Virginia Invasive Species Management Plan

Virginia Invasive Species Council
2005

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VIRGINIA INVASIVE SPECIES MANAGEMENT PLAN

prepared by:

VIRGINIA INVASIVE SPECIES COUNCIL
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EXECUTIVE SUMMARY

Invasive species are non-native plant, animal, or microbial species that cause, or are likely to cause, economic or ecological harm or harm to human health (Presidential Executive Order 13112). “Non-native” (or “alien,” “exotic,” or “nonindigenous”) means they have been introduced by human action, intentionally or accidentally, into a region outside their natural geographic range. Introductions occur along a variety of pathways, or vectors, such as through intentional transport of a species for trade, or by accidental means, as in the case of stowaway species found in the ballast-water of ocean-going vessels.

Currently, annual economic losses due to invasive species in the U.S. are estimated at over $137 billion (Pimentel et al. 2000). This figure includes damage to crop and pasture, forest losses, damage from insect and invertebrate pests, human diseases, and associated control costs. Losses due to invasive species in Virginia may be as high as one billion dollars annually (Pimentel personal communication).

Ecological harm caused by invasive species can include near extirpation of native species, as in the cases of Chestnut blight and hemlock wooly adelgid, and alteration of natural ecological communities, as with snakehead fish, zebra mussel, or Phragmites. Currently, 49% percent of 1180 imperiled or federally listed species are directly threatened by competition with or predation by invasive species (Wilcove et al. 2000). The Virginia Department of Game and Inland Fisheries identifies invasive species as a “crucial statewide conservation issue” (VDGIF 2005).

In 2003, the Invasive Species Council Act (ISCA) was passed into law by the General Assembly establishing the Virginia Invasive Species Council (VISC) to provide state leadership of invasive species issues in the Commonwealth and to prepare an invasive species management plan (*Code of Virginia* § 10.1-2600). The Secretary of Natural Resources chairs the Council. Other members of the Council include: the directors or commissioners, or their designees of the Department of Agriculture and Consumer Services, the Department of Forestry, the Department of Game and Inland Fisheries, the Department of Conservation and Recreation, the Department of Health, the Department of Transportation, the Virginia Marine Resources Commission, and the Virginia Institute of Marine Science.

The ISCA also called for the establishment of an “advisory committee of stakeholders to provide information and advice for consideration by the Council” and to “recommend actions that may be taken at local, state, regional, and ecosystem-based levels to achieve the goals and objectives of the management plan…” (*Code of Virginia* § 10.1-2605). Members of the advisory committee come from local, state, and federal government, academia, private citizens, private conservation organizations, and the business community.

Several state laws and regulations address invasive species from historical perspectives that pre-date contemporary concerns about and definitions of invasive species. Most laws protecting agricultural and silvicultural interests are concerned with “plant pests,” which may include weeds, insects, and plant pathogens such as rusts or viruses. A subcategory of plant pests is “noxious weed.” Virginia laws and regulations also identify animal threats to game species, wildlife, and livestock as “nuisance species.” Plant pest and nuisance species laws restrict importation and release of species identified as a threat and provide authority for eradication.

Other state laws and regulations specifically address impacts of predatory or undesirable species on native fish and wildlife resources (§29.1-542; 4VAC15-30-40), or of invasive aquatic species which may pose significant threat of harm to diversity or abundance of native species, ecological stability of state waters, or the commercial, industrial, agricultural, municipal, recreational, aquacultural, or other beneficial uses of state waters (§29.1-571; 4VAC15-20-210). The former law and regulations prohibit importation, possession, or sale of predatory or undesirable animals (a “black list”). The later law (Virginia Nonindigenous Aquatic Nuisance Species Act - VNANS) provides broad authority to the Virginia Department of Game and Inland Fisheries to conduct “operations and measures to suppress, control, eradicate, prevent, or retard . . . ” the spread of any designated nonindigenous aquatic nuisance species. To date, six taxa (zebra mussel, snakehead fishes, quagga mussel, New Zealand mudsnail, rusty crayfish, and black carp) have been designated by law or regulation as nonindigenous aquatic nuisance species. Unfortunately, no funding is provided by VNANS to the Department to implement these authorities or programs.

Broad statements in laws concerning the protection and propagation of wildlife or protection of the natural diversity of biological resources provide some grounds for action to prevent or control invasive species. For example, the Department of Game and Inland Fisheries is charged to “conduct operations for the preservation and propagation of game birds, game animals, fish and other wildlife in order to increase, replenish and restock the lands and inland waters of the Commonwealth” (§ 29.1-103). Further, they may “exercise powers it may deem advisable for conserving, protecting, replenishing, propagating and increasing the supply of game birds, game animals, fish and other wildlife of the Commonwealth” (§ 29.1-103). The *Code of Virginia* calls for the Department of Conservation and Recreation to “preserve the natural diversity of biological resources of the Commonwealth” (§10.1-211).

A wide array of invasive species efforts underway in Virginia is described by local, state, and federal agencies. Efforts by state agencies include monitoring of exotic mosquitoes capable of transmitting West Nile virus; fisheries biologists surveying waters of the Potomac River for snakehead fish; gypsy moth suppression activities; an aquatic invertebrate zoologist working with watermen in the Chesapeake Bay to capture and remove Rapa whelk; and land managers working to control Phragmites in hundreds of acres of coastal plain marshes.

The Virginia Invasive Species Management Plan was developed by the Council in cooperation with the Advisory Committee using models plans from other states and the federal government.

The scope of this plan covers all invasive species, both terrestrial and aquatic, from microbe to mammals, in Virginia. The purpose of the plan is to provide a framework for state agency action to minimize economic, environmental, and human harm from invasive species by acting on the seven goals of coordination, prevention, early detection, rapid response, control, research, and education.

The seven goals are

1. Coordination. Coordinate state, federal, and stakeholder prevention and management of invasive species infestations.
2. Prevention. Prevent known and potential invasive species from entering the state through detecting and interrupting all unauthorized species introductions.
3. Early Detection. Strengthen and support an early detection network capable of identifying and reporting the appearance of invasive species before they can become established and control becomes less feasible.
4. Rapid Response. Develop a rapid response capability to implement eradication or containment procedures for target species identified by early detection before the species can become permanently established.
5. Control and Management. Provide control of established invasive species through containment, abatement, and other management strategies to minimize environmental and economic impacts.
6. Research and Risk Assessment. Support or conduct research and risk assessment necessary to assess, prioritize, and control invasive species.
7. Education and Outreach. Provide current information on invasive species, their negative impacts to environmental and economic resources, and methods of prevention and control to the general public and special interest groups.

The plan identifies a wide range of strategies and actions that are required to achieve each of the goals. Actions are listed in an implementation table. Key actions necessary for immediate implementation are listed with lead agencies and a time frame for completion. As of December 2005, there are no general fund monies dedicated toward the plan's implementation. As indicated in the implementation table, the plan calls for one new FTE and $70,000 in salary and basic FTE costs, and $45,000/year in operating funds to begin implementation of this plan. The key actions are crucial to the implementation of many other actions. Key actions include making the Invasive Species Council a permanent body; creating teams on the advisory committee to oversee plan implementation; the development of memorandum of understanding between state agencies with invasive species programs; legal review of jurisdictional authorities held by state agencies with regard to invasive species and identify gaps in those authorities; and identifying funding needs for implementing actions.

I. INTRODUCTION – WHY DO WE CARE ABOUT INVASIVE SPECIES?

What Are Invasive Species?

Invasive species are non-native plant, animal, or microbial species that cause, or are likely to cause, economic or ecological harm or harm to human health (Presidential Executive Order 13112). "Non-native" (or "alien," "exotic," or "nonindigenous") means they have been introduced by human action, intentionally or accidentally, into a region outside their natural geographic range. Introductions occur along a variety of pathways, or vectors, such as through intentional trade of a species, or by accidental means, as in the case of stowaway species found in the ballast-water of ocean-going vessels. "Aquatic nuisance species" are a sub-set of invasive non-native species that impact aquatic ecosystems (U.S. Congress 1990).

Most intentional non-native species introductions are beneficial, as with the majority of agricultural and horticultural species. Species escaping cultivation or accidentally introduced most often have no negative impact in their new landscape. However, the tiny minority of species that do become invasive wreak significant ecological and economic harm. Invasive species have decimated forests, hampered agricultural production, threatened endangered species, and caused direct harm and even death to people.

Why Do We Care?

Currently, annual economic losses due to invasive species in the U.S. are estimated at over $137 billion (Pimentel et al. 2000). This figure includes damage to crops and pasture, forest losses, damage from insect and other invertebrate pests, human diseases, and associated control costs. Losses due to invasive species in Virginia exceed one billion dollars annually (Pimentel personal communication). As international trade and travel continue to expand and increase, new organisms will continue to find their way into new habitats and cause additional problems. Further, global climate change may alter conditions in Virginia and allow formerly non-invasive non-native species to become invasive (Ruiz and Carlton 2003; Mooney and Hobbs 2000).

Ecological harm caused by invasive species can include near extirpation of native species, as in the cases of chestnut blight and hemlock wooly adelgid, and alteration of natural ecological communities, as with snakehead fish, zebra mussel, or Phragmites. Currently, 49% of 1180 imperiled or federally listed species are directly threatened by competition with or predation by invasive species (Wilcove et al. 2000). The Virginia Department of Game and Inland Fisheries identifies invasive species as a "crucial statewide conservation issue" (VDGIF 2005).

Throughout evolutionary history, organisms have moved around the planet very gradually, expanding or shifting their native ranges and slowly changing to meet new conditions. However, human actions since the time of Columbus have transplanted species from their native ranges into new habitats at a steadily increasing rate and abundance. This has led some human-transplanted species to become established in new habitats. A relatively small proportion of these established transplants become invasive because of characteristics that give these species competitive advantages when freed from

the natural limiting factors found in their native range, such as predators or diseases. Unchecked, invasive species propagate and spread to the detriment of native species which have not evolved competitive strategies or immunity to compete with the newly introduced species.

Brief Overview of Nine Invasive Species

A brief overview of nine invasive species follows. It is important to note that these are in no way to be considered the priority species in Virginia, or the species most in need of funding and action, rather they were selected to describe the breadth of the issues. The following descriptions of nine invasive species, from the well-known pest species kudzu, to the recently emerging invasive species the emerald ash-borer, represent the full range of invasive organisms. Virtually any type of organism, from viruses to mammals, may become an invasive species. Each example illustrates another dimension of the problems posed by invasive species and underscores the need for concerted action to control established invasive species and prevent new organisms from becoming established. All of these species are either found in Virginia or have the potential to become established here.

Kudzu (*Pueraria montana*) is a well-known invasive plant. Intentionally introduced to the U.S. from its native Japan for use in soil stabilization, kudzu became the "vine that ate the South." Kudzu rapidly grows up and over all other vegetation and creates a dense canopy with its large leaves. It starves other plant species of sunlight and quickly reduces complex natural communities to tangled stands of kudzu. Currently, 7 million acres of land is infested with kudzu. Although used as forage, it produces low yields.
Annual costs to control kudzu by power companies in the Southeast have been estimated at 1.5 million dollars (Britton 2002).

Less than 100 years ago, the American chestnut was a dominant tree species in the Appalachian Mountains from Maine to Mississippi. It was a valued timber tree and produced a bounty of edible nuts. **Chestnut blight fungus** (*Cryphonectria parasitica*) was first noted on trees in New York City in 1904. The blight, introduced from Asia, kills the above ground part of the chestnut tree. By 1926, the chestnut blight had spread throughout the range of the American chestnut (Anagnostakis 2000). Surviving trees were reduced to shrubby stems that rarely reproduced. The industries that were dependent on American chestnut disappeared.

Northern snakehead fish (*Channa argus*) has become a recent concern in the Mid-Atlantic since being discovered in Maryland ponds and the Potomac River (Courtenay and Williams 2004). A voracious predator with sharp teeth and mature body length from three to four feet, snakeheads have the potential to drastically alter freshwater ecosystems by out competing native fish species, including many sport fish. Snakeheads prey on fish, frogs, crustaceans, and aquatic insects. Many species of snakehead fish, including northern snakehead, have the ability to breath air and crawl short distances between waterbodies. Northern snakehead is widely sold as live fish food, even in states where it is illegal to sell. Its native range suggests it could become established throughout the contiguous United States (Courtney and Williams 2004). Snakehead itself may introduce

yet another non-native species, a fungal pathogen (*Aphanomyces invadans)* known as epizootic ulcerative syndrome (EUS). EUS can harm native fish and stock in fish farms (USFWS 2002). All these factors potentially make northern snakehead a very destructive invader.

In 1990, one could visit Shenandoah National Park and walk under the huge old eastern hemlock trees of the Limberlost. Spared from timbering before the creation of the park, the stand was true old growth forest. Today, most of the hemlock at the Limberlost are dead and Virginia's hemlock population is in decline. The ancient giants were brought to their demise by a tiny aphid-like invasive insect, the **hemlock wooly adelgid** (*Adelges tsugae*). The adelgid sucks the sap out of hemlock needles and inject toxic saliva. It first appeared in Virginia in 1950, and is native to Asia. There is no effective management strategy currently available, and the adelgid continues to spread throughout the eastern U.S., causing tree mortality and population declines (USFS, no date). Loss of eastern hemlock significantly changes the character of natural communities in Virginia's mountains and may lead to an increase in stream erosion.

Phragmites (*Phragmites australis*), is a tall grass species found in many parts of the world with regional genetic variations. At least one variation, or genotype, was introduced into the U.S. and has become an aggressive invader of brackish wetlands in eastern and midwestern states (Saltonstall 2002). Phragmites overwhelms other marsh plant species from above and below with tall stem that may be 15 feet in height and fast growing rhizomes (underground stems) which form new shoots and a thick tangled root mat. By forming tall dense stands with few other plant species, Phragmites creates a habitat that lacks value to wildlife. Once established, it is very difficult and expensive to control (Marks et al. 1993). The Virginia Department of Conservation and Recreation recently mapped over 1200 acres of Phragmites that has invaded wetlands on the seaside and barrier islands of Virginia's Eastern Shore (Myers et al. 2004).

Detected in the U.S. in 1999, **West Nile virus** is a disease-causing virus that affects birds and mammals, including humans. It was first identified in Uganda in 1937 (Hayes et al. 2005). Since it was discovered in North America, it has spread at an astonishing rate. By 2004, West Nile virus had spread to California, north into Canada, and south into Central America and the Caribbean (Hayes et al. 2005). West Nile virus is transmitted by mosquitoes and can cause West Nile fever (a mild flu-like condition), meningitis, encephalitis or even a polio-like paralysis and death. Since 1999, over 16,000 cases of West Nile virus disease have been reported, with 666 resulting in death. However, most people infected with the virus never get sick, and some experience only mild, flu-like symptoms. West Nile virus also affects many wild and captive bird species, which are the primary means of dispersal (Hayes et al. 2005). Certain species, such as crows and jays, are particularly vulnerable and experience high rates of mortality. Some bird species are better reservoirs of the virus than others. The virus is transmitted from birds to humans by mosquitoes. Recent research also suggests it may be transmitted by blood transfusion, organ transplants, and breast milk (Hayes et al. 2005). The most likely pathway for the virus into the U.S. is via birds in zoos, or commercial and pet trade, although this has not

been proven. There are many different possible pathways by which the virus could have arrived in this country (Hayes et al. 2005; Marra et al. 2004; Rappapole et al. 2000).

Zebra mussel (*Dreissena polymorpha*), a native of Russia, spread in the 19th century to western Europe, and probably arrived in the U.S. in the ballast of a transatlantic ship. It was first identified in 1988 in Lake St. Claire in Michigan, which connects Lake Huron and Lake Erie. Less than ten years later, zebra mussel was found in all five Great Lakes and the Mississippi, Tennessee, Hudson, and Ohio River basins. Adult zebra mussels grow to 2 inches in length and form dense colonies of as many as one million individuals per square meter (USGS 2000). Colonies form on any hard surface, whether living or inanimate. Boats, pipes, piers, docks, plants, clams, and even other Zebra mussels serve as viable substrate for this species. Zebra mussel proliferation in U.S. water has had negative economic and ecological impacts. The U.S. Fish and Wildlife Service has estimated $5 billion economic impact over a ten-year period. Costs are associated with activities such as cleaning and maintenance of water intake pipes, removal of shell build-up on recreational beaches, and control efforts (USGS 2000). Zebra mussel has been discovered in one quarry pond in northern Virginia in 2003. VDGIF is leading control efforts.

Phytophthora ramorum, a fungal pathogen of unknown origin (Cave et al. 2005), causes damage to trees and shrubs. It is responsible for "**sudden oak death**" in California and Oregon, killing tanoak (*Lithocarpus densiflorus*), coast live oak (*Quercus agrifolia*), and Californian black oak (*Q. kellogii*). The fungus causes a wide range of symptoms on oak and rhododendron species, including many horticultural species. It has been detected in an ever-increasing number of nurseries in the U.S. and Europe (Cave et al. 2005), but so far has not been found in native forests in the eastern U.S. Nevertheless, *P. ramorum* remains a very high concern for foresters and the nursery industry. Many believe it is just a matter of time before it is found in high risk areas of Virginia and other states where known host plant species are widespread and climate conditions are favorable to its growth and dispersal (COMTF 2004; Cave et al. 2005). The only control methods known at this time are quarantine or burning host plants.

Emerald ash borer (*Agrilus planipennis*) is a small beetle discovered in Michigan in 2002. A native of China, Korea, Taiwan, and Japan, its larvae have killed 8 to 10 million ash trees (*Fraxinus* spp.) in Michigan, Ohio, and Indiana (www.emeraldashborer.info 2005). Evidence suggests the beetle has been established in Michigan for as long as six to ten years (USFS 2004). Michigan, Ohio, and Indiana state agencies and the U.S. Forest Service are conducting coordinated programs of research, eradication by means of tree removal, and quarantines to prevent further infestations. Several occurrences of emerald ash borer have been discovered in Maryland, all associated with ornamental trees originating from one nursery. This same nursery sold 16 infested ash trees to Fairfax County Public Schools in Virginia. The infested trees and all ash trees within one-half mile radius were removed and incinerated by Fairfax County Forest Pest Section and the Virginia Department of Agriculture and Consumer Services. Monitoring for emerald ash borer in Virginia continues (Fairfax County 2005).

Geographic Extent of this Plan
This management plan covers all lands and waters within the Commonwealth of Virginia, as well as that portion of the Chesapeake Bay from its mouth to the Virginia-Maryland state line, and near-shore waters of the Atlantic Ocean. However, it must be understood that invasive species are not limited by political boundaries. Therefore, elements of this plan call for coordination and partnerships with regional and national efforts to prevent and control invasive species infestations.

Scope, Purpose, and Goals of the Invasive Species Management Plan
The scope of this plan covers all invasive species, both terrestrial and aquatic, in Virginia. The purpose of the plan is to provide a framework for state agency action to minimize economic, environmental, and human harm from invasive species by acting on the seven goals of coordination, prevention, early detection, rapid response, control, research, and education.

Planning Process
The Virginia Invasive Species Council developed this plan through close coordination with the Council's Advisory Committee of stakeholders. The Advisory Committee includes representatives of Virginia's natural resource agencies, the Departments of Transportation and Health and Human Services, academic researchers, private citizens, non-profit conservation organizations, and private business associations. A complete list of Committee members and their affiliations can be found in Appendix C.

The plan is meant to be an evolving document that will be revised and updated every three to five years, using an adaptive management process. Ongoing accomplishments and new information will guide the refinement and revision of goals and strategies in future versions of the plan.

II. INVASIVE SPECIES MANAGEMENT PLAN
1. COORDINATION

The scope and complexity of the invasive species management challenge is such that it summons the strengths of different government agencies and private organizations in different ways. Not all will conduct control or restoration activities, nor will all be directly engaged in prevention measures. All stakeholders will not always agree on all issues. Nevertheless, the goals of this plan require understanding of the views and roles of each stakeholder and ongoing cooperation, communication, and dialogue. Further, there needs to be a thorough analysis of roles and responsibilities and their supporting legislation regarding invasive species. Gaps in authority and funding can then be identified. Last but not least, there must be strong monitoring and evaluation of the implementation of the goals, strategies and actions called for in this plan. Monitoring and evaluation will provide measures of success toward reaching goals and information for future iterations of this plan.

Goal 1: Coordinate state, federal, and stakeholder prevention and management of invasive species infestations.

Strategy 1.1: Strengthen invasive species coordination at the state level, between local and federal agencies, and with other stakeholders.

Action 1.1.1: Develop a Memorandum of Understanding (MOU) for presentation to state agencies involved in invasive species prevention, detection, control, research, and education. The purpose of this MOU is to:

- Help integrate and coordinate Virginia-wide agency invasive species actions and link them to national invasive species efforts.
- Develop and outline procedures that will help resolve jurisdictional and other agency issues regarding invasive species programs.

Action 1.1.2: Establish the Virginia Invasive Species Council (VISC) as a permanent body and fund key positions and activities.

Action 1.1.3: Maintain VISC Advisory Committee (VISAC) as the primary forum for stakeholder dialogue and coordination between state, federal and private organizations.

Action 1.1.4: Establish a sub-committee for oversight of each of the goals of this plan. Each sub-committee should present an annual summary of activities undertaken and progress toward the plan goals to the VISC.

Action 1.1.5: Strengthen state partnerships with local governments, federal agencies, and other stakeholders through memoranda of understanding where appropriate.

Action 1.1.6: Establish a conflict resolution process to address major policy differences between agencies and other stakeholders.

Strategy 1.2: Conduct an evaluation of current state and federal statutes and rules relevant to invasive species. The purpose of this evaluation is to concur on potential legislation revisions to close potential gaps or reduce duplication.

Action 1.2.1: Conduct authoritative evaluation of current statutes and rules relevant to invasive species.

Action 1.2.2: Identify jurisdictional and legislative needs for invasive species prevention, detection, response, control, research, and education.

Action 1.2.3: Identify funding needs for invasive species prevention, detection, response, control, research, and education.

Strategy 1.3: Establish monitoring and evaluation of the invasive species management plan implementation.

Action 1.3.1: Define clear, quantifiable outcomes for management actions.

Action 1.3.2: Require reporting of progress and accomplishments in the implementation of invasive species management plan strategies and actions.

2. PREVENTION

Preventing introduction of invasive species is the most cost-effective means to avert or reduce the risk of harmful infestations. Investment in prevention avoids the long-term economic, environmental, and social costs associated with invasive species infestations. Preventative actions would seek to verify authorized introductions, detect and interrupt illegal or unintentional introductions by monitoring key pathways. Prevention requires state agency support and cooperation with federal agencies tasked with similar responsibilities at the border and beyond. Implementation of preventative measures may require broadening legislative mandates, strengthening the capacity of some departments, and refining or consolidating legislative and regulatory tools. Prevention also includes increased public awareness of the invasive species issues. Educating key resource user groups is an important part of prevention efforts and is addressed in Goal 7.

Prevention of intentional and unintentional introductions is achieved through the application of pathway management and risk assessment. One model of pathway, or vector, management is a four-step process that includes 1) pathway analysis, 2) ranking of pathway strength, 3) pathway interruption, and 4) efficacy monitoring (Ruiz and Carlton 2003). This model recommends a precautionary approach that would only allow "approved" species entry into Virginia. Pathway management is an adaptive management process in which data and experience feed back over time into the refinement of each step.

An alternate or additional approach to prevention conducts a risk assessment to examine the potential impacts of known invasive species not yet present in Virginia. The result of this risk assessment would be a "target species list," or "black list," being a subset of future potential invasive species, that directs pathway interruption to specific pathways and early detection monitoring toward "sentinel sites," locations thought to be likely habitat for target species to appear. Risk assessment requires a model that integrates environmental, economic, social, and human health considerations. Risk assessment strategies and actions are found under Goal 6.

Goal 2: Prevent known and potential invasive species from entering the state through detecting and interrupting all unauthorized species introductions.

Strategy 2.1. Identify, support, or conduct invasive species pathway analysis and prioritize pathways according to risk.

Action 2.1.1: Coordinate with federal agencies to ensure assessments are conducted of all pathways and potential pathways of intentional and unintentional introductions, including commodities and transportation vectors.

Strategy 2.2: Develop and implement plans for managing both intentional and unintentional high-risk pathways.

Action 2.2.1: Identify authors or teams to create pathway management plans.

Action 2.2.2: Ensure that plans identify additional funding and legal authority, if needed.
Action 2.2.3: Encourage cooperation between federal and state agencies in the development and implementation of invasive species risk management partnerships at all significant ports of entry in Virginia.

3. EARLY DETECTION

When invasive species elude preventative actions and enter Virginia, early detection is the next line of defense. Early detection consists of monitoring for invasive species around critical pathways, protected areas, and urban and agricultural ecosystems. Monitoring of invasive species also supports several other strategic needs: it evaluates prevention and control programs, and provides information on invasion patterns and future management needs. Taxonomic expertise is an essential component of early detection efforts.

Goal 3: Strengthen and support an early detection network capable of identifying and reporting the appearance of invasive species before they can become established and control becomes less feasible and more costly.

Strategy 3.1: Identify current early detection programs/networks and existing gaps in coverage and funding.

Action 3.1.1: Survey and evaluate current monitoring programs/networks, including volunteer networks, identify geographic gaps, and make recommendations to improve detection efforts across institutional and jurisdictional boundaries.

Strategy 3.2: Establish a coordinated public monitoring network to detect and report invasive species.

Action 3.2.1: Support the refinement and growth of existing federal, state, and volunteer early detection networks and encourage communication of findings across these networks.

Action 3.2.2: Monitor the results and impacts of approved introductions and re-evaluate decisions to allow introductions if there are unexpected consequences.

Strategy 3.3: Identify or establish a core capacity of diagnostics and taxonomic expertise to accurately identify invasive alien species.

Action 3.3.1: Support existing diagnostic tools of biological collections and taxonomic libraries.

Action 3.3.2: Support taxonomic research.

Action 3.3.3: Support the establishment of new taxonomic expertise.

4. RAPID RESPONSE

When invasive species are detected by monitoring systems, it is essential to respond rapidly, before they become established, spread, and cause harm. Delay in response can lead to higher costs of control and management. Integrated rapid response programs are required. The objective of rapid response is containment or eradication of the target species. State, federal, and local agencies, and nongovernmental organizations need to coordinate response activities. Rapid response programs must be guided by contingency plans and supported with emergency funding.

Goal 4: Develop a rapid response capability to implement eradication or containment procedures for target species identified by early detection before the species can become permanently established.

Strategy 4.1: Develop systems and networks for rapid decision-making, communication, and implementation of an emergency response plan.

Action 4.1.1: Form a rapid response network of state and federal agencies and other stakeholders that individually or in concert can provide rapid response implementation.

Strategy 4.2: Develop contingency/emergency response plans for potential high priority invasive species. The *Virginia Pest Plant Emergency Action Plan* prepared by VDACS Office of Pest Plant Services provides an excellent model for such plans. See Appendix F.

Action 4.2.1: Catalog existing plans and assess the need for further plans.

Action 4.2.2: Identify planning teams for specific life form types (e.g., mammals, fish, mosquitoes, plant pathogens, etc.).

Action 4.2.3: Prepare plans for potential high priority invasive species. Incorporate these plans into the state emergency plan under the state homeland security system.

Strategy 4.3: Establish an emergency fund and ensure it can be readily accessed.

Action 4.3.1: Identify current available funds or fund sources for rapid response implementation and assess needs for more funding authority.

Action 4.3.2: Establish emergency funds through legislative action.

Strategy 4.4 Provide for personnel training and equipment.

Action 4.4.1: Identify and support personnel training needs and interagency partnerships for successful rapid response operations.

Action 4.4.2: Identify and acquire equipment necessary for successful rapid response operations.

5. CONTROL AND MANAGEMENT

Established invasive species require control through eradication, containment, or other management strategies to minimize environmental and economic impacts. Management objectives may include eradication within an area, population suppression, limiting spread, and reducing impacts. Control measures may include mechanical, chemical, biological, and integrated pest management strategies. In managed ecosystems, restoration is an essential component of control to prevent an invader from re-invading a site or new invaders from becoming established. Adequate funding, public awareness, and management expertise are critical to success.

Invasive species do not recognize political boundaries or agency jurisdictions. Therefore, an ecosystem approach should be used to manage invasive species within Virginia and across state lines. State agencies, federal agencies, and private organizations should coordinate efforts within the state and the region.

Invasive species should be prioritized for targeted management and research activities. Risk assessment, cost-benefit analysis, and other tools can be used to identify and select appropriate control measures. This need is addressed in Goal 6: Research and Risk Assessment.

Goal 5: Provide control of established invasive species through containment, abatement, and other management strategies to minimize environmental and economic impacts.

Strategy 5.1: Prepare and implement management plans to abate environmental and economic impacts of established high priority invasive species infestations (as identified in Action 6.2.1).

- **Action 5.1.1**: Develop and implement management plans for *established* high priority invasive species through a partnership/stewardship approach.
- **Action 5.1.2**: Develop and implement restoration plans for vulnerable wildland, aquatic, and agricultural ecosystems to provide conditions more suitable for native biota.
- **Action 5.1.3**: Identify information, staff, research, and budget needs to improve invasive species management in Virginia.

Strategy 5.2: Develop programs and information and establish funding to assist private landowners in control of invasive species.

- **Action 5.2.1**: Evaluate potential incentive programs or assistance for private landowners for the control of invasive species and make recommendations to the Virginia General Assembly to establish or enhance these programs.
- **Action 5.2.2**: Evaluate potential incentive programs or assistance for private landowners for the restoration of ecosystems vulnerable to invasion and make recommendations to the Virginia General Assembly to establish or enhance these programs.

6. RESEARCH, MONITORING, AND RISK ASSESSMENT

Research supports all facets of the management plan and is necessary to increase the effectiveness of prevention, detection, response, and control and management of invasive species. Science-based risk assessment tools are needed to evaluate invasive species before they reach Virginia's borders and to prioritize appropriate responses once they do. Significant research and monitoring efforts are currently underway at the Federal agencies (chiefly USDA, DOI and EPA) and universities. The principal role of State agencies will be to provide guidance to these institutions on research, monitoring and risk assessment needs and to provide feedback to researchers on the effective of the management tools they develop.

Research needs are both basic and applied. Science support for monitoring includes identifying statistically sound and repeatable standard techniques that can be applied to invasive plants and animals and can be used in multiple habitats, (terrestrial, freshwater and marine). The development of models to increase the ability of monitoring to accurately predict the distribution and impacts of invasive species is also a key need. Finally, risk assessment is a decision-support tool critical to the success of the prevention, detection, rapid response, and control components of this plan.

Goal 6: Support or conduct research, monitoring, and risk assessment necessary to assess, prioritize, and control invasive species.

Strategy 6.1: Building on existing state, federal and university programs, establish and coordinate a State invasive species research network. This network will develop long- and short-term research capacity and will collaborate and communicate invasive species research needs to other institutions.

Action 6.1.1: Identify priority research needs. These priorities should address invasive species research, monitoring and risk assessment needs in terrestrial, freshwater and marine habitats. Areas of research will include prevention, early detection, control and management, and restoration of affected habitats.

Action 6.1.2: Identify ongoing research, monitoring, and risk assessment efforts being conducted by other States, Federal agencies and universities and coordinate with these institutions. Support priority needs with adequate staff and funding in appropriate Virginia agencies and support collaboration with other states, federal agencies, and universities.

Strategy 6.2: Increase invasive species risk assessment capacity.

Action 6.2.1: Identify current risk assessments completed for invasive species already established in Virginia and identify needs for further analysis. This process should result in a list of "*established* high priority invasive species," which are 1) currently established in Virginia, and 2) widely recognized as a threat to ecological or economic resources.

Action 6.2.2: Participate with federal agencies and nongovernmental stakeholders to develop a fair comprehensive screening system for evaluating first-time intentionally introduced non-native species.
Action 6.2.3: Working with federal agencies and nongovernmental stakeholders, develop an "approved list" of species allowed into the Commonwealth.
Action 6.2.4: Implement a process for assessing *potential* invasive species that are likely to be introduced unintentionally and for which rapid response tools are necessary.
Action 6.2.5: Develop environmental and economic indicators for evaluating impacts of invasive species.
Action 6.2.6: Develop a "black list" of *potential* high priority invasive species based on the anticipated impact of these species on economic and natural resources. Target rapid response actions to the highest priority species on this list.

7. EDUCATION AND OUTREACH

Education and outreach are vital to all the other goals in this plan. Educating the general public and special interest groups, such as commercial importers and agricultural producers, on the impacts of invasive species will result in greater citizen support and involvement. General outreach and specialized training programs are required.

Goal 7: Provide current information on invasive species, their negative impacts to environmental and economic resources, and methods of prevention and control to the general public and special interest groups.

Strategy 7.1: Understand current public attitudes and perceptions of invasive species issues.

Action 7.1.1: Conduct literature survey for existing pubic surveys on invasive species.

Action 7.1.2: Conduct new public opinion survey to clarify, update, or fill gaps in understanding of Action 7.1.1.

Action 7.1.3. Prepare a report to the VISC on findings and make recommendations on education needs.

Strategy 7.2: Distribute information on current invasive species publications, education, prevention and control practices, and outreach programs.

Action 7.2.1: Compile current materials and make available through the Invasive Species Council web site.

Strategy 7.3: Develop and implement a coordinated public awareness campaign emphasizing public and private partnerships to address invasive species challenges.

Action 7.3.1: Evaluate federal and other state public awareness programs already in use.

Action 7.3.2: When currently unavailable, develop educational materials that raise awareness of the need to prevent future introductions of invasive species.

Action 7.3.3: Emphasize on-the-ground action through programs that directly involve communities in management of invasive species.

III. RECOMMENDATIONS FOR IMPLEMENTATION

Actions for each of the goals and strategies are listed in the Implementation Table below. Key actions necessary for immediate implementation are listed with lead agencies and a time frame for completion. The key actions are crucial to the implementation of many other actions.

Implementation Table

Action #	Action	Fund Source	Implementing Agency	Cooperative Agency	Time Frame	Cost of Recent Efforts ($$$/FTE)	Costs of Planned Efforts ($$$/FTE)
1.1.1	Develop interagency MOU		VISC VISAC DCR		June 2006		$2000
1.1.2	Make VISC a permanent body with funding		VISAC	NGOs	January – March 2006		Minimum 1 GF FTE $70,000/yr
1.1.3	Maintain the VIS Advisory Committee as stakeholder forum		VISC		Ongoing		$2500
1.1.4	Establish sub-committees for oversight of each goal		VISAC		August 2006		
1.1.5	Strengthen state and federal partnerships with MOU		VISC DCR VISAC		June 2006		$1000
1.1.6	Establish conflict resolution process		VISC	UVA Institute for Environmental Negotiation	December 2006		$5000
1.2.1	Evaluate current state invasive species laws		DCR	DGIF VMRC VDACS	December 2006	$2500	
1.2.2	Identify jurisdictional, legislative and funding needs		DCR TNC	VDGIF VMRC VDACS	August – September 2006		
1.3.1	Define clear, quantifiable outcomes for management actions		VISAC		Ongoing		
1.3.2	Require progress reports for implementation of management plan actions		Secretary of Natural Resources Annual Report		December each year		$1000
2.1.1	Ensure pathway assessments are conducted	Clean Water Act, Mid-Atlantic Aquatic Nuisance Species Task Force	VISC	VDACS DGIF VMRC VIMS DOF DCR	December 2006 (start date contingent upon funding)		$5000/assessment @ 2 assessments/ year

2.2.1	Identify authors of pathway management plans		VISC	VDACS DGIF VMRC VIMS DOF DCR	December 2006 (start date contingent upon funding)		
2.2.2	Ensure pathway management plans identify funding and legal authority		VISC	VDACS DGIF VMRC VIMS DOF DCR			
2.2.3	Encourage state and federal pathway management cooperation		VISC	VDACS DGIF VMRC VIMS DOF DCR MAANSTF			
3.1.1	Survey current early detection programs and identify needs/gaps		DCR	NISC VDACS DGIF VMRC VIMS DOF NGOs	December 2006		$3000
3.2.1	Support refinement and growth of existing federal and state early detection networks		VISAC NGOs		ongoing		
3.2.2	Monitor results and impacts of approved introductions						
3.3.1	Support existing diagnostic tools and taxonomic libraries						
3.3.2.	Support taxonomic research						
4.1.1	Form rapid response network	USDA NPS USFS	VISAC DCR		January 2007		
4.2.1	Catalog existing response plans and assess need for more plans		DCR VDACS VDGIF VMRC VIMS DOF		December 2006		$3000
4.2.2	Identify rapid response planning teams						
4.2.3	Prepare plans for high priority “black list” species						

4.3.1	Identify current available funds for rapid response		DCR	VDACS DGIF VMRC VIMS DOF	July – December 2006		
4.3.2	Establish emergency funds through legislative action						
4.4.1	Identify and support personnel training needs for rapid response						
4.4.2	Identify and acquire equipment necessary for successful rapid response						
5.1.1	Develop management plans for established high priority species						
5.2.1	Develop restoration plans for vulnerable ecosystems						
5.1.3	Identify staff, research, and budget needs for invasive species control		VISAC VISC DCR		August 2006	8/06	$2000
5.2.1	Evaluate potential incentive programs for private landowner control projects		VISAC VISC DCR		August 2006		$1500
5.2.2	Evaluate potential incentive programs for private landowner restoration projects		VISAC VISC DCR		August 2006		$1500
6.1.1	Identify invasive species research needs		VISAC		August 2006		$1500
6.1.2	Support priority research needs with adequate staff and funding		VISC		July 2007		
6.2.1	Identify risk assessments of invasive species, develop list of “established high priority invasive species”		VISAC VISC		August 2006		$2000
6.2.2	Participate with federal agencies in development of screening system						

6.2.3	Develop an "approved" species list		VISAC VISC		Fall 2006		
6.2.4	Develop and implement a process for identifying likely introductions		VISAC VISC		Fall 2006		
6.2.5	Develop indicators for evaluating invasive species impacts		VISAC VISC		Fall 2006		$2500
6.2.6	Develop a "black list" of potential invasive species to be targeted by rapid response		VISAC VISC		Winter 2006		
7.1.1	Conduct literature survey of public attitudes		DCR VISAC		Spring 2006		$1000
7.1.2	Conduct new public opinion survey						
7.1.3	Report to VISC on findings of public attitudes						
7.2.1	Make invasive species information available through web site		DCR VISAC	TNC	January 2006		$2500
7.3.1	Evaluate other public awareness programs in use		DCR VISAC		July 2006		$1500
7.3.2	Develop new material on preventing future introductions		VISAC VISC		December 2006		$5000
7.3.3	Encourage on-the-ground action programs that involve communities		DCR VISAC (via web)		ongoing		ongoing base operating cost $2500/yr

IV. CITATIONS

Anagnostakis, S. L. 2001. Revitalization of the majestic chestnut: chestnut blight disease. APSnet website. Available at http://www.apsnet.org/online/feature/chestnut [Accessed 1 August 2005].

Britton, K. 2002. Kudzu. In *Biological Control of Invasive Plants in the Eastern United States*, ed. R. Van Driesche, B. Blossey, M. Hoddle, R. Reardon. USDA Forest Service Publication FHTET-2002-04, 413 p.

Cave, G.L. B Randall-Schedel, and S.C. Redlin. Risk analysis for *Phytophthora ramorum* Werres, de Cock and In't Veld, causal agent of Phytophthora canker (sudden oak death), ramorum leaf blight, and ramorum dieback. United States Geologic Survey Animal and Plant Inspection Service, Plant Protection and Quarantine, Center for Plant Health Science and Technology, Raleigh, NC.

[COMTF] California Oak Mortality Task Force. 2004. *Phytophthora ramorum*: a review of North American and European activity. Available at http://www.suddenoakdeath.org [Accessed 2 August 2005].

Courtenay, W.R., and J.D. Williams. 2004. *Snakehead (Pisces, Channidae): A biological synopsis and risk assessment*. U.S.G.S. Circular 1251. 151 pp.

Fairfax County. 2005. Emerald ash borer. Fairfax County website. Available at http://www.co.fairfax.va.us/dpwes/environmental/eab_general.htm [Accessed 19 August 2005].

Federal Interagency Committee for the Management of Noxious and Exotic Weeds. 2003. A ational early detection and rapid response system for invasive plants in the United States. Washington, DC. 24 p.

GAO. 2002. Invasive species: clearer focus and greater commitment needed to effectively manage the problem. USGAO. GAO-03-1. 102 p.

Hayes, E.B., N. Komar, R. S. Nasci, S.P. Montgomery, D. R. O'Leary, and G.L. Campbell. 2005. Epidemiology and transmission dynamics of West Nile virus disease. Emerging Infectious Diseases 11:8 1167-1173.

Marks, M., B. Lapin, J. Randall. 1993. Element stewardship abstract for *Phragmites australis*, common reed. The Nature Conservancy. Available at http://tncweeds.ucdavis.edu/esadocs/phraaust.html [Accessed 29 November 2000].

Marra, P.P., S. Griffing, C. Caffrey, A.M. Kilpatrick, R. McLean, C. Brand, E. Saito, A.P. Dupuis, L. Kramer, and R. Novak. 2004. West Nile virus and wildlife. BioScience 54:5 393-402.

Mooney, H.A. and R.J. Hobbs. 2000. Invasive species in a changing world. Washington, D.C., Island Press. 457 pp.

Myers, R.K., K.E. Heffernan, J.T. Weber, and D.R. Young. 2004. Mapping and monitoring of Phragmites on the seaside of Virginia's Eastern Shore. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, Virginia. Natural Heritage Technical Report #04-15. 29 pp. plus appended map atlas.

National Aquatic Nuisance Species Task Force. Guidance for state and interstate aquatic nuisance species management plans. Available at http://www.anstaskforce.gov/state_guidance.htm. [accessed 4 April 005].

Rappole, J.H., S.R. Derrickson, and Z. Hubalek. 2000. Migratory birds and the spread of West Nile virus in the Western Hemisphere. Emerging Infectious Diseases 6:4 319-328.

Ruiz, G. M., and J.T. Carlton. 2003. Invasive species: vectors and management strategies. Island Press, Washington, DC. 518 p.

Pimentel, D., L. Lach, R. Zuniga, and D. Morrison. 2000. Environmental and economic costs of nonindigenous species in the United States. BioScience 50:1 53-65.

Pimentel, D., L. Personal Communication. Cornell University economist/ecologist David Pimentel, derives this figure for Virginia from his widely cited national study (see previous reference).

Saltonstall, K. 2002. Cryptic invasion by a non-native genotype of the common reed, Phragmites australis, into North America. PNAS 99:4 2445-2449.

Wilcove, D.S., D. Rothstein, J. Dubow, A. Phillips, E. Losos. 2000. Leading threats to biodiversity. In *Precious Heritage: The Status of Biodiversity in America*, ed. Stein, B. A., L. S. Kutner, J.S. Adams, pp 239-254. New York: Oxford University Press.

U.S. Congress. 1990. Nonindigenous aquatic nuisance prevention and control act of 1990. 16 U.S.C. 4701-4741.

U.S. Fish and Wildlife Service. 2002. Invasive species program: Snakehead fish—the newest aquatic invader. Available online at http://biology.usgs.gov/invasive/factsheets/SnakeHeadFish.pdf [Accessed 1 August 2005].

[USFS] U.S. Forest Service. No date. An exotic pest threat to Eastern hemlock: an initiative for management of hemlock woolly adelgid. USDA Forest Service Forest Health Protection website. Available at http://na.fs.fed.us/fhp/hwa/pub/hwa_mgt_plan.pdf [Accessed 1 August 2005].

U.S. Forest Service. 2004. Pest alert: emerald ash borer. Available at http://www.na.fs.fed.us/spfo/pubs/pest_al/eab.httm [Accessed 19 August 2005].

[USGS] United States Geologic Survey. 2000. Zebra mussels cause economic and ecological problems in the Great Lakes. USGS Great Lakes Science Center website. Available at http://www.glsc.usgs.gov/_files/factsheets/2000-6ZebraMussels.pdf [Accessed 3 August 2005].

[VDGIF] Virginia Department of Game and Inland Fisheries. 2005. Virginia's comprehensive wildlife conservation strategy. Richmond. Available at http://www.vawildlifestrategies.org/draft.html [Accessed 19 August 2005].

www.emeraldashborer.info. 2005. A collaborative website administered by Michigan State University with support from the USDA Forest Service and Michigan Department of Agriculture. [Accessed 19 August 2005]

APPENDICES

A. Glossary

B. Virginia Invasive Species Council Members

C. Virginia Invasive Species Council Advisory Committee Members

D. Survey of Virginia State Agencies Invasive Species Actions and Authorities

E. Overview of Virginia Invasive Species Laws

F. Summary Table of Virginia Invasive Species Laws

G. Virginia Plant Pest Emergency Action Plan

H. List of Acronyms Used in the Plan

APPENDIX A

GLOSSARY

approved species are species that have been screened through a risk assessment process and found to have of low potential for becoming invasive in the region of interest.

aquatic nuisance species are a sub-set of invasive non-native species that impact aquatic ecosystems (U.S. Congress 1990).

black list species are potential invasive species identified as of special concern and for which planning and education has been conducted to strengthen early detection and rapid response efforts.

ecosystem (or ecological system) all the living organisms and the nonliving components within a given area of the Earth

invasive species are non-native plant, animal, or microbial species that cause, or are likely to cause, economic or ecological harm or harm to human health (Presidential Executive Order 13112). *Established* invasive species are present in a specific region of interest to the extent that eradication is not feasible. *Potential* invasive species are considered to have high likelihood of becoming invasive in a specific region, are not yet established, and their establishment may be prevented through early detection and rapid response efforts.

native (or indigenous) species have evolved within a specific geographic region or expanded their range naturally, i.e., without the benefit of intentional or accidental human transport.

non-native (or alien, exotic, or nonindigenous) species have been transplanted from their native range by intentional or accidental human action.

pathway (or vector) is the artificial means by which species are transported from their native range into new regions. Ballast water, shipping containers, tourist luggage are examples of species pathways.

risk assessment is “a process for organizing and analyzing data, assumptions, and uncertainties to evaluate the likelihood of adverse ecological effects that may occur or are occurring as a result of exposure to one or more stressors.” (Source: “Ecological Risk Assessment in the Federal Government,” 1999, CENR/5-99/001)

APPENDIX B

VIRGINIA INVASIVE SPECIES COUNCIL MEMEBERS

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APPENDIX C

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Bill Bolin, Dominion Power
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APPENDIX D

2004 SURVEY OF AGENCIES AND ORGANIZATIONS CONFRONTING INVASIVE SPECIES ISSUES IN VIRGINIA

In 2004, the following survey was sent to representatives (listed at the end of the appendix) of local, state, and federal agencies that conduct invasive species management or monitoring. The responses give a snapshot of invasive species management in Virginia.

1. What type of responsibility does your agency currently have for invasive species?

A. Operations

Importation Regulatory Program	***Yes***	***No***
Detection	***Yes***	***No***
Control	***Yes***	***No***
Monitoring	***Yes***	***No***
Restoration	***Yes***	***No***

B. Research/Development ***Yes*** ***No***

C. Public Outreach Efforts ***Yes*** ***No***

D. Information Management (collect and manage information on the location, status, control of invasive species) ***Yes*** ***No***

Agency Responses to Question 1.

Agency/ Organization	A. Operations	B. Research/ Development	C. Public Outreach	D. Information Management
VDACS	I,D,C,M	No	Yes	Yes
VDCR	D,C,M,R	Yes	Yes	Yes
VDGIF	I,D,C,M,R	Yes	Yes	Yes
VDH	D,M	No	Yes	Yes
VDOT	I,D,R	No	Yes	Yes
VIMS	D,M	Yes	Yes	Yes
VMRC	I,R	No	No	No
USGS-VCFWU	R	Yes	Yes	No
NPS	D,C,M,R	No	Yes	Yes
USF&WS	I,D,C,M,R	Yes	Yes	Yes
APRCR	D,C,M,R	No	Yes	Yes
DRSAMP	M	Yes	Yes	Yes
FCPA	D,C,M,R	Yes	Yes	Yes
TCLAC	D,C,M,R	No	Yes	Yes
VNLA/VGIC	-	No	Yes	No
VNPS	-	No	Yes	No

Operations include: I-importation, D – detection, C-control, M-monitoring, R-restoration efforts.

Please provide a brief explanation for each Yes response.

VDACS
Yes - Review & Approve shipments of potential plant pests/invasive species and regulated articles into Virginia. Yes - Conduct detection surveys for exotic plant pests/invasive species of regulatory significance. Yes - Conduct suppression/eradication projects for plant pests/invasive species of regulatory significance. Yes - Conduct delimiting surveys for exotic plant pests/invasive species of regulatory significance. Yes - Conduct educational outreach to foster voluntary compliance and increased survey and detection of exotic plant pests of regulatory significance. Yes - Submit survey/suppression/ eradication data to National Agricultural Pest Information System (NAPIS) database.

VDCR
DCR does detection, control, monitoring and restoration on natural area preserves and state park lands. Extensive work is underway with Phragmites on the Eastern Shore, and joint Phragmites management efforts with the USF&WS and The Nature Conservancy in eastern Virginia. There is not a systematic inventory underway on DCR lands, and DCR is not conducting any type of statewide invasive inventory effort. DCR is conducting research on Phragmites management techniques, public outreach through brochures, web site information, and public presentations. Information management is limited to specific control and monitoring projects, and is not statewide.

VDGIF
Pursuant to Title 29.1 of the Code of Virginia, DGIF has broad management and regulatory authority over all wildlife in the Commonwealth, except that legally designated *threatened* or *endangered* species of the Class Insecta are under the jurisdiction of the Department of Agriculture and Consumer Services. Also, note that the state definition of "wildlife" does not include plant species. Therefore, our responsibility or jurisdiction regarding invasive plant species extends only to management of habitats for wildlife, which often entails management or control of invasive plants.

Regulatory control of importation, possession, transfer, and transportation of all wildlife is delegated to DGIF by Code. The Department, by regulation, provides that nonindigenous species may be imported and possessed for private use, except for species designated as predatory or undesirable wildlife, or as nonindigenous aquatic nuisance species. For species so designated, an individual must secure a permit (rarely granted) from the Department to import or possess the species. No species of nonindigenous wildlife may be released into the wild.

Except for designated nonindigenous aquatic nuisance species specific activities related to detection, control, monitoring, restoration, research, public outreach and education, and information management are conducted primarily in association with ongoing native wildlife research and management activities, rather than as independent programs or

projects within the Department. Except for the Millbrook Quarry zebra mussel eradication effort (discussed below) the Department has no funding delegated to monitoring, management, or control of nonindigenous species.

Passage of the Virginia Nonindigenous Aquatic Nuisance Species Act by the General Assembly greatly expanded the Department's jurisdiction and potential role to suppress, control, eradicate, prevent, or retard the spread of designated nonindigenous aquatic nuisance species in Virginia. Unfortunately, the bill specifies that such activities are not to be conducted unless funds are specifically designated to the Department for that purpose. Six taxa currently are designated under this Act and implementing regulations; snakehead fishes, zebra mussels, quagga mussels, black carp, New Zealand mudsnail, and rusty crayfish.

VDH
Because the VDH office of Epidemiology – Division of Zoonotic and Environmental Epidemiology is involved with vector surveillance as part of West Nile virus surveillance, we collect surveillance data about *Aedes albopictus* (the recently introduced Asian tiger mosquito) and *Ochlerotatus japonicus* (the newly introduced Asian bush mosquito). In this respect, our surveillance comprises detection, monitoring and information management about two invasive species. Our activities include public education about eliminating breeding habitats for mosquitoes, and particularly for these two imported container-breeding, human biting mosquitoes that are known disease vectors.

VDOT
VDOT does apply herbicides as a means of control for invasive species such as Tree of Heaven, Kudzu, Thistle, and Johnson Grass. We monitor our ROW for the spread of these 2 species as well as for standing water that may contain mosquitoes that carry the west Nile virus. VDOT conducts research through contracts with Virginia Polytechnic Institute on control methods for invasive species.

VIMS
Research projects to identify and monitor invasive species such as Rapa whelk and Phragmites australis. Public outreach through Sea Grant and Center for Coastal Resources Mgmt. communications programs; includes magazine articles/ announcements, newsletters, technical reports and web sites.

VMRC
Importation Regulatory Program: The Marine Resources Commission regulates the importation of certain hard clams, oysters, bay scallops, surf clams, soft clams, and blue crabs for introduction into the waters of the Commonwealth for aquaculture purposes. The regulation specifies that importations are permitted only when testing indicates the absence of known shellfish pathogens. The required testing is specified in the regulation. With respect to hard clam, certain certifications for the brood stock from the out of state hatchery are also required.

Restoration: The Agency operates an annual program for the restoration of native oyster populations that have been decimated by two pathogens, one of which is the introduced non-native MSX disease.

USGS-VCFWU
Restoration- As a research arm of USGS, VDGIF, and VT, the restoration of federally protected mussel species falls under my responsibility.
Research/Development- same as above(Virginia Cooperative Fish and Wildlife Research Unit); to develop techniques for restoration of mussels.
Public Outreach- I work with the fisheries and wildlife extension specialists at VT to produce posters, videos, and other informational products. In previous years, a couple products have been related to invasives.

NPS
[1.A. Detection] – It is part of our overarching nonnative species management program to preserve and protect natural and cultural resources as cited in the NPS Organic Act of 1916. Detection is handled through casual field surveillance and formal Long-Term Ecological Survey/Monitoring.
[1.A. Control] – It is part of our overarching nonnative species management program to preserve and protect natural and cultural resources as cited in the NPS Organic Act of 1916. Controls are implemented to achieve targeted periods of resource focus. In the case of battlefields, there are specific time frames prescribed. In the case of natural parks, the long range objective is to achieve pre-Columbus setting and function.
[1.A. Monitoring] – It is part of our overarching nonnative species management program to preserve and protect natural and cultural resources as cited in the NPS Organic Act of 1916. Monitoring is handled through casual field surveillance, formal exotic species monitoring, and formal Long-Term Ecological Monitoring.
[1.A. Restoration] – It is part of our overarching nonnative species management program to preserve and protect natural and cultural resources as cited in the NPS Organic Act of 1916. Impact areas are evaluated for passive and active restoration needs. Extensive or large active restoration projects may require funding reserved by the NPS for such needs. Obtaining such funding is on a competitive basis with other park units in the System.
[1.C. Public Outreach] – It is part of our overarching nonnative species management program to preserve and protect natural and cultural resources. We do not have specific mandated responsibility for public outreach, but it is recognized as an essential tool for long-term effectiveness.
[1.D. Information Mgt] – It is part of our overarching nonnative species management program to preserve and protect natural and cultural resources as cited in the NPS Organic Act of 1916, and moreover to “manage with science” as cited in the 1988 National Park Omnibus Management Act.

USF&WS
A. <u>Operations:</u>
The Lower Great Lakes Fishery Resources Office in Amherst, NY and the Chesapeake Bay Field Office (CBFO) in Annapolis, MD are both instrumental in programs designed to enforce importation regulations, establish monitoring networks,

attempt control measures and seek out restoration opportunities. Their areas of focus include a range of terrestrial and aquatic plant as well as shellfish and fish species. For example, the Maryland Fishery Resources Office (MFRO), co-located with CBFO is currently seeking adequate funding to implement a fishery program focused on the detection and control of invasive fish species within the baitfish industry. Earlier this year, there was joint coordination among MFRO, GFRO and the Virginia Department of Game and Inland Fisheries (VDGIF) to conduct detection and monitoring sampling in the Potomac River to address the resurgence and spread of the northern snakehead.

National Wildlife Refuges located on the Delmarva Peninsula and within the Rappahannock River valley are actively pursuing monitoring and control programs for invasive herbaceous plants, specifically phragmites (common reed). Refuges in Virginia, for example, Dismal Swamp NWR, via habitat projects focused on the restoration and recuperation of native tree types such as the Atlantic white cedar will indirectly combat present nuisance flora. The Virginia Field Office, namely the Partners for Fish and Wildlife Program is contributing significant technical and funding assistance toward such endeavors.

B. Research/Development

The FWS cooperates with universities and other capable facilities in efforts to fund research projects targeting invasive species issues, specifically phragmites, with the goal of practical application which ideally will eventually lead to the development of consistent and regionally recognized control programs.

C. Public Outreach and Education Efforts

The promotion of public awareness and education in the form of numerous types of printed materials are produced solely by the Service and in many instances, in cooperation with other state and federal agencies. Identification/alert cards, pamphlets, stickers, etc. are produced and distributed at the field station and headquarters level. Several years ago, the FWS in conjunction with the National Park Service, Chesapeake Bay Foundation and a host of others, produced a booklet listing invasive plants characteristic of mid-Atlantic natural areas which included Virginia. Official campaigns such as "STOP AQUATIC HITCHIKERS" are highlighting the importance of public outreach in publications and website formats.

D. Information Management

I am not aware of a formal tracking system as part of a Service-wide effort; however, the US Geological Survey has developed the NAS Alert System which is the Nonindigenous Aquatic Species Alert System to track the spread of invasive species nationwide. This system debuted in late July of 2004. Free service sign-up is available at http://nas.er.usgs.gov/Alert System/register.asp and archives of past alerts can be queried by state, date and/or taxonomic group. An increased number of research and monitoring programs jointly developed between the Service and USGS is anticipated for the future. The need for a more hands-on and proactive approach to Bay watershed management to effectively deal with water quality and invasive species issues has been recognized.

APRCR
Arlington County funds an invasive plant program that includes detection, control, monitoring and restoration of County parks impacted by invasive plants. Information management is also done to keep track of control efforts (date and locations of treatments). We are also beginning to map a few species in parks. This program also includes public outreach in the form of written materials and educational programs. We would like to include more research and development in our program and are working on plans to do so but are not currently doing research.

DRSAMP
As part of the Dragon Run Special Area Management Plan (SAMP) project funded by the Virginia Coastal Program at DEQ with a grant from the National Oceanic and Atmospheric Administration, the Middle Peninsula Planning District Commission has taken the lead on a multi-organization initiative to assess, monitor, and control invasive species in the Dragon Run. The initiative involves representatives from Virginia Commonwealth University, Chesapeake Bay National Estuarine Research Reserve at VIMS, The Nature Conservancy, Dept. of Game and Inland Fisheries, Dept. of Environmental Quality, Dept. of Conservation and Recreation, and Virginia Marine Resources Commission.
Monitoring: The initiative has taken responsibility for monitoring the extent and types of invasive species within the Dragon Run watershed.
Research/Development: The initiative has undertaken and plans to continue research on the extent and types of invasive species within the Dragon Run watershed.
Public Outreach Efforts: The initiative plans for an education/outreach component to prevent introduction of invasive species and gather information about the extent of established invasive species.
Information Management: The initiative is tracking the status and control of invasive species by collecting this information from available sources.

FCPA
Detection – field work to detect invasives is done within the context of natural resource inventories and operational work at individual sites.
Control – invasives control is done sporadically in conjunction with special projects and sporadic targeted removal and scheduled activities.
Monitoring – very little coordinated monitoring is done. Monitoring is primarily on a site-by-site basis.
Restoration – a limited number of restoration projects have been completed on a small scale.
Research/Development – some invasives research has been conducted primarily on control techniques for Microstegium at Huntley Meadows Park.
Public Outreach Efforts – site staff have conducted programs and articles discussing invasives issues and management techniques. One agency brochure has been published and other outreach efforts undertaken to reach out to homeowners and others to raise awareness of invasives issues and try to reduce future planting and promote control on private property.

Information Management – some data has been compiled on a site-specific level on the location and coverage of invasive plant species.

TCLAC
Please note that the Yes responses are based on the responsibilities given to our office by our Board of Directors and the three local counties Boards of Supervisors which we serve. There is a possibility that they could determine that they no longer wish us to work with any particular issue, including invasive species. These are not responsibilities given to us by the State**.**

For detection, control and monitoring our office has hired a contractor to complete an aquatic vegetation survey of Smith Mountain Lake for the past 3 years. The first year was a complete lake survey, the second and third years were simply re-surveys of the areas originally reported with invasive vegetation. We hired a contractor to treat areas with specific invasive aquatic vegetation each of those years.

Earlier this year we began a public outreach program for boaters and residents at the lake. We produced two separate brochures and a tackle box sticker for distribution. We also provided signs for installation at boat ramps.

Although it is not mandatory, our office has asked residents to let us know when they find suspect aquatic vegetation.

VNLA/VGIC
The VNLA (Virginia Nursery and Landscape Association) and the VGIC (Virginia Green Industry Council) at this time provide education information on invasives to their members. We will be suggesting that the two associations adopt the voluntary code of conduct for the nursery professionals.

VNPS
Virginia Native Plant Society is an NGO concerned about conservation of native plants and their habitats. Thus we are concerned about invasive species that threaten these. We are quite decentralized, with 14 chapters around the state. We have an Invasive Species Coordinator, Ruth Douglas, who does primarily public outreach efforts with VNPS chapters, garden clubs, Master Gardeners, tree stewards, horticulture industry groups, Monticello, Lewis Ginter Gardens and others, as invited. Individual chapters may have local projects. For example, the Potowmack chapter in Nrn. Va. has sponsored garlic mustard pulls at G. Richard Thompson Wildlife Refuge.

Ten years ago, Ted Scott of the VNPS worked with employees of the Natural Heritage Division to set up a list of invasive plant species in Virginia. This information is available today, with appropriate revisions, on line and as print materials. It is currently one of the most valuable tools available to educate citizens of Virginia about invasive plants.

2. Legal Authorities available to your agency
Please list the legal authorities your agency has for dealing with invasive species.

See Appendix E for Virginia Laws regarding invasive species.

3. Prevention of New Biological Invasions
Prevention activities can preclude the introduction and establishment of harmful invasive species and identify pathways that are serving as a means of introduction of new invasive species into Virginia.

Describe prevention activities currently undertaken by your agency.

VDACS
VDACS, in cooperation with USDA/APHIS-Plant Protection & Quarantine (PPQ): Enforced state/federal quarantines preventing the introduction of injurious plant pests into Virginia from other countries and states.

Required inspection and certification of regulated articles, such as, plants, soil, sod, logs, firewood, solid wood packing material, roofing tiles, cotton growing equipment, etc., shipped to Virginia from other countries and states.

Inspected, certified and monitored for two years before release certain high risk plants shipped to Virginia from other countries and subject to USDA's Post Entry Inspection Program to prevent the introduction of exotic plant diseases.

Inspected and registered 379 nurseries comprising 13,157 acres and 1,690 establishments selling retail nursery stock which were certified and randomly inspected to ensure the public of relatively pest-free nursery stock.

Monitored during planting, growing, and harvesting 14 field trials in 8 localities designed to test genetically modified tobacco, creeping bentgrass, and Kentucky bluegrass. Approved 11 requests for the shipment of transgenic seed not associated with any current field trials including one permit for shipment of transgenic corn for therapeutic use to France and one permit for goldfish plant, *columnea*, cloned-virus plasmids for inclusion in the American Type Culture Collection located in Prince William County.

Reviewed and approved 90 while denying 13 requests for the interstate shipment of plant pests for use in research and scientific projects being conducted in Virginia.

VDCR
Public education and outreach materials distributed by DCR on Invasive Species. DCR does not have the financial or staff resources to conduct early detection and control other than chance encounters. DCR Natural Area Preserve management staff are always on the lookout for new invasives on Natural Area Preserves, and Natural Heritage field biologists report new invasives as they are detected.

VDGIF
The Department is greatly concerned with habitat destruction by mute swans. Our efforts to manage this species effectively were previously hampered by the species' federal protection as a migratory bird. Mute swans and 124 other nonnative bird species that have been introduced to the United States or its territories, however, were recently excluded from federal protection under the Migratory Bird Treaty Act. Accordingly, DGIF has listed mute swans both as a nuisance species, and as a predatory and undesirable species in Virginia. A DGIF permit is required to possess, propagate, buy or sell any swan in Virginia. Currently no new permits are being issued.

Similarly, importation or possession of any species on our predatory and undesirable species list, or of any designated nonindigenous invasive aquatic species, is prohibited. As resources allow, we monitor and survey for presence of these species, train other agency personnel, (e.g., VDOT bridge and culvert inspectors and law enforcement dive teams) in detection and identification of exotic species, and develop public education materials promoting prevention of accidental spread or introduction of invasive species.

VDH - None

VDOT
VDOT has the RD-4 and Green Tag programs to screen seed for noxious weed seeds in order to prevent spread of invasive species such as Johnson Grass.

VIMS
Educational materials and cooperative projects with environmental educators and conservation organizations in the coastal zone. We also contribute to national legislation (e.g., reauthorization of NISA) through provision of Congressional Testimony.

VMRC
VMRC Regulation 4VAC20-395-10 et seq. "Ballast Water Discharge Reporting" lists a series of voluntary precautions to minimize the uptake and release of harmful aquatic organisms, pathogens and sediments. The regulation also specifies certain ballast water management practices.

USGS-VCFWU - None

NPS The National Park Service is active at many park units in early detection efforts of nonnative species introductions. It takes the form of periodical casual and formal surveillance. Most efforts are put into public education as noted below. Actual U.S. border patrol and port of entry surveillance is left to USDA-APHIS and others.

The National Park Service is active in questioning the proposed use of nonnative species to answer natural and cultural resource management challenges. The Service generally takes a negative posture when internal staff or cooperators suggest nonnative species introductions. The decision-making process is generally handled during internal staff review and public review of project proposal NEPA clearance.

The National Park Service is very reluctant to take part in bio-control research and implementation to address other nonnative species problems due to the potential for non-target species impacts. Full scientific rigor is enforced and a general agency bias against such is the norm.

USF&WS
The Aquatic Nuisance Species Task Force is chaired by officials involved with the Fisheries and Habitat Conservation programs of the FWS and a host of other Federal agencies including NOAA. This panel is tasked with the responsibility of strongly encouraging State and interstate planning entities to develop management plans that describe prevention, rapid response, detection, and monitoring strategies unique to their jurisdictions, and upon request, will provide necessary technical guidance throughout the process. Upon approval of a management plan, the ANS Task Force can award annual funding for multi-year implementation of outlined strategies. In certain cases, contingent upon available funds, emergency or rapid response funding can be provided through the Task Force to assist States in responding to critical situations.

The discovery of zebra mussels in the Millbrook Quarry in Prince William County, Virginia during the late summer of 2002, prompted VDGIF to establish a committee of local, State and Federal agencies, including the FWS (GFRO), focused on providing expertise and technical assistance to the State in its efforts to immediately respond to the existing zebra mussel population to prevent the spread of this invasive species into the surrounding watershed, including the drinking water supply for area municipalities. The ANS Taskforce provided nearly $20,000 through GFRO for VDGIF in support of preliminary investigative fieldwork conducted at the Quarry for the determination of the most effective eradication measures.

A number of potential funding sources for invasive species activities exist through the FWS, including legislative and CARA-Lite funds that the Service provides. The Service works with other grant programs, i.e. USDA-Wildlife Habitat Incentive Program (WHIP) and the National Fish and Wildlife Foundation to provide funding opportunities to States through project proposals demonstrate far- reaching habitat and ecosystem benefits.

APRCR
Surveying for small infestations and giving small infestations priority in treatment programs

DRSAMP
The initiative has plans for distributing educational materials so that citizens will not introduce invasive species in the Dragon Run and so that they will understand the threat and impacts of invasive species.

FCPA
The Fairfax County Park Authority is doing little right now independently to prevent new invasions. Recent cooperative efforts included working with the Fairfax County Urban Forestry Division, the Virginia Department of Forestry and USDA to prevent the spread of emerald ash borer from 7 infected trees in northern Fairfax County.

TCLAC
The boat ramp signs and brochures for boaters.

VNLA/VGIC - None

VNPS Public education only: encouraging people not to plant invasives.

4. Surveillance

Surveillance can serve to characterize invasion patterns, detect new invasions, suggest areas of new research, evaluate prevention and control programs, and project future management needs.

Describe surveillance activities your agency is currently involved with, including a discussion of infrastructure, trained personnel, and if present the network of experts that are able to identify new invaders.

VDACS
VDACS' 24 plant and pest inspectors conduct detection surveys for exotic plant pests not known to occur in Virginia under the USDA Cooperative Agricultural Pest Survey (CAPS) program. VDACS has a full-time employee to serve as Virginia's CAPS Coordinator/Invasive Species Coordinator utilizing 50% federal funding and 50% state funding. This employee 1) is responsible for overall coordination of the CAPS program in Virginia, and 2) planning and conducting detection surveys to determine the presence, distribution, and population levels of exotic plant pests in Virginia. New pests are identified and confirmed by designated USDA experts.

2004 CAPS TARGET SURVEYS
HOMELAND SECURITY PESTS & DISEASES:
- Fusarium Wilt of Cotton *(Fusarium oxysporum f. sp. Vasinfectum)*
- Bacterial Blight of Cotton *(Xanthommonas campestris pv. Malvacearum)*
- Soybean Rust *(Phakospora pachyrhizi)*
- Soybean Dwarf Virus *(Luteovirus)*
- Downy mildew of Corn *(Peronosclerospora maydis)*
- Late Blight of Potato *(Phytophthora infestans)*

PESTS & DISEASES OF FIELD CROPS:
- Egyptian Cottonworm (*Spodoptera littoralis)*
- Cotton Leafworm *(Spodoptera litura)*
- Old World Bollworm *(Helicoverpa armigera)*
- Silver Y Moth *(Autographa gamma)*

- Exotic Wireworms *(Agriotes spp.)*
- Karnal Bunt *(Tilletia indica)*

PESTS OF NURSERY STOCK:

- European Crane Fly *(Tipula spp.)*
- Viburnum Leaf Beetle *(Pyrrhalta viburni)*
- Emerald Ash Borer *(Agrilus planipennis)*
- Channeled Apple Snail *(Pomacea canaliculata)*
- Sudden Oak Death *(Phytophthora ramorum)*
- *Pryeria sinica* (Euonymus moth – no common name)
- Red Imported Fire Ant, *(Solenopsis invicta)*

FOREST PESTS & DISEASES:

- Siberian Moth *(Dendrolimus sibiricus)*
- Asian Longhorn Beetle *(Anoplophora glabripennis)*
- Sudden Oak Death *(Phytophthora ramorum)*
- Pine Shoot Beetle, (*Tomicus piniperda)*
- Gypsy Moth, *(Lymantria dispar)*

NOXIOUS WEEDS:

- *Inula brittanica*
- Giant Hogweed *(Heracleum mantegazzianum)*
- Clover Broomrape (*Orobanche minor)*
- Giant Salvinia *(Salvinia molesta)*

MISCELLANEOUS PESTS:

- Small Hive Beetle *(Aethina tumida)*

VDCR

DCR distributes information to raise awareness. While no DCR staff are specifically assigned to this task, Natural Heritage land managers and field biologists are on the lookout for new invasives to DCR lands and to new regions of the state. Resources do not exist to provide training to DCR statewide staff for early detection. There is not established systematic mechanism to report and manage this information on a statewide basis.

VDGIF

Reports of mute swans are recorded in annual waterfowl surveys and other field activities. A database of all known mute swan is maintained for all known captive and feral swans. VDGIF has conducted triennially surveys since 1986 to monitor mute swan population and distribution in Virginia. In August of 2002 aerial surveys were conducted in northern Virginia, along the Potomac River, Chesapeake Bay Islands and the Lower Peninsula and supplemented by reports from VDGIF staff, USFWS, Maryland DNR, Virginia Ornithological Society and the public.

Surveillance and monitoring efforts for West Nile Virus and Monkeypox also have received significant resources in recent years.

Surveillance and monitoring for zebra mussels, Chronic Wasting Disease, and snakehead fishes are described below.

VDOH
Because VDH receives mosquito surveillance data from various parts of the state, we would learn about any new areas being colonized by the newly introduced mosquito species, and learn about any other newly discovered exotic mosquito species.

VDOT
Roadside Managers and staff in each of our 9 District Offices posses pesticide certifications and /or ISA arborist certifications and are qualified to identify invasive species and apply herbicides to control spread. They have further been trained and certified by VDACS for mosquito surveillance in an attempt to slow the spread of west Nile virus by mosquitoes.

VIMS
Handled by researchers and their staff on a regular basis. Surveillance often follows control and management efforts and takes place over the long term. Surveillance of the invasion of the Rapa whelk is effected through a collaborative program with approximately 150 commercial fishermen through a bounty program . This provides us with between 10,000 and 100,000 sampling events per year in the region of interest.

VMRC
The Agency relies on the expertise and programs of the Virginia Institute of Marine Science for the detection and identification of new invaders. For example, VIMS identified the relatively recent invasive of the Rapa Whelk to the lower Chesapeake Bay and is following its life cycle and distribution.

USGS-VCFWU
No formal surveillance conducted, but our sampling of rivers throughout the state provides an informal means to discover invasives.

NPS
Levels of typical NPS surveillance includes:

a. Long-term Ecological Monitoring System (LTEMS) – Parkwide initial survey and periodical monitoring of ecosystem vital signs and specific taxa. LTEMS at Shenandoah National Park focuses on aquatic macroinvertebrates, fishes, terrestrial vegetation, rare plants, air quality, and water quality. Several other NPS units in Virginia have monitoring focusing on aquatic macroinvertebrates, fishes, and rare plants.
b. Focused survey/monitoring – Specific project-based monitoring. These efforts include park-based exotic vegetation monitoring, park-based rare plant monitoring, MAPS (birds), water quality sampling.

c. Cooperator monitoring – Surveillance done by both non-NPS and NPS staffs. These include annual butterfly counts and annual bird counts, among others.
d. Infrastructure – Staffing is robust at Shenandoah National Park and quite thin at smaller park units. Often, there is only one natural resource manager at a given site with very limited seasonal help and funding. There is an important and growing trend of traveling teams of experts that render assistance to small parks within the Northeast and Mid-Atlantic regions. A four-person Exotic Plant Management Team provides assistance to seven small NPS park units within Virginia (e.g., Appomattox Court House NHP, Booker T. Washington NM, Colonial NHP, Fredericksburg and Spotsylvania NMP, George Washington Birthplace NM, Petersburg NB, and Richmond NBP). Shenandoah National Park also has a resident seasonal team of fish survey experts that conducts occasional surveys at the same units as above.

APRCR
Park maintenance and landscape personnel have the opportunity to attend one or two invasive plant id workshops annually. The invasive plant id workshops allow park maintenance and landscape personnel to recognize invasive plants in their work areas. Staff survey parks when conducting invasive plant control work. We have a mapping program where we map target species in some of our control areas. There is no systematic surveying in place for detecting new species, although we did include hogweed id in one of our staff training workshops and published an article about hogweed which we distributed to volunteers. Hogweed has not been found in the county but we wanted people to be aware of what it looks like so if it shows up we can detect it early.

DRSAMP
The initiative uses existing sampling efforts to track invasive species, including work performed by VCU and DGIF. VCU's Center for Environmental Studies (CES) is investigating the use of multi-spectral imagery for detecting plant invaders. The CES' GIS Specialist is working with the US Army Corps of Engineers to develop algorithms for analyzing the data. The group also has plans to secure funds for contracting commercial fishermen to collect and report blue catfish from the lower Dragon Run and upper Piankatank.

FCPA
Surveillance efforts by the Fairfax County Park Authority are currently primarily concentrated within natural resource inventory projects and partnerships with other agencies such as Virginia Natural Heritage. The remainder of efforts are decentralized and are fairly anecdotal at a site level. Planning efforts are underway to develop a coherent invasives program as part of the implementation of our recently adopted Natural Resource Management Plan.

TCLAC
Our treatment contractor is trained to recognize and treat invasive aquatic vegetation.

VNPS
Individual chapters in some cases do some informal work in this area.

5. Rapid Response
Rapidly responding to new invasions is crucial as some new introduced invasives can be eradicated if the invasion is recognized early enough and the eradication effort is well-designed, comprehensive, and adequately funded.

Describe rapid response activities and resources your agency is currently devoting to this effort.

VDACS
- VDACS enhanced its surveillance and rapid response capabilities for potential plant pest bio-terrorism agents with the purchase and implementation of improved survey and communications equipment utilizing $75,000 in CAPS federal grant funding.
- VDACS also enhanced the State Plant Pathology Laboratory's diagnostic capabilities utilizing $52,000 in federal grant funding to purchase equipment and supplies needed to conduct DNA analysis of plant diseases.
- Cooperated with USDA/APHIS and the Fairfax County Urban Forest Program to locate, remove, chip and burn a total of 287 ash trees (99 trees in homeowners' yards and 188 trees in wetland/wooded areas) to eradicate an emerald ash borer infestation at a Fairfax County school that received 13 infested ash trees that were illegally shipped from Michigan to a Maryland nursery. All ash trees within a ½ mile radius of the infested school were destroyed to prevent the potential spread of this destructive pest of ash trees. Follow-up surveys are continuing to ensure the success of the eradication effort. The USDA/Forest Service and Virginia Department of Forestry cooperated to provide restoration funding to restore homeowners' lawns and common areas.
- Cooperated with Virginia Tech and the Virginia Department of Forestry to conduct a survey of Virginia's horticulture and forestry industries for *Phytophthora ramorum*, the causative agent of sudden oak death disease This is part of a National Sudden Oak Death Survey funded by USDA/APHIS to determine the possible presence and potential distribution of sudden oak death in the United States. These random survey efforts will continue through the fall of 2004.
- Inspected and sampled plants received at 20 Virginia nurseries and garden centers that traced back to a sudden oak death infected California nursery. Laboratory analysis confirmed that one Tidewater garden center did receive plants infested with *Phytophthora ramorum,* the fungus that causes sudden oak death disease. A total of 774 plants at nine Virginia nurseries were burned to ensure that all potentially infected plants were destroyed. Additional survey activities will to be implemented at suspect nurseries to ensure that the fungus has been contained and eradicated.
- Completed an intensive survey of approximately 100 acres at an Albemarle County peach/nectarine orchard for the presence of plum pox virus, a lethal disease of stone

fruit. A total of 11,760 leaves and 3,644 fruit were collected and laboratory tested for evidence of the plum pox virus. No evidence of the virus was detected.

- Cooperated with USDA/APHIS/PPQ in implementing a national recall on two imported products in the U.S. marketplace ensuring that these recalled commodities were removed from store shelves and disposed of according to USDA protocol. The two commodities, pine cones originating in India and Ya pears from China, were infested with new, and potentially harmful, exotic pests.
- Cooperated with USDA/APHIS/PPQ to survey greenhouse/nursery operations for the presence of a bacterial wilt disease caused by *Ralstonia solanacearum* race 3 biovar 2 on geranium plants of Guatemalan origin that represents a biological and economic threat to geraniums and other crops, such as, tomato, peppers, potato, tobacco, and eggplant. This disease of potential bio-terrorism significance was confirmed in plants at 7 greenhouses/nurseries in 6 Virginia localities. VDACS and USDA personnel monitored the destruction of 43,959 plants and greenhouse disinfection to protect Virginia's horticultural and agricultural industries.
- Enacted a Virginia Pine Shoot Beetle Quarantine to restrict and monitor the movement of pine products out of Clarke County in response to the discovery of this exotic pest of conifers during routine survey efforts at an abandoned Christmas tree nursery. Issues two compliance agreements with Clarke County establishments to ensure compliance with the new quarantine. In cooperation with USDA/APHIS and Virginia Tech, placed and monitored 96 pine shoot beetle traps at 32 sites in 12 northern Virginia counties with no additional beetles collected.
- Participated in a multi-state exercise scenario sponsored by the National Plant Diagnostic Network that dealt with the potential discovery in rural Virginia of soybean rust, an exotic crop disease that is on the Homeland Security list of select agents for bio-terrorism activity.
- Surveyed 4,663 acres for the presence of the imported fire ant in an effort to locate infestations that have entered Virginia from infested states with 3,729 acres treated to eradicate the pest.
- Conducted 37 Imported Fire Ant Quarantine violation inspections and provided USDA/APHIS with documentation, including the inspector's statement, necessary for the evaluation and processing of violations and assessment of civil penalties, if warranted, on 25 potential violations.
- Conducted 20 European Brown Garden Snail Quarantine compliance inspections at retail establishments to ensure that plant material shipped to Virginia is free of this pest.
- Surveyed 220 acres of hemlock located on 212 separate properties in southwestern Virginia with 98 acres found infested with hemlock woolly adelgid, an introduced insect pest of hemlock.
- Collected ten wheat samples from grain elevators and growers in ten Virginia localities for testing by USDA/APHIS for karnal bunt disease. No karnal bunt was detected continuing to enhance the international marketability of Virginia-grown wheat.
- Inspected 3,381 apiary colonies for disease and overall health of the honey bees with control initiated or recommended to maintain adequate pollination for crops and to meet interstate movement requirements.

- Cooperated with the VA Dept of Health, VA Dept of Emergency Management and FEMA in planning for the aerial spraying of mosquitoes on over 200,000 acres in parts of up to 23 cities/counties declared disaster areas by FEMA due to Hurricane Isabel by coordinating efforts to notify beekeepers, conducting reviews for federally endangered insects, and assisting the Dept of Health in oversight of contract spray operations.
- Identified 14 localities with confirmed infestations of the small hive beetle, *Aethina tumida*, a pest of honey bees. Measures to control the infestation of beetles through pesticide treatment and restrictions on hive movement were implemented.
- Protected Virginia's cotton crop by monitoring fields for the cotton boll weevil using 17,825 traps on 84,260 acres of cotton in Virginia. No weevils were detected.
- Surveyed, identified, dug, and destroyed 31 *Orobanche minor* plants at the infestation site in Washington County, Virginia in 2004. This infestation site was last fumigated with Methyl Bromide in 2002. No plants were detected during the 2003 site survey. The 31 plants were detected outside of the previous treatment area but are considered to be associated with the original infestation and are not considered a new infestation. The numerous, tiny seeds produced by this parasitic plant spread easily and can remain dormant for years until suitable conditions for germination occurs. The site will be surveyed in 2005 and additional treatments will be conducted if warranted.

VDCR
DCR does not have a statewide rapid response plan in place for new invasions on DCR lands or as they are discovered on private lands. DCR has no general fund money for the dedicated purpose of purchasing herbicide or implementing rapid response. On DCR lands resources are cobbled together as possible to deal with invasives. Discovery of *Salvina molesta* in a private pond in 2004 has yet to be adequately addressed as staff search for a cost allowable technique to handle the problem.

VDGIF
See discussion below regarding snakehead fish, zebra mussel, and Chronic Wasting Disease. VDGIF now employs a full-time wildlife veterinarian to assist in preparing for, monitoring, and responding to wildlife diseases and other pertinent issues which may arise via invasive species.

VDH
VDH has no capability to respond to, or control a newly discovered exotic mosquito species, but we would be able to recommend that the jurisdiction where the mosquito was discovered should take action against it, if they had mosquito control capabilities.

VDOT
No program exists currently, however Roadside Development staff are available to coordinate and assist other Agencies in such events.

VIMS
No specific activities. It needs to be rapid or it is of little use. We responded to the Rapa invasion by a bounty program, but it was too late for eradication. The response program

was “bootlegged” from other funds, and we have not dedicated any resources to this problem as part of normal activity.

VMRC
There are no efforts in this area.

USGS-VCFWU
None

NPS
The National Park Service is not well set up to rapidly respond to new species invasions. Most park units are funded at very tight levels with little flexibility to locally move action priorities for quick response. Rather, special funding must be sought on a competitive basis with other park units in the nation. Such funds are often one to three years out. As an example, insect & disease control is funded through competitive USDA-Forest Service Forest Health Protection funding, typically for the following fiscal year and rarely available until March. Vegetation and fauna response funds come through competitive USDI-NPS nation-wide funding for fiscal years two-to-three years hence.

USF&WS
None

APRCR
We have not conducted any rapid response activities for new species.

DRSAMP
None

FCPA
Rapid response is currently limited to a case-by-case basis due to lack of dedicated staff that are trained in invasives control and possess necessary certifications.

TCLAC
Our annual survey. At this point, we are hopeful of completing another lake wide aquatic vegetation survey in two years.

VNPS None

6. Control and Management

Control and management are the only actions available to lessen the impact if an invasive species is permanently established and or widely spread such that eradication and containment efforts are not viable.

Describe control and management projects your agency is currently involve with.

VDACS

- Participated in the federal Gypsy Moth Suppression Program by utilizing federal grant money to process requests from localities for reimbursement of expenses associated with gypsy moth egg mass surveys. No gypsy moth suppression treatments were conducted in 2004 due to wet weather conditions that allowed the fungus, *Entomophaga maimaiga*, to naturally reduce gypsy moth populations.
- Safely completed gypsy moth suppression treatments in 11 localities totaling 119,470 acres as part of the 2003 Virginia Slow the Spread (STS) Project.
- Employed and trained 18 private contractors who, along with currently employed VDACS personnel, placed and monitored 8,846 gypsy moth traps within Virginia's STS project action area, monitoring area, and non-infested areas across southern and southwest Virginia.
- Surveyed 59 Christmas tree lots containing 8,372 trees in southwest Virginia to ensure compliance with the Virginia Gypsy Moth Quarantine.
- Conducted 86 transit inspections, 39 campground inspections, and issued 19 new compliance agreements with loggers, saw mills, trailer dealers, and nurseries to ensure compliance with the Gypsy Moth Quarantine and confirm no life stages of the gypsy moth were being transported into non-infested areas of Virginia and other states.
- Provided financial support to the Virginia Cooperative Coyote Control Program which provides technical information to livestock producers and removes offending coyotes to protect Virginia's livestock industry.

VDCR

DCR has a wide variety of invasive plant control projects underway on Natural Area Preserves primarily, and some on State Parks. These include Japanese stilt-grass, Japanese spiraea, Chinese lespedeza, multiflora rose, Johnson grass, autumn olive, tree-of-heaven, Phragmites and others.

VDGIF

VDGIF is monitoring the Virginia mute swan population and, when appropriate, removes them from the wild. No new permits to import, buy, or possess mute swans are being issued.

Nutria are listed as a nuisance species in Virginia and can be trapped year round. We informally monitor the spread of this species but have not noticed any range expansion much beyond the Back Bay NWR and surrounding vicinity. We may explore an eradication program through USDA Wildlife Services, similar to a successful effort at Blackwater NWR in Maryland earlier this year.

See discussion below regarding snakehead fish, Chronic Wasting Disease, and zebra mussel.

VDH

None

VDOT We have performed basil-bark applications on tree of heaven in highly visible urban areas as a means to control the spread and herbicide applications on kudzu on a complaint basis to control the spread into adjoining properties. Again, VDOT's RD-4 and Green Tag program which analyzes seed prior to application helps to prevent the application of invasive species seed.

VIMS
Dr. Roger Mann has worked for several years with commercial fishermen to collect (and therefore control) the spread of the Rapa whelk. Dr. Walter Priest and Dr. Kirk Havens in the Center for Coastal Resources Mgmt. work to identify and quantify *Phragmites australis* in constructed wetlands and throughout the tidal zone. Grants have been awarded to study particular sites to understand how *P. australis* spreads. Also, work to eradicate through physical removal and herbicide controls.

VMRC
There are no efforts in this area.

USGS-VCFWU
None at this time.

NPS
The eight National Parks within Virginia served by the Mid-Atlantic Exotic Plant Management Team have the following management goals:

Goal 1 – Assess and prioritize invasive exotic vegetation threats, and compile necessary control protocols. Adaptively update strategic plans at all parks as new information develops.

Goal 2 – Control targeted exotic populations at all parks.

Goal 3 – Assess treated sites for further restoration needs. Implement prescribed fire and other management methods in an integrated fashion where needed and appropriate. Monitor exotics control and restoration actions.

Goal 4 – Maintain a cohesive and cooperative effort within the Cooperative that trains and benefits from individual park expertise. Develop collaborative ventures with outside agencies and landowners to control exotics and restore ecosystems on a broad scale.

National Parks within Virginia have exotic vegetation control activities for the following plant species, among others:

Targeted Exotic Species and Relative Priorities[1]	
Park	**Species (Common Names)**
APCO	Princess tree, tree of heaven, multiflora rose, Japanese honeysuckle, Johnson grass, Japanese stiltgrass, Japanese barberry, Chinese wisteria, bull & Canada thistles, crowned vetch, privet, mimosa tree, mulleins, periwinkle, spotted knapweed, chicory
BOWA	Kudzu, Johnson grass, tree of heaven, Japanese honeysuckle, Japanese

[1] Relative priority for each park is indicated by the order of listing.

	stiltgrass, gorse, and multiflora rose
COLO	Princess tree, tree of heaven, Asian bamboo, privet, Japanese knotweed, Oriental bittersweet, nonnative wisteria, phragmites, kudzu, English ivy, Japanese honeysuckle, Johnson grass, periwinkle, Japanese stiltgrass, multiflora rose, mimosa, wineberry, barberry, gill-over-the-ground, nonnative thistles
FRSP	Multiflora rose, tree of heaven, Japanese honeysuckle, English ivy, periwinkle. Others to add include Japanese knotweed, non-native thistles, mimosa, privet, autumn olive, and Japanese stiltgrass
GEWA	Autumn olive, Phragmites, English ivy, periwinkle, nonnative grasses, multiflora rose, Japanese honeysuckle, giant mullein. Others to add include Chinese lespedeza, garlic mustard, nonnative thistle, Japanese stiltgrass, barberry, spotted knapweed, gorse, and wisteria
PETE	Tree of heaven, Johnson grass, privet, Japanese stiltgrass, Japanese honeysuckle, mimosa, Chinese lespedeza, multiflora rose, periwinkle
RICH	Tree of heaven, privet, mimosa, Japanese honeysuckle, Oriental bittersweet, princess tree, English ivy, Johnson grass, Japanese stiltgrass, multiflora rose
SHEN	Mile-a-minute vine, kudzu, Oriental bittersweet, Japanese knotweed, bamboo, Johnsongrass, princess tree, tree of heaven, mulleins

Exotic plant control activities include (1) uprooting/cutting/mowing, (2) foliar, basal, cut-stump, injection, and wiped-on herbicide applications, and (3) limited use of prescribed fire in certain situations. Tentative reporting of treatment/retreatment activity by the MA-EPMT for fiscal year 2004 (ending September 30, 2004) amounts to 213 acres.

The National Parks within Virginia are served by a four-person Exotic Plant Management Team based at Shenandoah National Park (which also serves several parks in other states). In fiscal year 2004, Virginia parks received a total of 35 weeks on-site assistance. That equates to 4.4 weeks per park for control, management, and monitoring. Of that time, approximately 3 weeks each was devoted to control activity.

USF&WS

The U.S. Fish and Wildlife Service's Partners for Fish and Wildlife (PFW) Program located at the Virginia Field Office (Gloucester) has as one of its goals wetlands restoration in the Coastal Plain of Virginia, where phragmites has spread unchecked in many areas. As standard policy, the PFW Program controlsphragmites and any other invasive plant species on each of its individual project sites as part of the overall wetland restoration plan for the site. In addition, PFW has periodically participated in large-scale phragmites control efforts in targeted watersheds in Virginia. Currently, PFW and The Nature Conservancy's Virginia Coast Reserve have a grant pending that will allow for the control of phragmites on over 200 acres of wetlands and uplands on barrier islands of the Eastern Shore, Kiptopeke State Park, and on the Eastern Shore of Virginia/Fisherman Island National Wildlife Refuges.

APRCR
We are conducting control projects on established species in 30 parks within Arlington and have implemented control efforts on 35 acres since 2002.

DRSAMP
The initiative has primarily focused on blue catfish. Efforts to understand the status of the population are underway. Collected individuals are typically removed from the system.

FCPA
Control and management are currently limited to a case-by-case basis due to lack of dedicated staff that are trained in invasives control and possess necessary certifications. Invasives control and management projects are increasingly incorporated into volunteer projects such as those done in partnership with scouts, Americorps and with citizen volunteers. Recent efforts include the pulling, cutting and spraying of invasive terrestrial plants and the introduction of triploid grass carp under VDGIF permit to remove invasive SAVs in confined water bodies.

TCLAC
Our hiring of a contractor to treat specific aquatic invasive vegetation.

VNPS
Individual chapters are making some efforts at control.

7. Restoration
Restoration is an essential component to management of some invasive species impacts, as in some cases with wetland and upland habitats without restoration areas may simply become reinfested by the same or a new invasive species.

Describe restoration projects and or efforts your agency may have underway.

VDACS
N/A

VDCR
DCR has several Johnson grass restoration projects underway converting old pastures to warm season grass habitats and native vegetation of the site. The majority of the invasive control projects underway are being naturally recolonized with native plants of the area.

VDGIF
Restoration of habitats affected by invasive species, particularly plants, is undertaken within the normal context of wildlife habitat management operations of DGIF owned Wildlife Management Areas as human and financial resources permit.

VDH
None

VDOT
None currently

VIMS
Yes, through our Center for Coastal Resources Mgmt., restoration in both tidal and nontidal wetlands. Restoration involves physical removal of an invasive, followed by planting of indigenous species.

VMRC
The agency operates a native oyster restoration program. The goal of the program is to increase the oyster standing stock in Chesapeake Bay by 10-fold by the year 2010. The program attempts to restore certain oyster reefs through the planting of shell piles and the placement of disease resistant oyster brood stock. When oyster production is high, seed oysters are transplanted to grow out areas where they will serve as brood stock at additional sites. The agency has established over 80 sanctuary reefs throughout Chesapeake Bay and its tributaries to date.

USGS-VCFWU
Currently propagating and restoring federally endangered mussel species in SW VA. The negative effects of the invasive Asian clam (Corbicula fluminea) are not well documented, as affecting the status of these **listed bivalves.**

NPS
Restoration following exotic plant eradication/control treatments includes broadcast seeding of native warm season grasses in areas of disturbed soil. There have also been plantings of shrubs and trees in some settings. To date, most site restoration has been through natural regeneration with follow-up monitoring. That is most due to the fact that the exotic plant management program is still in its early development and less impacted sites have been attempted rather than ones needing extensive restoration efforts.

USF&WS
The U.S. Fish and Wildlife Service's Partners for Fish and Wildlife (PFW) Program evaluates phragmites control projects that it undertakes (discussed in #6) to determine the need for additional conservation actions to restore wetlands where phragmites control measures are in place. This might involve plugging man-made drainage ditches, or in tidal areas, restoring tidal flow by either removing impediments to flow or by installing sized culverts to allow cyclic water exchange. Vegetative plantings may also be utilized, especially native shrub plantings that might shade and reduce the suitability of the site for phragmites. In each instance, the feasibility, habitat restoration value, and cost are evaluated to decide what further restorative actions might occur after chemical control measures are taken.

APRCR
We work with our natural resource department to do some replanting of trees and shrubs in some of our control areas. This is an area that we feel needs further development.

DRSAMP
None

FCPA
Recently completed and currently planned restoration projects include reforestation, pond dredging and some stream restoration.

TCLAC
None at this time

VNPS
None

8. Public Education
Educating and informing visitors, importers, residents, nurserymen, land managers, waterman, hunters, recreational fishermen, and agricultural producers about the impacts of invasive species, and the importance of keeping new invaders out of the state is a critical component to an effective invasive species prevention and control strategy.

Describe invasive species public education efforts your agency is currently undertaking.

VDACS

- Enhanced effectiveness of Plant and Pest Services' programs by providing educational exhibits/presentations, conducting workshops/seminars, and participating in numerous meetings in support of the extension service, health departments, localities, Virginia Nursery & Landscape Association, master gardener training, garden clubs, schools, beekeeper clubs, cotton grower associations, fairs, homeowner associations, public clientele, etc.
- VDACS' CAPS/Invasive Species position compiled and disseminated information about the presence, distribution and population levels of exotic plant pests in Virginia. This position develops and provides informational material to VDACS inspectors and other stakeholders to enhance pest detection activities and to ensure compliance with exotic/invasive pest regulations and quarantines. Plans are to establish a VDACS web site to provide educational information on exotic plant pest species.
- Received numerous calls from the public regarding the nuisance effects of high population levels of Asian lady beetles, 17-year cicadas, mosquitoes, deer flies, millipedes, earwigs, ants and spiders.
- Contacted and provided educational information to 95 Virginia nursery growers, dealers, and landscapers that import and export nursery plants to improve compliance with the Imported Fire Ant Quarantine.
- Gained approval for the complimentary placement of the "*Don't Spread Gypsy Moths!"* rack card in Virginia Welcome Centers to enhance public awareness of

the threat of human or artificial spread of the gypsy moth to non-infested areas. Initial supplies of 500 cards were sent to 5 south and east bound centers.

VDCR
DCR began working with the VA Native Plant Society in 1991 to develop a list of invasive plant species, develop fact sheets for the highest priority invasives, develop lists of native plants that can be used as alternatives to non-native plants, and distribute this information in brochure and electronic form on the Internet. These publications are widely referenced and available on the Internet. DCR staff also make public presentations on invasives and erect signage on State Parks and Natural Area Preserves.

VDGIF
Invasive species issues routinely are covered in public educational presentations made by Department staff. We have recently published and distributed brochures, posters, and web-based materials regarding snakehead fishes. Posters and pocket identification cards regarding zebra mussels were widely distributed in the past, and we currently are finalizing design for a new public information poster and web-based public monitoring program for potential zebra mussel infestations. A substantial public education effort regarding Chronic Wasting Disease has been implemented. West Nile Virus and Monkeypox also have been subjects of significant public education efforts in recent years.

VDH
Although our public education campaign to fight West Nile virus through reduction of mosquito breeding habitats around the home is not directed specifically against the exotic mosquito species, the two introduced species are among the most common mosquitoes that breed in containers of water in people's yards around the state. Therefore, our pamphlets, posters, PSAs, media interviews and other public outreach efforts do teach citizens how to reduce the available habitat for these species.

VDOT
None currently.

VIMS
Periodic postings in the *Virginia Marine Resource Bulletin*, published by Virginia Sea Grant (circ. ~8,300). Through newsletters and technical reports published by the Center for Coastal Resources Mgmt. and scientific presentations at symposiums and lay-friendly talks to various public groups. We have produced a series of educational products on Rapa including a CD and teacher products for classroom use (see the web site at **http://www.vims.edu/mollusc/research/merapven.htm**

VMRC
There are no efforts in this area.

USGS-VCFWU
Nothing current.

NPS
The national office of the National Park Service is participating in the National Invasive Species Council, which endeavors to forward issues concerning both flora and fauna. The NPS units within Virginia have conducted or participated in the following outreach activities:

a. Hosting a one-day adult education seminar on the topic of exotic species impacts and management
b. Both initiating and responding to newspaper, radio and TV interviews on the topic of exotic vegetation impacts, NPS management, and the potential role for public involvement
c. Distributing brochures on the topic of exotic species impacts and the potential role for public involvement
d. Participating in Exotic Pest Plant Councils (both the Southeast EPPC and Mid-Atlantic EPPC)
e. Participating in professional seminars and conferences with speeches and posters to convey the NPS role in detecting exotic species introductions, our programmatic management and potential avenues for public involvement

Our audiences have therefore included the general public, park visitors, and fellow professionals.

USF&WS
The Gloucester Fishery Resources Office is currently involved in zebra mussel outreach efforts targeting Virginia's diving and recreational boater communities. Initial surveys are being conducted at regional/area dive shops, marinas, etc. to determine which specific types of educational materials will effectively convey the intended message while providing market appeal.

Fishery Resources Offices, Refuges and other Service facilities throughout the Northeast Region of the FWS participate in public education programs to varying degrees because the level of priority for invasive species issues, amount of funding and available staff differs from region to region.

APRCR
Brochures and information directed towards Arlington residents is available on the internet. We provide brochures and displays at community events. Educational programs describe the invasive plant program and cover invasive plant identification and control for homeowners. We also do occasional TV appearances on local cable channel.

DRSAMP
The initiative plans to undertake an outreach effort to distribute educational materials so that citizens will understand the dangers of introducing invasive species.

FCPA
Site staff have conducted programs and articles discussing invasives issues and management techniques. One agency brochure has been published and other outreach efforts undertaken to reach out to homeowners and others to raise awareness of invasives issues and try to reduce future planting and promote control on private property.

TCLAC
The production of brochures and tackle box stickers for distribution.

VNPS
Primarily, illustrated presentations about invasives to various groups, as described above. Also, used a display developed by VNPS at Virginia Tech's Farm and Family Showcase for two years, and recently at the Virginia Nursery and Landscape Association's field day in Virginia Beach. Collaborated with the VA Department of Conservation and Recreation's Natural Heritage Program on the production of the VA Invasive Plant Species List, Native Plants for Conservation, Restoration and Landscaping, and maintain information on the VNPS website. http://www.vnps.org/invasive.html

9. Please provide an overview of your agencies invasive species roles and responsibilities including focal areas and general and nongeneral fund expenditures:

VDACS
The Virginia Department of Agriculture and Consumer Services serves as the lead state agency relative to plant pest regulatory issues. The focus of VDACS' plant pest programs is to provide for early detection and rapid response to protect the Commonwealth's agriculture and environment from the damaging effects of newly introduced regulatory pests by containment, eradication or suppression activities on private lands. The National Plant Board defines regulatory pests as quarantine pests of economic concern that do not occur in a specified geographic area, or that are being officially controlled in that area. Many of VDACS' invasive species efforts are conducted jointly with various USDA program areas through Cooperative Agreements and Memorandums of Understanding. In FY 2004, VDACS expended $1,581,772 in state general funds, $560,154 in state non-general funds, and $1,116,596 in federal grant funds to plan and implement activities relating to regulatory plant pests.

VDCR
The Department of Conservation and Recreation (DCR) is trustee for the Commonwealth's Natural Area Preserve and State Park Systems. DCR's primary focus has been on outreach and education relating to invasive plant species, and on controlling invasive plant species on DCR lands. In FY 2003 DCR spent $50,000 state general funds primarily as salaries for natural area management staff to control invasives on state natural area preserves, and $100,000 federal non-general funds on invasive species with the majority of these going to Phragmites mapping and control.

VDGIF

The three nonindigenous invasive species of most current programmatic impact upon DGIF are snakehead fish, zebra mussel, and Chronic Wasting Disease. Updates on the current status of these species and DGIF activities regarding these species are provided below.

Snakehead Fish Background and Chronology

- Snakehead fishes are native to Asia and Africa. There are 29 species, most of which are found in tropical/subtropical regions. Two species, including the northern snakehead, are found in temperate climates and demonstrate great tolerance for a wide range of environmental conditions. As a family, snakehead fish range in size from 12 inches to more than 5 feet. Snakeheads have been introduced into waters outside of their native ranges, usually for one (or more) of three purposes:
    - Food source (northern snakehead is a favorite for this)
    - Aquarium interest (giant snakehead, several other species favorites for this)
    - Religious purposes (Buddhist prayer release most relevant)
- In late spring 2002, an established population of northern snakehead fish was discovered in a pond in Crofton, MD. The population was eradicated by the Maryland Department of Natural Resources six months later, with an estimated total cost to the agency of over $1 million.
- In response to agency and public concern regarding potential for snakehead fishes to infest Virginia waters, the Board of Game and Inland Fisheries in summer 2002 adopted regulations adding all species of snakehead fish to list of "predatory and undesirable" species, and banning them (dead or alive) from the state without a permit from DGIF (effective 1 January 2003). Owners were provided with a short grace period during which they could voluntarily surrender any snakehead fish already in possession in Virginia without penalty.
- Also in summer 2002, the US Fish and Wildlife Service adopted emergency regulations prohibiting the importation of live snakeheads (any species) into US, and prohibiting interstate transport of live fish. A permit system was put in place for scientific/education purposes.
- A northern snakehead was collected from a pond in Wheaton, MD, in late April 2004. The pond was drained by Maryland Department of Natural Resources, but no additional fish were found.
- A northern snakehead fish was caught in Little Hunting Creek, a Virginia tributary of the Potomac River, by an angler on May 7.
- Since then, many additional fish have been caught, primarily in Virginia tributaries of the Potomac.
- DGIF established an interdivisional Snakehead Fish Incident Management Team (Fisheries, Wildlife Diversity, Law Enforcement & Communications) to coordinate DGIF response to this situation
    - The team has convened two interjuridictional meetings to coordinate interstate efforts with MD Dept of Natural Resources, DC Division of Fish and Wildlife, Potomac River Fisheries Commission, Interstate

Commission on the Potomac River Basin, US Fish and Wildlife Service and US Geological Survey

- We have developed formalized response protocols to handle inquiries from anglers, established toll-free number to facilitate reporting of collections, and posted information at marinas and on our Web site.
- DGIF has conducted considerable sampling and surveying in Little Hunting and Dogue creeks using a wide variety of techniques (electrofishing, gill netting, airboat surveys). None of these techniques have proven particularly useful in collecting northern snakehead fish.
- The team developed an outreach campaign to educate Virginians about the threats posed by snakehead fish and comparisons with similar-appearing native species. This effort included updating the Agency fact sheet and Web site and developing a poster for use at boat ramps, marinas, etc. The Department has fielded hundreds of calls from citizens. To date, we have contributed to over 200 newspaper articles and radio and TV interviews. Important key messages included:
  - Northern snakeheads appear similar to several native fish species. Anglers should be aware of what they catch to minimize impacts to native populations.
  - Anglers should contact us if they collect a northern snakehead.
  - Northern snakeheads are a top-level predator which will likely impact our existing systems. No fish should be returned to the system if it is caught.
  - The introduction of exotic animals, including pets, into natural systems disrupts the balance of those systems. There are more appropriate means for removing an unwanted pet from the home.

- Evidence of reproduction: young-of-the-year fish have been collected, and at least four adult females collected have been ripe with eggs.
- Excluding the young-of-the-year fish, the animals collected from the Potomac system have ranged in age from 2-6 years. We do not expect, however, that animals have been in these waters for more than three years; there is a high likelihood that the older animals were released after being held in aquaria or culture facilities.
- Many captured snakehead fish have been submitted to the Smithsonian Institution for genetics testing to help answer two questions: are these fish from the same population (i.e. did they all come from one introduction into the river system?) and are these fish from the same population as the fish from Crofton, MD (officials know that a large number of juveniles were removed from the pond before rotenone was applied)?
- We are uncertain about the source of introduction of these fish into the Potomac system; DGIF Law Enforcement officers and USFWS agents are investigating possible leads.

<u>Monitoring and Other Future Efforts:</u>

- We are continuing periodic sampling of the northern Virginia waters/embayments to determine the general impacts of northern snakeheads on the resident fish

populations. However, given our current funding levels and other obligations, we are unable to sample more than once a month.

- We are continuing coordination with the other jurisdictions to encourage bans on the possession and transportation of snakeheads in these areas. Maryland recently enacted a regulation banning possession of live northern and barca snakehead species; all other snakehead species may be possessed. DC currently has no regulations prohibiting the possession of snakehead fish and does not expect to enact any new regulations.
- We are coordinating with Asian communities to ensure that information about the threats associated with snakehead fish is distributed through appropriate Asian news publications. We are also developing a multilingual poster for display at appropriate locations.
- Populations of northern snakeheads have been recently confirmed in PA (near Philadelphia) and MA. A single northern snakehead fish was also recently removed from a bay of Lake Michigan in the Chicago area. We have provided technical expertise to officials from all of these jurisdictions and have shared our educational materials.
- We have translated our snakehead fish fact sheet into several Asian languages to facilitate sharing our key messages with these communities.
- We are continuing to encourage anglers to remove these fish from the system when they are collected. We have not endorsed any bounty programs and do not think that "roundups" or other similar tournament approaches provide appropriate solutions to this situation.
- Our situation is unique in the country: there are only two other established populations of snakehead fish in the U.S., a recently-established population of bullseye snakeheads in Florida (near Miami), and giant snakeheads in Hawaii (population established before 1900 for food source). Very little information is available about the response of the species in new systems or about its biology in general.

Zebra Mussel Background and Chronology

- In August 2002, the Virginia Department of Game and Inland Fisheries (DGIF) received an unconfirmed report that a zebra mussel population was present in Millbrook Quarry in western Prince William County. While zebra mussels were discovered and removed from a boat at Smith Mountain Lake in 1993 before it was launched, a population had never before been documented in Virginia. Specimens were collected from the quarry on August 31 and forwarded to Dr. Richard Neves (VA Tech) and Mike Pinder (DGIF) for identification. On September 3, these specimens were confirmed as zebra mussels, thus documenting the first zebra mussel population in the state.
- Native to the Caspian, Black and Azov seas of eastern Europe, zebra mussels are believed to have been introduced into U.S. waters in 1986 through ballast water discharge. These mollusks have spread rapidly throughout most of the Great Lakes and Mississippi River Basin states. Currently, reproducing zebra mussel

populations occur in 24 states and extend westward into eastern Oklahoma and western Iowa. Unlike native freshwater mussels, zebra mussels have the ability to attach to firm substrates with their byssal threads allowing them to adhere to objects such as boats, which has accelerated their spread. Additionally, zebra mussels produce microscopic larvae that also can be easily transported from infested waters through ballast water discharge and on objects such as boats, jet skis, and dive gear. Each female zebra mussel has the capability to produce upwards of 1 million eggs per year making the spread of these larvae highly likely.

- With their rapid spread, zebra mussels have caused an enormous amount of economic and biological damage due to their prolific reproduction and ability to attach to any stable surface. Numerous water treatment and power facilities must now treat their systems to keep them clear of zebra mussels, beaches must periodically remove decaying masses of dead zebra mussels, and bottom-dwelling organisms are often covered by this exotic mussel. In the United States, congressional researchers estimated the zebra mussel cost the power industry alone $3.1 billion in the 1993-1999 period, with its impact on industries, businesses, and communities over $5 billion. Additionally, numerous freshwater mussel populations (as well as other aquatic species) have been extirpated from areas that zebra mussels now colonize.
- Within Virginia, this zebra mussel population can have significant immediate impacts. Millbrook Quarry is separated from Broad Run by a mere 200-300 feet. Currently, the property is leased exclusively to The Dive Shop (Fairfax, VA) as a dive site, primarily for training dives. Lake Manassas, just 5-1/2 miles downstream of the quarry, serves as the primary water supply for the City of Manassas and a number of municipalities in the area. Just downstream of Lake Manassas is the Occoquan Reservoir, which serves a larger water supply capacity (over 1 million people in northern Virginia), and a number of power supply facilities that could be significantly affected in a relatively short period of time. Fairfax Water (formerly the Fairfax County Water Authority) estimates that they would incur a $2 - $4 million capital outlay for chemical feed facilities, and $500,000 - $850,000 per year for chemicals and system maintenance. Annualized costs over a 20-year period (capital and O&M) range from $670,000 to $1.16 million. The City of Manassas would likely incur similar expenses to treat zebra mussels at its facility on Lake Manassas. Furthermore, water intake facilities throughout the Commonwealth would be potentially vulnerable, and many rare and declining freshwater species could suffer significant losses. The impacts to threatened and endangered freshwater mussels in the Commonwealth is a significant threat since Virginia has 81 species, 44 of which are listed as endangered, threatened, or special concern. A number of freshwater mussels in the upper Tennessee River Basin are endemic; therefore additional impacts could threaten their existence.
- Realizing the serious impacts this exotic mussel will have in Virginia if they escape from Millbrook Quarry, a number of federal, state, and local agencies and organizations established an ad hoc task force, chaired by DGIF, to determine how best to deal with this population. On October 28, 2002 the group held its

first meeting to review the situation and determine potential courses of action. At that time, all parties agreed that eradication of the population, if possible, should be the ultimate goal. Given the proximity of Millbrook Quarry to Broad Run and its use as a dive location, it is highly unlikely that the population could simply be isolated. Broad Run has historically flooded the bank separating it from Millbrook Quarry (1972, Hurricane Agnes), and unintentional transport by divers is likely.

- Elsewhere in the U.S., zebra mussel populations that colonize open or large water bodies are merely managed to mitigate the potential economic and biological impacts. While there are known groundwater connections between Millbrook Quarry and the adjacent Broad Run, there is no direct surface outflow or inflow, eliminating natural dispersal modes and rendering this population isolated. Since the population is isolated and is the only known population in Virginia, the potential for eradication exists, which would be the first known attempt to eradicate a zebra mussel population.
- Before an appropriate eradication plan could be developed, considerable information needed to be collected regarding the quarry and degree of infestation. The required information was grouped into three categories: 1) water chemistry; 2) hydrogeologic characteristics; and 3) physical parameters of the quarry and zebra mussel population. Initially, partner agencies attempted to complete the work in mid-November. These efforts were unsuccessful because of access requirements imposed by the property owner and dive shop owner. The group met again in November to review seven potential eradication options developed from literature review. These options included: application of chlorine; pH shift below 6.0; dewatering of the quarry; increase of water salinity; application of copper sulfate; application of potassium; and application of the molluscicide Clamtrol. Additionally, the group discussed potential avenues to gain access to the property in order to complete the necessary fieldwork. Concurrent with the passage and Governor's signing of HB 2752 (Aquatic Nuisance Species Act) in 2003 in mid-March 2003, the landowner and dive shop owner granted access to the property.
- In late April, experts from key agencies completed the fieldwork. Staff completed data analyses in late June. Based on the data gathered and group consensus, it was determined that chlorine, pH shift, dewatering the quarry, and increasing the salinity were not highly feasible options due to environmental concerns, impracticality, cost, or a combination of reasons. Likewise, copper sulphate treatment was considered a "last resort" option, given potential environmental concerns. Two options, Clamtrol and potassium, were determined by the group to be highly likely options for use at Millbrook Quarry. Other chemical or mechanical means of zebra mussel eradication or control are discussed in the literature, but the workgroup members did not have sufficient information to evaluate those options, pending solicitation of formal proposals.
- Assessment of the quarry and surrounding hydrology indicated that eradication of this population is feasible, and in August 2003, DGIF sought proposals from companies to effect on-site eradication via an emergency procurement process. Unfortunately, due to lack of funding to implement any eradication attempt, the

procurement process had to be terminated in fall 2003 before selection of a vendor or treatment process could be completed. DGIF efforts then focused on securing adequate funding to reinitiate the procurement process.

- Four hundred thousand dollars in federal funds was secured for this eradication effort through U.S. Fish and Wildlife Service and Natural Resource Conservation Service grants, and a similar sum was assured from non federal sources. Accordingly, a formal Request For Proposals was released on 29 November 2004, soliciting proposals to eradicate the zebra/quagga mussels from Millbrook Quarry.
- The interagency Millbrook Quarry RFP Evaluation Panel, established to review the proposals and select the best treatment process and vendor from proposals received, included representatives from DGIF; the Virginia Department of Mines, Minerals and Energy; the Virginia Department of Environmental Quality, the Virginia Department of Health, the Occoquan Watershed Monitoring Laboratory of Virginia Tech, the Cooperative Fish and Wildlife Research Unit of Virginia Tech, and FairfaxWater (formerly Fairfax County Water Authority).
- After thorough evaluation of three proposals submitted in response to our November 2004 Request for Proposals, the interagency panel unanimously recommended Aquatic Sciences for this task. Consideration of pricing, and negotiations pursuant to the Commonwealth's procurement regulations on Competitive Negotiation, confirmed Aquatic Sciences as the best proposal, and a contract was awarded to Aquatic Sciences, L.P., to eradicate the zebra mussel population.
- The selected treatment process entails infusion of muriate of potash (KCl) into the entire water column of the quarry. While the exact mode of action by potassium on mussels is unknown, evidence suggests that potassium kills mussels by interfering with the organisms' ability to transfer oxygen across gill tissue, resulting in asphyxia. This treatment should not kill non-target animals within the quarry, and off-site impacts should be minimal to non-detectable. Furthermore, the treatment will provide long-term (estimated at up to 33 years) inoculation of the quarry against future infestation with zebra mussels.
- Pursuant to the National Environmental Policy Act, an Environmental Analysis was submitted to the U.S. Fish and Wildlife Service, and also to DEQ for Environmental Impact Review and determination of consistency with Virginia's Coastal Zone Resources Management Program. That assessment has been approved by all parties, and a federal Finding of No Significant Impact has been finalized, as have the Commonwealth's EIR approval and Coastal Zone Consistency Determination.
- A special exemption to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) also is required to use potassium chloride as a pesticide in Virginia. That application has been approved by VDACS, and is undergoing final review by EPA.
- Pending FIFRA approval by EPA, we plan to conduct the eradication in January 2006.
- Eradication of zebra mussels from this quarry would be the first time that an open-water population of this size has been eliminated and would completely remove zebra mussels from the Commonwealth. If not eradicated, zebra mussels

probably will eventually escape and create significant economic and ecological impacts in Virginia for the foreseeable future.

Chronic Wasting Disease

- Chronic Wasting Disease is a progressive neurological (brain and nervous system) disease found in deer and elk, and belongs to a family of diseases known as transmissible spongiform encephalopathies (TSEs). The disease ultimately results in the death of the animal. Species known to be susceptible include elk, mule deer, white-tailed deer, black-tailed deer and moose.
- VDGIF immediately activated part of its CWD Response Plan when the disease was discovered in a deer in Hampshire County, West Virginia, in September 2005. The case was found approximately 10 miles from the Virginia state line. The Department established a surveillance area and with assistance from the Virginia Department of Transportation (VDOT) and local hunters, staff collected samples from road-killed and hunter-killed deer throughout the surveillance area.
- The Virginia Department of Game and Inland Fisheries conducted widespread Chronic Wasting Disease (CWD) testing in a surveillance area that included parts of western and northern Shenandoah, Frederick, and Clark counties. More than 550 samples from white-tailed deer collected this fall were tested and CWD was not detected. Samples were tested using the relatively new rapid ELISA test at the University of Minnesota Veterinary Diagnostic Laboratory.
- VDGIF Wildlife Division Director Bob Duncan said of the test results, “This is clearly good news, and we could not have achieved this without the hard work of the field biologists, and the cooperation and support of our partners. In particular, we owe a debt of gratitude to the staff of VDOT for their assistance with collecting road-killed deer, to local meat processors, and above all to the hunters who allowed us to test their deer.”
- Dr. Jonathan Sleeman, wildlife veterinarian for the Department added, “While we can never say that Virginia is entirely free of the disease without testing every deer, this sample size gives us a very high confidence that if CWD is present in the surveillance area, then it is at very low levels.”
- The Department will continue its CWD surveillance into 2006. VDGIF staff will meet with the West Virginia Division of Natural Resources to discuss results in both states and to coordinate efforts. VDGIF Deer Project Leader Matt Knox said of the coordination, “Our counterparts in West Virginia have been very helpful, and we will continue to work closely with them in the future.”
- All hunters and members of the public are asked to keep a look out for any deer showing symptoms consistent with the disease. These clinical suspects are defined as adult (18 months or older) deer or elk that have poor body condition with neurological signs such as abnormal behavior, tremors, stumbling, un-coordination, poor posture including droopy ears and a lowered head, drooling, and excessive thirst, and urination. Anyone who sees a CWD suspect deer should not attempt to contact, disturb or kill the animal. Instead, accurately document the location and immediately contact the Department of Game and Inland Fisheries by calling 1-804-367-1258. Arrangements will be made to investigate the report.

More information about CWD and the Department's management actions can be found on the VDGIF Web site www.dgif.virginia.gov/cwd.

VDH
The West Nile virus surveillance program that is run within the VDH - Division of Zoonotic and Environmental Epidemiology is involved with vector surveillance as part of West Nile virus surveillance. Although we look at many native mosquito species, our surveillance activities include the collection of surveillance data for two exotic mosquito species. One of these is *Aedes albopictus*, the recently introduced (1992) Asian tiger mosquito, and the other is *Ochlerotatus japonicus*, the newly introduced (2000?) Asian bush mosquito. Our surveillance activities also have the potential to detect other newly arrived exotic mosquito species. Our program's activities include public education about how to eliminate breeding habitats for mosquitoes, and by default, these two imported, container-breeding, human biting mosquitoes are targeted because they can be very common in containers around the home, and are known disease vectors.

VDOT
VDOT is responsible for all of the vegetation along our roadways. As part of our normal maintenance operations budget, our Roadside Development Sections in the 9 Construction Districts regularly perform herbicide applications on invasive vegetation species. They also perform inspections of any standing water they find and inspect them for mosquito larva on a complaint driven basis.

VIMS
Focal areas described above, primarily driven by grant-funded research. Our Rapa whelk program is all grant funded (approximately $400,000 to date) General funds are used, however, for public education initiatives and outreach to various constituent groups. General funds also support advisory services to management agencies, through Advisory Services and the Wetlands Advisory Program. In that capacity, scientists have collaborated with the Invasive Species work group of the Chesapeake Bay Program to identify and manage 6 species in the CB watershed. Go to: www.mdsg.umd.edu/exotics

VMRC
The Virginia Marine Resources Commission is responsible for regulatory controls designed to prevent introductions of non-native invasive species into the tidal waters of the Commonwealth. The agency operates a native oyster restoration program designed, in part, to mitigate the losses from non-native invasive disease. In FY 03, the agency spent $1, 001,741 in non-general and federal funds for oyster restoration.

USGS-VCFWU
As a research contractor, all activities directly related to invasive species are conducted by funding from responsible agencies. The Virginia Cooperative Fish and Wildlife Unit does not have any currently funded projects on this topic.

NPS
The USDI-National Park Service units within Virginia have roles of responsibility to preserve and protect the natural and cultural resources within their units and a court ordered responsibility (Sierra Club v. USDI, 1974) to ensure that neighboring land use activities are conducive to park protection. Making sure that exotic species do not derogate resource values is an integral part of the agency responsibility. Specific funding for exotic species control includes $25,000 of current annual park-base funding (for survey/monitoring, eradication/control activities, and public outreach) and another $300,000 of current annual nationally-based funding for activities within the Mid-Atlantic EPMT. Of the latter amount, perhaps $200,000 goes to National Parks in Virginia (for survey/monitoring, eradication/control activities, and public outreach).

APRCR
Arlington Department of Parks, Recreation and Community Resources manages and maintains county parks within Arlington County. In FY 2004, Arlington PRCR spent $85 000 on a County invasive plant program. These funds were used to cover salaries as well as equipment and administration for a parks invasive plant control program and public education.

DRSAMP
As part of the Dragon Run Special Area Management Plan (SAMP) project funded by the Virginia Coastal Program at DEQ with a grant from the National Oceanic and Atmospheric Administration, the Middle Peninsula Planning District Commission is coordinating a loose-knit group of representatives of agencies and organizations interested in limiting the introduction of and controlling established invasive species in the Dragon Run watershed. The group has focused on the top threat for both plants and animals that have potential control mechanisms – common reed and blue catfish. Up to this point, most activities have been performed during the course of other activities. The Dragon Run SAMP Director and an outreach specialist at CBNERR have devoted small amounts of time to this initiative, amounting to less than $5,000. Future hopes include grant funds for monitoring and control programs and educational materials.

FCPA
The Fairfax County Park Authority (FCPA) is the largest land owner in Fairfax County with over 23,000 acres. The majority of the acreage is in a natural state. FCPA plays a leading role in environmental education and planning efforts in the county. FCPA's primary focus has been on outreach and education relating to invasive species, and on controlling invasive species on FCPA land. Over the last several years, funds spent directly on invasives control have not exceeded $10,000. However, decentralized spending at the site level on invasive species management makes it difficult to determine exactly how much money has been spent. As of September 2004 there are three full-time staff devoted to natural resource management. A portion of their time is devoted to invasive species control and management. Maintenance and educational staff at park sites also play a role in invasive species management.

TCLAC
The Tri-County Lake Administrative Commission is a department of the three counties which surround Smith Mountain Lake. Three years ago, during a drought situation, invasive aquatic vegetation became an issue which we were asked to take some action. We proceeded with a lake wide survey during the first year, and partial surveys each of the following two years. Our office hired a contractor to treat some specific invasive species during each of the years. In the last 12 months, we developed what we hope, is only the beginning, of a public outreach program. With only three (1 position is fulltime, 2 are a shared 40 hour a week position) staff members, we obviously do not have the staff to concentrate on this issue. None of our staff has a background in invasive species. So far, less than $100,000 has been spent on this issue by this office.

VNPS
VNPS has a budget of about $900 per year available for duplication of print materials and for travel and attendance at meetings concerned with invasive species for the Invasive Species Coordinator and other VNPS members concerned about invasive plant species.

Respondents to this Survey by Agency/Organization

VDACS – *Frank Fulgham, Office of Plant Pest Services*
VDCR VA – *Tom Smith, Division of Natural Heritage*
VDGIF – *Ray Fernald, Wildlife Diversity Division*
VDH – *David N. Gaines, Ph.D., Office of Epidemiology, Division of Zoonotic and Environmental Epidemiology*
VDOT – *Scott P. Johnson, Landscape Program Manager*
VIMS – *Sally Mills and Roger Mann, Ph.D.*
VMRC – *Jack Travelstead*
USGS-VCFWU – *Richard Neves, Ph.D., VPI&SU, Dept of Fisheries and Wildlife Sciences*
NPS – *James Akerson*
USF&WS – *Lisa Moss Virginia Fishery Resources Office U.S. Fish and Wildlife Service*
APRCR – *Jan Ferrigan, Invasive Species Program Coordinator, Arlington County VA Cooperative Extension*
DRSAMP – *David Fuss, Dragon Run Special Area Management Plan Director*
FCPA – *Charles Smith, Naturalist III, Natural Resource Management and Protection, Fairfax County Park Authority*
TCLAC – *Pam Dinkle, Lake Coordinator*
VNPS VA Native Plant Society – *Ruth Douglas*

APPENDIX E

OVERVIEW OF VIRGINIA INVASIVE SPECIES LAWS

Introduction

Several state laws and regulations address invasive species from historical perspectives that pre-date contemporary concerns about and definitions of invasive species. Most laws protecting agricultural and silvicultural interests are concerned with "plant pests," which may include weeds, insects, and plant pathogens such as rusts or viruses. A subcategory of plant pests is "noxious weed." Virginia law and regulations also identify animal threats to game species, wildlife, and livestock as "nuisance species." Plant pest and nuisance species laws restrict importation and release of species identified as a threat and provide authority for eradication.

Other state laws and regulations specifically address impacts of predatory or undesirable species on native fish and wildlife resources (§ 29.1-542; 4VAC15-30-40), or of invasive aquatic species which may pose significant threat of harm to diversity or abundance of native species, ecological stability of state waters, or the commercial, industrial, agricultural, municipal, recreational, aquacultural, or other beneficial uses of state waters (§29.1-571; 4VAC15-20-210). The former law and regulations essentially prohibit importation, possession, or sale of predatory or undesirable animals (a "black list"). The later law (Virginia Nonindigenous Aquatic Nuisance Species Act - VNANS) provides broad authority to the Virginia Department of Game and Inland Fisheries to conduct "operations and measures to suppress, control, eradicate, prevent, or retard . . . " the spread of any designated nonindigenous aquatic nuisance species. To date, six taxa (zebra mussel, snakehead fishes, quagga mussel, New Zealand mudsnail, rusty crayfish, and black carp) have been designated by law or regulation as nonindigenous aquatic nuisance species. Unfortunately, no funding is provided by VNANS to the Department to implement these authorities or programs.

Broad statements in laws concerning the protection and propagation of wildlife or protection of the natural diversity of biological resources provide some authority for action to prevent or control invasive species.

See Appendix F for a table of Virginia laws regarding invasive species.

Virginia Invasive Species Council

"The Virginia Invasive Species Council is established as a policy council in the executive branch of government. The Council shall provide state leadership regarding invasive species and shall prepare an invasive species management plan" (Code of Virginia §10.1-2600).

Laws Concerning Protection of Biological Resources

Preservation and Propagation of Wildlife. The Department of Game and Inland Fisheries is charged to "conduct operations for the preservation and propagation of game birds, game animals, fish and other wildlife in order to increase, replenish and restock the lands and inland waters of the Commonwealth" (§ 29.1-103). Further, they may "exercise powers it may deem advisable for conserving, protecting, replenishing, propagating and increasing the supply of game birds, game animals, fish and other wildlife of the Commonwealth" (§ 29.1-103).

Natural Diversity of Biological Resources. The *Code of Virginia* calls for the Department of Conservation and Recreation to "preserve the natural diversity of biological resources of the Commonwealth" (§10.1-211).

VIMS Advisory Role to the VMRC. Section §28.2-1100 of the *Code of Virginia* directs the VIMS to "consider ways to conserve, develop and replenish fisheries resources and advise the Marine Resources Commission and other agencies and private groups on these matters."

Virginia Pest and Noxious Weeds Laws

VDA Office of Plant and Pest Services coordinates compliance with the Virginia Pest Law and the Noxious Weed Law. The Virginia Pest Law makes VDA responsible for conducting abundance surveys for plant pests and to "carry out operations or measures to locate, to suppress, control, or eradicate, or to prevent or retard the spread of pests" (§ 3.1-188.22). Plant pests are defined as any invertebrate animal, pathogen, parasitic plant or similar or allied organism which can cause disease or damage in any crops, trees, shrubs, grasses or other plants of substantial value" (§ 3.1-188.3). Staff conduct inspections, quarantine, and eradication programs. Currently, programs address insect species such as cotton boll weevil (*Anthonomus grandis*), fire ant (*Solenopsis invicta*) and gypsy moth (*Lymantria dispar*). Two plant species are regulated under this law: multiflora rose (*Rosa multiflora*), Johnson grass (*Sorghum halpense*). The Plant Pathology Program investigates reports of fungi, bacteria, viruses, nematodes, and parasitic high plants.

The Noxious Weed Law defines a noxious weed as "any living plant, not widely disseminated, or part thereof, declared by the Board through rules and regulations under this chapter, to be detrimental to crops, surface waters, including lakes, or other desirable plants, livestock, land, or other property, or to be injurious to public health or the economy" (§ 3.1-296.12). Currently, one species is declared a noxious weed under this law: purple loosestrife (*Lythrum salicaria* and *L. virgatum*). Listing as a noxious weed prohibits the sale and transport of the species in Virginia.

Virginia Plants and Plant Products Inspection Law

The Virginia Plants & Plant Products Inspection Law (§§3.1-188.32-49) provides VDA regulatory authority to inspect and certify nursery stock and license nursery growers and dealers to protect the interests of the Commonwealth from plant pests.

This statute also allows VDA to prevent the movement or sale of any nursery stock that is suspected of being infected or infested with a plant pest.

Nuisance Species

The Code of Virginia Section 29.1-100 identifies nuisances species as "blackbirds, crows, cowbirds, grackles, English sparrows, starlings, or those species designated as such by regulations of the Board, and those species found committing or about to commit depredation upon ornamental or shade trees, agricultural crops, wildlife, livestock or other property or when concentrated in numbers and manners as to constitute a health hazard or other nuisance." *The Virginia Administrative Code* 4VAC15-20-160 lists additional species as nuisance species.

Importation

Several laws (e.g, §29.1-542) regulate intentional transport and release of exotic species. The Virginia Administrative Code requires a permit from DGIF for the importation of predatory and undesirable species that have been identified as "detrimental to the native fish and wildlife resources of Virginia" Importation of exotic fish, shellfish, and crustaceans with the intent to release into the waters of the Commonwealth is regulated by the *Code of Virginia* and requires a permit from the VMRC if the species is not on the Commission's list of approved states, waters, and species (*Code of Virginia* §28.2-825; Virginia Administrative Code 4VAC 20-754-10).

Nonindigenous Aquatic Nuisance Species

The Virginia Nonindigenous Aquatic Nuisance Species Act (§29.1-571 *et. seq.*) provides broad authority to the Virginia Department of Game and Inland Fisheries to conduct "operations and measures to suppress, control, eradicate, prevent, or retard . . . " the spread of any designated nonindigenous aquatic nuisance species. To date, six taxa (zebra mussel, snakehead fishes, quagga mussel, New Zealand mudsnail, rusty crayfish, and black carp) have been designated by law or regulation as nonindigenous aquatic nuisance species. Unfortunately, no funding is provided by VNANS to the Department to implement these authorities or programs.

Ballast Water

Virginia adopted the federal voluntary guidelines for management of ballast water of commercial vessels as established by the National Invasive Species Act of 1996 (*Code of Virginia* § 28.2-111; *US Code* Title 16 Chapter 67).

APPENDIX F

Summary Table of Virginia Invasive Species Laws

Law	Code	Agency	Life forms	Definition/Action/Authority
Virginia Pest Law	§§3.1-188.20-31:2	VDACS	Plants, plant pathogens, terrestrial invertebrates	**§ 3.1-188.3.** "'Pest' means any invertebrate animal, pathogen, parasitic plant or similar or allied organism which can cause disease or damage in any crops, trees, shrubs, grasses or other plants of substantial value." **§ 3.1-188.22.** "The Commissioner, through his assistants shall direct abundance surveys for plant pests and is authorized to carry out operations or measures to locate, to suppress, control, or eradicate, or to prevent or retard the spread of pests."
Virginia Noxious Weed Law	§§3.1-296.11-21	VDACS	Plants	**§ 3.1-296.12.** "'Noxious weed' means any living plant, not widely disseminated, or part thereof, declared by the Board through rules and regulations under this chapter, to be detrimental to crops, surface waters, including lakes, or other desirable plants, livestock, land, or other property, or to be injurious to public health or the economy."
Virginia Plants and Plant Products Inspection Law	§§3.1-188.32-49	VDA	Plants	**§ 3.1-188.34.** "It shall be the duty of the Commissioner to protect the agricultural, horticultural, and other interests of the Commonwealth from plant pests and, either in person or by his assistants, supervise and direct the execution of this article and rules and regulations adopted pursuant thereto." **§ 3.1-188.37.** "It shall be the duty of the Commissioner through his assistants to provide

				for the annual inspection, or more often if necessary, of all plant nurseries within the Commonwealth. The Commissioner shall certify the relative freedom of injurious plant pests before issuing a license to the owners of all such nurseries. All stock in custody of any dealer or person shall be subject to inspection at any time."
Department of Game and Inland Fisheries powers	§ 29.1-103	VDGIF	All wildlife and freshwater fish, including vertebrates and invertebrates	**§ 29.1-103** "Conduct operations for the preservation and propagation of game birds, game animals, fish and other wildlife in order to increase, replenish and restock the lands and inland waters of the Commonwealth." "Exercise powers it may deem advisable for conserving, protecting, replenishing, propagating and increasing the supply of game birds, game animals, fish and other wildlife of the Commonwealth."
Nonindigenous Aquatic Nuisance Species Act	§29.1-571; 4VAC15-20-210	VDGIF	Any species designated by Law or VDGIF regulation	
Nuisance Species	§ 29.1-100	VDGIF	Any species designated by law or VDGIF regulation	"Nuisance species" means blackbirds, crows, cowbirds, grackles, English sparrows, starlings, or those species designated as such by regulations of the Board, and those species found committing or about to commit depredation upon ornamental or shade trees, agricultural crops, wildlife, livestock or other property or when concentrated in numbers and manners as to constitute a health hazard or other nuisance. However, the term nuisance does not include (i) animals designated as endangered or threatened pursuant to §§ 29.1-

				563, 29.1-564, and 29.1-566, (ii) animals classified as game or fur-bearing animals, and (iii) those species protected by state or federal law.
Importation requirements, possession and sale or nonnative (exotic) animals	VA Administrative Code 4VAC15-30-40	VDGIF	Any species designated by law or VDGIF regulation	"A special permit is required and may be issued by the department, if consistent with the department's fish and wildlife management program, to import, possess, or sell those nonnative (exotic) animals listed below that the board finds and declares to be predatory or undesirable within the meaning and intent of §29.1-542 of the Code of Virginia, in that their introduction into the Commonwealth will be detrimental to the native fish and wildlife resources of Virginia"
Importing fish, shellfish, crustaceans	§28.2-825	VMRC	fish, shellfish, crustaceans	**§28.2-825.** "It shall be unlawful for any person to import any fish, shellfish or crustacea into the Commonwealth with the intent of placing such fish, shellfish or crustacea into the waters of the Commonwealth unless one of the following conditions exists: 1. The fish, shellfish or crustacea are coming from within the continental United States from a state or waters which are on the Marine Resources Commission's list of approved states and waters, and are species which are on the Marine Resources Commission's list of approved species; or 2. The person has notified the Commissioner of Marine Resources of such intent and has received written permission from the Commissioner of Marine Resources."

Ballast water	§§28.2-109 - 28.2-111	VMRC	Aquatic	**§28.2-109.** "'Ballast water' means any water or matter taken on board a vessel to control or maintain trim, draft, stability or stresses of the vessel, without regard to the manner in which it is carried." **§ 28.2-111.** "The Commission shall adopt the federal guidelines as the guidelines governing voluntary ballast water management practices to be followed by the operators of commercial vessels. The guidelines adopted by the Commission shall not require a commercial vessel to be operated in a manner that may threaten the safety of the commercial vessel, its crew or its passengers."
VIMS as VMRC consultant	§ 28.2-1100	VIMS, VMRC	Aquatic	**§28.2-1100. "**The Virginia Institute of Marine Science shall hereafter be referred to as the Institute. The Institute shall: 1. Conduct studies and investigations of the seafood and commercial fishing and sport fishing industries; 2. Consider ways to conserve, develop and replenish fisheries resources and advise the Marine Resources Commission and other agencies and private groups on these matters."
Invasive Species Council	§10.1-2600	VDCR-DNH	All	**§10.1-2600.** "The Virginia Invasive Species Council is established as a policy council in the executive branch of government. The Council shall provide state leadership regarding invasive species and shall prepare an invasive species management plan."

Department of Conservation and Recreation duties	§10.1-211.1	VDCR	All	**§10.1-211.** "In addition to other duties conferred by law, the Department shall, subject to the provisions of this article: 1. Preserve the natural diversity of biological resources of the Commonwealth."

APPENDIX G

Summary of the
Virginia Plant Pest Emergency Action Plan

The *Virginia Plant Pest Emergency Action Plan* provides guidance to state and federal agencies for the coordinated response to plant health emergencies arising from natural, accidental, or intentional introduction of plant pests, diseases, or other plant health issues that threaten Virginia's agricultural, horticultural, and forest resources. VDACS and USDA-APHIS-PPQ have primary jurisdiction for enforcement of plant pest laws and regulations and have designated personnel for leadership roles in coordinating state and federal response to emergencies. Other cooperating agencies include USFWS, Department of Homeland Security Customs and Border Protection, Federal Emergency Management Agency, Virginia Tech Cooperative Extension Service, VDOF, VDGIF, VDOT, VDCR, VDEQ, and VISC.

The goals of the plan are to prevent, control, or eradicate plant pests that threaten Virginia's agricultural, horticultural, and forest resources.

The objectives of the plan are to:

- Develop and maintain procedures and protocols in the event of an agricultural emergency.
- Define roles and responsibilities of each agency through a Cooperative Agreement or Memorandum of Understanding.
- Coordinate a response to the agricultural community to effectively convey information as to the nature, extent, and relevancy of the emergency.
- Provide resources.
- Enforce laws and regulations relevant to the emergency.

In support of these goals and objectives, plant health surveillance and pest detection systems have been developed. Information on pest detection is available to cooperators and the public through the VDACS OPPS website (http://www.vdacs.virginia.gov/plant&pest/index.html) and websites of other cooperating agencies. The plan includes protocol for the activation of emergency response actions, a communication plan, specimen sampling and pest quarantine procedures. VDACS and USDA-APHIS-PPQ annually review and revise the plan using new information and feedback from cooperating agencies.

- This plan ensures that state and federal resources are utilized in an effective and efficient manner in addressing exotic plant pests threatening Virginia. A coordinated response eliminates duplication of efforts while targeted detection surveys based upon pest risk analysis ensure early pest detection and containment thereby greatly increasing the potential success of eradication efforts. The *Virginia Plant Pest Emergency Action Plan* is a component of the Virginia Department of Agriculture and Consumer Services' Emergency Response Manual and the Commonwealth of Virginia Emergency Operations Plan.

APPENDIX H

LIST OF ACRONYMS USED IN THE INVASIVE SPECIES MANAGEMENT PLAN

VDACS	Virginia Dept of Agriculture and Consumer Services
VDCR	Virginia Dept of Conservation and Recreation
VDGIF	Virginia Dept Game and Inland Fisheries
VDH	Virginia Department of Health
VDOT	Virginia Dept of Transportation
VIMS	Virginia Institute of Marine Sciences
VISAC	Virginia Invasive Species Advisory Committee
VISC	Virginia Invasive Species Council
VMRC	Virginia Marine Resources Commission
USDA-APHIS	U.S. Department of Agriculture Animal and Plant Health Inspection Service
USGS-VCFWU	U.S. Geological Survey, VA Polytechnic Institute Cooperative Fish & Wildlife Unit
NPS	National Park Service
USF&WS	U.S. Fish and Wildlife Service
APRCR	Arlington Parks, Recreation & Community Resources
DRSAMP	Dragon Run Special Area Management Plan
FCPA	Fairfax County Park Authority
TCLAC	Tri-County Lake Association Commission
VNANS	Virginia Nonindigenous Aquatic Nuisance Species Act
VNLA/VGIC	Virginia Nursery & Landscape Association/ Virginia Green Industry Council
VNPS	Virginia Native Plant Society