VIRGINIA INVASIVE SPECIES MANAGEMENT PLAN 2012

Virginia Invasive Species Management Plan 2012

Prepared by
Virginia Invasive Species Advisory Committee

Prepared for
Virginia Invasive Species Working Group

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EXECUTIVE SUMMARY

Invasive species are nonnative 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). “Nonnative” (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 through a variety of pathways, including via intentional transport of a species for commercial purposes or accidental movement through the ballast-water of ocean-going vessels.

Currently, annual economic losses due to invasive species in the U.S. are estimated at over $120 billion (Pimentel et al. 2005). 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 et al. 2005).

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 zebra mussel and Phragmites. Almost half of 1180 imperiled or federally listed species were found to be directly threatened by competition with or predation by invasive species (Wilcove et al. 2000). The Virginia Department of Game and Inland Fisheries identified invasive species as a “crucial statewide conservation issue” (VDGIF 2005).

Local, state, and federal agencies are conducting a wide variety of invasive species efforts in Virginia. Efforts by state agencies include: health officials monitoring exotic mosquitoes capable of transmitting West Nile virus; fisheries biologists surveying waters of the Potomac River for snakehead fish; foresters suppressing gypsy moth infestations; a marine biologist working with Chesapeake Bay watermen to capture and remove Rapa whelk; and natural area stewards working to control Phragmites in hundreds of acres of coastal plain marshes.

Due to the many program-specific management priorities, limited resources, and the abundance of invasive threats, a statewide plan is essential for the efficient coordination of the many interested stakeholders toward shared goals. Therefore, the Virginia Invasive Species Management Plan (hereafter referred to as the Plan) was developed by the Virginia Invasive Species Working Group (VISWG) in cooperation with the Advisory Committee (AC) using model plans from other states and the federal government.

The scope of the 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 of the Plan 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. Promote and enhance professional and volunteer invasive species early detection through education and reporting tools.
4. Rapid Response. Enhance rapid response capability to implement eradication or containment procedures for target species through planning.
5. Control and Management. Provide control of priority invasive species through containment, abatement, and other management strategies—including habitat restoration and use of native species—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, environmental nongovernmental organization, special interest groups and K-12 science teachers.

The Plan identifies a 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.

I. INTRODUCTION

What Are Invasive Species?

Invasive species are nonnative 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). “Nonnative” (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 species that impact aquatic ecosystems (U.S. Congress 1990).

Many intentional nonnative species introductions are beneficial, as with the majority of agricultural and horticultural species. Species escaping cultivation or accidentally introduced usually have no negative impact in their new landscape. However, the 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 $120 billion (Pimentel et al. 2005). 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 are estimated to exceed one billion dollars annually. As international trade and travel continue to expand and increase, new organisms will continue to find their way into novel habitats and cause additional problems. Further, impacts of invasive species are exacerbated by climate change (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” (DGIF 2005).

Throughout evolutionary history, organisms have moved around the planet gradually, modifying their native ranges and adapting to meet new conditions. However, human actions in North America since the time of Columbus have transplanted species from their native ranges into new habitats at a dramatically increasing rate with resulting establishment in new habitats. Some of these established transplants have become invasive. 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.

Invasive Species Case Histories

A brief overview of nine invasive species follows. These are not considered the priority species in Virginia, rather they were selected to describe the diversity of the invasions that have occurred. Many types of organisms, from viruses to mammals, may become an invasive species. Each example illustrates a dimension of the problems posed by invasive species and underscores the need for concerted action to control established invasive species and prevent new ones from becoming established. All of these species listed either found in Virginia or have the potential to become established here.

Kudzu (*Pueraria montana*) is an 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, blocking sunlight from reaching other plant species. Complex natural communities are replaced by tangled stands of kudzu. Currently, 7 million acres of land in the U.S. are infested with kudzu (Britton 2002). Although used as forage, it produces low yields. Annual costs to control kudzu by power companies in the Southeastern U.S. have been estimated at 1.5 million dollars (Britton 2002).

Less than 100 years ago, the American chestnut (*Castanea dentata*) 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 body length up 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). Snakeheads may carry yet another nonnative 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 an aphid-like invasive insect, the **hemlock wooly adelgid** (*Adelges tsugae*). The adelgid sucks the sap out of hemlock needles and injects toxic saliva. Hemlock wooly adelgid first appeared in Virginia in 1950, and is native to Asia. There

are a number of management strategies available, including promising biological control options. However, the adelgid continues to spread throughout the eastern U.S., causing tree mortality and population declines (USFS 2005). Loss of eastern hemlock significantly changes the character of natural communities in Virginia's mountains and may lead to an increase in soil erosion stream sedimentation.

Phragmites (*Phragmites australis*), is a tall grass species found in many parts of the world with regional genetic variations. At least one 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 plants from above and below with tall stems that may be 15 feet in height and fast growing rhizomes (underground stems) which form new shoots and a thick tangled 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 (DCR) recently mapped over 12,000 acres of Phragmites that has invaded wetlands of the Chesapeake Bay, Back Bay, and the seaside and barrier islands of Virginia's Eastern Shore.

Detected in the New York City area 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. From 1999 to 2010, over 30,000 cases of West Nile virus disease were reported in the U.S., with 1208 cases resulting in death (Center for Disease Control 2011). 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. The virus is transmitted from birds to humans via mosquitoes. Recent research also suggests the virus 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, such as via birds in zoos or the commercial pet trade, but none have been proven (Hayes et al. 2005; Marra et al. 2004; Rappapole et al. 2000).

Zebra mussel (*Dreissena polymorpha*), a freshwater bivalve native of Russia, spread during the 19th century to western Europe via trade through open waterways and canals. It 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). In 2002, zebra mussel was discovered in a quarry pond in northern Virginia. Department of Game and Inland Fisheries (DGIF) led control efforts and successfully eradicated the invading mollusk.

Ramorum blight (*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 destruction of host plants.

Emerald ash borer (*Agrilus planipennis*) is a small beetle discovered in Michigan in 2002. EAB probably arrived in the United States on solid wood packing material carried on cargo ships or airplanes originating in its native range of Asia. The adult beetle does little damage, but the larvae (immature stage) feed on the inner bark of ash trees, disrupting the tree's ability to transport water and nutrients. EAB has become established in large areas of the U.S. and has killed many millions of ash trees, potentially costing municipalities, property owners, nursery operators, and forest products industries hundreds of millions to billions of of dollars (Snydor et al. 2007). USDA and state agencies have instituted quarantines and fines to prevent potentially infested ash trees, logs or hardwood firewood from moving out of areas where EAB occurs. (www.emeraldashborer.info 2011) Due to the extent of the outbreak and the challenges of locating and eradicating new infestations, regulatory agencies are now seeking methods for managing this destructive pest throughout North America. EAB was first detected in Virginia in 2003 on infested nursery stock illegally shipped from Michigan to Maryland and planted in Virginia. As of August 2012, the entire state of Virginia is under state and federal Emerald Ash Borer Quarantines. For more information, go to www.vdacs.virginia.gov/plant&pest/index.shtml.

Geographic Extent of the Plan

The 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 the 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 the 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 Working Group developed the 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 Working Group and Committee members and their affiliations can be found in Appendix C and D, respectively.

The Plan is an evolving document, which will be revised every four years. Ongoing accomplishments and new information will guide the refinement and revision of goals and strategies in future versions of the Plan.

II. INVASIVE SPECIES AUTHORITIES

Invasive species are addressed by a variety of laws and regulations overseen by a number of agencies. At the federal level, Executive Order 13112, the Lacy Act, and the Animal Health Protection Act, among many others, direct invasive species management actions for the protection of agricultural and natural resources. In Virginia, the Virginia Pest Law, the Nonindigenous Species Act, and the Noxious Weed Law are but a few of the instruments used to prevent, regulate, and control invasive species. It must be noted that what are now often referred to as "invasive species" are sometimes, but not always, referred to as pest, nuisance, or noxious species. However, the latter designations may include native species. See Appendix I for a table of invasive species laws and regulations.

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." Plant pest 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, or of invasive aquatic species that 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.

Broad statements in laws concerning the protection and propagation of wildlife or protection of the natural diversity of biological resources provide 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). In another example, the *Code of Virginia* directs the Department of Conservation and Recreation to "preserve the natural diversity of biological resources of the Commonwealth" (§10.1-211).

Invasive species often defy jurisdictional boundaries. Therefore, government agencies—federal, state, and local—private businesses and nonprofit organizations have formed broad partnerships to effectively address invasive species impacts.

State Agency Authorities and Programs

Invasive Species Working Group (ISWG) was created by the General Assembly in 2009 (*Code of Virginia* § 2.2-220.2) The ISWG is chaired by the Secretary of Natural Resources and the Secretary of Agriculture and Forestry serves as vice-chair. The Secretaries are directed to "coordinate the development of strategic actions to be taken by the Commonwealth, individual state and federal agencies, private businesses, and

landowners related to invasive species prevention, early detection, rapid response, control and management, research and risk assessment, and education and outreach."

Members of the ISWG include: Department of Conservation and Recreation; Game and Inland Fisheries; Environmental Quality; Forestry; Agriculture and Consumer Services; Health; Transportation; the Marine Resources Commission; the Virginia Cooperative Extension; Virginia Institute of Marine Sciences; representatives of the agriculture and forest industries; the conservation community; interested federal agencies; academic institutions; and commercial interests. See Appendix C for a full list of ISWG members.

The ISWG is required to develop a state invasive species management plan and a list of invasive species that pose the greatest threat to the Commonwealth. General goals outlined in the enabling legislation include:

1. Prevent additional introductions of invasive species.
2. Procure, use and maintain native species to replace invasive species.
3. Implement targeted control efforts on those invasive species that are present in the Commonwealth and are susceptible to such actions.
4. Identify and report the appearance of invasive species before they can become established and control becomes less feasible.
5. Implement immediate control measures if a new invasive species is introduced in Virginia, with the aim of eradicating that species from Virginia's lands and waters if feasible given the degree of infestation.
6. Recommend legislative actions or pursue federal grants to implement the plan. No new funding is allocated for the actions of the ISWG. The Department of Conservation and Recreation provides staff for the ISWG.

ISWG continues work begun by previous legislation and Executive Directives. 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 chaired the Council, and membership was similar to the current Working Group.

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.

When the ISCA expired in 2006, the governor continued the body, now referred to as the Invasive Species Working Group, by issuing two Executive Directives, which along with some refinements to membership and changed the name to Invasive Species Working Group.

Department of Agriculture and Consumer Services (DACS). The Virginia Pest Law and the Plant and Plant Products Inspection Law grant DACS most of its authority and responsibility for responding to invasive species issues.

The Virginia Pest Law authorizes VDACS to "protect the agricultural, horticultural, and other interests of the Commonwealth from plant pests" (§ 3.2-701). Toward that end, the law empowers VDACS to "direct abundance surveys for plant pests and may carry out operations or measures to locate, suppress, control, eradicate, prevent or retard the spread of pests" (§ 3.2-702). Organisms covered by this law include: insects, diseases, parasitic plants, or other organisms of any character causing or capable of causing injury or damage to any plant or part thereof. The law also grants quarantine authority: VDACS may: "quarantine this Commonwealth or any portion thereof when they determine that such action is necessary to prevent or retard the spread of a pest into, within, or from this Commonwealth" (§ 3.2-703). Further, the law makes any violation of the law, including a quarantine violation, a Class 1 misdemeanor (3.2-710).

A quarantine prohibits the movement or sale of "regulated articles" into or out of the quarantined area. Regulated articles defined as products capable of carrying the target pest out of the quarantine. VDACS may designate a quarantine as temporary or permanent. Quarantines may be directed toward the entire state or any part thereof.

The Plant and Plant Products Inspection Law confers upon VDACS the duty to "protect the agricultural, horticultural, and other interests of the Commonwealth from plant pests" (§ 3.2-3801). The law authorizes VDACS to certify and inspect nurseries and nursery stock and defines a plant pest as "any living stage of insects, mites, nematodes, slugs, snails, protozoa, other invertebrate animals, bacteria, fungi, other parasitic plants, parasitic plant parts, viruses, any other similar organism, or any infectious substances that can injure, infect, or damage any plant or plant products" (§ 3.2-3800). The law grants VDACS the authority to inspect nursery stock and to stop delivery or sale, treat, or order returned to the point of origin any nursery stock or plant products for sale or distribution if a plant pest infection or the visual symptoms of infestation are found (§ 3.2-3808). Plant material found to be infected will be seized, destroyed, treated or returned to the point of origin at the owner's expense" (§ 3.2-3809). The law makes any person who imports a plant pest into Virginia without a permit from VDACS guilty of a Class 1 misdemeanor (§ 3.2-3810).

The Noxious Weed Law allows the VDACS Board to declare as a "noxious weed" any plant not widely disseminated that is determined to be detrimental to crops, surface waters, including lakes, or other desirable plant, livestock, land, or other property, or to be injurious to the public health or the economy" (§ 3.2-800). The Board may adopt regulations pertaining to regulated articles and conditions governing movement their movement in order to eradicate or suppress and prevent the dissemination of noxious weeds (§ 3.2-802). In order to prevent the introduction or spread of noxious weeds, VDACS' Commissioner is given the authority to "stop delivery, stop sale, seize, destroy, treat, or order returned to the point of origin, at the owner's expense, any noxious weed, article, or substance whatsoever, if transported or moved within the Commonwealth, or if existing on any premise, or brought into the Commonwealth from any place outside thereof, if such is found by him to be infested with any noxious weed" (§ 3.2-805).

Species designated as noxious weeds in Virginia include purple loosestrife (*Lythrum salicaria* and *L. virgatum*). As this plan goes to press, changes to the Noxious Weed Law regulations are pending review. An addendum to the Invasive Species Management Plan will be published once the new regulations are approved.

Department of Forestry. Through the Insect Infestation and Diseases of Forest Trees Law, the DOF "is authorized and responsible for (i) investigating insect infestations and disease infections which affect stands of forest trees, and (ii) devising and demonstrating control measures to interested persons" (§ 10.1-1177). The law defines an "infection" as "any disease affecting forest trees which is declared by the State Forester to be dangerously injurious to forest trees," an "infestation as "any insect which is declared by the State Forester to be dangerously injurious to forest trees," and a "person" as including "an individual, partnership, corporation, company, society or association" (§ 10.1-1178).

The law directs the State Forester to investigate any instance of infestation or infection where believed to exist. If an infection or infestation are found, the State Forester must notify "each landowner within the affected area, advising him on the nature of the infestation or infection, and the recommended control measures, and offering him technical advice on methods of carrying out control measures" (§ 10.1-1179). DOF does not have authority to establish quarantines.

Department of Health (DH). DH Division of Environmental Epidemiology (DHDEE) works "to prevent and control human diseases and conditions due to exposure to chemical and biological agents in the environment and transmission from animals to humans." Some of these diseases and the biological agents that spread them are considered invasive species. One example of a disease that effects humans and animals is West Nile virus, which originated in Africa. West Nile virus is spread by birds and non-native mosquitos, particularly the Asian tiger mosquito. DHDEE conducts surveillance of and reports on disease outbreaks that may be due to such environmental factors.

Department of Game and Inland Fisheries. DGIF is charged with protection of the state's game birds, game animals, fish, and other wildlife, except for species legally designated threatened or endangered species of the Class Insecta, which are the jurisdiction of VDACS. The state definition of "wildlife" does not include plant species, therefore, management of invasive plant species extends from management for wildlife habitat. DGIF has discretionary authority to "conduct operations for the preservation and propagation of wild animals in order to increase, replenish and restock the lands and inland waters of the Commonwealth" (§ 29.1-103).

Nonindigenous Aquatic Nuisance Species Act (§ 29.1-571-577) authorizes DGIF to classify nuisance species and to "conduct operations and measures to suppress, control, eradicate, prevent, or retard the spread of any nonindigenous aquatic nuisance species" (§ 29.1-572-573). The Act defines "nonindigenous aquatic nuisance species" as "a nonindigenous aquatic freshwater animal species whose presence in state waters poses or is likely to pose a significant threat of harm to (i) the diversity or abundance of any species indigenous to state waters; (ii) the ecological stability of state waters; or (iii) the commercial, industrial, agricultural, municipal, recreational, aquacultural, or other

beneficial uses of state waters" (§ 29.1-571). See Table 3 for a list of nonindigenous aquatic species currently listed by DGIF.

DGIF is given discretionary power to "control, eradicate, prevent, or retard the spread of any nonindigenous aquatic nuisance species" (§ 29.1-573). The Act places prohibitions on the public, stating "No person shall knowingly import, possess, transport, sell, purchase, give, receive, or introduce into the Commonwealth any member of a species designated as a nonindigenous aquatic nuisance species without a permit from the Director [of DGIF]" (§ 29.1-574). An exception is made for anyone who catches a snakehead fish, provided the fish is killed and DGIF is notified as soon as practical. Any person who violates this Act may be fined no more than $25,000.

Table 3. Nonindigenous Aquatic Nuisance Species listed by DGIF.

Common Name	**Scientific Name**
Zebra mussell	*Dreissena polymorpha*
Quagga mussel	*Dreissena bugensis*
Snakehead fish	*Channa* spp.
Black carp	*Mylopharyngodon piceus*
New Zealand Mudsnail	*Potamopyrgus antipodarum*
Rusty crayfish	*Orconectes rusticus*

Virginia Marine Resources Commission. VMRC is charged with protecting tidal waters "to promote the general welfare of the seafood industry and to conserve and promote the marine resources of the Commonwealth" (§ 28.2-201(1)). VMRC regulates the importation of "live fish, shellfish, and crustacea into the Commonwealth" when the intention is to place "such fish, shellfish, or crustacea in to waters of the Commonwealth" (§ 28.2-825). Specific conditions, including the concurrence of the director of the Virginia Institute of Marine Science, must be met before an introduction is permitted.

Virginia Institute of Marine Science. VIMS is empowered to study and investigate matters affecting marine resources. VIMS is responsible for advising the VMRC, other state agencies, and private groups on marine resource issues (§ 28.2-1100). VIMS is authorized to administer and monitor protected estuarine and coastal lands in support of coastal resource management efforts (§ 28.2-1103).

Department of Conservation and Recreation. DCR manages 35 state parks and 61 natural area preserves encompassing 116,000 acres. Its invasive species jurisdiction is limited to these lands. For natural area preserves, DCR is authorized to "preserve the natural diversity of biological resources of the Commonwealth" in all natural area preserves (§ 10.1-211). On these and other public and private conservation lands, DCR conducts or assists with invasive species detection, control, monitoring, and restoration. In partnership with the Virginia Native Plant Society, DCR conducts public outreach and education on invasive plants through brochures, fact sheets, agency web pages, and public presentations.

As directed by the 2009 invasive species law, DCR serves as staff for the Invasive Species Working Group (§ 2.2-220.2).

Regional Program

The Interstate Pest Control Compact is an agreement signed by Virginia and 39 other states, including all of Virginia's neighbors except Kentucky. Member states pledge to assist each other in the control of pests and share the cost of an insurance fund. The compact defines "pest" 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" (Interstate Pest Control Compact, Article II) The compact "serves to remedy funding restraints, bridge the jurisdictional gaps that exist among federal and state governments and more adequately address the realities of dynamic plant pest infestations or outbreaks. Through contractual agreements, the Compact allows individual states to contribute to plant pest control, suppression, or eradication beyond their state boundaries" (Interstate Pest Control Compact website). DACS or the Governor can invoke the compact if they determine a pest threat exists in another state or in an area that crosses the Virginia border. Funds go to the recipient state to expedite management actions. A governing board manages the fund by representation from each signatory state. As of 2009, 30 projects received a grand total of $1,096,000. Virginia last received funds in 1997 to conduct a survey for corn cyst nematode.

Federal Agencies and Entities with Invasive Species Authority

National Invasive Species Council (NISC) was established in 1999 by and Executive Order 13112. Thirteen Department heads sit on the Council, which is co-chaired by the directors of the Departments of the Interior, Commerce, and Agriculture. NISC serves to coordinate federal invasive species management efforts. E.O. 13112 established the now widely used definition of "invasive species" as alien (or nonnative) species that "does or is likely to cause or are likely to cause economic or environmental harm or harm to humans." It also directs the Council to develop a national invasive species management plan.

United States Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS) is charged with protection of America's agriculture and natural resources from agricultural pests and diseases. Its authority comes from numerous laws, including the Animal Health Protection Act (7 U.S.C. § 8301), the Plant Health Protection Act (7 U.S.C. § 7701), The Animal Damage Control Act (7 U.S.C. §§ 426-426c, March 2, 1931, as amended 1987 and 1991), and the Lacy Act (16 U.S.C. § 3371). USDA-APHIS is represented in the Commonwealth by the Animal Care, Plant Protection and Quarantine, Veterinary Services, and Wildlife Services Programs. APHIS programs work at U.S. borders and ports to prevent accidental or intentional importation of pests or diseases, and respond to invasive species infestations within their respective program areas.

United States Fish and Wildlife Service (USFWS) serves to "protect fish, wildlife, plants and their habitats for the continuing benefit of the American people." The USFWS

operates 14 National Wildlife Refuges and two Ecological Services offices in Virginia. Most of the Service's invasive species management activities occur on Refuges which currently total over 123,000 acres in Virginia. Invasive species also may be managed on non-refuge properties through our Partners for Wildlife program. In addition, the USFWS Fisheries program supports aquatic invasive species management throughout the Mid-Atlantic region. Authority regarding invasive species comes from Executive Order 13112, the Lacy Act (16 U.S.C. § 3371), the Nonindigenous Aquatic Nuisance Prevention and Control Act, and the Nutria Eradication and Control Act.

The National Park Service (NPS) was created by the National Park Service Organic Act of 1916. NPS manages the National Park System "to conserve the scenery and the natural and historic objects and wildlife therein, and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 U.S.C. 1). In Virginia, NPS manages over 300,000 acres that include Shenandoah National Park, Prince William Forest Park, Blue Ridge Parkway, and other units such as national battlefield memorial parks. On these lands, NPS conducts invasive species surveys, control, and monitoring.

United States Forest Service (USFS), an agency of the USDA, manages 155 national forests and 20 national grasslands. Its mission is "To sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations." Additional authority for the control of invasive plants comes from The Federal Noxious Weed Act of 1974, as amended, requiring cooperation with State, local, and other Federal agencies in the application and enforcement of all laws and regulations relating to management and control of noxious weeds. The George Washington and Jefferson National Forests manage about 1,600,000 acres of National Forest System lands in the Commonwealth. USFS currently inventories lands for a variety of aquatic and terrestrial non-native invasive species. It has implemented control treatments for species such as gypsy moth, hemlock woolly adelgid, tree of heaven, autumn olive, and mile-a-minute weed. Annually USFS treats about 1,000 to 2,000 acres of non-native invasive plants.

II. INVASIVE SPECIES MANAGEMENT PLAN GOALS AND STRATEGIES

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 stakeholders conduct control or restoration activities, nor do all engage in prevention measures. All stakeholders will not always agree on all issues. Nevertheless, the goals of the Plan require understanding of the views and roles of each stakeholder and ongoing cooperation, communication, and dialogue. 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: Continue the Virginia Invasive Species Working Group (ISWG) (VISC) as a permanent body and fund key positions and activities to help integrate and coordinate Virginia-wide agency invasive species actions, link them to national invasive species efforts, and outline procedures that will help resolve jurisdictional and other agency issues regarding invasive species programs.

Action 1.1.2: Maintain VISWG Advisory Committee (VISAC) as the primary forum for stakeholder dialogue and coordination between state, federal and private organizations.

Action 1.1.3: 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 VISWG.

Action 1.1.4: Strengthen state partnerships with local governments, federal agencies, and other stakeholders through memoranda of understanding where appropriate.

Action 1.1.5: As needed, address major policy differences between agencies and other stakeholders within the VISAC.

Strategy 1.2: Identify potential legislation revisions to close potential gaps or reduce duplication.

Action 1.2.1: Identify jurisdictional and legislative needs for invasive species prevention, detection, response, control, research, and education.

Action 1.2.2: 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: Report 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 seek to verify authorized introductions, detect and interrupt illegal or accidental introductions by monitoring key pathways. Prevention requires state agency support and cooperation with federal agencies tasked with similar responsibilities beyond state lines. 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 addressed in Goal 7.

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 efforts, such as the NISC and ANSTF Pathways Task Team, 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 accidental high-risk pathways working with existing regulatory authorities as appropriate.

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, IDENTIFICATION, AND REPORTING

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.

Formal responsibility for early detection of new invasions is distributed across several state agencies with dedicated staff who survey or monitor for invasive species: VDACS and DOF conduct surveys for plant pests; DGIF monitors nuisance species and aquatic (freshwater) invasive species; VMRC aquatic (saltwater); and DOH monitors nonnative mosquitoes that carry human pathogens. Other state and federal agencies with technical expertise and roles that place professional staff in position to make early detections are the DCR, VIMS, VMRC, DEQ, and Cooperative Extension Service at the state level, and USDA-APHIS, NPS, USFS, and USFWS at the federal level. Localities and non-profit conservation organizations also have resource professionals that play an important role in early detection. Clear detection targets and reporting protocol will enable more of these staff to recognize and report early detection species of high concern.

Volunteers who regularly use and enjoy Virginia's natural resources offer another opportunity to enhance early detection capability through directed surveys and chance encounters. Effective participation of volunteers in early detection requires outreach, training, and tools to assist in identification and reporting potential invasive species. The following strategies and actions will enhance both professional and volunteer participation in early detection.

Verification of a suspected new invasive species requires taxonomic expertise. Once verified, information about the infestation needs to get to the appropriate agency. Data collection protocol and data collection forms will help ensure useful data are collected at the time of the first detection. Sharing early detection data as soon as possible with the wider network will help increase alertness to the species in question and signal the need for next steps in the rapid response process. See Figure 1.

Goal 3. Promote and enhance professional and volunteer invasive species early detection through education and reporting tools.

Strategy 3.1. Enhance the likelihood of early detection and reporting of suspected new species by supporting volunteers and professionals with information and tools to detect and report invasive species of high concern.

- 3.1.1 Develop a targeted list of 15-20 species of high concern for early detection training and education.
- 3.1.2. Post an early detection network directory on vainvasivespecies.org. See Appendix F.
- 3.1.3. Provide training and information for resource professionals to enhance their knowledge of early detection species and reporting protocols.

3.1.4. Create an early detection listserv for professional resource staff.
3.1.5. Provide early detection training materials and workshops for Virginia Master Naturalists to train others in early detection.
3.1.6. Create an online early detection species identification guide
3.1.7. Post and promote an online early detection reporting form.
3.1.8. Encourage and support personnel at local cooperative extension offices to act as contacts for early detection network. Virginia Cooperative Extension agents in particular are well positioned to implement this task.

3.2 Ensure the timely identification and reporting of new species introductions.
3.2.1 Develop and encourage the use of early detection data collection protocol.
3.2.2 Ensure access to taxonomic expertise such as those at Virginia Cooperative Extension Diagnositic and Laboratory Services.
3.2.3 Use iMapInvasives.org to report, map, and catalog new species introductions.
3.2.4 Encourage archiving of confirmed new species introductions at appropriate institutions.
3.2.5 Report confirmed new introductions to the Invasive Species Working Group and Advisory Committee.
3.2.6 Facilitate media coverage of new introductions.

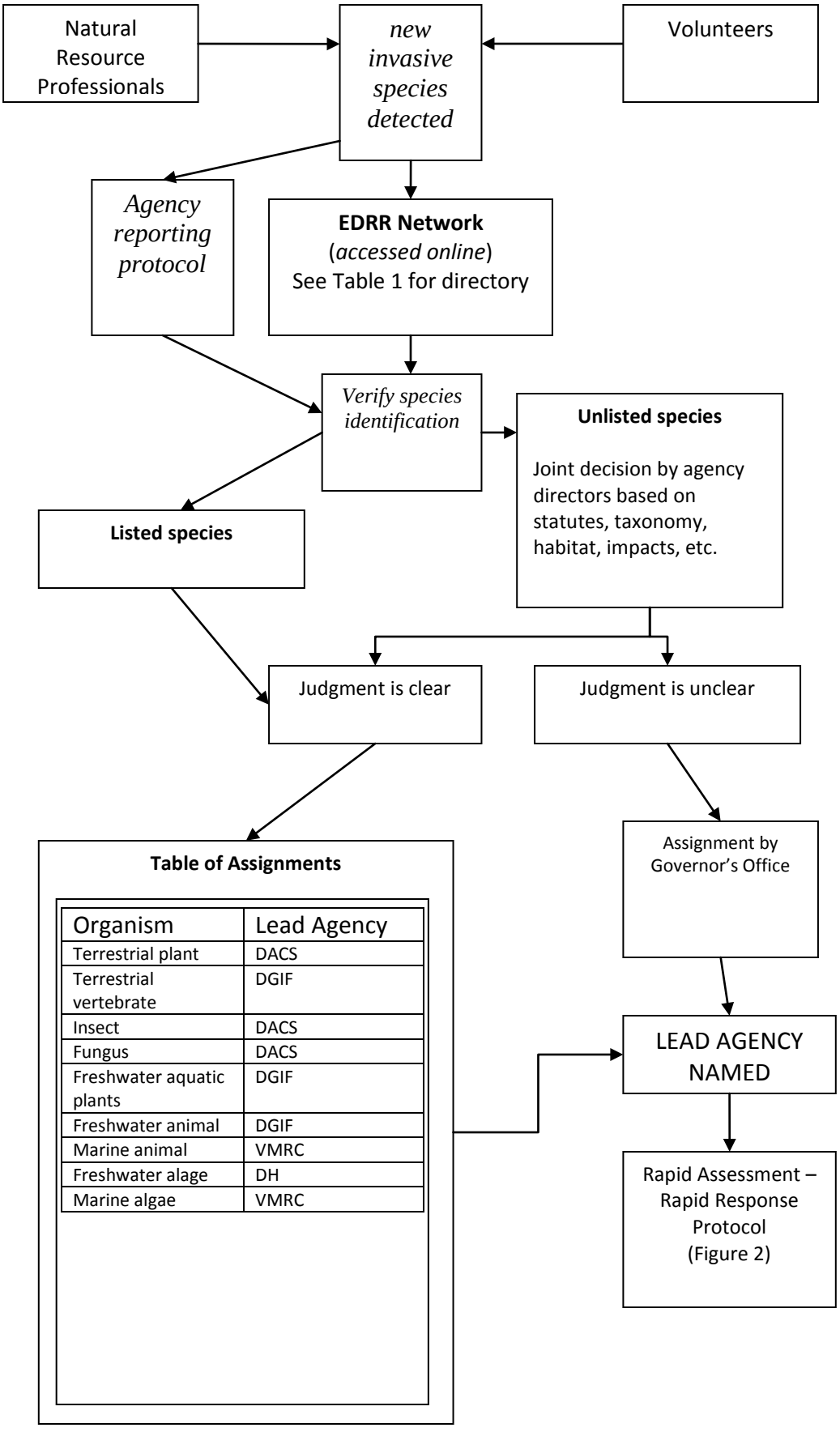

Figure 1. Early Detection

4. RAPID ASSESSMENT AND RAPID RESPONSE

When new invasive species are discovered, it is essential to respond rapidly, before they become established, spread, and cause harm. Delay in response can lead to profoundly 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, seek pre-approval for likely management actions, and be supported with emergency funding. When a species is detected for which a plan has not been prepared, a rapid assessment process is recommended.

Goal 4: Enhance rapid response capability to implement eradication or containment procedures for target species through planning.

Strategy 4.1: Develop contingency/emergency response plans for potential invasive species of high concern most likely to be introduced. [The *Pest Plant Emergency Action Plan* prepared by VDACS Office of Pest Plant Industry Services provides a model for such plans. See Appendix E]

Action 4.1.1: Form planning teams for specific life form types (e.g., mammals, fish, mosquitoes, plant pathogens, etc.).

Action 4.1.2: Prepare response plans and incorporate these plans into the state emergency plan under the state homeland security system.

Action 4.1.3: Seek pre-approval for anticipated management actions from regulatory agencies.

Action 4.1.4: Develop and test a generic rapid response plan with a mock invasion scenario.

Strategy 4.2: Identify current available funds or fund sources for rapid response implementation and assess needs for more funding authority.

Strategy 4.3: Encourage interagency partnerships for successful rapid response operations.

Strategy 4.4: Facilitate media coverage of rapid response actions.

Strategy 4.5: When early detection identifies an invasive species of high concern for which no plan has been prepared, conduct rapid assessment. Generally, a team will be required to rapidly assess the species and situation to determine next actions. Assessment will determine jurisdictional purview, regulatory status, permitting needs, etc. Federal agencies may be helpful at this stage to provide technical assistance and possibly emergency funding.

4.5.1: Identify staff for rapid assessment teams. Identify partnering potential with watermen, recreational fishermen, others.

4.5.2: Conduct rapid assessment to determine potential invasiveness and economic and ecological threats posed by verified new species.

4.5.3: Determine appropriate regulatory status of new species.

4.5.4: Seek technical and other assistance from federal agencies.

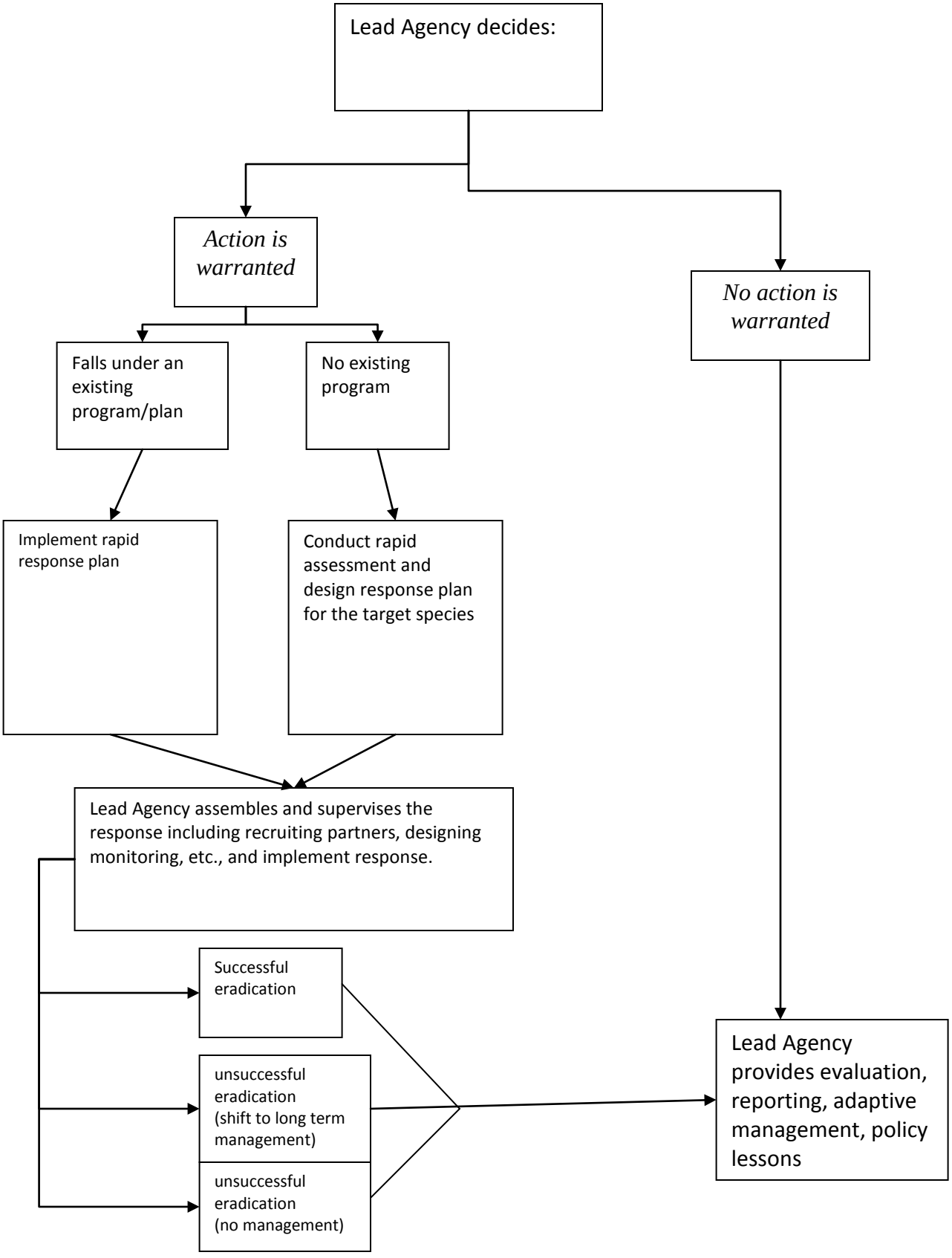

Figure 2. Rapid Response

5. CONTROL AND MANAGEMENT

Established invasive species require control through containment, abatement, or other management strategies to minimize environmental and economic impacts. Management objectives may include 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 will need to 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 priority invasive species through containment, abatement, and other management strategies—including habitat restoration and use of native species—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 and to prevent re-infestation by invasive species.
- **Action 5.1.3:** When feasible, encourage the procurement and use of native species for restoration, soil conservation, and landscaping.
- **Action 5.1.4**: 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.

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 potential 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 Federal agencies (chiefly USDA, DOI and EPA) and universities. The principal role of State agencies will be to partner with these institutions regarding research, monitoring, and risk assessment needs, and to provide feedback on the efficacy of current management tools.

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 prevention, early 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 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 encourage collaboration with other states, federal agencies, and universities.

Action 6.1.2: 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.

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) recognized as a threat to ecological or economic resources.

Action 6.2.2: Participate with federal agencies and nongovernmental stakeholders in the development of a fair and comprehensive screening system for evaluating first-time intentionally introduced nonnative species.

Action 6.2.3: Implement a process for assessing potential invasive species that are likely to be but not yet introduced and for which rapid response tools are necessary.

Action 6.2.4: Develop environmental and economic indicators for evaluating impacts of invasive species on Virginia's economy and environment.

7. EDUCATION AND OUTREACH

Education and outreach are vital to all the other goals in this plan. Educating specific constituencies, such as hikers, anglers, commercial importers, and agricultural producers on the impacts of invasive species will result in more citizen involvement. General outreach and specialized training programs are required to support other goals of this plan.

Accomplishments since 2005 plan: invasive species information has been made available on VISWG website; a list was developed highlighting twelve invasive species for education and outreach; a brochure, two posters, and supporting web pages for twelve invasive species of high concern were created and distributed.

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, environmental nongovernmental organization, special interest groups and K-12 science teachers.

Strategy 7.1: Develop and implement a coordinated public awareness campaign emphasizing public and private partnerships to address invasive species challenges.

Action 7.1.1. Develop programming for Master Naturalists and others to take into schools.

Action 7.1.2: Using the Internet, distribute educational information and materials that raise awareness of the need to prevent future introductions of invasive species.

Action 7.1.3. When feasible, emphasize involvement through on-the-ground action to directly involve communities in management of invasive species.

Action 7.1.4. Ensure Cooperative Extension agents have training, tools, and information for educating the public on invasive species.

Strategy 7.2 Work with conservation and professional societies, gardening associations, to guide awareness and capacity for education and outreach.

Action 7.2.1. Create listserv or other social media channels for distributing invasive species news and information among interested stakeholders.

Action 7.2.2. Connect to a wider circle of agencies and organizations engaged in invasive species actions and education. Examples include garden clubs, horticultural programs, botanical gardens, and landscape architects associations.

IV. 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	Continue the ISWG		VISWG VISAC DCR			$1200	$1200
1.1.2	Maintain the VISAC as primary invasive species stakeholder forum		DCR	VISAC		$2400	$2400
1.1.3	Establish sub-committees for oversight of each goal		VISAC		2013		
1.1.4	Strengthen partnerships via MOUs when appropriate		VISWG VISAC				
1.1.5	Address policy conflicts within VISAC		VISWG VISAC				
1.2.1	Identify jurisdictional, legislative and funding needs		VISAC DCR	VDACS VDOF VDGIF VMRC VDH			
1.2.2	Identify funding needs for invasive species management plan goals		VISAC	VDACS VDOF VDGIF VMRC VDH DCR	2013		
1.3.1	Define clear, quantifiable outcomes for management actions		VISAC				
1.3.2	Report progress on implementation of management plan actions		VISWG DCR	VISAC	December each year		
2.1.1	Ensure pathway assessments are conducted	Clean Water Act, Mid-Atlantic Aquatic Invasive Species Species Task Force	VISAC	USDA-APHIS USFWS NISC	2015		

Action #	Action	Fund Source	Implementing Agency	Cooperative Agency	Time Frame	Cost of Recent Efforts ($$$/FTE)	Costs of Planned Efforts ($$$/FTE)
2.2.1	Identify authors of pathway management plans		VISAC	VDACS DGIF VMRC VIMS DOF DCR	2014		
2.2.2	Ensure pathway management plans identify funding and legal authority		VISAC	VDACS DGIF VMRC VIMS DOF DCR	2015		
2.2.3	Encourage state and federal pathway management cooperation		VISAC	VDACS DGIF VMRC VIMS DOF DCR MAANSTF			
3.1.1	Develop a priority early detection species list	USFWS	VISAC DCR	VDACS DGIF VMRC VIMS DOF NGOs USFWS USDA-APHIS USFWS	2013		$3600
3.1.2	Post early detection network contacts online		VISAC DCR		2012		
3.1.3	Provide early detection training	USFWS	VISAC DCR VCE		ongoing		$3600
3.1.4	Create and maintain an early detection listserv		VISAC DCR		2013		
3.1.5	Develop early detection training materials and workshops	USFWS	VISAC DCR VCE		2012		$3600
3.1.6	Create online early detection species identification guide	USFWS	VISAC DCR		2013		$3600
3.1.7	Post and promote an online early detection reporting form		VISAC DCR		2012		
3.1.8	Encourage local VCE agents to act as early detection contacts		VISAC VCE		2013		
3.2.1	Develop early detection data collection protocol		VISAC DCR		2012		

Action #	Action	Fund Source	Implementing Agency	Cooperative Agency	Time Frame	Cost of Recent Efforts ($$$/FTE)	Costs of Planned Efforts ($$$/FTE)
3.2.2	Ensure access to taxonomic expertise						
3.2.3	Promote and use iMapInvasives.org to share GIS data		VISAC DCR		2013		
3.2.4	Encourage archiving of confirmed new species introduction		VISAC				
3.2.5	Report confirmed new introductions to the VISAC and VISWG		VDACS DGIF DOF DCR				
3.2.6	Facilitate media coverage of new introductions		VISAC				
4.1.1	Form rapid response network planning teams for specific life form types		VISAC		2013		
4.2.1	Catalog existing response plans and assess need for more plans		VISAC		2013		
4.2	Identify rapid response funding		VISAC		2013		
4.3	Encourage interagency rapid response partnerships		VISWG	VISAC			
4.4	Facilitate media coverage of rapid response actions		VISAC				
4.5.1	Identify staff and potential private partners for rapid assessment teams		VISAC DCR		2013		
4.5.2	Conduct rapid assessment for verified new species introductions		VISAC				
4.5.3	Determine regulatory status of verified new introductions		VISAC				
4.5.4	Seek technical and other assistance from federal agencies		VISAC	USDA-APHIS USFWS			

Action #	Action	Fund Source	Implementing Agency	Cooperative Agency	Time Frame	Cost of Recent Efforts ($$$/FTE)	Costs of Planned Efforts ($$$/FTE)
5.1.1	Develop management plans for established high priority species		VISAC		2015		
5.2.1	Develop restoration plans for vulnerable ecosystems		VISAC		2015		
5.1.3	Encourage use of native plant species of restoration, soil conservation, and landscaping		VISWG	VISAC DCR VNPS	2012		
5.1.4	Identify information, staff, research, and budget needs for invasive species management		VISAC	VISWG	2013		
5.2.1	Evaluate potential incentive programs for private landowner control projects		VISAC	VISWG	2015		
5.2.2	Evaluate potential incentive programs for private landowner restoration projects		VISAC	VISWG	2014		
6.1.1	Identify ongoing invasive species research		VISAC		2013		
6.1.2	Support priority research needs with adequate staff and funding		VISAC				
6.2.1	Identify risk assessments of invasive species, develop list of “established high priority invasive species”		VISAC		2013		
6.2.2	Participate with federal agencies in development of screening system		VISAC				
6.2.3	Develop and implement a process for identifying likely introductions	USFWS	VISAC DCR		2014		$3600
6.2.5	Develop indicators for evaluating invasive species impacts		VISAC DCR		2014		
7.1.1	Develop programming for Master Naturalists to take into classrooms	USFWS	VISAC	VCE DCR	2013		$3600

Action #	Action	Fund Source	Implementing Agency	Cooperative Agency	Time Frame	Cost of Recent Efforts ($$$/FTE)	Costs of Planned Efforts ($$$/FTE)
7.1.2	Use Internet outlets to distribute educational materials		VISAC DCR				
7.1.3	Use on-the-ground actions to engage communities in management of invasive species		VISAC	VCE DOF VNPS DCR TNC	ongoing		
7.1.4	Ensure VCE staff have training, tools, and information to educate public on invasive species	USFWS	VISAC DCR	VCE	2013		$3600
7.2.1	Create listserv and social media channels for distributing invasive species news and information		VISAC DCR		2013		
7.2.2	Connect to wider circle of stakeholders, including garden clubs, botanical gardens, and landscape architects associations		VISAC DCR		ongoing		

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APPENDICES

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Appendix A

GLOSSARY

aquatic nuisance species are a sub-set of invasive 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

2009 Invasive Species Working Group Enabling Legislation

Code of Virginia

§ 2.2-220.2. Development of strategies to prevent the introduction of, to control, and to eradicate invasive species.

A. The Secretaries of Natural Resources and Agriculture and Forestry shall coordinate the development of strategic actions to be taken by the Commonwealth, individual state and federal agencies, private businesses, and landowners related to invasive species prevention, early detection and rapid response, control and management, research and risk assessment, and education and outreach. Such strategic actions shall include the development of a state invasive species management plan. The plan shall include a list of invasive species that pose the greatest threat to the Commonwealth. The primary purposes of the plan shall be to address the rising cost of invasive species, to improve coordination among state and federal agencies' efforts regarding invasive species prevention and management and information exchange, and to educate the public on related matters. The Secretaries of Natural Resources and Agriculture and Forestry shall update the state invasive species management plan at least once every four years. The Department of Conservation and Recreation shall provide staff support.

B. The Secretary of Natural Resources shall establish and serve as chair of an advisory group to develop an invasive species management plan and shall coordinate and implement recommendations of that plan. Other members of the advisory group shall include the Departments of Conservation and Recreation, Game and Inland Fisheries, Environmental Quality, Forestry, Agriculture and Consumer Services, Health, and Transportation; the Marine Resources Commission; the Virginia Cooperative Extension; the Virginia Institute of Marine Science; representatives of the agriculture and forestry industries; the conservation community; interested federal agencies; academic institutions; and commercial interests. The Secretary of Agriculture and Forestry shall serve as the vice-chair of the advisory group. The advisory group shall meet at least twice per year and shall utilize ad hoc committees as necessary with special emphasis on working with affected industries, landowners, and citizens, and shall assist the Secretary to:

1. Prevent additional introductions of invasive species to the lands and waters of the Commonwealth;

2. Procure, use, and maintain native species to replace invasive species;

3. Implement targeted control efforts on those invasive species that are present in the Commonwealth but are susceptible to such management actions;

4. Identify and report the appearance of invasive species before they can become established and control becomes less feasible;

5. Implement immediate control measures if a new invasive species is introduced in Virginia, with the aim of eradicating that species from Virginia's lands and waters if feasible given the degree of infestation; and

6. Recommend legislative actions or pursue federal grants to implement the plan.

C. As used in this section, "invasive species" means a species, including its seeds, eggs, spores or other biological material capable of propagating that species, that is not native to the ecosystem and whose introduction causes or is likely to cause economic or environmental harm or harm to human health; however, this definition shall not include (i) any agricultural crop generally recognized by the United States Department of Agriculture or the Virginia Department of Agriculture and Consumer Services as suitable to

be grown in the Commonwealth, or (ii) any aquacultural organism recognized by the Marine Resources Commission or the Department of Game and Inland Fisheries as suitable to be propagated in the Commonwealth.

Nothing in this section shall affect the authorities of any agency represented on the advisory group with respect to invasive species.

(2009, cc. 144, 619.)

Appendix C

Virginia Invasive Species Working Group Members with Alternates

The Honorable Douglas W. Domenech
Chairman of the Working Group
Secretary of Natural Resources
Patrick Henry Building
1111 East Broad Street
Richmond, VA 23219
(804) 786-0044

The Honorable Todd Haymore
Vice-Chair of the Working Group
Secretary of Agriculture and Forestry
Patrick Henry Building
1111 East Broad Street
Richmond, VA 23219
(804) 692-2512, Todd.Haymore@Governor.Virginia.Gov

Karen Kanody -- Commercial
Dominion Power
4111 Castlewood Road
Richmond, VA 23234
(804) 273-3893, karen.k.kanody@dom.com

Tom Thompson -- Agriculture Industry
Natural Art Landscaping
3540 South Belmont Road
Richmond, VA 23234
naturalartlandscaping@yahoo.com

Greg Scheerer -- Forest Industry
MeadWestvaco
7057 Richmond Hwy.
Appomattox, VA 24522
(434) 352-7132, greg.scheerer@mwv.com

David Phemister -- Conservation Community
The Nature Conservancy
490 Westfield Road
Charlottesville, VA 22901
(434) 951-0571, dphemister@tnc.org

Ken Landgraf
Planning & Forest Ecology Group Staff Officer
George Washington and Jefferson National Forests
5162 Valleypointe Parkway

Roanoke, VA 24019-3050
(540) 265-5170
klandgraf@fs.fed.us

Shepard M. Zedaker, Ph.D. -- Academic Institution
Virginia Polytechnic Institute & State University
Department of Forestry
313 Cheatham Hall-0324
Blacksburg, VA 24061
(540) 231-4855, zedaker@vt.edu

P. Loyd Hipkins, Ph.D. -- VA Coop. Extension
Virginia Polytechnic Institute and State University
Department of Plant Pathology, Physiology and Weed Science
Glade Road Research Center (0330)
Blacksburg, VA 24061-0330
(540) 231-9842, lhipkins@vt.edu

Matt Lohr, Commissioner
Department of Agriculture and Consumer Services
1100 Bank Street
Richmond, VA 23219
(804) 786-3501, Matt.Lohr@vdacs.virginia.gov
Alternate: Larry Nichols
(804) 786-3515, Larry.Nichols@vdacs.virginia.gov

Carl E. Garrison, III, State Forester
Department of Forestry
Fontaine Research Park
900 Natural Resources Drive, Suite 800
Charlottesville, VA 22903
(434) 977-6555, carl.garrison@dof.virginia.gov
Alternate: Chris Asaro
(434) 977-6555, Chris.Asaro@dof.virginia.gov

David A. Johnson, Director
Department of Conservation and Recreation
203 Governor Street, 3rd Floor
Richmond, VA 23219
(804) 786-2123, david.johnson@dcr.virginia.gov

David Paylor, Director
Department of Environmental Quality
629 East Main Street
PO Box 1105
Richmond, VA 23218
(804) 698-4020, David.Paylor@deq.virginia.gov
Alternate: Rick Weeks
Rick.Weeks@deq.virginia.gov

Jack Travelstead, Commissioner
Marine Resources Commission
2600 Washington Avenue, 3rd Floor
Newport News, VA 23607
(757) 247-2200, jack.travelstead@mrc.virginia.gov
Alternate: Robert O'Reilly
(757) 247-2200, rob.o'reilly@mrc.virginia.gov

Karen Remley, Commissioner
Department of Health
1500 E. Main Street
Main Street Station, Room 214
Richmond, VA 23219
(804) 864-7005, Karen.Remley@vdh.virginia.gov

Gregory A. Whirley Sr., Commissioner
Department of Transportation
1401 E. Broad Street
Richmond, VA 23219
(804) 786-2701, GA.Whirley@vdot.virginia.gov
Alternate: Brian Waymack
(804) 786-0967, Brian.Waymack@vdot.virginia.gov

Bob Duncan, Director
Department of Game and Inland Fisheries
4010 W. Broad Street
Richmond, VA 23230
(804) 367-1000, Bob.Duncan@dgif.virginia.gov
Alternate: Ray Fernald
(804) 367-8364, ray.fernald@dgif.virginia.gov

John T. Wells, Director
Virginia Institute of Marine Science
P.O. Box 1346
Gloucester Point, Virginia 23062-1346
(804) 684-7103, wells@vims.edu
Alternate: Roger Mann
(804) 684-7360, rmann@vims.edu

Appendix D

Virginia Invasive Species Advisory Committee

Christopher Asaro, Ph.D., Virginia Department of Forestry

Bernetta Barco, US Department of Agriculture, Animal and Plant Health Inspection Service

Scott Barras, US Department of Agriculture, Animal and Plant Health Inspection Service

Margaret Chatham, Virginia Native Plant Society

Gwynn Crichton, The Nature Conservancy

Pam Dinkle, Tri-County Lake Administrative Commission

Ruth Douglas, Ph.D., Virginia Native Plant Society

Ray Fernald, Virginia Department of Game and Inland Fisheries

Kevin Heffernan, Virginia Department of Conservation and Recreation

Greg Garman, Ph.D., Virginia Commonwealth University

P. Lloyd Hipkins, Ph.D., Virginia Polytechnic Institute and State University, Department of Plant Pathology, Physiology and Weed Science

Todd Lookingbill, Ph.D., University of Richmond

Roger L. Mann, Ph.D., Virginia Institute of Marine Science, College of William and Mary

Lisa Moss, Virginia Fishery Coordinator Office, U.S. Fish and Wildlife Service

Rick Myers, Ph.D., Virginia Department of Conservation and Recreation

Richard J. Neves, Ph.D., Virginia Polytechnic Institute and State University

Larry Nichols, Plant Industry Services, Department of Agriculture and Consumer Services

Tom Smith, Virginia Department of Conservation and Recreation

Bill Tanger, Friends of the Rivers of Virginia

APPENDIX E

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 Plant Industry Services 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.

			from plants	3.1-188.34 Penalty: Any person who imports a plant pest into Virginia is guilty of a Class 1 misdemeanor. § 3.1- 188.47
European Black Currant Quarantine	2 Va. Admin. Code § 4-450- 10	VDACS	European black currant	Quarantine imposed under the Plants and Plant Products Inspection Law and Virginia Pest Law
Noxious Weed Law	§§ 3.1-296.11 to .21	VDACS	Any plant declared to be detrimental to crops, surface waters, desirable plants, livestock, land, or property	Provides that VDACS "shall make surveys for noxious weeds." § 3.1-296.13 Quarantine authority: VDACS authorized to impose statewide quarantines in order to eradicate or prevent the spread of a noxious weed. § 3.1-296.14 Penalty: Any person who imports a plant pest into Virginia is guilty of a misdemeanor. §§ 3.1-296.16, .18.
Control of Avian Influenza	§§ 3.1-741.3 to .6; 2 Va. Admin. Code §§ 5-190-10 to 5-195-180.	VDACS	Any avian species or egg from an area where H5 or H7 avian influenza has been found	Empowers VDACS to promulgate and enforce regulations designed to prevent the spread of avian influenza.
Powers of Department of Conservation and Recreations Officers	§§ 10.1-104, -116 to -117.	VDCR		The VDCR "may promulgate regulations necessary to to carry out the purposes and provisions of [§§ 10.1-100 to -1026]. A violation of any regulation shall constitute a Class 1 misdemeanor unless a different penalty is prescribed . . . ." § 10.1-100(B). Conservation officers have jurisdiction to enforce Virginia law and VDCR regulations on all lands and waters under