

## MANAGEMENT OF INVASIVE SPECIES

### ISSUE STATEMENT

An invasive or nuisance species is defined as a non-native plant or animal species that adversely affects the habitat and location they invade economically, environmentally, and/or ecologically.<sup>1</sup> Invasive species tend to dominate regions, particular habitats, and/or urban interface land with disturbed landscapes.

The Sierra Nevada is one of the most biodiverse regions of the western United States. While the Sierra Nevada make up only twenty percent of the total land area of California, fifty percent of the native plant species in the state occur within this region (Shevock 1996). This diverse vegetation lends itself to a rich complement of wildlife within the numerous different ecosystem types that exist within the mountain range. Today this famed diversity is at risk due to alterations caused by human use, altered fire regimes, climate change, and invasions by non-native species following these human-caused alterations.

In freshwater ecosystems, invasive species' greatest impacts are demonstrated through their alterations of native food webs, disruption to ecosystem function through predation and/or exclusion of native sensitive species, potential genetic weakening through hybridization with natives, degrading restoration efforts, and dominating the system as a monoculture. Their effects are often unknown and they may become unmanageable once established or naturalized.

Research shows that many invasive plant species are in their early stages of invasion throughout the Sierra Nevada, compared with other regions

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<sup>1</sup> Invasive Species Definitions, available at: <http://www.dfg.ca.gov/invasives/> and [http://en.wikipedia.org/wiki/Invasive\\_species](http://en.wikipedia.org/wiki/Invasive_species)

throughout California at lower elevations (Keeley et al. 2003). However, non-native invasive plants have been found in disturbed sites even at high elevations (Hobbs & Huenneke 1992; D'Antonio et al. 1999). Thus, rapid response to early invaders and instituting a strong prevention program for those that have not yet arrived is essential to the long-term preservation of these pristine wildlands.

In an economic analysis survey conducted by the California Invasive Plant Council (Cal-IPC 2008), data findings showed that federal agencies in California spent approximately \$21 million dollars in invasive plant control alone (Cal-IPC 2008). The Lake Tahoe Aquatic Invasive Species Plan estimates that invasive species introductions by species such as quagga (*Dreissema bugensis*) and zebra mussel (*Dreissema polymorpha*), or expansion of aquatic invasive plant populations would create a combined economic cost of approximately \$22.4 million a year to recreation value, tourism spending, property values, and increased boat/pier maintenance (USACE 2009) to the Tahoe watershed alone. These staggering cost estimates are examples demonstrating why spending on prevention and early eradication on national forest lands would produce a higher cost benefit ratio than post-infestation control programs.

The forest plan revision process gives an opportunity to examine the existing prevention and control practices being implemented at the forest level to determine the management standards throughout the region. In addition, this process provides an opportunity to expand the breadth of species under consideration. The 2004 forest plan amendment record of decision (ROD) standards and guidelines (#36-49) address noxious weeds, but do not consider aquatic invasive species (USDA Forest Service 2004). In the revision, consideration should be given to a comprehensive invasive species list, design and management measures that can maintain or improve current levels of vector management, control predation of special status species, and minimize further spread of invasive species. It will also be important to consider standardized

management practices for prevention and control of existing and new invasive species.

The Forest Service should maintain and explore new partnerships at Federal, State, local government and nongovernmental levels to focus on restoration, monitoring, rapid response, prevention, and control activities. In addition, region-wide monitoring questions need to be examined that consider the following (D'Antonio 2002):

- What species are demonstrating invasive qualities or hampering native recovery and protection?
- Which habitat types are most commonly being invaded?
- Which species should be prioritized due to their ability to transform landscapes?
- What pathways are promoting their spread so we can limit these introductions?
- What control methods are effective?

A strategic and thorough examination of these questions incorporated into the revised plan will be a crucial step in reducing existing invasive species numbers and minimizing new introductions. Thus, the development of a decision matrix should focus on priority species and prevention, detection, and control actions (Orr 1993).

## **POLICY ACTIONS NEEDED**

### ***Proposal for Revision to Forest Plan Direction***

**A. Desired Condition** *The following statements represent the desired future condition of the landscape and may not reflect the current conditions.*

Desired Condition INV-1. Terrestrial and aquatic invasive species are controlled or prevented using management practices that benefit native plants, wildlife, and habitats consistently across all forests.

Desired Condition INV-2. Each forest coordinates on a national, regional, local, and programmatic

level to implement an early detection and rapid response plan for invasive species.

Desired Condition INV-3. Practices to prevent the introduction, establishment, and spread of invasive species, such as the use of equipment and materials that are free of invasive species and their propagules, are included in plans, projects and on-going programs.

Desired Condition INV-4. Spread of established invasive species and introduction of new invasive species is minimized to a no-net gain.

Desired Condition INV-5. A robust monitoring program ensures that the entire landscape is thoroughly inspected for invasive species occurrences.

Desired Condition INV-6. An annual risk assessment, based on monitoring results and potential future invasive species, is performed to evaluate risk and prioritize species and management actions leading to clear reductions in invasions.

Desired Condition INV-7. A comprehensive outreach campaign is conducted to all user groups on prevention activities.

Desired Condition INV-8. The Forest Service recognizes that maintaining intact, functioning ecosystems with a full range of native species is the first line of defense in the prevention of invasion.

## **B. Objectives**

Objective INV-1. Perform a risk assessment for all potential invasive species by year 5 of the plan. This assessment should be based on the species' threats to ecosystem function, native species populations and habitat, economics, recreation or other forest value. The presence or absence of vectors for that species and the potential for establishment of that species should also be considered in the risk assessment. Such plans should:

- Identify invasive species distribution and encroachment at multiple scales (e.g., stand level, watershed, forest and region).
- Evaluate risks of invasive species to native plants and wildlife in the region.
- Assess the impact of invasive species on biodiversity trends in the region.
- Evaluate the contribution of invasive species to changes in fire frequency and intensity.
- Assess the contribution of management and other human activities on the forest to invasive species introduction and spread including forestry, dams and other water diversions, off-highway vehicles, temporary and permanent roads, livestock and packstock, mining, and recreational watercraft so that targeted vector prevention measures can be implemented to help minimize future spread and invasion.
- Evaluate the potential effects of climate change on invasive species distribution and risks for new invasions and within the context of synergy of stressors.
- Consider leading edge vulnerability areas for climate change, such as bass moving upstream as water warms.

Objective INV-2. Prepare control and prevention plans for high priority invasive species identified in Objective INV-1.

Objective INV-3. Implement an integrated pest management (mechanical, chemical, and biological controls) approach for all invasive species of concern that includes evaluating the effectiveness of control practices per ecosystem and invasive species of concern.

Objective INV-4. Establish region-wide consistency in the prevention and control standards.

Objective INV-5. Update invasive species watch lists annually in coordination with regional partners and researchers.

Objective INV-6. Monitor populations annually and actively manage populations to decrease potential spread.

Objective INV-7. Maintain GIS layer for emergency fire response plans including: waterbuckets, staging areas, fuel breaks, etc. and locations of invasive aquatic species. Use this information to undertake emergency actions in ways that minimize the risk of spread.

Objective INV-8. Post-5-year review, increased measures will be taken to halt continued vector advancement due to program related re-introductions of invaders in treated areas.

Objective INV-9. Chemical treatments will not be utilized as a means of controlling native vegetation.

Objective INV-10. Plan, projects and on-going programs will continue to select native species for restoration as a target over desirable non-native species.

### **C. Standards**

Standard INV-1. All projects or permits shall incorporate design measures to prevent the introduction and spread of invasive species.

Standard INV-2. Project decisions that result in land disturbance shall include an invasive species assessment that includes design criteria to limit introduction and spread, and reduce the extent of invasive species that are a high priority for treatment.

Standard INV-3. Ensure that management strategies do not interfere with special status species restoration and protection efforts.

Standard INV-4. Emergency fire response plans address concerns about the introduction and spread of invasive species and identify critical resources that could be affected by emergency response

actions such as water bucket sites, staging areas, fuel breaks, etc.

Standard WM-5. In selecting among the methods to manage invasive species, the selected method shall pose the least risk of damage to surrounding organisms and ecosystems, while accomplishing management goals.

Standard WM-6. Use herbicides or pesticides for eradication only when an interdisciplinary analysis has determined that:

- Other methods are unlikely to be successful; and
- All appropriate measures to minimize risk of adverse impacts to non-target organisms have been identified and will be implemented.
- Monitoring of effectiveness of chemical control measures both effects and risk to non-target species and success in limiting invasions.

#### **D. Regionwide Land Allocations**

None specifically identified for this resource area. Desired conditions, objectives and standards apply to all land allocations.

#### ***Recommended Actions at the National Forest Level Not Directly Addressed in the Forest Plan***

- Coordinate with other regions on encroaching invaders and methodology.
- Consult with UC Cooperative Extension and the Lake Tahoe Basin Weed Management Group on their development of “A Builder and Contractor’s Guide to Preventing the Introduction and Spread of Invasive Weeds,” as an example to effective best management practices.

#### ***Recommendations for New Regional Direction or Policy***

- The Region adopts a conservation strategy for the Sierra Nevada region that emphasizes how invasive species connect among the national forests and identifies practices that limit spread and establishment.
- The Region identifies a regional plan for invasive species and coordinates on specific actions and priorities in each forest.
- The Region performs a programmatic level NEPA and ESA analysis for prevention and control methods for specific types of invasive species actions.

#### ***Additional Recommendations***

- Promote the development of invasive species management plans to owners or operators of reservoirs or other water bodies that include actions to mitigate expansion into other areas.
- Promote the adoption of an aquatic invasive species plan by the State of California. The implementation of such a plan should be coordinated with the respective national forest, e.g., watercraft inspection programs.
- Developing agreements with academic institutes to broaden scientific input.

#### **INVASIVE SPECIES OF CONCERN IN THE SIERRA NEVADA**

The species in the following list have demonstrated invasive qualities and potentially pose a risk to the preservation and restoration of national forest lands within the Sierra Nevada. This is not a complete list, but rather a broad look at species to consider for evaluation and possibly management. In some areas these species may have become unmanageable due to naturalization. The Generic Non-indigenous Aquatic Organisms Risk Analysis (Orr 1993) adapted to incorporate vector identification and management (Orr 2003 in Ruiz and Carlton 2003)

may serve a useful basis for the decision matrix when considering these species.

Some of the species below are game species, e.g., rainbow trout, and may be desirable in some environments. The identification of an invasive

species that merits eradication is dependent on a variety of factors, including risk to target species or ecosystem functions and ability to eliminate. This is the primary reason we recommend that an assessment be completed for each species under consideration.

Table IV.G-1. A selection of species that have demonstrated invasive qualities and potentially pose a risk to the preservation and restoration of national forest lands in the Sierra Nevada bioregion. Ratings for plants taken from Cal-IPC (2012).

PLANTS and FUNGI			
Scientific Name	Common Name	Cal-IPC Rating (plants only)	Notes
<i>Ailanthus altissima</i>	Tree of Heaven	Moderate	
<i>Cardaria draba</i>	Hoary cress	Moderate	
<i>Carduus nutans</i>	Musk thistle	Moderate	Low elevations only
<i>Centaurea maculosa</i>	Spotted knapweed	High	
<i>Centaurea diffusa</i>	Diffuse knapweed	Moderate	
<i>Acroptilon repens</i>	Russian knapweed	Moderate	
<i>Centaurea solstitialis</i>	Yellow starthistle	High	
<i>Chondrilla juncea</i>	Rush skeletonweed	Moderate	
<i>Chrysanthemum leucanthemum</i>	Oxeye daisy	Not rated	
<i>Cirsium arvense</i>	Canada thistle	Moderate	
<i>Cirsium vulgare</i>	Bull thistle	Moderate	Managing infestations
<i>Cronartium Ribicola</i>	White pine blister rust	Not rated	Fungus
<i>Cytisus scoparius</i>	Scotch broom	High	
<i>Dipsacus fullonum</i>	Teasel	Moderate	
<i>Dittrichia graveolens</i>	Stinkwort	Moderate	
<i>Egeria densa</i>	Brazilian egeria	High	Aquatic plant
<i>Hydrilla verticillata</i>	Hydrilla	High	Aquatic plant
<i>Hypericum perforatum</i>	Klamathweed	Moderate	
<i>Lagarosiphon major</i>	Oxygen weed	Not rated	Aquatic plant
<i>Lepidium latifolium</i>	Perennial pepperweed	High	
<i>Limnobiium laevigatum</i>	South American spongeplant	Not rated	Aquatic plant
<i>Linaria genistifolia ssp. dalmatica</i>	Dalmatian toadflax	Moderate	
<i>Linaria vulgaris</i>	Yellow toadflax	Moderate	
<i>Myriophyllum aquaticum</i>	Parrot feather	Not rated	Aquatic plant
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Not rated	Aquatic plant

PLANTS and FUNGI			
<i>Onopordum acanthium</i>	Scotch thistle	High	Low elevations only
<i>Potamogeton crispus</i>	Curlyleaf pondweed	Not rated	Aquatic plant
<i>Potentilla recta</i>	Sulfur cinquefoil	Not rated	
<i>Taeniatherum caput-medusae</i>	Medusahead	High	
<i>Tamarix spp.</i>	Tamarisk/saltcedar	High	
<i>Trapa natans</i>	Water chestnut	Not rated	Aquatic plant
INVERTEBRATES			
Scientific Name	Common Name	Status	Notes
<i>Dreissena polymorpha</i>	Zebra mussel	N/A	
<i>Dressena bugensis</i>	Quagga mussel	N/A	
<i>Potamopyrgus antipodarum</i>	New Zealand mudsnail	N/A	
<i>Corbicula fluminea</i>	Asian clam	N/A	
<i>Bythotrephes longimanus</i>	Spiny waterflea	N/A	
<i>Didymosphenia germinata</i>	Didymo or Rock snot	N/A	
AMPHIBIANS /REPTILES			
Scientific Name	Common Name	Status	Notes
<i>Rana catesbeiana</i>	Bullfrog	N/A	Widespread
<i>Trachemys scripta elegans</i>	Red-eared slider	N/A	West-slope Foothills
<i>Ambystoma mavortium mavortium/Ambystoma mavortium nebulosum</i>	Barred tiger salamander/ Arizona tiger salamander	N/A	South-western slope of Sierra.
FISHES			
Scientific Name	Common Name	Status	Notes
<i>Micropterus salmoides</i>	Large mouth bass	N/A	
<i>Micropterus dolomieu</i>	Small mouth bass	N/A	
<i>Lepomis macrochirus</i>	Bluegill	N/A	
<i>Pomoxis nigromaculatus/annularis</i>	Black /White crappie	N/A	
<i>Ictalurus nebulosus</i>	Brown bullhead catfish	N/A	
<i>Oncorhynchus mykiss gairdneri</i>	Rainbow trout	N/A	Desirable non-native game fish
<i>Salvelinus fontinalis</i>	Brook trout	N/A	Desirable non-native game fish
<i>Salmo trutta</i>	Brown trout	N/A	Desirable non-native game fish
<i>Salvelinus namaycush</i>	Mackinaw/Lake trout	N/A	Desirable non-native game fish
<i>Oncorhynchus nerka</i>	Kokanee salmon	N/A	
<i>Cyprinus carpio</i>	Carp	N/A	
<i>Esox lucius</i>	Northern pike	N/A	
<i>Gambusia affinis</i>	Mosquitofish	N/A	

BIRDS			
Scientific Name	Common Name	Status	Notes
<i>Molothrus ater</i>	Brown headed cowbird	N/A	
<i>Sturnus vulgaris</i>	European starling	N/A	
<i>Strix varia</i>	Barred owl	N/A	

Definitions of ratings for plants (Cal-IPC 2012):

**High** – These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

**Moderate** – These species have substantial and apparent – but generally not severe – ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

**Limited** – These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

## REFERENCES

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