USDA
United States Department of Agriculture

Guidance for Invasive Species Management in the Southwestern Region

Forest Service
Southwestern Region
TP-R3-16-34
Revised November 2019

Cover: Yellow bluestem (*Bothriochloa ischaemum*) during late growing season on the Sierra Vista Ranger District, Coronado National Forest. The invasive grass is in a near-monoculture condition after expanding over an area burned during the Ryan fire in 2002. Monocultures of yellow bluestem can lower biodiversity of native plant communities as well impact livestock grazing. Photo courtesy of Allen White, Region 3 Coordinator for Invasive Species and Pesticides.

Citation: USDA Forest Service. 2019. Guidance for invasive species management in the Southwestern Region. US Dept. Agric., Forest Serv., Southwestern Region. TP-R3-16-34. Albuquerque, NM.

Guidance for Invasive Species Management in the Southwestern Region

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List of Commonly Used Acronyms

BAER	Burned Area Emergency Response
BMP	best management practice
CWMA	Cooperative Weed Management Area
EDRR	Early Detection and Rapid Response
EO	Executive Order
FSH	Forest Service Handbook
FSM	Forest Service Manual
FSM Supp.	Forest Service Manual Supplement
FY	fiscal year
HUC	Hydrologic Unit Code
NEPA	National Environmental Policy Act
NF	National Forest
NFS	National Forest System
NPDES	National Pollutant Discharge Elimination System
ROW	right-of-way
S&PF	State & Private Forestry
TESP-IS	Threatened, Endangered, Sensitive Plants, and Invasive Species

Forest Service Management of Invasive Species

Under Executive Order 13751, an invasive species means, with regard to a particular ecosystem, a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health.[1] Policy in Forest Service Manual (FSM) 2900 - INVASIVE SPECIES MANAGEMENT states that all US Forest Service (USFS) management activities must be designed to minimize or eliminate the possibility of establishment or spread of invasive species on the National Forest System (NFS) or to adjacent areas. FSM 2903 stipulates that actions must be initiated, coordinated, and sustained to (1) prevent, control, and eliminate priority infestations of invasive species in aquatic and terrestrial areas of the NFS by using an integrated pest management approach, and (2) collaborate with stakeholders to implement cooperative invasive species management activities in accordance with law and policy. When applicable, invasive species management actions and standards must also be incorporated into resource management plans at the forest level, and in programmatic environmental planning and assessment documents at the Regional or national levels (FSM 2903).

This guidance is intended to assist USFS invasive species and pesticide-use coordinators in the Forest Service's Southwestern Region (Region 3) who are responsible for invasive species management on NFS lands. It may also be used by personnel in other USFS programs or agencies for planning purposes. Although the primary focus of the guidance is on invasive weed management, other invasive species currently found in the Region are also addressed. The Regional Invasive Species/Pesticides Coordinator in Albuquerque may be contacted at (505) 842-3280 for information pertaining to this guide. Additional direction and sources of information for Forest Service management of invasive species include–

- National and Regional direction for invasive species management

  Forest Service Manual (FSM) 2900

  FSM R3 Supplement (Suppl.) 2900

- National and Regional direction for pesticide use

  FSM 2150 and Forest Service Handbook (FSH) 2109

  FSM R3 Suppl. 2150

- Forest Service programs for invasive species

  Invasive Species (http://www.fs.fed.us/invasivespecies/index.shtml)

  Invasive Species, Pests, and Diseases (https://www.fs.fed.us/science-technology/invasive-species-pests-disease)

[1] Executive Order 13751 - Safeguarding the Nation from the Impacts of Invasive Species of December 05, 2016 amended E.O. 13112 - Invasive Species, which was previously issued February 8, 1999.

- Region 3 website for invasive species

  Invasive Species (http://www.fs.usda.gov/main/r3/forest-grasslandhealth/invasivespecies)

National Goals and Objectives

The *USDA Forest Service Strategic Plan: FY 2015–2020* includes–

Strategic Goal - Sustain Our Nation's Forests and Grasslands

Strategic Objective A. Foster resilient, adaptive ecosystems to mitigate climate change

Means and Strategies

Maintain resilient land and water conditions at the watershed level and restore deteriorated lands and waters (such as abandoned mine lands and areas of unmanaged recreation use needing rehabilitation).

Develop and apply detection, prediction, prevention, mitigation, treatment, restoration, and climate adaptation methods, technologies, and strategies for addressing disturbances such as wildfire, human uses, **invasive species**, insects, extreme weather events (e.g., storms), and changing climatic conditions.

The Strategic Plan's objective of fostering resilient, adaptive ecosystems by (1) maintaining resilient land and water conditions and (2) addressing disturbances such as invasive species may be achieved by integrating the following four key elements of invasive species management across programs and business areas:

1. **Prevention** – Actively prevent the introduction and spread of invasive species into U.S. forest and rangeland ecosystems.

2. **Detection** – Find, identify, and quantify new infestations of aquatic or terrestrial invasive species prior to establishment as sustainable, expanding populations.

3. **Control and Management** – Identify and prioritize which invasive species will be controlled and implement effective management plans for priority species.

4. **Rehabilitation and Restoration** – Attempt to rehabilitate or restore degraded areas to an appropriate proper ecological function that will prevent new invasive species infestations or prevent reoccurrence of invasive species after removal.

Regional Priorities

Overall priorities for managing invasive species in Region 3 include these action items:

- Maintain a cadre of trained coordinators and applicators sufficient for invasive species management and pesticide use across all national forests and grasslands.
- Complete inventories of invasive species and increase the number of treated/monitored acres relative to meeting stated treatment goals and objectives for these species.
- Develop weed management plans and implement treatment projects that can eradicate, contain, and/or control prioritized invasive weeds in accordance with forest planning for watershed restoration, desired conditions, and other resource-related management goals.
- Establish or support Cooperative Weed Management Areas (CWMAs) or allied organizations like Soil and Water Conservation Districts (SWCDs) as appropriate to address invasive weed management on all NFS lands as well as neighboring lands.
- Cooperate with other agencies and governments in supporting successful management programs for invasive species.
- Increase partnerships through outside partnership agreements and funding to maximize effectiveness and efficiency of treatment projects on priority landscapes.
- Reduce the number of terrestrial and aquatic ecosystems at risk through education and prevention activities.

Coordinator and Line Officer Responsibilities

Invasive Species Coordinators

Responsibility for management of invasive species on NFS lands is shared between invasive species coordinators and personnel from associated programs such as wildlife biologists, fishery biologists, range specialists, wilderness specialists, etc. Technical assistance for treating certain invasive species with pesticides may be provided by pesticide-use coordinators. Although invasive species coordinators are primarily responsible for invasive plant management on NFS lands, personnel designated as invasive species coordinators are also expected to serve as overall coordinators across all taxa of invasive species. Depending on the level of expertise, specialists from other Forest Service programs may have the lead for managing certain invasive species such as management of invasive aquatic or terrestrial animal species by wildlife biologists. In addition to native forest pests, the Region's Forest Health Protection (FHP) program is responsible for survey and monitoring of invasive forest pathogens and insects.

Forest Invasive Species Coordinator: The Forest Invasive Species Coordinator has lead responsibility for coordinating management activities for invasive species on the forest. These responsibilities include–

1. Maintaining contact and familiarity with all invasive species activities on the Forest, which includes surveying, inventory, treatment, and monitoring.

2. Providing technical assistance and direction to Forest staff for invasive species management in accordance with current Federal, State, and Forest Service laws and/or regulations.

3. Implementing measures associated with invasive species management in forest plans and other resource management and project-level plans.

4. Collecting and reporting information related to invasive species infestations, impacts, and management activities occurring on NFS lands. This includes reporting all invasive species survey, inventory, and treatment activities for the forest into the FACTS database of record by using the required TESP-IS (Threatened, Endangered, Sensitive Plants, and Invasive Species) software application.

5. Developing and updating as necessary lists for priority invasive plants and weed management plans that can be used to implement management strategies for eradication, containment, or control of invasive species.

6. Developing and prioritizing treatment projects for invasive plants and, as appropriate, applying these projects to overall forest goals of watershed restoration, desired conditions, or wilderness stewardship.

7. Ensuring that at least 50 percent of acres treated annually on the forest are monitored.

8. Preparing or supporting district preparation of an annual budget to incorporate invasive species management in all priority forest or district restoration projects and submitting it during the budget cycle.

9. Developing and managing annual forest WorkPlan for invasive species program management.

10. Coordinating with Forest Service leadership, other Forest Service program areas, State and local agencies, tribes, and landowners in control and restoration efforts associated with invasive species management.

11. Maintaining working relationships with committees, districts, boards, and other organizations at the State or local level that are involved with managing invasive species.

District Invasive Species Coordinator: Responsibilities for district-level invasive species coordinators are similar to those of forest invasive species coordinators. District invasive species coordinators should assist the Forest Invasive Species Coordinator in activities such as treatment, data collection, and monitoring. The District Invasive Species Coordinator should also participate in district-level activities such as providing input to WorkPlan and working with local organizations involved with invasive species management.

Pesticide Coordinators

Pesticide coordinators are responsible for coordinating pesticide uses across their area of responsibility on the Forest and providing advice and assistance to Forest Service personnel on pesticide issues. To retain authority in approving pesticide uses not specifically excluded in FSM 2150.44, line officers must maintain expertise at the unit level by designating a Pesticide Coordinator who has been trained in pesticide use and certified (licensed) by the respective State licensing agency (FSM R3 Supp. 2150). FSM R3 Suppl. 2155.2 requires Regional employees, partnering workers, and volunteers to have a current pesticide license from their respective State licensing agency if their duties entail one of the following:

1. Serving as a Pesticide Coordinator or Fisheries Biologist for their Forest or District with the responsibility of developing or reviewing Pesticide-use Proposals (PUPs).

2. Handling, mixing, loading, or applying pesticides (any general-use pesticide, restricted-use pesticide, or biopesticide) in the absence of onsite supervision by a licensed R3 employee.

3. Supervising pesticide applications by other personnel.

Properly trained Forest Service employees (including seasonal applicators and project workers), partnering workers, and volunteers do not require a pesticide license for projects that (1) involve only general-use pesticides and (2) are supervised onsite by a licensed R3 employee. Contractors, permittees, and special-use holders applying pesticides on NFS lands or lands administered by the Forest Service must be licensed with the State(s) in which that Forest or USFS-administered land is located.

Forest Pesticide Coordinator: The Forest Pesticide Coordinator has lead responsibility for coordinating pesticide activities for the forest. These responsibilities include–

1. Ensuring that safety requirements for pesticides are met by

    a. Acquiring training and any necessary certification in the proper application and safe use of pesticides that will be used during a pesticide project.

    b. Preparing and implementing a safety plan for all pesticide-use projects except for

        i. Housekeeping-type uses;

        ii. Minor uses of less than one pound active ingredient for any one project (except for use of any amount of sodium cyanide, strychnine, or other products of concern that require a safety plan); or

        iii. Fish restoration projects with a piscicide where a safety plan has been completed beforehand by a State game and fish agency.

    c. Purchasing and using protective clothing and equipment prescribed on the pesticide label or otherwise required by the Forest Service or a Safety Data Sheet (SDS).

    d. Bi-annually inventorying and properly storing pesticides in non-flammable, self-contained storage areas that are in compliance with FSH 2109.14, Chapter 40 - STORAGE, TRANSPORTATION, AND DISPOSAL.

    e. Immediately reporting every pesticide incident or accident to line management and then forwarding any required reports to the Regional Safety Manager including a written report in compliance with FSH 2109.14, Chapter 70 - FORMS, REPORTS, AND PUBLICATIONS.

    f. Training forest personnel in the proper application and safe use of pesticides.

    g. Permitting use of restricted-use pesticides only by certified personnel or those under the direct supervision of a certified applicator.

    h. Approving contracts only with applicators who are licensed in the State(s) where pesticide treatment will occur.

2. Maintaining a current list of certified applicators and their pesticide license numbers for the forest. The list should be forwarded to the Regional Invasive Species/Pesticides Coordinator upon request.

3. Completing and approving Pesticide-Use Proposals (Form FS-2100-2) according to direction found in FSH 2109.14, Chapter 70 whenever pesticides are proposed for use. A Pesticide-Use Proposal (PUP) must be sent to the Regional Forester for review and approval or disapproval if it involves

    a. Any pesticide use in wilderness, which includes wilderness study areas;

    b. Any pesticide use in established or candidate research natural areas; or

    c. Any use of any amount of sodium cyanide.

4. Ensuring that

    a. A post-treatment evaluation report is completed within nine months after finishing a pesticide project; and

    b. If warranted, monitoring occurs after completion of a pesticide project.

5. Completing forms and reports necessary for compliance with regulations of EPA's National Pollutant Discharge Elimination System (NPDES) program. This includes Notices of Intent (NOIs), pesticide discharge management plans (PDMPs), and annual reports as required by EPA or individual State EPAs.

6. Advising and assisting Forest Service field units on

    a. Preparation and review of documents associated with environmental analysis, appeals, and litigation dealing with pesticide use; and

    b. Interpretation of pesticide laws and Executive orders, Departmental directives, and Forest Service direction on pesticide use.

7. Coordinating with invasive species managers, fishery biologists, foresters, and other forest pesticide users in compiling pesticide use information for all invasive species treatments that will be recorded in the FACTS database.

8. Coordinating with other agencies and organizations with an interest in Forest Service pesticide-use activities.

District Pesticide Coordinator: Responsibilities for district-level pesticide coordinators are similar to those of forest pesticide coordinators. However, the Forest Pesticide Coordinator has lead responsibility for (1) maintaining a current forest-wide list of certified pesticide coordinators and applicators, and (2) preparing and submitting required NPDES documents to EPA or State EPA agencies. District pesticide coordinators should coordinate with the Forest Pesticide Coordinator before submitting a PUP to the Forest Supervisor or Regional Forester

Line Officers

Invasive species

As directed under FSM 2904, line officers in the Forest Service are required to–

1. Appoint staff to coordinate invasive species management activities in accordance with law and policy.

2. Maintain working relationships with the State or local invasive species or noxious weed management committees, districts or boards, and other invasive species stakeholder organizations.

3. Establish, as appropriate, agreements and memorandums of understanding with other Federal and State agencies, non-government organizations, Tribes, and other partner organizations to address invasive species issues. Foster collaborative efforts such as "cooperative weed management areas", "cooperative invasive species management

areas", and similar collaborative partnerships to address invasive species across the landscape.

4. Prevent the introduction and establishment, as well as providing for the containment and suppression, of aquatic and terrestrial invasive species, and coordinating with State and local agencies, Tribes, and landowners in the prevention, control, and restoration efforts associated with the management of invasive species. Outbreaks and newly detected infestations should be reported promptly.

5. Collect, maintain, and report information related to invasive species infestations, impacts, and management activities (including inventories, surveys, assessments, treatments, and treatment efficacy) occurring on the national forest or grassland and associated program performance and accountability information, in compliance with national invasive species program protocols, criteria, rules, and requirements.

6. Identify and record the spatial extent of site-specific invasive species treatment activities, and monitoring invasive species treatments to determine efficacy and evaluate impacts to effected resources. Collect and maintain treatment records and associated spatial information in the national database of record in compliance with national invasive species program protocols, rules, and requirements.

7. Implement the elements, activities, and measures associated with invasive species management in Forest Land and Resource Management plans, Forest Environmental Management System plans, and other resource management and project-level plans.

8. Determine the risk of invasive species introduction or spread as part of the project planning and analysis process for proposed actions, especially for ground disturbing and site altering activities, and public use activities.

9. Ensure that staff are properly trained on invasive species management consistent with national and regional, and State requirements, including training programs associated with invasive species record keeping, integrated pest management techniques, invasive species inventory and treatment monitoring, and other invasive species related training.

10. Collaborate with internal and external partners to develop public information and educational materials/ programs to increase the awareness and understanding of aquatic and terrestrial invasive species, their biology, impacts, and management.

11. Cooperate with State governments and Tribes to implement and enforce applicable regulations, plans, and guidance on invasive species management across the forest or grassland, which includes but is not limited to:

    a. State regulations related to prevention and control of aquatic and terrestrial invasive species (and noxious weeds);

    b. State regulations associated with utilizing, storing, transporting, or certifying invasive species-free (and/or noxious weed-free) straw, hay, mulch, gravel, forage, seed, or other materials;

c. Statewide aquatic nuisance species management plans, fish and wildlife management plans, early detection and rapid response plans, or other statewide or regionwide invasive species management plans affecting the respective forest or grassland.

12. Issue orders, rules, or other regulations under the authority of 36 CFR (Parts 221, 222, 228, 241, 251, 261, 290, 292, 293, 296, and 297), Departmental Regulation 1512-1, and consistent with national or regional policy, to prevent and control the introduction and spread of aquatic and terrestrial invasive species (including noxious weeds), when necessary.

13. Coordinate and cooperate with State and county agencies, Tribes, non-government organizations, and adjacent landowners in invasive species prevention, early detection and rapid response, control and containment, restoration and rehabilitation, and inventory and monitoring activities.

14. Ensure that contracts and permits contain clauses and specifications requiring the implementation of measures to prevent, control, and/or contain aquatic or terrestrial invasive species (including noxious weeds) and restoration measures to offset associated impacts. Oversee contract and permit administration to ensure compliance with the invasive species provisions.

Pesticide use

In Region 3, forest supervisors are required under FSM R3 Suppl. 2150.47 to appoint a trained and certified (i.e., licensed) forest pesticide coordinator who is responsible for (1) coordinating pesticide uses, (2) reviewing Pesticide-use Proposals (PUPs), and (3) providing advice and assistance to line officers. District-level pesticide coordinators may also be designated as needed by line officers for review of PUPs providing that the coordinator has also been trained and certified (FSM R3 Suppl. 2150.47). Other responsibilities for line officers as directed under FSM 2150.47 and FSM Region 3 Suppl. 2150.47 include–

1. Ensuring that Forest Service personnel responsible for conducting or directly supervising pesticide applications within the forest and district are properly trained or certified.

2. Ensuring compliance with Forest Service requirements for pesticide-use management and coordination, national handbook guidance, and laws, regulations, and Executive orders related to pesticide use.

3. Preparing appropriate environmental analyses, assessments, plans, and other documents required under NEPA and NFMA for forest or district pesticide-use planning efforts and decisions.

4. Ensuring that complete and accurate records are collected and maintained for pesticide-use activities occurring on areas or facilities administered by the Forest Service within the forest or district as required.

5. District rangers must coordinate the preparation of PUPs for all proposed uses of pesticides within the district, including uses by licensees, permittees, grantees, States, and other Federal agencies. District rangers must review, and approve or disapprove, those

PUPs for which they have been delegated authority. Forest supervisors must review, and approve or disapprove, PUPs for which they have authority. District rangers and forest supervisors must review, consolidate, and forward the remaining PUPs not under their authority to the Regional Forester for review and approval or disapproval.

Invasive Species in Region 3

Invasive Species Taxa

Major invasive species currently found on NFS lands in Region 3 include both terrestrial and aquatic invasive species of pathogens, plants, invertebrates, and vertebrates. Sources of information on general locations of invasive species relative to individual national forests and grasslands in Region 3 include–

- *Review and Assessment of Programs for Invasive Species Management in the Southwestern Region, 2015* (http://www.fs.usda.gov/main/r3/forest-grasslandhealth/invasivespecies)
- *Arizona Game & Fish Department Director's Order 2 – Designation of Waters or Locations Where Listed Aquatic Invasive Species Are Present* (https://s3.amazonaws.com/azgfd-portal-wordpress/azgfd.wp/wp-content/uploads/2018/12/06155757/2018-DO-2.pdf)

Pathogens

There are a variety of parasites and diseases of plants and animals that currently exist in the Southwestern Region. Some of those with the highest impacts are described below. In general, the best methods to limit spread of pathogenic organisms are to (1) practice sanitation procedures such as disinfection of vehicles and equipment and (2) prevent movement of infected individuals, contaminated materials, or water from areas where outbreaks have occurred.

Plant: White pine blister rust (WPBR) is currently spreading in five-needled pine species across Region 3. The three main susceptible species are southwestern white pine (*Pinus strobiformis*), limber pine (*P. flexilis*), and Rocky Mountain bristlecone pine (*P. aristata*). Species in the genus *Ribes* (gooseberry, currants, etc.) serve as alternate hosts during the life cycle of *Cronartium ribicola*, which is the rust fungus responsible for WPBR. Disease-resistance to WPBR has been identified in various populations of southwestern white pine, and surveys are now being conducted region-wide to determine the extent of this disease resistance. Further information on white pine blister rust may be found in the *Field Guide to Insects and Diseases of Arizona and New Mexico Forests* (http://www.fs.fed.us/r3/resources/health/field-guide/), which may be obtained as a hard copy from Forest Health staff at zone offices located in Flagstaff, AZ (928-556-2075) or Albuquerque, NM (505-842-3288). Forest pathologists in the Forest Health program of the Forest Service's State & Private Forestry (S&PF) branch may be contacted at zone offices for more specific information or technical assistance.

Fish: The myxosporean parasite *Myxobolus cerebralis* causes whirling disease in juvenile trout and is a major threat to cold water fisheries in Region 3. The pathogen is currently found on the Santa Fe NF but could easily be transported to watersheds on other national forests. Whirling disease impacts juvenile fish by causing skeletal deformation and neurological damage. Sanitation measures such as cleaning fishing equipment and preventing transportation of fish or spores from one water body to another can help protect against cross-contamination of waterways. Fishery biologists at the forest or Regional Office level have responsibility for whirling disease management on NFS lands and should be contacted for further information.

Amphibian: As an etiologic agent, the chytrid fungus (*Batrachochytrium dendrobatidis*) can induce mortality and subsequent population declines in amphibians. The fungus is currently

affecting amphibians on the Gila NF and possibly other NFS lands in Region 3. Apart from sanitation measures taken to stop the spread of this pathogen, selection and propagation of disease-resistant stock of affected species may be the only strategy in mitigating impacts once this invasive pathogen is present. Wildlife biologists at the forest or Regional Office level may be contacted for further information in managing this disease.

Aquatic plants

Didymo (*Didymosphenia geminate*) is an invasive algal species that is present in the Pecos River on the Santa Fe NF. Didymo can undergo explosive growth, thereby creating dense mats of algal blooms that can impact native fish by affecting their food base of algae and invertebrates. The invasive alga also can alter water chemistry and hydrology. Recreational activities in didymo-infested stretches of water should be avoided, and sanitation measures should be implemented to prevent spread of didymo. Wildlife biologists and the Forest Invasive Species Coordinator on the Santa Fe NF may be contacted for further information and technical assistance.

A single species of golden algae (*Prymnesium parvum*) commonly causes fish kills, which occur when blooms of the alga produce toxins harmful to gill-breathing organisms. A number of lakes on NFS lands in Arizona have been listed as susceptible to golden algae blooms. However, effective treatment for golden algae can only be done in small reservoirs and ponds. Fishery biologists may be contacted for further information.

The aquatic invasive plant, Eurasian watermilfoil (*Myriophyllum spicatum*), has been found in water ponds on the Coconino NF and in Parker Canyon Lake on the Coronado NF. This invasive species primarily affects other species by crowding them out. Sanitation measures such as boat cleaning or preventing discharge of aquarium water may help protect establishment of the species in water bodies. The Forest Invasive Species Coordinator on the Coconino NF may be contacted for further information and technical assistance.

Terrestrial plants

Terrestrial invasive plants in Region 3 include annual, biennial, and perennial species of grasses, forbs, shrubs, and trees. A considerable number of these species are listed by States in Region 3 as "noxious weeds." Under statutory requirements, landowners are required to control noxious weeds; however, these species are typically quite difficult to control once established.[2] Many deep-rooted perennial species cannot be controlled by either manual or mechanical methods and require chemical treatment for effective control. In some cases, biological control agents may be available for certain invasive plant species. Effective control of a number of invasive plants may require more than one method of treatment or a series of separate treatments. Re-treatment of infested sites may be necessary over a period of years to control seedlings arising from seed banks or to prevent regrowth from residual plant propagules such as root fragments. Invasive species coordinators at the district, forest, or Regional Office levels may be contacted for further information and technical assistance.

[2] Noxious weed lists for AZ and NM can be found at (1) Arizona Department of Agriculture (https://agriculture.az.gov/pests-pest-control/agriculture-pests/noxious-weeds) and (2) New Mexico Department of Agriculture (http://www.nmda.nmsu.edu/apr/noxious-weed-information/). Lists of introduced, invasive, and noxious weeds maintained by individual States are at the Natural Resources Conservation Service (https://plants.usda.gov/java/noxiousDriver).

Acreage of NFS lands infested by invasive plant species in Region 3 is extensive and expanding on most of the Region's forests. The estimated number of acres infested within Region 3 in 2012 was approximately 981,000 acres. Over a 10-year period from 2002 to 2012, the Carson and Prescott NFs had a relatively stable level of estimated acreage of invasive plants; however, all other Region 3 forests registered an overall increase in infested acreage during this period. The increases for estimated infested acreage on most Region 3 forests possibly reflect a combination of (1) an upward trend in infestations resulting from the spread of invasive plant species, (2) loss of native species and establishment of invasive plants due to wild fires, and (3) improved methods for survey and inventory. The overall number of acres treated for invasive weeds in Region 3 averages about 7,000 acres/year; however, the amount of acreage treated annually is generally inadequate on individual forests that have seen increases in infested acres over the last decade.

Non-invasive weeds: In addition to invasive plant species, there are a number of common weed species that occur extensively on NFS lands such as common mullein (*Verbascum thapsus*) on the Apache-Sitgreaves NFs and Russian thistle (*Salsola* spp.) on the Coconino and Kaibab NFs. These common weed species also require treatment when their infestations impact native plant communities. Pesticide use coordinators at the district, forest, or Regional Office level may be contacted for further information and technical assistance.

Molluscs

Quagga mussel (*Dreissena bugensis*) and zebra mussel (*D. polymorpha*) are potential aquatic invasive species in Region 3 water bodies and are considered to be present in some reservoirs on the Tonto NF. Once established, these mollusc species can clog water systems and compete with native species. Priority should be given to preventing infestations through sanitation measures such as boat cleaning as well as eradication of incipient infestations. Fishery biologists at the forest or Regional Office level may be contacted for further information and technical assistance.

Crustaceans

Invasive northern crayfish (*Orconectes virilis*) and red swamp crayfish (*Procambarus clarkia*) have been confirmed on the Coconino, Coronado, and Tonto NFs. Non-native crayfish (likely the aforementioned species) also occur on other forests as well but these have not been identified at the species level. The crayfish diet of larval fish, aquatic plants, and insects can seriously impact aquatic ecosystems and possibly cause declines in other species once introduced. Sanitation measures such as preventing transportation of crayfish as bait from one water body to another can help protect against cross-contamination of waterways. Fishery biologists at the forest or Regional Office level may be contacted for further information and technical assistance.

Insects

To date, invasive insect pests of trees have not reached thresholds for forest-wide outbreaks in Region 3; however, native insect pests such as bark beetles (in particular, beetle species in the genera of *Ips* and *Dendroctonus*) and defoliating moths reach outbreak thresholds in forests with some regularity. The Region has been a cooperator in a national Early Detection/Rapid Response program for invasive bark beetles that potentially come into the U.S. via shipping ports of entry and other potential entry pathways. Trapping for European and Asian species of gypsy moth (*Lymantria* spp.) is conducted annually across the Region with assistance from district staff and external partners. Individual moths have occasionally been intercepted, but no reproducing populations have ever been found.

Entomologists with Regions 3's Forest Health staff may be contacted at zone offices located in Flagstaff, AZ (928-556-2073) or Albuquerque, NM (505-842-3287) for technical assistance and questions regarding invasive or native insect pests of forests. Further information on insect pests in Region 3 may be found in the *Field Guide to Insects and Diseases of Arizona and New Mexico Forests* (http://www.fs.fed.us/r3/resources/health/field-guide/), which may be obtained as a hard copy from Forest Health staff at zone offices.

Fish

Various introduced, non-native fish species can adversely impact native fish species through predation, competition, or hybridization with closely related species. Many non-native species such as trout, catfish, sunfish, pike, and bass are managed as sport fish. To decrease conflicts with native fish populations, forests should work with state wildlife departments in managing fisheries. Early detection, preventative measures (educational outreach, signing, inspections, bait regulations, etc.), and projects to remove non-native fish are the most useful ways to help prevent spread of non-native species between waterways. Fishery biologists at the forest or Regional Office level may be contacted for further information and technical assistance.

Amphibians

The American bullfrog (*Lithobates catesbeiana*) is now found on the Apache-Sitgreaves, Coconino, Coronado, Gila, and Tonto NFs. The bullfrog preys on small native species as well as competes with them. Sanitation measures such as preventing transportation of bullfrogs as bait from one water body to another can help protect against cross-contamination of waterways. Fishery biologists at the forest or Regional Office level may be contacted for further information and technical assistance.

Mammals

Feral swine (*Sus scrofa*) occur throughout the Southwest. They are currently found on national grasslands in Region 3 and on the Lincoln and Prescott NFs. Feral swine damage includes (1) destruction of native habitats, crops, and stream banks through rooting and wallowing, (2) transmittal of diseases and parasites, and (3) opportunistic predation of ground-nesting birds and other small wildlife. Since hunting alone cannot control feral swine, Region 3 has engaged the Wildlife Services program of USDA's Animal and Plant Health Inspection Service (APHIS) which provides direct assistance for managing feral swine. Wildlife biologists at the forest or Regional Office level have responsibility for feral swine management on NFS lands and should be contacted for further information.

Managing Invasive Species

Agency Responsibilities

Lead agency responsibility for managing invasive species and other pests associated with NFS lands or waters varies with taxon (table 1). On NFS lands, the Forest Service is principally responsible for managing invasive weeds and forest-related species of insect pests and plant pathogens. For other taxa, the Forest Service generally has a cooperating role depending on agency mission and regulatory authorities.

Table 1. Agency responsibility for management of invasive species and other pests

Species Group	USFS Lead	USFS Cooperating	USFS Program, Agency, or Agency Group
Invasive pathogens of fish and wildlife (whirling disease, chytrid fungus, etc.) in NFS waters and on NFS lands		X	State wildlife agencies, USFS Wildlife, USFS Fisheries
Invasive aquatic weeds and invertebrates (mussels, crustaceans, etc.) in NFS waters		X	USFS Fisheries, USFS Invasive Species, State wildlife agencies, interagency working groups
Invasive and common weeds on NFS lands	X		USFS Invasive Species, USFS Range
Forest-related insect pests and plant pathogens on NFS and non-NFS lands	X	X	USFS Forest Health Protection*, State forestry agencies, APHIS**
Non-native fish and other aquatic vertebrate pests in NFS waters		X	State wildlife agencies, USFS Fisheries
Invasive vertebrates on NFS lands		X	APHIS, USFS Wildlife, USFS Invasive Species

* The USFS Forest Health Protection program has the lead for forest-related insect pests and plant pathogens on all Federal lands but is a cooperator on State and private lands.

** APHIS - USDA Animal and Plant Health Inspection Service

Prevention

Prevention is potentially the least expensive and most effective control method for keeping invasive species from becoming established. While prevention activities may increase initial treatment costs, prevention can facilitate greater efficiencies for managing invasive species over the long term. However, even the best prevention efforts should not be expected to stop all invasive species. Sources of general information on preventative Best Management Practices (BMPs) for plants include–

- *Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers*

  https://www.cal-ipc.org/resources/library/publications/landmanagers/

Additional BMPs and guidance documents for specific activities are referenced below.

Forest Service emphasis on prevention: Policy in FSM 2900 stipulates that every effort should be made to ensure that all materials used on the National Forest System are free of invasive species and/or noxious weeds (including free of reproductive/propagative material such as seeds, roots, stems, flowers, leaves, larva, eggs, veligers, and so forth). Preventive measures such as requiring pre and post-work cleaning of equipment, certified weed-free seed, etc. should be implemented through contracting, permitting, and other administrative processes. All Forest Service-owned and leased facilities, vehicles, and equipment should be kept free of invasive species by implementing necessary sanitary measures such as herbicide treatments, vehicle inspections, air-blowing or washing of equipment, etc. In particular, administrative sites should be maintained as weed-free to set an example for others.

Although there is no NFS performance measure associated with prevention activities at this time, forests and districts should emphasize this important activity and transfer associated expenses for prevention into reportable accomplishments for protected acres. Forests should provide educational materials (e.g., invasive species guides) and outreach programs designed to increase employee, public, and permittee awareness of prevention, especially through distribution of such materials at office front desks or public meetings. Forest personnel may also assist in providing technical information and training to organizations, agencies, and individuals as requested.

Aquatic activities

Recreational activities: For anything (boats, trailers, gear, clothing, dogs, etc.) that comes in contact with known infested waters or potentially infested waters during watercraft operation or other recreational activities, the *Boat Inspection and Cleaning Procedures for All Water Craft Owners* (http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_014876.pdf) should be followed between trips. Other measures that can be taken to prevent transfer of aquatic invasive species through recreational activities include–

- Use a public education program to inform waterbody users of infestation risk and measures to prevent infestations.
- Monitor susceptible waters to allow early detection of aquatic invasive species. Promptly post sites if aquatic invasive species are found and, if feasible, close facility until infestation is contained.
- Maintain a 100-foot buffer free of aquatic weeds around boat launches and docks.
- Never release plants, fish, or animals into a body of water unless they originally came from that particular body of water. This also includes performing these precautionary procedures after a fishing trip:
    - Disposal of all bait into trash bins.
    - Emptying and drying any buckets used for bait.
    - Cleaning and drying all live-wells used for bait and caught fish on boats.

Didymo prevention measures: To help prevent spread of didymo, recreational activities in stretches of water infested with didymo should be avoided if possible. Otherwise, anglers and other users of infested waters should remove all obvious clumps of the algae and look for hidden clumps. Any didymo clumps found should be left at the site. If didymo clumps are found later,

they should not be washed down a drain but treated for at least one minute in either (1) hot water heated to140 º F, (2) a 2 percent solution of household bleach, or (3) a 5 percent solution of salt, antiseptic hand cleaner, or dishwashing detergent. The treated clumps should then be dried and put into a rubbish bin. In addition, anything that may have contacted didymo should be soaked, scrubbed, and treated with one of the three aforementioned treatment methods. When cleaning is not practical (e.g., pets or livestock), the affected object or animal should be completely dried and given a waiting period of at least 48 hours before contact or use in any waterway. The New Mexico Department of Game & Fish may be contacted for further information and technical assistance.

Quagga or zebra mussel prevention: To prevent and minimize invasive mussel infestations in western U.S. waters, the action plan of the Aquatic Nuisance Species Task Force (ANSTF) (http://www.anstaskforce.gov/QZAP/QZAP_FINAL_Feb2010.pdf) should be used.

Sampling or monitoring activities: To prevent spread of aquatic diseases and other invasive species during sampling or monitoring activities, all aquatic equipment (waders, nets, traps, etc.) should be decontaminated after use and prior to use between waterbodies. Protocols developed by Seese et al. (2009) for decontamination of equipment are–

1. Decontaminate gear before leaving each stream site. Decontamination activities should be at least 300 ft (100 m) from a water source.
2. Remove visible mud/organic debris from equipment with a stiff bristled brush.
3. Create a decontamination solution of Sparquat 256 (4.5 oz Sparquat/1 gal water).
4. Soak for at least 10 minutes.
5. Pour solution back into carrying container for reuse. Discard when solution no longer produces suds.

If working in areas that are likely infested, separate sets of gear for sampling or monitoring should be used so that non-infested water bodies will not become infested. More specific decontamination protocols may exist for areas with sensitive amphibians or other species. USFS wildlife or fishery biologists should be consulted for more information.

Fire

Prevention during fire-fighting: In accordance with FSM R3 Suppl. 2903, all potentially contaminated equipment should be cleaned between operations according to the *Guide to Preventing Aquatic Invasive Species Transport by Wildland Fire Operations PMS 444* (https://www.nwcg.gov/publications/444), which is available at. **Note that quaternary compounds should only be used to decontaminate fire equipment if (1) disposal of the wastewater complies with label and local requirements, and (2) the wastewater can be contained and disposed of through an industrial wastewater NPDES-permitted facility (with advance approval).**

BMPs that should be implemented for prevention of invasive weed infestations as a result of fire-fighting efforts include–

- Consider weed prevention as part of daily fire-fighting operations and increase weed awareness/prevention in fire training. Information on preventing spread of aquatic invasive species during fire-fighting activities may be found at Region 4's website: (http://www.fs.usda.gov/detail/r4/landmanagement/resourcemanagement/?cid=fsbdev3_016113).

- Include education on weed risk factors and weed prevention practices as part of resource advisor duties on all Incident Management Teams and BAER teams. Resource advisors should be able to provide briefings that identify operational practices that can reduce weed spread such as minimizing disturbance and avoidance of known weed infestation areas when locating fire lines. Weed identification aids should be provided as necessary to resource advisors and fire-fighting personnel.

- Implement sanitary regulations stated in FSM 2520 for the Forest Service's Burned Area Emergency Response (BAER) program during a major fire to prevent introduction of invasive plant seed and other propagules found in seed, straw, and other plant or construction materials. These sanitary regulations include compliance with FSM 2900, Executive Order 13112 [as amended by E.O. 13751], and applicable State noxious weed prevention requirements.

- Avoid staging equipment and resources in areas infested with invasive weeds and ensure that fire-fighting equipment and personal gear/clothing are free of invasive weeds before being brought into a staging area.

- During fire-fighting activities, avoid drafting water from waterbodies with known infestations of aquatic invasive species.

- Clean hides, legs, and hooves of pack animals by brushing prior to moving them into a fire-disturbed area. Ensure that the pack animals have previously cleared their digestive system of invasive weed seed over a period of 3-5 days while being fed weed-free forage.

- When possible, use fire suppression tactics that reduce disturbances to soil and vegetation.

- Delineate weed-infested areas and establish measures such as a barrier to prevent spread from these areas.

Prescribed fires: BMPs that should be implemented for prescribed fires include–

- Inventory the project area and evaluate potential weed spread with regard to the fire prescription. Areas with moderate to high weed cover should be managed for at least two years prior to the prescribed burn to reduce the number of weed seeds in the soil.

- Given a choice of tactics for prescribed burns, avoid ignition and burning in areas at high risk for weed establishment or spread.

- When possible, use staging areas and helibases that are maintained in a weed-free condition.

Burned area rehabilitation: In accordance with FSM R3 Suppl. 2903, weed-free seed and mulch used for BAER and other fire restoration activities must be tested, inspected, and certified according to the *Guidelines for Weed-Free Seed, Forage, Mulch, and Fill Materials in Region 3* (https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd582264.pdf).

BMPs that should be implemented for rehabilitation of burned areas after a fire include–

- Implement rehabilitation measures immediately after fire suppression such as seeding and revegetation techniques that will minimize disturbance while gaining a high rate of plant establishment.
- Develop a burned-area integrated weed management (IWM) plan, including a monitoring component, to detect and eradicate new weeds early.
- Monitor, document, and treat weeds at fire access roads, cleaning sites, fire lines, staging areas, and within burned areas in the following growing season. Also review weed inventories and identify pre-existing infested areas that can be targeted for treatment.
- Control infestations to prevent spread within burned areas; control nearby infestations to prevent spread into burned areas. Use the best IWM approach to control newly established invasive weeds in burned areas.
- Use certified weed-free seed in burned areas and also require use of locally chipped/shredded woody materials for mulch or, if necessary, use certified weed-free mulch.
- Defer livestock grazing in burned areas until vegetation has successfully reestablished, usually after two growing seasons.
- Restrict travel to established roads to avoid compacting soil, which could hinder the recovery of desired plants.
- Request that a weed specialist review rehabilitation reports for burned areas to ensure proper weed prevention and management is addressed effectively.

Lands

Measures that can be taken to prevent the spread of invasive weeds in regard to land planning requirements (easements, permits, appraisals, etc.) include–

- Incorporate weed risk assessment, prevention, and treatment in all special use permit applications and amendments.
- Amend existing special use permits to include weed prevention and control measures.
- Consider and compensate for infested properties during real estate appraisals prior to land acquisition or land exchanges.
- Ensure acquired lands are properly re-vegetated with weed-free seed. In accordance with FSM R3 Suppl. 2903, seed must be tested according to the *Guidelines for Weed-Free Seed, Forage, Mulch, and Fill Materials in Region 3*, which can be found at https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd582264.pdf.

- Require special use road lessors to maintain weed-free roadside vegetation.

Livestock

Weed-free forage and bedding: In accordance with FSM R3 Suppl. 2903, weed-free forage and bedding used for livestock must be inspected and certified according to standards specified in the *Guidelines for Weed-Free Seed, Forage, Mulch, and Fill Materials in Region 3* (https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd582264.pdf).

Although Region 3 does not have weed-free closure orders for livestock forage or bedding materials brought onto NFS lands, use of these materials in hunting camps, campgrounds, and other special uses should be encouraged as a preventive measure. Sites where livestock feeding has occurred or where bedding materials have been used should be monitored and treated when weeds are found. Incidents where invasive plant establishment is suspected of being the result of weed seed contamination in forage or bedding materials should be documented as part of the invasive plant inventory and reported to the Regional Invasive Species/Pesticides Coordinator.

Grazing: Measures that can be taken cooperatively with permittees to prevent the spread of invasive weeds by livestock include–

- Ensure weed prevention and control is considered in management of all grazing allotments including revising grazing permit clauses to address invasive weed management (e.g., grazing at most advantageous periods for impacting specific weed species).
- Promote weed awareness and prevention efforts among range permittees.
- Manage the timing, intensity, duration, and frequency of livestock activities to maintain high range condition and minimize areas of exposed soil.
- Avoid moving livestock from weed-infested areas into weed-free areas.
- Ensure that livestock in infested areas have cleared their digestive system of invasive weed seed over a period of 3-5 days while being fed weed-free forage prior to moving them into a non-infested area.
- Consider excluding livestock from sites with new invaders or treat new invaders in these areas before entry by livestock.
- Inspect areas with concentrated livestock use for weed establishment and treat new infestations.
- Avoid grazing re-seeded areas such as burns until native vegetation is well established.
- Reduce ground disturbance by changing salt licks, restoring or protecting watering sites, and restoring areas with concentrated livestock use.
- Consider re-vegetating abandoned salt grounds by raking the site before and after broadcast seeding with weed-free seed, then fencing the site until seedling are well established. Compacted soils may require scarification before broadcast seeding.

- If livestock are contributing to seed spread in a weed-infested area, schedule livestock grazing prior to seed-set or after seed has fallen. Avoid grazing same plants at the same time year after year by altering season of use.
- Consider grazing weed-infested areas with sheep during early summer to minimize flowering and seed production of weeds. Cattle grazing may be scheduled after sheep grazing at a time when desirable grasses have matured and their seed has dispersed.

Minerals-related operations

To help prevent establishment of invasive weeds resulting from minerals-related operations, direction from the following chapters of FSM 2800 - MINERALS AND GEOLOGY should be used:

1. FSM CHAPTER 2810 – MINING CLAIMS
2. FSM CHAPTER 2820 – MINERAL LEASES, PERMITS, AND LICENSES
3. FSM CHAPTER 2840 – RECLAMATION
4. FSM CHAPTER 2850 – MINERAL MATERIALS

Measures that can be taken in collaboration with forest or district minerals staff to prevent the spread of invasive weeds in minerals-related operations (mining sites, well sites, pits, etc.) include–

- Incorporate weed prevention into all new mining operation permits, plans, and reclamation projects.
- Require that soil disturbed by minerals-related activities under a permit or plan be re-vegetated within a specified timeframe.
- Inspect well sites, mine sites, and pits prior to and after construction activities for invasive weeds and treat them as necessary.
- Inspect and require high pressure cleaning of equipment prior to moving from an infested site to a non-infested area.
- Ensure that all gravel, borrow material, and storage areas are inspected and determined to be weed-free prior to transport, use, and storage. In accordance with FSM R3 Suppl. 2903, fill and stockpiled materials must be inspected and certified according to standards in *Guidelines for Weed-Free Seed, Forage, Mulch, and Fill Materials in Region 3*, which can be found at https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd582264.pdf.

Off-road vehicles and equipment

Movement of uncleaned off-road vehicles and equipment from an infested area into areas free of invasive weeds or other invasive species should be prevented on NFS lands. Unless a project area is already infested with specific invasive weed species of concern, contract provisions should ensure that all off-road vehicles and equipment are certified to be free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds. Vehicles and equipment to be used off-road should be power-washed of all mud, dirt, and plant parts before moving into the project area.

However, cleaning of vehicles and equipment should not be allowed on NFS lands unless agreement is reached on (1) methods for cleaning, (2) locations for the cleaning, and (3) control of on-site or off-site impacts. Specific information on vehicle cleaning technology may be found at–

> *Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species* (http://www.usbr.gov/mussels/prevention/docs/EquipmentInspectionandCleaningManual2012.pdf)
>
> Vehicle Cleaning Technology for Controlling the Spread of Noxious Weeds and Invasive Species (http://www.fs.fed.us/eng/pubs/pdf/05511203.pdf)

BMPs that may be implemented to prevent establishment of invasive plants by off-road vehicles and equipment include–

- Map invasive weed-infested areas and establish measures such as no-travel zones to prevent spread from these areas. Ensure that areas designated as open to cross-country travel under the Travel Management Rule (36 CFR 212.51) are actively managed for weeds.
- Locate weed-free areas where project equipment can be staged prior to commencement of project activities.
- Avoid invasive species populations when feasible and minimize spread of invasive species during any soil disturbing activities.

Recreational areas

Measures that can be taken to prevent spread of invasive weeds in recreational areas include–

- Post messages on weed awareness and prevention practices at strategic locations such as trailheads, roads, boat launches, and forest entrances. Messages should discourage picking of unidentified “wildflowers” and discarding them along trails or roadways.
- Promptly post sites if invasive plant species are found and, if feasible, close access until infestation is controlled. In areas susceptible to weed infestations, limit vehicles to designated and maintained travel routes.
- Encourage public land users to inspect and clean motorized and mechanized trail vehicles of weeds and their seeds before recreating on public lands. If practical, provide facilities for cleaning contaminated vehicles and equipment.
- Annually inspect all campgrounds, trailheads, and recreation areas that are open to public vehicle use for weeds and treat new infestations. Chronic weed infestations should be assessed as to why they are occurring, and steps should be taken to mitigate or reduce the risk of infestation. Consider seasonal or full time closure to campgrounds, picnic areas, and other recreation use areas until weeds are reduced to levels that minimize potential spread.

- Maintain trailheads, boat launches, outfitter and public camps, picnic areas, airstrips, roads leading to trailheads, and other areas of concentrated public use in a weed-free condition.

- Inspect and document travel corridors in recreation sites for weeds and treat well before seed production. In areas susceptible to weed infestation, limit vehicles to designated travel routes.

Roadsides and utility corridors

Measures that can be taken to prevent invasive weed spread along roadsides and utility corridors include–

- Incorporate weed prevention into project design, alternative evaluations, and decisions, including travel management. Contractors should also be required to maintain control of invasive plants during the entire contract period. The Forest Service's *National Desk Guide to Preparing Vegetation Management Procedures for Power Line Authorizations* can be accessed at http://fsweb.r1.fs.fed.us/lands/land_uses/guides/2013.12_Final Veg Mgmt Guide.docx [internal USFS website]. Lands and Minerals staff in Forest Service offices may also be contacted for a copy.

- Ensure that provisions are implemented by State and County governments as well as by utility companies to maintain weed-free rights-of-ways (ROWs) in their easements. Treat invasive plant species in ROWs or other disturbed areas associated with road or utility corridors on NFS lands or adjacent to NFS boundaries.

- Train road maintenance staff to recognize invasive weeds and report locations to invasive weed coordinators.

- Inspect system roads and ROWs periodically for invasive weeds. Whenever soils are disturbed in weed-infested areas, document and inspect these areas for at least three growing seasons and provide follow-up maintenance as required.

- Treat weeds after road decommissioning or other reclamation projects before roads are made impassable. Re-inspect and follow-up based on initial inspection and documentation.

Vehicle and equipment sanitation: Measures that should be implemented for proper cleaning of vehicles and equipment include–

- Ensure that vehicles and equipment used in ROWs of roads and utility corridors on NFS lands are power-washed of all mud, dirt, and plant parts before moving into the project area. Cleaning of vehicles and equipment should not be allowed on NFS lands unless agreement is reached on (1) methods for cleaning, (2) locations for the cleaning, and (3) control of off-site impacts. Specific information on vehicle cleaning technology may be found at–

    - *Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species (http://www.usbr.gov/mussels/prevention/docs/EquipmentInspectionandCleaningManual2012.pdf)*

    - *Vehicle Cleaning Technology for Controlling the Spread of Noxious Weeds and Invasive Species (http://www.usbr.gov/mussels/prevention/docs/EquipmentInspectionandCleaningManual2012.pdf)*

- Inspect and clean mowers and other types of maintenance equipment before moving this equipment from infested areas into un-infested areas.

- Locate and use weed-free staging areas for projects.

- Ensure that maintenance personnel inspect, remove and properly dispose of weed seed and plant parts found on clothing and equipment. Proper disposal includes bagging seed and plant parts and then incinerating the bags or else disposing in a landfill.

Equipment operations: Measures that should be implemented for operation of equipment include–

- Evaluate the need to grade each road or section of road rather than following a set schedule for road maintenance. Avoid unnecessary removal of soil and shading vegetation. If possible, avoid blading or pulling roadsides and ditches infested with invasive plants unless doing so is required for public safety or protection of the roadway.

- Before ground-disturbing maintenance activities begin, inventory and prioritize weed infestations for treatment in project operation areas and along access roads. Control weeds as necessary and as early as possible in the project planning process.

- Avoid road or ditch maintenance activities during and after seed dissemination if possible. Schedule blading in areas with invasive plants when seeds or propagules are least likely to be viable and to be spread.

- Direct road maintenance activities such as blading, brushing, and ditch cleaning from un-infested areas toward infested areas to the greatest extent possible. Blading should be done by minimizing soil surface disturbance, and bladed material should be contained on areas already infested.

Materials handling: In accordance with FSM R3 Suppl. 2903, fill or stockpiled materials used for roadsides and utility corridors must be inspected and certified according to standards specified in the *Guidelines for Weed-Free Seed, Forage, Mulch, and Fill Materials in Region 3* (https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd582264.pdf).

Measures that should be implemented for handling fill or stockpiled materials include–

- Ensure that gravel, dirt, asphalt, and other materials are stockpiled away from areas infested by invasive weeds. Maintain stockpiled materials in a weed-free condition.

- Use only clean fill material from a weed-free source rather than borrowing fill from a weed-infested stockpile, road shoulder, or ditch line.

- Document areas where material from any treated infested source has been used. These areas need to be inspected and treated for invasive weeds for at last three years after project completion.

Timber management

Measures that can be taken to prevent the spread of invasive weeds onto timber sale sites and other timber operations include–

- Consider weed risk and prevention factors in all silvicultural prescriptions and appropriate NEPA.
- When feasible, plan harvesting activities to move from non-infested cut units to infested cut units to minimize cleaning requirements.
- Incorporate the Timber Sale C or CT-Provision and/or Service Contract Clause for invasive weed control and containment into all contracts.
- Require high pressure cleaning of equipment prior to moving from an infested timber site to a non-infested area or adjacent sale-unit.
- Collect and designate KV (Knutson-Vandenberg) or other funds to treat the invasion of invasive weeds after harvest activities.
- Encourage operators to maintain weed- free mill yards, equipment parking, and staging areas.
- Train contract administrators to identify noxious weeds and select lower risk sites for landings and skid trails.
- Treat weeds on projects used by contractors, emphasizing treatment of weed infestations on existing landings, skid trails, and helibases before activities commence.
- Minimize soil disturbance through actions such as winter skidding, limiting fire-line dozing, etc.
- When possible, locate landings, skid trails, and haul routes in weed-free areas.

Watersheds

Risks for introducing invasive species should be analyzed in watershed restoration projects and water quality management plans (Clark, 2003). Transfer of infested water between drainages or between unconnected waters within the same drainage should be avoided or minimized. In addition, infested water in any volume should not be dumped directly into un-infested water bodies. Hydrological operations potentially involving water transfers susceptible to aquatic invasive species should be monitored. Water bodies should be promptly posted if aquatic invasive species are found and, if feasible, the waterbody until should be closed to recreation and other activities until the infestation is eradicated or contained.

Prevention measures for invasive weeds: Specific prevention measures recommended by Clark (2003) for invasive weed management in watersheds include–

- Avoid and remove sources of weed seed and propagules in riparian areas and waterbodies when feasible.

- Inspect and document riparian areas, wetlands, and waterbodies for establishment and spread of invasive weeds on a frequent and systematic basis. Since effective control of invasive weeds in these areas is generally limited, new infestations should be eradicated immediately.
- When possible, maintain conditions (e.g., water levels) that allow desirable plant communities in waterbodies, wetlands, or riparian areas to compete effectively with weeds.
- Promote high densities of desirable vegetation along banks of waterbodies and in riparian areas and wetlands to minimize sites for establishment of weed seeds and propagules that are drifting downstream.

Prevention measures for quagga or zebra mussels: To prevent and minimize establishment of invasive mussel infestations in watersheds, the ANSTF action plan (http://www.anstaskforce.gov/QZAP/QZAP_FINAL_Feb2010.pdf) should be followed.

Detection

Invasive species identification

Species identification is critical for detection and proper management of invasive species. Invasive species coordinators and associated field personnel should have adequate training in identifying potential problem species and be able to locate these species with portable data recorders or similar devices on a geospatial basis. Botanists or other plant specialists should be consulted to help identify new or unfamiliar plant species encountered in the field. Region 3 has published a weed identification guide entitled *Invasive Plants and Weeds of the National Forests and Grasslands in the Southwestern Region, 2nd Edition* (http://www.fs.usda.gov/main/r3/forest-grasslandhealth/invasivespecies) that may be obtained from the Regional Invasive Species/Pesticides Coordinator. State-issued publications on invasive plants such as *Arizona's Invasive Weeds* (49 pp.) and *Troublesome Weeds of New Mexico* (88 pp.) are also available from State extension services.

Invasive plant detection

Invasive plant species in landscapes or watersheds should be detected through regularly conducted surveillance, searches, and/or surveys as discussed below:

- **Surveillance** – Surveillance can be employed during work activities or while traveling along roads or trail systems. Established, uncontrolled weed infestations should be kept under surveillance; any new infestations should be observed and reported when sighted.
- **Searches** – A search is generally used to investigate the most likely points of entry for new infestations. Any occurrence of invasive plants found in such areas should be recorded and reported. Searches can be widened as time and resources permit.
- **Surveys** – With this technique, a geographic area is systematically surveyed for invasive species to determine whether these species are present. By surveying the landscape, invasive plant cover and/or number of patches can be recorded through inventory and mapping to determine the intensity of infestation and acres covered.

A procedure should be set up to track areas that have been searched or surveyed vs. areas that have not. An appropriate time of the year (e.g., during flowering or seed-head development) should be chosen to allow identification of invasive weed species when using any detection technique. Although most species may be detected by ground travel, aircraft or drones may be needed to detect infestations in remote or non-accessible locations. Possible points of entry for invasive plants that need high-priority search or surveillance efforts include–

- ROWs along highways, County roads, railways, and utility corridors, especially after new construction or maintenance activities.
- Trails, livestock loading areas and driveways, winter hay feeding areas, livestock water developments, hunting camps, fire lines, and other similar areas of disturbance.
- Lands adjacent to streams, rivers, and lake shores, especially after recent flooding or high-flow periods.
- Burned or storm-damaged areas in the years following disturbance.

If a new species or population is detected, delimiting surveys should be conducted across the landscape or target area. To meet specific management objectives, survey information is normally collected and compiled into maps as part of an inventory that contains information regarding the particular invasive species and extent of infestation. Procedures for surveying, inventorying, and mapping of invasive species infestations in the Forest Service are now conducted through the TESP-IS software application (see **Data Management**, p. 73).

Control and Management

Integrated weed management

Under FSM 2902, management activities for aquatic and terrestrial invasive species (including vertebrates, invertebrates, plants, and pathogens) should be based upon an Integrated Pest Management (IPM) approach on all areas within the National Forest System, and on areas managed outside of the National Forest System under the authority of the Wyden Amendment (P.L. 109-54, Section 434). IPM (termed Integrated Weed Management (IWM) when specifically used with weeds) is defined as the process by which one selects and applies a combination of management methods or techniques (physical, cultural, biological, and chemical) that together will control a particular pest species or infestation with minimal adverse impacts to non-target species. The objective of the IPM process is to identify control methods or techniques that are effective while minimizing adverse ecological and social impacts. Reliance on one particular method or restricting use of one or more weed management tools may prove less effective.

Region 3 has developed a series of IWM field guides for managing invasive plant species (http://www.fs.usda.gov/main/r3/forest-grasslandhealth/invasivespecies). Information on IWM practices is also available from State extension services, weed societies, private companies, etc.

Physical control

Physical methods to control weeds generally focus on reducing seed production and preventing germination, which typically may be accomplished through removal of seed heads and/or root systems. Physical methods such as manual methods (hand-pulling, hoeing, etc.), mechanical methods (tillage, mowing, etc.), and prescribed fire may accomplish this with some weed species

but may be inappropriate with others. Mechanical treatments such as mowing or tillage are generally most applicable to tap-rooted weed species, level terrain, and infestations that can be revisited on a regular basis in order to remove seedlings or curb re-sprouting. Although mechanical treatments may reduce seed production during the season of treatment, these treatments should not be expected to eradicate weeds permanently due to recruitment from the seedbank or seed from unmown flower heads. Moreover, mechanical treatments are generally ineffective against deep-rooted perennial species which are often difficult if not impossible to control without herbicide application.

Cultural control

Cultural methods to control weeds are generally targeted toward enhancing desirable vegetation to minimize invasive plant invasions. Common cultural treatments are (1) planting or seeding desirable species to out-compete or shade invasive weeds, (2) applying fertilizers to establish or support desirable vegetation, and (3) controlling livestock grazing. Appropriate methods for cultural control of invasive species should be implemented according to the most cost-effective means possible for preventing new infestations or limiting spread from areas already infested. Measures such as public education, vehicle or livestock inspections, and weed screens on irrigation water intakes may also provide additional protection against spread of invasive plants but should not be expected to stop new infestations indefinitely. Information, training, and appropriate weed identification materials should be provided to anyone who may potentially be involved with introduction, establishment, or spread of invasive weeds on NFS lands. This includes agency managers, employees, forest workers, contractors, permit holders, and recreational visitors.

Biological control

Biological control of invasive plants typically involves either livestock grazing or classical biological control.

- **Grazing** – Livestock grazing may be used to reduce invasive plants either by direct consumption or else by manipulation of vegetative conditions on rangeland. Range condition on grazing allotments should be maintained at relatively high levels sufficient to prevent overutilization which can lead to a decline in desirable plant cover and a concurrent rise in invasive plants. Possible indications of overutilization are the appearance of cheatgrass (*Bromus tectorum*) and mustards in the spring or establishment of kochia (*Kochia scoparia*) or gumweed (*Grindelia* spp.) during the summer (Enloe, 2006). Heavy infestations of thistle species on rangeland may also indicate over-grazing. In some cases, targeted grazing using different classes of livestock (sheep, goats, or cattle) may be used to manipulate grazing such that invasive target plants are placed at a competitive disadvantage relative to other plants in the community. Efforts to improve range condition for allotments should be coordinated with range specialists. Sources of information such as the Region 3 field guides should be consulted for information on using livestock grazing as a tool to reduce invasive plant presence.

- **Classical biological control** – Classical biological control is defined as the use of an exotic, host-specific natural enemy against exotic or native pests. To improve long-term success, approved and acceptable biocontrol agents may be used as part of an effective control program. Biocontrol agents for invasive plants are typically utilized when weed infestations are so extensive and chronic that herbicide application is cost prohibitive or

else occur in areas that are too inaccessible for conventional herbicide spraying. Use of certain biocontrol agents may require relatively large populations of invasive plants that are in close proximity to sustain the biocontrol agent over time. The Forest Service's Forest Health Assessment & Applied Sciences Team or FHAAST (formerly, the Forest Health Technology Enterprise Team or FHTET) has published a series of biocontrol guides specific for invasive plants (http://www.fs.fed.us/foresthealth/technology/pub_programareas.shtml). The guides and other publications on control methods are available online.

With some exceptions, biocontrol agents used alone as a treatment may reduce but generally will not entirely eradicate invasive plant populations. Therefore, other integrated management techniques such as pesticide application or prescriptive grazing may be used to complement biocontrol. Biocontrol is relatively slow but may be more sustainable and persistent as compared to other treatment methods. The efficacy of biocontrol is usually measured over the long term and is not necessarily comparable to mechanical or pesticide treatments where annual efficacy reporting is concerned. It may take up to five years before biocontrol efficacy can be accurately measured whereas mechanical or pesticide treatment efficacies may normally be measured during the same season of treatment or the year following treatment.

Agents used for biocontrol in the Southwest should be adaptable to arid environments and local conditions. Biological control agents may be obtained from commercial sources or from local APHIS offices when available. Weed biocontrol specialists in the Forest Health Protection program or Rocky Mountain Research Station may be able to provide guidance and, in some cases, biocontrol agents to agency land managers without cost [Contact: Dr. Sharlene Sing, RMRS research entomologist, 406-994-5143].

A permit must be obtained from APHIS before biological control agents can be transported across State boundaries. Regulations and permit applications (PPQ 526 permit forms) pertaining to interstate shipment of biological control agents are available from APHIS (http://www.aphis.usda.gov/wps/portal/aphis/ourfocus/biotechnology). Although biocontrol agents may be collected and released within a given State without a permit from APHIS, the State's department of agriculture or extension service should be consulted for any regulations relating to movement of these agents within the State.

Chemical control

Although the IWM process requires selection of a combination of management methods or techniques (i.e., physical, cultural, biological, or chemical) that will control a particular pest species with minimal adverse impacts, many deep-rooted perennial weeds can only be effectively controlled with herbicides. The series of IWM field guides developed for managing invasive plants in Region 3 (http://www.fs.usda.gov/main/r3/forest-grasslandhealth/invasivespecies) should be consulted first for appropriate herbicides that can be used to control individual invasive plants. Other herbicides may also be appropriately applied, but use of these herbicides should be thoroughly evaluated.

Pesticide labels may not always provide specific information on effectiveness of a particular herbicide against a particular weed species. Chemical companies generally focus herbicide trials on agricultural weed species and do not always conduct comprehensive trials for some rangeland or forestland weed species. Therefore, field trials may be necessary to test whether an invasive

weed species not found on the pesticide label may be controlled by a particular herbicide as might be suggested by similar or vegetatively related weed species already listed on the label. **Any sites used for testing or actual application against target species must be the same as those specified by the label**. Further information on use of pesticides is found below in the **Pesticide Use for Invasive and Non-Invasive Species** section (p. 33).

Rehabilitation and Restoration

An IWM program for invasive plants can be an important component for implementing rehabilitation or restoration. Rehabilitation is defined as short-term mitigation to ensure minimum site stability and functionality. Rehabilitation can be facilitated by actions (e.g., BAER actions) to prevent or limit disturbance such as site preparation and seeding of non-native vegetation for soil stabilization, mulching disturbed sites with straw or chipped wood, construction of straw, rock or log dams in small, eroding tributaries, and placement of logs to catch sediment on hill slopes.

In contrast to rehabilitation, restoration has the long-term objective of re-establishing biotic integrity of a damaged ecosystem in terms of pre-existing species composition and community structure. Since disturbed conditions encourage many invasive species, improvement of site condition can help prevent establishment of invasive populations and reduce long-term ecosystem impacts. Terrestrial invasive species management in these cases may include re-seeding with native species to increase competition or using IWM practices such as pesticide application or biocontrol agents to minimize or control invasive weed infestations. Revegetation may also involve topsoil replacement, fertilizing, and weed-free mulching. Although restoration efforts have common elements, each site should be treated as unique. Therefore, work must be guided by site-specific considerations and analysis. The results of monitoring should always be used to assess the effectiveness of restoration actions.

Under FSM 2020.3, it is Forest Service policy to emphasize ecosystem restoration across the National Forest System and within its multiple use mandate. **However, it should be anticipated that even the best restoration efforts may not return a site or ecosystem infested with invasive species to its desired condition as these species can overwhelm or interfere with natural processes associated with ecosystem recovery. Therefore, it is necessary to prevent or control invasive species before rehabilitation or restoration is required**.

Restoration for saltcedar-infested areas: Because of the release of four species of saltcedar leaf beetle (*Diorhabda* spp.) in the Southwest as biocontrol agents for invasive saltcedar (*Tamarix* spp.), saltcedar stands in the region can undergo repeated defoliation by these beetles. However, total saltcedar mortality in defoliated stands has rarely occurred if at all. Areas occupied by defoliated saltcedar may become infested by other invasive plants or common weeds that could require treatment. In addition, saltcedar defoliation from *Diorhabda* beetles threatens saltcedar nesting habitat now used by the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) in lieu of its former nesting habitat of native willow. Restoration projects that can replace dead or defoliated saltcedar with native willows and other riparian species should be a priority in flycatcher nesting areas.

Burned Area Emergency Response (BAER)

The Forest Service's Burned Area Emergency Response (BAER) program may be used to stabilize and prevent unacceptable degradation to natural and cultural resources (FSM 2523). Emergency response or emergency stabilization activities such as broadcast seeding of grasses

(usually by aircraft) may be authorized through BAER. BAER funds may also be used for invasive species detection surveys and, if warranted, rapid response actions within the first year following fire containment (FSM 2523.2). However, BAER funding cannot be used to treat pre-existing infestations of weeds. Invasive species detection, monitoring, treatment, re-treatment, or maintenance beyond the first year must be funded with other program appropriations. Guidance on BAER is found at https://www.fs.fed.us/naturalresources/watershed/burnedareas.shtml. BAER coordinators at the forest or Regional Office level should be contacted for further information.

Sanitary regulations in BAER should be consulted to prevent introduction of weed seed and other weed propagules in seed, straw, and other plant or construction materials after major fires. For contracted projects, contract specifications should require the contractor to use weed-free materials (seed, mulch, etc.) and maintain the project site as weed-free for a specified time. In accordance with FSM R3 Suppl. 2903, weed-free seed and mulch used for BAER and other fire activities for rehabilitation or restoration must be tested according to the *Guidelines for Weed-Free Seed, Forage, Mulch, and Fill Materials in Region 3* (https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd582264.pdf).

BAER teams and local resource managers should incorporate prevention of invasive weeds and the re-establishment of native or desired non-native species into post-fire planning. Sites where potential seed-bearing materials (hay, straw, mulch, etc.) have been applied for erosion control should be monitored and treated when weeds are found. Contractors should not be allowed to skip weed control to save time on a project. Incidents where invasive plant establishment is suspected of being the result of weed seed contamination in materials used for erosion control should be documented as part of the invasive plant inventory and reported to BAER coordinators and to the Regional Invasive Species/Pesticides Coordinator.

Seeding

Seeding disturbed areas is often necessary to prevent erosion and provide cover for successful establishment of native species. Following ground-disturbing activities, bare soil may need to be seeded depending on erosion potential of the site and the potential for timely natural regeneration. Prior to seeding, eroded areas should be stabilized by using Forest Service-approved erosion control measures such as mulching, waterbars, etc. The soil in areas to be seeded should have a roughened condition favorable to the retention and germination of seed (usually ½ inch of loose surface soil). Seeding generally should occur within seven days of final disturbance if possible and should not be done during extremely windy or rainy weather. Seed should not be applied to frozen ground. Areas that do not achieve adequate cover with seeding may require additional scarification, fertilizing, and/or mulching before reseeding. Range specialists or vegetation ecologists may be consulted in setting up seeding projects.

Appropriate seed mixes and procedures for seeding sites may be determined by consulting a forest's seed mix or local seeding guidelines. Policy in FSM 2070.3 promotes the use of native plants in rehabilitation and restoration when practicable. Native seed collected locally may be used where available and cost effective. As per FSM R3 Suppl. 2903, seed purchased from outside sources must be tested prior to seeding in accordance with the Guidelines for Weed-Free Seed, Forage, Mulch, and Fill Materials in Region 3 (https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd582264.pdf). Seed used by project contractors must also be tested and the results reported to respective forest and district invasive species coordinators.

Sites where seeding has occurred should be monitored and treated when invasive weeds are found. Incidents where invasive plant establishment is suspected of being the result of contamination in seed mixtures used for planting should be documented as part of the invasive plant inventory and reported to the Regional Invasive Species/Pesticides Coordinator.

Pesticide Use for Invasive and Non-Invasive Species

Pesticide-Use Requirements

Forest Service policy for using pesticides as part of the IPM process requires

1. Basing actual and recommended uses of pesticides on analysis of effectiveness, specificity, environmental impacts, economic efficiency, and human exposure;

2. Reviewing and approving all proposals for the use and application of pesticides on NFS lands; and

3. Using pesticides in compliance with all Federal, State, and local laws and regulations.

Pesticide training and certification

All Forest Service employees must be certified under either a State or Federal certification program if they personally use or supervise the use of restricted-use pesticides (RUPs) (FSM 2155). In addition, Pesticide-Use Proposals (PUPs) can be approved by line officers in Region 3 only if a certified forest or district pesticide coordinator can complete and review the PUP (FSM R3 Suppl. 2155.2). Therefore, Region 3 employees must take the certification exam from their respective State licensing agency if their job entails (1) serving as a pesticide coordinator for their forest or district with the responsibility of developing PUPs; (2) buying, mixing, loading, or applying RUPs; or (3) supervising RUP applications by other personnel. The piscicides rotenone and antimycin A used in native fish restorations on NFS lands are RUPs and therefore require certification through State licensing.

Although Forest Service employees are not required to be certified for application of general-use pesticides, it is highly recommended that all Region 3 applicators (other than short-term project workers) have a State pesticide license to (1) avoid potential safety problems, (2) ensure knowledge and compliance with State regulations for pesticide use, and (3) establish professional credibility with the public, stakeholders, and cooperators. In addition, every Forest Service employee must receive initial training and refresher courses under the Hazard Communications/ Global Harmonization System (GHS) as outlined under 29 CFR 1910.1200 in order to handle or apply pesticides.

Only pesticide coordinators and applicators who are adequately trained and qualified in the proper use of pesticides may implement pesticide-use projects. Region 3 personnel needing initial training in pesticides or weed management should take BLM's 9000-01 course entitled "Integrated Pest Management & Pesticide Application Certification" [Contact: BLM Training Center, 602-694-3771] or a comparable course. Regional fisheries biologists should take more specialized pesticides training from the US Fish & Wildlife Service or a State game & fish agency. Pesticide coordinators and applicators should maintain their State license annually by taking Continuing Education Units (CEUs) for recertification which may be obtained from the Regional pesticide workshop or other appropriate training courses as published on State agency websites. For activities involving pesticides (handling , application, etc.), training should be obtained from a Forest Safety Manager or Hazardous Materials Coordinator in fulfilling the HAZCOM/GHS Standard before initial assignment as required under 29 CFR 1910.1200. Regional training requirements are found in the *Plan for Pesticide Training and Certification in Region 3* (http://www.fs.usda.gov/main/r3/forest-grasslandhealth/invasivespecies). The plan can also be obtained by contacting the Regional Invasive Species/Pesticides Coordinator.

Pesticide coordinator designation

In Region 3, forest supervisors are required to ensure compliance with relevant FSM and FSH direction by appointing a Forest Pesticide Coordinator who is responsible for coordinating pesticide uses and providing advice and assistance to line officers (FSM Region 3 Suppl. 2150.47). District-level pesticide coordinators may also be designated as needed (FSM 2150.47). PUPs can be approved by line officers in Region 3 only if expertise is maintained at the field level by appointing a forest or district pesticide coordinator who has been trained and certified, i.e., licensed (FSM R3 Suppl. 2150.47). In the absence of a trained and certified Forest Pesticide Coordinator (or a qualified District Pesticide Coordinator who can act for the forest), PUP approval must be made by the Regional Forester. Coordinators should be designated formally at the field level by the relevant supervisor by writing a letter in the Forest Service correspondence database with notification to the Regional Invasive Species/Pesticides Coordinator.

Pesticide-use proposals

Pesticides cannot be applied on NFS lands or other Forest Service-managed areas without (1) a signed decision or Category Exclusion under NEPA, and (2) a Pesticide-use Proposal (PUP) on file completed and reviewed at the respective Forest Service office. The PUP form (Form FS-2100-2) must be completed for any proposed application of an herbicide, vertebrate pesticide, insecticide, fungicide, or any other kind of pesticide registered by EPA with the exception of household pesticides (FSH 2109.14, Chapter 74). Although pesticide coordinators normally provide information for a PUP, non-USFS organizations (e.g., State game & fish agencies) or individuals with appropriate expertise may also provide information for a PUP. However, signatory authority for approving the PUP still resides with the delegated USFS line officer. A fillable PUP form may be obtained from https://www.fs.fed.us/foresthealth/protecting-forest/integrated-pest-management/pesticide-management/index.shtml or from the Regional Invasive Species/Pesticides Coordinator.

All PUPs generated on a forest must be reviewed by the Forest Pesticide Coordinator and by relevant district pesticide coordinators. Prior to applying pesticide(s) on NFS lands or other Forest Service administered areas, all PUPs must be reviewed for

1. Completeness and accuracy;
2. Compliance with pesticide labeling;
3. Considerations for applicator health and safety;
4. Compliance with applicable law and policy, including groundwater protection policy found in FSM 2560.03;
5. Appropriateness of application technique(s); and
6. Effectiveness against targeted organism(s).

The *Guidance for Approving Pesticide Use in Region 3* should be consulted for R3 procedures for PUP approval and line officer delegation (see https://www.fs.usda.gov/detail/r3/forest-grasslandhealth/invasivespecies/?cid=stelprd3833403). Forest Supervisors and District Rangers must review and approve, or disapprove, those PUPs for which they have delegated authority (FSM 2150.47). However, only the Regional Forester can approve pesticide use for

1. Designated or study wilderness areas,
2. Designated or candidate research natural areas, and
3. Any use of sodium cyanide (FSM 2150.44).

The approval authority for these three particular pesticide uses cannot be delegated, and requests for approval of any PUPs involving these three uses must be made through a letter from the Forest Supervisor to the Regional Forester. The Regional Invasive Species/Pesticides Coordinator should be consulted before a PUP is submitted for approval by the Regional Forester.

It is the responsibility of each pesticide applicator to ensure that PUP information is current for their projects. A properly completed and approved PUP can remain in effect for the duration of the project as long as pesticide application activities described in the PUP remain consistent with pesticide product registration, label information, and a valid NEPA document.

Pesticide-use safety planning

Under FSM 2151.3, Forest Service units must prepare a safety plan for all pesticide-use activities, except as described in the Pesticide-Use Management and Coordination Handbook (FSH 2109.14). A Job Hazard Analysis (JHA), form FS-6700-7, must be prepared for pesticide-use activities; however, the five-step process for risk management as described in FSM 6718.2 may also be used in lieu of a JHA. The Health and Safety Code Handbook (FSH 6709.11) should be referenced for instructions on completing a Job Hazard Analysis form.

Pesticide incidents and accidents

Pesticide incidents include non-life-threatening situations such as minor pesticide spills, non-target pesticide applications, unusual occurrences of drift, adverse effects on wildlife or other components of the environment, and any other situation that may affect public welfare or may be of special interest to the public or media. Accidents are usually more severe than incidents and can involve major pesticide spills, significant adverse pesticide impacts to the environment, aircraft crashes, or employee injury or death. Appropriate care of the injured must be the first action in response to accidents or emergencies. Subsequent emergency action(s) depend on the situation. Safety procedures outlined in FSH 2109.14, CHAPTER 60 - SPILLS, INCIDENTS, AND ACCIDENTS must also be followed.

Incidents and accidents resulting from pesticide use on NFS lands must be reported immediately (FSH 2109.14, CHAPTER 62). The unit involved with an incident or accident is required to present an initial report to the Regional Office which then decides whether to forward the report to the Washington Office. The written follow-up outline found in FSH 2109.14, CHAPTER 71.3 should be used to report pesticide incidents and accidents.

NEPA

Management activities such as pesticide application on NFS lands may not be undertaken unless documentation for a project is in compliance with the National Environmental Policy Act (NEPA) (FSM 1950). However, a NEPA document may not be required for a special-use permit issued to a State game & fish agency conducting a fish restoration project with a piscicide. Information on the NEPA process for analyzing invasive plants may be found in the Forest Service's *Invasive*

Plant Management Decisions and Environmental Analysis, which may be obtained by contacting the Regional Invasive Species/Pesticides Coordinator for a copy.

Pesticide risk assessments

All NEPA documents involving pesticides must be based on relevant information from an appropriate risk assessment (FSM 2151). The pesticide risk assessment is used to evaluate the probability that use of a particular pesticide might pose harm to humans or other species in the environment. Risk assessments help guide agency decision-making and are also used to disclose potential environmental effects to the public. The Forest Service has prepared a number of Human Health and Ecological Risk Assessments (HERAs) for pesticide activities on NFS lands (http://www.fs.fed.us/foresthealth/pesticide/risk.shtml). Risk assessments from non-Forest Service sources may be used for the NEPA process; however, these alternative risk assessments must be comparable in quality and scope to Forest Service risk assessments. The Regional Invasive Species/Pesticides Coordinator should be consulted before using any alternative risk assessment in a NEPA document.

Updating NEPA documents

NEPA planning should incorporate sufficient flexibility for timely implementation or substitution of new technologies that fall within the scope of the original decision. A review should be made periodically of existing environmental analysis and decision documents to determine whether a new NEPA document is necessary to allow use of newly available technologies, e.g., biocontrol agents or "new chemistry" herbicides. In Region 3, some forests have relatively outdated EAs or EISs for invasive plant management that do not include biocontrol agents or new herbicides such as aminopyralid or aminocyclopyrachlor. These new types of herbicides can be more cost effective and potentially have better human safety profiles with fewer environmental impacts. Older environmental analyses for herbicide use may also need to be updated to allow use of biocontrol agents and to revise control methods or strategies that have proven inadequate. Such strategy revisions may include replacement of relatively small scale herbicide treatment with larger scale treatments.

To allow use of additional herbicides that were not originally included in an existing NEPA document, a supplemental information report (SIR) may be used in accordance with FSH 1909.15, Chapter 10, Section 18.1. The SIR (sometime called a Section 18 review) allows review of new information or changed conditions for a national forest and helps determine whether new application technologies have the same or similar impacts compared to analyses and effects evaluated in earlier NEPA documents. If addition of new herbicides is consistent with the existing environmental analysis, the SIR may be used in lieu of supplementing or revising the existing NEPA document and issuing a new decision. Forest Service risk assessments (http://www.fs.fed.us/foresthealth/pesticide/risk.shtml) should be referenced in the SIR if they address the herbicide to be added. However, the Regional Invasive Species/Pesticides Coordinator should be consulted before using any alternative risk assessments in a NEPA document other than those on the Forest Service website. The SIR review should also be coordinated with NEPA personnel. Once the SIR process is completed, a memo should be added to the correspondence database together with the SIR as an attachment. The memo and SIR should also be added as part of any official file that contains the original NEPA document.

NPDES

Beginning October 31, 2011, discharges of pesticides into "Waters of the United States" (WOTUS) are required to be authorized through an EPA or State-issued Pesticide General Permit (PGP) in compliance with National Pollutant Discharge Elimination System (NPDES) regulations of the Clean Water Act. For the purpose of determining WOTUS, forests in Region 3 must consider all waterbodies, wetlands, canals, irrigation ditches, and bottomland areas (riparian areas, floodplains, etc.) on NFS lands as WOTUS unless these areas can be positively excluded by the Forest or Regional Hydrologist. This includes waterbodies or wetlands that are ephemeral or intermittent (seasonally dry).

The PGP for a particular State provides NPDES coverage for operators (Applicators and/or Decision-makers) who have (1) met conditions of eligibility defined in the permit and (2) submitted a Notice of Intent (NOI) and other documents in accordance with permit requirements. For purposes of PGP compliance, the Forest Service is considered to be a large entity Decision-maker. In addition to the NOI, an up-to-date pesticide discharge management plan (PDMP) is required for permit coverage of pesticide applications unless otherwise exempted by a permitting agency. The intent of the PDMP is to identify and evaluate control measures that will comply with pollutant restrictions and minimize discharges.

The Forest Pesticide Coordinator has the lead responsibility for preparing required NPDES documents for the forest (FSM R3 Suppl. 2150.47). For fish restoration projects involving a piscicide, a State game & fish agency may provide the necessary NPDES documents if that State agency is the project lead. Each NOI or self-certification form filed by a forest with a permitting agency for pesticide treatment on NFS lands involving WOTUS must be authorized by the Regional Forester who serves as the certifying official for the Forest Service. In addition to submitting NOIs and PDMPs to the Regional Forester for approval and eventual submittal to NPDES permitting agencies, forests with pesticide discharges into WOTUS are required to prepare an annual report each calendar year for the duration of PGP coverage, regardless of whether discharges from the application of pesticides have been made. EPA's official reporting form (http://www.epa.gov/npdes/pubs/pgp_appg.pdf) may be used by forests in Arizona, New Mexico, and Oklahoma as the annual report's template. The annual report for Arizona forests must be completed by February 14 and kept with the PDMP. For forests in New Mexico and Oklahoma, an annual report on pesticide application activities performed by Forest Service personnel under each NOI is due to EPA no later than February 15. The forest must submit the annual report electronically through EPA's notice processing system (eNOI) or by mailing the completed annual template form directly to EPA. Further information may be found in the *NPDES Guidance for Region 3* (http://www.fs.usda.gov/main/r3/forest-grasslandhealth/invasivespecies).

Management Strategies and Weed Prioritization

Management Strategies

As indicated below in a graph derived from Chippendale (1991), the abundance of invasive species over time generally follows a logistic (cumulative) growth pattern whereby populations of these species (1) are first established during the introductory phase, (2) undergo a lag phase before reaching a maximum rate of expansion during the colonization phase, and then (3) taper off as resources for growth are fully utilized and the species becomes naturalized in the environment.

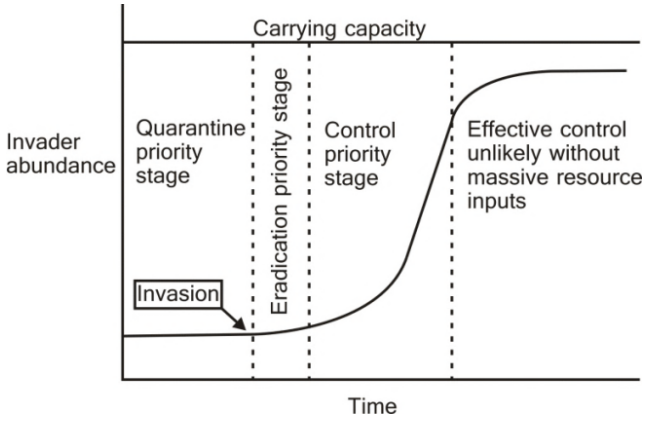

Figure 1. Growth patterns and management priorities for invasive species (after Chippendale, 1991)

According to figure 1, management options for invasive species vary according to the stage of population growth for these species. Strategies for managing invasive species are therefore generally governed by the progression of logistic growth patterns. Fundamentally, there are three practical approaches that can be used to manage invasive species after establishment: (1) eradication, (2) containment, and (3) control. Both eradication and containment may be emphasized at the early stages of infestation. Once populations of an invasive species have reached the naturalization stage where populations are fully expanded, the only control options typically are local control on a limited basis or possible use of biocontrol agents if available.

Eradication

In many cases, invasive species exhibit a prolonged lag period following introduction and can normally be eradicated if detected in time. Almost any species can be eradicated within a small area if sufficient resources are available; however, the biology of some species may make eradication less feasible (Simberloff, 2003). Simberloff (2003) identified requirements for successful eradication as including

1. Detectability of the target species at low densities,
2. Biological features of the species that are susceptible to treatment,
3. Adequate resources to complete necessary treatments,
4. Commitment to complete the project, and
5. Ability to conduct intensive management of the system on a follow-up basis.

Early Detection and Rapid Response: Early detection and rapid response (EDRR) should be used to stop establishment of invasive species before eradication becomes impossible and management expenses become unreasonable. To achieve eradication, EDRR requires (1) early detection, (2) rapid assessment, and (3) rapid response. Early detection may be accomplished by the surveillance, search, or survey techniques as described above in the **Detection** subsection (p. 26). The detection of an invasive species should initiate the rapid assessment process that determines whether a response is necessary. If a response is warranted, rapid response efforts should then be used to eradicate or else contain invasive populations. Response efforts should be prepared to cross jurisdictional boundaries which may involve partnering with the private and/or other public sectors. EDRR may be based in part on enlisting an informed and vigilant public who have the ability to remove new populations once detected. Further information on the EDRR may be found at USDA's EDRR webpage (http://www.invasivespeciesinfo.gov/toolkit/detection.shtml).

Forests and districts should promote and fund EDRR activities. Although EDRR requires considerable time and resources to find and treat new invaders, overall expenses for this type of activity can be relatively cost-efficient as compared to other efforts to manage invasive species. High risk invasive species (animal, plant, pathogen, etc.) should have highest priority for EDRR.

Invasive plant eradication: Invasive plants can spread by seed and by vegetative means such as rhizomes, runners, shoots, and tubers. To successfully eradicate infestations, targeted plants and viable propagules must be completely eliminated over the entire infested area. Unless control is 100 percent, viable seed can still be added to the soil bank thereby allowing reproduction to continue (Zamora et al., 1989). Viable seeds from targeted weeds must therefore be prevented from becoming part of the seed bank, and residual propagules such as root or stem fragments should not contribute to further vegetative spread. Dismembered weed parts with immature seed structures or long-lived root fragments should be expected to re-establish sometime in the future if not adequately monitored and treated.

In general, forests should attempt to eradicate invasive weed infestations whenever feasible. However, the ability to eradicate infestations declines over time given expected increases in the level of infestation and the costs required to treat infestations successfully. Total eradication of invasive species populations may be possible only when there is still a realistic chance for successful completion. Probabilities for successfully eradicating invasive plant populations during the lag phase and early part of colonization may be judged according to table 2. Note that probabilities for successful eradication of infestations within acreage ranges shown in the table are generalized and may vary according to availability of project resources, invasive species characteristics, landscape attributes, etc. Attempts to eradicate should be based on factors such as weed priority and the ability to provide sufficient resources for completion of the eradication effort.

Table 2. Probabilities for successful eradication projects (Rejmánek and Pitcairn, 2002) [3]

Infested acreage	Eradication probability
< 2.5 acres	100%
2.5 – 250	33%
250 – 2,500	25%
> 2,500	almost none

For relatively large infestations that can still be eradicated, satellite populations and perimeter edges should be treated first with the entire infestation scheduled to be reduced and eradicated in a series of steps over a period of several years. Regardless of the size of the infested area, eradication efforts should be maintained rigorously throughout the growing season. Areas undergoing eradication need to be monitored and treated until recruitment from seed bank and/or residual propagules no longer occurs.

Containment

Containment of invasive species infestations that are beyond eradication generally has a relatively low probability of success over the long term. Expansion of invasive species populations through natural migration or transport by humans, vehicles, livestock, etc. is difficult if not impossible to control indefinitely. Containment requires a protracted management commitment and should only be used as a last resort to maintain relatively small, non-eradicable populations indefinitely or else used on a short-term basis to contain large-scale infestations that will gradually be reduced through treatment projects. To prevent expansion, the goal should be to contain the invasive species infestations by (1) treating satellite populations and infestation perimeters, and (2) implementing sanitation measures to minimize transport of individual organisms or propagules along roadways, trails, waterways, and other transportation pathways across or away from the infestation. Treatment should be adjusted according to outcomes of previous management actions.

Control

Unless action is taken to keep an invasive species from spreading, it can reach carrying capacity in its new environment where it will eventually become naturalized and displace native species (Radosevich 2002). The only effective approach to forestall unduly harmful effects resulting from species that are beyond eradication or containment is to control their colonization processes. During the colonization phase, the relative growth and reproduction of an invasive species should be managed such that community dynamics are favorably shifted toward desirable species (Sheley et al. 1996). Reductions in invasive species population and increases in desirable species

[3] Eradication probabilities given in table 2 are based on a study by Rejmánek and Pitcairn (2002) that reviewed 53 weed eradication projects in California. The study found that attempts to eradicate exotic weed infestations smaller than 2.5 acres (one hectare) were generally successful. Projects attempting to eradicate infestations between 2.5 acres and 250 acres were successful only one-third of the time and only one-fourth of the time for acreage between 250 and 2,500. Infestations larger than 2,500 acres (approx. 4 sq. miles) were almost never eradicated due to realistic limits on available resources necessary to control them.

may be achieved by applying management actions (e.g., herbicide applications or release of biocontrol agents) in a manner that takes advantage of natural processes (Sheley et al. 1996).

In general, a control strategy is typically used for large-scale suppression and reduction of invasive plant populations during the colonization phase. **Note that EDRR and eradication efforts should be used as part of an overall control strategy in protecting local areas that are currently uninfested and can be kept weed free indefinitely.** Containment of an invasive plant infestation that is too large for eradication may be attempted as part of a control strategy that must be continued indefinitely.

Adaptive management: Realistic goals and objectives should be established for management of widely distributed invasive species that are impractical to control through eradication or containment efforts alone. To improve long-term success with non-eradicable infestations of an invasive species, an adaptive management approach should be used (see Williams et al., 2009). Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs as determined by objective evidence. Although adaptive management may be used in conjunction with all three management strategies (eradication, containment, or control), it generally is most applicable to controlling extensive, widely dispersed infestations. The stepwise process for adaptive management involves

1. Assessment of the overall problem,
2. Establishing management goals and objectives,
3. Implementation of control strategies,
4. Monitoring the effectiveness of management actions,
5. Evaluating actual outcomes in relation to expected results, and
6. Adjusting practices as necessary.

Steps in the adaptive management process should be repeated in sequence as part of a continuous learning cycle that improves management planning and strategy by learning from outcomes of previous actions. In general, a management strategy using an adaptive management approach is considered to be successful if

1. Stakeholders are actively involved and remain committed to the process,
2. Monitoring and assessment are used to adjust and improve management decisions, and
3. Management goals and/or objectives for the resource are being achieved.

Adaptive management example: A simplistic example of an adaptive management approach to manage invasive weeds in a watershed is outlined below:

Goal

Rehabilitate and restore a watershed by reducing overall acreage of invasive plants.

Strategy

Procedures:

1. Inventory and prioritize populations of invasive plant species of highest concern in the watershed.
2. Identify infested areas in the watershed that can be controlled or possibly even successfully eradicated. This includes identifying pathways for invasive plant spread such as roads, trails, utility corridors, livestock driveways, waterways, and other potential weed infested areas that can be treated to minimize transport of seed or propagules into non-infested parts of the watershed.
3. Develop a weed management plan for managing priority invasive weeds in the watershed (see the **Weed Management Plans** subsection in the next section).
4. Implement control methods and monitoring in project areas that are necessary for suppression or reduction of priority plant species infestations (including eradication of relatively small, isolated patches of invasive plants).
5. Implement restoration activities and monitoring as necessary in project areas.
6. Evaluate treatment results and make necessary adjustments in accordance with the adaptive management process.

Invasive Weed Prioritization

Risk assessments

Under FSM 2903, site-based and species-based risk assessments should be developed and utilized to prioritize management of invasive species infestations in aquatic and terrestrial areas of the NFS. A risk assessment is particularly necessary if the potential for invasiveness of a newly introduced species is unknown. The risk assessment should involve identifying characteristics of the species as well as assessing habitat susceptibility. Considerations for assessing the potential risk of a weed species should include

1. Listing on a State or Federal noxious weed list;
2. Potential for disruption of an ecosystem or resource;
3. Invasiveness (seed production rate, root expansion potential, etc.);
4. Availability of pathways or vectors allowing spread (road systems, trails, livestock drives, waterways, etc.);
5. Proximity of infestations on non-NFS lands to NFS boundaries and likelihood of spread;
6. Threat to TES species or high value areas (wilderness, national parks, municipal watershed, un-infested areas, scenic by-ways, etc.); and
7. Feasibility of effective management (prevention, eradication, control, restoration, etc.).

Further information on weed risk assessments may be found at USDA APHIS noxious weeds program website (https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/pests-and-diseases/sa_weeds/sa_noxious_weeds_program/ct_riskassessments). The Regional Invasive Species/Pesticides Coordinator should be contacted if a new species (pathogen, plant, or animal) is determined to be invasive after an initial risk assessment has been conducted.

Priority weed classes for Region 3

Invasive weeds should be prioritized according to relative threats and management emphases. Three invasive weed classes of A, B, and C are ordinarily used in State noxious weed lists (e.g., the New Mexico list) to prioritize different levels of threat and expected management response. However, it may not be feasible for some Region 3 forests to use just three classes to prioritize invasive weed species due to the hazard presented by certain invasive weeds with widespread infestations. Examples of extreme threats from invasive weeds include (1) periodic fire cycles and vegetation-type conversion induced by buffelgrass (*Cenchrus ciliaris*) on the Coronado NF, (2) overwhelming expansion of musk thistle (*Carduus nutans*) affecting grazing on the Lincoln NF, and (3) cheatgrass-fueled fires on the North Kaibab Ranger District of the Kaibab NF. These particular species require additional management response to preserve vulnerable or valuable resources (e.g., native plant communities) and/or adequate ecophysiological conditions (e.g., soil fertility).

Because of the additional threat and greater management response required for some invasive weed species in Region 3, four classes for prioritizing invasive plants may be used:

1. **Class A species** – These invasive weed species are newly established or else have the potential to become established on the forest, district, or within a particular watershed. Such species pose a major or unacceptable threat to watershed condition, TES (threatened, endangered, or sensitive) species, wilderness, or other natural and economic resources. Weeds species in this classification should receive highest priority for prevention, eradication, containment, control, and/or restoration. Management emphasis is to prevent and eradicate whenever possible or else use containment as a last resort.

2. **Class B species** – These invasive weed species currently have limited distribution on the forest, district, or else within a particular watershed; however, these species still pose a substantial threat to watershed condition, TES species, wilderness, or other natural and economic resources. Weed species in this classification receive a lower priority for eradication, control, or restoration as compared to Class A species. Management emphasis is to eradicate on a local basis or else control established infestations by using an adaptive management approach.

3. **Class C species** – These invasive weed species are widely distributed across the forest, district, or else within a particular watershed but do not pose additional threats to watershed condition, TES species, wilderness, or other natural and economic resources (e.g., widely scattered cheatgrass infestations that do not unduly impact native vegetation or contribute to periodic fire cycles). Weed species in this classification generally receive the lowest priority for control or restoration as compared to species in other classes. Management emphasis is to use a control strategy with an adaptive management approach on a local basis only when necessary to achieve desired goals and/or objectives and to limit overall impacts.

4. **Class E species** – These invasive weed species currently have widespread distribution across the forest, district, or else within a particular watershed and pose an unacceptable, extreme hazard (accordingly, E) to watershed condition, TES species, wilderness, or other natural and economic resources. These particular wide-ranging species must be controlled vigorously and continuously to prevent overwhelming damage to natural resources (e.g., a fire cycle introduced by buffelgrass into Sonoran Desert plant communities unadapted to fire). Weed species in this classification should receive high priority for control and restoration, which may supersede Class B species for treatment priority. To limit impacts and achieve desired goals and/or objectives, management emphasis is to control infestations on a broad-scale basis by using a control strategy with an adaptive management approach.

Treatment priorities

Forests in Region 3 should assign treatment priority for invasive weed species in the classes according to monitoring data and threat assessment. Class A weed species should have priority for treatment over Classes B and C. Eradication is the primary objective for Class A species and possibly for Class B species under limited circumstances (e.g., new infestations of a particular Class B species in a previously un-infested area that can be kept free of this weed indefinitely). Class E species must have high priority for treatment if natural resources such as native plant communities or TES species are unduly threatened. Not all forests will need to list and implement management provisions associated with the E class if invasive weed species currently in their weed inventory do not qualify. However, an invasive weed species should be designated as a Class E species when infestations of that particular weed species have reached a stage where broad-scale treatment is required on an annual basis to preserve natural resources.

Priority weed lists

A comprehensive list detailing infested acreage, priority classifications, and treatment objectives for invasive plant species should be maintained by each forest invasive species coordinator. Based on need, the list should be developed for either (1) the entire forest, (2) every individual district on the forest, or (3) every 6th Hydrologic Unit Code (HUC) watershed on the forest. A determination should be made as to whether a single forest-wide list will suffice for invasive weed management on the forest or whether development of separate lists that address districts or 6th HUC watersheds individually on the forest will be more useful. With the separate list approach, a species that qualifies as a particular class in one district (or watershed) may be re-classified into a different class in another district (or watershed) depending on its presence. Priority lists compiled on a district-by-district basis may provide the greatest accuracy and flexibility for invasive weed management on a forest.

Once developed, priority lists for invasive weed species should be updated periodically as needed by the Forest Invasive Species Coordinator and distributed to each district on the forest. A simplistic, hypothetical example of a priority weed list for a ranger district is shown in the table below.

Table 3. Priority weed list example for the Santa Catalina Ranger District, Coronado NF

Common Name	*Specific Name*	Acreage	Class	Treatment Objectives
Buffelgrass	*Cenchrus ciliaris*	8,000	E	Broad-scale Control
Giant reed	*Arundo donax*	40	B	Eradicate or Control
Lehmann lovegrass	*Eragrostis lehmanniana*	500	C	Monitor/Control if necessary
Onion weed	*Asphodelus fistulosus*	no occurrence yet	A	Prevent/Eradicate
Sahara mustard	*Brassica tournefortii*	< 5	A	Eradicate/Prevent
Sweet resinbush	*Euryops subcarnosus*	10	B	Eradicate or Contain

Planning

Forest Weed Management Plans

Each forest should have a comprehensive management plan for invasive weeds that can either serve uniformly across the entire forest or else is partitioned on a district-by-district or possibly a watershed-by-watershed basis. A forest weed management plan can serve as the basis for determination of priority acres for treatment which are used in end-of-year accomplishment codes (see **WorkPlan and Accomplishments Reporting** section below, p. 79). The forest weed management plan should be compatible with existing NEPA documents and address overall goals, objectives, and target metrics (inventory, treatment, and monitoring) for management of individual invasive weed species on the forest. Weed inventory information and maps in the plan should be based on survey data collected from the field and entered into the FACTS database with the TESP-IS application. Priority weed lists at the forest, district, or watershed-level should be developed for the plan as necessary.

Although existing NEPA documents have been used in lieu of a forest weed management plan, such NEPA documents generally do not accurately reflect current conditions for invasive weeds across the forest. They also do not incorporate specific objectives, targets, and strategies in sufficient detail that invasive weeds on the forest can be properly managed into the future. The Regional Invasive Species/Pesticides Coordinator should be consulted in regard to the adequacy of using a NEPA document in lieu of a forest weed management plan.

In general, the weed management plan for a forest should be designed to prevent weed expansion and/or limit seed dispersal, while also shifting the competitive balance toward re-establishing healthy plant communities whenever desired vegetative cover is at a low point. The forest management plan should incorporate strategies with treatment projects that will manage specific invasive weed species in accordance with priority weed lists. Forests with at least one E class species should develop strategies that will control these particular species on a broad-scale basis. Landscape features susceptible to invasive weed infestations such as specific roads, trails, waterways, campgrounds, heavy equipment facilities, etc. should be addressed in the plan in detail. Scheduling for activities such as surveying, treatment cycles, and monitoring of these landscape features should also be included. In some cases, local CWMAs may be able to assist forests in developing weed management plans. Please refer to an example of a forest management plan (entitled as Draft 2012 Invasive Species Action Plan) (http://fsweb.sanjuan.r2.fs.fed.us/invaspecies.shtml) that was developed for the San Juan NF.

Project Planning

As required by the National Forest Management Act (NFMA) and the NFS Land Management Planning Rule, all projects and activities authorized by the Forest Service must be consistent with the forest plan. Forest plans set desired conditions and the standards and guidelines for management, protection, and use of a particular forest. Treatment projects for invasive species should therefore be designed to support various management objectives and goals stated in the forest plan for an individual forest. In addition to desired conditions, other forest objectives and goals to support are those associated with (1) five-year restoration, (2) watershed restoration, and (3) wilderness stewardship. An interdisciplinary approach should be taken to address potential ecological, aesthetic, cultural, or economic impacts on target areas.

Project risk assessments

The need for weed prevention and maintenance (including herbicide use) should be determined at the onset of project planning. All projects that involve ground disturbance or site alteration should be assessed for potential establishment of invasive weeds once the project is undertaken. For a NEPA-level project, environmental analysis for projects and maintenance programs will need to (1) assess weed risks, (2) identify prevention practices, and (3) analyze potential treatment of high risk sites for weed establishment and spread. If necessary, bonds for invasive weed concerns in regard to ground disturbing projects should be retained.

A field reconnaissance of the project site should be conducted to determine the presence of invasive plants prior to project implementation. Before ground-disturbing activities begin, onsite weed infestations should be inventoried and prioritized for treatment in project operating areas and along access routes. The field reconnaissance should include inspection of potential off-site areas such as gravel pits, equipment yards, or similar disturbed areas for invasive weeds that could contribute to infestations on NFS lands in conjunction with the proposed project. Local records of the Forest Service, County/State weed boards, etc. may also be consulted to determine whether noxious or invasive weeds have been sighted in or are adjacent to the project area. For NEPA-level projects, a sample design should be used in the reconnaissance to show that possible areas for invasive plant occurrence were adequately searched at the proper time of year for species identification. Reconnaissance findings for a NEPA-level project should be documented in the NEPA document. All sightings on invasive weed species should also be reported to the local Forest Service unit, County and/or State weed agencies, and other affected parties.

Proposed projects causing disturbance should be rated in regard to relative risk for invasive plant establishment. Risk ratings of none, low, moderate, or high may be used to describe information necessary for further actions regarding project modification or implementation. A brief summary of factors that can be used to describe the likelihood of invasive weed establishment into a proposed project area along with management actions necessary for remediation are shown in table 4 below.

Site assessments for a NEPA-level project should prescribe project actions necessary to reduce or prevent spread of invasive weeds where the risk of invasive plant establishment is moderate to high. If the project area has a moderate or high risk rating after disturbance, project planning should include preventative measures to prevent establishment of these invasive weeds in the project area. As an example, project areas involving prescribed burns should be inventoried and evaluated for potential weed spread with regard to the fire prescription. Areas with moderate to high weed cover already present should be managed for at least two years prior to the prescribed burn to reduce the amount of weed seed. Vigilant weed management will be necessary after the burn.

Table 4. Risk assessment for proposed projects

Site Status and Project Consequences	Risk Rating	Management Actions Needed
Invasive weed species are not present within or immediately adjacent to the project area. Project activities are not likely to result in the establishment of invasive weeds in the project area.	None	None. Project may proceed as planned.
Invasive weed species are present in areas adjacent to but not within the project area. Project activities may possibly result in establishment of invasive weeds in the project area.	Low	Project may proceed as planned. Control measures should be implemented for infestations of weeds in Class A, B, or E as they occur. Class C weeds may require management only if their establishment interfers with project goals.
Light to moderate infestations of invasive weed species are located within or immediately adjacent to the project area. Project activities are likely to result in some areas becoming infested with invasive weeds even when preventative management actions are followed.	Moderate	Control measures are essential to prevent the spread of invasive weeds in Class A, B, or E within the project area. Class C weeds may require management only if their establishment interfers with project goals. A project plan should be developed with preventative measures that will reduce the risk of introduction or spread of invasive weeds in the project area. The measures should include seeding of disturbed sites with desirable species. The area should also be monitored for at least three consecutive years and provide for control of newly established invasive weeds along with follow-up treatment for previously treated infestations.
Heavy infestations of invasive weed species are located within or immediately adjacent to the project area. There is a high probability that project activities will cause the establishment and spread of invasive weeds on disturbed sites throughout much of the project area even when actions for preventative management are used.	High	Control measures are essential to prevent the spread of invasive weeds in Class A, B, or E within the project area. Class C weeds may require management only if their establishment interfers with project goals. The project should be modified as necessary by a project plan that includes preventative measures that will reduce the risk of invasive weed establishment, including control of existing infestations of invasive weeds prior to project activity and subsequent seeding of disturbed sites with desirable species. The project must provide for control of newly established invasive weeds along with follow-up treatment for previously treated infestations. The project should also provide for at least five consecutive years of monitoring.

Designing weed treatment projects

In designing treatment projects for invasive plants, the priority of individual weed species for treatment should be taken into consideration. In general, sites with Class A, B, or E species present will probably require a higher level of management actions and monitoring due to potential high risk from weed establishment as compared to sites with only Class C species present. Potential objectives and management emphases for designing treatment projects according to weed classification are summarized in table 5 below.

Table 5. Treatment project objectives by weed classification

Class	Treatment Project Objectives
Class A	Treatment projects for Class A species should eradicate or at least contain infestations across the entire forest regardless of site. EDRR should be emphasized for these species, particularly along potential entry areas.
Class B	In areas infested by Class B species, treatment projects should be designed to control infestations by stopping or slowing any further spread. These species should be aggressively controlled along highway ROWs, utility corridors, and waterways to prevent or minimize spread on NFS lands.
Class C	Treatment projects for landscapes with widespread infestations of Class C species that have naturalized within the ecosystem should generally be attempted only when the level of infestation threatens resources at a local scale and adequate control over the target area is feasible.
Class E	Treatment projects for Class E species should be designed to prevent or limit unsustainable impacts to landscape resources resulting from widespread infestations of invasive species in this class. A continuous series of treatment projects for this class should be set up on a scale sufficient to accomplish management objectives for protecting resources at the landscape level.

Treatment projects should be undertaken first in high risk areas with invasive species that can be eradicated (locally), contained, or controlled. Treatment priority may be based in part on whether a project is in an area of concentrated use or a dispersed area. Areas of concentrated use such as facilities, boating areas, corrals, stock ponds, and fire camps should have high priority for weed control. Commonly used livestock trails and high use recreation areas (trails, campgrounds, etc.) should particularly have high priority. Dispersed areas with comparatively less concentrated use may have a lower priority for treatment. These areas include, but are not limited to transportation and utility ROWs, fuels treatment areas, T&E species habitat, water bodies and wetlands, grazing allotments, wildlife winter range, fire-breaks in burned areas, timber sale areas, wilderness areas, research natural areas, etc.

A treatment project should be based on inventory established after the weed infestations have been surveyed and mapped. **Random acts of treatment or restoration should be avoided with all projects**. A decision should be made as to whether the project will attempt total eradication of an invasive plant population or whether infestations have progressed to a point where the project will necessitate either containment or a control strategy with an adaptive management approach. Eradication projects should be completed within a sufficiently short time frame such that reasonable success is assured. Projects using a control strategy with an adaptive management approach should have a formal plan that defines ways in which overall management goals and objectives will be attained on a landscape or watershed level over an extended time period.

To prevent weed expansion, projects should generally treat infestation perimeters and satellite populations first since weeds often spread as an advancing front (Enloe, 2006). Treatment of satellite populations of large infestations should be emphasized over infestation perimeters due to higher rates of spread associated with the satellites (Moody and Mack, 1988). A combination of containment and strategically located eradication treatments may be used to stop large infestations from spreading (Zamora et al., 1989). EDRR for new infestations will be a necessary component of any containment-eradication plan using adaptive management. When large-scale weed control over a landscape does become necessary, large infestations may be divided up into small units and worked from the outer edges toward the interior of the infestation (Enloe, 2006). For invasive plant species infesting riparian areas, treatment projects should be implemented first at the top of the watershed and then moved down the watershed in successive treatments.

For treatment projects, all IWM options (physical, cultural, biological, and chemical) should be reviewed to select which combination of management methods or techniques will most effectively control targeted species Impacts to non-target species should be evaluated and balanced against benefits resulting from treatment of target species. Characteristics of targeted invasive plant species such as the life cycle and population dynamics should be considered when designing treatment projects. In general, treatment projects should be implemented prior to flowering or seed-head development for most species. At a minimum, seed head development should not progress to a point whereby immature seed can ripen and become part of the seed bank. Nor should residual live fragments from roots or stems be capable of re-establishing invasive plants in treated areas. Re-treatment with an extended period of desiccation for fragments may be necessary after disturbance (e.g., tillage) to eliminate live fragments completely. Projects should entail monitoring and any retreatments necessary to deplete the seed bank or reestablishment from residual root or stem propagules. Although herbicides and other types of control methods may initially cause large reductions in weed populations, projects should allow for any additional treatments that may be necessary, including spot treatments.

It should be anticipated that many weed populations will eventually recover to pre-treatment densities unless the underlying causes of weed invasion are corrected (Jacobs, 2007). Underlying causes for the original invasive plant infestations (overgrazing, off-road driving, fire regime change, etc.) should be addressed in project planning. In some cases, early seral invasive species can dominate a treated area but can be expected to disappear over time due to natural succession (Jacobs, 2007). Treatment projects should always consider necessary measures for rehabilitation and restoration as part of an overall plan. When possible, perennial native grasses that have been suppressed by weed infestations should be encouraged to regain dominance and forestall return of weeds. In some cases, revegetation with native species may be necessary.

Project-specific plans

For each treatment project, a project plan should be developed. In addition to defining the scope and magnitude of treatment, the project plan should address factors such as

1. Chosen herbicides;
2. Rate, timing, and method of applications;
3. Sensitive or high-value areas requiring monitoring within and adjacent to the treatment area; and

4. Public concerns about the program.

Project plan outline: Basic features of a project-specific plan for weed management are shown in the following outline (as adapted from Tu and Meyers-Rice, 2001)–

INTRODUCTION

A. Short Description of Weed Threat and Interference with Management Goals

B. Overview of Proposed Weed Management Strategies

DESCRIPTION OF THE SITE OR MANAGEMENT AREA

A. Boundaries

B. Resource Base (Biological Communities, T&E Species, Land-Use History, etc.)

INVENTORY OF WEED SPECIES

A. Inventory of Weed Species (Areas Searched, Weed Species Targeted, etc.)

B. Maps of Weed Infestations (as generated by TESP-IS software, other sources, etc.)

MANAGEMENT GOALS AND WEED MANAGEMENT OBJECTIVES

A. Land Management Goals (Including Desired Conditions, Five-Year Restoration, Watershed Restoration, Wilderness Stewardship, etc.)

B. Weed Management Objectives (i.e., Achievable Measures for Sites with Deadlines)

PRIORITIES FOR WEED MANAGEMENT

A. Description of Prevention Priorities

B. List of Priority Weed Species Specific for Forest, District, or Watershed

C. Infestation Priorities (Including Maps of High, Medium, and Low Priority Patches)

WEED MANAGEMENT ACTIONS

A. List of Specific Actions for Prevention and Detection (Including EDRR)

B. Specific IWM Approach for Controlling Priority Weed Species

C. Management Strategy for Controlling Priority Species in Project Area

D. Coordination with External Organizations (CWMAs, State agencies, etc.)

E. Summary of Planned Treatment Actions

Table 1- List and Description of Planned Treatment Projects

Table 2 - Implementation Schedule for Treatment Projects

Table 3 - Projected Resource Needs (Equipment, Supplies, etc.) and Costs

Table 4 - Itemized Actual Annual Costs and Labor Worksheets

MONITORING

A. Criteria and Measures to Evaluate Effectiveness of Control Actions

B. Schedule for Monitoring

REFERENCES

APPENDICES

Appendix 1. Emergency Information/Directions and Map to Hospitals or Clinic

Appendix 2. Regional Field Guides for Invasive Species (or alternatives)

Appendix 3. Description of Required Personal Protective Clothing and Equipment

Appendix 4. Copies of Forms for Collecting Monitoring Data (optional)

If herbicides are to be used:

Appendix 5. Herbicide Use Protocols (Storage, Mixing, Transport, Application, Disposal)

Appendix 6. Copy of Pesticide-use Proposal (PUP) for Project

Appendix 7. Herbicide Labels

Appendix 8. Safety Data Sheets (formerly MSDSs)

Appendix 9. Record Forms for Herbicide Use

Further information on developing weed plans may be found at The Nature Conservancy's website (https://www.invasive.org/gist/products/plans/WeedTemp.pdf).

Projects in support of desired conditions

In accordance with the forest plan, treatment projects for invasive species should be designed and implemented to support desired conditions for forest landscapes and watersheds. Desired conditions use the best available science and encompass both current conditions and goals for desired conditions in the future. Desired conditions do not necessarily reflect reference conditions since it may not be possible, or desirable, to return to those conditions.

Desired conditions may be based on ecological or social objectives, or both. Treatment objectives and priorities for invasive species management may be used to support ecological desired conditions since these conditions are typically based on the concepts of ecosystem sustainability, resilience, and adaptive capability. Ecological desired conditions may also be used to direct restoration strategies for sites with invasive species. However, desired conditions may not be attainable in a single treatment and may require hundreds of years to reach. Since the ability to achieve desired conditions may be limited by operational or fiscal constraints, landscapes may need to be prioritized to facilitate realizing desired conditions on high priority landscapes.

Conditions described for landscapes or watersheds are normally stated in broad, general terms and have no specific timeframe by which they are to be achieved. Descriptions at various scales are developed to provide detail and guidance for the design of future projects and activities that

can help achieve desired conditions over time.[4] Descriptions at the landscape scale (10,000 acres or greater) provide overall desired conditions for terrestrial resources (e.g., ponderosa pine forest type) across large land areas. Mid-scale (100 to 1,000 acres) and fine scale (less than 10 acres) descriptions provide further details necessary for guiding future site-specific projects and activities. These smaller scale descriptions may be used to provide biophysical and vegetative information necessary for invasive species management. As an example, the following set of desired conditions was developed to address invasive species in the Apache-Sitgreaves forest plan across all potential natural vegetation types (PNVTs):

Desired Conditions for Invasive Species

Landscape Scale Desired Condition (10,000 acres or greater)

- Invasive species (both plant and animal) are nonexistent or in low occurrence to avoid negative impacts to ecosystems.

Mid-Scale Desired Conditions (100 to 1,000 acres)

- Undesirable nonnative species are absent or present only to the extent that they do not adversely affect ecosystem composition, structure, or function, including native species populations or the natural fire regime.
- Introduction of additional invasive species rarely occurs and is detected at an early stage.

Objectives for Invasive Species

- Annually, contain, control, or eradicate invasive species (e.g., musk thistle, Dalmatian toadflax) on 500 to 3,500 acres.
- Annually, control or eradicate invasive species (e.g., tamarisk, bullfrogs) on at least 2 stream miles.

Standards for Invasive Species

- Projects and authorized activities shall be designed to reduce the potential for introduction of new species or spread of existing invasive or undesirable aquatic or terrestrial nonnative populations.

Guidelines for Invasive Species

- Projects and activities should not transfer water between drainages or between unconnected water bodies within the same drainage to avoid spreading disease and aquatic invasive species.

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[4] The landscape scale (10,000 acres or greater) is composed of variable elevations, slopes, aspects, soils, plant associations, and disturbance processes. This "big-picture" scale is formed from mid-scale units (100 to 1,000 acres) that individually make up a homogeneous forest stand or plant community. A combination of 10 mid-scale units or more typically comprises the landscape scale. In turn, mid-scale units are composed of fine scale units (less than 10 acres) that provide details on vegetation patterns such as species composition, age, structure, and plant distributions.

- Project areas should be monitored to ensure there is no introduction or spread of invasive species.
- Treatment of invasive species should be designed to effectively control or eliminate them; multiple treatments may be needed.
- Pesticide use should minimize impacts on non-target plants and animals.

In contrast to terrestrial resources, desired conditions for aquatic resources are described by using HUC watershed scales to help provide their relative importance or niche.[5] Conditions for large land areas are described under 4th to 5th HUC levels of watershed scale whereas site-specific conditions are described at the 6th HUC level.

In general, treatment projects for invasive plants should be designed at the mid or fine-scale to address objectives for desired conditions adequately. Projects may have generalized objectives such as ensuring that invasive species are absent or are present only to the extent that these species do not adversely affect expected species composition or natural processes such as the normal fire regime. Therefore, projects should ensure that new invasive species are not introduced and that existing populations are eradicated, contained, or controlled. Projects may also be developed to rehabilitate or restore sites previously infested with invasive species through practices such as re-seeding with native species.

Forest planners, silviculturists, vegetation ecologists, soil scientists, and other pertinent specialists should be consulted in setting up invasive species treatment projects in support of desired conditions for a particular landscape or watershed. In some cases, desired conditions may not be known or else established for particular landscapes or watersheds on individual forests due to a lack of science necessary to provide descriptions at multiple scales. Therefore, treatment projects for invasive species may be focused more appropriately on watershed restoration rather than on desired conditions.

Restoration Planning

Five-year restoration plans

In addition to the forest plan, each forest has a five-year restoration plan that guides its restoration work. The five-year restoration plan provides a description of the work to be done with the forest's base budget as well as identify additional projects that could occur with supplementary funding. Each plan is updated annually to add another year of planned restoration work and refine existing information. **Invasive species coordinators should engage in the development of five-year restoration plans for their forest. Coordinators should ensure that all benefits and accomplishments accruing from an invasive species project are accurately attributed in the plan as well as reporting of any additional benefits or accomplishments**.

[5] A hydrologic unit code (HUC) is a hierarchical sequence of numbers or letters used by the U.S. Geological Survey to identify a unique hydrological feature, i.e., a river, river reach, lake, or an area like a drainage basin or catchment. The 4th HUC level is the SUBBASIN which has at least 448 K acres in size whereas the 5th level or WATERSHED typically ranges from 40 to 250 K acres. The 6th HUC level of classification is the SUBWATERSHED, which typically ranges from 10 to 40 K acres.

Both the forest plan and the five-year restoration plan for a forest should be consulted along with relevant NEPA documents in prioritizing and setting up treatment projects for invasive species. The five-year restoration plan for a forest should be reviewed in particular for information on

- Identification and prioritization of landscapes,
- Plan restoration needed in landscapes,
- Implementation of needed restoration work, and
- Implementation and monitoring of treatment projects.

Watershed restoration

As part of the restoration process for a watershed, efforts to restore watershed conditions should be supported by reducing degrading factors within the watershed. Degrading factors include, but are not limited to, high departure from historic vegetation conditions, poor soil condition, nonfunctioning riparian areas, impaired species habitat, occurrence of invasive species, unmanaged grazing, and sedimentation from roads or trails. Treatment of invasive species may therefore be used to reduce degrading factors within targeted watersheds by helping to restore biological integrity and ecological function.

In accordance with FSM 2520 and the *USDA Forest Service Strategic Plan: FY 2015-2020*, treatment activities should be developed to restore ecological condition and improve or maintain the watershed condition class of priority watersheds. The Forest Service's Watershed Conditions Framework (WCF) process is used to identify and prioritize priority watersheds across NFS lands at the 6th HUC level of classification (USDA Forest Service, 2011). The six steps of the WCF process are:

Step A: Classify the condition of all 6th-level watersheds in the national forest by using existing data layers, local knowledge, and professional judgment.

Step B: Prioritize watersheds for restoration: establish a small set of priority watersheds for targeted improvement equivalent to a 5-year program of work.

Step C: Develop Watershed Restoration Action Plans that identify comprehensive project-level improvement activities.

Step D: Implement integrated suites of projects in priority watersheds.

Step E: Track restoration accomplishments for performance accountability.

Step F: Verify accomplishment of project activities and monitor improvement of watershed and stream conditions.

The WCF process was established to facilitate the Forest Service's primary objective of restoring watershed and forest health on NFS lands by improving the watershed condition class. The WCF accomplishes this objective by (1) classifying the condition of watersheds found on NFS lands, (2) prioritizing relative restoration needs, and (3) implementing integrated restorations actions, as well as tracking and monitoring outcomes and accomplishments. Further information on the WCF process is available at https://apps.fs.usda.gov/wcatt/.

IPM treatment projects for invasive species should be established in conjunction with watershed restoration as called for in the forest's five-year restoration plan. In particular, treatment projects may be set up for watersheds that have watershed restoration action plans (WRAPs). Treatment projects for invasive species should be identified as an essential project within a WRAP. To ensure effectiveness and efficiency, a majority of treatments may be focused in priority watersheds or other high-value landscapes such as wilderness areas, habitat areas for TES species, and other sensitive sites. High priority should especially be given to invasive plant treatments that restore diversity and abundance of native vegetation, aquatic species habitat, and soil productivity in the watershed.

Although many activities funded with the NFVW BLI (budget line item) are intended to help restore priority watersheds, not all activities are expected to occur within priority watersheds as there can be a need for restoration outside of these areas. **A balance should be struck between work performed in priority watersheds and work done for other forest or Regional priorities.** Funds from other programs (Hazardous Fuels, Forest Health Management, Trails, Roads (CMRD & CMII), etc.) may be utilized as appropriate to implement restoration actions identified as part of a targeted approach to improving watershed condition class. Forest planners, botanists, biologists, hydrologists, range conservationists, and other pertinent specialists should be consulted in setting up invasive species projects in support of restoring a particular watershed.

Coordination and Cooperation

Invasive Species Issue Teams

In accordance with the *Forest Service National Strategic Framework for Invasive Species Management* (USDA Forest Service, 2013), a national invasive species issue team (NISIT) and respective Regional invasive species issue teams (RISITs) are used to coordinate management activities and research needs across deputy areas at the Region, Station, and Area levels. RISITs are multidisciplinary and are responsible for implementing the national strategy for invasive species management within the Region or Area. In addition to the RISIT, forest-level invasive species issue teams (FISITs) may also be set up to coordinate various staffs and programs across a particular forest.

Coordination with USFS Branches of R&D and S&PF

When practicable, the USFS branches of Research & Development (R&D) and State & Private Forestry (S&PF) along with other programs or agencies may be enlisted in employing applied research to develop technology and techniques for reduction of invasive species impacts to NFS lands (FSM 2903). This includes identification of priority/high-risk invasive species that threaten aquatic and terrestrial areas on NFS lands. The Rocky Mountain Research Station (505-842-3671) in Albuquerque, NM or the Regional Invasive Species/Pesticides Coordinator (505-842-3280) may be contacted for further information.

Highway Departments and Utilities

Forests should coordinate with State departments of transportation (DOTs), County road maintenance departments, and utilities on management of vegetation in highway or road ROWs and utility corridors traveling through NFS lands to limit the spread of noxious weeds and nonnative invasive plants. Management activities for all parties must be in compliance with an appropriate NEPA document. In addition, a PUP must be submitted by the DOT, road department, or utility to the applicable forest unit(s) where the pesticide will be applied.

Cooperative road agreements: In some cases, it may be possible to work with State, County, or local public road authorities to control invasive plants in ROWs that are covered under a cooperative agreement. Under FSH 1509.11, CHAPTER 31.2 – COOPERATIVE FOREST ROAD AGREEMENTS, the Forest Service is allowed to work cooperatively with State, County, or local public road authorities for the cooperative planning, survey, design, construction, reconstruction, improvement, and maintenance of certain “Forest Roads.” The Forest Service may require, but not be in conflict with an existing permit, easement, contract, or other agreement, the user or users of a road, to maintain the roads in a satisfactory condition commensurate with the particular use requirements of each road. Forest road agreements must contain a complete list of cooperative roads under “Schedule A” which determines which roads are under jurisdiction of the cooperator and which roads are under jurisdiction of the Forest Service. The Forest Service may reimburse the cooperator for up to 100 percent of their costs (both for in-house costs and/or contract costs) to perform the Forest Service’s share of the work on roads identified under Schedule A. Forest road agreements may be used as a means to pay the cooperator to perform work that is the Forest Service’s responsibility. [Contact: forest road managers, grants & agreements personnel]

State highway MOUs: In Arizona, an MOU has been set up between ADOT, Federal Highways Administration (FHWA), and the Forest Service that allows management of invasive plants and hazardous vegetation along highways managed by ADOT on NFS lands. The MOU has a provision for an annual maintenance plan that contains specific information on weed control measures for ADOT or FHWA-managed ROWs and construction projects. In Arizona, treatments conducted by ADOT for invasive weeds in ROWs on NFS lands can be reported in FACTS as part of the overall treated acreage accomplishment for a forest. A similar arrangement is currently being reviewed between the Forest Service and NMDOT in New Mexico.

Utility corridor management: For specific information on recommended vegetation management procedures for power line authorizations, the Forest Service's *National Desk Guide to Preparing Vegetation Management Procedures for Power Line Authorizations* (Dec. 20, 2013) should be consulted. The desk guide is intended to provide (1) utility holders of a special use authorization for a power line with a set of comprehensive vegetation management procedures for utility corridors and (2) consistent guidance to Forest Service staff in reviewing and approving these vegetation management procedures. [Contact: forest lands and minerals personnel]

Cooperative Weed Management

Policy direction given in FSM 2903 for management of invasive species across the National Forest System includes the following provisions:

> *As appropriate, collaborate and coordinate with adjacent landowners and other stakeholders to improve invasive species management effectiveness across the landscape. Encourage cooperative partnerships to address invasive species threats within a broad geographical area.*

In line with Forest Service policy and the Service's *National Strategic Framework for Invasive Species Management* (USDA Forest Service 2013), program coordinators for invasive plants and/or pesticides in Region 3 should promote and support cooperative efforts with Cooperative Weed Management Areas (CWMAs) when feasible. CWMAs (or similar entities) are local organizations consisting of land managers, land owners, and other interested parties whose purpose is to facilitate cooperation in managing common weed problems across jurisdictional boundaries within the defined area of the CWMA (see figures 2 and 3 below).

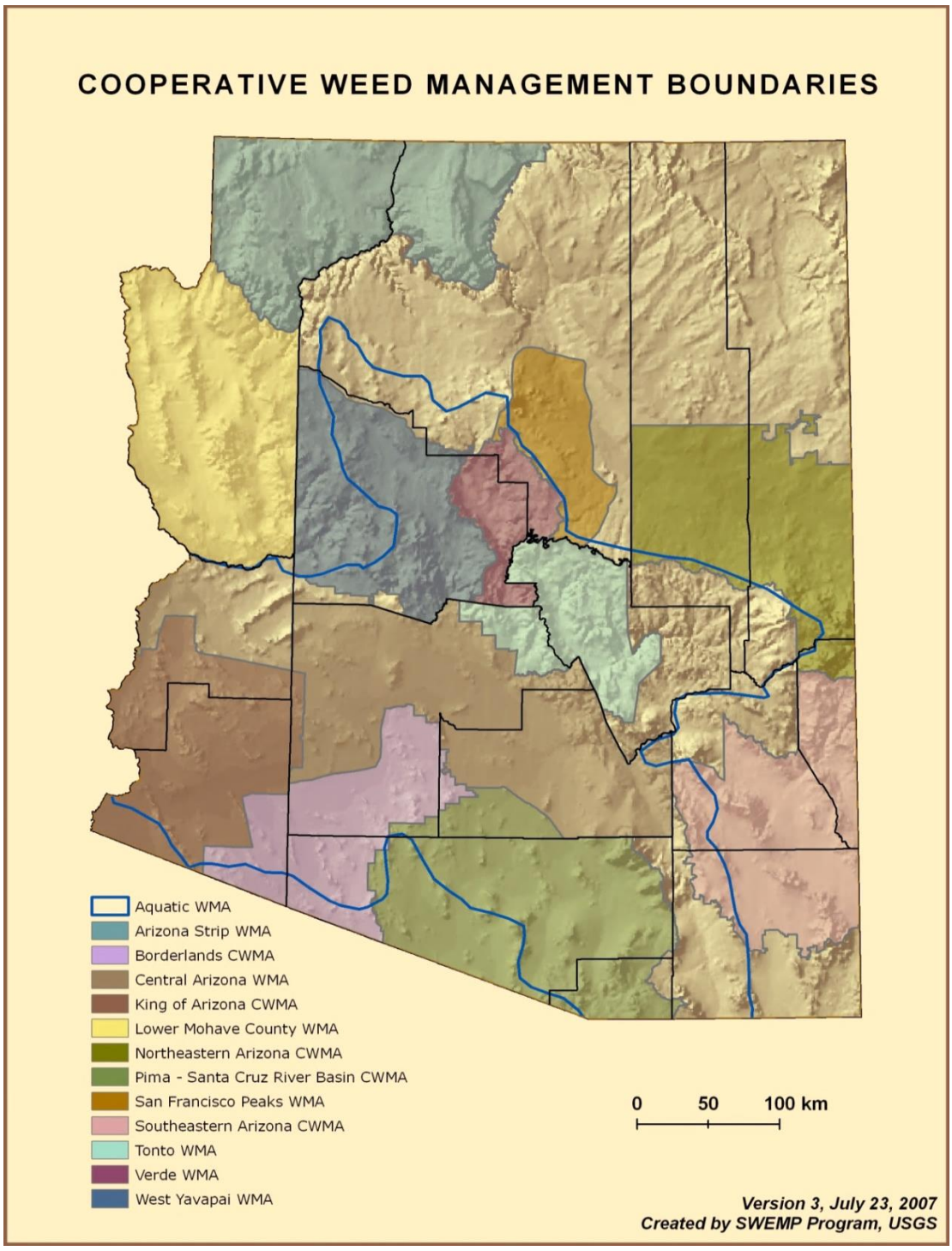

Figure 2. Cooperative Weed Management Areas in Arizona

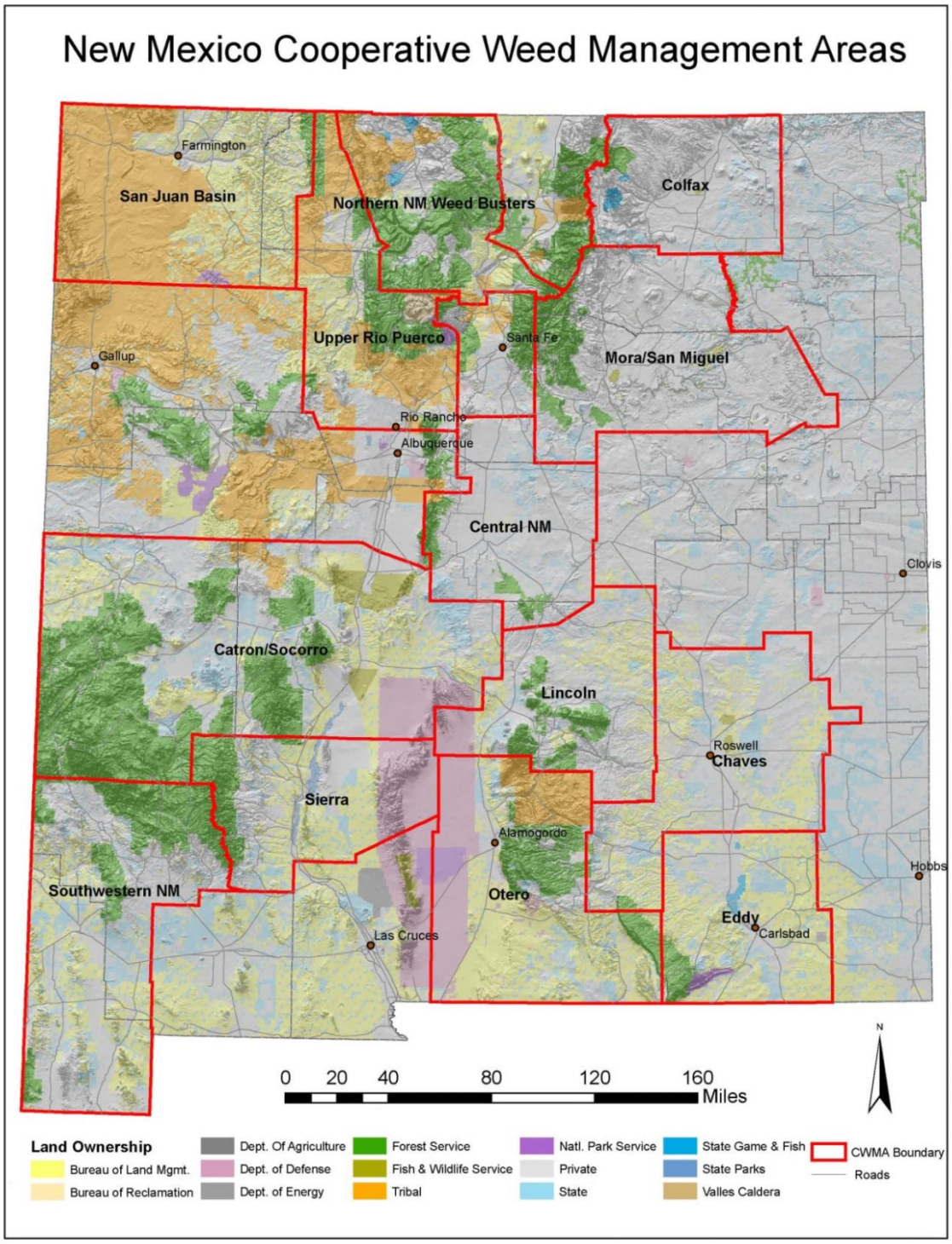

Figure 3. Cooperative Weed Management Areas in New Mexico

Major CWMA advantages include

1. Encouraging cooperators to plan for effective weed management across ownership boundaries and to prioritize management efforts;

2. Enhancing participation in weed management activities of mapping, planning, monitoring, and treatment of weeds within the CWMA;

3. Pooling of talent and resources for weed management; and

4. Providing channels of communications between cooperators.

Due to their large land base, forests should be key participants in applicable CWMAs, which are typically co-located with local Soil and Water Conservation Districts (SWCDs). In some cases, CWMAs may be able to help forests develop their own weed management plans. Existing CWMA plans may have already identified priority weed species of local concern and have developed maps of priority areas for treatment. CWMAs may also provide (1) training for local landowners, (2) weed identification publications, and (3) treatment guidance that is specific to local areas. Instructions for setting up CWMAs may be found in the *CWMA Cookbook* (http://www.fs.fed.us/invasivespecies/documents/cookbook.pdf).

Regional cooperation with Cooperative Weed Management Areas

Region 3 principles for CWMA participation are–

1. Forest Service personnel involved with invasive plant management are encouraged to participate in local CWMAs and help initiate CWMAs when applicable.

2. Cooperation with CWMAs by Forest Service participants should be based on a planned process for weed management that employs integrated weed management principles.

3. CWMA activities should be focused on invasive plants that have the greatest potential for impacting resources within the CWMA including NFS lands.

4. Management of invasive plants on NFS lands should be coordinated with CWMA activities whenever possible.

5. Agreements such as cooperative agreements, participating agreements (including Wyden Amendment-based agreements), challenge cost-share agreements, and MOUs should be used between the Forest Service and CWMAs when practical.

Objectives for CWMA support: Major objectives for supporting CWMAs include (1) building CWMA capacity, (2) providing technical support, and (3) managing information. Forest Service cooperation with CWMAs in Region 3 should facilitate these objectives. The following actions may be used to help achieve these three objectives.

1. **Building CWMA capacity**

   Actions include–

   a. Conducting outreach efforts to involve as many stakeholders within the CWMA as possible.

b. Holding regular meetings to develop and coordinate CWMA activities.

c. Developing a weed management plan and a timeline for the CWMA to achieve management objectives for targeted invasive weed species across the CWMA.

d. Developing and maintaining a list of funding sources for invasive plant control. (See **Resources for Cooperative Management and Partnership** in the following subsection)

e. Seeking funding through grants or cost-share agreements for projects that target a select group of critical invasive plant species.

f. Providing information to public on CWMA activities either informally through networking or formally through presentations or posters.

g. Developing "success stories" based upon the successful completion of funded projects and sharing broadly within the State.

h. Participating in State and national-level organizations for invasive plants/species such as advisory committees, planning committees, exotic plant councils, etc.

2. **Providing technical support**

Actions include–

a. Developing a priority list for targeted invasive species and revising as needed.

b. Providing services for local weed control or by contracting with commercial applicators.

c. Developing EDRR procedures to detect and eradicate newly established invasive plants.

d. Providing training on invasive plant identification and methods for surveying and treatment.

e. Conducting site visits to assess local projects and making recommendations for improvement.

f. Promoting pilot projects to develop new strategies and technology for control.

g. Transferring new invasive plant management technology to land managers through websites, presentations, posters, articles, publications, training, etc.

h. Developing or supporting the development of user-friendly taxonomic keys to aid in field identification of important invasive plant species.

i. Identifying "experts" who are able to classify important invasive plant species.

j. Supporting the development and distribution of high quality digital images of important invasive plants species and "look-alike" species.

k. Supporting local projects for biological control from their initiation through the release and monitoring phases.

l. Assessing the status of current biological control research and evaluating existing programs for potential partnerships.

3. **Managing information**

Actions include–

a. Developing an efficient, user-friendly methodology for inputting field data for purposes of mapping and surveying.

b. Assuring that accurate plant distribution data is available and facilitating a process for easily updating information on invasive plant populations.

c. Identifying and evaluating existing invasive plant mapping databases to determine which ones best serve the needs of invasive plant managers.

d. Supporting risk mapping of targeted invasive plants.

Resources for Cooperative Management and Partnership

State & Private Forestry grant program for invasive plants

The Forest Service provides funding through its S&PF branch for cooperative invasive plant management on State and private lands. Funds provided by S&PF's Forest Health Protection program as a grant to individual State Forester offices can be used specifically by weed management organizations to control invasive weeds in forest and woodland areas of the State. A major goal of the program is to promote Forest Service partnership with non-Federal cooperators such as CWMAs in projects on non-Federal lands that will complement invasive weed management on NFS lands. Priority for funding is given to projects that will treat invasive plants on non-Federal lands of State, County, municipal, or private entities that can affect national forests or grasslands. Projects for treatment may therefore be coordinated with treatments conducted on nearby forests. For additional program information, refer to the Invasive Plant Program website (http://www.fs.fed.us/foresthealth/management/fhm-invasives-plants.shtml). [Contact: State Forester offices in AZ (602-771-1400) and NM (505-867-2334)]

Federal agency agreements

Agreements may be made between CWMAs and Federal agencies (Forest Service, BLM, etc.) to manage invasive plants. This includes Cooperative Agreements, Participating Agreements, Challenge Cost-share Agreements, and Memoranda of Understanding.

1. **Cooperative agreements** – A Cooperative Agreement (CA) is a form of Federal financial assistance (similar to a grant) where the Federal agency is substantially involved in the project (e.g., Forest Service collaboration, participation, or intervention). To implement a CA (or a grant), there must be a specific statute that authorizes Federal financial assistance along with providing appropriate funding. For some types of CAs, a particular

funding authority may require a non-Federal matching contribution. [Contact: grants and agreement specialists]

2. **Participating agreements** – Participating agreements (PAs) with non-Federal parties may be used by the Forest Service in cooperative, mutually beneficial projects that involve national forests. PAs associated with the Cooperative Funds and Deposits Act of 1975 may be used specifically for forestry protection (including weed control) and for developing publications associated with cooperative environmental education. Wyden Amendment-based PAs may be used when the Forest Service enters into cooperatively performed work on private or public land that benefits natural or cultural resources on national forest lands within the watershed. PAs created through the Secure Rural School and Community Self-Determination Act of 2000 allow the Forest Service to enter into contracts, grants, cooperative agreements, and partnership agreements with individuals and non-profit organizations for projects that have been recommended by a Resource Advisory Committee (RAC) and approved by the Forest Service. It encourages the use of local residents to accomplish the work. Through a PA, both parties are expected to contribute towards costs of the project on a 50:50 basis; however, the cooperators contribution may not be less than 20 percent. [Contact: grants & agreement specialists]

3. **Challenge cost-share agreements** – Challenge cost-share agreements (CSs) are used when the Forest Service cooperatively develops, plans, and implements projects with other parties that are mutually beneficial and can enhance Forest Service activities. CSs may be based on Interior Committee appropriations or on the Secure Rural School and Community Self-Determination Act of 2000 which allows the Forest Service and cooperators to enter into projects that have been recommended by the Resource Advisory Committee (RAC). Cooperator contributions to a CS are generally a 50:50 match that may be satisfied by providing cash, real or personal property, services, and/or in-kind contributions such as volunteer labor. As a general rule, if the cooperators only contribution is indirect costs, then the contribution is extremely weak and will not qualify for a CS. [Contact: grants & agreement specialists]

4. **Memoranda of Understanding** – A Memorandum of Understanding (MOU) is ordinarily used to establish a framework or a better relationship but does not have special legislative authority. It is simply a "gentlemans handshake" agreement with no promises or obligations by either party. Therefore, MOUs do not commit the Forest Service or other agencies to provide resources, funding, property, technical services, or anything of value now or in the future. As an example, MOUs have been set up between the Forest Service, Federal Highway Administration, and various State departments of transportation to facilitate invasive species management in ROWs on NFS lands in conjunction with requisite NEPA documents. [Contact: forest program managers and grants & agreement specialists]

County funding: Some counties in Region 3 may provide funding to CWMAs for the purposes of weed control and information/education on weeds. [Contact: local County offices]

Soil and Water Conservation Commission grant programs: Soil and Water Conservation Commissions (SWCCs) in individual States annually fund special projects relating to water quality and conservation. These funds are awarded by the SWCC through the Water Quality and

Conservation Grant Program. [Contact: executive directors of SWCCs (http://www.nacdnet.org/).]

Soil and Water Conservation District funding: Many Soil and Water Conservation Districts (SWCDs) contribute funding and/or staff hours to CWMA efforts. As subdivisions of State governments, SWCDs receive limited State funding but have the ability to implement mill levy taxes through local referenda. [Contact: local Soil and Water Conservation District offices]

USDA grant programs: USDA publishes an annual workbook entitled *U.S. Department of Agriculture (USDA) Grant and Partnership Programs that Can Address Invasive Species Research, Technical Assistance, Prevention and Control* that has information on USDA programs that may be used to fund and support invasive species-related projects. The workbook lists USDA programs that provide funding or technical expertise such as programs offered by the Natural Resource Conservation Service (NRCS), which includes the Environmental Quality Incentives Program (EQIP) and the Plant Materials Program. In addition to providing funding for CWMAs, funds may also be available for invasive species projects on NFS lands. An electronic copy of the workbook may be obtained from the National Invasive Species Information Center website (http://www.invasivespeciesinfo.gov/toolkit/grants.shtml) or by contacting the Regional Invasive Species/Pesticides Coordinator.

Wilderness and Other Natural Areas

Due to potentially less disturbance or lack of pathways (roads, utility corridors, etc.) that can contribute to invasive weed spread, natural areas such as wilderness or research natural areas (RNAs) may be less susceptible to invasive weed introductions as compared to other types of public lands. However, invasive weed infestations can still expand exponentially within these areas, especially along waterways, livestock driveways, and trails. As a natural area, a wild and scenic river may particularly be vulnerable to invasive weed spread due to concentrated traffic of humans and watercraft along the river system. Invasive weeds should also be expected to move along road systems or waterways that lead into wilderness, RNAs, or wild and scenic rivers.

Regulations and Requirements

Wilderness

Both prevention and EDRR should be emphasized for invasive species management in wilderness areas due to the need to avoid or limit trammeling (syn., hampering). The term “trammeling” is derived from Section 2(c) of the Wilderness Act of 1964 which describes wilderness as "...an area where the earth and its community of life are untrammeled by man..." Thus, management activities for invasive species in wilderness should not unduly disturb the natural and untrammeled qualities of wilderness character, which is based on the particular combination of biophysical, observed, and symbolic qualities that distinguishes a wilderness from all other lands. Projects for managing invasive species in wilderness should be coordinated between wilderness resource managers and invasive species coordinators.

Wilderness IWM: In developing IWM for wilderness, practices with relatively low impact such as adjustment of livestock grazing rates or use of traditional/primitive tool skills should be employed when possible. Implementation of IWM methods in wilderness generally must conform to ten “prohibited uses” listed in Section 4(c) of the Wilderness Act of 1964:

commercial enterprise	permanent roads
landing of aircraft	motorized equipment
motor vehicles	structures
temporary roads	installations
motorboats	mechanical transport

Because of the ten prohibited uses in Section 4(c), IWM for wilderness typically tries to forego mechanized control methods by putting greater emphasis on alternatives such as treatment with biocontrol agents. However, short-term trammeling with mechanized equipment may be necessary to protect or improve wilderness character when prevention or EDRR measures are inadequate to control an invasive species. In some cases, it may be necessary to consider aerial application of herbicide to control invasive weeds.

To allow short-term trammeling in wilderness such as herbicide application or use of mechanized equipment, completion of a Minimum Requirements Decision Guide (MRDG) form will be necessary. MRDGs are primarily used to assess whether management actions in wilderness such as controlling invasive species or performing research is necessary and if so, how they can be implemented with the least impact on wilderness character. The MRDG also determines whether one or more of the "prohibited uses" listed above is necessary to achieve wilderness management objectives. The MRDG often helps develop alternatives that may be considered in the NEPA process and can be done in advance or at the same that NEPA is being prepared. **To facilitate EDRR in wilderness, documents required for management activities such as MRDGs, PUPs, and NEPA should be prepared and approved prior to invasion by invasive species.** MRDGs and PUPs involving wilderness on NFS lands must be approved by the Regional Forester. MRDG forms and further information are at Wilderness Connect (http://www.wilderness.net/MRA).

Wilderness Stewardship Performance: Wilderness Stewardship Performance (WSP) is a framework used by the Forest Service to track how well wilderness character is being preserved. To meet WSP standards, every Forest Service unit associated with the National Wilderness Preservation System must score at least 60 points or more to achieve "Wilderness meeting baseline performance for preserving wilderness character" (a.k.a., "Wilderness Managed to Standard"). Invasive species is one of the scoring elements in the framework that may be selected to attain the standard. Under this element, highest priority populations of invasive terrestrial and aquatic species in a wilderness are assessed and treated with an emphasis on prevention and early detection/rapid response (EDRR). Survey, inventory, and treatment records for invasive species must be entered into NRM's corporate database through the TESP-IS software application (see the **Data Management** section below, p. 73). The expected outcome for accomplishing the invasive species element is that the wilderness has been successfully treated. Wilderness personnel, vegetation ecologists, and other pertinent specialists should be consulted in setting up treatment projects in support of preserving or restoring wilderness condition.

Research natural areas

The Forest Service's network of RNAs permanently protects examples of natural ecosystems for the purposes of scientific study, education, and also for conserving biological diversity. Included in this network are (1) high quality examples of widespread ecosystems, (2) unique ecosystems or ecological features, and (3) rare or sensitive species of plants and animals and their habitat. Specifically, RNAs may only be used for

1. Research and development,
2. Study,
3. Observation,
4. Monitoring, and
5. Educational activities that do not modify conditions for which the RNA was established.

The prime consideration in managing RNAs is maintenance of natural conditions and processes which must be protected against human activities that directly or indirectly modify the integrity of ecological processes (FSM 4063.3). Only non-manipulative types of research or monitoring may

be used in RNAs. Exotic plants or animals in RNAs must be removed to the extent practicable (FSM 4063.34). If exotic plants or animals have been introduced into an established RNA, the Station Director and the Regional Forester must exercise control measures that are in line with established management principles and standards to eradicate them, as practical (FSM 4063.3).

Only tried and reliable IWM techniques should be used and then applied only where the vegetative type would be lost or degraded without management. The criterion is that management practices must provide a closer approximation of the naturally occurring vegetation and the natural processes governing the vegetation than would be possible without management (FSM 4063.34). The Station Director, with the concurrence of the Forest Supervisor, may authorize management practices that are necessary for invasive weed control or to preserve the vegetation for which the RNA was created (FSM 4063.3). These practices may include grazing, control of excess animal populations, or prescribed burning. Any pesticide use to control invasive species requires approval by the Regional Forester (see **Pesticide Use for Invasive and Non-Invasive Species**, p. 33).

Wild and scenic rivers

The Wild and Scenic Rivers Act of 1968 established the National Wild and Scenic River System. Forest supervisors are responsible for developing boundary descriptions, river classifications, and management plans for designated rivers. Under FSM 2354.31, river management is placed under direction given in the Forest Management Plan. Some wild and scenic rivers are entirely or partially within the National Wilderness System and are managed accordingly. Forest pests found in designated or study wild and scenic rivers must be controlled in a manner compatible with the Act and management objectives of contiguous NFS lands (FSM 2354.42l).

Management of Natural Areas

Weed management

A general approach that may be employed in natural areas to manage invasive plants is shown in the outline below:

Goal

Reduce sources for invasive plant spread into a wilderness area.

Strategy

Procedures:

1. Inventory and prioritize populations of invasive plant species of highest concern in wilderness and surrounding areas.

2. Identify pathways and sources of invasive plant spread such as trails, livestock driveways, waterways, campsites, and other potential weed infested areas that can be treated to minimize transport of seed or propagules into non-infested wilderness. This includes (a) canyons that serve as primary trail accesses to the wilderness and (b) upstream areas that contribute to streams or rivers running through the wilderness.

3. Develop a weed management plan for managing priority invasive weeds in wilderness area. The plan should include a formal, written strategy that outlines a system for consistent detection and surveillance of invasive species.

4. Implement control methods and monitoring as necessary for treatment of targeted sites including eradication of relatively small, isolated patches of invasive plants when feasible.

5. Evaluate treatment results and make necessary adjustments in accordance with the adaptive management process.

Weed management plans: A specific, detailed weed management plan should be developed to address invasive species in natural areas such as wilderness and wild and scenic rivers. Under the *Wilderness Stewardship Performance* framework, development of an integrative management plan for invasive species in wilderness may be used to score a greater number of points toward achieving the goal of "Wilderness meeting baseline performance for preserving wilderness character." The plan should incorporate IWM techniques and entail detailed planning in accordance with the **Forest Weed Management Plans** subsection above (p. 46). In cases where invasive weed infestations in natural areas are too extensive to eradicate or contain, a control strategy with an adaptive management approach should be incorporated in the plan.

Prevention

Currently, many natural areas in the Region remain uninfested or are slightly infested by invasive weeds. Therefore, early consideration should be given to possible factors that could contribute to invasive plant establishment such as livestock grazing rates, high-use trail heads, and potential vectors (livestock, wildlife, pets, etc.). Potential weed invaders should be identified and prioritized before infestations occur, and viable management strategies and treatments should be specifically developed. Forests should particularly make concerted efforts to anticipate and manage weeds in remote areas. Managers should ensure that permittees and outfitters are held responsible for weed infestations in grazing allotments and outfitter camps. Also, recreationists need to be made aware of the need to prevent transfer of weed seed into pristine areas by following measures such as use of weed-free hay for horses and removal of seed from clothing and pets.

General prevention measures: Measures that can be taken specifically to prevent introduction of invasive weeds into natural areas include–

- Avoid moving through weed infestations whenever possible.
- Minimize soil disturbance from activities such as hiking, camping, treatment projects, etc.
- For weed awareness and prevention, post signs at trailheads in weed-infested areas that–
    - Advise visitors to inspect animals, clothing, and vehicles for seeds and remove seed when leaving the infested area.
    - Discourage picking of unidentified "wildflowers" and discarding them along trails or roadways.

- For livestock operations in natural areas–
  - Encourage livestock permittees and backcountry pack-and-saddle stock users to feed livestock with weed-free forage for 3-5 days before travel into wilderness areas.
  - Encourage use of weed-free forage or bedding for livestock or pack-and-saddle stock.
  - Clean out livestock trailers and vehicles before reaching trailheads.
  - Encourage inspection and brushing of horses, mules, llamas, and herding dogs before entering natural areas.
- While working in natural areas–
  - Avoid wearing pants with cuffs where seed may collect.
  - Remove all seeds and debris from equipment, clothes, boots, and personal protective equipment (PPE) before entering or exiting.
  - Always cover loads or else bag plant parts before transporting invasive plants that have developed seeds.
  - Regularly inspect areas used by visitors and lessees and those areas where offsite materials (straw, hay, etc.) have been used.

Detection and surveillance

The presence of invasive weeds and other invasive species in natural areas should be detected through regularly conducted efforts involving surveillance, searching, and/or survey. A formal, written strategy should be developed for natural areas that outlines a systematic approach for detection and surveillance of invasive species. The strategy should ensure that early detection and surveillance of invasive species is incorporated as part of the regular work duties of wilderness personnel, range management specialists, hydrologists, or other personnel as applicable. Early detection of invasive species in wilderness may be enhanced by setting up a network that relies jointly on wilderness personnel, wilderness partners, and an educated public. Consideration should also be given to the addition of a requirement for detection and surveillance of invasive plants in permits that concern outfitter guides and range allotments.

Inventory and monitoring

Once invasive species are detected in a natural area, a survey should be conducted whereby information is collected on the populations or infestations of the invasive species according to procedures outlined in the **Data Management** section (p. 73). Locations of invasive species infestations within natural areas must be entered into the FACTS database through the TESP-IS application. Treatment data and treatment locations must also be entered into FACTS through the application. Information on invasive species infestations in the FACTS database becomes part of the inventory by which these species can be managed and monitored.

For invasive weed infestations in wilderness, inventory information that can be entered into FACTS with the TESP-IS application may be obtained from an invasive plant survey form, which is used by wilderness strike teams in Region 3 to report occurrences of invasive plants in wilderness areas. Inventory and monitoring data shown on these forms for invasive plants should

be used by invasive species coordinators and pesticide applicators for project planning and for locating populations of invasive plants for treatment. Invasive plant survey forms for wilderness and further information may be obtained by contacting the Regional Wilderness Program Coordinator in Albuquerque at (505) 842-3233.

Fire management

Fire-related BMPs (p. 17) along with BAER requirements such as use of weed-free seed should be followed for fires in natural areas. BAER funds may be used for detection surveys of invasive species in natural areas and, if warranted, rapid response actions within the first year following fire containment. An MRDG is necessary for BAER treatment projects in wilderness that are used to treat highly erosive soils, heritage sites, and potential flooding of communities and tribal lands. BAER teams and managers of natural areas should incorporate re-establishment of native or desired non-native species in burned wilderness areas into post-fire planning. In preparation for fire incidents in a wilderness or RNA, a seed bank operated by a facility that can store seed of native or rare species for post-fire planting should be considered.

Pesticide use

All pesticide-use proposals (PUPs) addressing pesticide use in candidate or designated wilderness and RNAs must be approved by the Regional Forester rather than approved at the forest level (FSM 2151.44 and 2323.04c). PUPs submitted by the Forest Supervisor to the Regional Forester for approval of pesticide use in wilderness should be accompanied by an MRDG. Both the wilderness and pesticide coordinators at the Regional Office should be contacted prior to submission of the combined PUP and MRDG package.

Animal-mounted spray operations: For herbicide spray operations in natural areas or other types of roadless areas, sprayers mounted on horses or llamas may be used in lieu of backpack sprayers that have to be transported over long distances. Mules may serve better as water carriers rather than using them for spraying (M. Tucker, Rangeland Manager, San Juan NF – personal comm.). Animal-mounted spray operations employing either CO_2 or battery-powered sprayers can be used instead of motor vehicles or mechanized equipment which are part of the ten "prohibited uses" of the Wilderness Act. Animal-mounted sprayers can be operated by a person on foot or by spraying from a saddle horse while leading the pack animal. Operators of animal-mounted sprayers must have a good working knowledge of horsemanship and packing. Useful contacts for animal-mounted spray operations may be found in the **Appendix** of this document.

Herbicide considerations: So-called "new chemistry" herbicides such as aminocyclopyrachlor (e.g., Perspective®) or aminopyralid (e.g., Milestone®) may be more useful for spray operations in natural areas rather than older herbicide products since these newer herbicides typically require less product to be applied on a per acre basis and can be more efficient to transport. For example, weeds can be controlled with aminopyralid at rates from 4-7 fluid ounces per acre as compared to the 48-64 fluid ounces per acre required by some 2,4-D products.

Public notification: The public should be kept informed about pesticide spray operations in designated natural areas. Notification of spray operations in natural areas should be made in local papers and with signage at each trailhead. A project overseer may need to be present during spraying to talk to passersby. Receptionists at the local field office and possibly at the forest supervisor's office should have copies of the spray schedule and project map so the public can be kept informed.

Volunteerism

As a means of limiting invasive weed establishment in wilderness or wild and scenic rivers, users of natural areas (hikers, outfitters, rafters, etc.) as well as nearby private landowners should be encouraged to volunteer in detecting invasive weeds and performing IWM activities. In some cases, partnering coalitions may be established (e.g., adoption of a specific watershed or river stretch by non-governmental organizations (NGOs) for detection and control of invasive plants). Volunteerism may be encouraged by actions such as–

- Performing outreach to individuals and organizations potentially interested in volunteering.
- Providing volunteers with training in identification and control of invasive weeds.
- Identifying and contributing to resources needed for the volunteer program.
- Recognizing efforts of volunteers through awards and other means of recognition.

Wild Spotter program: The Wild Spotter program is a citizen science-based project that enlists volunteers to survey and report invasive species in wilderness areas. Wild Spotter is a collaboration between the University of Georgia, Wildlife Forever, and the Forest Service together with other national, regional, state and local partners. Under this project, volunteers can assist National Forests or National Grasslands by locating and documenting invasive species in wilderness areas with geo-tagged observations and photos and then alerting the forest or grassland about the presence of these species.

To become a Wild Spotter volunteer, one must register either online at https://wildspotter.org/register.cfm or else download the Wild Spotter Mobile App from this website on a smartphone or other mobile device. Once registered, the volunteer may contact a National Forest or National Grassland to participate in surveying invasive species in a wilderness.

Currently, the Wild Spotter project has been initiated on only two forests in Region 3 (the Lincoln and Santa Fe NFs); however, other forests and grasslands are expected to participate in the future. To obtain further information, volunteers should visit the Wild Spotter website at https://wildspotter.org/ or send an email to mappinginvasives@gmail.com.

Data Management

National forests and grasslands are required to maintain detailed records on all infestations and treatment activities for all taxa of aquatic and terrestrial invasive species. This includes infestations and treatment activities in wilderness areas, research natural areas, or other types of natural areas. The term "treatment" refers to any activity or action taken directly to eradicate, control, or otherwise manage the spread of an invasive species or weed. Treatment activities typically fall within any of the four general categories of IWM techniques (i.e., physical, cultural, biological, or chemical treatments). As per national protocols, a minimum of 1/10 acre should be reported for any invasive species infestation mapped, treated, restored, or monitored. Forest Service business rules and applications for invasive species inventory and treatment are available at http://fsweb.wo.fs.fed.us/invasivespecies/data.shtml [internal USFS website]. The website has links to the following sets of rules and guidelines:

- *National Forest System Invasive Species Management Record Keeping Business Rules and National Standards*
- *Data Recording Protocols and Requirements for Invasive Species Survey, Inventory, and Treatment Records*
- *Supplement Guidance and Requirements for Planning and Accomplishing Invasive Species Treatments Funded with CWKV* [6]

TESP-IS Integrated Application

As mandated in a June 3, 2013 letter to regional foresters by the NFS Deputy Chief, both tabular data and a site-specific spatial feature (polygon) are currently required for each survey, inventory, and treatment record associated with invasive species management activities conducted on NFS lands and on adjacent areas when accomplished under the Wyden Amendment. Regardless of funding source or project objective, all surveys, inventories, and treatment records for invasive species must be entered into the national Natural Resource Manager (NRM) database structure by using the required TESP-IS software application. The TESP-IS integrated application is specifically designed for entering, editing, and storing field-collected data. In addition, all performance reports, pesticide use reports, and other spatial and tabular reports or summaries for the NFS invasive species program are generated through the TESP-IS application.

Data entry with the TESP-IS integrated application may be made through either a mobile version or a non-mobile version. The mobile software version, *Invasive Species Mobile (ISM) with ESRI Collector*, is designed to integrate mapping infestations and treatments collected in the field with GPS-enabled tablets.[7] The non-mobile version of the TESP-IS application allows direct entry of data onto ArcGIS maps through Citrix from PCs. In lieu of using the mobile application on a tablet, NFS field forms found at the Invasive Species website (http://fsweb.wo.fs.fed.us/

[6] CWKV is the fund code for Cooperative Work, Knutson-Vandenberg. The Knutson-Vandenberg (K-V) trust fund is derived from timber sale receipts and is used for a variety of projects such as reforestation, improvement of forestland ecological conditions, and maintaining biological diversity.

[7] Note to users of *Invasive Species-Mobile with ESRI Collector* – The mobile application will work with Android, iOS, or WIN10 tablets. It also works with WIN10 PCs.

invasivespecies/data.shtml) [internal USFS website] may be used for collection of field data (survey, inventory, and treatment) to enter into TESP-IS.

Data entered through the TESP-IS application is automatically transferred into two NRM master databases of record: the FACTS (Forest Activity Tracking System) database for treatments and the TESP-IS database for invasive species surveys and inventories. The FACTS database stores records on all management activities that have actually occurred on NFS landscapes. In particular, any pesticide use information required for regulatory compliance and/or pesticide use reporting on NFS lands is compiled directly from pesticide data recorded in FACTS. On some forests, the overall treated acreage reported in FACTS may reflect treatment conducted on NFS lands by outside organizations such as treatment of ROWs by State or County highway departments.

Reports and editing

Records on invasive species management activities that have not been entered into FACTS through the TESP-IS application will not be summarized in annual program performance reports. All required fields in FACTS should be filled out including the name of the certified applicator, infestation(s) treated, and the specific spatial polygon of the pesticide application. When the license number of a certified applicator is unavailable (e.g., treatments made by unlicensed applicators using repellants, pheromones, or borax), the name of the applicator should be used and the code "NA" added to the license number field in the Certified Applicator table in FACTS.

The Forest Invasive Species Coordinator or a qualified Forest-level data steward appointed by the Forest Supervisor must ensure that specific GIS-based records of all survey, inventory, and treatment activities are recorded in NRM-TESP-IS (FSM R3 Suppl. 2904.07). All treatments must be recorded as accomplished on or before September 30 of the FY in which they were initiated. Performance credit is given for treatment activities that occurred during the fiscal year in which the activities were planned and funds expended. For purposes of performance accomplishments and target attainment, activities are not allowed to cross fiscal years. Treated acres are counted for both Force-Account and awarded Contracts/Agreements when the accomplishment date is within the fiscal year where funds were obligated. Treatment contract work that straddles the fiscal year break should be attributed to the year in which the contract was awarded regardless of the actual date the work is completed. **To meet the October 31 deadline for final accomplishments, data should be entered when accomplished or else entered quarterly into FACTS with the TESP-IS application.**

Current invasive treatment data for performance reports that have been provided by individual USFS units may be accessed from the NRM main portal under FACTS Reports Tab: https://iweb.fs.usda.gov/login/welcome.html. Pesticide summary reports are available through FACTS Web Reports: http://fsweb.nrm.fs.fed.us/applications/facts/web_reports/index.php. To view treatment data in FACTS after it has been entered through the TESP-IS application, one should go to NRM Read-only Access pull-down menu found on the NRM Main Menu (https://iweb.fs.usda.gov/login/welcome.html) [internal USFS website] and select the specific Region and forest.

Editing of existing treatment records must be completed through the TESP-IS application. Individuals responsible for invasive species inventory and treatment data entry will need roles for both the FACTS User and the TESP/IS Editor approved for the unit(s) on which they work. Although the FACTS User role is district-based, the TESP-IS Editor is forest-based. Further

information on FACTS and TESP-IS roles may be obtained by contacting the Regional FACTS Coordinator in Albuquerque at 505-842-3483.

Application training: NRM currently provides both classroom and on-line training for the required TESP-IS application. Classroom training for the TESP-IS application primarily addresses equipment setup, data entry, and editing of spatial and tabular data with the Invasive Species Mobile software. Training for Region 3 personnel with mobile and non-mobile modules is offered annually through AgLearn. The Training Calendar for scheduling AgLearn courses can be accessed through the NRM training webpage (http://fsweb.nrm.fs.fed.us/support/training/) [internal USFS website]. The NRM TESP-IS Account Manager (208-373-4351) or Regional Invasive Species/Pesticides Coordinator (505-842-3280) should be contacted for further information.

Data Management Guidelines

Polygon delineation

For purposes of delineating polygons in TESP-IS, the following definitions are applied:

1. *Total Area* is considered to be an area, in acres, that is occupied by an invasive species as delineated by a polygon that may represent a general area where the population is found or may represent the spatial extent of the infestation or population.

2. The *Infested Area* is defined to be an area of land or water, in acres, containing a single invasive species as delineated by the actual perimeter of the infestation (defined by the outer edge of the canopy cover of plants) or the visible population of other taxa (e.g., home range or stream reach for vertebrates). An *Infested Area* essentially lies within the perimeter of the population and excludes adjacent areas not infested.

3. *Percent Infested* (*% Infested*) is the proportion of the *Total Area* (0.1 acre minimum) that is infested with the target invasive species. The estimate of *% Infested* is based on the

    a. Perimeter of the infestation,

    b. Distribution of plants within the perimeter,

    c. Species growth characteristics,

    d. Site characteristics, and

    e. Degree to which the created feature represents the actual infestation.

The default value for *% Infested* is 100 percent. A value of 0 is allowed to be entered for *% Infested* only when a re-measured record needs to indicate that treatment has eradicated an infestation or else that an infestation has been eliminated under natural conditions. When creating infestation polygons of 1/10 acre or less, the *% Infested* value should always be set at 100 percent.

Guidelines for polygon delineation: To determine overall acreage or area polygons of an infested area, the following guidelines should be used for reporting weed populations:

1. In general, weed patches or single plants that are more than 1/8 mile (660 ft.) away from each other should be considered as a separate population and documented accordingly.

2. If necessary, infestations as small as a single invasive plant may be mapped as an entire, discrete infestation rather than be included with other infestations. These small, tightly drawn polygons must be entered into FACTS as 0.1 acre with the TESP-IS application and set at 100 percent infested as mentioned above. However, such small infestations should ordinarily not be mapped separately unless they are least 1/8 mile away from the nearest infestation.

3. For sites that have at least 1-5 percent canopy cover of invasive plants where individual invasive plants and patches are evenly distributed across the site, the spatial extent of the infestation is equal to the area of the polygon created at the perimeter of the infestation. The *% Infested* value should be set at 100 percent.

4. For sites that have at least 1-5 percent canopy cover of invasive plants where individual invasive plants and patches are irregularly distributed (e.g., infested gullies eroding into an otherwise uninfested landscape), the spatial extent of the infestation is still equal to the area of the polygon created at the perimeter of overall infestation. However, the *% Infested* value entered should reflect a lower percentage to indicate the smaller distribution of infested area actually contained within the larger polygon.

Polygon delineation example: As an example of how the definitions and guidelines detailed above may be used for polygon delineation, consider a situation where a number of discrete patches or small infestations of spotted knapweed (*Centaurea maculosa*) are found in a large drainage. Through onsite investigation of the drainage and by looking at aerial photos, the overall size of the area infested by knapweed is determined to be approximately 600 acres. However, it is estimated that only about 40 percent of the total area is actually infested. Since spotted knapweed is randomly distributed throughout the area, there is no added value or utility in mapping each small infestation within the overall area of 600 acres. Therefore, a single polygon may be created with a *Total Area* of 600 acres (as generated from the area of the spatial feature) that has a value for *% Infested* set at 40 percent. The *Infested Area* as calculated by the TESP-IS application is 240 acres (= 600 acres x 0.4). Alternatively, each knapweed patch could be mapped as a feature thereby creating a multi-part polygon to represent areas that are completely infested. In this approach, the TESP-IS application will still calculate *Infested Area* to be 240 acres when *% Infested* is set at 100 percent.

Survey and inventory

All invasive species survey and inventory information must be collected and recorded in the TESP-IS database. Invasive species survey is the process of systematically searching a geographic area for a particular target invasive species or a list of numerous species. Surveys should be conducted as described above in the **Detection** subsection (p. 26). Surveys may also be conducted as part of the EDRR process as well as during project planning where the purpose of the survey is to locate any invasive species within the project area prior to site disturbance. Even if target species are not located, it is important for future reference to know where and when surveys have occurred. A tracking system may be employed to show where surveys have been done and where survey efforts still need to be accomplished.

Invasive species inventory is a collection of data related to the occurrence, population, or infestation of a detected invasive species across a landscape or a more narrowly-defined area or site. For survey and inventory processes, a required set of attributes in TESP-IS must be entered (what was found, where was it found, how much was found, etc.). Further information on conducting survey and inventory can be found in relevant sections of the (1) *National Forest System Invasive Species Management Record Keeping Business Rules and National Standards* and (2) *Data Recording Protocols and Requirements for Invasive Species Survey, Inventory, and Treatment Records.* Both are located at http://fsweb.wo.fs.fed.us/invasivespecies/data.shtml [internal USFS website].

Treated areas

For purposes of delineating polygons for treated areas, the following definitions are applied:

1. *Infested Area Treated* (labeled as *Acres Treated* in the TESP-IS application) is the treated portion, measured in acres, of an area infested by a single invasive species. The *Infested Area Treated* represents the portion of a single species infestation that was prioritized and treated.

2. The *Treatment Area* is a specific piece of land or water on which a management activity or series of management activities occur across the entire area. A *Treatment Area* may include an entire invasive species infestation, a portion of an infestation, or include multiple infestations that are adjacent or overlapping. Treatment Areas may overlap, but cannot be divided.

The smallest area that can be entered on the *Treatment Activity* form and given credit for *Acres Accomplished* is 1/10 acre. For release of biological control agents, a single one-time credit of five acres is allowed for each agent release on a treatment area for a given day. Release sites must be a minimum of 1/4 mile apart to allow additional credit of the 5-acre accomplishment. Regardless of whether an area is treated with herbicide or biocontrol agents, the pattern of treatment applications must be consistent throughout areas reported as being treated rather than being reported as a gross polygon whereby only a portion of the polygon was actually treated but the entire infested area was reported as an accomplishment. Further information on treatment requirements can be found in relevant sections of (1) the *National Forest System Invasive Species Management Record Keeping Business Rules and National Standards* and (2) *Data Recording Protocols and Requirements for Invasive Species Survey, Inventory, and Treatment Records.* Both are located at http://fsweb.wo.fs.fed.us/invasivespecies/data.shtml [internal USFS website].

Monitoring

Monitoring may be done by visual survey (presence or absence) or by using sampling techniques (quadrats, line-intercept transects, etc.). Monitoring for invasive species management can involve (1) re-measuring inventoried infestations at scheduled times and/or (2) evaluating the effectiveness of treatment activities used to control infestations. The monitoring cycle should be based on the threat posed by a particular species. Highly invasive species will probably need to be monitored more often than less invasive species. Sites where seed or other materials (hay, straw, mulch, etc.) have been applied should be monitored, and any new weeds on the site should be eradicated before they can develop seed.

The business area requirement (national target) for treatment monitoring is 50 percent of the acres treated. The acres monitored are calculated from the *Infested Area Treated* (labeled as *Acres Treated*) field of the treatment activity. At least 50 percent of the total acres treated for a given year must be monitored for treatment efficacy with the data entered through the TESP-IS application. Treatment efficacy monitoring below the 50 percent level will result in no (zero) accomplishment credit given for the forest's performance outcome (percent of priority acres restored). Monitoring for completed treatments will be credited to the fiscal year in which the monitoring occurred, no matter in which year the respective treatment occurred. However, the evaluation date must be later than the completed date for each treated species monitored. Further information on monitoring can be found in relevant sections of the (1) *National Forest System Invasive Species Management Record Keeping Business Rules and National Standards* and (2) *Data Recording Protocols and Requirements for Invasive Species Survey, Inventory, and Treatment Records*. Both are located at http://fsweb.wo.fs.fed.us/invasivespecies/data.shtml [internal USFS website].

WorkPlan and Accomplishments Reporting

Coordinators for invasive species or pesticide use at the forest or district level should be involved in all phases of the budget process either by entering budget information directly into WorkPlan or else by being able to provide input on needed program funding to the relevant budget coordinator. This includes (1) developing projects that qualify for program funding, (2) setting up grants or agreements and working with contractors, and (3) reporting accomplishments into FACTS by using TESP-IS. Once all projected accomplishments for invasive species have been placed in WorkPlan, the actual field accomplishments should be reported by the coordinator into FACTS via the TESP-IS application. Further information on performance measures, guidance, and definitions for the NFS Invasive Species Program is available at http://fsweb.wo.fs.fed.us/invasivespecies/documents/budget/fy2018/InvSppWorkplanGuidanceFY2018.pdf [internal USFS website].

WorkPlan

Project planning in WorkPlan

At a minimum, coordinators for invasive species or pesticide use should use WorkPlan to plan for basic activities to be accomplished by their program in the upcoming fiscal year including prevention, EDRR, detection, inventory, treatment, and monitoring. Specialists in other programs should be consulted as necessary to plan joint projects involving invasive species. Planned projects should support restoration projects outlined in the forest's five-year restoration plan as well as forest goals in watershed restoration or desired conditions as described above in the **Restoration Planning** subsection (p. 54). Cooperative work to be done with other agencies, organizations, or individuals such as CWMAs, DOTs, and wilderness volunteers should also be entered into WorkPlan.

Targets to be accomplished by the relevant unit should be mutually agreed upon when allocating resources; however, it is up to the Forest Supervisor as advised by his/her staff to determine annual priorities and targets for the forest. When available, additional funding may be allocated to a forest in order to meet Regional priorities and needs. Forests should provide adequate baseline funding through WorkPlan to perform EDRR for all invasive species taxa (including Class A weed species). Supplement funding should be requested and entered into WorkPlan if EDRR funding is inadequate. Forests with Class E infestations should allocate sufficient funding in WorkPlan to conduct necessary treatment projects on a scale sufficient to protect landscape resources. WorkPlan should also include any planned treatment projects for Class B species (and possibly Class C species in some cases) that are designed to meet management objectives such as reducing existing infestations, stopping any further spread, or protecting localized resources.

Work activity codes for invasive species management

WorkPlan guidance for NFS invasive species management may be found at the website: http://fsweb.wo.fs.fed.us/invasivespecies/documents/budget/fy2018/InvSppWorkplanGuidanceFY2018.pdf [internal USFS website]. When planning invasive species management projects in WorkPlan, forests are required to utilize the following three **work activity codes** for the invasive species program as dictated by the type and scope of individual projects:

1. **ISC – Invasive Species Control (Treatments and Treatment Monitoring)**. Invasive species control activities include any **direct** treatment or action to eliminate, reduce,

contain, or remove a population (or infestation) of aquatic or terrestrial invasive species. The work activity code includes all invasive species treatments or actions (pesticide applications, biocontrol activities, trapping, mowing, grazing, burning, etc.) and all treatment monitoring efforts (including treatment efficacy monitoring activities). Separate projects should be planned under the ISC code according to whether a proposed treatment project will (1) eradicate new or small infestations or (2) involve long-term operations to control large infestations with multiple treatments. Accomplishment measures linked to the ISC code are measured in acres.

2. **ISD – Invasive Species Detection (Surveys, Inventories, and Mapping)**. Invasive species detection activities include any project or action to search, survey, detect, inventory, or map any invasive species in aquatic or terrestrial areas of the National Forest System. This work code also includes early detection activities where the detection activity is typically conducted with the expectation that small infestations will be rapidly eradicated or contained to prevent their establishment or spread (see ISC definition above). Environmental sampling to detect eDNA of targeted species can be included in this work code. Projects to survey, inventory and/or map any invasive species infestation should be coded in WorkPlan as ISD. For larger populations detected and quantified, it may be necessary to plan for long-term control operations as a separate project. At this time, there is no NFS accomplishment measure associated with this new work activity code.

3. **ISP – Invasive Species Prevention (All Prevention Activities)**. Invasive species prevention activities include a wide variety of pre-emptive actions and activities that focus on vectors and invasion pathways as a means of reducing or eliminating the risk of invasive species establishment. Activities under this code include programs for education and awareness as well as preventative or exclusionary activities such as decontamination of equipment/vehicles, boat inspections, or developing a barrier to prevent spread of an aquatic invasive species. In addition, prevention activities include any cleaning, scraping, sanitizing, or any other physical removal of invasive species attached to equipment, structures, animals, people, or vehicles. At this time, there currently is no NFS accomplishment measure associated with prevention activities.

Appropriate linkages to a wide variety of budget line items have been made for each of these work activity codes, as well as to the program accomplishment measures (performance measures) where necessary. Overall performance measures (outputs and outcome) for the national NFS invasive species program will correspond to the respective work activity code for each of the core budget line item funding sources, including those under NFVW.

Core and integrated accomplishments

Project planning information such as planned expenditures and accomplishments must be entered into WorkPlan. Accomplishments in WorkPlan are categorized as either core accomplishments or integrated accomplishments as discussed below:

1. **Core accomplishments** – A core accomplishment is achieved through direct expenditure of Forest Service funds. Core accomplishments are typically those measures that are associated with the same resource as the specified budget line item (BLI) or associated with a particular performance measure. For example, the acreage resulting from treatment

of invasive aquatic invertebrates by using NFVW funding is a core accomplishment for the INVSPE-AQUA-FED-AC accomplishment measure.

2. **Integrated accomplishments** – Integrated accomplishments are those that are achieved by using funds from one or more BLIs that are unassociated with the resource program tied to that particular accomplishment measure. For example, the acreage resulting from treatment of WUI hazardous fuels by using partial NFVW funding is an integrated accomplishment. The results of integrated projects are intended to achieve multiple goals and objectives. However, work activity codes for invasive species in WorkPlan are not available for integrated budget line items.

Planned accomplishments are categorized as Core or Integrated in WorkPlan regardless of the system (database) of record for the accomplishment code. The sum of both accomplishments (**core** + **integrated**) equals the unified accomplishment and will count toward the *Unified Target* assigned by the Region. FACTS is the database of record used for projects listed under the ISC and ISP activity codes. The system of record for ISD activities is the TESP-IS application. However, projects for detecting invasive species are not categorized as either a core or integrated accomplishment at this time.

All accomplishment codes that are linked to a specific BLI/work activity combination are considered to be "Core" accomplishments and are available to assign to the project once the work activity is selected. The user can either choose to add the core accomplishment(s) to the project or not. Core accomplishments added to the project will be displayed under the heading "Core" on the project general screen. Accomplishment codes that are not linked to the specific BLI/work activity combination on the project are considered as "Integrated" accomplishments. Any other accomplishment code can be added to the project by selecting the "Add Integrated" link. Integrated accomplishments added to the project will be displayed under the heading "Integrated" on the project general screen. When new projects are created, accomplishment codes are no longer automatically added to a project. Note that projects (survey, inventory, and mapping) coded with the "ISD" work activity code in WorkPlan are not to be categorized as either a core or integrated accomplishment at this time.

Priority acres: Priority acres are used in some accomplishment codes to determine performance measures and are derived primarily from program or project plans at the forest or district or level. Plans such as weed management plans can be used to identify priority areas on which to focus integrated management actions to directly prevent, control, or eradicate a priority/high-risk aquatic or terrestrial invasive species. Priority areas identified for invasive species treatments may include any specifically-delineated project area. Examples include–but are not limited to–fuels treatment areas, developed recreation areas, transportation corridors, wilderness areas, research natural areas, utility ROWs, etc. The size of the priority area treated is typically measured in acres. For linear features (such as a stream/river, trail, roadway, power-line, ditch, etc.), the area size can be calculated from the length and average width. In some cases, a smaller portion of a delineated project area infested by invasive species may be prioritized for treatment over the larger infestation.

Accomplishments Reporting for Invasive Species

Performance measure reporting

As summarized in table 6 below, all projected core and integrated accomplishments should be planned in WorkPlan and reported as actual accomplishments in the appropriate system of record by the October 31 deadline. The appropriate accomplishment code(s) and BLIs should be used according to the planned project.

Table 6. Reportable items

Accomplishment Code *	Description	Core BLIs **	Integrated BLIs **	Unit of Measure	Database of Record	Measure Category
INVPLT-NXWD-FED-AC	Highest priority acres treated annually for noxious weeds and invasive plants on National Forest System lands	NFVW	*various*: CFLN CWKV NFN3 RIRI SSCC WFW3 etc.	acres	FACTS	Vegetation and Watershed Management
INVSPE-TERR-FED-AC	Highest priority acres treated annually for invasive terrestrial and aquatic species on National Forest System lands	NFVW	*various*: CFLN CWKV NFN3 RIRI SSCC WFW3 etc.	acres	FACTS	Wildlife, Fish & TES Habitat Management
SP-INVSPE-FED-AC	Number of acres treated annually for invasive species on Federal lands	SPFH		acres	FACTS and ForHealth***	SPF-Forest Health Protection

* To receive an outcome-based accomplishment for treating invasive species, input into FACTS must document that a minimum of 50 percent of acres treated were monitored for treatment effectiveness. The date of evaluation MUST be entered later than the completion date of the accomplishment; otherwise, the performance data will not be credited.

** BLI codes:

CFLN–COOPERATIVE FOREST LANDSCAPE
CWFS–COOPERATIVE WORK TRUST FUND
CWKV–COOPERATIVE WORK, KV
NFN3–REHAB AND RESTORATION
RIRI–RESTORATION OF IMPROVMNTS - FOREST LANDS
SPFH–FOREST HEALTH MANAGEMENT - FEDERAL LANDS
SSCC–STEWARDSHIP CONTRACTING
WFW3–WILDLANDS REHAB AND RESTORATION

*** In addition to input recorded in FACTS, data is also recorded in the ForHealth (Forest Health Project Accomplishments) database by S&PF staff as a core accomplishment.

National performance reporting

Annual performance information for the NFS Invasive Species program is compiled from data maintained in the NRM-FACTS database. Treatment activities and efficacy records generated for invasive species by Forest Service field units and reported in FACTS are used to create annual performance reports (including program outputs and outcome) for the program. However, there are no associated national performance measures for pre-treatment survey and inventory accomplished by local field units since such work is not reported at the national level. Guidance, definitions, and performance measures for the NFS Invasive Species program are available at the Invasive Species Program budget website (http://fsweb.wo.fs.fed.us/invasivespecies/budget.shtml) [internal USFS website].

Program performance measures: The primary **output** performance measures for invasive species treatments on NFS lands and waters as well as areas treated under the Wyden Amendment are–

INVPLT-NXWD-FED-AC = Number of priority acres treated annually for invasive plants and noxious weeds on National Forest System lands

INVSPE-TERR-FED-AC = Number of priority acres treated annually for (non-plant) invasive terrestrial and aquatic species on National Forest System lands

The two performance measures are compiled across all invasive taxa for the number of treated acres completed annually on NFS lands and waters into the following output measure (**Output #1**):

INVPLT-INVSPE-COMP-FED = Number of acres of priority treatments completed annually against invasive plants (and noxious weeds) and other invasive terrestrial and aquatic species on National Forest System lands

National business rules and standards require that at least 50 percent of the total acres treated during the year must be monitored for treatment efficacy. This applies to all treatment activities conducted on NFS lands and waters, and on other areas treated under the Wyden Amendment. When this minimum level of monitoring is met, efficacy data is averaged and extrapolated across all treatments and applied towards the restoration performance calculations for the reporting year. The program performance output measure (**Output #2**) used to determine number of priority acres monitored across all taxa for treatment efficacy is–

INVPLT-INVSPE-MON-FED = Number of priority treated acres annually monitored for treatment efficacy on National Forest System lands - All Aquatic and Terrestrial Invasive Species Taxa (plants, vertebrates, invertebrates, pathogens, fungi, and algae)

The number of priority acres successfully restored on NFS lands is based on accomplishing planned objectives of Forest Service field units for the prevention, eradication, or control of

targeted species on priority acres. The NFS program accomplishment measure for restoration across all taxa is defined as–

INVPLT-INVSPE-REST-FED = Number of priority treated acres successfully restored and/or protected against invasive plants and noxious weeds, and aquatic and terrestrial invasive species on National Forest System lands.

National performance for the NFS invasive species program is summarized across all taxa for the reporting year and is calculated by using output data from acres completed and acres restored. This **Outcome** performance measure is represented as a percentage and is defined as–

INVPLT-INVSPE-REST-FED-PCT = Percent of priority treated acres successfully restore and/or protected against invasive plants and noxious weeds and aquatic and terrestrial invasive species on National Forest System lands

The **Outcome** performance measure for the NFS invasive species program currently has a national target of 65 percent and is assessed and updated every five years to account for the long-term nature of outcome performance. The national outcome target will be adjusted in FY2020 based on the previous five-year average. Although the national target is based on data compiled at the Regional levels, the target is applied only at the national level.

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Appendix

Contacts for Animal-Mounted Spray Operations

Horsemanship, packing, and spray operations

Ninemile Wildlands Training Center

Address: Ninemile Wildlands Training Center, Ninemile Ranger Station, 20325 Remount Road, Huson MT 59846

Phone: (406) 626-5201

Website: http://www.fs.usda.gov/detailfull/lolo/home/?cid=STELPRDB5085919

Animal-mounted sprayers

High Country Sprayers, LLC

Address: 1995 S. Elba/Almo Hwy. Elba, ID 83342

Cell phone: (208) 431-9547

Website: http://www.highcountrysprayers.com/index.html

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CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.