

Future Trends in Agricultural Trade



The U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) is a Government agency that moves with the times. As agricultural trends become apparent, APHIS is there to work with producers on issues such as trade, plant and animal pests, invasive species, biotechnology, and methods development for dealing with new plant and animal pests and diseases.

APHIS scientists work with other Government agencies, industry, academia, and stakeholder groups to ensure that the agency is solving today's problems and will be positioned properly to deal with tomorrow's.

Invasive Species

Over the past 200 years, several thousand foreign plant and animal species have become established in the United States. Today, about one in seven nonnative species introduced into the United States has become invasive, leading to problems that cost this country more than \$138 billion a year. Imagine what those figures will be like 1 year, 10 years, 20 years from now. As more and more countries enter the world marketplace, the United States needs to look forward in order to prevent the continued introduction of invasive species into the country.

An invasive species is an alien species whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health. Invasive plants, animals, and aquatic organisms often lessen the economic productivity and ecological integrity of U.S. agricultural and natural resources.

The most common vertebrate invasive species in the continental United States include house sparrows, European starlings, commensal rodents (roof rat, Norway rat, and house mouse), and nutria. Additionally, numerous invertebrate invasive species have also become established in the United States. Examples include zebra mussels, imported fire ants, Africanized honey bees, and many other insects. Feral animals are domesticated animals that have escaped and become wild, including their offspring born in the wild. In Hawaii and some mainland States, feral pigs, goats, and cats have severely affected natural and environmental resources.

Many harmful invasive species impair biological diversity by causing population declines, species extinctions, shifts in predator–prey dynamics, shifts in species niches, changes in habitat, and reductions in ecosystem complexity. The establishment of invasive species destroys the uniqueness of habitats, making all areas biologically alike.

In 1993, the Congressional Office of Technology Assessment reported that devastating invasions of plants, insects, aquatic invertebrates, pathogens, and other organisms have changed ecosystems and permanently diminished the biological diversity associated with them. Examples of these in the United States include melaleuca (a wetlands tree), gypsy moth, spruce bark beetle, zebra mussel, larch canker, chestnut blight, and Japanese beetle. Concern about the incursion of other harmful invasive species, such as the brown tree snake, is increasing.

Conservation experts have found that in the United States, invasive alien plant infestations cover 100 million acres and are spreading at a rate of 14 percent per year. Recent studies have also revealed that the San Francisco Bay is invaded by a new exotic species on the average of once every 12 weeks.

Naturally occurring movement of species into the United States is uncommon. Most invasive species arrive in association with human activities or transport. Species can be brought into the country and released intentionally, or their movement and release can be an unintentional byproduct of cultivation, commerce, tourism, or travel.

Many species enter the United States each year as contaminants of commodities. Agricultural produce, nursery stock, cut flowers, and timber can harbor insects, plants pathogens, slugs, and snails. Weeds continue to enter the United States as seed contaminants. Plant pathogens arrive as unintended contaminants of plant materials.

Fish and shrimp pathogens and parasites have been introduced into the United States on infected stock for aquaculture. Crates and containers can harbor snails, slugs, mollusks, beetles, and micro-organisms. Military cargo transport also brings in harmful species, such as the Asian gypsy moth and the brown tree snake. Ballast water that is released from ships as cargo is loaded or unloaded has brought in several destructive aquatic species.

A 1999 Executive Order mandated the enhancement and coordination of Federal activities to control and minimize the economic, ecological, and human health impacts caused by invasive species. That Order also established a National Invasive Species Council to oversee a management plan detailing the goals and objectives of the efforts of the involved Federal agencies. APHIS is an active participant on the Council since the basic work performed by APHIS already helps to keep pests and diseases that threaten our biological resources from being introduced into and becoming established in the United States.

Both ecosystems and the individual species within them are vulnerable to invasive pests and pathogens. APHIS is responsible for excluding and managing invasive species that can potentially affect plant and animal health, either directly or indirectly. Through its activities, APHIS protects not only agriculture but also forest, rangeland, and wetland ecosystems. APHIS works closely with USDA's Forest Service and the U.S. Department of the Interior's Bureau of Land Management, National Park Service, and U.S. Fish and Wildlife Service. APHIS controls certain types of invasive species and vertebrate pests that affect native ecosystems rather than agricultural resources. Other activities focus on protecting and managing endangered species as well as migratory bird populations.

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The first and most effective means of protection is through exclusion or prevention of intentional or accidental entry of harmful invasive species. A second strategy uses tactics that include detecting, eradicating, managing, or controlling specific pests that have become established.

Endangered species also need special protection against a host of attackers. Endangered species are rescued from illegal trade at ports of entry and protected within the United States. Invasive species can be a threat to indigenous endangered species. Finally, human populations need help in coping with the needs of certain wild animals, such as migratory birds, so that human activity and wildlife can coexist.

APHIS is continuously improving techniques to prevent the accidental introduction of nonnative species into the United States while at the same time working to eradicate foreign species that have already established a foothold. While invasive species will continue to present problems into the future, APHIS scientists are also working with the agriculture seed industry to ensure that a new type of technology, biotechnology, does not.

Biotechnology

Biotechnology allows for the production of genetically modified organisms (GMOs). A GMO is developed by altering an organism's genetic material, deoxyribonucleic acid (DNA), for the purpose of creating a better organism. As technology improves, applications for GMOs increase, and the number of GMOs being created grows more rapidly. GMOs have frequently been aimed at creating plants with pest resistance that enables growers to use less pesticides. Genetically engineered varieties exist now for almost all of the major crops. There are more than 28,000 sites throughout the United States testing GMOs. Genetic engineering is being

used in the production of pharmaceuticals, nutraceuticals ("functional foods"), gene therapy, and the development of animals and plants with borrowed genetic traits. In 1999, a third of the corn, half the soybeans, and almost 60 percent of the cotton grown in the United States were genetically engineered.

Genetically modified plants that can tolerate herbicides, resist insects or viruses, or produce modified fruit or flowers are being grown and tested. Copies of genes for these traits have been transferred to the plants by genetic engineering techniques from other unrelated plants, bacteria, or viruses. Corn plants that produce an insecticidal protein to resist European corn borers, the most serious insect threat to American corn today, and potatoes that resist both virus and insect attacks from the Colorado potato beetle are examples of recently developed transgenic plants.

APHIS regulates the field testing of genetically engineered plants by administering the Plant Protection Act. While this Act authorizes the agency to regulate the interstate movement and importation of materials with a pest risk, it also authorizes the release (for field testing) of "organisms and products altered or produced through genetic engineering, which are plant pests or which there is reason to believe are plant pests." A plant pest is a risk to other plants and agroecosystems. The term "plant pest" is generally applied to weeds, insects, and diseases but can be applied to GMOs. Applying "plant pest" to a genetically engineered plant means only that the nonpest nature of the plant has yet to be demonstrated.

Biotechnology is the cutting edge of agricultural science, and APHIS will continue to work with the industry to confirm that new products pose no plant pest risk. There is, however, a new threat or risk that APHIS hopes never to see realized: acts of bioterrorism.

In an agricultural context, bioterrorism is the use of existing or genetically modified plant and animal diseases to attack the food supply. APHIS currently has a system in place for tracking agricultural diseases and disease vectors. Through its Plant Protection and Quarantine (PPQ) and Veterinary Services programs, APHIS emergency response teams stand ready to travel to any part of the country and work to stop a disease outbreak, natural or purposeful. In the event of a bioterrorist attack, APHIS will work with military and law enforcement agencies to contain, eradicate, and monitor the attack.

The Race for Better Tools

When APHIS needs to examine its existing capabilities, expand its intelligence base, or develop new methods or tools for work on biotechnology, invasive species, animal diseases, or animals in the wild, it calls upon one of its several laboratories, such as the National Veterinary Services Laboratories (NVSL) in Iowa and New York or the National Wildlife Research Center (NWRC) in Colorado.

NVSL activities are administered under APHIS' Veterinary Services program. NVSL comprise three laboratories located in Ames, IA (Diagnostic Bacteriology Laboratory, Diagnostic Virology Laboratory, and Pathobiology Laboratory), and one located on Plum Island, NY (Foreign Animal Disease Diagnostic Laboratory).

Specialists at NVSL, the only Federal facility in the United States dedicated to the diagnosis of both domestic and foreign animal diseases, provide support for APHIS programs designed to protect the health of the Nation's livestock and poultry. Those programs include brucellosis, tuberculosis, animal and bird quarantine, foreign animal products importation, *Salmonella enteritidis*, animal importation, scrapie, bovine spongiform

encephalopathy surveillance, the National Animal Health Monitoring System, the National Poultry Improvement Plan, foreign animal disease diagnosticians' training, and fraudulent blood testing. In addition to diagnostic testing services, the NVSL disseminate scientific information, provide reagents to domestic clients, and offer training for APHIS employees. NVSL personnel work closely with APHIS' International Services office to provide consultation, reagents, and training for foreign governments.

Under the Wildlife Services program, the NWRC provides scientific information on wildlife, its habitat, and its relationship to agriculture and public safety. At NWRC and in the field, specialists conduct scientific inquiries into the problems of wildlife damage and look for solutions to these problems. NWRC seeks to protect wildlife from the adverse effects of human activities while also reducing the damage and hazards that wildlife cause to agriculture, forests, industry, public health and safety, and other areas of human involvement. The reconciliation of these two conflicting priorities is the challenge that the NWRC faces today.

NWRC's objective is to increase the effective methods available for wildlife damage management through (1) assessing damage and other problems caused by wildlife to agriculture, the environment, and human health and safety; (2) investigating the biology and behavior of problem animals; (3) evaluating the impact of wildlife management practices on wildlife and the environment; (4) developing and improving technology to reduce wildlife problems; (5) supporting registration of chemicals and drugs used to manage wildlife; (6) providing scientific consultation and specialized technical training; (7) transferring scientific and technical information; and (8) providing scientific guidelines on wildlife damage for use by regulatory agencies.

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The Center evaluates damage situations and develops methods and tools to reduce or eliminate damage and resolve land-use conflicts. NWRC scientists study birds, mammalian predators, rodents, and other wildlife that cause serious but localized damage problems. The Center designs studies to ensure that the methods developed to alleviate animal damage are biologically sound, effective, safe, economical, and acceptable to the public.

NWRC scientists produce the appropriate methods, technology, and materials for reducing damage caused by animals. Through the publication of results and the exchange of technical information, the Center provides valuable data and expertise to the public and the scientific community. APHIS' PPQ unit also conducts methods-development and intelligence-gathering activities for its work in protecting plant health.

Methods and policies developed for use in an emergency outbreak situation by USDA's rapid response teams must be environmentally acceptable and in compliance with Federal, State, and local laws such as those governing pesticide use and notification to enter or treat private property. A Mediterranean fruit-fly find or outbreak of Karnal bunt has potential to excite concern among our trading partners, who need to be reassured that U.S. commodities will not introduce pests or diseases into their ecosystems. Emergency response methods must bring our exports into compliance with international standards as established by the World Trade Organization and trade pacts such as the North American Free Trade Agreement.

APHIS-PPQ carries out methods development to translate research findings into operational program activities at 10 different field stations known as plant protection centers. These field stations are located at Edinburg, TX, Gulfport and Starkville, MS,

Gainesville and Miami, FL, Waimanalo, HI, Otis Air National Guard Base (Cape Cod), MA, Phoenix, AZ, and Oxford, NC. There is one PPQ methods group working outside the country, in Guatemala. PPQ also works collaboratively on international projects with organizations like the North American Plant Pest Organization and other cooperators or trade partners. Pest advisory groups, science panels, and other ad hoc advisory and regulatory organizations are formed by PPQ to respond to new pest finds, evaluate current pest programs, and deal with other phytosanitary issues.

Other scientific information and methods development work is done through PPQ's Center for Plant Health Science and Technology. The Center, with headquarters in Raleigh, NC, serves as the umbrella organization for PPQ labs and the National Biological Control Institute. The Center's multidisciplinary staff concentrates on analyzing scientific and technical elements of plant protection programs and systems and identifying needs and appropriate ways to meet present and future phytosanitary challenges. PPQ forges collaborative working partnerships with Federal and State agencies, academic institutions, and the private sector to accomplish its work.

Through its development of new methods, tools, and intelligence, APHIS continues to look toward the future. Invasive species, biotechnology, and a number of other trends point the way toward the agriculture of tomorrow. APHIS intends to be there, on the forefront, ready to serve stakeholders in an ever-changing world.

For more information about APHIS programs, visit the APHIS homepage at <http://www.aphis.usda.gov>

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