

PART 3: AQUATIC INVASIVE SPECIES; Endorsement

The Rocky Mountain Region’s Aquatic Nuisance Species Strategy provides regional direction for the future management of emerging threats to our National Forests and Grasslands. We recognize the importance of preparing ourselves and our partners in meeting the challenges ahead. We, the undersigned, embrace the challenge of supporting and implementing this strategy, as a key part of our Forest Service Mission of “Caring for the Land and Serving People.”

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ROCKY MOUNTAIN REGION INVASIVE SPECIES MANAGEMENT STRATEGY

PART 3 AQUATIC NUISANCE SPECIES



Rocky Mountain Region
USDA Forest Service
June 9, 2009

Part Three: Aquatic Nuisance Species

PURPOSE AND SCOPE

The purpose of this strategy is to identify a framework for the management and prevention of aquatic nuisance species (ANS), and promote working relationships with partners, permittees, stakeholders and employees in prevention, detection and management efforts. ANS can be defined as any species or taxa that are native or non-native, and have significant deleterious effects on native aquatic species and ecosystems, recreation, water development structures and other important resources. This strategy is intended as a framework defining the scope of responsibilities and roles for United States Forest Service (USFS) units, within funding capabilities and authorities.

The goal is a consistent approach region-wide to proactively manage against ANS, recognizing that it will evolve along with our understanding of the biology, impacts, and management of aquatic nuisance species. Additionally, the goals of the Regional strategy include:

- protection of aquatic ecosystems, municipal water supplies, and recreational opportunities;
- proactive and reasonable approaches to preventing introductions of ANS;
- a mechanism to implement the national goals and objectives at the Unit level; and
- provide tools and information to Forests and Grasslands to limit the spread of ANS.

The scope of this strategy includes considerations for proactive management of non-native aquatic species that pose threats to water bodies on NFS lands administered by the Rocky Mountain Region. The strategy focuses on, but is not limited to, threats associated with the following organisms:

- aquatic invertebrates (e.g. [New Zealand mud snail](#), [zebra mussel](#), [quagga mussel](#));
- aquatic microbes and fungi (e.g. [whirling disease](#), [chytrid fungus](#));
- free-floating or submerged aquatic plants (e.g. [Eurasian watermilfoil](#)); and
- vertebrates (e.g. [bull frog](#)).

Non-native trout are not addressed in this strategy, as they are typically well established and managed for as recreational resources in many cases. In terms of native species restoration, each Forest will coordinate directly with State fish and wildlife management agencies, stakeholders, and partners to the maximum extent feasible.

Although aquatic plants are discussed in this document, management for these nuisance species are also described in Part I of the Regional Invasive species strategy. Aquatic vascular plants that are considered nuisance species are listed on State noxious weed lists.

BACKGROUND

[Executive Order 13112](#) (1999) directs federal agencies to use programs and authorities to;

- (1) prevent the introduction of invasive species;
- (2) detect and respond rapidly to and control invasive populations efficiently and safely;
- (3) monitor invasive populations;
- (4) restore native species and habitat conditions in ecosystems that have been invaded; and
- (5) promote public education on invasive species.

The Executive Order also established the [National Invasive Species Council](#) who was directed to develop a [National Management Plan](#) (2008) for invasive species and update that plan every two years. The National Plan identifies performance oriented goals and objectives and specific measures of success for Federal agencies.

The [Forest Service Strategy](#) (2004) provides national direction to minimize the threat of invasions from non-native species on National Forest System lands. The Rocky Mountain Region has followed with a programmatic strategy for terrestrial plants (Part I) and is providing this document to address aquatic nuisance species (ANS). Part III of the Regional strategy will help guide coordination and cooperative efforts with other agencies, stakeholders, permittees and awareness for Regional employees, in the management of non-native aquatic species. Our actions must reflect a proactive effort that addresses the implications that ANS have, related to aquatic ecosystems, municipal water supplies, and recreational opportunities.

In order to affect the goals, objectives, and strategies described above, each Forest Service Unit within the Region will develop a 3-year Aquatic Nuisance Species Action Plan (Appendix A) to provide for;

- assessing risks and outcomes of ANS invasions on waters located on NFS lands;
- fostering relationships with partners, permittees, and stakeholders;
- identify funding and personnel needs to enable an appropriate and effective ANS program;
- monitoring and evaluation of program implementation over time; and
- awareness and support of Forest roles and responsibilities throughout the organization and among partners.

Individual States agencies have responded to the elevated risks of ANS by taking various actions. For example, the state of Colorado recently passed [Senate Bill 08-226](#), which prohibits the introduction of ANS, and provides funding to regulate those efforts. The Region wishes to cooperate with State agencies, recognizing that as ANS issues expand across political boundaries, similar legislation may be passed for other western states. See Appendix D for links to other State efforts.

CURRENT SITUATION

While efforts are being made to understand the current distribution and population levels of various ANS, our knowledge is limited, regarding distribution of species, ecological implications, management solutions, etc. In addition, their presence in streams and riparian wetland habitats makes treatment extremely difficult. Because this is a rather “new” management issue in the region, funding is very limited for all agencies involved. Combined with the imminent threat of infestation and the seriousness of ANS impacts, the result is a complex and difficult situation. Some of the more well known species are already present within or adjacent to lands managed by the Rocky Mountain Region and are described below. It is our intent to minimize the spread of these populations, and prevent the introduction of new ones in the future.

Whirling Disease *Myxobolus cerebralis*

A parasite that often results in deformities in the vertebrate of all native salmonids in the United States. Infected fish are unable to survive the rigors of natural environments, and rarely survive past the juvenile stage. Currently found in Colorado and Wyoming (in Region 2). See current [distribution map](#)

Chytrid Fungus *Batrachochytrium dendrobatidis* (Bd)

Chytrid fungi are found world wide and have been documented as causing the extinction of amphibians in Australia and other countries. The mechanisms for movement include winds (primarily spores), and coming into contact with various sources where it is transported to other water bodies. Documented in boreal toad and northern leopard frog populations throughout Colorado, including populations in Rocky Mountain National Park, near Grand Lake ([Muths et al. 2003](#)), the Arapahoe Roosevelt National Forests in Clear Creek County ([Morehouse et al. 2003](#)) and suspected in Larimer County and the West Elk Mountains on the Gunnison NF ([Carey et al. 1999](#)). For distribution of chytrid fungus see the [distribution map](#) (Spatialepidemiology 2008)

Didymo *Didymosphenia geminata*

Found throughout the entire region, but more commonly in Colorado and Wyoming. Didymo is a diatom found throughout most of the northern hemisphere. While historically found in relatively low densities in streams and lakes, extremely high densities are occurring more frequently, often suffocating other biota. See the [distribution map](#) (USEPA 2008)

New Zealand Mud Snail *Potamopyrgus antipodarum*

Currently found in Colorado in Boulder Creek near the city of Boulder and Elevenmile Canyon in the headwaters of the South Platte River. In Wyoming it has been documented in Yellowstone National Park, the Big Horn River near Wind River Canyon, and in the Shoshone River near Cody, WY. A native of New Zealand, this small snail can reach extremely high densities, eliminating stream periphyton and smothering habitat for other biota. See the following [distribution map](#) (Benson 2008a).

Quagga and Zebra Mussels *Dreissena bugensis* and *Dreissena polymorpha*

Quagga and zebra mussels are closely related bivalves within the genus *Dreissena*. Transported in the ballasts of large ships, these prolific species are found in many parts of the country, causing hundreds of millions of dollars of damage each year. Quagga mussel larvae or veligers were recently documented in several reservoirs in Colorado. Zebra mussels have been identified in Pueblo Reservoir in Colorado and larvae have been documented in the Missouri River along the South Dakota/Nebraska border and. See the [distribution map](#) for Quagga mussel (Benson 2008b) and the [distribution map](#) for Zebra mussel (Benson 2008c).

Eurasian watermilfoil *Myriophyllum spicatum*

Watermilfoil is another non-native species currently found in Region 2, in the following states Colorado, Nebraska, and South Dakota. This aquatic vascular plant can develop thick mats that preclude other plants, waterfowl and other species. See the [distribution map](#) for watermilfoil (USDA 2008).

IMPLICATIONS

There is a need to understand the current distribution of ANS and accelerate our efforts to minimize the establishment in waters within the Rocky Mountain Region. Prevention is critical to the control of these ANS. Once these species become established, they are extremely difficult if not impossible to control and the ecological changes can be irretrievable in many cases. If the agency is not prepared for ANS introductions, displacement of native organisms, changes to aquatic habitats, loss of aquatic biodiversity, degradation of water quality and impacts to water management infrastructure may occur. In addition, mitigating for the effects of established species, such as boat inspections, decontamination, and cleaning fouled infrastructure are extremely costly. Potential impacts from some of the more aggressive species are described below.

Didymo adversely affects freshwater fish, plant and invertebrate species by smothering habitats. It is not considered a significant human health risk, but can affect stream habitats, sources of food for aquatic organisms, and make recreational activities unpleasant.

In high densities, the New Zealand mud snail will compete with other grazing invertebrates and inhibit colonization by other macroinvertebrates ([Kerans et al. 2005](#)), alter nutrient flows and consume large amounts of gross primary production ([Hall et al. 2003](#)), cause declines in species richness and abundance of native snails, or alter food chains in aquatic ecosystems. A prolific species, the mud snail has the potential to impact municipal water supply facilities drawing from infested waters. There is some evidence in their native range that trout may avoid these snails as a prey.

Zebra and quagga mussels are prodigious water filterers, removing phytoplankton and suspended particles. By removing phytoplankton, the food web can be altered. Impacts include increases in water transparency, decreases in mean chlorophyll a concentrations, and accumulation of pseudofeces ([Claxton and Mackie 1998](#)). Water clarity increases light penetration causing a proliferation of aquatic plants that can alter the entire ecosystem. The pseudofeces that is produced from filtering the water, accumulates and as the waste particles decompose, oxygen is

used up, and the ambient pH becomes very acidic and toxic byproducts are produced. In addition, these mussels accumulate high densities of organic pollutants within their tissues which can be passed up the food chain ([Snyder et al. 1997](#)). Another major threat from zebra and quagga mussels involves the fouling of native freshwater mussels. They are known to heavily colonize any hard substrates, including native mussels and other invertebrates, causing stress and even mortality due to feeding interference. These organisms can also clog water intake structures, such as pipes and screens, therefore reducing pumping capabilities for power and water treatment plants. Recreation-based industries and activities have also been impacted in other areas of the country. The costs associated with managing the impacts of ANS mussels is extremely high where they occur in high densities.

Water milfoil forms very dense mats of vegetation on the surface of the water. These mats interfere with recreational activities such as swimming, fishing, water skiing, and boating. In eastern Washington milfoil interferes with power generation and irrigation by clogging water intakes. The sheer mass of plants can cause flooding and the stagnant mats can create good habitat for mosquitoes. Milfoil mats can rob oxygen from the water by preventing the wind from mixing the oxygenated surface waters to deeper water. The dense mats of vegetation can also increase the sedimentation rate by trapping sediments. Milfoil also starts spring growth sooner than native aquatic plants and can shade out these beneficial plants and decrease diversity of other aquatic plants. While some species of waterfowl will eat milfoil, it is not considered to be a good food source.

KEY ELEMENTS

Four main elements of this strategy are critical in ANS management and include; prevention, early detection and rapid response (EDRR), control and management, and restoration and rehabilitation.

1) PREVENTION, EDUCATION, and AWARENESS

The most effective strategy against invasive species is to prevent them from being introduced and established. Preventive measures typically offer the most cost-effective means to minimize or eliminate environmental and economic impacts. Prevention relies on a diverse set of tools and methods, including education. Given the potential ecologically destructive and irreversible nature of ANS establishment, prevention is arguably the most important component of this strategy, and considered the priority management tool for ANS. Our emphasis will be to identify and protect forests and grasslands that have not been invaded by invasive species.

Involvement in both internal and public *education* and *awareness* and other preventative measures is critical. Forests within the Region are encouraged to distribute educational materials targeting internal and external entities for education and awareness of ANS threats. The goal of education and awareness is to promote voluntary compliance of recommended practices that reduce the potential for accidental introductions. Education should be directed at forest visitors, communities, stakeholders, cooperators, permittees, and employees. Coordination with state and local tourism boards, local tackle shops, chambers of commerce, may also be avenues for educational outreach. In order to facilitate education and awareness outreach, the Regional

Office will post materials on the [FSWeb](#), and [internet](#), to enhance the level of internal and external awareness.

Units must identify vulnerable areas, to minimize the risk of introductions, based on the level of human activity, potential water transmission infrastructure, recreational impacts, or other factors. The Region will be an active partner in assessments of high-risk waters and in developing plans to prevent or manage established populations, considering assessments that may have already been developed by State agencies.

Consistent incorporation of best management practices is expected to minimize the potential for accidental introductions. Addressing invasive species during project planning is recommended to ensure that preventative measures are considered to the maximum extent possible, especially when the risk of ANS establishment is high. Projects should be flexible enough to allow for timely implementation or substitution of new technologies, within the scope of the original decision. All programs should employ Integrated Pest Management (FSM 2905) principles and include education and prevention as the first line of defense.

Water based, recreational activities are the main vectors for the introduction and establishment of aquatic nuisance species, but there may also be a disproportionate and unrecognized potential to spread ANS through our own activities. Activities that might necessitate prevention and internal awareness might include the following;

- fire fighting (helicopter bucketing, float pumps, etc...);
- aquatic or hydrologic studies, population surveys, and other similar activities;
- special use permitting for outfitters, boating, etc...; and
- other authorized activities that might provide direct contact with water on USDA Forest Service administered lands.

Livestock, off-road vehicle use, outfitter guides, and other authorized activities may need to be addressed in the future, as potential avenues for ANS introductions. Information describing appropriate actions for these activities is limited.

Appendix B provides some basic information to minimize the spread of ANS and Appendix D provides additional resources for education, awareness, and outreach.

2) EARLY DETECTION AND RAPID RESPONSE (EDRR)

When new infestations are detected, a prompt and coordinated containment and eradication response can reduce environmental and economic impacts. This action results in lower cost and less resource damage than implementing a long-term control program after the species is established. Under existing authorities, the lead agencies for monitoring and inventory may not be the Forest Service. The Region will, participate and cooperate with appropriate lead agencies to facilitate monitoring and inventory efforts. When invasive species are detected, the Region will cooperate with lead agencies, permittees and stakeholders to facilitate management activities in a timely and cost-effective manner.

3) CONTROL/CONTAINMENT, and MANAGEMENT

A key component is to determine the extent and progression of invasive species that have been introduced into aquatic and terrestrial ecosystems. Programs for control/containment and management activities need to be developed at the Unit level. Many of these activities are accomplished with partners across jurisdictional boundaries. When invasive species become established as free-living populations in an ecosystem, a strategic approach for control is required to minimize their impacts or reduce their spread. Effective control relies on a clear understanding of the target species including its biology, the ecosystem it has infested, and associated introduction pathways and effective tools. It also relies on persistent follow-through with monitoring of treatment efficacy.

Forest Service control/containment and management activities are founded on integrated pest management (IPM) principles that may include a combination of physical or mechanical, biological, cultural, and chemical techniques. This integrated approach also includes assessments of risk, identification of thresholds for action, and planning to reach the most desired outcome. Tools such as Operation and Maintenance Plans developed by Forest Service and partners support our control and management activities.

Upon the early stages of an ANS establishment, it is also critical to focus on additional education and awareness and develop working relationships with stakeholders, permittees, cooperators, and the public. Control and management of established aquatic nuisance species is typically facilitated by State agencies, Bureau of Reclamation, municipal water suppliers, or other partners in cooperation with the Forest Service. When ANS are determined to be within a project planning area, an interdisciplinary team should address control measures during the NEPA process to facilitate future eradication efforts if possible.

Closures, special orders or other restrictions which limit public access are the authority of Forest Supervisors under [36CFR261.50](#) and [36CFR261.58](#) and will only be initiated after careful consideration, including OGC review, stakeholder participation and NEPA, unless emergency conditions exist. The current operational mode is to assess the risks on a case by case basis and encourage IPM techniques. For example, threatened, endangered, and sensitive species or other special circumstances play an important role when assessing management actions.

4) RESTORATION AND REHABILITATION

Because each invasion characteristic is unique, specific restoration and rehabilitation programs need to be designed at the appropriate level. The application of appropriate restoration and rehabilitation concepts to ANS is also a critical component of a fully functional invasive species program. Pooling the expertise of partners, permittees and stakeholders in rehabilitation and restoration efforts and technology development will improve the effectiveness of this strategy.

ROLES AND RESPONSIBILITIES

The following designations, roles, and responsibilities should be implemented to the extent that funding and personnel allow. FSM 2904 outlines specific responsibilities within the agency.

Regional Office ANS Coordinator

The Regional Office Coordinator is responsible for facilitating coordination at the individual state level and providing information to the field for education and awareness.

- Provide information via internal and external websites (educational materials, BMPs etc..)
- Explore funding opportunities to enhance program capabilities annually
- Cooperate with State agencies in the developing response plans
- Seek legal council to determine applicable laws and regulations, authorities, and agency policy
- Coordinate with partners and stakeholders on emerging issues
- Coordinate with State and other agencies in public communications related to early detections
- Develop MOUs with partners and stakeholders for each state within the Region
- Explore innovative ways to integrate ANS management into ongoing Forest activities
- Develop cost share agreements with States in order to effectively address emergency situations
- Coordinate with States during risk assessments and develop appropriate measures to make those determinations
- Identify internal cooperators and coordinate annual meetings with Regional Office program area specialists to refine roles and responsibilities

Regional Office Law Enforcement

Regional Office Law Enforcement is responsible for providing information to the Regional coordinator as to the appropriate laws and regulations that may be used for management of ANS.

- Determine how LEOs and FPOs will be involved in enforcement actions pursuant to the agency authorities, regulations, and State laws.

Forest Supervisor

Forest Supervisors are responsible for maintaining an active ANS program on their unit.

- Promote coordination with applicable State agencies
- Cooperate with stakeholders when considering actions that limit recreation opportunities
- Issue closure orders or other actions to prevent ANS infestations, according to agency policy
- Coordinate with the Regional Office to promote state-wide and regional consistency
- Designate ANS coordinator and facilitate the development of 3-Year ANS Forest Action Plan
- Cooperate with stakeholders on closures, inspections, and other actions in emergency situations
- Incorporate terms and conditions in existing and new SUA's as appropriate

Unit ANS Coordinator

Each Unit ANS Coordinator is responsible for implementing an active and responsive ANS program, to the best degree possible, given personnel and budget constraints.

- Provide education and awareness for unit employees, FLT, partners, permit holders, etc...
 - Facilitate discussions of situation and risk with line officers during project planning efforts
 - Develop a risk assessment, in cooperation with partners, for specific waters on the Unit
 - Target high risk waters and develop an inventory and monitoring program
-

- Cooperation with state agencies at high risk water bodies for prevention, containment, or educational activities.
- Meet annually with applicable state agencies and other partners to facilitate ANS dialog
- Ensure inventory data for ANS are migrated into corporate or other databases when available
- Provide for public education and awareness at areas with high levels of recreation Facilitate communication efforts initiated by partners, including press releases and other outreach
- For chemical eradication efforts, by other entities, coordinate prior to application. (Ref. Pesticide Use: R2 [FSM 2150](#) and service-wide [FSH 2109.14](#))

District Rangers

District Rangers are responsible for facilitating the implementation of the Unit ANS program during project planning.

- Ensure consideration of ANS for all projects, based on Forest risk assessments
- In coordination with Forest Supervisor, take proactive measures as risks are realized
- Apply a conservative approach for protection of resources, while addressing recreational opportunities
- Designate District employees who are interested and capable of promoting the ANS strategy

AUTHORITIES OF THE USFS

Water conveyance structures and storage facilities on NFS, access to these facilities, and recreational activities around these facilities will be reviewed and treated on a case by case scenario under Forest Action Plans. Numerous individual scenarios exist related to authorities and responsibilities. Examples include:

- Lakes and reservoirs on USDA Forest Service (USFS) administered lands are usually under the jurisdiction of the USFS. The maintenance of access structures, (roads, boat ramps, etc), as well as the regulation of public access to them, is most often a USFS responsibility for bodies of water on USFS lands.
 - In many of the above scenarios, USFS can regulate access to water bodies. In some cases, the FS has chosen to provide recreation opportunities for these facilities through a campground concessionaire authorized by a Special Use permit. In this case, the FS operates as the landlord and has primary responsibility for the management of the government owned facilities. The concessionaire acts as a tenant, and in that role, is not responsible for the overall management of the site. Rather, the agency is responsible.
 - Reservoirs, ditches, canals, or other water conveyance facility are often under various types of special use authorizations, Department of Interior grants or easements, etc. The recreational facilities and activities associated with that body of water may also be USFS-controlled and authorized via a special use authorization.
 - Facilities such as marinas operated on NFS lands under special use authorization require close coordination with the permit holder.
 - Existing Memorandums of Understanding and other agreements defining management of activities, including assignment of specific responsibilities for a given body of water should be reviewed by the appropriate personnel.
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In order to make appropriate ANS management decisions, Forests should consider existing authorizations associated with the water conveyance structures, developed recreation facilities, and other existing authorized activities, and authorized recreation activities associated with a particular body of water.

In developing ANS plans with partners, Forests should coordinate closely with the Regional office regarding closures, restrictions, etc which may affect existing agreements, permits, or other circumstances.

AUTHORITIES OF OUR PARTNERS

The various agencies operating within the region have a host of inter-related and sometimes overlapping authorities. The complex nature of the ANS issue requires that all agencies and groups work together to the maximum extent possible. Generally speaking, partner authorities associated with this issue are summarized accordingly:

- State parks and recreation agencies issue licenses and regulations relating to boats and other watercraft activities.
- State wildlife management agencies have the authority to manage fauna in their respective states.
- Animal and plant pest problems are the responsibility of the US Department of Agriculture's Animal and Plant Health Inspection Service USDA-APHIS.

Forest are urged to cooperate with partners for positive outcomes, and to consider the roles, authorities and responsibilities when developing management activates and agreements.

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*Rocky Mountain Region
Aquatic Nuisance Species Strategy*

U.S. Department of Agriculture (USDA) 2008. Distribution map – Distribution of MYSP2 in the United States Retrieved [September 02, 2008] from <http://plants.usda.gov/maps/large/MY/MYSP2.png>

U.S. Environmental Protection Agency (EPA) 2008. Distribution map – Confirmed presence of *D. geminata* in the United States and Canada. Retrieved [August 11, 2008] from http://www.epa.gov/region8/water/didymosphenia/na_dis.map.pdf

AQUATIC NUISANCE SPECIES ACTION PLAN

_____ **National Forest**

*Three Year Actions
For the Prevention and Management of Aquatic Invasive Species*



FY 2009 – 2011

Rocky Mountain Region
USDA Forest Service

Due May, 2009

Signed _____
Forest Supervisor

Date _____

Introduction:

This Action plan is designed to serve as a strategic tool for implementation of the aquatic invasive species management program on the _____ National Forest. This plan becomes Part Three of the Forest’s Invasive Species Action Plan. This plan should be reviewed and adjusted as necessary each year to reflect emerging needs, shifting priorities, or changes in available funding.

1) Overview of Current Forest ANS Program and Expected Changes:

Provide a simple narrative covering an assessment of the validity and effectiveness of the Unit’s overall program and current Aquatic Invasive Species Action Plan. Identify strengths and weaknesses, and summarize the actions needed to correct program shortcomings and improve success. For the initial effort, describe current/desired program.

2) Priority Species and Populations on the _____ NF

The species listed below are priority invasive species, based on the following criteria:

- i) Currently low in abundance
- ii) Control is feasible.
- iii) Potential to disrupt the aquatic ecosystem, degrade aquatic habitat, impact municipal water supplies, or reduce recreational opportunities.

In coordination with State agencies and other stakeholders, develop a risk assessment of water bodies on the Unit. Use the table below to identify priority species and provide information as to how prevalent on the Unit and if any treatment, inventory, or monitoring has occurred and the expected impacts. Other strategies that specify the management of each species in specific locations on the Unit is appropriate in narrative form. You must provide the rationale for your determination of ecological, social, or economic impacts, in a narrative form below the table. In other words, we don’t want to be arbitrary in our conclusions.

Species and Location	Priority (#)	Total Occurrences (miles, acres, #)	Past Treatment, Inventory or Monitoring	Expected Impacts
Species A; Lake X;				
Species B; Stream Y				

3) Management area maps for each priority species.

For the primary aquatic invasive priorities, show schematically on a ½ inch per mile map (precise detail not needed) where the Forest will adopt prevention, EDRR, control, or restoration strategies. GIS format is preferred, using color coding by species.

4) Priority treatment areas 2009-2011

Utilizing the table below, identify priority projects that address prevention, EDRR, control and management measures, or restoration efforts. Identify partners and lead agencies and align priority waters according to state risk assessments, if available. Colorado has already completed a risk assessment for waters across the state, which should be evaluated. If using the Colorado risk assessment, coordination with the state may be necessary to validate their determination on USFS waters. Include number of sites educational outreach, number of meetings internally and with external partners if possible.

FY	Location	Action	Target*	Partner, Cooperator, permittees, Stakeholder, or Functional Area on the Unit
2009	Lake A	Education and outreach at X sites	acres	
	Stream B	1.5 miles of manual eradication	miles	
	TOTAL			
2010				
	TOTAL			
2011				
	TOTAL			

***-Treatment and restoration of streams and lakes are identified under NFWF as a legitimate target accomplishment (see FY08 budget narrative.**

5) Lake and Stream Corridor Invasive Species Monitoring Schedule

Identify areas on the unit that are potential locations of high risk that have the greatest potential for EDRR.

FY	Location	Target Species

6) Coordinated Management Activity

Identify external partners or other stakeholders that are important in the management of ANS on the Forest or Grassland.

Partner/Stakeholder	Contact Name	Location	Phone Number

Include a narrative outlining necessary Forest involvement in, or establishment of cooperative efforts. For example, can elevated USFS involvement assist in management efforts by a responsible agency? Where cooperation has been limited, what proactive measures could the Forest or Grassland take to facilitate management and coordination efforts with other agencies, partners, and stakeholders? How can we better communicate concerns regarding management of emerging threats? Use the table to highlight specific actions to accomplish the above, including who is responsible for what actions.

FY	Coordination Activity	Responsibility
2009		
2010		
2011		

7) Organizational Capacity

The Regional Office understands that program responsibilities are collateral duties. Some Units may be unable to respond with effective programs. Forests and Grasslands within the Region should strive for adequate staffing and skills to implement effective programs.

Using the table below, assign the role of Unit ANS Coordinator and other Unit resource areas that are needed to implement the strategy, identify existing staffing capabilities and expected staffing needs, define roles and responsibilities, and address the current situation and future developments that may affect existing workload capabilities. Also identify needed training to improve capabilities of existing people.

Staff	Responsibilities	Skills/Training Needed (By Year)

8) Funding

Identify funding necessary to implement an effective ANS management program and incorporate these needs into the budget planning process. Include appropriate funding codes, grants, partnership monies, etc..., to reflect the estimated annual cost and how those funds will be

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distributed across the key elements from the national strategy. This budget analysis may be a valuable starting point for future planning. Include a brief narrative to accompany the table to discuss assumptions, trends, challenges, etc...

FY	Fund A	Fund B	Fund C	Grants	Partnership	TOTAL
2009						
2010						
2011						

FY	Prevention	EDRR	Control	Restoration	TOTAL
2009					
2010					
2011					

APPENDIX B

Aquatic Disinfectant Guidelines

These guidelines are **not meant to be implemented by just biologists**, but by all resource managers coming in contact with infected or potentially infected waters.

1. Before leaving the waters edge wash and remove all organic material.

Choose one of the following options for complete disinfection of water related equipment:

- A. Completely dry all equipment for 4 to 5 days before re-use.
 - B. Submerge all equipment in boiling water for a minimum of 10 minutes.
 - C. Store all equipment at temperatures below freezing for at least 24 hours.
 - D. Submerge equipment in a 7% bleach solution for 10 minutes AND then spray down equipment with Commercial Solutions Formula 409® cleaner degreaser disinfectant. Let 409 sit for 10 minutes. Rinse all equipment with tap water. Discard bleach solution in accordance with local and state laws. Most bleach solutions may be disposed of in municipal waste water drains. **DO NOT** discard into water bodies or storm drains. **7% bleach solution = 9 liquid oz. bleach per 1 gallon of water.**
 - E. Submerge equipment in a 3% Sparquat 256® solution for a minimum of 15 minutes. After soaking rinse all equipment with tap water and discard solution in accordance with local and state laws. This solution is safe for municipal waste water drains. **DO NOT** discard into water bodies or storm drains. **3% Sparquat solution = 4 oz sparquat per 1 gallon of water.**
 - F. Expose equipment for 10 – 15 minutes to 100% Formula 409 or 3.5% Sparquat 256 ([Schisler et al. 2008](#))
-

APPENDIX C

Aquatic Disinfectant Guidelines (Watercraft)

The following guidelines represent the most recent methodologies available. Until new methods and chemicals are developed, each Unit should use these guidelines or others that are at least as rigorous.

1. Before leaving the waters edge wash and remove all organic material.
2. Before leaving the waters edge empty all standing water from watercraft.

Choose one of the following options for complete disinfection of watercraft:

- A. Completely dry all equipment for 4 to 5 days before re-use.
- B. Clean watercraft with a 7% Clorox® bleach solution. Use sponge or towel to completely clean all surfaces of the watercraft with the bleach solution.** After cleaning rinse watercraft and towel or air dry. Most bleach solutions may be disposed of in municipal waste water drains. DO NOT discard into water bodies or storm drains. **7% bleach solution = 9 liquid oz. bleach per 1 gallon of water.**
- C. Clean watercraft with a 3% Sparquat 256® solution. Use sponge or towel to completely clean all surfaces of the watercraft with the sparquat solution.** After cleaning rinse watercraft and towel or air dry. This solution is safe for municipal waste water drains. DO NOT discard into water bodies or storm drains. **3% Sparquat solution = 4 oz sparquat per 1 gallon of water.**

** It generally takes 10 to 15 minutes of submersion in these solutions to be completely effective. It is not practical or possible to submerge watercraft in chemical solutions. The act of scrubbing boats with these chemicals will kill chytrid fungus and greatly reduce the chance of spreading any other aquatic nuisance and invasive species.

APPENDIX D

On-line Resources for ANS

General Information

Topic (source)	Link
Region 4 ANS program	http://www.fs.fed.us/r4/resources/aquatic/index.shtml
Lake Tahoe Basin Mgmt Unit program	http://www.fs.fed.us/r5/ltbmu/invasive-species/quagga.shtml
Region 9 ANS framework	http://www.fs.fed.us/r9/wildlife/nnis/documents/r9_nnis_framework.pdf
ANS (CO State Parks)	http://parks.state.co.us/NaturalResources/ParksResourceStewardship/AquaticNuisanceSpecies/
Invasive species program (USFS)	http://www.fs.fed.us/invasivespecies/
Aquatic nuisance species (NOAA)	http://www.research.noaa.gov/oceans/t_invasivespecies.html
Aquatic nuisance species (F&WS)	http://www.fws.gov/contaminants/ANS/ANSSpecies.cfm
Aquatic invasive species (USDA)	http://www.invasivespeciesinfo.gov/aquatics/main.shtml
Aquatic nuisance species (USGS)	http://nas.er.usgs.gov/
ANS, a Canadian perspective	http://www.invadingspecies.com/indexen.cfm
ANS Task Force	http://www.anstaskforce.gov/default.php
National Invasive Species Node	http://invasivespecies.nbi.gov/index.html
ANS experts database	http://www.anstaskforce.gov/experts/search.php

Education, Awareness, and Outreach

Topic (source)	Link
ANS prevention (Forest Service)	http://www.fs.fed.us/invasivespecies/documents/Aquatic_is_prevention.pdf
“Zap The Zebra” brochure	http://www.100thmeridian.org/ZTZ2007.asp
“Don’t Move A Mussel” online video	http://wildlife.state.co.us/NewsMedia/Videos/Mussel.htm
Education, prevention, and BMPs	http://www.protectyourwaters.net/
Education and prevention	http://www.habitattitude.net/
Whirling disease education	http://fwp.mt.gov/fishing/etiquette/whrlpt01.html
Education	http://www.anstaskforce.gov/education.php
Educational materials	http://parks.state.co.us/NaturalResources/ParksResourceStewardship/AquaticNuisanceSpecies/EducationalMaterials
Communicating Effectively About Aquatic Nuisance Species, workshop	http://www.fishwildlife.org/science_ANSworkshop.html
Aquatic Invasive Species Education Handbook	http://www.uwex.edu/erc/pdf/AI/AquaticInvasivesHandbook.pdf
Education and outreach materials	http://www.clr.pdx.edu/projects/edoutreach/content/browse.php?table=title
Eurasian watermilfoil control	http://fwcb.cfans.umn.edu/research/milfoil/milfoilbc.html
Wildlife Forever threat campaign 2007	http://www.wildlifeforever.org/documents/WEB-THREATCAMPAIGN2007.pdf

Inventory and Monitoring

Topic (source)	Link
Monitoring recommendations for zebra mussels (100 th Meridian)	http://www.100thmeridian.org/component4.htm
Monitoring protocols for ANS (USGS)	http://nas.er.usgs.gov/queries/protocols/protocollister.asp
Early detection and rapid response links (USDA)	http://www.invasivespeciesinfo.gov/aquatics/detection.shtml
Collecting water samples for veligers (100 th Meridian)	http://www.100thmeridian.org/Documents/Dreissena%20Collection%20Protocol%20for%20PCR-USBR.pdf

Laws, Regulation, and Authorities

Topic (source)	Link
State of Colorado	http://www.100thmeridian.org/Laws/StateInfo.asp?state=Colorado
State of Kansas	http://www.100thmeridian.org/Laws/StateInfo.asp?state=Kansas
State of Nebraska	http://www.100thmeridian.org/Laws/StateInfo.asp?state=Nebraska
State of South Dakota	http://www.100thmeridian.org/Laws/StateInfo.asp?state=South%20Dakota
State of Wyoming	http://www.100thmeridian.org/Laws/StateInfo.asp?state=Wyoming
Federal laws and regulations	http://www.invasivespeciesinfo.gov/laws/federal.shtml
Executive Order 13112	http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=1999_register&docid=fr08fe99-168.pdf
Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990	http://www.anstaskforce.gov/Documents/nanpca90.pdf
CFR 261.58, Occupancy and Use of Areas Designated by Order	http://frwebgate.access.gpo.gov/cgi-bin/get-cfr.cgi

Species Specific Information

Topic (source)	Link
Chytrid fungus (Amphibian Ark)	http://www.amphibianark.org/chytrid.htm
Didymo (EPA)	http://www.epa.gov/Region8/water/didymosphenia/
Didymo prevention (Quebec)	http://www.mddep.gouv.qc.ca/eau/eco_aqua/didymo/didymo-en.pdf
Eurasian watermilfoil (Washington)	http://www.ecy.wa.gov/Programs/wq/plants/weeds/milfoil.html
Eurasian watermilfoil (UMN)	http://fwcb.cfans.umn.edu/research/milfoil/milfoilbc/milfoil.html
New Zealand Mud Snail (PYW)	http://www.protectyourwaters.net/hitchhikers/mollusks_new_zealand_mudsnail.php
New Zealand Mud Snail (MSU)	http://www.esg.montana.edu/aim/mollusca/nzms/
Whirling Disease Initiative	http://whirlingdisease.montana.edu/
Whirling disease (Trout Unlimited)	http://www.tu.org/site/c.kkLRJ7MSKtH/b.3596607/
Whirling disease (PYW)	http://www.protectyourwaters.net/hitchhikers/others_whirling_disease.php
Whirling disease (CDOW)	http://wildlife.state.co.us/Research/Aquatic/WhirlingDisease/

Zebra mussels (CO State Parks)	http://parks.state.co.us/Zebra+Mussels.htm
Zebra and quagga (100 th Meridian)	http://www.100thmeridian.org
Zebra and quagga control measures (Cornell EIS)	http://www.utilities.cornell.edu/utl_lsceis_mussels.html
Zebra and quagga FAQs (USGS)	http://fl.biology.usgs.gov/Nonindigenous_Species/Zebra_mussel_FAQs/Dreissena_FAQs/dreissena_faqs.html
Zebra and quagga infestation prevention and response planning guide	http://www.nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=3875

State Resources

Topic	Link
Colorado	http://www.invasivespeciesinfo.gov/unitedstates/co.shtml
Kansas	http://www.invasivespeciesinfo.gov/unitedstates/ks.shtml
Nebraska	http://www.invasivespeciesinfo.gov/unitedstates/ne.shtml
South Dakota	http://www.invasivespeciesinfo.gov/unitedstates/sd.shtml
Wyoming	http://www.invasivespeciesinfo.gov/unitedstates/wy.shtml
