NP 304 Crop Protection and Quarantine Annual Report

FY 2006

Introduction

The Crop Protection and Quarantine National Program (NP 304) addresses high-priority insect, mite and weed pest problems of crops, forests, urban trees, rangelands, postharvest systems (e.g. stored grains) and natural areas. The goals of NP 304 are to understand the biology, ecology and impact of these pests on agricultural production and natural systems, and to develop, improve, and integrate environmentally safe technologies to exclude, eradicate, or manage pest populations. A priority is placed on sustainable and integrated practices that enhance the productivity, quality, and safety of U.S. agriculture while protecting natural resources, native ecosystems, human health, and the overall environment.

To accomplish its goals, the Crop Protection and Quarantine National Program is divided into two research mission areas: 1) insects and mites; and 2) weeds. Each mission area is comprised of several components.

There are six research components for insects and mites:

I. Identification and Classification of Insects and Mites
II. Biology of Pests and Natural Enemies (includes microbes)
III. Plant, Pest, and Natural Enemy Interactions and Ecology
IV. Postharvest, Pest Exclusion, and Quarantine Treatment
V. Pest Control Technologies
VI. Integrated Pest Management Systems and Areawide Suppression Programs

There are four research components for weeds:

VII. Weed Biology and Ecology
VIII. Chemical Control of Weeds
IX. Biological Control of Weeds
X. Weed Management Systems

Since the Plant Diseases National Program (NP 303) addresses plant pathogens and nematodes, these pests are excluded from NP 304. As an exception to this, the IR-4 Minor Use Pesticide Program (which falls under the direction of NP 304) deals with all pests, including plant pathogens and nematodes. The emerging field of invertebrate genomics is included here.

National Program 304 addresses research on native and introduced/exotic and invasive insects, mites, and weeds. All invasive species (insects, weeds, plant pathogens and nematodes) cost the U.S. over $137 billion per year, which is equal to about $500 per U.S. citizen each year. Invasive species impact on production agriculture is staggering, and is second only to habitat loss in causing negative effects on the natural environment and biological diversity. Currently, there are more than 30,000 invasive species in the U.S. and the number of new species introduced increases each year. The growing threat of introduced organisms prompted the formation of the National Invasive Species Council in 1999, which provides guidance for agencies to increase their efforts to exclude, detect, and eradicate incipient populations and to manage established species.

Invasive insects such as the glassy-winged sharpshooter, emerald ash borer, silverleaf whitefly and other whiteflies, Asian longhorned beetle, *Sirex* wood wasp Russian wheat aphid, pink hibiscus mealybug, cereal leaf beetle, Chinese soybean aphid, numerous fruit flies, imported fire ant, Formosan termite, lobate lac scale, and many others are high priority targets of NP 304. The ultimate goal of NP 304 is to develop area-wide and integrated pest management strategies to mitigate these problems. On average, insect and mite pests destroy 13% of crop production each year, which amounts to about a $36 billion loss. Invasive arthropods are responsible for about $14 billion of this total. Asian longhorned beetle and glassy-winged sharpshooter represent threats of $620 billion and $45 billion respectively. Just the loss due to lawn and garden pests, e.g., Japanese beetle, is $1.5 billion annually. Invasive insects and mites are a frightening threat to the U.S., with new species appearing each year.

Invasive weeds threaten U.S. agriculture and the environment, and are also a great concern of the Crop Protection and Quarantine National Program. Over 100 million acres are currently infested by invasive weeds such as leafy spurge, melaleuca, Old World climbing fern, giant salvinia, salt cedar, hydrilla, waterhyacinth, yellow starthistle, downy brome, Brazilian pepper, jointed goat grass, and purple loosestrife. Total weed populations increase 8% to 20% annually. As aggressive, destructive pests, they are extremely difficult to control. In addition to being hard to kill, weeds are difficult to control over wide areas because land is owned and managed in a discontinuous manner. Land ownership and use is like a checkerboard pattern, therefore control actions are not coordinated across boundaries. Challenges to manage weeds safely and economically occur in production agriculture, grazing lands, and natural areas. Each year, weeds reduce crop yields by about 12% (about $36 billion in losses) and 20% of forage yields (about $2 billion in losses). Aquatic weeds also are a major problem with $100 million spent annually on their control. Besides losses to the agricultural economy, invasive weeds also damage the environment. About half of the threatened and endangered plant species in the United States are primarily at risk because of invasive weeds.

Many NP 304 research activities on invasive species are conducted in support of action agencies, such as the Animal and Plant Health Inspection Service (APHIS). The research has resulted in the exclusion of more potential invasive species, faster detection, and more effective eradication of new invading species. The research already is resulting in more efficient long-term management of established invasive species. These improvements result from emphasizing weed identification, systematics, biologically based areawide and integrated pest management, and ecosystem management.

In 1995, ARS implemented its first areawide integrated pest management (AWPM) partnership project against the codling moth on apples and pears in the Pacific Northwest. Three additional projects were initiated shortly thereafter with corn rootworms, stored wheat insects, and leafy spurge weed as targets. These four projects have been completed and now enjoy great success with adoption of the technologies by end-users. Between 2000 and 2002, ARS initiated six new areawide IPM projects aimed at both invasive and established species: 1) fruit flies in the Hawaiian Islands in multiple crops, especially fruits and vegetables, using field sanitation, male annihilation, protein bait applications, biological control, and sterile insect technology (Hilo, Hawaii, FY 2000); 2) fire ants in Florida, Texas, Oklahoma, Mississippi, and South Carolina, on pastures using natural enemies, microbial pesticides, attracticides and GIS/GPS tracking (Gainesville, Florida, FY 2001); 3) Russian wheat aphid and greenbug on wheat in the U.S. Great Plains using crop diversification, aphid-resistant varieties, biological control agents, and other biologically-based pest control technologies (Stillwater, Oklahoma, FY 2002); 4) the melaleuca tree in Florida using natural enemies and microbial biological control (fungus), judicious use of herbicides, mechanical (mowing) and physical (fire) control, and combinations of these tactics (Fort Lauderdale, Florida, FY 2002); and, 5) the tarnished plant bug on cotton in the delta of Mississippi and Louisiana using alternate/non-crop host destruction, host-plant resistance, and remote sensing technology (Stoneville, Mississippi, FY 2002). Most of these projects have received one or more prestigious awards for their customer outreach and technology transfer successes. A methyl bromide areawide project (Fort Pierce, Florida, and Davis, California FY2006) is associated with NP 308.

ARS has made significant progress during Fiscal Year 2006 in crop protection and quarantine research. Some noteworthy examples are listed below, representing a few of the many accomplishments that have been reported from the numerous in-house and extramural projects assigned to National Program 304. Each project's annual progress report can be accessed at this site. The reader may obtain additional information on all of NP 304's programs and accomplishments by accessing the annual progress reports.

Insects and Mites
Component I: Identification and Classification of Insects and Mites

Armored scale book provides identification tools. Armored scales are among the most damaging and least understood pests inflicting damage to forest trees, fruit and nut crops, and landscape plants. ARS scientists have published a book that provides tools for the identification of the 110 pest species that occur in the United States. This book is useful to arborists, nurserymen, IPM workers, Federal and state identifiers, farmers, and many others.

Aphid pest identification. ARS scientists have published a paper that identifies over 260 aphids that are found in America north of Mexico. Aphids feed on many of the world's agriculturally important crops as well as transmitting many plant diseases. This paper identifies principal host plants, dates of establishment in the U.S. and Canada, probable origins of the insects. This research will be of special interest to quarantine personnel at Federal and State levels.

Comprehensive review of gypsy moth genus completed. This review includes 31 species and two subspecies of Lymantria (gypsy moth) that, if accidentally introduced into North America could result in severe economic loss to native forests. Descriptions, distributions, and illustrations of adults are included. Larvae of thirteen species and two subspecies are described and illustrated. This review will facilitate the identification of Lymantria species coming from temperate Asia.

DNA barcoding unearths cryptic species in flies. DNA sequences of flies from Costa Rica were sampled extensively. The data indicate that there is greater host-specificity in parasitoids in tropical America than previously noted. This will require great care in identifying and characterizing species being considered as biological control agents from the tropic.

Over 30,000 insects and mites identified by ARS systematists. Identification of insects and mites serves as the first line of defense against the introduction of invasive pests into the United States through ports of entry. ARS scientists identified over 30,000 insects (5,256 of URGENT priority.) In addition, scientists provided identification and classification of potential biological control agents.

The ARS Collection of Entomopathogenic Fungai (ARSCEF) is freeze drying over 700 isolates a year. As the world's largest and most taxonomically diverse germplasm repository for fungal pathogens affecting insects, mites, spiders, and other invertebrates of agricultural, veterinary, and medical significance, ARSCEF has operated since with a major focus as a service collection while still maintaining a strong research program utilizing the collection's resources. ARSCEF currently comprises more than 8000 isolates of more than 550 fungal taxa from 1100 different hosts and 1700 locations throughout the world; the collection is managed by a single curator. During FY 06, more than 430 isolates were accessioned including 91 isolates from an orphaned CSIRO collection in Australia.

New species of glassy-winged sharpshooter egg parasitoids discovered. It is usually important to identify biological control agents that originate from the area of the pest's origin. One of the primary parasitoids of GWSS eggs in California was thought to be from Texas, however, ARS scientists discovered, using diagnostic markers, that this was a new species originating in California. Thus, biological control may be expedited by, additionally, importing the Texas parasitoid.

Component II: Biology of Pests and Natural Enemies (includes microbes)

Mutagenic compounds in microbial agents. Some fungi can infect many insect pests, making them useful for development as insect biological control agents. However, it is important to identify key bioactive chemistries that are present in the organism prior to use as a biological control agent. ARS scientists have recently identified two compounds of a *Fusarium* species as mutagenic. While the relevance of this is currently unknown, it heightens the need to develop a more complete understanding of these organisms and their products.

<u>Corn rootworm infestations in Europe coming from multiple introductions from North America.</u> The Western corn rootworm is the most destructive pest of corn in the United States and is now in several European countries after first being detected near Belgrade in 1992. ARS scientists using DNA markers were able to show that the species is not only invading Europe by spreading from the original introduction but also through repeated new introductions from North America. These results show the role of transoceanic transport of harmful pest species.

Component III: Plant, Pest, and Natural Enemy Interactions and Ecology

<u>Soybean crop cultural practices for bean leaf beetle population management</u>. Bean leaf beetle, an emerging soybean insect pest of great economic importance in the U.S., has three subterranean immature (larval) stages that feed on underground portions of soybean plants. Because bean leaf beetle larvae consume soybean root nodules, crop cultural practices that affect soybean nodulation may have the added function of reducing bean leaf beetle populations. In greenhouse and field studies, ARS scientists at Brookings South Dakota, investigated the impact of soil nitrogen management on soybean nitrogen relations and bean leaf beetle population dynamics. Preliminary findings suggest that bean leaf beetle larvae obtained from soybean plants given nitrogen starter fertilizer were smaller than those obtained from plants that were not given starter fertilizer. Because the mechanisms mediating these interactions were not readily apparent, further research on the feeding behavior of bean leaf beetle larvae, as well as the mechanisms underlying the relationships between soybeans, nitrogen, and bean leaf beetle, is underway. Successful completion of this research, which will result in soil nitrogen fertilizer application recommendations for soybeans that will reduce larval feeding damage without using insecticides, will allow soybean farmers to decrease production costs and increase soybean yield, quality, and profitability.

Component IV: Postharvest, Pest Exclusion, and Quarantine Treatment

<u>Quarantine treatment against scale insects</u>. First-ever quarantine irradiation treatments were developed for two diaspidid scale insects by scientists at the ARS Pacific Basin Agricultural Research Center, Hilo, Hawaii. Coconut scale and white peach scale are high-risk quarantine pests of banana and papaya respectively. Research showed that an irradiation dose of 150 Gy is sufficient to provide quarantine security for both pests. The research on white peach scale provides information to lower the papaya irradiation treatment from 400 Gy to 150 Gy which will significantly reduce treatment costs. Using radiation as a treatment, approximately 5 million lbs of papayas are currently exported from Hawaii to the U.S. mainland. Irradiation can be an important alternative to fumigation with methyl bromide when it is effective and doesn’t cause unacceptable phytotoxic effects.

Component V: Pest Control Technologies

Stink Bug Attractant. Lures are being investigated for both monitoring and management of these bugs. The newly invasive brown marmorated stink bug (BMSB) is immune to genetically modified crops such as cotton, therefore other control strategies must be found.   Potential attractants (methyl 2,4,6-decatrienoates) were field-tested by ARS scientists in Beltsville, Maryland, resulting in the first captures of adult and nymphal BMSBs, and the unexpected finding that various isomers of the tested chemicals attract certain native stink bugs. This discovery may lead to the development of lures useful in controlling stink bugs.

Soy wax: an ideal release system for pheromones that disrupt mating of insect pests. Mating disruption is a pesticide–free method of controlling insect pests by inhibiting the ability of insects to locate potential mates through their signaling pheromones. The ideal pheromone release system being developed by ARS scientists in Peoria, Illinois, should provide consistent, long-term release of the active pheromone. Pheromones embedded in granules of soy wax (a renewable and biodegradable resource) has proven to be an effective system for providing this timed release.

Gypsy moth mating disruption treatments remain effective for up to two years. Scientists at the Insect Biocntrol Laboratory in Beltsville, Maryland found that mating success is reduced the year after treatment by up to 80%. In addition, the capture of males in pheromone traps is reduced by up to 50%. These findings are significant because they suggest that the currently-used method of deploying disruptants yearly may not be necessary. If confirmed, this will lead to savings in deployment.

Validation of the Sterile Insect Technique (SIT) for the cactus moth. The cactus moth, *Cactoblastis cactorum*, has been used in many countries to great advantage as a beneficial biological control agent for invasive cacti. It appeared in Florida in 1989, where it is highly invasive, and attacks native cacti. There is concern that it may move westward, following the Gulf States, and enter the American desert southwest and Mexico, where cactus biodiversity is high, and where the cacti are highly valued agricultural, horticultural, and cultural plants. A control methodology is therefore needed that halts the westward spread of the invasive cactus moth into areas of high cactus biodiversity and areas where cactus is an important. Year-round releases of sterile moths accompanied with removal of infested cactus plants and immature moths (sanitation) were compared against sanitation efforts alone. The release of sterile moths in combination with sanitation resulted in substantial reduction in pest population levels. This validates the concept that a SIT program could be used to prevent the moth’s spread and control of isolated outbreaks in North America.

Development of synthetic beetle pheromones. Nitidulid beetles are significant pests of a variety of ripe/harvested fruits and grains worldwide. ARS Scientists at the National Center for Agricultural Utilization Research (NCAUR) in Peoria, Illinois, developed an improved synthetic method for nitidulid beetle pheromones. The pheromones (previously discovered at NCAUR) have been commercialized, but the original synthesis has been rather complicated and costly. The new method, using dimethylhydrazone phosphonates as key intermediates, has a smaller number of steps, improved yields, and better product purities than the original method. The new method is expected to lower pheromone cost and lead to better availability of the compounds.

Development of novel fungal granule for soil applications. In collaboration with the USDA ARS National Center for Agricultural Utilization Research (NCAUR), in Peoria Illinois, ARS scientists at the Northern Plains Agricultural Research Laboratory in Sidney, Montana, developed a novel *Metarhizium* fungus granule that has manufacturing properties, shelf life, efficacy, and field persistence superior to the conventional granular formulation of this fungus. This formulation could greatly increase the attractiveness of using the fungus against soil insect pests, in sugar beets and in other crops, including organic crops, and thereby improve its adoption by industry and the farming community.

Suppression of adult corn rootworms with semiochemical insecticides: More insecticide is applied to corn than any other crop in the U.S. Most of this insecticide is targeted against corn rootworms. In experiments conducted in South Dakota Corn Rootworm Areawide Management Sites, we examined the efficacy of aerially applied semiochemical baited insecticides for suppression of adult western and northern corn rootworm populations over a 5 year period (1997 – 2001). Timing of insecticide application was based on action thresholds of adult beetles captured in Pherocon AM yellow sticky and CRW lure traps. We found significant reductions in the number of both adult western and northern corn rootworms captured one and two weeks following application – with populations remaining low thereafter. This method of managing corn rootworm populations could substantially reduce the amount of insecticides applied for corn rootworm control and has been adopted in some parts of the U.S. Corn Belt.

Minor use pesticide registrations. ARS scientists at Beltsville, Maryland; Charleston, South Carolina; Corvallis, Oregon; Prosser, Washington; Salinas, California; Tifton, Georgia; Wapato, Washington; Weslaco, Texas; and Wooster, Ohio, conducted 246 field use trials and 271 ornamental trials to support minor use pesticide registrations. This research will provide growers with safer and more effective chemical pesticides necessary to reduce pest losses and maintain yield and quality with less impact on the environment.

Scientists work to prevent *Bt* resistance in European corn borer. Transgenic corn containing the *Bacillus thuringiensis* toxin CrylAb is extremely effective in protecting against the European corn borer, a major pest of corn throughout the Corn Belt. It is possible that the European corn borer will develop resistance to CrylAb. Scientists working on insect resistance management have been hampered by the lack of resistant laboratory colonies. ARS scientists have established a highly resistant colony by exposing larvae to freeze dried maize tissue containing the Cry1Ab toxin. Analysis of the colony shows that there are multiple genes involved in resistance. The development of this resistant colony will provide a way to conduct research leading to better resistance prevention and monitoring tactics.

Genes may provide protection against the destruction of the Colorado potato beetle. ARS scientists have identified and cloned three genes that are induced in potato by infestation of the Colorado potato beetle; two of these genes are not induced by wounding. This indicates that these genes are not specific to the plant/insect interaction. Further research should ultimately allow the development of a resistance gene that, when cloned into the potato, will create a plant that specifically expresses this transgene when Colorado potato beetle feeding occurs. This should result in diminishing the overall amount of genetically engineered plant material produced.

Selenium diet supplement slows infection in tobacco budworm. Currently, the control of insect pests often requires expensive inputs of insecticides, fuel, and labor. Baculoviruses are a promising, environmentally-friendly alternative to oil-based pesticides. ARS scientists have shown that the course of baculovirus infection the tobacco budworm was significantly slowed by a dietary selenium supplementation.

Component VI: Integrated Pest Management Systems and Areawide Suppression Programs

Area-wide pest management partnership approach drastically suppresses imported fire ant populations at sites in five affected Southern states. Imported fire ants were inadvertently introduced into the United States in the early 1900's and now infest over 130 million hectares in a number of southeastern states. The U.S. economic impact of fire ants is estimated at more than $5 billion annually in damage to agriculture, for control measures, and for medical treatments as a result of stings. ARS scientists in Gainesville, Florida, and Stoneville, Mississippi, APHIS, land grant universities in Florida, Mississippi, Oklahoma, South Carolina, and Texas, and state agencies joined forces to execute the first area-wide pest management program for (AWPM) fire ant management program on pasture and farmland using self-sustaining biological control agents (fire ant pathogens and phorid fly parasites), and bait toxicants as needed. Fire ant population levels have been reduced to 80-90% and have stayed at that level for 4-5 years where the AWPM approach was used. New demonstration sites have been established on "high value" properties such as parks, golf courses, natural areas, military facilities, and poultry farms.

Areawide pest management program of fruit flies in Hawaii adopted in three demonstration site areas. Growers and cooperators in Waimea, Hawaii, Kula, Maui, and Central Oahu Island have adopted the areawide pest management approach for control of tephritid fruit flies demonstrated by ARS over the last few years. Almost 8,000 acres are currently under suppression. As a result of this, there has been a dramatic reduction in organophosphate insecticide use in these areas. This program is augmented by research at the ARS Beltsville Agricultural Research Center, Beltsville, Maryland, that has found a synthetic fluorinated analog of methyl eugenol that might replace this oriental fruit fly attractant, thereby avoiding methyl eugenol's reported cancer-causing properties. Aiding in these efforts is progress in developing new formulations of the fruit fly attractants methyl eugenol (oriental fruit fly) and cuelure (melon fly) by scientists at the ARS U.S. Pacific Basin Agricultural Research Center, Hilo, Hawaii, in collaboration with scientists in Beltsville and the industry. New trap designs that incorporate more environmentally compatible toxicants such as fipronil and spinosad, as well as pesticide free traps, were developed for use with these fruit fly lures. The improvements will increase our ability for early detection of invasive alien fruit flies and ultimately make it more efficient for end users working in detection, control, and eradication action programs to deploy traps for detection and control.

Weed Science

Component VII: Weed Biology and Ecology

<u>Tropical spiderwort can eliminate peanut yield</u>. Tropical spiderwort, *Commelina benghalensis,* an exotic invasive weed, has quickly spread in the Southeast Coastal Plain and is the second most-troublesome weed in peanut. Researchers from the ARS Crop Protection and Management Research Unit in Tifton and Dawson, Georgia, cooperated with University of Georgia scientists to conduct field studies to determine the length of time that peanut fields need to be kept free of tropical spiderwort to minimize yield losses. Research demonstrated that tropical spiderwort was capable of causing 100% peanut yield loss after just six weeks of competition. Peanut yield loss was less than 10% when plots were kept free of spiderwort for 3- to 6-weeks after peanut planting. This critical period of weed control coincided with peak spiderwort emergence. Growers will use this information to implement a strategy that eliminates spiderwort competition during this interval, saving considerable resources.

<u>To vine or not to vine</u>. The mechanisms by which tendrils of invasive vine weeds coil have been a mystery since Darwin's study of vines in the late 1800s. Understanding this mechanism will contribute to development of control strategies for invasive vines. Recent theories have described mechanisms based on more elongation of the tendral on the surface away from the touched object, and less elongation on the touched surface, or a second mechanism based upon changing orientation of plant growth, leading to spiraling. Studies of redvine tendrils conducted at the Southern Weed Science Research Unit in Stoneville, Mississippi, found that neither of these mechanisms is the cause of vining. Rather, the tendril elongates and then coils around an object. The ability to coil coincides with the development of a unique fiber system called gelatinous fibers, which until this work was only known in tree branching. In the redvine tendril these fibers occur as a band in the cortex of the tendril, about 5 cells wide. Higher lignification towards the touched surface prevents the cells on that surface from twisting as much as cells on the outer surface, thus allowing for the development of coils around various sized and shaped objects. This remarkable system of coiling allows the vine to climb many objects, with a relatively small amount of biomass.

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Component VIII: Chemical Control of Weeds

Component IX: Biological Control of Weeds

Initiation of biological control of giant reed. A biological control program for the invasive weed giant reed or Carrizo cane, *Arundo donax*, has been initiated. Giant reed is a serious ecological threat to the Rio Grande River Basin because it displaces beneficial vegetation and uses excessive water needed to grow crops. It also places Customs and Border Protection officers from the Department of Homeland Security at risk because smugglers hide in dense arundo infestations. Scientists at the Beneficial Insects Research Unit in Weslaco, Texas, have imported three potential biological control agents from Europe into USDA quarantine facilities in Texas for biological control of giant reed. These biological control agents are a shoot-feeding wasp (*Tetramesa romana*), a cane-burrowing fly (*Cryptonevra* spp.), and a rhirzome-infesting scale (*Rhizaspidiotus donacis*). There is significant interest and support for the program from the International Boundary and Water Commission, Department of Homeland Security, Bureau of Reclamation, Fish and Wildlife Service, Texas Rio Grande Watermaster, Texas Parks and Wildlife, Texas Department of Transportation, Texas Lower Rio Grande Valley Irrigation Districts, PRONATURA Mexico, and CONANP Mexico.

Integrated control of redvine and trumpetcreeper in glyphosate-resistant soybean. Redvine, *Brunnichia ovata*, and trumpetcreeper, *Campsis radican***,** are perennial, deep-rooted vines found extensively in crop and noncrop lands in the lower Mississippi Delta region. Glyphosate alone can not provide complete control of these weeds, so additional management tactics are needed that are affordable and sustainable. Scientists at the Southern Weed Science Research Unit in Stoneville, Mississippi, completed a 4-year field study to determine the effectiveness of fall deep-tillage and glyphosate on redvine and trumpetcreeper populations and soybean yield. Fall deep-tillage (~18 inches) reduced redvine density compared with shallow-tillage (~6 inches), but deep-tillage did not reduce trumpetcreeper density. Glyphosate applied preplant and in-crop postemergence reduced trumpetcreeper density, but not redvine compared with no glyphosate. Soybean yields were higher with deep- *vs*. shallow-tillage. These results demonstrated that integration of fall deep-tillage and glyphosate applications could be an effective strategy to manage these vines in glyphosate-resistant soybean.

Component X: Weed Management Systems

Successful eradication of a major invasive marine weed. The invasive marine algal weed, *Caulerpa taxifolia* (caulerpa) was eradicated from California through a cooperative interagency effort. Caulerpa had spread to over 30,000 acres in the Mediterranean Sea from 1985 to 1999, and in 2000, the first two U.S. infestations of this species were discovered in California. These infestations threatened over 600 miles of western coastal subtidal habitat. ARS scientists at the Davis, California, worksite of the Exotic and Invasive Weed Research Unit conducted research and provided technology transfer as part of a multi-agency eradication effort during the past five years. This work was essential in development and implementation of methods for effective eradication of caulerpa. It also provided a very rare example of a quantitative evaluation of eradication efficacy, and helped establish scientifically based criteria for determining how and when eradication of an invasive weed could be achieved. Results have culminated in a formal declaration of eradication by the California Department of Fish and Game (July 12, 2006) and the program is sure to have saved the State of California millions of dollars by reducing damage and control costs and averting a potential environmental disaster.