shelters, in old trails and old campsites have lost their top layer of humus and soil. So, what you have left to work with is a compacted, very acid subsoil that is low in nitrogen. Many native species do not require high nitrogen levels as our garden and house plants do. Douglas (1974) did soil analyses on some plots in the Cascade Pass area and suggested that low nitrogen levels are not limiting for Luetkea pectinata, a ground cover in subalpine areas. Brink (1964), however, found in working with grasses in the British Columbia mountains that nitrogen was indeed too low for their survival without fertilizer.

If you have a pocket soil test kit, check the pH of the soils. We suggest this because many plants have a definite preference as to pH and will refuse to grow in even slightly different soil. If fire rings are present, try grasses in them rather than acid loving plants, as the wood ash has probably raised the pH.

One of your main problems will be doing something about the compaction of the soil. When soil is compacted, the air spaces between the individual soil particles are reduced or eliminated. Gupta (1935) found that compact soil decreased permeability and water movement, two important things needed by plants. To reduce compaction, dig up your plots with a shovel or spading fork.

Since the humus layer is probably lacking, incorporate peat moss or other decayed plant material into the soil by turning it under. Humus gathered form surrounding areas in lowland forest sites could by used if peat moss in not available. However, do not strip all the humus form one area. Soil temperatures in subalpine and alpine meadows reach 120 F (Ballard, 1972), causing seedling mortality. Mulching is important even in lowland areas. A layer of needles or forest debris over plots will help to retain moisture. In subalpine areas digging in peat moss and around small plants will help keep roots cool and moist. If peat is used, be sure it is well mixed with soil and solid peat on the surface dries to a hard layer, repels water and is blown away by the wind. Whenever using peat, be sure it is moist, especially if you are using it in a mix around seeds or young plants.

III. Methods

Determine what method of revegetation you will use--seeding, propagation of cuttings or divisions, transplants, or just digging up the compacted soil so that nature can do it its way.

The available facilities may make the decision for you, since rooting cuttings and seeding in containers require the use of a greenhouse or cold frame. Some plant divisions also require cold frame protection for the first winter. So, this leaves direct seeding or transplants if you do not have access to a greenhouse or if your project is in a remote area where transporting cuttings and seedlings presents problems.

The time of the year you are working also limits your approach. Seed is only collected in the fall and cuttings are usually taken in late summer or fall. Both of them require a year or more before planting back at the site, again best done in the fall before the winter snows begin. This is to avoid summer heat and drought. New and transplanted plants are very sensitive to long dry spells and die easily if soil moisture fails.

Root patterns sometimes limit your ability to transplant successfully material you think necessary for a particular area. This is particularly true in alpine areas (Daubenmire, 1941). Vine maple, with its rambling roots or adult lupine with its long tap root may force you to take cuttings or

try seed. Generally, however, transplanting is the easiest way to get an immediate start on revegetating a bare spot--if you do it right.

IV. Transplanting Suggestions

1. Pre-Planting

If the soil is dry and water is available, water both the plants to be moved and the newly dug up area a day or so before transplanting takes place. If you can choose a cloudy or rainy day, it is better than a hot, sunny one. Plants will not dry out or go into shock (collapse) so readily. If it is hot, work in the late afternoon. Collect the soil additives you are going to use--peat, forest humus. Don't remove all the forest humus from one area; take a little here and there. You can collect it in large plastic bags. If you are using commercial peat moss and it is dry, add water to it to dampen it. Dry peat moss blows away.

Collect your tools. We like to use a small shovel for hole digging and lifting plants and a spading fork for turning over the soil. Small hand trowels are useful hole diggers after the soil has been worked. A bucket or some container is necessary for carrying water. Plastic bags are useful for carrying small plants if they need to be transported any considerable distance. A large plastic tarp is helpful for moving larger tress or shrubs (in lowland areas).

Pick out bushy, healthy looking plants, not leggy ones. Small plants transplant much better than large ones. Learn something about the root system of the species you are to transplant so as to lessen the number of plants killed by root amputation.

Completely dig up the area you are to plant, turning under a layer of humus or damp peat moss. Raking is not necessary and may even cause erosion. Leave the surface of the soil rough.

2. Planting

Dig carefully around the plant to be moved, aiming down with your shovel rather than in toward the plant. Do this at least as far out as the drip line, farther out if in doubt about the roots (feel around root area with your fingers to see how roots run). Root hairs are very important as the plant depends on them to take up water. Never leave a dug plant in the sun. Cover exposed roots with soil, wet paper or plastic tarp. Plant immediately if possible.

Some plants need their own mycorrhiza (associated fungi) or soil bacteria to thrive, so mix some of the parent soil in the new site before planting the plant. Pyrola and prince's pine (pipsissewa) are two examples of plants which will live a short time and then die unless they have their special symbiotic mycorrhiza.

Check roots when you plant to make sure they are not doubled under the plant. This is especially important for trees. Plant at the same level as before and orient tree seedlings in the same general direction as in the original site. Dogwoods do not transplant well except in winter and are very sensitive to orientation.

Firm soil around the roots and build up a ring of soil to make a temporary cup to aid in watering. Water well (deeply). Shade the planting if possible, using tree branches, rocks, logs, etc. If you move whole logs with plants on them, dig them in a few inches to aid in water retention.

If transplanting plants with runners, be sure to bury the runners partially in soil to encourage new plants. Do not plant the runners by themselves. The roots on most of them are not sufficient to support the part above the ground. Treat such runners as cuttings.

If you know you have lost roots in the process of digging, cut back the top, prune out branches or tips of branches or parts of leaves to reduce transpiration (water loss). An anti-transpirant, a solution of a petroleum compound in water, is very useful in preventing water loss until the plant becomes established.

In subalpine and alpine areas plants often are heaved out of the ground in winter by needle ice formed under the plant. Firm the plant in the ground and mulch around it to insulate it. Use rocks, debris, jute netting.

Transplanting moss by pulling it off trees, branches or stumps to use as a cover for a denuded area is a temporary cosmetic treatment and is not recommended. it will not live. If you wish to transplant moss, treat it as any other plant, being careful in duplicating its exposure, soil and community preference. Moss growing on trees prefers trees, not soil.

Repair the holes you have left, particularly in subalpine meadows, by filling them with soil or soil and rocks. Firm down the soil to protect adjacent plants. Do not denude another area to get your plants or take all of one species from one area. In more accessible subalpine and alpine areas we feel it is preferable to propagate from cuttings and seed rather than to transplant. In these fragile areas growth is so slow because of the severe conditions of wind, dryness and short seasons that the holes in existing meadows do not fill in for many years. If this is your only source of plants, make certain that holes are filled with rock and soil and well watered.

Do not ever transplant rare or endangered species. If in doubt about a species, do not use it. Work with something that is more abundant.

V. Seeding Suggestions

1. Collection

Pick ripe seed. Test by shaking pods or seed heads into a paper bag. The color of the seed head is also a clue, since it usually turns brown when ripe. If you wish to test the viability of seed, varying lengths of time are required, depending on the species. An easy way to do this is to place the seed on a wet paper towel, roll it up inside a plastic bag and keep in a warm place. This may not be very helpful in the field, as the germination time may be longer than you will be working in the area.

2. Seeding indoors

If growing indoors (or greenhouse or coldframe), plant the seeds in milled sphagnum or a mixture of peat and perlite or vermiculite in covered plastic boxes or clean pots with glass or plastic covers. Most seeds require darkness until germination and then good light but not full sun. After leaves have formed, harden off by leaving off the top. Prick out after development of the 2nd and 3rd leaves and plant in pots or flats 1 inch or more apart. Keep in light and keep moist. Ahlstrand 91973) at Mt. Rainier found that stratification was helpful in sprouting Anemone occidentalis, Aster ledophyllus and a grass, Festuca viridula. Stratification means keeping the seed in a refrigerator in moist sand or a peat and sand mix.

Ferguson and Monsen (1974), working with containerized shrubs and forbs in Utah, found that a peat-vermiculite mix with the addition of osmocote, a slow acting fertilizer, gave good results in the greenhouse. They used benlate for mold problems.

3. Direct seeding in the field

Sow the seeds in late fall, hopefully just before the start of the autumn rains and snow. Plant seeds of plants that fit the site. No species adapted to dry, sunny areas will like a damp, shady spot. Plant in a well worked seed bed with humus dug in if is lacking in the soil. Scatter seeds, cover with about 1/2 inch of soil or soil-peat mix, or poke holes in soil and drop seeds in. Firm the soil down with your hands or feet. Mulch with jute netting, burlap or debris to hold down the soil and provide shade.

Soaking some seeds for 24 hours before planting helps them germinate. However, Farmer (1974), working with a Montana strip-mine revegetation project, found that to plant germinated seeds in dry soil is lethal to the young seedlings. After planting, water the seed bed lightly so as not to wash the seed. If the seed bed is on a slope, do not rake or smooth the soil and use logs, sticks or rocks to make check dams to prevent erosion from heavy rains.

The temperature necessary for seed sprouting varies according to the species, some alpine species requiring 90°F. Most, however, sprout at lower temperatures. Brink (1964) found a rock mulch aided the germination of his grass seeding plots at high elevations.

VI. Propagation from Cuttings

1. Collecting in the field

Many herbs and shrubs can be propagated from cuttings, but the exact month of the year giving the best results depends on a number of factors. In the North Cascades the weather is the most important influence on cutting maturity, and this varies from year to year. Generally, however, late summer to early fall is a good time to take cuttings. Soft wood cuttings are taken from the current season's growth. To test whether a plant is at the proper stage, bend a twig between the fingers. It should break with a snap. If it merely crushes or bends, it is too young or too old.

The length of the cutting will vary with the species. Usually on small ground covers the cutting will not be more than 2 inches long. On larger plants it should not exceed 4 to 6 inches. Cut the twig of the current year's growth with a clean, sharp knife and place it immediately in a moistened plastic bag. Generally, you should cut well below a node (place where the leaves come out) so when you are ready to insert the cutting in the rooting mix, you can recut and make a node cutting. Heel cuttings can also be made by pulling small twigs of the current season's growth off the old wood, leaving a "heel" at the base. Do not take all the young branches off one plant. Keep each species in separate labeled bags. Closing the bag with a rubber band helps keep the moisture level up. Store out of the sun until you get back to the greenhouse. A camp ice chest is a good place in which to transport the bags by car.

2. Preparing cuttings in the greenhouse.

There are many sterile mixes used for rooting media and all seem to work for certain species of material. We have used 1 part peat and 1 part perlite with the addition of small quantities of dolomite lime, super phosphate (0-18-0) and complete fertilizer (5-14-10) and also 3 parts peat and 2 parts perlite with the same additives. Both mixes gave good results (Miller and Miller, 1976). The University of Washington Arboretum greenhouse uses 1 part peat and 1 part perlite with no fertilizer or lime but during the winter months feeds the plants with fish fertilizer or osmocote after they have rooted and been transplanted to pots. Some plantsmen use 1 part peat to 3 parts sand. Whatever the mix, it is placed in 4 inch deep wooden boxes that have good drainage holes in the bottom and well watered so that the peat is not dry. Firm the mix down with a board or the hands.

Using a sharp razor blade, make a fresh slanting cut just below the node on a woody plant cutting. Again with the razor blade, "wound" the cutting at its base by cutting into the cortex tissue. Remove enough bottom leaves from the stem so that they will not touch the soil when inserted. Dip the cutting into a rooting hormone (trade names--Hormonex, Hormodin, Rootone) and shake off the excess. The stem should be coated 1 to 2 inches, depending on its length.

With a nail, stick or dibble make a hole in the mix and insert the cutting without wiping off the hormone powder. The cutting should have half its length in the rooting mix. Space cuttings at least 1 inch apart so they do not touch each other. If the leaves are large, cut off half each remaining leaf to reduce e transpiration and prevent shading neighboring cuttings. Carefully firm soil around each cutting. After inserting all cuttings label with the date, species and location where the cuttings were taken on a plastic plant tag. Sprinkle with water to settle the mix and place in the greenhouse bench or cold frame.

If no greenhouse or cold frame is available, place a half hoop of heavy wire at each end of the wooden flat and cover with clear sheet plastic to maintain the humidity. Leave a few inches of air space between the plastic and the tips of the cuttings. Tie the plastic firmly around the edge of the flat and store in a sheltered place with good light but out of direct sun.

Check your flats periodically for moisture in the mix and pick out decayed leaves to cut down mold. Fungus or mold also forms when flats are too damp or the greenhouse or cold frame is not ventilated enough. The cuttings can be checked for roots by inserting a fork and gently prying a cutting out of the medium, being careful not to disturb the rest of the flat. If white roots are present, pot up in a regular soil mix if desired. If there are no roots, place back and press down soil around it. Some plants take 3 months to a year or more to root.

VII. Special Problems

1. Easily trampled areas

Plants with showy flowers are the easiest to wipe out with the lug or vibram soled boots of hikers and backpackers. use hardier and more resistant ground covers. Look for native grasses and sedges in the area you are working in. We found Luetkea pectinata (Alaska Spiraea), Sibbaldia procumbens, Carex nigricans, C. spectabilis (Sedges), and Potentilla flabellifolia (fringed Cinquefoil) all durable species at Cascade Pass.

Put logs, sticks, rocks in plots to discourage sleeping baggers.

Bell and Bliss (1972) found slopes in Olympic National Park more vulnerable than flat areas to trampling. Netting is often used successfully on slopes, but it sometimes seems to invite instead of discourage walking (carpeted pathway). use large, sharp-edged rocks, down snags, debris, stakes in the middle of the netting to discourage this. While you are working in fragile areas like high mountain meadows, be aware of your own impact. Carry a pair of tennis shoes or moccasins in your pack and wear them while you are working on your plots. A "sneaker freak" has minimum impact on the vegetation.

2. Fire rings

Old fireplaces, because of their accumulations of wood ash, have a higher pH than surrounding areas. Many acid-loving plants of nearby areas will not do well there. de Keijzer and Hermann (1966) found seed beds containing charcoal also reach temperatures lethal to seedlings when exposed to summer sun. So, if you are seeding fire rings, you should either dig out the layers of charcoal and replace with regular soil or use species tolerant to higher temperatures and mulch with debris and shade with branches. It is probably best to stick with native grasses that can withstand a higher pH.

3. Frost heaving

In the winter months, moisture gets into the soil and the alternate freezing and thawing heaves the plants out of the ground. This is a particular problem at higher elevations. Mix humus in the soil, transplant a little lower (in a small depression), mulch surface with humus or debris. Netting seems to help somewhat on south facing slopes.

4. Gullies or deeply worn trails

Since soils in these areas are usually lacking in humus and aeration, do anything you can to improve the soil condition. If possible, fill in with additional soil. If this is not possible, spade up the gully. Add rocks here and there, making check dams for catching soil. A wilderness guard once dug up some large plants of heather and set them down in an old deeply worn trail at Cascade Pass. Ten years later the plants are still alive, but they are sitting up on pedestals and haven't grown an inch. Dig up compacted soil.

5. Large areas-old shelter sites

Dig up the whole area. Seed or use cuttings if a cold frame is available and intersperse with transplants. Try to make a variety of habitats like the surrounding forest. Bring in logs, debris, large

rocks. Use a variety of plants. If you use nurse logs with plants growing on them, partially imbed them in the soil to help hold moisture in the log.

6. Large shrubs, trees

Don't bite off more than you can carry! Make the root ball at least to the drip line. Soil is heavy! Drag on a tarp if near the site. Make the planting hole larger than the root ball. Tamp soil down and water well. Cut back the top to compensate for loss of roots. Stake and tie to keep from whipping in the wind. Do not tie tightly around the tree, as this will girdle it. use loops and three stakes. An anti-transpirant is helpful on evergreens, but moving large plants in the summer months is a gamble at best.

7. Divisions

Some plants are not divisible. Trees, many shrubs, heathers, have only one set of roots. If you do use rooted branches of heather, they should spend at least one year in a greenhouse or cold frame facility. If you transport divisions back to a cold frame, place them in a moist plastic bag and keep them out of the sun. Divisions are generally treated as cuttings, but since they already have some roots, are somewhat easier to handle. They usually do not require a rooting hormone.

8. Difficult to impossible to transplant

a. Adult lupine. The tap root is very deep. Take seeds or cuttings instead.

b. Vine maple. The root travels horizontally and then vertically. Seedlings are a much better bet if you can find them.

c. Dogwood. Should be transplanted only in winter when the leaves are off and the plant is dormant. Even then, only small plants will survive. It is very sensitive to its place in the plant community. Orient in the same direction and shade the trunk. You will need a large can to transport the root ball.

d. pyrola, prince's pine (pipsissewa). Special symbiotic mycorrhiza in the soil are needed for them to survive. Take lots of soil with them and mix it in with the soil at the new site. Do not move until after flowering. These plants need an acid soil with lots of humus.

e. Rhododendron albiflorum. Very difficult-impossible either to root from cutting or transplant. Has been grown from seed.

f. Trillium. Usually the bulb is very deep. Prepare to dig 2 to 3 feet down. Seedlings are easier to establish.

g. Vaccinium deliciosum (Subalpine huckleberry) Usually occurs in great clumps and to get one plant means ruining several others. Try cuttings or seed instead.

h. Arctostaphyllos uva-ursi (Kinnikinnick). Adult plants are nearly impossible to move. Take cuttings or find small seedlings.

i. Penstemon. Take the small pieces that have broken off and are rooted nearby rather than the old plant.

j. Mimulus (Monkeyflower) Some are only annuals and are not worth transplanting unless you have exactly the same conditions (near stream,

k. Lewisia. The tap root is very deep and usually under the largest rocks around. Leave alone or try seeds instead.

l. Calypso bulbosa and all other orchids. Most are on the rare and endangered list. Leave alone!

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