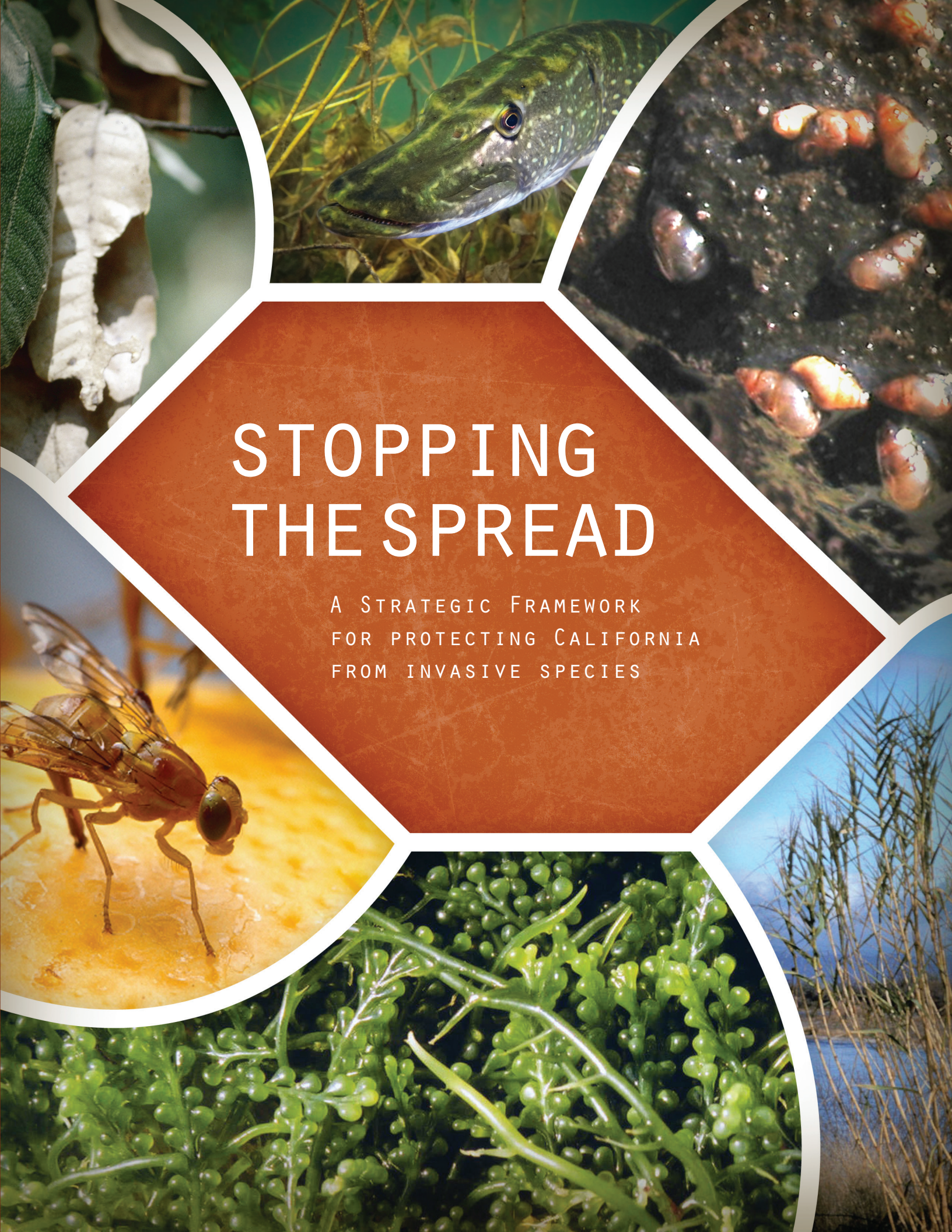


STOPPING THE SPREAD

A Strategic Framework for protecting California from invasive species

A report prepared by the California Invasive Species Advisory Committee and approved by the Invasive Species Council of California on August 2, 2011

Secretary Karen Ross (Chair)
Department of Food and Agriculture

Secretary John Laird (Vice Chair)
Natural Resources Agency

Secretary Matthew Rodriquez
Environmental Protection Agency

Acting Secretary Traci Stevens
Business, Transportation and Housing Agency

Secretary Diana S. Dooley
Health and Human Services Agency

Acting Secretary Mike Dayton
Emergency Management Agency

www.iscc.ca.gov

Cover photos, clockwise from top left: Sudden oak death caused by the pathogen *Phytophthora ramorum*, northern Pike (*Esox lucius*), a freshwater predator; New Zealand mudsnail (*Potamopyrgus antipodarum*) from a stream; giant reed (*Arundo donax*); grape caulerpa (*Caulerpa racemosa*), an aquatic alga; Mexican fruit fly (*Anastrepha ludens*), laying eggs on citrus.

EXECUTIVE SUMMARY

California's diverse peoples and landscapes are world-renowned. The Mediterranean climate and varied topography provide for a stunning array of ecosystems, while rich soils provide abundant agricultural productivity. However, California's natural environment, agriculture, public health and economy are all at risk.

Invasive species, defined as "non-native organisms which cause economic or environmental harm," present a significant risk to the top agricultural economy in the country, valued at $36 billion. While difficult to quantify, the impacts to the environmental health of the state are also indisputably substantial. The risk continues to increase as modern travel and trade open new and broader avenues for the introduction of these harmful organisms into California.

In 2009, state agencies created the Invasive Species Council of California (ISCC), following the lead of the federal government and more than a dozen other states. The ISCC appointed 24 stakeholder representatives to the California Invasive Species Advisory Committee (CISAC), which provides recommendations for a series of interrelated actions to strengthen the state's response to invasive species over the next three years. The ISCC will update this plan as circumstances change, with a comprehensive revision by the end of 2014. Annual progress reports will be prepared.

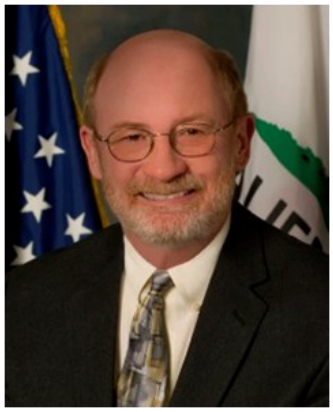
The goal of this framework is to reduce the damage caused by invasive species in California by improving the effectiveness of our response. Although all of the recommended actions are important, we believe that the following five actions provide the overarching conditions needed to implement the rest of the structure and should be implemented as soon as possible.

1. **Create and fund a Rapid Response Working Group. (DR-1)**
2. **Identify and address new and existing pathways for entry and movement of invasive species. (PE-1)**
3. **Increase interagency communication to ensure coordinated prevention approaches. (PE-2)**
4. **Develop and deliver a consistent outreach message based on stewardship. (OPE-1)**
5. **Secure adequate long-term funding to sustain effective invasive species programs. (LC-1)**

This plan provides a blueprint for stopping the spread of invasive species in California. Acting now to strengthen our response to invasive species is vital to protecting California for future generations.

Invasive Species Council of California Message

Secretary Karen Ross



Secretary John Laird

It is our pleasure to introduce the California Strategic Framework: "*Stopping The Spread: A Strategic Framework For Protecting California From Invasive Species*." This is our blueprint for stopping the introduction and spread of invasive species in California. Acting now to strengthen our response to invasive species is vital to protecting California's natural resources, farms and environment for generations to come.

In 2009, California agencies created the Invasive Species Council of California (ISCC). The ISCC appointed 24 stakeholder representatives to the California Invasive Species Advisory Committee (CISAC), which recommends actions to strengthen the state's response to invasive species.

In 2010, the first draft of the Strategic Framework was released for a 45-day public comment period. CISAC held four public listening sessions throughout the state. Changes were made based on that feedback, and the second draft of the Strategic Framework was finalized in 2011. Due to the change in administration and new members of the ISCC, an additional comment period was opened and an additional listening session was conducted in Sacramento, which was also available via webinar.

Stopping The Spread lays out 46 recommendations broken out into different categories, including Leadership and Coordination; Prevention and Exclusion and Outreach and Public Engagement. The Strategic Framework is an excellent resource for various California state agencies and others as they continue their efforts to prevent, reduce, and control the establishment of invasive species in our state. The ISCC is sincerely grateful for the tireless efforts and continued commitment of the CISAC to the goals and ideals on which the CISAC was established.

The Strategic Framework represents the collective input of a range of experts, and has been vetted by stakeholder communities. The ISCC will update this plan as circumstances change, with plans for a comprehensive revision by the end of 2014. The recently initiated series of 21st Century Pest Management Symposia will also serve as a valuable resource as we look to continue this important work on invasive species.

Karen Ross

Chair, Invasive Species Council of California

Secretary, California Department of Food and Agriculture

John Laird

Vice-Chair, Invasive Species Council of California

Secretary, California Natural Resources Agency

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INTRODUCTION

PROTECTING OUR HERITAGE

California is genuinely unique. Our temperate climate and varied landscape support a suite of plants and animals found nowhere else on the planet. Rich soils produce more than 400 agricultural commodities that account for a large portion of the nation's food supply, and over 11 percent of U.S cash farm receipts. Our population is a diverse mix of ethnic backgrounds, from Native Americans, whose ancestors lived here for hundreds of generations, to the many others who have arrived in recent centuries and who continue to join our community every day. This natural and cultural heritage is in our keeping, held in trust for future generations.

Invasive species are a serious global problem. These species cause economic and environmental harm in California, increasingly compromising ecological and agricultural systems that our well-being depends upon. Given resources and resolve, we can address the problem effectively.

HARM FROM INVASIVE SPECIES

Invasive species are organisms that have invaded California from elsewhere and that damage our environment, agricultural production, public health, and economy. Some of these organisms were introduced inadvertently while others were introduced intentionally, without consideration of the harm they might cause. Although most of the thousands of species brought into our state cause little or no apparent harm, a few are able to thrive in California to the detriment of native biological diversity, recreation, agriculture, infrastructure, and public health. Though it is difficult to compute harm from invasive species in financial terms, an often-cited report from Cornell University conservatively places the cost to the United States at over $100 billion each year. (The scientific literature on invasive species and their impacts is extensive. For examples, see citations at www.invasivespeciesinfo.gov.)

These invasive species range from diseases such as the insidious sudden oak death, to 200-pound feral pigs; from quagga mussels that clog waterways to insects that infest crops and forests. Some introduced species are voracious predators, others out-compete native species for resources, and some are capable of re-engineering the environment to suit their preferences, changing hydrology, soil chemistry and fire regimes.

Invasive species have a range of damaging impacts that touch all of our lives. They are detrimental to California's agriculture and food supply. They cause harm to home gardens, landscaping and structures. They interfere with water supply and place financial burdens on public infrastructure. They present public health risks due to organisms that transmit disease, or create hazards such as dead trees susceptible to wildfire. They degrade recreational activities from hunting to boating, camping, and hiking. They harm California's wildlife by disrupting native plant and animal communities. Collectively, invasive species are recognized as

a major threat to biodiversity; they significantly impact over half of all federally listed threatened and endangered species. Eminent ecologist E.O. Wilson of Harvard University proposes that the ecological harm wrought by invasive species is second only to that caused by habitat loss.

Programs addressing invasive species can also have impacts. For example, removing invasive plants on sensitive stream banks may require extensive replanting to avoid erosion. Eradicating northern pike from California's Lake Davis stressed the local tourist economy. Use of control methods to manage invasive species can have public health and environmental impacts that must always be considered. Entire crops must sometimes be destroyed to keep species from spreading. Weighing such factors is a critical part of planning response programs. Prevention is key for minimizing management risks, as are strong programs with proactive strategies for responding appropriately to invasive species that do get inroduced or established in California.

STRATEGIES FOR A STRONG AND HEALTHY CALIFORNIA

In 2008, the National Invasive Species Council generated a revised federal management plan, laying out a blueprint for action. Increasingly, states are following this lead, seeking the benefits of a coherent plan to coordinate the many agencies whose missions touch on the problem. Our plan for California builds on two existing plans, the California Noxious & Invasive Weed Action Plan (2005) and the California Aquatic Invasive Species Management Plan (2008). These plans provide extensive and detailed recommendations for improving particular aspects of the state's invasive species response infrastructure. This current plan consolidates important themes from those plans and fills gaps.

California has valuable institutional assets on which to build, with many long-standing and effective pest detection and response programs. Today's mounting challenges require strengthening these existing programs and developing innovative new ones. This plan recommends high-priority actions, broken into six complementary strategic sections. Our recommendations do not suggest responsible entities, timelines, necessary resources, or performance measures. Identifying these will be early tasks for implementing each action. Many of the actions connect to other recommended actions. This comprehensive approach can keep California's environment, agriculture, and economy strong and healthy.

THE TIME IS RIGHT

In 2009, the Invasive Species Council of California (ISCC) and the California Invasive Species Advisory Committee (CISAC) were formed to bring relevant agencies—state, federal and local—together with external stakeholders to develop and implement effective measures to forestall the harm caused by invasive species. In 2010, these collaborative bodies produced the state's first comprehensive list of invasive species (online at www.ice.ucdavis.edu/invasives).

AB 2763, signed by the Governor in 2008, directed state agencies, under the leadership of the California Department of Food and Agriculture to strengthen planning to anticipate

the potential responses needed for future invasive species. Decisive action upon discovery of a new invasive species is critical, and broad-based public support for appropriate control options must be in place to address new infestations in a timely manner. This strategic plan seeks to contribute to advance planning and to strengthen program effectiveness.

The plan represents the collective input of a range of experts, and has been vetted by stakeholder communities. Ideally, it should be revisited regularly to add and adjust recommendations and incorporate input from an even broader base of contributors. We intend for the entire plan to be revised by the end of 2013. The invasive species threat grows each year, but never before have there been as many tools and partners for addressing the problem. California is positioned to be a leader in this field, and for the sake of future generations it is vital that we seize this opportunity to act.

"Invasive species are everywhere. They damage our crops, our industries, the environment and public health. Scientists, academics, leaders of industry, and land managers are realizing that invasive species are one of the most serious environmental threats of the 21st century."

— *Meeting the Invasive Species Challenge: Management Plan, National Invasive Species Council, 2001*

SUMMARY LIST OF RECOMMENDED ACTIONS

LEADERSHIP AND COORDINATION

LC-1. Secure adequate long-term funding to sustain effective invasive species programs.

LC-2. Share responsibility for invasive species outreach more equally among ISCC agencies.

LC-3. Formalize the ISCC and CISAC for long-term stability.

LC-4. Review California laws and regulations affecting invasive species response.

LC-5. Build a strong coalition of stakeholder groups.

LC-6. Create an online clearinghouse for information on invasive species programs, laws, and research.

LC-7. Create a working group to review public health risks of invasive species and their management.

PREVENTION AND EXCLUSION

PE-1. Identify and address new and existing pathways for entry and movement of invasive species.

PE-2. Increase interagency communication to ensure coordinated prevention approaches.

PE-3. Support uninterrupted high-risk inspection activities.

PE-4. Develop and Implement Best Management Practices (BMPs) to prevent invasive species spread.

PE-5. Partner with import industries to improve preventive screening.

PE-6. Encourage individual actions to prevent entry of invasive species.

PE-7. Maintain a list of invasive species that harm or could harm California.

PE-8. Strengthen California's restrictions on live non-agricultural animal imports.

PE-9. Adopt strong guidelines for biofuel production.

PE-10. Include invasive species prevention in California Environmental Quality Act (CEQA) compliance.

DETECTION AND REPONSE

DR-1. Create a standing Rapid Response Working Group to guide response to new invasive species, supported by a Rapid Response emergency fund.

DR-2. Complete a Program Environmental Impact Report (PEIR) for response to new invasive species.

DR-3. Align regulatory processes to facilitate rapid response and eradication of newly discovered invasive species.

DR-4. Expand invasive species surveillance efforts, integrating new tools in risk assessment to set priorities.

DR-5. Formalize a standard rapid response plan.

DR-6. Train key individuals and organizations to detect new invasive species.

DR-7. Continue to train staff for rapid response.

ERADICATION AND MANAGEMENT

EM-1. Expand biological control efforts.

EM-2. Support regional collaborations and public-private partnerships.

EM-3. Increase the number of field biologists working on invasive species.

EM-4. Increase on-the-ground workforce and job training for invasive species management.

EM-5. Develop more effective management tools and restoration techniques.

EM-6. Establish standardized mapping and reporting protocols.

EM-7. Strengthen the state's invasive plant listing process and rating systems.

EM-8. Minimize invasive plant spread along roadsides and utility corridors.

EM-9. Develop and implement prioritization models for managing invasive species.

EM-10. Expand training programs for using Integrated Pest Management (IPM) principles and Best Management Practices (BMPs).

OUTREACH AND PUBLIC ENGAGEMENT

OPE-1. Develop and deliver a consistent outreach message based on stewardship.

OPE-2. Provide clear public health information for invasive species management.

OPE-3. Support inclusion of invasive species in environmental education curricula.

OPE-4. Establish activities to engage public participation.

OPE-5. Evaluate effectiveness of outreach and public engagement techniques.

OPE-6. Facilitate effective participation by volunteer groups.

FUNDAMENTAL AND APPLIED RESEARCH

FAR-1. Assess the ecological, agricultural and economic impacts of invasive species in California.

FAR-2. Study the biology of invasive species to support effective management.

FAR-3. Study restoration outcomes.

FAR-4. Study interactions of native species and invasive species.

FAR-5. Address invasive species in relation to climate change and other high-visibility issues.

FAR-6. Research new invasive species control methods and expedite the assessment of existing methods.

STRATEGIES AND RECOMMENDED ACTIONS

LEADERSHIP AND COORDINATION

Invasive species are varied and impact many different aspects of our lives. Consequently, they are addressed by a multitude of organizations in California. Agencies from federal to local touch on the issue, as well as non-governmental organizations ranging from the Sierra Club to the California Farm Bureau Federation, and watershed restoration groups to 4-H clubs. Both public and private landowners need to be involved in invasive species prevention and management. Coordination of this wealth of organizational capacity is essential to ensure maximum effectiveness—invasive species do not stop at property lines, recognize political boundaries, or acknowledge inter-agency lines of authority. Achieving a high level of coordination takes focused leadership that clearly delineates roles and responsibilities, expedites exchange of information, eliminates duplicate or conflicting efforts, and maximizes scarce financial and human resources.

LC-1. Secure adequate long-term funding to sustain effective invasive species programs.

California agencies have extensive potential capacity to conduct invasive species prevention, detection, and management activities. Our research universities can find improved tactics for addressing invasive species, but, these activities require steady funding (and offer significant job-creation potential). The state's long-term planning should include providing consistent, long-term funding for invasive species programs at a level commensurate with the hazard they pose to California's economy, agriculture and environment. Sources for funding programs include state general fund dollars, fees and fines related to invasive species impact, federal grants, and private foundation grants. Innovative new funding mechanisms should be explored, as well as the feasibility of establishing a special emergency fund to use for quick response to new finds of fast-spreading invasive species. Additional funding for both fundamental and applied research on invasive species such as that conducted by the University of California's Exotic Invasive Pests and Diseases Research Program is critical. Equitable linkages of costs to risks should be evaluated, and existing fine schedules, such as those imposed at border inspection stations, should be reviewed. Annual agency expenditures on invasive species programs should be tracked, aggregated, and reported.

LC-2. Share responsibility for invasive species outreach more equally among ISCC agencies.

Among state agencies, the Department of Food and Agriculture currently bears primary responsibility for informing the public about the invasive species issue as it relates to agricultural damage. The Natural Resources Agency has an aggressive campaign to inform boaters, anglers, water users, and

recreationalists. Sharing responsibility among all ISCC agencies would diversify perspectives and increase credibility for many Californians who are unaware of the range of harmful effects of invasive species. Particularly in urban areas, invasive species are often perceived primarily in an agricultural context, in which farmers need to control weeds or crop pests as a cost of doing business. Additional information on impacts to our environment, infrastructure, recreation, and public health and safety can engage Californians in more fully understanding the effect invasive species have on their lives, and the benefits of preventing introductions.

LC-3. Formalize the ISCC and CISAC for long-term stability.

The ISCC and CISAC play a role in facilitating leadership and coordination through their member agencies and stakeholder representatives. To ensure that the work underway continues and to maintain this valuable forum for coordinating state programs, the state should formally institutionalize the Invasive Species Council of California and the California Invasive Species Advisory Committee. This can occur through an executive order, legislation, or other legal action that provides long-term stability and the appropriate level of flexibility and authority for the groups. The council and committee should receive appropriated funding to cover their basic administrative functions, including preparation of regular progress reports, plus modest project budgets for communications and outreach activities.

LC-4. Review California laws and regulations affecting invasive species response.

Though California's legal authority with regard to invasive species is relatively strong, a formal review of existing state and federal laws and regulations should be conducted to identify and address gaps in responsibility, and to clarify lead agencies and scopes of authority. Existing state-by-state comparisons of invasive species laws and regulations can provide a basis for recommendations to improve California's existing legal authority regarding invasive species.

LC-5. Build a strong coalition of stakeholder groups.

CISAC's broad membership provides a natural point of connection with many partners. This represents an excellent opportunity to broaden the response to invasive species in California. Organizations should be encouraged to adopt the CISAC statement of principles, and CISAC should maintain regular communication with these partners.

LC-6. Create an online clearinghouse for information on invasive species programs, laws, and research.

The extensive and varied information on invasive species is not easily accessible in a single online location. California should create a portal that provides access to information on state programs, legal authorities, educational resources, research findings, management tools, Best Management Practices for prevention, press materials, directories of experts and key contacts, reporting hotlines, and any other relevant topics. Such a portal

would enhance the ability of Californians to access information on risk assessments underlying program priorities. New online media offer powerful tools to increase public engagement through such a site.

LC-7. Create a working group to review public health risks of invasive species and their management.

Both invasive species and some methods used to control them can impact public health. Agencies including the US and California Environmental Protection Agencies, the California Health and Human Services Agency, and the California Office of Environmental Health Hazard Assessment are key players in evaluating health impacts of invasive species and control methods. Science-based public interest groups also play an important role in evaluating risks and communicating with decision-makers and the public. Because public trust and support is fundamentally vital to the success of programs addressing invasive species, it is important to go beyond the level of public review required by environmental regulations to make sure that risk assessments performed by public health professionals (and the decision making based on them) are as fully vetted as possible. A working group should be formed to provide a forum for open discussion of public health risks and implications for invasive species management programs, and to make recommendations for improvements that will minimize those risks. The working group should include balanced representation from state, county, university and non-governmental public health scientists, and should consider topics including pesticide inert ingredients, sensitive populations, and cumulative exposure to multiple pesticides. Useful guidance can be provided by those county Integrated Pest Management (IPM) programs that actively engage in such issues at the local level. This working group can help ensure that public health considerations of invasive species programs are a priority and assessed in a scientifically rigorous and transparent manner.

"Alien species that become invasive are considered to be a main direct driver of biodiversity loss across the globe. In addition, alien species have been estimated to cost our economies hundreds of billions of dollars each year."

— Convention on Biological Diversity, United Nations Environment Programme, www.cbd.int/invasive

PREVENTION AND EXCLUSION

The first line of defense and the most cost-effective strategy against the establishment of new invasive species is exclusion, to prevent their entry into California. Likewise, with invasive species already in California, it is critical to employ effective prevention practices to keep them from spreading to new areas. Both efforts require intervention into an extensive network of activities that can spread invasive species into and around the state. These "pathways" range from aquatic organisms carried on boat hulls, to food items and plants smuggled into the state, and programs to address these pathways require significant sophistication and resources to be effective.

PE-1. Identify and address new and existing pathways for entry and movement of invasive species.

Experts in invasive species detection continue to identify new and previously unrecognized pathways associated with the movement of people and trade, such as interstate and intrastate transport of firewood and express parcel shipments. Internet sales represent a rapidly expanding potential source of invasions. California needs a comprehensive study of entry and spread pathways for invasive species, including the most effective options for addressing each pathway. Research is needed to identify novel pathways, and to determine which pathways pose the greatest risk for new introductions. A range of disciplines, including anthropology and sociology, can make contributions to developing effective approaches to address each pathway. Researchers should work in partnership with public and private land managers to develop Best Management Practices (BMPs) for identifying new potential pathways and preventing the introduction and spread of invasive species.

PE-2. Increase interagency communication to ensure coordinated prevention approaches.

Many effective programs are already in place in California, but coordination between these programs can be improved. To increase effectiveness and efficiency, agencies – federal, state and local – as well as non-governmental organizations should participate in a regular forum to enhance communication, exchange information, and share tools. Such communication can be incorporated directly into invasive species projects as a requirement for funding. An example of coordination is the existing memorandum of understanding between federal, state and local agencies on standards for weed-free hay, straw and mulch. This cooperative agreement and others should receive sufficient resources to be implemented in an effective, comprehensive manner that provides incentives for innovation.

PE-3. Support uninterrupted high-risk inspection activities.

Local, state, and federal agencies perform a variety of essential inspection activities designed to minimize the risk of invasive species entering the state. Additional capacity is needed to address the expanding number of pathways and increasing volume of trade and traffic. Canine inspection teams are one especially effective component that should be considered for expansion.

PE-4. Develop and Implement Best Management Practices (BMPs) to prevent invasive species spread.

IInadvertent spread of invasive species can occur along numerous pathways, including hay used as horse feed or erosion control, construction materials, and recreational equipment. Many useful examples of BMPs exist already, and new ones continue to be developed, such as Yosemite National Park's model program for weed-free aggregate and mineral materials used for roads and construction. Incentives are needed to strengthen implementation of BMPs, and training and outreach materials are needed to address a wide range of audiences, such as recreational boaters and campers, firefighters, timber operators, maintenance workers for roads and utilities, and others. BMPs for management of linear corridors such as utility lines, railroads, roadways, and canals are of particular importance since they can provide dispersal vectors across significant distances. An online directory should be developed to make BMPs available and to provide updated information on sources of materials produced in accordance with preventive BMPs. Incentives for encouraging entities to follow applicable BMPs should be explored.

PE-5. Partner with import industries to improve preventive screening.

Industries such as the nursery, pet and aquarium trades that routinely import animal and plant material from areas with similar climates have a high potential to introduce invasive species. Efforts like the California Horticultural Invasives Prevention partnership show the potential for productive collaboration to explore improved methods for pre-screening import species to assess their risk of becoming invasive. Existing partnerships should be supported, and additional partnerships considered for other import industries.

PE-6. Encourage individual actions to prevent entry of invasive species.

Some entry pathways result from the actions of individuals. Thus is it important to make Californians aware of ways that they can help prevent the entry or spread of invasive species. Programs should convey the risk of invasive species to individual homeowners, their gardens and communities, as well as to California's environment and economy, and should focus on practical steps that citizens can take to help exclude invasive species.

PE-7. Maintain a list of invasive species that harm or could harm California.

Effective invasive species response requires good information on which non-native species are causing harm in the state, as well as which species could potentially cause harm. This effort commenced with the compilation of the California Invasive Species List, a living document released in April, 2010. Using a numerical grading system based on a standard list of analytical criteria, the list provides a common foundation for assessing the full range of species and impacts. This will serve as a baseline with which to measure future trends and progress. The list for California is compiled from a range of authoritative sources and covers all taxonomic areas. Scorecards rate each species' detrimental impacts (and any beneficial impacts) to California's environment, agriculture, infrastructure, culture, and public

health. Scorecards also rate the difficulty of addressing the impacts of the species, and what level of tools are already in place to do so. The list is set up to accept and display online comments from expert reviewers, and over 100 reviewers are currently signed up to contribute information. This is an essential aspect in that the information evolves rapidly, and the range of expertise on diverse taxa is difficult to assemble. This listing effort should continue and be further refined. Though no list can be truly comprehensive, this resource is a key foundation for work on invasive species in California.

PE-8. Strengthen California's restrictions on live non-agricultural animal imports.

California's restrictions on the importation of live animals (through the pet trade, live seafood, etc.) depend on a list of restricted species, which are illegal to import without a permit. Other states have strengthened their defenses against introduction of invasive fauna by creating complementary lists of allowed species that have been pre-cleared for import, and barring species that do not appear on either list until a thorough risk assessment shows a strong likelihood that the introduction will be safe. The benefits and costs of this approach should be reviewed for California, with examination of regulatory or legislative actions needed for implementation. Resources will be needed for adequate enforcement.

PE-9. Adopt strong guidelines for biofuel production.

Many of the plant and algal species being considered for use as biofuel crops are invasive. Their ability to grow fast with few inputs is part of their benefit. Strong guidelines should be developed to address screening of potential crops with an emphasis on use of non-invasive species, safe containment and transport of living materials, mitigation if the species does become a problem, and eventual restoration of lands when facilities are decommissioned.

PE-10. Include invasive species prevention in CEQA compliance.

Some projects that require review under CEQA have the potential to spread invasive species into wildland or agricultural areas Consideration of this potential effect should become a routine part of the CEQA review process by adding it to the Environmental Checklist Form in Appendix G of the CEQA Guidelines.

"Integrated pest management (IPM) is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment."

— UNIVERSITY OF CALIFORNIA, INTEGRATED PEST MANAGEMENT PROGRAM

DETECTION AND RESPONSE

Early detection and the ability to respond rapidly are critical for preventing wide-scale invasion of many organisms, particularly those with a high reproductive potential or a high dispersal capacity. As a new invasive species spreads, the cost of control rises, the feasibility of eradication falls, and the potential for economic and environmental impacts increases. Early detection requires targeted surveillance conducted by specialists, and can benefit from more casual "detection partners" who receive short training sessions in identification of key species. These individuals offer unique capacity because their normal activities cover vast areas of the state beyond the ability and resources of the specialists. Rapid response is essential to successfully eradicating newly arrived invasive species before they can become established. Upon initial detection, a delimitation survey determines the extent of the infestation. In conjunction with life cycle biological information, this provides an estimate of how long the species has been present in California. A science-based rapid response working group could produce a statewide overview to assess the potential impact of invasive species, guide regulations establishing authority, suggest priorities for action, design protocols for response within an Integrated Pest Management (IPM) framework, and establish a basis for adequate funding of response efforts. Control activities are undertaken by a responsible agency or group of agencies that specialize in on-the-ground projects appropriate to the particular invasive species.

DR-1. Create a standing Rapid Response Working Group to guide response to new invasive species, supported by a Rapid Response emergency fund.

Timely response to a new invasive species requires that technical expertise and infrastructure be in place. The Rapid Response Working Group would include representatives from all involved agencies, as well as individuals with taxonomic, environmental and public health expertise to provide technical guidance teams with expertise in specific invasive species. The working group would also include a range of stakeholder representatives who would serve to engage their communities in decision-making and outreach. The working group would oversee development and implementation of a standard rapid response plan, use of a rapid response emergency fund, training for staff likely to be involved in response activities, and collaborative commitments between agencies. Because it is impossible to know in advance the particulars of where a new infestation will be detected, and what type of organism it will be, and because prompt actions are most likely to be successful in stopping spread of an organism, the emergency fund provides critical flexibility to put the right resources to work in the right place, right away.

DR-2. Complete a Program Environmental Impact Report (PEIR) for response to new invasive species.

If appropriately designed and implemented, such a PEIR document will provide a sound basis for evaluation of invasive species response projects, while allowing for the rapid response necessary to contain and

possibly eradicate new infestations before they have a chance to spread. Article 11 §15168 of the Guidelines to the California Environmental Quality Act (CEQA) provides for the preparation of a PEIR under several circumstances, including "individual activities carried out under the same authorizing statutory or regulatory authority and having generally similar environmental effects which can be mitigated in similar ways." Use of a Program EIR offers advantages such as "more exhaustive consideration of effects and alternatives [and] . . . cumulative impacts that might be slighted in a case-by-case analysis" while avoiding "duplicative reconsideration of basic policy considerations" and allowing consideration of "broad policy alternatives and programwide mitigation measures at an early time when the agency has greater flexibility to deal with basic problems or cumulative impacts." It is likely that these advantages would all apply to the implementation of a PEIR as the first stage of environmental review for invasive species control measures. Currently, responses to each invasive species must be evaluated individually, even though many treatment options and impacts are similar. A detailed, comprehensive PEIR based on rigorous scientific principles could provide responsible agencies with an overarching environmentally compatible framework that evaluates the features of invasive species response programs that are common to similar organisms, while leaving unique aspects to be examined later on a site- and project-specific basis. In instances when such a PEIR does not fully evaluate and mitigate impacts (such as terrain, surrounding agricultural practices or land and water uses, and public exposure) related to a particular species, site, or project, a supplemental project-level EIR must be prepared, tiered upon the PEIR. This approach has significant benefits in terms of effective invasive species response and opportunity for public environmental review. CEQA-approved public processes including evaluation of alternatives and potential health impacts should be structured to maximize public engagement and review, above and beyond the minimum participation prescribed by law.

DR-3. Align regulatory processes to facilitate rapid response and eradication of newly discovered invasive species.

The regulatory process for responding to new invasive species can be cumbersome and time consuming, and can impede the implementation of even well-developed response strategies. Delay can lead to rapid expansion in the distribution of the species, thus increasing the cost and decreasing the success of eradication efforts. It is critical that invasive species response efforts find ways to work efficiently within existing regulatory structures by improving coordination among government agencies, land owners and managers, environmental groups, and private industry partners. A committee should be created to address regulatory coordination, with the goal of clarifying and aligning the environmental regulatory processes, including National Environmental Protection Act (NEPA), CEQA, Endangered Species Act (ESA), and the National Pollutant Discharge Elimination System (NPDES). Contracts should be developed for use by multiple agencies and organizations to enable full environmental compliance while maintaining the ability to respond to invasive species in a timely and effective manner.

DR-4. Expand invasive species surveillance efforts, integrating new risk assessment tools to set priorities.

Surveillance efforts that lead to rapid response are more cost-effective than eradication of invasive species populations that have become established. These efforts should be expanded. Integrating knowledge of how invasive species respond to California's specific environmental conditions can help efficiently focus surveillance efforts on high-risk locales. New developments in geospatial risk assessment using, for instance, climatic parameters, water pH, or presence of native predators can help delimit the expected range of occurrence of a new invasive species.

DR-5. Formalize a standard rapid response plan.

Building on existing tools, the state should develop, publicize and use a standard rapid response plan. This plan will describe protocols for science-based assessment, public engagement, environmental permitting, quarantine authority, and efficient decision-making based upon a modified Incident Command System. The plan should address the full range of situations anticipated for new invasive species finds, based on types of organism and introduction pathway.

DR-6. Train key individuals and organizations to detect new invasive species.

Expanding the pool of "citizen scientists" and "detection partners" who can recognize, collect and report new invasive species has the highest benefit-to-cost ratio of options to extend the detection capabilities of existing programs. Non-governmental organizations (NGOs) or university cooperative extensions could identify key partners and perform awareness and recognition training similar to the First Detector Training Program operated by the National Plant Diagnostic Network (a division of the Department of Homeland Security). In addition, appropriate tools to facilitate reporting of sightings should be developed, similar to the online system created by the Bay Area Early Detection Network and Calflora.

DR-7. Continue to train staff for rapid response.

An ongoing program of proactive training on rapid response techniques is needed. Regular training on the Incident Command System, rapid response techniques and options should continue to be provided to new employees, to those changing job responsibilities within an agency, and as part of continuing education to existing staff. Such training should include real-world experience, and make provision for the timely transfer of information from field staff to policymakers. Continuing Education Units or a similar methodology should be established as target training requirement, tiered across levels of staff and management to ensure high proficiency in rapid response approaches.

ERADICATION AND MANAGEMENT

Management efforts address invasive species already established in California, with the goal of reducing impacts. Eradication of an invasive species means eliminating the species entirely from a given area, and is the ideal goal of management, though this is seldom feasible if the species is already well-established. Nonetheless, management of invasive species already widespread remains important in order to protect areas and critical resources not yet impacted. Management efforts should employ Integrated Pest Management (IPM), an ecosystem-based strategy for the long-term prevention of pest damage through a combination of low-risk techniques. (See Glossary for full definitions)

EM-1. Expand biological control efforts, when appropriate.

For invasive species that are already widespread, biological controls may be the best and most economical long-term strategy for management. To be effective, biological control efforts must involve collaboration among federal, state, and local agencies, as well as university researchers. It is recommended that biological control efforts be increased among involved state and local agencies for targeted invasive species, and that cooperation and integration with the United States Department of Agriculture biological control programs be strengthened.

EM-2. Support regional collaborations and public-private partnerships.

All invasive species management happens in a given place, and local involvement is essential to successful management. Bringing agencies together with important partners to prioritize, coordinate, and implement local invasive species management projects (for example, as is done by Weed Management Areas in cooperation with the county agricultural commissioners) is a cost-effective strategy, well-adapted to local conditions, that merits ongoing financial support. Other models for regional partnership can also add value and provide for sustained efforts. Such efforts should be supported.

EM-3. Increase the number of field biologists working on invasive species.

The ranks of state agency biologists working on invasive species have been reduced significantly, thus weakening the state's ability to manage invasive species. County agricultural commissioners lead local efforts to implement and coordinate many management programs. Their work needs regional support from state biologists, who provide coordination and linkage to state labs.

EM-4. Increase on-the-ground workforce and job training for invasive species management.

On-the-ground invasive species management conducted by existing organizations such as the California Conservation Corps and local conservation corps contribute to the workforce addressing invasive species, offer excellent opportunities for job training and provide significant potential for job creation. This workforce and job training should be increased.

EM-5. Develop more effective management tools and restoration techniques.

Existing management tools and techniques can be improved to increase long-term effectiveness. It is recommended that the state invest in the development and implementation of new science-based invasive species management tools as well as techniques for restoring high-value ecosystems to meet desired habitat conditions. Improved tools and techniques can be developed through active partnerships between researchers and practitioners, as well as funding and permitting agencies. These partnerships are also important for rapid transfer of new technologies to the field.

EM-6. Establish standardized mapping and reporting protocol.

Mapping invasive species is fundamentally important for guiding management efforts and enabling long-term monitoring. Standard basic mapping protocols should be established, central aggregation structures put in place, and resources dedicated to increasing the quantity and quality of spatial data on invasive species. All eradication and control projects should be required to generate appropriate maps and project reports. Project reports should be aggregated in an accessible database, such as the Natural Resources Project Inventory. These programs should be designed to mesh with multi-state and national invasive species mapping activities.

EM-7. Strengthen the state's invasive plant listing process and rating systems.

California should examine the potential benefits of the transparent "weed board" approach used by many other states to integrate university and stakeholder expertise. Existing rating systems should be modified to officially recognize invasive plants whose harmful impacts are primarily environmental. Many projects across the state work to address these plants, including projects funded by the state, and some future federal funding can only be utilized for formally recognized species. In addition to listing species, such a board can play a critical role in evaluating invasive plant program effectiveness and assisting with strategic guidance.

EM-8. Minimize invasive plant spread along roadsides and utility corridors.

Disturbed ground along roads and utility rights-of-way serves as a primary vector for spreading invasive plants into new areas. Maintenance activities can inadvertently facilitate this spread. Projects should include management of invasive plant populations along these major pathways and corridors to prevent further spread, with updated information on effective methods regularly provided to maintenance personnel.

EM-9. Develop and implement prioritization models for managing invasive species.

With limited resources, prioritization of management efforts is a necessary part of addressing invasive species issues throughout California. Risk assessment approaches in conjunction with improved data on current distribution can provide the basis for prioritization analysis that helps determine the most cost-effective and efficient strategy for managing invasive species populations at a county, regional, and/or statewide level.

EM-10. Expand training programs for using Integrated Pest Management (IPM) principles and Best Management Practices (BMPs).

IPM programs evaluate and integrate compatible management tactics for effective control at a specific location. State supported training and continuing education opportunities are needed to certify federal, state, county, or private organizations or individuals who are involved in early detection, eradication and management actions for different types of invasive species. Continued research and development of practices such as companion planting and protection of natural predators and parasites that can reduce the potential impact of invasive species infestations and the need for pesticide use and other costly control methods should be actively promoted and assistance provided for implementing them. In addition, the principles of IPM should be a central theme in all educational outreach programs to clearly communicate the state's management approach.

"Invasions by nonindigenous species are a growing global problem, costing U.S. taxpayers hundreds of billions of dollars annually in environmental degradation, lost agricultural productivity, expensive prevention and eradication efforts, and increased health problems."

— Lodge et al, Biological Invasions: Recommendations for U.S. Policy and Management, in the journal Ecological Applications, 2006, 16(6) pp. 2035–2054

OUTREACH AND PUBLIC ENGAGEMENT

Awareness of the impacts of invasive species varies widely among Californians. A dynamic outreach program should be targeted to diverse constituencies utilizing a consistent message, and to the greatest extent possible, a pro-active rather than reactive approach. The skillful transmission of information alone is not sufficient; encouragement of active public engagement throughout the process is necessary to achieve the core objectives, which are for a broad spectrum of Californians to understand the benefits of addressing invasive species, to be actively engaged in identifying and implementing effective solutions, and to support coordinated action.

OPE-1. Develop and deliver a consistent outreach message based on stewardship.

An effective stewardship message emphasizes conserving resources, safeguarding California's heritage, taking joint responsibility for the future, utilizing sensible science and using open dialogue to lead to informed decisions. Active public engagement should always be encouraged, along with acknowledgment that successful control efforts must simultaneously address effectiveness, environmental sensitivity and concern for human health. In addition, it is necessary that responsible agencies coordinate their messages, with provisions for unified editorial oversight. The ISCC, with recommendations and assistance from the CISAC, is ideally situated to provide this coordinated oversight.

OPE-2. Provide clear public health information on invasive species management.

Invasive species management programs require effective communication with Californians regarding the potential risks to public health (from the species themselves and from management). Efforts to engage the public should be creative and sustained. To the extent possible, such dialog should take place on an ongoing basis so that we are ready for urgent situations that arise when a new invasive species is detected. Management programs with the potential for health impacts must incorporate appropriate infrastructure to record, report and address adverse health impacts related to the program. Information about pesticides and other tools used for controlling invasive species should be posted in an online clearinghouse to make the information as accessible as possible. The disclosure of all inert ingredients in products used for invasive species management is encouraged.

OPE-3. Support inclusion of invasive species in environmental education curricula.

Human behavior leads to most introductions of invasive species. Education and awareness are key components to preventing those introductions. Invasive species are beginning to be addressed in K-12 educational materials in California, such as that recently developed by the state's landmark Education and Environment Initiative. Invasive species prevention should be included in programs such as Ag in the Classroom, Project WILD (Wildlife In Learning Design), Project WET (Water Education for Teachers), and Project

Learning Tree. It is essential to work with the Department of Education to ensure that up-to-date information and educational tools are available. Creation and distribution of age-appropriate curricula on invasive species prevention will increase the depth of Californians' awareness as adults.

OPE-4. Establish activities to engage public participation.

Many formats exist for engaging groups in constructive dialog on tough issues, and creative formats should be explored for engaging public participation in decision making on invasive species issues, while encouraging the collaboration of private landowners that is essential to the implementation of many control programs. A concerted effort is needed to identify specific ways that individual choices can help minimize the impact of invasive species on California, with inclusion of these recommended behaviors in outreach materials when appropriate, and by creating a regular system to allow members of the public to report invasive species. To be of value, such a process must be widely publicized. Consideration should also be given to creating a comprehensive interactive public website, as an effective, inexpensive way to make information readily available and accessible, including online versions of printed materials and up-to-date news on invasive species issues. Press kits, regular email newsletters, Facebook pages, and Twitter feeds are all additional tools for informing the public.

OPE-5. Evaluate effectiveness of outreach and public engagement techniques.

Information quality and appropriateness of delivery pathways should be evaluated for effectiveness. Regular public surveys can gauge awareness of invasive species issues, knowledge of existing campaigns, and level of support for proposed or ongoing programs. The number of public forums and level of participation should be monitored, and website effectiveness assessed.

OPE-6. Facilitate effective participation by volunteer groups.

Knowledgeable and committed volunteers have the potential to be powerful messengers in their community. Many existing programs, such as Watershed Groups and Weed Management Areas, have developed ways to make effective use of volunteers, both by organizing them directly and by establishing collaborative relationships with service clubs, youth groups, and other existing organizations. Not only does this strategy multiply scarce financial resources, it also educates the volunteers on the necessity and processes of invasive species control, and can create ambassadors for the programs. Such efforts can also provide a forum for bringing diverse partners together around a common goal. This valuable resource should be magnified by identifying and evaluating programs that use volunteers effectively, and looking for ways to provide additional funding.

FUNDAMENTAL AND APPLIED RESEARCH

Increased scientific understanding of invasive species – the characteristics and circumstances of invasion, their biology and impacts, and effectiveness of management – will reduce future economic and ecological harm. Previous efforts have enumerated specific research needs in areas ranging from basic biology to policy and law, and some of those recommendations are incorporated here. Effective mitigation of the complex invasive species problem must be based on scientific research conducted in cooperation with federal, state and local governments, industry, and the public.

FAR-1. Assess the ecological, agricultural and economic impacts of invasive species in California.

More detailed information is needed on the impacts of each invasive species. Determining the financial impact of invasive species is especially challenging. Working together, ecologists and economists can develop standard protocols for assessing the impacts of a given invasive species in order to provide the accurate information needed for making wise policy decisions.

FAR-2. Study the biology of invasive species to support effective management.

While some species may be well-studied in their home range, their biological traits often differ upon entry into a new area. Studies of reproduction and population dynamics can be key in assessing life-cycle characteristics that lend themselves to effective management approaches. Accurate identification by experts is critical, and to the extent possible should be provided in a format that can also be used by local observers. One key need is to eliminate sources of new invasions (such as an invasive plant species "seed bank" in the soil) over the long-term.

FAR-3. Study restoration outcomes.

In order to develop BMPs for restoring habitat through invasive species removal, studies of the long-term outcome of a range of approaches is needed, using a standard monitoring protocol. This should include both active and passive approaches. Some agricultural recommendations exist, but they need further development to include a wider range of species in a broader range of environmental conditions. Scenarios should be examined where control of an invasive species results in increased population growth of another invasive species.

FAR-4. Study interactions of native species and invasive species.

Assessment of positive and negative impacts of invasive species on native species is needed, such as quantification of reproductive success, and direct or indirect toxicity to humans and wildlife.

FAR-5. Address invasive species in relation to climate change and other high-visibility issues.

California's climate change adaptation planning has identified invasive species management as a top action that can be taken to mitigate the impact of climate change on the state's ecosystems. Likewise, the California Wildlife Action Plan cites invasive species as a top threat to the state's wildlife.

High-visibility issues like climate change and wildlife protection clearly intersect with invasive species, and this intersection deserves more study. These veins of inquiry may yield increased support and implementation.

FAR-6. Research new invasive species control methods and expedite the assessment of existing methods.

Currently very few control methods are available for the treatment of some invasive species within California, especially aquatic invasive species. More information and coordination is needed so that professionals engaged in eradication and management efforts have the most effective tools available, and are trained in ways to use them safely and appropriately. Research and development of additional techniques, along with an increased public information campaign, is also needed to prevent accidental invasive species introductions by individuals who are potential vectors through either their work or recreation.

"State surveys indicate that at least 607 species of aquatic invaders can be found in California's estuarine waters. These invaders cause major impacts: disrupting agriculture, shipping, water delivery, recreational and commercial fishing; undermining levees, docks and environmental restoration activities; impeding navigation and enjoyment of the state's waterways; and damaging native habitats and the species that depend on them."

— CALIFORNIA AQUATIC INVASIVE SPECIES MANAGEMENT PLAN, 2008, PAGE XII

GLOSSARY

BIOLOGICAL CONTROL – a management tool using living organisms, such as predators, parasites, and pathogens, to control an invasive species. An ideal biological control agent only damages the target species. Introduction of biological control agents is subject to extensive permitting requirements that require years, often decades of testing.

CONTROL – management of invasive species populations, including preventing their spread and potentially including additional restoration activities if control is in a wildland setting.

ERADICATE – completely eliminate an invasive species from a given area, including all latent reproductive material (such as seeds in the soil). Statewide eradication of an invasive species is typically possible only if the first organisms to enter are detected immediately and quickly controlled.

ESTABLISH – form a permanent, self-sustaining population. A "well-established" species likely has numerous populations that make eradication difficult or virtually impossible.

INTEGRATED PEST MANAGEMENT (IPM) – as defined by the University of California, "Integrated pest management (IPM) is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment" (www.ipm.ucdavis.edu/WATER/U/ipm.html). The US EPA defines IPM as "an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment." (www.epa.gov/opp00001/factsheets/ipm.htm).

INTRODUCTION – the intentional or unintentional placement of a species into an ecosystem as a result of human activity.

INVASIVE SPECIES – a non-native species that causes harm. The federal government defines them as "alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health" (Executive Order 13112). In California, AB 2763 defines them as "animals, plants, insects, and plant and animal diseases or groups of those animals, plants, insects, and plant and animal diseases where introduction into California would or would likely cause economic or environmental harm, that have a reasonable likelihood of entering the state and for which a detection, exclusion, eradication, control, or management action by the state might be appropriate."

NATIVE SPECIES – a species within its natural range or natural zone of dispersal, i.e., within the range it would or could occupy without direct or indirect introduction by humans.

NON-NATIVE SPECIES – a species that is introduced by humans into a region beyond its historic geographic range. Also known as exotic, alien, or non-indigenous species.

PATHWAY – the route of entry or spread for invasive species, such as ship ballast water or the international pet trade.

These definitions, which were primarily drawn from the *California Aquatic Invasive Species Management Plan,* are provided for the general guidance of readers and should not be regarded as being legally binding.

"California is a large producer of many fruit, vegetable and tree nut products and accounts for more than 70 percent of U.S. sales for at least 25 crops... For every $1 billion in farm sales, there are 18,000 jobs created in the state, about 11,000 in the farm sector itself plus about 7,000 among other employers. Farming, processing and closely related activities are especially significant to the economy of the Central Valley where, including ripple effects, agriculture generates 24.2 percent of the private sector employment... About $450 million, including $161.6 million in federal emergency funds, was spent by the state and federal governments to control invasive agricultural pests and diseases in California during 2003, including an outbreak of Exotic Newcastle Disease on poultry farms."

— The Measure of California Agriculture, University of California Agricultural Issues Center, 2009

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