



FLORIDA A&M UNIVERSITY  
**CENTER FOR  
BIOLOGICAL CONTROL**  
COLLEGE OF AGRICULTURE AND FOOD SCIENCES

Protecting the Nation's Food Supply,  
Natural Resources and Human Health



# STRATEGIC PLAN (2025-2030)

COLLEGE OF AGRICULTURE AND FOOD SCIENCES  
FLORIDA AGRICULTURAL AND MECHANICAL UNIVERSITY



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# Message from the Dean



It is a privilege to present the 2025–2030 Strategic Plan of the Center for Biological Control (CBC), College of Agriculture and Food Sciences (CAFS) at Florida A&M University (FAMU). As an 1890 land-grant institution, FAMU carries a special responsibility to advance agricultural research, teaching, and extension programs that not only uplift our communities but also safeguard the broader systems of food, natural resources, and trade that sustain society. The CBC embodies this mission by developing and applying innovative biological control strategies to address today’s most critical challenges in pest management, environmental protection, and agricultural sustainability.

The strength of the Center rests firmly on the foundation of its enduring partnerships with our federal collaborators, particularly the United States Department of Agriculture’s Agricultural Research Service (USDA–ARS) and Animal and Plant Health Inspection Service (USDA–APHIS). These agencies provide essential scientific collaboration, technical expertise, and resources that enable the CBC to support growers, industries, and communities with science-driven solutions. Together, we are tackling the management of serious invasive and native pests that threaten crop production, degrade natural resources, and disrupt ecosystems. Moreover, by protecting agriculture and the environment, our joint work plays a vital role in safeguarding domestic and international trade, ensuring that agricultural commodities meet phytosanitary standards and can move freely in global markets.

Equally central to the Center’s mission is its commitment to student training and workforce development. The CBC provides unique opportunities for students to gain hands-on experience in research, diagnostics, and extension programs, strengthening their knowledge, skillsets, and abilities in entomology, plant health, and integrated pest management. These experiences prepare our graduates to become leaders in the national agricultural and natural resource workforce, filling critical roles across academia, government agencies, and industry. By investing in our students, the Center ensures that the next generation is well-equipped to meet emerging challenges, from invasive pest incursions to the need for more resilient agricultural systems.

Looking forward, the 2025–2030 Strategic Plan positions the CBC to build upon its history of excellence while embracing new opportunities. Through innovative research, stakeholder-driven outreach, and student-centered training, the Center will continue to play a leading role in protecting agriculture, conserving natural resources, safeguarding trade, and managing pest threats. This work reflects the enduring vision of FAMU as an 1890 institution: To serve our communities, strengthen the agricultural enterprise, and prepare future leaders to safeguard the nation’s food, environment, and economic security.

G. Dale Wesson, Ph.D., PE  
Dean and Director, Land-Grant Programs

# Message from the Director



I am excited to present the 2025–2030 Strategic Plan of the Center for Biological Control (CBC), College of Agriculture and Food Sciences, Florida A&M University (FAMU). This plan is a roadmap for addressing one of Florida’s most urgent challenges: the growing threat of invasive pests to agriculture, natural resources, tourism, and trade. Guided by our mission and vision, the CBC is positioned to expand its leadership in developing and delivering solutions that protect our state’s economy, environment, and communities.

The plan is vital not only for our federal partners including the United States Department of Agriculture’s Agricultural Research Service (USDA, ARS) and Animal and Plant Health Inspection Service (USDA, APHIS) but also for the growers, ranchers, foresters, industry leaders, trade partners, and communities we serve. Together, these partners form the backbone of Florida’s agricultural and natural resource sectors, and without science-based solutions the state’s \$160 billion agricultural economy, world-renowned tourism, and position as a global trade hub would remain under constant threat.

Florida continues to face incursions of serious invasive pests that illustrate the scale of the challenge before us. Most recently, the arrival of the cotton jassid (*Amrasca biguttula*) in 2025 poses a significant threat to many crops, while the spotted lanternfly (*Lycorma delicatula*), though not yet established, poses a looming risk to vineyards, orchards, and specialty crops. The red palm weevil (*Rhynchophorus ferrugineus*) threatens native and ornamental palms central to Florida’s landscapes and tourism, and giant African land snails (*Lissachatina fulica*) have re-emerged as both an agricultural and public health threat. In specialty crops, the Asian citrus psyllid (*Diaphorina citri*), vector of citrus greening, continues to erode one of Florida’s most iconic industries, while wood-boring beetles such as the southern pine beetle (*Dendroctonus frontalis*) compromise forest health. These examples underscore that invasive and native pests are not distant threats but current and costly realities.

In this strategic plan, we emphasize cost-effective, science-driven pest management solutions that integrate classical biological control with innovations in molecular diagnostics, artificial intelligence, ecological modeling, and digital detection. Our holistic approach ensures that solutions are both practical for stakeholders and grounded in cutting-edge science. Equally important is our responsibility to train the next generation of scientists and practitioners. Students at the CBC gain experience in field and laboratory research, diagnostics, and extension activities, strengthening their ability to manage insect pests and natural enemies. Workforce development remains central to our mission, producing graduates who are competitive globally and ready to lead the fight against invasive pests.

The ecological, economic, and social impacts of invasive species demand coordinated action. Through this strategic plan, the CBC will continue to work together with federal partners, state agencies, industry groups, and local communities to protect Florida’s agriculture and natural resources while contributing to national food and environmental security. By strengthening partnerships, embracing innovation, and delivering impactful outreach, we will ensure the CBC remains a leader in the fight against invasive pests during the next five years and beyond.

Muhammad Haseeb, Ph.D.  
Director, Center for Biological Control

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# History, Mission and Vision

**History:** The Center for Biological Control (CBC) was established at Florida A&M University (FAMU) in 1999 as one of the premier research centers within the College of Agriculture and Food Sciences (CAFS). Since its inception, the Center has operated as a collaborative hub, uniquely positioned through a formal partnership between FAMU and two agencies of the United States Department of Agriculture (USDA), the Agricultural Research Service (ARS) and the Animal and Plant Health Inspection Service (APHIS). This foundational alliance ensures that the Center's mission is closely aligned with national priorities in sustainable agriculture, invasive species management, and food security.

Beyond its federal partners, the CBC has cultivated strong linkages with state agencies, private industry stakeholders, grower associations, and other academic institutions, most notably the University of Florida (UF/IFAS) and the Florida Department of Agriculture and Consumer Services (FDACS). These partnerships expand the Center's capacity to address regional and national challenges in biological control through integrated research, education, and outreach efforts. A hallmark of the Center's success is its commitment to strategic planning. Every five years, the CBC develops a forward-looking plan to guide its research priorities, capacity building, and community engagement. The five most recent strategic plans have collectively advanced the Center's impact, enabling substantial progress in areas such as applied and basic research, graduate and undergraduate training, extension programming, and public outreach. These accomplishments have positioned the CBC as both a leader in entomological research and a trusted resource for science-based solutions in pest management.

This document presents the Strategic Plan for 2025–2030, which outlines a comprehensive roadmap for the Center's continued growth and evolution. Building upon its past achievements, the CBC will implement a dynamic and focused program designed to address pressing challenges such as invasive species threats, climate change impacts on pest dynamics, and the integration of cutting-edge technologies (e.g., AI-based pest detection, molecular diagnostics). At the same time, the plan establishes a foundation for meeting future challenges by investing in workforce development, fostering international collaborations, and enhancing stakeholder engagement. Importantly, the CBC recognizes that long-term solutions to pest management must not only safeguard Florida's agricultural and natural resources but also strengthen food security, protect public health, and sustain rural livelihoods. Through its inclusive and science-driven approach, the Center is uniquely positioned to provide leadership at the state, national, and global levels in addressing the complex and evolving threats posed by invasive pests.

**Mission:** The mission of the CBC at FAMU is to generate, apply, and transfer innovative, ecologically based solutions to pest problems affecting agriculture, natural resources, and human health, while simultaneously developing human capacity for continued future innovation. The Center achieves this by providing biologically based pest control solutions for various stakeholders and conducting research and training in the field of integrated pest management (IPM).

Importantly, the 2025–2030 plan is carefully aligned with the broader strategic visions of FAMU and CAFS, ensuring that the Center contributes directly to the University's land-grant mission of teaching, research, and extension. It also remains closely linked to the strategic priorities of USDA–ARS and APHIS, thereby reinforcing the CBC's role as a critical partner in safeguarding U.S. agriculture, natural resources, and trade. Through this new plan, the Center for Biological Control reaffirms its commitment to innovative research, impactful outreach, and capacity building. Together with its partners, it will continue to generate ecologically based, practical solutions to pest management challenges while preparing the next generation of scientists and practitioners who will carry forward this vital mission.

**Vision:** To become a nationally recognized leader in ecologically-based pest management, achieving excellence through quality and effectiveness in research, training, and outreach.

# Goal and Objectives

The long-term goal of the Center is to become internationally recognized for innovation in ecologically-based pest management. It will be characterized by truly collaborative partnerships, with strong linkages from its various stakeholders.

The Center will continue moving steadily towards this goal by focusing its activities on four key objectives:

**OBJECTIVE 1:** To generate and apply knowledge in the development of ecologically-based management of pests, with a particular focus on invasive alien species.

**OBJECTIVE 2:** To develop human capacity for continued future innovation, through undergraduate, graduate and specialist training.

**OBJECTIVE 3:** To implement innovative knowledge transfer and public outreach efforts, ensuring that solutions generated by the Center benefit the targeted end-users.

**OBJECTIVE 4:** To develop science based policies to protect production systems, human health, and natural resources.

**OBJECTIVE 5:** To ensure operational effectiveness and growth of the Center.

These objectives are interlinked and while Center's activities will continue to have a strong emphasis on the state of Florida, the Center will also continue to engage in national and international projects, and foster linkages and cooperation with appropriate partner institutions. For instance, the invasive alien species work will necessarily have research and training activities with key United States trading partners. Through these interlinked efforts, the Center advances its long-term vision to protect the Nation's food supply, safeguard natural resources, and improve public health. By integrating research, extension, and education, and by leveraging both local expertise and international cooperation, the Center positions itself as a hub of innovation and leadership in invasive species management and ecological pest control. In doing so, it not only addresses present challenges but also builds the human capacity and institutional linkages necessary to confront future threats effectively.





# Objective 1: Generation and Application of Knowledge



The Center will continue to maintain a strong balance between basic and applied research, ensuring that its work remains both innovative and practical. Research activities are organized around two core themes that directly align with state and national priorities while building on the Center's existing strengths and future growth potential:

- Management of invasive alien species
- Integrated pest management

## 1.1 MANAGEMENT OF INVASIVE ALIEN SPECIES

In recent years, the importance of invasive alien species (IAS) as one of the most significant drivers of global change has come to the forefront. IAS pose a serious threat to agriculture, natural resources, and human health. Globalization of trade and transport has compounded the risk of IAS, especially in Florida, which has an extremely high visitor rate and major seaports and airports that serve as primary entry points for traded goods into the United States. Not surprisingly, the last two decades have seen an accelerated rate of entry and establishment of alien species, many of which have become serious threats to agriculture and natural resources. This is clearly demonstrated in the case of invasive insects, where more than ten new alien pests have become established in Florida every year. Associated with the increased threat of IAS, the specter of agro-terrorism has also become a significant concern. An effective approach for dealing with IAS requires a multi-pronged strategy that emphasizes prevention as the first line of defense. Should alien species gain entry, emphasis shifts to AI-powered early detection systems, eradication programs, and, as a last resort, sustainable management strategies. The Center will be involved in activities across this spectrum, from prevention to long-term management and restoration.



Particular focus will be placed on the following sub-themes, each of which integrates artificial intelligence and machine learning innovations:

- **Offshore pest mitigation.** Application of predictive analytics and machine learning to assess high-risk pathways and prioritize inspection resources at Caribbean and Latin American points of origin.
- **Ecologically based management of invasive insect pests and weeds.** Integration of AI-enhanced ecological models (e.g., MaxEnt, DDRP) to forecast spread, evaluate climate suitability, and design adaptive management strategies under different environmental scenarios.
- **Development of electronic diagnostic tools and resources for insect identification.** Expansion of AI-based image recognition, acoustic sensing, and molecular barcoding tools,
- enabling inspectors, growers, and researchers to rapidly identify pests such as fruit flies, scale insects, and beetles in the field with mobile apps.
- **Economics of invasive species.** Use of machine learning to quantify economic losses and predict cost-benefit outcomes of various control strategies, helping policy makers allocate resources more efficiently.
- **Improving the safety of biological control.** Development of AI-based risk assessment tools to evaluate host specificity, ecological compatibility, and long-term sustainability of biological control agents, reducing unintended impacts while maximizing control success.

By embedding AI and machine learning across all stages from pathway risk analysis and offshore mitigation to early detection, spread modeling, and control evaluation; the Center will strengthen Florida's preparedness and response capacity against invasive species.



## 1.2 Offshore Pest Mitigation

Because of the close proximity and strong economic links between the Caribbean basin countries and Florida, the Caribbean has become an important entry route through which invasive alien species (IAS) reach the United States. Prevention is the most effective and desired approach, and this may comprise a range of options, including offshore mitigation actions at points of origin as well as port-of-entry inspections. Offshore mitigation has clear advantages in the Caribbean basin context, where regional coordination and rapid response can help to significantly reduce establishment risks. The success of any offshore effort depends on sound scientific knowledge – both in terms of identifying which species pose the greatest risks and in applying the best available technologies to minimize pest populations at their points of origin.

In recent years, progress has been achieved in understanding plant invasions, but much less has been done with insect pests of agriculture, forestry, livestock, and public health importance. This represents a significant challenge that requires both basic and applied research. The large number of alien species becoming established in Florida every year provides many opportunities to conduct relevant studies that can improve our understanding of invasion biology and strengthen predictive models of invasiveness.

The advent of the Pink Hibiscus Mealybug (*Maconellicoccus hirsutus*) in the Caribbean, and the success of offshore efforts by USDA-APHIS to develop technologies for its management, not only slowed its rate of spread but also greatly enhanced response time when the pest reached Florida. Building on this success, attention must also be directed at other groups of high-risk pests:

- Economically important fruit flies (Tephritidae) of specialty crops, such as the Caribbean fruit fly (*Anastrepha suspensa*), guava fruit fly (*Anastrepha striata*), and potential threats like the South American cucurbit fly (*Anastrepha grandis*), which threaten citrus, mango, guava, cucurbits, and other specialty crops central to Florida's economy.
- Scale insects (e.g., hibiscus, cycad aulacaspis, and armored scales), which are highly polyphagous and can devastate ornamentals, palms, and tropical fruit crops.
- Whiteflies (*Bemisia tabaci* and related species), which are efficient vectors of plant viruses affecting vegetable and ornamental industries throughout Florida and the Caribbean.
- Red palm weevil (*Rhynchophorus ferrugineus*), one of the most destructive pests of palms worldwide, posing a major threat to Florida's iconic landscape and nursery industries.
- Coconut rhinoceros beetle (*Oryctes rhinoceros*), an emerging palm pest in the Pacific with potential risk to Florida's ornamental and coconut palms through Caribbean trade pathways.
- Pests of animal and human health, such as New World screwworm (*Cochliomyia hominivorax*), mosquitoes (*Aedes aegypti* and *Aedes albopictus*) which transmit arboviruses, and biting midges, which could spread livestock diseases. These pests not only affect agriculture but also tourism, public health, and food security.



At present, several initiatives by U.S. agencies, such as the APHIS Caribbean Strategic Initiative, are focused on addressing these threats. However, given the multiplicity of IAS and the strong Florida-Caribbean trade linkages, there is an urgent need for the generation of scientific knowledge to address imminent threats.

The Center will focus its efforts on:

- Establishment of the Center as a key partner in Caribbean-wide safeguarding initiatives against IAS, working closely with APHIS, Caribbean plant health organizations, and universities.
- Conducting research on high-risk species already present in the Caribbean, including ecological and behavioral studies to generate baseline information essential for prevention and management. Building on previous successes with mealybugs, this work will be expanded to include whiteflies,
- scale insects, fruit flies, red palm weevil, coconut rhinoceros beetle, and other Hemiptera and Coleoptera of concern.
- Conducting basic research to improve understanding of the traits that make some species more invasive than others, enabling more accurate risk assessments, prioritization, and offshore mitigation strategies.

### 1.3 Ecologically Based Management of Invasive Insect Pests and Weeds

Even with the best mechanisms for prevention available today, an inescapable fact is that invasive alien species (IAS) will continue to become established and spread. Some of these

IAS may expand into already complex cropping systems where other pests currently require control, compounding the burden on farmers and land managers. There are increasing societal, environmental, and economic pressures to create innovative solutions to these pest problems. The traditional paradigm of relying primarily on chemical pesticides has proven to be neither sustainable nor sufficiently effective in modern agricultural and natural resource management. Biologically based pest management techniques, such as classical and augmentative biological control, offer great potential to suppress pest populations within agroecosystems and to slow the spread of invasive species to new geographic areas. However, greater knowledge of basic insect behavior, life cycles, and ecology is needed to develop novel control techniques and to integrate them into existing agricultural, forestry, and aquatic management practices. Although biological control remains a cornerstone of sustainable pest management, its limitations under certain conditions require complementary tactics such as the Sterile Insect Technique (SIT), habitat manipulation, and host-plant resistance. These approaches are essential to reduce pesticide reliance, enhance sustainability, and protect ecosystem services. Under this theme, research will be directed toward improving the sustainability of agricultural, forestry, and aquatic production while reducing environmental degradation caused by invasive alien species. This includes addressing current and emerging threats such as:

- Emerald ash borer (*Agrilus planipennis*), which continues to devastate ash tree populations in North America, requiring integrated monitoring and biological control solutions.
- Pine bark beetles, which threaten Florida's pine forests and can cause large-scale mortality during outbreaks, particularly following climatic stress events such as drought.
- Asian longhorned beetle (*Anoplophora glabripennis*), a high-risk invasive wood-borer capable of killing multiple hardwood tree species and disrupting ecosystems and trade in timber and nursery stock.
- Cotton jassid (*Amrasca biguttula*), recently detected in the Caribbean Basin and Florida, which poses a serious threat to cotton and other specialty crops through direct feeding damage and transmission of plant stress.
- Spotted lanternfly (*Lycorma delicatula*), an invasive planthopper that threatens vineyards, fruit orchards, and ornamental plants, and has the potential to cause heavy losses in Florida's specialty crop sector if established.
- New World screwworm (*Cochliomyia hominivorax*), a devastating parasite of livestock and wildlife that causes severe tissue damage and economic losses, and requires sustained surveillance and SIT-based eradication strategies to prevent reintroduction into Florida and the southeastern United States.





- Water hyacinth (*Eichhornia crassipes*), one of the most destructive aquatic weeds worldwide; Florida's long-running biological control programs using weevils (*Neochetina* spp.) and moths have
- demonstrated strong benefit-cost outcomes, reducing management costs and restoring aquatic ecosystem functions.
- Air potato (*Dioscorea bulbifera*), a highly invasive vine that smothers native vegetation and forests; release of the host-specific air potato beetle (*Lilioceris cheni*) has proven to be a cost-effective and environmentally safe biological control program in Florida.



**Specific activities will include:**

- Research to address how polyphagous herbivores such as thrips, whiteflies, and cotton jassid select and utilize host plants, and how the plant matrix of agroecosystems can be altered to reduce pest dispersal and feeding pressure.
- Research to exploit beneficial companion plants to increase the abundance and activity of predatory insects and parasitoids, thereby strengthening natural pest suppression.
- Research to increase the effectiveness of existing SIT applications, such as against the invasive Argentine cactus moth and New World screwworm, while exploring the feasibility of adapting SIT for other species like spotted lanternfly and red palm weevil.
- Research to determine which life stages of invasive weeds are most susceptible to natural enemy attack and how integrated control methods affect their spread, with examples including hydrilla, water hyacinth, and Chinese tallow.
- Research to develop alternative IPM-compatible tools for honey bee pests such as Varroa mite and small hive beetle, including mycopathogen-based biopesticides.
- Research to strengthen biological control and monitoring of invasive forest pests such as emerald ash borer, pine bark beetles, Asian longhorned beetle, and redbay ambrosia beetle, with emphasis on trap optimization, semiochemical lures, and natural enemy discovery.
- Research to evaluate predictive models and risk-mapping tools to anticipate the spread of emerging pests such as spotted lanternfly and cotton jassid under climate and trade-driven scenarios, supporting rapid detection and early eradication programs.
- Research to expand, refine, and evaluate successful biological control programs for invasive plants such as water hyacinth and air potato, ensuring long-term cost-effective management and reduced reliance on herbicides.



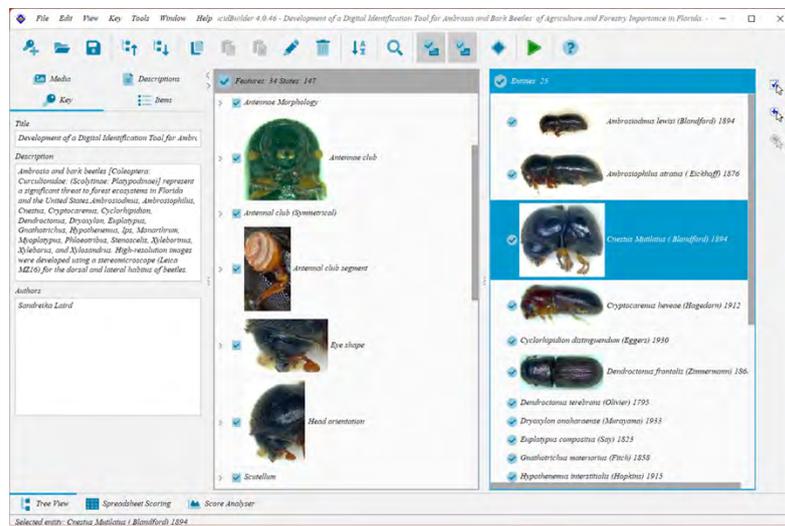
**1.4 Development of Electronic Diagnostic Tools and Species**

**Distribution Models**

Accurate and immediate identification of organisms is vital for a variety of purposes, including quarantine, biological control, and early detection of invasive pests. The Center has a long history of involvement and achievement in taxonomic work. In the context of invasive species, rapid and reliable identification is of paramount importance. Modern diagnostic and identification characters presented in high-quality images,

spectral signatures, acoustic recordings, and molecular data, combined with detailed taxonomic information, are highly valuable for end-users ranging from growers and inspectors to researchers and policy makers.

Current and future efforts will emphasize the integration of artificial intelligence (AI) and machine learning (ML) into digital diagnostic systems. By leveraging large annotated image datasets, convolutional neural networks (CNNs) and other ML algorithms can be trained to automatically recognize pest insects, weeds, and pathogens from field or laboratory images, providing faster and more accurate identifications than traditional approaches. Computer-based Expert Information Systems, enhanced by AI, will focus on specific taxa and commodity groups, and will allow users to receive real-time identification support via mobile applications and cloud-based platforms. In addition, advanced species distribution models will be linked with machine learning approaches to improve predictions of potential invasiveness and geographic spread under different scenarios, including climate change, global trade flows, and habitat disturbance. These predictive analytics will provide stakeholders with actionable insights into emerging threats, enabling better resource allocation and proactive management strategies. AI-driven models can also incorporate citizen science data, satellite imagery, and environmental monitoring inputs to continuously refine predictions. Strong collaborations and linkages with USDA APHIS, the Florida Division of Plant Industry, and the University of Florida will be enhanced to accelerate the development, testing, and deployment of these tools.



Work will specifically be focused on:

- Development of digital identification tools/resources for key pest and commodity groups using AI-powered image recognition, acoustic sensing, and molecular diagnostics.
- Development of linkages with taxonomic experts and data scientists to ensure that the facilities developed for digital tools are maximized and continuously validated with expert knowledge.
- Promoting training in AI-based diagnostic tools, mobile applications, and digital resources to ensure adoption and effective use by growers, inspectors, students, and extension personnel.
- Predicting potential distribution of invasive species in the invaded range using ML-enhanced ecological niche models (e.g., MaxEnt, DDRP, CLIMEX) that integrate climate, trade, and land-use variables.

## 1.5 Economics of Invasive Species

Of the more than 50,000 foreign plant and animal species that have become established in the United States, about one in seven have become invasive, causing over \$120 billion in losses per year. The economic impacts of invasive species may be far-reaching, affecting agricultural productivity, displacing more important native species, disrupting ecosystems, lowering real estate values, and posing health and safety concerns for humans and their agricultural interests. The Center recognizes the importance of documenting and reporting the economic damage of invasive exotics. Knowledge of these economic impacts assists policy makers who evaluate the level of support they should provide for control and eradication efforts and determine the relative efficiency of these programs. It also becomes an important tool for educating the public on the overall effects of invasive species. Within the last ten years, the CBC has undertaken several benefit/cost studies to assess the economic efficiency of high-profile biological control and management programs. For example, the introduction of *Lilioceris cheni* (air potato beetle) to control invasive air potato vines has shown strong cost savings compared to repeated herbicide treatments. Likewise, biological and mechanical suppression of aquatic weeds such as water hyacinth (*Eichhornia crassipes*) in Florida's waterways has generated substantial economic benefits by reducing navigation blockages, restoring recreational value, and preventing damage to hydropower and irrigation infrastructure. Early detection and eradication programs for invasive arthropods such as the red palm weevil (*Rhynchophorus ferrugineus*) are also economically justified, since preventing its establishment saves millions of dollars in landscape, nursery, and tourism losses that would otherwise accrue if palms were widely destroyed.

Similarly, management of the citrus root weevil (*Diaprepes abbreviatus*), a pest that threatens Florida's citrus and ornamental industries, has demonstrated favorable cost-benefit outcomes, as timely biological and cultural interventions reduce yield losses and avoid expensive long-term chemical reliance.

Florida's specialty crops face additional invasive pest pressures. In vegetable production, the pepper weevil (*Anthonomus eugenii*) causes significant yield and quality losses in peppers, with integrated control programs offering substantial economic savings over repeated broad-spectrum insecticide use. In root crops, the sweet potato weevil (*Cylas formicarius*) represents one of the most serious threats, where prevention, sanitation, and host-plant resistance measures yield long-term economic benefits by protecting both smallholder and commercial production. Florida's apiculture sector also faces major invasive threats: the small hive beetle (*Aethina tumida*), which damages honey, pollen stores, and combs, and the Varroa mite (*Varroa destructor*), which weakens honey bee colonies and transmits viruses. Both pests cause millions of dollars in annual losses, and investments in integrated control strategies (cultural, mechanical, and chemical) have proven far less costly than colony collapse and replacement.

These examples highlight benefit-cost ratios often exceeding 10:1 which demonstrate that strategic public investment in prevention and control yields large net returns to Floridians, safeguarding agriculture, natural resources, and trade.

- Support more complex and complete economic studies by expanding beyond the concept of economic impact to the more important concept of economic value. Moving in this direction will permit policy makers to not only document control expenditures and their impact on regional economies, but to also document the more comprehensive losses related to social welfare and opportunity.
- Expand beyond terrestrial weeds. While previous efforts have focused on terrestrial weeds, this work will be extended to include aquatic weeds such as water hyacinth as well as invasive arthropods like red palm weevil, citrus root weevil, pepper weevil, sweet potato weevil, small hive beetle, Varroa mite, giant African land snail, and other high-risk pests threatening Florida's agriculture and natural resources.

## 1.6 Integrated Pest Management Programs

Florida is among the nation's leaders in horticultural crop production. According to the USDA NASS 2024 Florida Agricultural Overview, the value of vegetables and melons in Florida reached \$2.26 billion (2023 data). This is a marked increase from the \$1.3 billion figure for 2009, underscoring the growing economic scale and stakes for the vegetable sector.

Because many of Florida's horticultural crops are of high value, growers often resort to heavy pesticide use to prevent economic losses from insect, disease, and weed pressures. However, this approach carries serious drawbacks: the evolution of pesticide resistance in pest populations, secondary pest outbreaks, and harmful impacts on beneficial organisms (including biological control agents). Moreover, excessive pesticide use is expensive and may provide diminishing returns.





Beyond those agronomic concerns, there is increasing recognition of the environmental and social costs of pesticide reliance. Public awareness about the negative effects of chemical inputs has grown, fueling consumer demand for low-residue or organically produced fruits and vegetables. In Florida, the organic farming sector showed growth from 2016 to 2021, with organic crop sales rising from about US \$72 million to over US \$108 million (nearly a 50 % increase). While state-level certified organic data beyond 2021 are limited, broader national trends suggest continued expansion: U.S. organic retail sales reached an estimated \$69.7 billion in 2023.



Within Florida, anecdotal and extension reports indicate that although certified organic acreage remains relatively small (less than 1 % of total farmland), interest is rising. Many growers who are not formally certified are adopting integrated, biologically based strategies to reduce chemical inputs, driven by consumer demand, sustainability goals, and market differentiation (e.g. through regenerative or low-input practices). Given this reality, the need for research that yields practical, scalable solutions is clear. Biological control plays a critical role in that mix. But to fully harness its potential, we must deepen our understanding of how pests and beneficial species interact in real-world farming systems and determine how biological control can be effectively integrated (or combined) with other tactics.



Because both organic production and integrated pest management are knowledge-intensive, solutions must often be tailored to specific local conditions (soil, climate, pest complex, cropping systems). Also, to succeed, biological control must shift from reactive (curative) use to a more preventive orientation embedded into system design.



Against this backdrop, the Center will focus its IPM research along several targeted sub-themes:

- Participate in and provide coordination for the Florida A&M University's Integrated Pest Management initiative.
- Investigate the biological and ecological interactions of selected priority pests, their natural enemies, and their crop environments; use these insights to design and validate enhanced biological control options.
- Develop biologically based control and integrated pest management strategies tailored to low-input and organic vegetable production systems, where chemical options are restricted or discouraged.
- Devise protocols and decision tools to evaluate compatibility between pesticides and beneficial organisms, helping producers select "soft" or reduced-risk options that preserve natural enemy function.
- Investigate push-pull cropping systems and natural enemy refuges as habitat-manipulation strategies, especially for pests such as whiteflies.
- Develop biologically based pest management strategies using companion crops in vegetable systems to reduce pest pressure and enhance beneficial insect activity.
- Develop integrated pest management approaches for selected small-fruit and specialty crops, with particular emphasis on invasive and emerging pests such as cotton jassid, spotted lanternfly, brown marmorated stink bug, pepper weevil, sweet potato weevil, citrus root weevil, and others.



# Objective 2: Developing Human Capacity for Future Innovation



The demand for qualified specialists in the area of ecological and biological pest management is expected to continue rising at a time when such fields face challenges in attracting potential scholars. This creates both a challenge and an opportunity: to attract, retain, and train a new generation of students equipped not only with ecological expertise but also with skills in data science, machine learning, and artificial intelligence, which are increasingly essential for modern pest management. An integral part of the Center for Biological Control will be to build human capacity to meet these future needs for innovation through training, with a special focus on minority and underserved communities.

The Florida A&M University Entomology Program, in collaboration with the Center for Biological Control, will develop innovative graduate and undergraduate curricula in ecological and biological pest management that explicitly integrate AI and ML applications. Students will gain experience in digital diagnostics, AI-powered species identification, ecological modeling, and data-driven decision support systems. Participation in interdisciplinary research will complement classroom instruction, ensuring students graduate with both theoretical knowledge and practical, future-ready skills.

In partnership with the entomology program, training will be designed to prepare students for



service in the public and private sectors, including careers as inspectors within USDA-APHIS Plant Protection and Quarantine Service, or as specialists in agricultural technology firms, extension programs, and international development agencies. The graduate curriculum will support the Master of Science in Agricultural Sciences degree and prepare students for the Ph.D. in Entomology with the University of Florida, while embedding AI and digital agriculture modules that enhance employability.

To achieve this, the Center will:

- Recruit graduate students to conduct research that integrates ecological/biological pest management with machine learning applications such as pest detection, risk modeling, and economic impact forecasting.
- Recruit undergraduate students as interns, providing hands-on experience with AI-assisted tools (e.g., image recognition systems for pest ID, drone-based monitoring platforms, and predictive modeling software).
- Contribute to the development of a strong graduate curriculum in entomology, including specialized courses on AI in agriculture, computational ecology, and digital pest management systems.
- Expand regulatory plant science training by incorporating modules on AI-based risk assessment, digital surveillance, and remote sensing for pest monitoring. Partnerships
- with other universities will be expanded, especially in the context of online and distance learning.
- Develop interactive and digital learning technologies, including AI-driven virtual labs and digital classrooms, where students can simulate pest outbreaks, apply predictive models, and test IPM strategies in real time.



# Objective 3: Knowledge Transfer and Public Outreach



An integral part of the Center's applied research program will be to ensure that new knowledge is effectively transferred to target audiences, including farmers, extension personnel, industry representatives, small business owners, youth, consumers, and the general public. By involving stakeholders and constituencies at appropriate stages of research, the Center will be able to co-create solutions and more effectively transfer knowledge in ways that are practical, locally relevant, and impactful. To achieve this, the Center will develop specific outreach activities designed to inform and engage diverse constituents on its outputs and initiatives. Strong partnerships will be established with growers, regulatory agencies, and private industry. At Florida A&M University, the Cooperative Extension Program an outreach arm of the College of Agriculture and Food Sciences will play a pivotal role in ensuring that useful, practical, and research-based information is disseminated across Florida and the broader Caribbean region.

Specific initiatives will include:

- Building strong partnerships with key stakeholder groups such as growers, commodity associations, extension agents, and regulatory bodies to ensure two-way communication and relevance of research outcomes.
- Increasing interactions with extension personnel to better identify and serve the needs of clientele. This will include joint initiatives and direct involvement of extension staff in problem identification, priority setting, and delivery of solutions.
- Promoting public education in biological control and integrated pest management (IPM) through seminars, workshops, demonstration projects, and user-friendly fact sheets.
- Maintaining the Center's annual newsletter to keep faculty, staff, students, and stakeholders informed of ongoing activities, new developments, and emerging opportunities.
- Expanding digital outreach through a dynamic, interactive website linked to FAMU and other biological control and pest management resources, ensuring public access to up-to-date information.
- Leveraging digital tools, AI, and machine learning platforms to provide stakeholders with access to mobile apps, real-time pest identification tools, predictive risk models, and decision-support dashboards.
- Engaging urban and rural communities, with tailored outreach that ensures access to IPM resources and training for farmers.
- Encouraging youth involvement by incorporating entomology and pest management modules into 4-H, FFA, and STEM programs, thereby fostering the next generation of agricultural leaders and scientists.



Through these initiatives, the Center will foster a culture of knowledge sharing, community engagement, and innovation adoption, ensuring that research outputs are translated into real-world impact.





# Objective 4: Developing Science Based Policies to Protect Production Systems, Natural Resources and Human Health



The complexity of invasive species management, agricultural sustainability, and environmental stewardship requires policies that are firmly grounded in science-based evidence. The Center for Biological Control will play a leading role in generating the data, models, and recommendations that inform such policies at the local, state, national, and international levels. By combining research, innovation, and stakeholder engagement, the Center will contribute to policies that safeguard Florida's agricultural production systems, conserve natural resources, and protect human and animal health.

## Key Policy Priorities

### 4.1 Invasive Species Prevention and Management

- Provide risk assessments and predictive models to inform federal and state quarantine regulations, border inspection priorities, and offshore mitigation strategies in the Caribbean Basin.
- Develop science-based thresholds and protocols for early detection, rapid response, and eradication programs.
- Integrate AI-powered diagnostics, remote sensing, and digital monitoring systems into state and federal invasive species policy frameworks.



### 4.2 Sustainable Agricultural Production and IPM

- Support policies that reduce pesticide reliance by validating biologically based and ecologically sound IPM strategies.
- Promote the adoption of push-pull systems, habitat manipulation, and companion cropping to reduce pest pressure.
- Develop compatibility guidelines for pesticide use that protect pollinators and natural enemies, ensuring that regulatory frameworks balance productivity with ecological safety.



### 4.3 Protection of Natural Resources

- Provide data to guide management of invasive pests threatening forests, wetlands, and aquatic ecosystems, such as pine bark beetles, hydrilla, water hyacinth, and air potato.
- Contribute to restoration and conservation policies that integrate biological control as a long-term tool to reduce invasive species impacts on native biodiversity.
- Model the ecological and economic costs of invasive species to natural areas to inform state and federal conservation funding allocations.

#### 4.4 Human and Animal Health

- Develop policies and best-practice guidelines for pests of public and veterinary concern, such as Varroa mite, small hive beetle, New World screwworm, and mosquitoes that vector diseases.
- Integrate One Health approaches into pest management policy, recognizing the interconnection between environmental health, agricultural productivity, and human well-being.
- Support safe food production policies by advancing residue-free or reduced-risk pest control options that align with consumer demand for healthier products.

##### Strategies for Policy Development

- **Science-to-Policy Translation:** Publish policy briefs, fact sheets, and impact assessments that summarize research outcomes in formats accessible to decision-makers.
- **Stakeholder Engagement:** Strengthen partnerships with USDA-APHIS, NIFA, FDACS, EPA, and international organizations to ensure research priorities align with policy needs.
- **Digital Policy Tools:** Develop interactive dashboards and AI-powered decision-support systems that provide policymakers with real-time data on pest risks, economic impacts, and control outcomes.
- **Capacity Building:** Train students, extension agents, and regulatory staff in policy-relevant skills, ensuring the next generation of scientists and policymakers are equipped with both technical and digital expertise.
- **Public Awareness and Trust:** Use outreach campaigns and extension programs to explain policy decisions to the public, increasing transparency and fostering community participation in safeguarding agriculture and natural resources.





# Objective 5: Operational Effectiveness and Growth



Success in meeting the objectives of this ambitious strategic plan will depend on the establishment of effective operational procedures and strong linkages, as well as ensuring that the financial, human, and infrastructure resources required for implementation are in place. A key challenge for the Center will be to broaden and diversify its funding base, which is essential to guarantee long-term stability, resilience, growth, and scalability. Addressing these challenges will require deliberate actions in several key areas as outlined below:

## 5.11 Expansion of the Funding Base

To effectively maintain and expand the Center's funding base, the Center must anticipate and adapt to the changing priorities of state, national, and international funding agencies, particularly the USDA National Institute of Food and Agriculture (NIFA), USDA-APHIS, NSF, EPA, and foundations that support food security, invasive species management, and climate resilience. Targeted strategies will include:

- Strategic profiling and positioning of the Center with NIFA and other funding agencies, ensuring that the Center's programs are aligned with national and global research priorities.
- Cultivating relationships with new funding entities, including international organizations, commodity boards, grower associations, and private industry, through development of targeted, innovative grant proposals.
- Building stakeholder-driven initiatives by identifying and engaging farming groups, extension personnel, and industry partners to co-develop proposals that address on-the-ground pest management needs.
- Strengthening institutional partnerships to foster multi-institutional, multi-state, and multidisciplinary collaborations, enabling the Center to compete more effectively for large extramural grants and cooperative agreements.
- Leveraging digital innovation and AI-driven pest management tools as a funding priority area, positioning the Center as a leader in cutting-edge solutions that attract both public and private investment.
- Exploring philanthropic and endowment opportunities, including corporate sponsorships and donor engagement, to provide more flexible, long-term financial support.



# 6. Student Support



Expanding the Center’s training and experiential learning capacity is essential for cultivating a pipeline of future scientists, extension professionals, and industry leaders who can address the complex challenges of invasive species management, biological control, and integrated pest management (IPM) (Table 1). To achieve this vision, the Center will prioritize the following strategies:

- **Graduate Student Fellowships and Funding:**  
Actively pursue competitive grant proposals and external partnerships to support M.S. and Ph.D. students. These fellowships will ensure sustained financial support for students conducting critical research in biological control, ecological interactions, and invasive pest risk assessments.
- **Tuition Waivers and Assistantships:**  
Collaborate with institutional leadership to secure tuition waivers and assistantships that strengthen recruitment and retention. Special emphasis will be placed on engaging students from historically underrepresented groups, building a diverse and inclusive scientific workforce.
- **Professional Development through Conferences:**  
Allocate dedicated funding to support student travel and participation in national and international scientific meetings. Presenting research at these venues will enhance visibility, build professional networks, and facilitate collaboration with leading experts in entomology, ecology, and pest management.
- **Internships and Experiential Learning:**  
Expand opportunities for undergraduate and graduate students to participate in hands-on internships, summer research programs, and field-based experiential learning in collaboration with USDA, UF/IFAS, FDACS, industry partners, and international institutions. These experiences will prepare students for careers across academia, government, and private sectors.
- **Infrastructure for Student Research:**  
Provide well-equipped laboratory and office spaces, access to modern instrumentation, and digital resources for data collection and analysis. Investments will include advanced imaging systems, molecular diagnostic tools, and UAVs for remote sensing of pest outbreaks.
- **Expanded Library and Digital Resources:**  
Grow access to entomological, ecological, and IPM-focused literature through journal subscriptions, online datasets, and advanced digital repositories. Students will also gain access to AI-based diagnostic platforms, modeling software, and machine learning-enabled tools for pest detection and forecasting.
- **Integration of Emerging Technologies into Training:**  
Incorporate AI, machine learning, and big data analytics modules into student curricula. This training will ensure that graduates can design and apply data-driven solutions for complex pest management challenges, such as early detection, real-time monitoring, and predictive modeling.



Table 1. Growth Roadmap for Operational Effectiveness and Expansion Growth.

Strategic Area	Goals	Key Actions	Expected Outcomes
Funding	Broaden and diversify financial base	<ul style="list-style-type: none"> <li>Align proposals with USDA–NIFA, APHIS, NSF, and FAMU foundations</li> <li>Engage commodity boards, grower groups, and industry partners</li> <li>Pursue philanthropic gifts and endowments</li> </ul>	Stable and resilient funding streams; increased competitiveness for large, multi-institutional grants
Partnerships	Strengthen collaboration networks	<ul style="list-style-type: none"> <li>Build multi-state, multi-institutional research consortia</li> <li>Develop joint stakeholder-driven projects</li> <li>Formalize industry and extension linkages</li> </ul>	Stronger national and international profile; stakeholder-driven, applied solutions
Student Support	Expand training and experiential learning	<ul style="list-style-type: none"> <li>Develop grant-funded graduate fellowships</li> <li>Provide tuition waivers and assistantships</li> <li>Fund travel to conferences and workshops</li> <li>Offer undergraduate internships in biological control/IPM</li> </ul>	Increased recruitment and retention; highly skilled graduates prepared for public and private sector careers
Infrastructure	Enhance facilities and resources	<ul style="list-style-type: none"> <li>Expand lab and office space for graduate students</li> <li>Invest in modern diagnostic and digital equipment</li> <li>Broaden library access to journals, databases, and AI-driven tools</li> </ul>	World-class training environment; state-of-the-art research capacity
Innovation	Position Center as a leader in digital pest management	<ul style="list-style-type: none"> <li>Integrate AI/ML training modules in curricula</li> <li>Apply machine learning to pest detection, diagnostics, and economic forecasting</li> <li>Develop digital decision-support platforms and mobile apps</li> </ul>	Recognition as a hub for innovation; stronger attraction of talent, funding, and partnerships

# 7. Facility and New Location



The College of Agriculture and Food Sciences (CAFS) leadership is moving forward with a transformative initiative to relocate the Center for Biological Control (CBC) early next year to the Collins Building in Innovation Park, Tallahassee, Florida. This state-of-the-art facility will provide modern space to house scientists, postdoctoral fellows, technical staff, and students, offering an environment designed to accelerate innovation in invasive species management, biological control, and integrated pest management (IPM). This relocation represents more than a physical move which will serve as a catalyst for strengthening collaborative partnerships with federal and state agencies, academic institutions, and industry stakeholders. By fostering these alliances, the Center will expand its ability to conduct cutting-edge, multidisciplinary research addressing some of the most serious threats posed by invasive alien species to U.S. agriculture, forestry, natural resources, and public health.

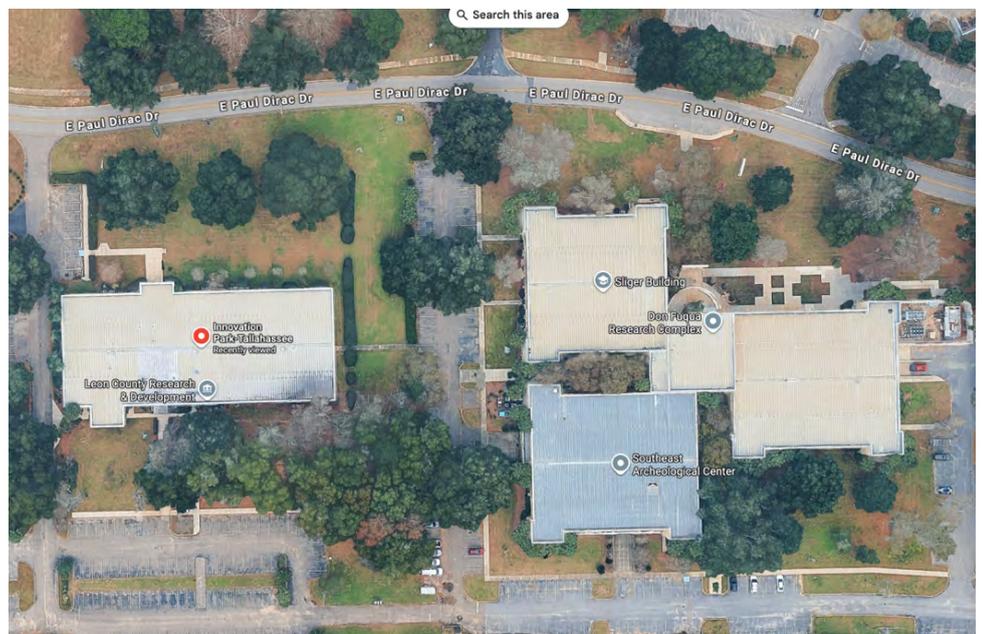


The facility will be designed with a student-centered focus, creating a dynamic environment that energizes researchers, faculty, and students. Enhanced laboratory and collaborative spaces will encourage cross-disciplinary teamwork, facilitate technology transfer, and ensure that students gain hands-on experience with emerging tools and methods. This environment will play a crucial role in preparing the next generation of pest control professionals, biological control scientists, and academic leaders, thereby advancing Florida A&M University's land-grant mission.

To support this initiative, FAMU has already taken critical preparatory steps:

- Designating dedicated space within Innovation Park.
- Conducting environmental surveys and preparing detailed architectural blueprints.
- Establishing new partnerships with public agencies and private industry to broaden research and training opportunities.
- Seeking additional funding support through grants, legislative appropriations, and stakeholder engagement to sustain long-term growth.

Once the renovation is completed, the facility will not only enhance the Center's research and training capabilities but will also serve as a regional and national hub for biological control and invasive species management, reinforcing FAMU's role as a leader in safeguarding agricultural productivity, protecting ecosystems, and ensuring food security.

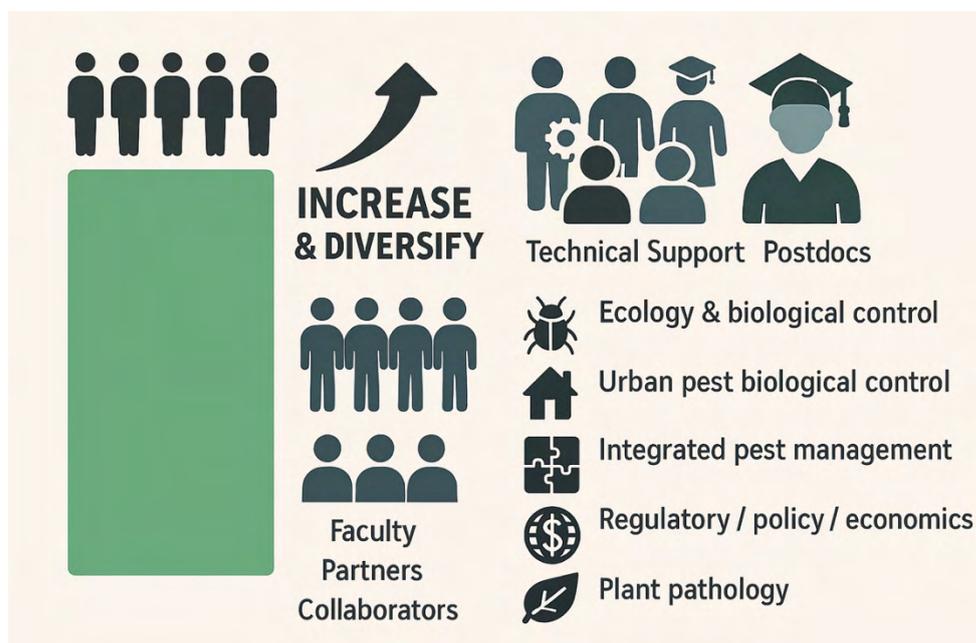


# 8. Personnel



The Center has grown in terms of numbers of research faculty since its inception. While efforts will continue to develop productive partnerships with non-Center faculty as well as outside cooperators, it is desirable that the Center increase and diversify its faculty. The initial long-term vision for the Center to house 8-10 scientists, as well as their associated technical support staff, 2-3 postdoctoral researchers and 10-15 graduate students is achievable and indeed should be surpassed. Additionally, elevation of the Center to a state-funded research Center would help enable it to reach its full potential. This objective will be targeted during the 2025-2030 period. A prioritization of new faculty research areas that would help diversify the capabilities of the Center while at the same time maintaining some focus and building on its current strengths includes:

- Ecology and biological control: This position will focus on supporting offshore research on IAS, with particular emphasis on management.
- Urban and landscape (including interiorscape) pest biological control: This position could collaborate with the Landscape Design Management Program within the College, help support the large residential and tourist attraction landscape industry in Florida, and bring biological control to the home gardener. This position will also interlink with the urban pest control professionals.



- Integrated pest management (research/extension): A field crop/vegetable IPM position, focusing on applied research and technology transfer: This position would complement existing research programs on biological control of field crop pests. An emphasis on technology transfer will make biological control technologies accessible to end-users and increase integration of biological control into pest management programs.
- Regulatory/Policy/Economics: To address the increasing challenges in regulatory pest management in a globalized and complex world, including trade issues.
- Plant Pathology: This position will focus on plant and insect disease interactions. it will complement research on integrated pest management.

# 9. Annual Work Plans and Evaluation of Progress



To ensure that the Center’s activities meet the needs of clientele and stakeholders, we will institutionalize a framework for the assessment of the impact of our work. The Center’s activities are captured in the attached logic model. The specific activities, plan of work and key milestones will be approved by the Advisory Council on an annual basis. Specific measurable indicators of progress for each objective are listed in Table 2. The assessment should also provide information to the Center to adjust and continuously improve its programs.

Table 2. Framework for the Assessment of Impact of CBC’s Activities.

IMPACT AREAS	MEANS OF ACHIEVING	INDICATORS
<ul style="list-style-type: none"> <li>• Generation and application of knowledge</li> </ul>	<ul style="list-style-type: none"> <li>• New technologies made available</li> <li>• Scientific publications,</li> <li>• Publications in other fora</li> <li>• Participation in conferences</li> </ul>	<ul style="list-style-type: none"> <li>• Number of citations of CBC’s publications</li> <li>• Adoption of new technologies e.g. number of farmers</li> <li>• Number of pests brought under control</li> <li>• Feedback from clientele</li> </ul>
<ul style="list-style-type: none"> <li>• Development of future human capacity for innovation</li> </ul>	<ul style="list-style-type: none"> <li>• New researchers and extension trained</li> </ul>	<ul style="list-style-type: none"> <li>• Number of undergraduate and graduate students</li> <li>• Number of visiting scientists</li> </ul>
<ul style="list-style-type: none"> <li>• Knowledge transfer and public outreach</li> </ul>	<ul style="list-style-type: none"> <li>• Extension and public oriented publications</li> <li>• Field days and conferences organized</li> </ul>	<ul style="list-style-type: none"> <li>• Number of citations of CBC publications</li> <li>• Number of field days, conferences, posters</li> <li>• Number of clientele trained/ exposed</li> </ul>
<ul style="list-style-type: none"> <li>• Ensuring operational effectiveness and growth</li> </ul>	<ul style="list-style-type: none"> <li>• Increased number of faculty</li> <li>• Greater understanding of operational procedures and stronger linkages with relevant university departments e.g. sponsored research</li> <li>• Expanded funding base number of new grants</li> </ul>	<ul style="list-style-type: none"> <li>• Number of faculty and staff Number of funding sources</li> <li>• Clientele responses (survey of clientele perception (annually))</li> <li>• Number or lack of complaints</li> </ul>

## 10. Logic Model for The Center for Biological Control Strategic Plan (2025-2030)

SOLUTIONS	INPUTS	ACTIVITIES
<p>INVASIVE ALIEN SPECIES (IAS): They pose a serious threat to agriculture, natural resources and human health. The risk of IAS is especially high in Florida, which has an extremely high visitor rate and its ports are major entry points for traded goods into the United States. An effective approach for dealing with IAS requires a multi-pronged approach that emphasizes prevention in the first instance. Should alien species gain entry, then emphasis will be on early detection and eradication, and as a last resort, management, with emphasis on biologically based approaches.</p> <p>NEEDS FOR IPM SOLUTIONS: Florida is one of the leading states in the production of horticultural and vegetable crops. Recent years have also seen an increased demand for organically or IPM-grown produce. As a result, organic production is expanding among small scale vegetable producers in Florida. Pests including IAS continue to pose a serious challenge to crop production and therefore there is a need for research to provide practical integrated pest management solutions.</p> <p>GETTING KNOWLEDGE TO WORK: An integral part of the applied research components will be to ensure that new knowledge is transferred to the target stakeholders.</p> <p>TRAINING MUCH NEEDED SPECIALISTS: The demand for qualified specialists in the area of ecological/biological pest management is expected to continue rising at a time when such fields have been losing attractiveness to potential scholars. In addition, there is a notable shortage of minority scientists in these related fields.</p>	<p>Stakeholder input</p> <p>Center for Biological Control Faculty</p> <p>FAMU Support ARS</p> <p>Support FDACS</p> <p>APHIS Support</p> <p>Funding &amp; Materials</p> <p>Strategic Partnership</p> <p>Field Days and Workshops</p> <p>Extension Programs</p> <p>M.S. &amp; Ph.D. Graduate students &amp; Undergraduate Students</p>	<p>Collaboration with local, state and federal agencies and other stakeholders</p> <p>Offshore Pest Mitigation</p> <p>Ecologically Based Management of Invasive Insect Pests and Weeds</p> <p>Development of electronic identification tools and resources</p> <p>Economics of Invasive Species</p> <p>Integrated Pest Management Programs as defined in this Plan</p> <p>Develop Science Based Policies to Protect Production Systems, Human Health and Natural Resources</p> <p>Faculty mentor and teach M.S. &amp; Ph.D. graduate students</p> <p>M.S. &amp; Ph.D. students conduct research</p> <p>Teach and mentor graduate and undergraduate students</p> <p>Experiential Learning for graduate and undergraduate students</p> <p>Recruit top undergraduates to graduate programs</p>
		<p><b>Assumptions:</b> Biological control and IPM strategies provide sustainable, long-term solutions for managing pests and invasive alien species (IAS). The Center for Biological Control will prioritize building human capacity through training, with emphasis on minority and underserved communities. CAFS will strengthen its graduate curriculum in ecological pest management, while ensuring active participation of both graduate and undergraduate students in research.</p>
		<p><b>External Factors:</b> Biological control and integrated pest management (IPM) strategies offer long-term, environmentally sustainable solutions for managing pests and IAS. A core function of the Center for Biological Control will be to strengthen human capacity for future innovation through targeted training programs. Emphasis will be placed on ecological pest management, with active involvement of graduate and undergraduate students in research as a top priority.</p>

## OUTCOMES

OUTPUTS	KNOWLEDGE	ACTIONS	CONDITIONS
<p>Solutions for established IAS problems</p> <p>Contingencies for offshore IAS threats</p> <p>IPM solutions for both pest problems of managed and natural ecosystems.</p> <p>Available list of invasive alien species</p> <p>Peer reviewed papers resulting from studies</p> <p>Well trained graduates at B.S. M.S. and Ph.D. levels</p> <p>M.S. Thesis &amp; Ph.D. Dissertations</p> <p>Public education events and information - seminars, workshops, and printed materials</p> <p>Annual newsletter and a dynamic website which provides relevant information to stakeholders</p> <p>Strong research and partnerships responding to emerging problems</p>	<p>Well-trained scientists including minority scientists (entomologists etc.) join the Nation's workforce</p> <p>Provide trained support staff and graduate students</p> <p>Public awareness of moving invasive organisms from location to location</p> <p>Pro-active stakeholder base</p> <p>Farmers well informed and knowledgeable about new IPM approaches</p> <p>Key stakeholders informed about safe application of biological control</p> <p>Policy makers apply knowledge of IAS including economic consideration in decision making</p>	<p>US and trading partners take effective actions to prevent or limit the spread of IAS</p> <p>Effective mitigation actions applied against established IAS</p> <p>Farmers apply improved IPM tactics and ecologically based production techniques</p> <p>Conscientious public help limit the spread of invasive organisms</p> <p>Stakeholder linkages including effective feedback mechanisms sustained.</p> <p>Linkages with new stakeholders and funding entities established.</p> <p>Strong partnerships in action with other institutions including multi- state, multi-disciplinary partnerships for extramural funding opportunities</p>	<p>Long term environmentally sound management strategies and solutions established for IAS problems.</p> <p>Sustainable agricultural production systems</p> <p>Enhanced local food production. Sustained economic benefits related to the adoption of IPM practices</p> <p>Strong partnerships with key stakeholder groups such as farmers and local communities</p> <p>Reduced potential human health risks from pests and the use of pest management practices</p> <p>Reduced adverse environmental effects from pests and the use of pest management practices with positive impacts on: Agro-ecosystems and provision of ecosystem services.</p> <p>CBC is operationally effective providing solutions to pressing problems for agriculture and the environments</p>

# 11. Relevance of CBC Objectives to the Goals of FAMU, USDA and Other Key Partners



The activities proposed in this strategic plan directly addresses the integrated components of the 1890 Land Grant Mission as outlined in FAMU's strategic plan (<https://www.famu.edu/about-famu/strategic-plan/index.php>). The CBC strategic plan also addresses critical societal challenges laid out in the USDA five years strategic plan (<https://www.usda.gov/sites/default/files/documents/usda-fy-2022-2026-strategic-plan.pdf>), and The Florida Fish and Wildlife Commission's Strategic Plan (<https://myfwc.com/media/23688/2020-2024-fwc-strategic-plan.pdf>). This strong strategic linkage is evidenced by ongoing and new programs that directly link with different components of USDA's strategic goals (Table 3). Specifically, the CBC's research, outreach and education programs focus on keeping American agriculture competitive while ending world hunger. Other areas to be addressed include mitigating and adapting to climate change, improving food safety, and improving nutrition to reduce childhood obesity. The educational programs of the Center promote the long-term viability of US agriculture by producing highly trained graduates who will be part of the future workforce of agricultural scientists, teachers, extension agents, and the agricultural industry. The proposed work on invasive species also ties in directly with the United States Department of Interior Invasive Species Strategic Plan (<https://www.doi.gov/sites/doi.gov/files/doi-invasive-species-strategic-plan-2021-2025-508.pdf>) and the Statewide Invasive Species Strategic Plan for Florida ([https://static1.squarespace.com/static/5d5179e7e42ca1000117872f/t/5f3188faee24dd148baac212/1597081854901/Statewide\\_Invasive\\_Species\\_Strategic\\_Plan\\_for\\_Florida\\_2002.pdf](https://static1.squarespace.com/static/5d5179e7e42ca1000117872f/t/5f3188faee24dd148baac212/1597081854901/Statewide_Invasive_Species_Strategic_Plan_for_Florida_2002.pdf)).



Table 3. Ongoing and New Programs that Directly Link with Different Components of our Partners.

Strategic Goals	Activities of the Center for Biological Control
Strategic goal 1: Enhance International Competitiveness of American Agriculture	The Center will contribute to this Strategic Goal through research and outreach programs to improve the sanitary and phytosanitary system (SPS) and policies to facilitate agricultural trade.
Strategic goal 2: Enhance the Competitiveness and Sustainability of Rural and Farm Economies	The Center will contribute to this Strategic Goal through research and outreach programs that will provide new scientific and technological capabilities that will expand domestic markets for agricultural producers. The Center will also contribute to this Strategic Goal through programs to improve the sustainability of US agriculture, which will increase the efficiency of domestic agricultural production and marketing systems.
Strategic goal 3: Support Increased Economic Opportunities and Improved Quality of Life in Rural America.	The Center will contribute to this Strategic Goal through programs that will increase the sustainability of the United States Agriculture, which will help increase the economic viability of the United S farms.
Strategic goal 4: Enhance Protection and Safety of the Nation’s Agriculture and Food Supply.	The Center will contribute to this Strategic Goal through research and outreach programs that will lead to reductions in the number, severity and distribution of agricultural pest and disease outbreaks.
Strategic goal 5: Improve the Nation’s Nutrition and Health.	The Center will contribute to this Strategic Goal through research and outreach programs that which will help to assure the availability of locally grown nutritious produce.
Strategic goal 6: Protect and Enhance the Nation’s Natural Resource base and Environment.	The Center will contribute to this Strategic Goal through research and outreach program that will promote the conservation and efficient use of pasture and range lands through the biological control of weeds.

# 12. Faculty



## 12.1 Core Faculty

**Alexander M. Gaffke**, Ph.D. – USDA, ARS CMAVE. Research Entomologist. Research Interests: Chemical ecology, biological control, and insect plant interactions.

**Anamika Sharma**, Ph.D. – Assistant Professor CBC. Research Interests: IPM of structural and medically important insect pests.

**Janice Peters**, MS. – Research Entomologist. Research Interests: Ecology and taxonomy of mayflies, urban and aquatic entomology.

**Lambert H.B. Kanga**, Ph.D. – Professor/Chair, Entomology. Research Interests: Insect toxicology, insect pathology, biological control, insect physiology, biology, insecticide resistance, and integrated pest management.

**Muhammad Haseeb**, Ph.D. – Associate Professor/Director CBC. Research Interests: Integrated pest management of established and invasive insect pests of agriculture and forests.

**Raymond L. Hix**, Ph.D. – Professor. Research Interests: Invasive species biology and biological control of weeds and pests of perennial crops.

## 12.2 Affiliated Faculty

**Alejandro Bolques**, Ph.D. – Director, FAMU Research and Extension Center. Research Interests: Protected agriculture, hydroponics, specialty crops, and green industry BMPs.

**Amy Roda**, Ph.D. USDA, APHIS, PPQ, CPHST – Adjunct Associate Professor. Research Interests: Management of Invasive Pests.

**Andrew K. Rasmussen**, Ph.D. – Research Assistant Professor. Research Interests: Aquatic entomology, systematics of Trichoptera (Caddisflies), and bioassessment of aquatic ecosystems.

**Jennifer Taylor**, Ph.D. – Associate Professor. Interests: Small farm programs that offer educational and hands-on training that are designed to impact agricultural production.

**Jesusa (Susie) C. Legaspi**, Ph.D. – USDA-ARS CMAVE (retired) /FAMU Courtesy Professor. Research Interests: Ecology, biological control and integrated management of invasive pests.

**Katherine A. Milla**, Ph.D. – Professor/Laboratory Director, GIS/Remote Sensing Laboratory. Research Interests: Use of geospatial technologies.

**Michael H. Thomas**, Ph.D. – Professor Emirates. Research Interests: Economics, environmental resource economic.

**Michee A. Lachaud**, Ph.D. – Associate Professor. Research Interests: Resource management economics monitoring and impact evaluation statistics and applied econometrics climate change economics.

**Oghenekome U. Onokpise**, Ph.D. – Professor. Research Interests: Forestry; Biological Control of cogongrass.

**Stephen D. Hight**, PhD. – Adjunct Associate Professor (retired), Research Entomologist USDA-ARS and FAMU. Research interests: Biological control of invasive species with emphasis on terrestrial weeds.

**Vijay Chhetri**, Ph.D. – Assistant Professor. Research Interests: Dynamics of survival and growth of human pathogens in food and developing novel pre- and post-harvest technologies.

**Wills R. Flowers**, Ph.D. – Professor Emeritus. Research interests: Systematics and ecology of Chrysomelidae (leaf beetles) and aquatic insect biodiversity.

# 13. Cooperators



## 13.1 USDA-APHIS-PPQ-S&T

The United States Department of Agriculture’s Animal Plant Health Inspection Service (USDA APHIS) provides national leadership in ensuring the health and care of animals and plants, improving agricultural productivity and competitiveness, and maintaining the economy and public health. Plant Protection and Quarantine’s (PPQ) multidisciplinary staff concentrates on identifying present and future phytosanitary needs and then identifying or developing appropriate technologies and methodologies to meet these challenges. Within APHIS-PPQ, Science and Technology (S&T) support PPQ’s regulatory decisions and operational programs through methods development work, scientific investigations, and systems analyses. S&T’s Biological Control Unit focuses on the development of biological control technologies that reduce the risk of exotic pests spreading to the United States and provide the Agency with effective long-term management options should the pests become established.

The Biological Control Coordinator for S&T works with the Director of the FAMU Center for Biological Control to help identify critical needs, leverage support for proposed initiatives, and facilitate the transfer of developed technologies. APHIS also helps to provide training and job opportunities for undergraduate and graduate students in the area of biological control, as well as regulatory science and risk analysis.

## 13.2 USDA-ARS

As the in-house research arm of the U.S. Department of Agriculture, the Agricultural Research Service (ARS) provides initiative and leadership in agricultural research. ARS scientists conduct research designed to produce the new knowledge and technologies required to assure the continuing vitality of the nation’s food and agricultural enterprise. ARS has placed one full-time scientist at FAMU. ARS also seeks to recruit and develop future biological control experts by providing opportunities for graduate studies in the Center for Biological Control.

## 13.3 Additional Collaborators

The strategic plan of the Center brings together a wide array of expertise and resources and creates collaborative opportunities, attracts several commodity groups, expands and strengthens our extension and support activities. The objectives will be accomplished by building collaborative educational and research ventures with state, federal, universities, private institutions and stakeholders. The key partners include:

- University of Florida units, e.g., administration, Research and Education Centers, Pesticide Information Office, Doctor of Plant Medicine Program, Small Farms Program



- Florida Department of Agriculture and Consumers Services, Division of Plant Industry
- Cooperative Extension, e.g., county offices, agents, Master Gardeners
- IPM, e.g., State IPM Coordinators, Regional IPM Centers, International IPM symposium, IPM Institute of North America
- Governmental institutions, e.g., USDA, NIFA, NRCS; EPA
- Professional societies, e.g., ESA, FES, IOBC, APS, ANBP, IBMA
- FGGA, Florida Grape Growers Association
- FFVA, Florida Fruit and Vegetable Association
- FOG, Florida Organic Growers
- FNGLA, Florida Nursery, Growers and Landscape Association
- Florida School IPM
- Florida Cattlemen's Association
- FPMA, Florida Pest Management Association
- FDEP, Florida Department of Environmental Protection
- UF/IFAS small farms program
- Red Hills Small Farm Alliance
- Xerces Society (an invertebrate conservation group)
- Florida Pest Control Associations

# 14. Advisory Council



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