Botany Field Survey Protocol

Region One

United States
Department of
Agriculture

Forest Service

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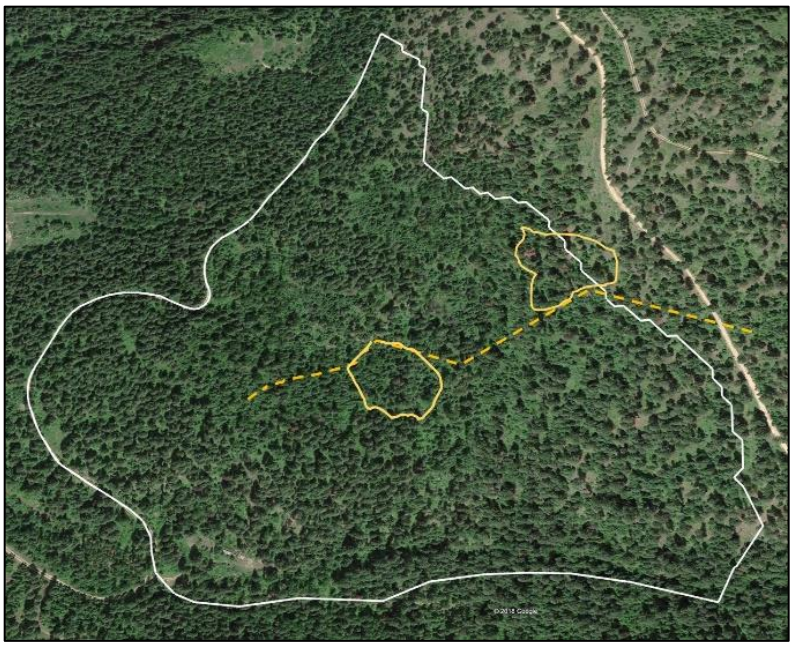


Platanthera praeclara
Western Prairie Fringed Orchid

Penstemon lemhiensis
Lemhi Beardtongue

CONTENTS

INTRODUCTION

Conservation of plant species at risk, as identified by the U.S. Forest Service (USFS) and the U.S. Fish and Wildlife Service (USFWS), is integral to the maintenance of ecosystem resilience, and serves to provide wildlife habitat, restore and maintain biological diversity, and provide opportunities for research and public enjoyment. The goal of the U.S. Forest Service botany program is to conserve these at-risk species to meet agency objectives and policies for ecological sustainability on the national forests and grasslands. This protocol outlines the steps followed during project evaluation, and tools that are used for efficient incorporation of these plant conservation goals in USFS management activities. Most of the approaches described have been used for many years by botanists in state and federal agencies, and are designed to balance efficiency in National Environmental Policy Act (NEPA) analysis and the management of USFS lands with agency requirements for the conservation of at-risk plant species. The protocol is also intended to support EADM (Environmental Analysis and Decision-Making) initiatives for increasing efficiency in NEPA.

The USFS is currently making changes regarding the identification, categorization, and policy direction for plant species that are in need of conservation measures. Given these ongoing changes, the general phrase "species at risk" is used in this document. It specifically refers to USFWS threatened, endangered, proposed, and candidate species, USFS species of conservation concern (SCC), and USFS Regional Forester's sensitive species. Forest and grassland plans revised under the 2012 Planning Rule address SCC, while those developed under the 1982 Planning Rule address sensitive species until such time as SCC have been identified for their unit. In both cases, evaluation of potential project effects on USFWS threatened, endangered, proposed, and candidate species is also conducted.

REGULATORY FRAMEWORK

National Forest Management Act

The National Forest Management Act (NFMA) of 1976, as amended to the Forest Rangeland and Renewable Resource Planning Act of 1974, is the primary statute governing administration of national forests and grasslands. The NFMA requires that National Forest System lands provide for diversity of plant and animal communities based on the suitability and capability of the land. Its implementing regulations at 36 CFR 219 require the development, revision, and amendment of land management plans to provide for ecological integrity and persistence of native species in the plan area.

Forest/Grassland Plan Direction

Each national forest or grassland has a land management plan which provides an integrated set of management directions that provide for the social, economic, and ecological sustainability and multiple uses of NFS lands and resources. They also include plan components or direction regarding conservation of plant species at risk. Each planning area (forest or grassland) must refer to their respective planning document when addressing at-risk plant species during project development and subsequent NEPA analysis.

Current planning regulations at 36 CFR 219 require the identification of species of conservation concern (SCC) during plan revision. However, the regional forester may identify SCC for an administrative unit at any time. Until SCC have been identified for a unit, and a determination has been made that the land management plan provides the ecological conditions to support long-term persistence of the SCC, the regional forester's sensitive species list applies to the unit. A species of conservation concern (SCC) is a species, other than federally recognized threatened, endangered, proposed, or candidate species, that is known to occur in the plan area and for which the regional forester has determined that the best available

scientific information indicates substantial concern about the species' capability to persist over the long-term in the plan area (36 CFR 219.9; FSH 1909.12, Ch. 10, 12.52). The Forest Service Manual (2670.15) defines sensitive species as those identified by the regional forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in numbers, density, or habitat capability that would reduce a species' distribution.

Specific land management plan direction for SCC or sensitive species varies by unit; however, compliance with plan direction, the NFMA diversity requirement, and if applicable, the ESA requires knowledge of where plant species at risk occur and whether project-level mitigation or design criteria is necessary.

In addition, at the time of release of this protocol, FSM 2670 requires biological evaluations that review proposed activities for their potential effects on sensitive species, and outlines policies, objectives, and procedures for conducting the reviews.

Regardless of plan revision status, or updates to the FSM direction, this protocol describes approaches for meeting our project design and analysis obligations under the NFMA, the ESA, and the NEPA.

Endangered Species Act

The purpose of the Endangered Species Act (ESA) is to provide a means whereby the ecosystems upon which threatened and endangered (T&E) species depend may be conserved and to provide for the conservation of these federally listed species. The ESA directs federal agencies to ensure that any actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of T&E species or result in the destruction or adverse modification of their critical habitats (ESA Section 7(a)(2)).

Other Direction

Unit-specific direction, such as forest and grassland-wide weed control or grazing management decisions, typically provides design criteria or other guidance for management activities near at-risk plant populations. These resource management plans should be consulted during project design and analysis.

PROJECT EVALUATION PROCESS

Project-level evaluations for at-risk plant species typically involve the steps summarized in Figure 1 and further described below.

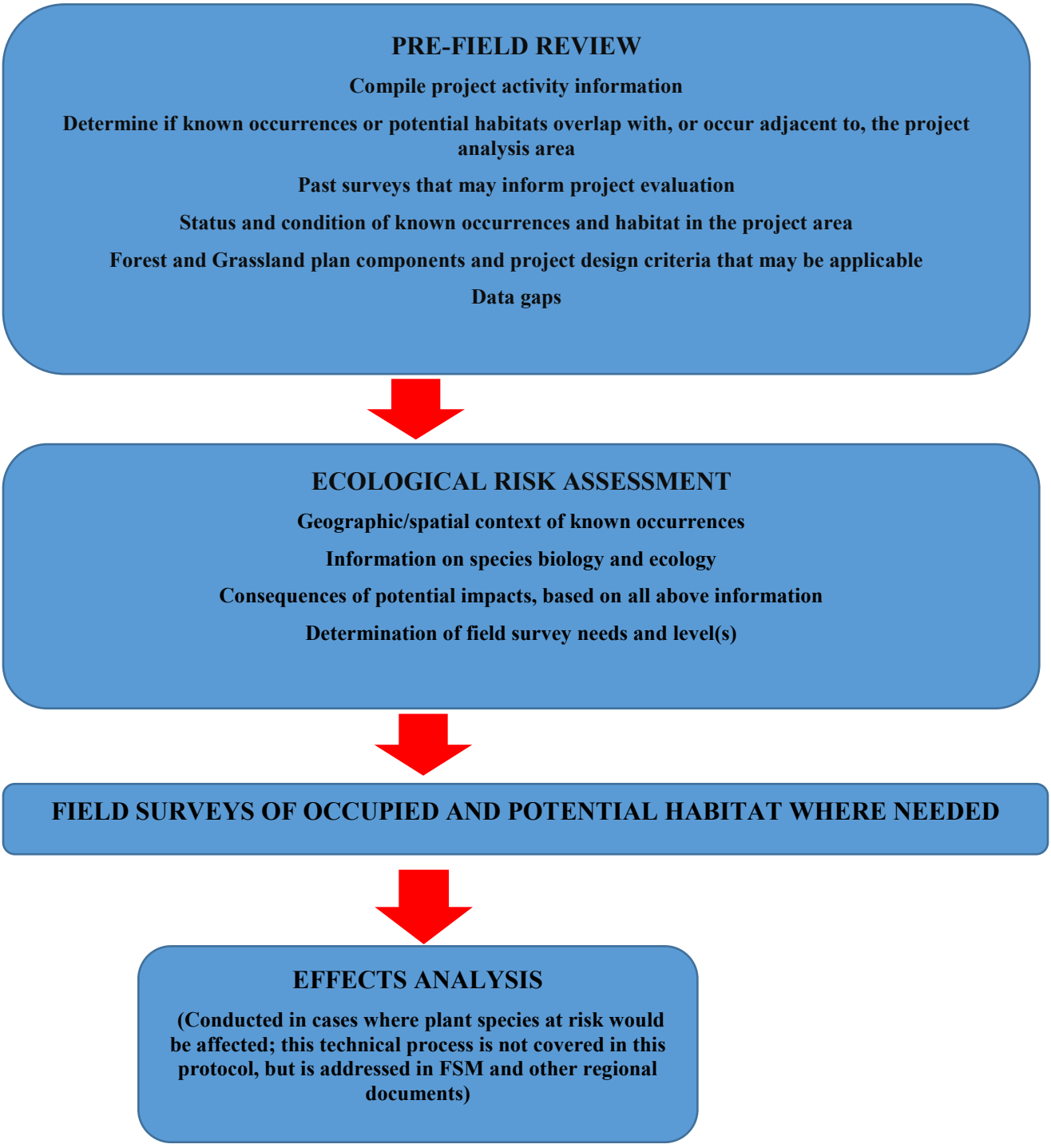


Figure 1. Overview of project evaluation process

A. **Pre-field review** - Assess available information to determine which at-risk plant species or their habitats are known or may potentially occur in a project analysis area.

B. **Ecological risk assessment to determine survey level** - Use pre-field review results and additional data and information to assess the potential risks and benefits to at-risk plant species and to document the survey level needed for evaluating potential effects (see sidebar for examples of data sources and tools).

C. **Field surveys** - Document at-risk plant species in and near project activities, and validate assumptions.

D. **Data entry and accomplishment reporting** to input and retrieve data for analysis.

E. **Specialist reports or other documentation** to disclose the potential effects of the project on documented at-risk plant populations or suitable habitat, including:

   a. Effects determinations.

   b. Project design criteria or mitigation measures to conserve at-risk plant populations, and effectiveness monitoring in cases of uncertainty regarding the criteria or measures.

Data Sources and Tools

Species and habitat accounts

- Available reports on species and/or habitats, including previously completed project-level reports
- Forest/Grassland plan EIS species or habitat accounts
- Flower-timing charts: used to identify appropriate survey time frames when species are most detectable or identifiable

Occurrences

- Online herbarium databases (e.g., http://www.pnwherbaria.org/), Natural Heritage Programs, NatureServe, USDA Plants Database, Fire Effects Information System (FEIS), Biota of North America Program (North American Vascular Flora)

Vegetation models

- FS-Veg, V-map, LiDAR, regional and national GIS and corporate data resources (AGOL, NRM, FSVEG, VMAP, FIA, etc.)
- Suitable habitat models, e.g., http://mtnhp.org/models/
- Habitat guilds
- Site-specific knowledge and judgment of botanists and other resource specialists familiar with the project area

Specialist reports, effects determinations, and development of project design criteria or mitigation measures are not discussed further in this document. Information on completing these steps is provided in FSM 2670 and the sensitive plants chapter in the regional desk guide to effects analysis (1990).

A. Pre-field review

1. Compile Project Activity information

Pertinent information may include the proposed equipment types, methods, timing and locations of activities, and access routes. Information sources include the project initiation letter, scoping document, NEPA small project summary form, and/or GIS layers depicting locations of potential activities, including units/unit numbers where applicable.

2. Determine if known or potential occurrences or habitats overlap with proposed project activities

Several approaches can be used to develop a list of at-risk plant species or their habitats known or suspected to occur within or near the project analysis area:

- **Occurrences:** Use available data sources and tools to document any known occurrences found within or near the project analysis area.
- **Habitat:** Use available aerial imagery, suitable habitat models, remote sensing tools, and professional judgment to document known or potential habitats found within or near the project

analysis area. Assess the quality of the known and potential habitats and the confidence levels associated with the above tools (i.e., level of validation).

- **Project adjacency:** For occurrences and habitats that do not occur within the analysis area, but are near project activities, assess any potential indirect impacts to at-risk plants (e.g., changes in hydrology, changes in invasive species vector pathways, promotion of unauthorized use patterns, etc.) that may occur as a result of the project.
- **Past surveys:** Evaluate the sufficiency of any previous floristic surveys conducted in the project area vicinity, considering such factors as:
    a. How long ago surveys were conducted and appropriateness of survey timing
    b. Qualifications of survey personnel
    c. Whether target survey species and habitats were identified
    d. Intensity or level of previous surveys
    e. Whether habitat and habitat guilds were documented
    f. What changed conditions may have occurred since the last documented survey
    g. Validation needs of data collected
    h. Whether data entry for historic surveys is up to date in databases of record

3. Status/condition:

Assess the status of the known occurrences/habitats within or adjacent to the project activities. Document available information regarding life history characteristics, demography, condition, threats, climate vulnerabilities, sensitivities to disturbance and stressors, etc., using literature, previous monitoring, and other available resources.

4. Forest and Grassland Plan standards and guidelines and other best management practices:

Determine the existing forest/grassland plan standards and guidelines and other documented best management practices that would mitigate impacts to suspected or known occurrences or habitat.

5. Data gaps:

Consider what information is needed to reduce uncertainty for a meaningful evaluation of potential project effects. Document the relevant unavailable or incomplete information, e.g., unknown or new threats or benefits from changed conditions since previous field surveys.

PRE-FIELD REVIEW OUTCOMES

a. Project activity information that is pertinent for analysis regarding at-risk plant species.
b. Determination of the sufficiency of previous field surveys (if conducted).
c. Presence and condition of previously documented at-risk plant occurrences within and adjacent to the project analysis area.
d. Potential species at risk, habitats, or habitat guilds within and adjacent to the project analysis area.
e. Information needs and additional data that would inform the project evaluation.

B. Ecological Risk Assessment

Once a list of known or potential at-risk plant species and habitats specific to the project analysis area is compiled, a risk assessment considers the potential biological and ecological effects of the proposed project on these resources. This assessment is used to determine the

need for field surveys and the level of survey where needed. Individual species, guilds of species that share a common habitat, and the types of management activities can be incorporated in the risk assessment based on project characteristics.

1) Geographic/spatial context of known occurrences

The geographic context of known or suspected occurrences and habitat relative to other occurrences outside the project analysis area, on the national forest or grassland, and range-wide, is an important consideration for risk assessment. Factors such as proximity to other known occurrences or suitable habitat, occurrence size (including number of plants and acres of occupied habitat), status on the specific national forest or grassland, and location of the occurrences in relation to the overall range of the species, should be considered. Habitat conditions in the analysis area are also important. Specific approaches and examples for assessing geographic context are provided in the sensitive plants chapter in the regional desk guide to effects analysis (1990).

2) Information on species biology and ecology

Biological and ecological risks to at-risk plant species are determined by professional evaluation of the pre-field review information to assess 1) the likelihood that proposed activities will impact species at risk or their suitable habitat (e.g., estimated levels of potential disturbance), and 2) the potential consequences of the impacts to species at risk (Table 1; Figure 2).

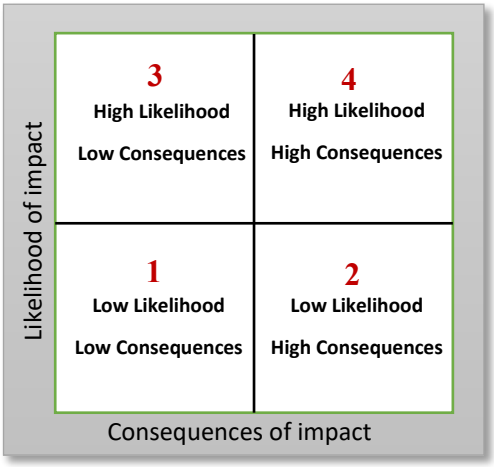


Figure 2. Risk Assessment Matrix

Although some project types may have a narrow scope, such as trail construction, the disturbance level to that specific site may be high. Project analysis and design criteria can then be used to avoid impacts to at-risk plants, for example by moving a trail tread slightly to avoid a population. The disturbance levels in Table 1 are general and it is possible to have some species- or project-specific variations depending on the habitat, life history requirements for individual species, season and location. Some activities have a disturbance level that may not be related to soil disturbance, but is related to direct impacts or stresses to plant populations themselves. This is not a comprehensive list of resource management activities that may be conducted. For any project type not listed in this table, the botanist should determine the disturbance level based on site conditions and the proposed project activity.

Table 1. Estimated Project Disturbance Levels

Disturbance Level				
High	**Moderate to High**	**Low to High**	**Low to Moderate**	**Low**
• Facility construction (campgrounds, administrative sites) • Machine scarification • Mining • Road construction (specified and temporary) • Road decommissioning • Sub-soiling • Timber harvest activities - summer (tractor, whole tree yarding, cut to length, landings) • Machine piling and burning • Fuel break/fireline construction • Trail construction • Dams • Land conversion and exchanges • Conversion of native prairie • Oil and gas development	• Prescribed fire: Broadcast or underburning • Hand piling and burning • Timber harvest activities – skyline • Mechanized pre-commercial thinning (biomass removal, daylighting) • Commercial firewood harvest • Utility line burial (including pipelines) • Road maintenance and reconditioning • Aquatic Organism Passage (AOP) structure installation	• Special Use Projects • Grazing • Hand piling and burning • Herbicide use • Wildlife habitat improvement • Hazard tree removal (roadside, administrative, campgrounds) • Meadow restoration • Post and pole sales • Salvage (fire, disease, insect)	• Timber harvest activities - winter (tractor, skyline, whole tree yarding, cut to length, landings) • Trail maintenance • Utility line maintenance • Road storage • Revegetation – trees, shrubs, and native plant materials • Aspen restoration • Whitebark pine daylighting • Special botanical product collection (boughs, mushrooms, huckleberries, native plants, and seed)	• Carbaryl spraying • Non-mechanized pre-commercial thinning (lop-scatter) • Biological weed control • Facility and sign maintenance • Gate installation

3) Consequences of potential impacts, based on all above information

Using project information, the data and tools described above, and professional judgment, botanists can determine the potential impacts and consequences of project activities to at-risk plant species. The outcome can then be summarized using the risk assessment matrix in Figure 2. Examples of risk assessment outcomes are provided in Appendix B.

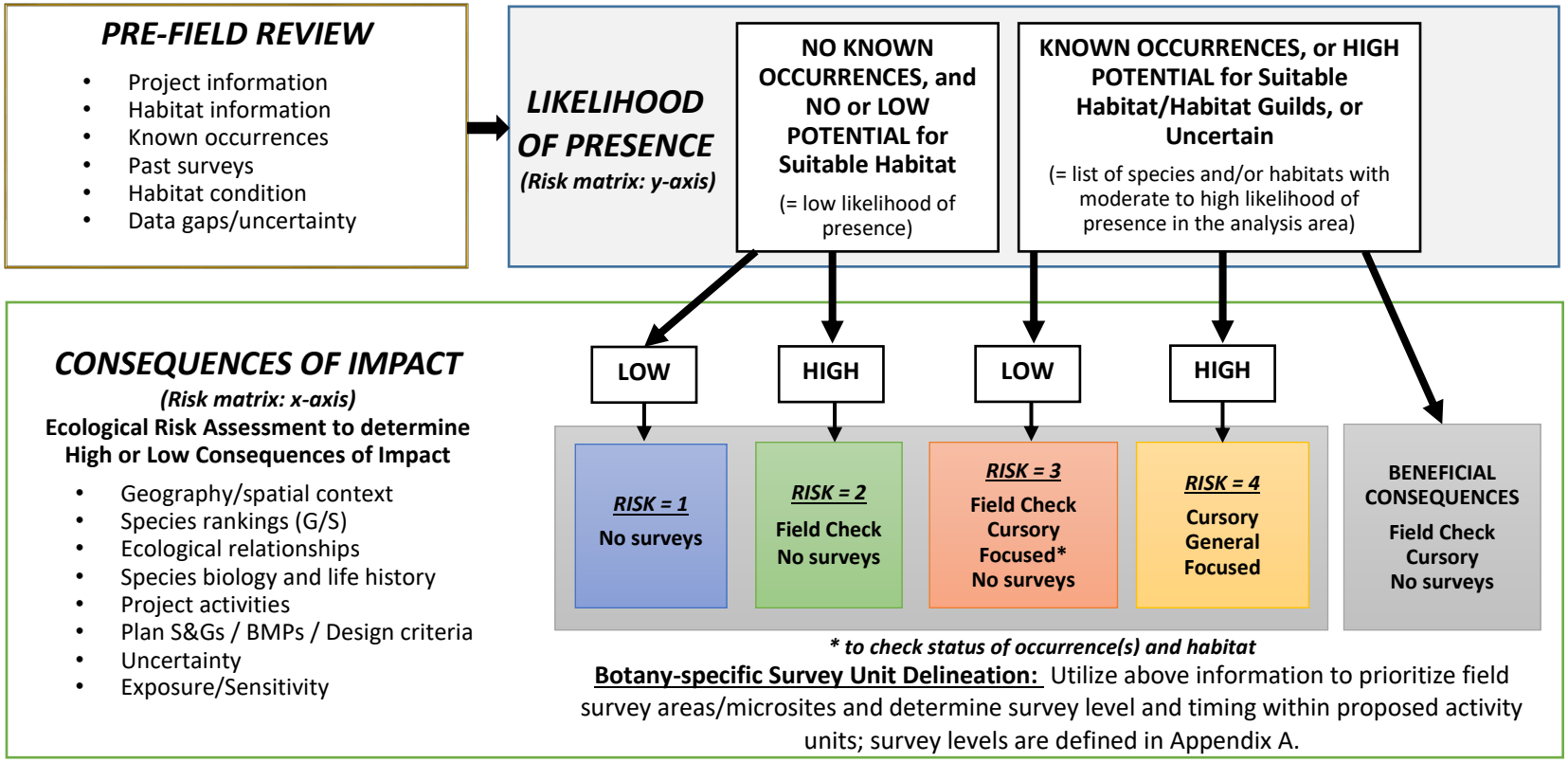
The results from the pre-field review and ecological risk assessment can vary depending on the specifics of a given project proposal, so even in the examples above there may be cases where a different risk matrix outcome could occur.

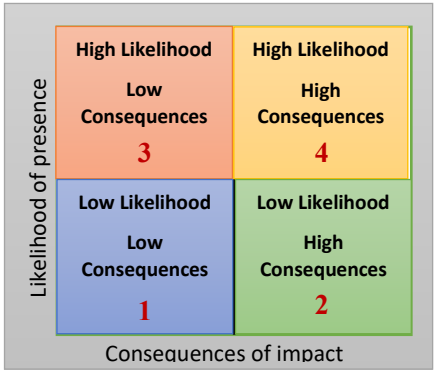
4) Determination of field survey needs and level(s)

Information from the pre-field review and the risk assessment matrix (1, 2, 3, or 4) is used to determine the survey needs and level(s) needed for project evaluations (Figure 3). The known and potential occurrence and habitat information gathered in the pre-field review is used in conjunction with the ecological risk assessment and resulting survey needs determination to prioritize field survey areas with

the highest likelihood of presence and consequences in the proposed analysis area. Appropriate survey timing for each activity unit is based on target species phenology and geographic range. The survey level used in each activity unit is based on the professional judgment of the botanist or qualified surveyor.

Figure 3. Pre-field review and ecological risk assessment to determine field survey level





Risk Assessment Matrix

Notes:

1) **Where more than one survey level is indicated, professional botanical judgment based on project- and species-specific information determines survey level.**
2) **In landscape-scale projects, different survey levels may be indicated for different treatment units or parts of the analysis area.**
3) **During implementation of surveys, the survey level may change to FOCUSED when potential habitat or new occurrences are detected.**
4) **Where beneficial impacts are predicted, no surveys may be needed or a lower survey level may be indicated.**
5) **Where consequences are uncertain, a different survey level may be needed.**

ECOLOGICAL RISK ASSESSMENT OUTCOME:

Documentation of the survey needs and level(s) necessary for project evaluation is compiled. A subset of activity units to be surveyed for at-risk plant species is identified, based on the pre-field review, ecological risk assessment, and survey needs assessment (Figure 4). Target species and habitats, as well as survey timing, are identified for activity units needing botany surveys.

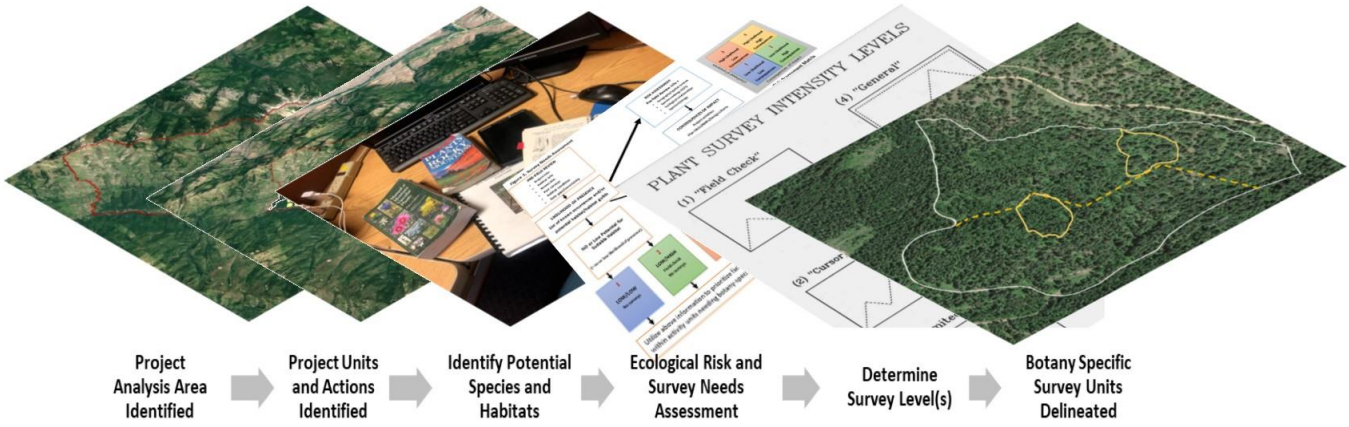


Figure 4: Summary of steps to determine survey needs and level(s) for plant species at risk

C. Field surveys of potential habitat

In most cases, those areas with high potential for impacts and high potential consequences result in a Focused (Intuitive Controlled) survey level. The survey level used in each activity unit is based on the professional judgment of the botanist or qualified surveyor. Qualified botanists (those who meet the qualifications for the GS-0430 series) may train field technicians, contractors, or volunteers to conduct field surveys for plant species at risk. However, a qualified botanist should review and approve the results.

Accomplished acreage per day depends on factors such as habitat quality, drive time, terrain, the number and local experience of surveyors, weather, road conditions, accessibility, documentation, detectability of the target species (size, color, etc.), and unforeseen circumstances.

Compilation of plant species lists during field surveys is important for identifying potential at-risk plant habitat in an area, for compiling general plant species lists for the national forest or grassland, and identifying changes in plant species composition if those areas are repeatedly visited over time. Species lists are also critical for documenting the completeness of the survey work that was conducted and to validate competency of the surveyor. These records are also valuable for future evaluations of survey needs for future project analysis. Each surveyor needs to balance thoroughness and efficiency when compiling species lists for project areas. A floristic approach for documenting surveys is described by Goff *et al.* (1982).

In cases where an analysis area is very large and contains extensive acreage of potential habitat, the botanist or qualified surveyor can determine a method for prioritizing a subset of areas to survey, in order to gauge the likelihood that at-risk plant species occur in the area. Based upon presence or absence of at-risk species within the surveyed subset areas, the botanist or qualified surveyor can then determine whether surveys need to be continued or modified.

D. Data entry and accomplishment reporting

The NRM TESP-IS application is the national database of record for storing botanical survey information and occurrence records of plant species at risk. Project work planning should include time to enter accomplishment reporting of project-related survey and occurrence information in this database. Specific protocols and field forms for recording data on surveys and occurrences is found on the NRM website at http://fsweb.nrm.fs.fed.us/support/docs.php?appname=tesp. Occurrence records are shared with the state natural heritage programs (NHP) via electronic data transfer from NRM TESP-IS. Due to workloads and changes in species at-risk, the NHP databases may not be up to date.

PROJECT IMPLEMENTATION

Results from risk assessment and surveys will inform effects determinations and project design criteria for botanical resources within the project area. Implementing pre-field review, ecological risk assessment and appropriate field survey levels will provide the most informative effects analysis and provide the best opportunity for conservation of at-risk plant populations, as needed to meet both policy and regulatory requirements and agency goals for ecological sustainability.

If the ecological risk assessment determines surveys are needed for effects analysis, and surveys are not conducted prior to a signed decision, the effects analysis should disclose the lack of surveys and data gaps. The effects analysis should be based only on the available information and not on potential future information. If design criteria are included in the decision document to conduct surveys and mitigate identified impacts, post-decision and pre-implementation, then the rationale should be documented based on the risk assessment. The following design criteria are suggestions for line officers and botanists to consider as mitigation for potential impacts when appropriate or when survey completion is not possible due to project timelines and survey windows:

- complete the analysis presuming presence of unsurveyed potential habitat
- avoidance of known populations in the project area
- avoidance of specialized habitats or highly suitable microsites
- adjustment of treatment unit boundaries
- adjustments to treatment types within or near highly suitable habitats or microsites
- adjustments to the tools/equipment, methods, or timing of proposed activities
- completion of any needed botanical survey prior to contract offer

BOTANY ANALYSIS EFFICIENCIES

The Region 1 botany program has developed a tablet-based ArcGIS Online (AGOL) data collection tool for field data collection and download. This geodatabase enables consistent data collection across units, increases fieldwork efficiency, and can readily be used to load data into USFS databases. Other approaches to increase efficiency in project analysis are summarized below and are currently used:

- Stratify potential occurrence for various species or habitat groups in different parts of each national forest or grassland (e.g., using a coarse filter [habitat]/fine filter [species] approach)
- Use a coarse filter approach to determine potential presence of at-risk species based on their association with broader vegetation types or habitats (e.g., mapped sagebrush-steppe habitat for Lemhi penstemon)
- Use predictive habitat models where available, to inform the risk analysis and plan efficient field surveys
- Delineation of areas that do not need surveys because they are already protected under forest

plan components or established design criteria, e.g., riparian management zones and wildlife habitat buffers.

- Pre-field review with available tools (as discussed above) to prioritize highest priority microsites to survey, and to determine appropriate survey level
- Prioritize a subset of areas to survey in extensive project areas, especially in cases where there is extensive suitable habitat
- Early identification of known populations, botanical "hotspots," or at-risk plant communities to narrow survey needs
- Stratify portions of project areas by degree of potential impact risk (e.g., prescribed fire areas may be lower risk than sites with ground-disturbing activities)
- Assess ecological and life history characteristics of at-risk species, to evaluate their vulnerability or tolerance to various management activities
- Coordinate with other resource program areas for survey assistance where appropriate (e.g., whitebark pine)
- Consult with other resource specialists who can help identify areas with specialized habitats (e.g., wetlands, fens, or riparian areas) to narrow survey areas
- Use online technical tools such as the Fire Effects Information System (FEIS), especially for projects involving fire use
- A regional list of potential design features can be developed to help provide consistency across the region

CONDITION-BASED NEPA

Condition-based management clearly identifies the management actions that will be undertaken, and any design elements that will be implemented, when a certain set or range of conditions are present. The NEPA analysis should disclose the potential effects of condition-based actions, including consideration of design criteria that limit such actions. Such proposals or alternatives must also describe the process by which conditions will be validated prior to implementation. By using the methods outlined above for pre-field review and efficient field surveys, botanical resources can be effectively incorporated in all phases of condition-based NEPA analysis.

Botanists can coordinate with the deciding official regarding the most appropriate way to conduct background review, field surveys and GIS analysis of proposed implementation areas to confirm that activities can be implemented consistent with the decision document and in compliance with applicable laws, regulations and policies. Surveys confirm location-specific conditions and the results may be used to refine activity design criteria, identify the need for additional mitigation measures, and/or result in a modification of the activity location or timing.

STRATEGIES FOR BOTANY INTEGRATION IN PROGRAMS OF WORK AND PROJECT PLANNING

When project timelines are short, effective coordination with botanists and other resource specialists is needed for timely integration. Specific approaches to increase efficiency in project review and analysis for at-risk plant species and habitats include the following:

- Botanists are engaged in developing programs of work, ID team meetings, and NFMA analyses.

- Advanced coordination occurs a season ahead where possible, and during all phases of project development, including changes to project design, to enable botanists and qualified surveyors to meet NEPA requirements and timelines, especially for large landscape areas. Lead time allows for efficient and effective pre-field review, risk analysis, and initial surveys.

- As funding allows, conduct broad-scale botanical surveys in advance, targeting areas with the highest likelihood for species at risk, to provide data for future project proposals. For example, a watershed that is likely to have proposed vegetation management could be analyzed and surveyed, without project boundaries identified.

- Botany services are acquired through collaboration where feasible. Collaboration with state agencies and other partners is providing an additional means for increasing efficiency in project analysis and NEPA efficiency. For example, under the Good Neighbor Authority (GNA) botany surveys are conducted by staff with the Montana Department of Natural Resources and Conservation during early phases of project development. This collaborative work greatly enhances timely project review and analysis.

- Foster relationships and provide training to resource program colleagues, so they can help with identification of potential habitats for species at risk.

- Continued support of the Region 1 AGOL application and technology tools (tablets).

- This protocol will help to increase efficiencies in the NEPA process. It provides relevant information on streamlining NEPA analysis for at-risk plants and their habitats, using a reasoned process, to make informed recommendations for appropriate survey needs and design criteria options for line officer consideration. This consistent and adaptable protocol presents options for botanists and line officers. The process increases understanding between line officers and botanists on what are reasonable and minimum information needs to ensure consistency with applicable laws, regulations and policies.

Summary

Use of the methods and tools outlined in this protocol, especially regarding risk analysis and prioritized field surveys, increases efficiency in addressing botanical resources in project design and implementation. Use of scientific integrity in analysis for at-risk plants is also critical to reduce the potential for objections or litigation and additional listing of species as threatened or endangered. This protocol provides a framework for helping to meet the USFS goals for conserving at-risk plant species and their habitats.

REFERENCES

Elzinga, C.L., D.W. Salzer, and J.W. Willoughby. 1998. Measuring and Monitoring Plant Populations. BLM Technical Reference 1730-1. Denver, Colorado.

Goff, F.G., G.A. Dawson, and J.J. Rochow. 1982. Site examination for threatened and endangered plant species. Environmental Management 6: 307-316.

USDA Forest Service. 1990. Desk Guide – Our Approach to Effects Analysis. USDA Forest Service, Region 1. Missoula, Montana.

USDA Forest Service. 2005. Forest Service Manual 2670. USDA Forest Service, Washington, D.C.

USDA Forest Service. 2016. NRM: Threatened, Endangered, Sensitive Plants – Invasive Species - (TESP-IS) User Guide. 318 pages. Accessed at: http://fsweb.nrm.fs.fed.us/support/index.php

APPENDIX A. SURVEY LEVELS

This system of defining field survey levels was originally developed in USFS Region 6 in 1990, and is included in the NRM Threatened, Endangered, Sensitive Plants – Invasive Species (TESP-IS) application user guide (http://fsweb.nrm.fs.fed.us/support/docs.php?appname=tesp). When used with a risk assessment as described in this protocol, the need for field surveys in a given project area or treatment unit can be defined, and the level determined in cases where surveys are indicated.

Survey Level	Description
Field Check	In a Field Check, the survey area is given a quick "once over" but the surveyor does not walk completely through the project area. The entire area is not examined.
Cursory	A Cursory survey is appropriately used to confirm the presence of species of interest identified in previous surveys or in the pre-field analysis. By its nature, the cursory survey is rapid, and does not provide in-depth habitat information. The entire area is traversed at least once. For example, stand condition as seen in aerial photography can be verified by a cursory survey. Also, a cursory survey can be used to determine if a plant population that had been previously documented at a site remains present or intact.
General	The survey area is given a closer review by walking through the area and its perimeter or by walking more than once through the area. Most of the area is examined.
Focused (Intuitive Controlled)	The Focused, or Intuitive Controlled, survey is the most commonly used and most efficient method of surveying for at-risk plants. During pre-field analysis, potential suitable habitat is identified for each species of interest and the survey effort is focused in those areas. This method requires adequate knowledge of suitable habitat in order to accurately select the areas for focused surveys. When conducting intuitive controlled surveys, an area somewhat larger than the identified suitable habitat should be surveyed to validate current suitable habitat definitions.
Random	Random surveys employ an undirected, typically non-linear, traverse through a project area. They are employed either when there is inadequate natural history information about a species to discern its suitable habitat and the surveyor is simply surveying for occurrences, or when a target species is very abundant within a search area and the surveyor is attempting to make estimates of population parameters such as intra-patch variations in density or the occurrence of predation or herbivory. However, a stratified random survey may be more effective in these latter cases.
Stratified Random	The Stratified Random survey is most often used within known population areas of target species, or when an area to be surveyed is of unknown habitat suitability and is relatively large. Stratified random surveys employ a series of randomly selected plots of equal size within a project area that are each thoroughly surveyed for target species. When conducting a stratified random survey, it is important to sample an adequate number of plots that are of sufficient size if statistical inference regarding the survey area is desired (for discussion of sample designs, see Elzinga *et al.* [1998]).
Systematic	The Systematic survey is typically used in limited areas where the likelihood of occurrence of a target species may be evenly distributed throughout the survey area. Systematic surveys are often employed either within focused search areas (e.g., stratified random and intuitive controlled methods), or when a proposed project is likely to produce significant habitat alterations for species that are especially sensitive to the proposed activities.

APPENDIX B. RISK ASSESSMENT EXAMPLES

Brief examples of risk assessment outcomes for at-risk plant species are described below:

Example 1: Clustered lady's-slipper (*Cypripedium fasciculatum*), a perennial orchid species often associated with mixed conifer stands having a moderately open understory.

Impact Potential: Some projects that have a likelihood of impacting the species include mechanical thinning or harvest and prescribed burning. Vegetation management that leaves some canopy intact may not be detrimental to the populations if partial shade is retained, whereas complete canopy removal will likely not be tolerated by the species. With respect to fire, low intensity burns that do not overheat the upper soil layer can actually benefit the species by reducing competition and providing a nutrient increase, but high intensity fire has been shown to remove populations due to lethal heating of the root system.

Risk Assessments:

1. *Risk Level 3*: Known/High Likelihood for occurrences AND Low Impact
   Activities in project areas where there are known occurrences or there is a high likelihood of plants or suitable habitat present, but that involve low intensity burns or carefully designed partial thinning, may have low consequences of impact to the plants (level "3" in Figure 2). Depending on the specifics of the project, some level of field survey (field check, cursory, or focused [intuitive controlled]) may be indicated, although no surveys may be necessary if in the professional judgment of the botanist the consequences of impact are likely to be very low or mitigation measures are applied.
2. *Risk Level 4*: Known/High Likelihood for occurrences AND High Impact
   Projects with known occurrences or a high likelihood of plants present, and where fire intensity may be high or canopy removal will occur, suggest a higher likelihood of impacts with adverse consequences (level "4" in Figure 2). Cursory, general, or focused (intuitive controlled) surveys would be needed in these cases.
3. *Risk Level 2*: Low Likelihood of occurrences AND High Impact
   If there is a low likelihood of occurrences or suitable habitat in a project area but high potential consequences of impact based on the proposed activities (level "2" in Figure 2), a field check may be appropriate to confirm assumptions about the presence of suitable habitat, or no surveys may be needed.

Example 2: Lodgepole pine habitat

Many vegetation management projects in Region 1 involve thinning or harvest in lodgepole pine (*Pinus contorta*) stands. These stands generally do not represent potential habitat for at-risk plant species.

Risk Assessment:

1. *Risk Level 1*: Low Likelihood of occurrences AND Low Impact
   The likelihood of presence of such species or their habitat is low, and the potential consequences of impact to any at-risk plant occurrences or habitat is also low (level "1" in Figure 2). Typically, no field surveys would be needed in such cases.

Example 3: Peatlands (fens)

Peatlands (fens) in Region 1 provide habitat for a number of at-risk plant species that are found only in these ecologically specialized wetland habitats.

Impact Potential: While impacts to areas adjacent to these habitats could adversely affect the hydrological characteristics important to the persistence of the fens, and thus to the group ("guild") of associated plant species, land management plan standards and guidelines and other best management practices (BMPs) typically provide for buffers around them.

Risk Assessment:

1. *Risk Level 3*: Known/High Likelihood for occurrences AND Low Impact
   As such, while the likelihood of occurrence of at-risk plant species is high in peatlands, the likelihood (and therefore the consequences) of impact will most often be low (level "3" in Figure 2). Assuming implementation of mitigation measures or BMPs, field surveys might not be needed. Field check, cursory, or focused (intuitive controlled) surveys of the fen habitat may be appropriate in some cases though, e.g., to assess the current condition of the habitat or any known occurrences of at-risk plant species.

Note: The results from the pre-field review and ecological risk assessment can vary depending on the specifics of a given project proposal, so even in the examples above there may be cases where a different risk matrix or survey level outcome could occur. Also, these examples are abbreviated to provide a general idea of the protocol process and potential outcomes; complete pre-field review, ecological risk assessment and survey level determination will typically be more detailed.