Invasive Pests: A $120 Billion-a-Year Threat to America's Farms and Lands

Ongoing Investment in Integrated Pest Management Safeguards America's Agricultural Industry and Food Supply

Executive Summary

Invasive Diseases, Insects and Weeds Take a Bite Out of American Agricultural Productivity

Despite the best efforts of federal and state regulators and inspectors, invasive pests routinely slip into the United States. Because these non-native insects, weeds and diseases rarely have natural predators here, they can quickly spread to threaten American agriculture, natural areas and even human health. These pests cause an estimated $120 billion in damage annually in the United States.

Once established, invasive species become almost impossible to eradicate. Instead, they must be managed and the damage they do mitigated. The best way to do this is through a science-based approach known as integrated pest management, or IPM, that uses all available tools and technologies to control pests in an environmentally safe way.

The irony – and difficulty – of invasive pests is that they also disrupt successful IPM programs developed to manage existing agricultural pests. So when a new invasive pest arrives, not only must IPM scientists develop approaches to stop that pest, they often also have to reinvent existing IPM programs that had successfully been protecting crops and beneficial insects while reducing health risks to people and the environment.

That's why new IPM research and Cooperative Extension outreach by America's land-grant university scientists will always be needed – to develop and deliver tactics that curtail damage from new invasive pests and our agricultural industry, natural resources and citizens.

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Understandng Invasive and Emerging Pests

Invasive pests

Invasive pests are organisms that are not native to an area and whose introduction results in environmental, economic or human-health harm (Beck et al. 2008). Fortunately, only a few of the thousands of non-native species introduced each year cause harm. Unfortunately, those that do can have long-lasting negative impacts on agriculture, human health, infrastructure as well as our natural resources. The table lists some of the most widely known and damaging invasive pests in the United States.

Emerging pests

Emerging pests are species that have been present in an area for some time but whose negative economic and environmental impacts are increasing. As farming practices or environmental conditions change, insects, for instance, may expand their range or food sources, attack additional crops, overwinter in higher numbers or increase their reproductive rates. Diseases can increase following extreme weather events. With climate change bringing about longer, hotter growing seasons, growers have to manage more generations of insects and diseases have more opportunity to adapt and overcome previously pest-resistant crop varieties (Gowda et al. 2018). IPM tactics that worked in the past can lose efficacy and new strategies need to be developed.

Invasive Pests Found in the United States*

Plant Diseases

- Citrus Greening, or HLB
- Sudden oak death
- Tar spot of corn
- Chestnut blight

Weeds

- Tropical soda apple
- Cheatgrass
- Mile-a-minute weed
- Yellow starthistle

Insects

- Asian citrus psyllid
- Emerald ash borer
- Brown marmorated stink bug
- Spotted wing drosophila

Vertebrate Pests

- Feral hogs
- Nutria
- European starling
- Coqui frog

* (and many, many others...)

The Tremendous Impact of Invasive Pests

When an invasive insect, weed or disease is introduced, the economic impact and ecological disruptions can be extreme. The emerald ash borer was first detected in the United States in 2002, and to date has killed hundreds of millions of ash trees across 35 U.S. states. Other recent invasive insect detections include spotted wing drosophila, a fruit fly causing extensive damage to cherries, berries and other soft-sided fruit, and the spotted lanternfly, which threatens grapes, hops and other crops and is spreading quickly from the Mid-Atlantic region.

Invasive diseases pose an equally significant threat. Tar spot, for example, has quickly become one of the most significant diseases of corn. It can spread quickly and cause corn plants to prematurely dry down and die. Under conditions favorable to the disease, the pathogen can cause yield losses greater than 50 percent. Tar spot was first found in the continental United States in Illinois and Indiana in 2015 but has spread each growing season and has now reached eight states and Ontario, Canada.

Plant diseases spread in similar ways than many diseases in humans. For example, HLB, a disease that sours citrus fruit, has spread West from Florida – where it has devastated the fresh citrus industry – across the southern half of the country to California. Like COVID, HLB spreads from trees that are infected but asymptomatic, making detection difficult.

The full cost of invasive species damage in the United States is unknown. A 2004 study estimated the cost at $120 billion annually (Pimentel, et al. 2005) and the U.S. Department of the Interior spends $100 million every year on invasive species prevention, early detection and rapid response, control and management, research, outreach, international cooperation and habitat restoration (U.S. Fish and Wildlife Service, 2012).

Loss of trade is another threat posed by invasive pests. Infectious diseases are one of the few reasons authorized by the World Trade Organization for blocking imports of agricultural products, and restrictions on trade may continue for up to two years and result in lost sales ranging from millions to tens of billions of dollars. For example, after karnal bunt, a fungal disease of wheat, was discovered in north Texas in 2001, more than 25 countries banned wheat imports from four affected counties, resulting in a loss of revenue of about $250 million (Tucker, J. 2011).

The U.S. Department of Agriculture's Animal and Plant Health Inspection Service is tasked with keeping damaging invasive species out of the United States but cannot stop every threat. Insect pests, diseases and weeds do arrive and very few can be successfully eradicated once they establish. Instead, they must be managed and the damage they cause minimized.

How Integrated Pest Management Helps Farmers Overcome New Invasive Threats

A good example of the damage invasive species can do to crops and effective IPM programs occurred in 2008 when the spotted wing drosophila, a type of fruit fly, was detected on the West Coast. Unlike other fruit flies that only lay eggs in damaged fruit, spotted wing drosophila have a saw-like appendage that pierces the skin of healthy fruit so they can deposit eggs in soft fruit like cherries, strawberries, and blueberries. For growers, this can be devastating. If any fruit fly larvae are found in those fruits, whole crops can be rejected.

Before the spotted wing drosophila arrived, university researchers had helped cherry growers develop an extremely effective IPM program to protect their crops. Using a combination of cultural tactics and selective pesticides, growers controlled their major insect pests and preserved beneficial insects in their orchards. Those beneficial insects preyed on one of their major pest threats, a tiny insect known as San Jose scale.

But when this new fruit fly appeared, cherry growers responded by increasing pesticide applications in their orchards and using broader-spectrum insecticides to kill the new pest. Unfortunately, those increased pesticide applications also killed their beneficial insects and San Jose scale populations exploded, killing whole limbs of cherry trees (Van Steenwyk, 2014). For several years, this crop – which had been managed with very few, very selective pesticide applications – was now being sprayed with broad-spectrum insecticides repeatedly throughout the growing season to control both spotted wing drosophila and San Jose scale.

Eventually, researchers identified another method of managing spotted wing drosophila that began to restore some biological control. Cooperative Extension specialists brought that knowledge to growers and taught them how to use it in their orchards. While effective at mitigating some of the damage, research continues to improve these management tactics while Cooperative Extension provides area-wide monitoring and outreach to ensure growers adopt the most effective strategies.

This is one example in one crop of the compounding effect of an invasive pest disrupting an industry and also shows the years of research and outreach necessary to re-establish – or in some cases re-imagine – stable IPM programs. The same efforts are being expended in crops across the country where growers are battling different invasive weeds, diseases and insects.

An Ongoing Threat – and Need

The threats posed by invasive and emerging species to America's agriculture industry, natural lands and citizens are not going away. And with an estimated price tag of $120 billion annually, American farmers, ranchers and taxpayers are already paying for it.

To reduce the damage and costs, increased investments in research and Cooperative Extension funding can help IPM scientists respond more effectively to invasive and emerging pests and limit their economic and environmental damage. Restoring effective IPM programs quickly also can reduce the need for reactive pesticide applications. This benefits rural communities where these chemicals are applied and protects the health of the people who apply them and people who live, work or go to school nearby.

More research capacity can also help increase the resilience of American agriculture to recover from new pest invasions or climate-related shifts in emerging species.

References

Bebber, D.P., M.A. Ramotowski, and S.J. Gurr. 2013. Crop pests and pathogens move polewards in a warming world. Nature Climate Change 3: 985–988.

Beck, K.G., K. Zimmerman, J.D. Schardt, J. Stone, R.R. Lukens, S. Reichard, J. Randall, A.A. Cangelosi, D. Cooper, and J.P. Thompson. 2008. Invasive Species Defined in a policy Context: Recommendations from the Federal Invasive Species Advisory Committee. Invasive Plant Science and Management 1:414-421.

Gowda, P., J.L. Steiner, C. Olson, M. Boggess, T. Farrigan, and M.A. Grusak, 2018: Agriculture and Rural Communities. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 391–437. doi: 10.7930/NCA4.2018.CH10

Pimentel, D., R. Zuniga, and D. Morrison. 2005. Update on the environmental and economic costs associated with alien-invasive species in the United States. Ecological Economics. 52 (2005) 273 – 288. doi:10.1016/j.ecolecon.2004.10.002

Seebens, H., S. Bacher, T.M. Blackburn, C. Capinha, W. Dawson, S. Dullinger, P. Genovesi, P. E. Hulme, M. van Kleunen, I., Kühn, J. M. Jeschke, B. Lenzer, A. M. Liebhold, Z. Pattison, J. Pergle, P. Pysek, M. Winter and F. Essl 2020. Projecting the continental accumulation of alien species through 2050. Global Change Biology DOI: 10.1111/gcb.15333 https://www.fs.fed.us/nrs/pubs/jrnl/2020/nrs_2020_seebens_001.pdf

Tucker, J. 2011. The Economic Impact of Crop and Livestock Diseases, in Case Studies in Agricultural Biosecurity. Federation of American Scientists website. https://

biosecurity.fas.org/education/dualuse-agriculture/1.-agroterrorism-and-foodsafety/economic-impact-of-crop-and-livestock-diseases.html

U.S. Fish and Wildlife Service. 2012. The Cost of Invasive Species. https://www.fws.gov/verobeach/PythonPDF/CostofInvasivesFactSheet.pdf

Van Steenwyk, R. 2014. Spotted Wing Drosophila (SWD) Recommendations for Sweet Cherry. IN: Caprile JA, Symmes EJ, Adaskaveg JE, Baldwin RA, Roncoroni JA, Westerdahl BB, Coates WW, Daane KM, Grant JA, and Van Steenwyk RA. Revised continuously. UC IPM Pest Management Guidelines Cherry. UC ANR Publication 3440. Oakland, CA. http://ipm.ucanr.edu/PDF/MISC/2014_Cherry_Spotted_Wing_Drosophila.pdf

The National Integrated Pest Management Coordinating Committee is a committee of the Experiment Station Committee on Organization and Policy and the Extension Committee on Organization and Policy within the Association of Public and Land-grant Universities governing structure. It assists in development of reports and strategic plans on pest management issues and pursues activities that facilitate coordination and collaboration nationally among and between IPM research and extension at the land-grant universities, and between the land-grants and federal agencies involved in IPM.

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