

RARE AND ENDANGERED PLANT GUIDE
for
TIMBER HARVEST PLANS
in
COASTAL MENDOCINO COUNTY
(Office Manual)

By
Gordon E. McBride, PhD.



Edited by
Tamara Camper, Shayne Green,
Darcie Mahoney and Geri Hulse-Stephens

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INTRODUCTION

The purpose of this manual is to provide guidance for Registered Professional Foresters (RPFs) faced with discovery, identification, and protection of rare or endangered plants. When preparing a Timber Harvest Plan (THP), the RPF must address these botanical resources per the criteria of CalFire, California Department of Fish and Wildlife (DFW) and other public and private groups.

This manual will review:

- Authorities that deal with rare or endangered plants
- Databases used to generate information on these plants
- Field search parameters
- Survey reports
- Plant identification references
- Herbarium use

Accompanying the office manual is a field guide ([download a free copy](#)) that provides descriptions, photographs, and line drawings of each species. The office manual also argues for a stewardship management philosophy by foresters and timberland owners which can replace potential contentious or adversarial interactions between interested parties.

Timber-related legal requirements relating to botanical resources are dynamic. Periodic revisions of this manual are planned as time and circumstance dictate. Foresters should feel encouraged to communicate any vague, misleading, or incorrect statements that should be rectified in subsequent editions.

THE FLORA OF CALIFORNIA AND MENDOCINO COUNTY

The Jepson Manual presents an excellent discussion of the biogeographical subdivisions of California (p. 37-48). Mendocino County is in the North Coast Range sub-region of the Northwestern California bioregion.

Within this sub-region there are a variety of plant communities that are described in the Preliminary Descriptions of Terrestrial Natural Communities of California (Holland, 1986). Most of the coastal Mendocino timber resources occur in the North Coast coniferous forest community (NCCF). As such, this manual addresses only plants within this community. However, because other habitats can exist within a THP, it may also be necessary to address special plants within those habitats.

AUTHORITIES AND AGENCIES

The California Native Plant Society (CNPS)

Of the several thousand plants in California, CNPS places approximately one third of them in plant rankings, depending upon their degree of rarity or threat of endangerment. These plants are distributed in six categories within this ranking system: 1A, 1B, 2A, 2B, 3, and 4.

Rank 1A – Plants Presumed Extinct in California

This list includes two species in Mendocino County, neither of which occur in NCCF:

- Mendocino bush mallow (*Malocothamnus mendocinensis*)
- Mayacamas popcorn flower (*Plagiobothrys lithocaryus*)

While it may seem incongruous to be concerned with plants presumed to be extinct, the effort is occasionally rewarded. As of 1984, CNPS considered showy Indian clover (*Trifolium amoenum*) to be extinct. However, in 1993 a single plant was discovered near Occidental, Sonoma County and 18 plants were germinated from the seed. In 1996, 225 individuals were discovered near Dillon Beach and several populations have since been established near Bodega Marine Laboratory. Careful management of showy Indian clover has prevented its extinction (Science News, 16 Jan 1999, p. 43).

Closer to home, the Humboldt milk-vetch, once thought to be extinct, was discovered in 1999 growing luxuriantly in Jackson State Forest north of Chamberlain Creek Conservation Camp. By the spring of 2002, foresters and botanists had discovered at least 38 additional populations totaling some 35,000 plants (McBride, unpublished).

It is mandatory to give Rank 1A plants full consideration when preparing a THP or other California Environmental Quality Act (CEQA) document.

Rank 1B – Plants Rare or Endangered in California and Elsewhere

This rank includes the following species within the NCCF:

- Humboldt milk-vetch (*Astragalus agnicidus*)
- Franciscan Onion (*Allium peninsulare* var. *franciscanum*)
- coastal bluff morning-glory (*Calystegia purpurata* ssp. *saxicola*)
- swamp harebell (*Campanula californica*)
- minute pocket moss (*Fissidens pauperculus*)
- coast lily (*Lilium maritimum*)
- white-flowered rein orchid (*Piperia candida*)
- North Coast semaphore grass (*Pleuropogon hooverianus*)
- Siskiyou checkerbloom (*Sidalcea malviflora* ssp. *patula*)
- robust false lupine (*Thermopsis robusta*)
- Santa Cruz clover (*Trifolium buckwestiorum*)
- Monterey clover (*Trifolium trichocalyx*)

It is mandatory to give Rank 1B plants full consideration when preparing a THP or other CEQA document.

Rank 2A – Plants Presumed Extirpated in California, But Common Elsewhere

This rank includes one species in Mendocino County, but not within NCCF:

- livid sedge (*Carex livida*)

Rank 2B - Plants Rare or Endangered in California but More Common Elsewhere

This rank includes the following species within the NCCF:

- false gray horsehair lichen (*Bryoria pseudocapillaris*)
- northern clustered sedge (*Carex arcta*)
- lagoon sedge (*Carex lenticularis* var. *limnophila*)
- green yellow sedge (*Carex viridula* var. *viridula*)
- bunchberry (*Cornus canadensis*)
- coast fawn lily (*Erythronium revolutum*)
- small groundcone (*Kopsiopsis hookeri*)
- marsh pea (*Lathyrus palustris*)
- seacoast ragwort (*Packera bolanderi* var. *bolanderi*)
- angel's hair lichen (*Ramalina thrausta*)
- great burnet (*Sanguisorba officinalis*)

It is mandatory to give Rank 2B plants full consideration when preparing a THP or other CEQA document.

Rank 3 - Plants about which we need more information--A Review List

This rank includes only two species within the NCCF:

- false gray horsehair lichen (*Bryoria pseudocapillaris*)
- streamside daisy (*Erigeron biolettii*)

Here, DFW regulatory jurisdiction is confusing because all plants constituting Rank 3 are eligible for state listing under the California Endangered Species Act. These are plants for which insufficient information exists to either advance them to a higher ranking or reject them from any ranking. Therefore, they must be considered during THP preparation.

Rank 4 - Plants of Limited Distribution – A Watch List

This rank includes the following species within the NCCF:

- brassy bryum (*Bryum chrysie*)
- Bolander's reed grass (*Calamagrostis bolanderi*)
- leafy reed grass (*Calamagrostis foliosa*)
- large-flowered mariposa lily (*Calochortus uniflorus*)
- Pacific golden saxifrage (*Chrysosplenium glechomifolium*)
- Oregon goldthread (*Coptis laciniata*)
- California lady's slipper (*Cypripedium californicum*)
- clustered lady's-slipper (*Cypripedium fasciculatum*)
- mountain lady's-slipper (*Cypripedium montanum*)
- Humboldt County fuchsia (*Epilobium septentrionale*)
- Tracy's tar plant (*Hemizonia congesta* ssp. *tracyi*)
- harlequin lotus (*Hosackia gracilis*)
- redwood lily (*Lilium rubescens*)
- heart-leaved twayblade (*Listera cordata*)
- running pine (*Lycopodium clavatum*)
- leafy-stemmed miterwort (*Mitellastra caulescens*)
- California pinefoot (*Pityopus californicus*)
- nodding semaphore grass (*Pleuropogon refractus*)
- Lobb's aquatic buttercup (*Ranunculus lobbii*)
- maple-leaved checkerbloom (*Sidalcea malachroides*)
- Methuselah's beard lichen (*Usnea longissima*)
- fringed false hellebore (*Veratrum fimbriatum*)

Though these plants are of limited distribution, their current vulnerability to threat is low. However, their status is checked regularly, and CNPS recommends they be evaluated during THP preparation.

Threat Ranks

The CNPS Threat Rank is an extension added onto the Rare Plant Rank which designates the level of endangerment by a 1 to 3 ranking, with 1 being the most endangered. A Threat Rank is given to Rare Plant Ranks 1B, 2A, 2B, and 3, but seldom to Rank 4.

- 0.1 - Seriously threatened in California
- 0.2 - Fairly threatened in California
- 0.3 - Not very threatened in California

The Federal Government – US Fish and Wildlife Service (USFWS)

The Federal Endangered Species Act of 1973 (FESA) charged the USFWS with identifying and protecting threatened plants and animals. The FESA plant species in California fall into four categories:

FE – Federally Listed Endangered

This list includes any species in danger of extinction throughout all or a significant portion of its range. At this time, no FE plants occur in NCCF.

FE listed species must be given full consideration when preparing a THP or other CEQA document

FT – Federally Listed Threatened

This list includes any species likely to become endangered. At this point in time, no FT plants occur in NCCF.

FE listed species must be given full consideration when preparing a THP or other CEQA document

FPE or FPT – Federally Proposed for Endangered or Threatened

This list includes species proposed for endangered or threatened status, but no final action has been taken. At this time, there are no FPE or FPT species in California.

FPE and FPT listed species must be given full consideration when preparing a THP or other CEQA document.

State of California – California Department of Fish and Wildlife (DFW)

DFW administers rare and endangered plants under the authority of the 1970 California Environmental Quality Act (CEQA), the 1984 California Endangered Species Act (CESA), and the 1997 Native Plant Protection Act (NPPA).

SE – State Listed Endangered

This list includes species with prospects of survival in immediate jeopardy. Currently, there is one SE species in NCCF:

- Humboldt milk-vetch (*Astragalus agnicidus*)

SE listed species must be given full consideration when preparing a THP or other CEQA document.

ST – State Listed Threatened

This list includes species not presently in danger of extinction, although they are likely to become endangered in the absence of special protection. At this time, one species occurs in the NCCF:

- North Coast semaphore grass (*Pleuropogon hooverianus*)

ST listed species must be given full consideration when preparing a THP or other CEQA document.

SR – State Listed Rare

This list includes species not presently threatened, but may become so if their environment deteriorates. There is one species currently listed in NCCF:

- leafy reed grass (*Calamagrostis foliosa*)

SR listed species must be given full consideration when preparing a THP or other CEQA document.

SC - State Candidate for Listing

There are no current state candidates for listing.

SC listed species must be given full consideration when preparing a THP or other CEQA document

In addition to the State listings, a Global Ranking (G-rank) is given to each species. This is a reflection of the overall species status throughout its global range. Both the Global and State ranks utilize a “letter plus number” score that combines rarity, threat, and trend factors.

- Global Rank G1 - Critically Imperiled; a very high risk of extinction due to extreme rarity, population decline, or other factors.
- Global Rank G2 – Imperiled; a high risk of extinction due to very restricted range, very few populations, steep decline, or other factors.
- Global Rank G3 – Vulnerable; a moderate risk of extinction due to restricted range, relatively few populations, recent and widespread decline, or other factors.
- Global Rank G4 - Apparently Secure; uncommon but not rare; some cause for long-term concern due to population decline or other factors.
- Global Rank G5 - Demonstrably Secure; common, widespread, abundant.

Subspecies may receive a T-rank attached to the G-rank. While the G-rank reflects the condition of the entire species, the T-rank reflects the condition of only the subspecies or variety.

The State Rank is assigned in much the same way as the Global Rank, but State Rank refers to the status only within California:

- S1 - Critically Imperiled
- S2 - Imperiled.
- S3 - Vulnerable.
- S4 - Apparently Secure.
- S5 - Secure.

DATABASES

There is no question that the partial overlapping and contradictory lists of the three authorities (CNPS, federal, state) present a confusing picture. The most conservative and common approach is to use the CNPS Electronic Inventory and the DFW Natural Diversity Database (CNDDDB) to search the quadrangle of the proposed THP, as well as the eight contiguous quadrangles. This search will generate a “shopping list” of rare or endangered plants. Remember, be prepared to give full consideration to any species within the following:

- CNPS List: 1A, 1B or 2A, 2B
- State List: SE, ST, SR, or SC
- Federal List: FE, FT, FPE, FPT

CNPS Electronic Inventory

CNPS has produced an easy-to-use Electronic Inventory of Rare and Endangered Vascular Plants of California (available online at [CNPS rare plant inventory](#)). This Inventory is compiled from the same information pool used in the NDDB.

When preparing a THP, the most useful application of the Electronic Inventory is to identify rare plants in the quadrangle(s) concerned. In this way the forester can derive a list of plants that should be addressed. I find the CNPS Electronic Inventory to be the most useful database available. It provides the scientific name, common name, family, life form, rare plant rank, state rank, and global rank. Location maps show the county of occurrence.

DFW Natural Diversity Database (CNDDDB)

The NDDB provides essentially the same information as the Electronic Inventory. It requires the use of location maps, not found on the computer, which must be used in conjunction with the database printouts. While quadrangle searches are possible with the NDDB, habitat information is somewhat more difficult to extract. The big disadvantage of the NDDB is the cost: an initial fee of \$600, with annual renewals at \$400/year. Specific area searches are available from DFW without purchasing the entire NDDB (for instance, one can have individual quad searches). See the DFW website ([CA Dept. of Wildlife CNDDDB](#)).

DFW also produces a “Special Plants List” and “State and Federally Listed Endangered, Threatened, and Rare Plants of California”. These can be obtained from DFW headquarters in Sacramento (916-324-3812) or from the DFW website. New issues are updated at least yearly.

Calflora Database

The University of California has developed an on-line database that provides location maps and photographs of many, but not all, of the rare or endangered plants of concern to coastal Mendocino County foresters. The Calflora database is accessed at: www.calflora.org

This user-friendly data base contains easy-to-follow directions. The shortcoming is that its digital plant picture resolution leaves something to be desired compared to 35 mm photography. Location maps show site occurrences. Cost is on a sliding scale. Calflora requests that, if used for paid work, you subscribe at a rate your budget allows (from \$0 to \$150).

SCOPING

To determine which species must be considered, it is necessary to use either the CNPS Electronic Inventory or the NDDDB to scope the project. Calfire spelled out THP scoping requirements in its memo of 6 September 1995:

“The occurrence of special status species or natural communities in the vicinity of the assessment area may be an indication that they would also occur in your project assessment area. It is recommended that areas within five miles of the biological assessment area be checked with the NDDDB. The NDDDB is a scoping tool and does not necessarily negate the need to conduct surveys for sensitive biological resources.”

Since both the NDDDB and the CNPS Electronic Inventory provide the same data, I have historically used the CNPS Inventory with excellent results. As a practical matter, the smallest area that either database can query is a USGS 7.5 min. quadrangle. At a bare minimum, the legal requirement is to scope both the quadrangle wherein the THP occurs and other quadrangles within a five-mile radius. However, DFW recommends scoping the subject quadrangle and all eight contiguous quadrangles. This approach will probably produce a more acceptable scoping process.

FIELD SEARCH PARAMETERS

DFW has published “Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities” (24 November 2009). These protocols specify how and when acceptable field searches should be undertaken and reported. See the Appendix for the protocols.

It is important that a field search should be conducted during the appropriate time of year. In the case of herbaceous flowering plants, the search should occur during the blooming window, when all criteria necessary for identification are present. While some plants can be identified any time of year, others (such as manzanitas or ceanothus) are taxonomically difficult and can only be confidently identified when buds, flower, and fruit are present.

A field search should not be predictive – meaning that the presence or absence of a plant should not be established solely on the presence or absence of its habitat.

Field searches should be consistent with conservation ethics. A suspected rare plant should not be collected indiscriminately. If a suspected rare plant is represented by only a few individuals, it is best to have a botanist make a field identification. No collection should be made. Even a color photograph may not be sufficient for identification because species differences may reside in microscopic detail.

If the suspected rare species is represented by a larger population, it may be acceptable to remove a plant or two for laboratory identification. Since important characteristics may often be found in all parts of a plant--roots, stems, leaves, flowers, and fruits--it is necessary to collect enough material to make identification possible. The more material available the better the chance of correct identification. Adequate collection should include roots, stems, leaves, flowers and fruits from one or more plants.

Once collected, the specimen should be pressed between dry newspaper with as much information about habitat as possible, including:

- associated species
- altitude
- proximity to water
- GPS location
- slope

A popular field alternative is to place the specimen in a plastic bag or container with wet newspaper to keep the plant moist. The sooner the material is presented to a botanist, the better the chance for correct identification. Once identified, the finding should be reported to the appropriate lead agency and the CNDDDB using the appropriate form, map, GPS location, and photographs.

PLANT IDENTIFICATION REFERENCES AND KEYS

The Jepson Manual - Vascular Plants of California, 2nd Edition is by far the most useful document for plant identification. A magnificent reference, it is the culmination of more than 50 years of work by hundreds of botanists, writers, editors, and illustrators. To effectively use the dichotomous key, foresters should have courses in both introductory botany and plant taxonomy under their belt. However, if one is willing to use the illustrated glossary when unfamiliar terms are encountered and to carefully follow the keys, specific identifications can be made. Because of time constraints, however, most foresters may opt to leave this effort to trained botanists. Nonetheless, the Jepson Manual should be in the library of every modern forester.

Using the dichotomous key is a matter of making a stepwise series of choices that are based on specific characteristics of the subject plant. Keying plants is generally a frustrating process that depends upon understanding the terms used in the key, observing the plant anatomy, and choosing the correct alternative choice in the key. This process is repeated until the plant is identified to the correct species. A dissecting microscope and/or a hand lens is often necessary. If a novice is willing to carefully read, understand, and correctly make the choice offered by each step in the key, the process can be successful. The outstanding feature of the Jepson Manual is the excellent

illustrated glossary that makes it easier to understand botanical terms used in the key. Even experienced botanists regularly resort to checking the glossary for the strict meaning of a botanical term. Willingness to use the glossary is the most important advice I can offer to the forester.

Hitchcock's Manual of the Grasses of the United States, while long out of print, is still an excellent source of illustrations for this plant group. This reference should be used in conjunction with the Jepson Manual-- running the keys in Jepson, while using the illustrations, maps, and species descriptions in Hitchcock. Hitchcock's Manual can still be found in college libraries.

Another old, but very useful reference is Herbert Mason's A Flora of the Marshes of California. This manual deals mainly with wetland species. However, many of the rare plants that a forester may encounter are found in wet areas. Illustrations from this reference should also be used with the keys of the Jepson Manual.

For most of the last century, many botanists learned plant taxonomy from A California Flora (Munz and Keck). This reference is very difficult to use because there are almost no illustrations. Attempting to identify the infinite variety of California flowering plants without illustrations ignores the time-honored observation that "a picture is worth a thousand words". I recommend A California Flora to only the most hardened botanist.

Robert Holland's Preliminary Description of the Terrestrial Natural Communities of California is a critical reference for the forestry library. Holland's classification is a three-tiered, hierarchical system. It begins with broad ecological classes (i.e. forest communities), divides them into supercommunities, then sub-divides them into smaller communities.

For example:

- Forest Community (ecological class)
 - North Coast Coniferous Forest (super-community)
 - ❖ Alluvial Redwood Forest (smaller community)

Both the CNDDDB and the CNPS Electronic Inventory use super-communities (i.e. North Coast Coniferous Forest) as habitat descriptions. The smaller community (i.e. Alluvial Redwood Forest) provides the accepted name, description, site factors, and characteristic species of most of the plant communities in California. Within North Coast Coniferous Forests, there are six plant communities described:

- Sitka Spruce-Grand Fir Forest
- Western Hemlock Forest
- Alluvial Redwood Forest
- Upland Redwood Forest
- Coastal Douglas Fir-Western Hemlock Forest
- Upland Douglas Fir Forest

After reading the descriptions, site factors, and characteristic species, any experienced forester should soon be able to recognize these communities in the field. The value of the

“supercommunity” concept is that it puts everyone (including NDDB and CNPS) on the same page when discussing plant habitat. Holland’s manual is downloadable at: www.cal-ipc.org/ip/inventory/pdf/HollandReport.pdf This document needs revision and expansion, and it is my hope that such would become a priority of DFW.

A Manual of California Vegetation, 2nd edition (Sawyer and Keeler-Wolf), also provides good descriptions of California plant communities. While Holland’s supercommunities are presently used as habitat descriptions in the NDDB and the Electronic Inventory, Sawyer and Keeler-Wolf’s descriptions will also eventually be used. It can be obtained from CNPS online for \$82. Note that Holland actually, better describes the redwood forest and habitat types of the Mendocino Coast.

A final very useful reference is A Flora of Vascular Plants of Mendocino County, California (Smith and Wheeler). Its real value is the detailed cataloging of all vascular plants from the county and the habitats where they have been collected.

There exist many on-line sources of native plants which can be valuable when a forester encounters revegetation situations. Examples are: cnps.org/cnps/grownative/where_to_buy.php and ucanr.edu/sites/scmg/files/29792.pdf.

HERBARIA

Most vascular plants lend themselves very well to being preserved by drying and pressing. For hundreds of years, botanists have been collecting, pressing, and storing specimens in herbaria. These resources are valuable to the forester who wants to see what a specific plant may look like. It is often possible to make arrangements with herbarium staff, visit a facility, and look at pressed specimens.

To be sure that herbarium staff can accommodate a visit, call ahead, explain your needs, and make an appointment. If you are bringing material to be identified, seal it in a plastic bag or press it between sheets of newspaper. Do not bring it into the herbarium storage area until staff is aware of what you have; you could be transporting insects that pose a threat to preserved specimens. Often, before comparing your material to herbarium specimens in the storage area, it must be sterilized by microwaving or other means.

There is a small herbarium in the Fort Bragg branch campus of the College of the Redwoods. However, there is no full-time staff and access must be coordinated ahead of time. Make an appointment by calling 707-962-2600.

There is a good northern California plant herbarium at Humboldt State University, Arcata. It is found in the Engineering and Biological Sciences Building (Science D), Room 161. A user’s guide to the collection at the herbarium can be found at <https://www2.humboldt.edu/herbarium/>. The phone number of the herbarium is 707-826-4801.

Sonoma State University, Rohnert Park, has a good collection of northern California plants. Contact the School of Science and Technology at 707-664-2171.

The University of California, Berkeley, houses an outstanding herbarium in the Life Science Building on the main campus. It has an excellent home page that can be accessed at <http://ucjeps.berkeley.edu/eflora/>, and one can download information necessary for visiting the herbarium. The Calflora database, mentioned above, is produced by the University of California and Jepson Herbarium.

I FOUND IT – NOW WHAT?????

When a rare plant is located in the THP assessment area, the first step is to mark the population(s) with flagging to make it easier to re-find. It then should be located accurately on the THP map. If possible, identify the site with a GPS coordinate. The next step is to complete and submit a NDDB form (see Appendix), attach a map clearly showing the plant location(s), and submit it to DFW, Sacramento.

DFW may opt to send representatives for a field review. The population(s) may be in wet areas or along streams, in which case the habitat is usually protected by the Forest Practice Rules. In other cases (particularly with the swamp harebell, coast lily, Bolander's reed grass, leafy reed grass and maple-leaved checkerbloom), the plants may be intermingled with timber. Prior to tree felling or equipment operation, the rare plant population should be shown to the Licensed Timber Operator (LTO) and the protective measures explained.

Until DFW establishes a policy regarding rare plants that appear to benefit from timber harvest, the best advice is to avoid any direct impacts. If a buffer area is recommended by DFW, then it should be flagged and made known to the LTO. DFW may also require post-harvest monitoring.

When identifying certain species (particularly grasses, manzanitas, and members of the sunflower family) is beyond the forester's ability, several alternatives exist. In order of preference:

- Bring a local botanist to the site (preferred)
- Take a good photograph and show it to a local botanist
- Lastly, collect a specimen and send it to a qualified botanist. This method should only be used if the botanist determines that the population can tolerate the loss of individuals. This process is cumbersome and time-consuming, but with some plants it may be the only game in town.

Transplant mitigation could be used where plants exist on a site that will be impacted by timber operations (i.e. on an existing haul road). I have never favored this option, and have only seen it undertaken once. This involved a swamp harebell population growing on a haul road which was the only THP access. DFW mandated transplanting plugs containing swamp harebell rhizomes. Although conducted by a skilled botanist and 80% successful, the mitigation was probably neither cost-effective nor even necessary. The swamp harebell population remaining on the road survived the log hauling and grew back the next season.

I discourage the drastic action of transplanting rare plants because we know too little about the ecological subtleties of each species. This amounts to attempting surgery without adequate knowledge of anatomy.

THE STEWARDSHIP ETHIC

The forester may undoubtedly be confused and frustrated regarding the regulations associated with scoping, field search, identification, and protection of rare or endangered plants. The reality of timber harvest in California is that landowners, foresters, and LTOs must consider biological resources far more than in historic times. Society has mandated that raw material (i.e. timber) should be made available only in ways that do not compromise significant botanical resources. There remains both considerable uncertainty and a diversity of opinion as to how to best accomplish this, particularly considering California's demand for a steady flow of timber products.

I submit that all involved parties--- landowners, foresters, regulatory agencies, private conservation groups, botanists, the educational community--- have more to gain by agreeing on forestry that protects biological resources, than by opposing each other to protect their own special interests. The ultimate goal should be a united conservation ethic that recognizes the need to manage our forests while accepting and protecting all ancillary resources associated with timber harvest.

Many rare plants occur in wet areas, serpentine outcroppings, or other special habitats that are isolated "islands" within the broader matrix of productive timberlands. These areas can be easily designated as "non-entry" for harvest activities. Where rare plants do occur in timber, it is often possible to avoid direct impacts and still harvest trees (i.e. swamp harebell and maple-leaved checkerbloom).

These occurrences present opportunities for objective long-term research on the impact of disturbance to rare plants. As populations wax or wane over time, it may be possible to document correlations between plant response and ecological parameters such as shading, rainfall, soil disturbance, plant competition, and herbivore grazing. Research results will provide valuable new information to entities concerned with preserving rare plants. When foresters identify rare plant habitats, they offer important knowledge to the botanical community.

To provide the best rare plant protection, all the primary protagonists must better understand the biology of these species. Despite laws protecting these plants, without more knowledge of their ecology, we will continue to be ill-equipped for the task at hand.

A conservation ethic is critical to the survival of rare and endangered plant species in our timberlands. But a conservation ethic cannot simply be mandated--- it must grow out of constructive interaction among interested parties, just as an ecosystem develops from the interaction of organisms living in a shared environment. The lesson of this model should not be lost on those of us who work, recreate, study, or meditate in the forest.

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