



# The INNOVATION SUMMIT

VISION+SCIENCE+TECHNOLOGY=SOLUTIONS

DECEMBER 5, 2016 · WASHINGTON, DC

## REPORT

*The Federal Government defines invasive species to mean, with regard to a particular ecosystem, a non-native organism whose introduction causes, or is likely to cause, economic or environmental harm, or harm to human, animal, or plant health.*

—EXECUTIVE  
ORDER 13751

### INVASIVE SPECIES: URGENT ACTION IS REQUIRED

It is the policy of the United States to prevent the introduction, establishment, and spread of invasive species, as well as to eradicate and control populations of invasive species that are established.<sup>1</sup> Every aspect of national security is at risk. Invasive species adversely impact plant and animal health, limit food and water availability, jeopardize the integrity of critical infrastructure, threaten the livelihoods and cultures of people who are largely dependent upon local resources, increase the likelihood for large-scale damage from natural disasters, and infest military equipment and training facilities, thus compromising military readiness. The harm caused by invasive species costs governments, industries, and private citizens substantial economic losses. In the United States, environmental damages and associated losses are already amounting to more than \$100 billion annually.<sup>2</sup>

### MAKING THE CASE FOR INNOVATION

Although policy makers, land managers, and the public are increasingly aware of the invasive species issue, the commitment to problem resolution remains well below that needed to address the problem. Why? In part, the answer is that the invasive species issue has been plagued by a limiting belief – a misconception. Invasive species challenges are frequently considered too complex, too difficult, and too costly to overcome. This perspective undermines political and public will, as well as the financial and intellectual investments necessary to overcome substantial challenges. It undermines the inspiration and capacity to innovate.

It is clear, nevertheless, that investments in technology innovation can be game changing. Routinely, they are demonstrating that seemingly insurmountable challenges can be overcome with substantial return on investment. Problems can be solved. The current toolbox for addressing invasive species is incomplete and, in many cases, inadequate. However, investments in technology innovation can enable us to change the invasive species conversation from “We can’t” to “We can!”

1 Executive Order 13751; [https://www.fedcenter.gov/Bookmarks/index.cfm?id=30579&pge\\_id=1606](https://www.fedcenter.gov/Bookmarks/index.cfm?id=30579&pge_id=1606)

2 Pimentel et al. 2005; <http://www.sciencedirect.com/science/article/pii/S0921800904003027>

*The current toolbox for addressing invasive species is incomplete and, in many cases, inadequate. Investments in technology innovation enable us to change the conversation from “We can’t” to “We can!”*

—JAMIE K. REASER  
Executive Director  
National Invasive  
Species Council

### THE SUMMIT: A GAME CHANGING OPPORTUNITY

Federal and non-federal partners committed to finding solutions to the most pressing invasive species challenges hosted an Innovation Summit on December 5th, 2016 at the Smithsonian Institution. Funding was provided by the Laura and John Arnold Foundation. Additional partner organizations included the National Invasive Species Council (NISC) Secretariat, Island Conservation, Conservation X Labs, and the Aquatic Nuisance Species Task Force (ANSTF). More than 300 people participated in person or via webcast, including invasive species scientists and managers, technology innovators, experts in technology regulation, and technology grantmakers.

The Summit provided the first ever opportunity for leading scientists and entrepreneurs to come together to solve seemingly intractable invasive species problems. It provided a forum in which to celebrate new opportunities to prevent, eradicate, and control invasive species, as well as identify the next big scientific and technical challenges to be overcome. Through presentations and panel discussions, experts representing a wide range of disciplines reviewed “grand challenges” in invasive species management (e.g., preventing the introduction of invasive species via ballast water and eradicating brown tree snakes), new approaches and applied technologies to address these invasive species challenges, mechanisms for incentivizing innovation, the need to create an enabling environment for technology application (including overcoming regulatory, legal, and social barriers), and how best to attract technology innovators. Throughout the event, presenters and discussants made recommendations for advancing technology development and application in the invasive species context.

The Summit agenda, summary of remarks, abstracts, and presenter bios have been published in a separate annex to this report and are available on the NISC website at: <https://www.doi.gov/invasivespecies/innovation-summit-project>. The audio recordings of Summit presentations and panel discussions are available at: <https://www.doi.gov/invasivespecies/innovation-summit-2016-presentations>.

### KEY FINDINGS: WE CAN DO THIS

The conference committee<sup>3</sup> identified the following key points arising from the Innovation Summit:

1. THERE IS A NEED TO SPREAD THE WORD ~ Those with the problems need to become far more visible to those who are highly motivated to innovate solutions. Invasive species experts need to find ways to communicate the grand challenges in invasive species prevention, eradication, and control to the entrepreneurial community across a wide range of sectors.

<sup>3</sup> Smithsonian Institution (Scott Miller & Will Pitt), Laura and John Arnold Foundation (Michael Stebbins), NISC Secretariat (Jamie K. Reaser, Stas Burgiel, Jason Kirkey), Island Conservation (Karl Campbell), Conservation X Labs (Alex Dehgan, Barbara Martinez), U.S. Department of Agriculture (Ann Bartuska), and White House Office of Science and Technology Policy (Fabien Laurier)



2. INCENTIVES WORK AND CAN COME IN MANY FORMS ~ The Federal government, funding foundations, and other sponsor institutions can create incentives for technology innovation in the invasive species context. Competitions, prizes, and innovator gatherings (e.g. “hack-a-thons”) can inspire entrepreneurs to tackle the most pressing invasive species challenges.

3. GRANTS NEED TO DO MORE THAN SUPPORT START UPS ~ Granting programs that take a holistic “idea to impact” approach to supporting technology innovation can foster timely, sustainable, cost-efficient solutions. Entrepreneurs often need funding, as well as guidance on good business practices, navigating the regulatory environment, garnering private sectors investments, and delivering the product into the marketplace. Funding agencies that provide financial support, training, and peer-to-peer networking can foster long-term solutions to societal challenges and contribute to economic growth.

4. HIGH-TECH SOLUTIONS ARE ON THE WAY AND WE NEED TO PREPARE FOR THEM ~ Advancements in surveillance, automation, and gene-based technologies are dramatically improving opportunities to prevent, eradicate, and control invasive species. The rate of innovation in these fields is, however, outpacing the ability of regulatory systems to effectively assess and mitigate the potential risks of their application. There is a need to explore mechanisms for educating regulators on these technology advancements and evolving regulatory frameworks in a timely manner. The speed and breadth of technology advancement also poses challenges to natural resource managers. There is a need to provide those planning and executing invasive species projects with the programmatic flexibility necessary to incorporate the most effective prevention and mitigation tools.

5. LOW TECH CAN MAKE A DIFFERENCE TOO ~ In order to be effective, advancements in technology innovation need not require substantial scientific breakthroughs or investments in time or money. There are numerous “low tech” innovations being made with relatively rapid, cost-efficient outputs. For example, intellectual advancements in risk analysis and horizon scanning approaches improve our capacities to target high risk invasive species and invasion pathways. Websites and smartphone applications are enabling invasive species managers and the public to access the information necessary for the early detection of and rapid response to invasive species. Detector (“sniffer”) dogs are being trained to locate a wide range of invasive species – from zebra mussels to Burmese pythons – in order to facilitate eradication and control opportunities. Small modifications in gun design are enabling the broadcasting of herbicides and toxic baits into environments that are difficult to access.

6. TECHNOLOGY REAPPLICATION CAN BE COST-EFFECTIVE AND EXPAND MARKETS ~ Many of the technologies that could help us prevent, eradicate, or control invasive species already exist, but they were developed for other applications. Increasingly, these technologies are emerging out of the



*Regulatory systems need to keep pace with advancing technologies. Failure to do so, not only results in economic inefficiencies, regulatory conflicts, and litigation, it also leaves major societal problems unresolved.*  
—KARL CAMPBELL  
Project Director  
Island Conservation



*Technology application can solve problems, while also providing a return on investment that creates incentives for new investments and breakthroughs.*

—ALEX DEHGAN  
Founder & President  
Conservation X Labs

intelligence, energy, and defense sectors. The repurposing or dual use of existing technologies can be extremely cost-effective and facilitate the emergence of new private sector markets. Technology innovation is a catalyst for public-private partnership. For example, Whooshh Innovations has been developing soft, flexible air-filled tubes that use gentle pressure variances to move objects – initially large volumes of fruit. With support from the Department of Energy, they are now using the system to cost-effectively photograph, sort, and move fish upstream. Although the initial target of the work was to transfer native fish (e.g. salmon or trout) over dams and other barriers, further adaptations to the system are being explored to enable the automated detection and extraction of invasive carp, lampreys, and other harmful aquatic species.

7. AS THE TOOLBOX GROWS, TOOLS CAN BE USED IN EFFECTIVE COMBINATION ~ Opportunities are emerging to assemble a comprehensive toolbox to address some of the most imperative invasive species challenges. For example, barriers (e.g. underwater electroshock barriers, walls of carbon dioxide bubbles, fencing, locks), species-specific toxins, genetic engineering (e.g. to influence hybridization, sterilization, and sex determination), environmental DNA (eDNA), and overharvest approaches are being employed in combination to improve the management of Asian carp. Satellites, drones, automated trapping systems, and DNA sampling techniques are being combined to develop predictive models to better understand and arrest the transmission of human disease via invasive mosquitoes.

8. FLEXIBILITY IS NECESSARY – INNOVATION CAN ENABLE FLEXIBILITY ~ Best practices for technology application are context specific, one approach will not fit all scenarios. Considerations for developing “fit to purpose” approaches need to explore such variables as the biology of the target species, time of year/day for maximizing effectiveness, ecological and socio-cultural context, legal and institutional frameworks and, of course, budget constraints and timeliness. Innovations that permit the flexible application of technologies according to local parameters are needed to effectively address the invasive species issue.

9. SOCIAL ACCEPTANCE IS IMPERATIVE ~ In order for technologies to make a real difference on the ground, entrepreneurs and their sponsors need to look and act beyond the realm of scientific research. They need to engage in public education and outreach – strategically working to facilitate public understanding of emerging technologies and fostering the social acceptance that is necessary for technology application. This is particularly true with regard to some of the technologies that hold the greatest potential to make a significant impact on a large scale. Public concern and resistance is already apparent for the use of drones (for everything from surveillance to injecting toxins), the development and release of biocontrol agents, and the use of genetic-based tools to eradicate populations of invasive species. Collaborations with the social science community and the application of social marketing approaches can be employed to identify barriers to and opportunities for garnering social acceptance of specific technologies. Citizen science initiatives could also help build public understanding and acceptance of specific technologies, as well as foster a sense of public ownership and pride for enacted solutions.



10. THERE ARE CLEAR OPPORTUNITIES FOR FEDERAL LEADERSHIP ~  
The Federal Government has numerous roles to play in advancing technologies for the prevention, eradication, and control of invasive species. Examples include:

- communicating the severity of the invasive species issue and the need for technology innovation to address pressing invasive species challenges;
- undertaking the scientific research necessary for technology advancement;
- catalyzing and incentivizing technology innovation and re-application;
- enabling innovators to reach proof of concept and put their ideas to work on meaningful scales, potentially producing new industries and jobs in the process;
- creating, advancing, and maintaining the regulatory frameworks necessary for technology development and application;
- facilitating international cooperation and development assistance, particularly in the areas of information and technology sharing, technology research and application, and the development of relevant legal frameworks; and
- applying technologies to prevent entry, detect, and respond to potential invasive species before they have a chance to cause harm, and to eradicate and control those invasive species that are already established.



#### **A CALL TO ACTION**

Investments in technological innovation are rapidly advancing our ability to prevent, eradicate, and control invasive species. There is renewed hope that we can overcome the “grand invasive species challenges” that have thus far seemed insurmountable. The application of repurposed and emerging technologies can represent a long-term cost-savings compared to the existing, often inefficient and ineffective, practices currently in the invasive species toolbox. Prioritizing technology innovation can have substantial payoffs – potentially saving millions of dollars in costs posed by a single invasive species. Federal agencies and their partners can identify challenges and opportunities, inspire innovation, expand investment, and reduce barriers to the development and application of possible solutions. Together, we can create an innovation culture that fosters creative thinking and game changing solutions to pressing invasive species problems. Future Innovation Summits can play a key role in achieving this outcome.

**WE CAN DO THIS...**  
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This report fulfills contract obligation #D16PX00293 to the National Invasive Species Council (NISC) Secretariat. April 2017.

The report is complemented by an Annex available at: <https://on.doi.gov/2pDP8NJ>