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Tools, Techniques and Teamwork: TRANSFERRING NEW TECHNOLOGIES FOR WILDLIFE MANAGEMENT, CONSERVATION AND ECONOMIC DEVELOPMENT

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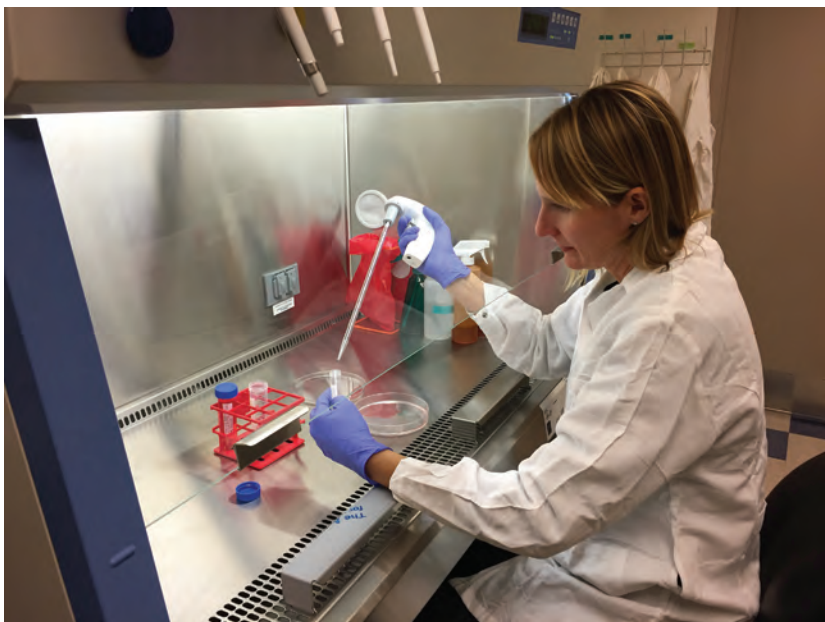
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Tools, Techniques and Teamwork

TRANSFERRING NEW TECHNOLOGIES FOR WILDLIFE MANAGEMENT, CONSERVATION AND ECONOMIC DEVELOPMENT

By John Eisemann and Gail Keirn



Credit: USDA APHIS-Wildlife Services



Credit: USDA APHIS-Wildlife Services

▲ Researchers at Wildlife Services' National Wildlife Research Center work with technology transfer experts to take their ideas and make them into practical, feasible and cost-effective wildlife damage management tools.

Did you ever wonder who invented radio telemetry? Or breakaway snares? What about the bird repellent methyl anthranilate or the livestock protection collar?

These and many other tools used in wildlife damage management resulted from creative thinking by biologists, technicians, researchers and managers working to solve complex wildlife issues. Over the past 90 years, these “aha moments” within the U.S. Department of Agriculture’s Wildlife Services program have ranged from developing novel scare devices, traps and vaccines to exploiting an animal’s visual capabilities to stop unwanted behaviors. Once discovered, these unique ideas may lead to practical, feasible and cost-effective wildlife damage management tools. However, without the appropriate promotion and development, many great ideas go unused.

The USDA-WS National Wildlife Research Center’s primary goal is for natural and agricultural resource managers to adopt the tools and techniques resulting from its scientists’ research. NWRC scientists have always published research findings, produced technical notes and factsheets, presented at scientific meetings and hosted demonstrations and workshops.

However, in 2014, the NWRC Technology Transfer program began a concerted effort to encourage and support formal product development collaborations with partners outside of NWRC and the transfer of the center’s research discoveries to the private sector. This effort is pinned to [The Federal Technology Transfer Act of 1986](#) and later legislation that changed how federal laboratories, such as NWRC, do business. These laws allow federal laboratories, universities and industry to form commercial partnerships that enhance the development of new technologies that advance USDA’s mission. These partnerships transfer the technologies into the marketplace while at the same time offering financial benefits to federal inventors. This flexibility allows



NWRC to work with a variety of U.S. and foreign partners, both large and small.

Wildlife biologists and other natural resource managers are among the most creative people when it comes to solving difficult resource management problems. Staff specifically trained in technology transfer can help them move their creative solutions from the idea stage to a tool or technique that wildlife managers, in and out of government, can use. Sometimes this involves pursuing industry or university partnerships. Sometimes it involves patenting and licensing the invention to the private sector, including commercial products. It always involves working with inventors to see the value of their ideas beyond the problem at hand.

Regardless of the approach used to advance the technologies, this focused effort has proven very effective for making new tools available to wildlife managers and others. Below are examples of WS' technology transfer successes.

Building a better snake trap

Invasive or nonnative reptiles have been in Florida for over 100 years and their populations have increased quickly in the last half century. Large non-native snakes and lizards, such as Burmese pythons (*Python bivittatus*), Argentine giant tegu lizards (*Salvator merianae*) and Nile monitor lizards (*Varanus niloticus*) are all breeding in Florida with devastating consequences for native flora and fauna. Developing new tools to control them and the damage they cause is vital to protecting native wildlife and ecosystems.

In 2013, the U.S. Patent and Trade Office issued a patent for a unique trap for snakes, developed by a wildlife biologist stationed at the NWRC Florida field station in Gainesville. This 5-foot-long trap is the first to utilize two trip pans, which must be depressed simultaneously. The design allows it to capture long, heavy animals, such as invasive Burmese pythons and monitor lizards, but nontarget animals, such as small native snakes, raccoons and opossums, are unlikely to trigger it.

The patent is licensed to [Tomahawk Live Trap](#), which now sells the trap through its website. The development and licensing of it is an excellent example of transferring federally-developed technology into the private sector and receiving a return on taxpayer dollars.



Credit: USDA APHIS-Wildlife Services

◀ Wildlife Services employees develop new tools and technologies, such as this trap for large snakes and lizards. Such products are often licensed to private companies for commercialization.

Animals don't always like what they see

Birds and rodents damage agriculture by eating newly planted, maturing, ripening and stored crops, as well as livestock feed. Their feces may also contaminate crops, feed and equipment. Tools that prevent bird and rodent damage can save the American public millions of dollars each year.

NWRC scientists have longstanding partnerships with private companies and industry groups to investigate bird and rodent repellent compounds, formulations and application strategies for reducing wildlife damage. One such partnership with [Arkion Life Sciences](#) has resulted in five co-owned patented or patent-pending technologies and associated repellent products that are marketed and sold nationally and internationally. Recent advances have also led to the development of a new repellent application strategy that takes advantage of both visual cues and post-ingestive consequences, such as an unpleasant taste or sickness in the animals that eat the repellents.

Anthraquinone, or AQ, a naturally occurring plant compound, was first patented as a bird repellent in 1944 to reduce bird damage to agricultural crops. At the time, it was assumed that the compound's repellency was only due to its unpleasant taste or ability to make the animal feel ill. Recent NWRC-Arkion research has shown that AQ can also cause avoidance behaviors in birds and mammals through visual cues related to the compound's absorption of the ultraviolet spectrum.

As a result, NWRC and Arkion designed repellent products and application strategies that "trick" birds



▲ Wildlife Services researchers worked with engineers from a private company to transform their “proof-of-concept” ideas for an aerial bait for brown treesnakes into a manufacturable product and associated automated bait delivery system.



Credit for both: USDA APHIS-Wildlife Services

and mammals into overlooking food items or deter them from sitting or perching on treated structures because of the way the items look. NWRC research has also shown that if birds are exposed to AQ and experience unpleasant effects, AQ can be used in lower application rates later, or less expensive compounds with similar UV spectral features can be substituted.

Future NWRC-Arkion research efforts are focused on developing AQ-based products that can be applied directly to the leaves of crops; to fruit and nut trees; on structures at poultry, beef and dairy facilities; and added to rodenticide baits. It is expected that applications of this repellent technology will increase throughout the United States and internationally, saving farmers money and helping to protect a wide variety of resources.

Automatic aerial bait delivery for brown treesnakes

First introduced to the island of Guam in the late 1940s, brown treesnakes now number about 1 million to 2 million on this 200-square-mile island. Unchecked by natural predators, the invasive snake has devastated Guam’s natural ecosystems, causing

the disappearance of 12 of Guam’s 14 native bird species. Additionally, the snakes cause frequent power outages and numerous bites requiring medical attention each year.

Since the 1980s, WS scientists and field biologists have worked with the government of Guam and federal agencies to reduce the number of brown treesnakes on the island to lessen their impacts and keep them from spreading to other islands. WS and its partners developed many control tools and strategies, including traps, detector dogs, cargo and vehicle inspection protocols and rapid response teams. Despite their success in capturing and trapping nearly 10,000 snakes per year, more cost-effective tools were needed to target them in remote and rugged habitats.

One of the most recent tools is a toxic bait. In the late 1990s, NWRC scientists discovered that a child’s dose of acetaminophen, a commonly used analgesic, is lethal to brown treesnakes. After rigorous laboratory and field tests, they produced an acetaminophen-based

bait using dead neonatal mice. The NWRC product registration team worked with the U.S. Environmental Protection Agency to register this bait in 2004 for lethal control of brown treesnakes. This tool alone more than doubled the annual take of brown treesnakes.

In 2009, NWRC and the engineering firm [Applied Design Corporation](#) entered into a series of cooperative agreements to design a manufacturing and delivery system that allows for the mass production and aerial delivery of acetaminophen baits to snakes inaccessible within large forest tracts on Guam. The NWRC supplied information on the snake’s ecology and behavior, guidance on federal pesticide regulations and early prototype concepts. ADC provided technical engineering and manufacturing expertise. Together, they developed a biodegradable bait cartridge and automatic delivery system that can systematically disperse bait cartridges via helicopter or fixed-wing aircraft — a system captured in the video [Battling the Brown Treesnake](#).

In 2019, ADC manufactured more than 60,000 baits for use on Guam. That number will grow as the



tool becomes more widely used. This collaboration also yielded a jointly owned U.S. patent for the bait cartridge. ADC is seeking at least one patent on the novel aspects of the manufacturing system.

This project is a shining example of interagency and private partner collaboration. The departments of Defense and Interior have provided more than \$6.5 million for research and the development of the aerial baiting system. Through their support and NWRC's collaboration with ADC, tools are now available for conducting landscape-scale snake control, hopefully leading to the restoration of Guam's native species and habitats. In addition, this collaboration helped a private company launch a new business and increased job opportunities and economic development—a key mission of federal technology transfer efforts.

Wild horse and burro contraception

Overpopulation of legally protected wild horses and burros, ecologically feral species, is a significant concern in the United States. These animals overgraze native plant species and compete with livestock and native wildlife for food and habitat. The Bureau of Land Management estimates more than 95,000 wild horses and burros are roaming on BLM-managed rangelands in 10 western states—nearly 70,000 more than the agency believes the landscapes can withstand.

Management options are limited. In most cases, BLM can only remove horses and burros from the range and offer them for adoption or hold them indefinitely. More than 49,000 wild horses and burros taken from BLM-managed lands are cared for at short-term corrals and long-term pastures.

Contraceptive technologies could provide a cost-effective tool for managing these populations on public lands and in BLM holding facilities. In 2007, NWRC registered an injectable immunocontraceptive vaccine through the EPA for use in white-tailed deer (*Odocoileus virginianus*). Captive trials conducted in conjunction with the BLM and the National Park Service demonstrated that the same vaccine was also effective in horses.

In 2013, the EPA issued a registration to the USDA-Animal and Plant Health Inspection Service to use GonaCon-Equine in adult female wild horses and burros. This contraceptive vaccine, deliverable by hand injection or darting, provides wildlife

managers another option in their work to reduce overabundant populations.

NWRC scientists who developed the contraceptive technology received a U.S. patent in 2009 and the NWRC Technology Transfer program began seeking a private company to license and manufacture GonaCon-Equine. [SpayFIRST!](#), an Oklahoma-based public-benefit company, entered into a license agreement in 2015 allowing the company to produce and sell the vaccine in the United States and



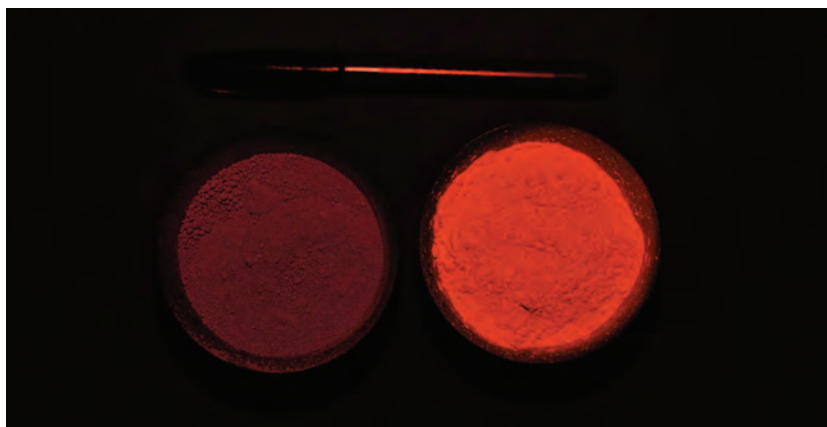
Credit: USDA APHIS-Wildlife Services

◀ A European starling samples an ear of corn treated with Arkion's anthraquinone-based avian repellent product.

▼ Wildlife Services licensed a new contraceptive vaccine called GonaCon-Equine to a public-benefit company. The company plans to manufacture and sell the vaccine to help reduce overabundant populations of wild horses and burros.



Credit: USDA APHIS-Wildlife Services



Credit: USDA APHIS-Wildlife Services

▲ Anthraquinone is used as a bird repellent in part due to visual cues related to the compound's absorption of the ultraviolet spectrum. Note in this UV image, which has been lightened for publication, how the UV-reflective feeding cue is orange.

internationally. Working with NWRC product registration staff, SpayFIRST! submitted a registration application to the EPA in 2017 and received EPA approval in 2019. The company is currently developing a suite of wildlife contraceptive products.

This product development story is unique because the market value of Gonacon-Equine was far too low for commercial business investment. However, the product fits well within the mission of a public-benefit company and meets the needs of federal agency management objectives. The collaboration is another example of the way in which federal laboratories, like the NWRC, work with private entities to address critical needs of federal agencies while creating business opportunities and jobs.

Facilitating product development partnerships

Federal laboratories use a variety of tools to seek and establish product development partnerships and commercialize technologies. Partners typically are found through public and professional networks, such as conferences, meetings and events, direct inquiries to manuscript authors and chance secondhand recommendations.

Federal labs also have a wonderful outreach tool through the [Federal Laboratory Consortium](#) whereby stakeholders can identify labs with the expertise or technical capabilities they need to advance their ideas or find existing intellectual property available to license, produce and grow their business. If a company is interested in licensing existing technology, exclusivity and royalty rates can be negotiated.

The most powerful tool available to federal labs and private partners is the Cooperative Research and Development Agreement. CRADAs provide partners access to government facilities and expertise, the

promise of confidentiality, the transfer of materials for R&D, ownership of co-developed intellectual property and the right to an exclusive license to commercialize the new intellectual property if they choose. CRADAs benefit the government by advancing partnerships and extramural funding opportunities for government scientists and by making technologies more available to government programs and the public and providing tangible returns on taxpayer investments.

Meeting mission needs

Wildlife damage management professionals seek to reduce resource damage to the lowest possible level while also limiting impacts on native wildlife. However, traditional methods and tools they use face increased scrutiny from regulatory agencies and the public. The future success of wildlife damage management depends on new tools and technologies. Together NWRC's researchers and WS Operations staff work to develop and test sound, effective, safe and economical tools and techniques to meet those future needs.

Ideally, private entities would provide the tools needed by wildlife professionals. However, in reality, the market potential of many tools is limited and few private companies are financially willing or able to pursue new registrations or handle the risks involved in developing new products. Government plays a valuable role in absorbing these risks and encouraging innovation and discovery.

The NWRC Technology Transfer program continues to work hard to promote the development and protection of intellectual property developed by WS employees and to transfer new tools and techniques to private industry. These efforts not only support WS' mission. They provide benefits to the country by creating jobs, stimulating the economy and protecting American agriculture and natural resources. ■

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