

Introduction

Invasive species have a global impact by causing economic losses, decreased biodiversity, human health hazards, and disruption of native ecosystems. In the U.S., it is estimated invasive species cause losses at \$13 billion annually. In Florida, over \$4 billion worth of agricultural commodities for export were produced in 2014. Florida is one of the first places for invasive species in the U.S. due to travel, major ports, and importation of cut plant materials. Consequently, the potential impact of invasive species to Florida's agriculture is significant. Despite the importance of invasive species and agriculture, the general public, and especially the American youth, remain uninformed.

Some of the recent pest or pathogen problems that have or could potentially impact Florida include: Mediterranean fruit fly, *Ceratitidis capitata*; Oriental fruit fly, *Bactrocera orientalis*; light brown apple moth, *Ephiphysas postvittana*; European pepper moth, *Duponchilia fovealis*; spotted-wing drosophila, *Drosophila suzukii*; citrus greening, *Candidatus Liberibacter asiaticus*; giant African land snail, *Achatina fulica*; sudden oak death, *Phytophthora ramorum*; Bagrada bug, *Bagrada hilaris*; emerald ash borer, *Agilus planipennis*; Asian long-horned beetle, *Anoplophora glabripennis*; and the old world bollworm, *Helicoverpa armigera*.



Project Goals

1. Evaluate current understanding of invasive species and biosecurity issues among middle and high school aged students.
2. Increase awareness through outreach events and evaluate the effectiveness of these events.
3. Expand the program to include additional topics which increase student engagement in invasive species and biosecurity topics.

Methods

Audience

The target audience is middle school and high school aged students throughout Florida. Schools were selected based on the presence of biology, agriculture, or natural science classed. Teachers were contacted via email and programs were scheduled with interested instructors. Teachers selected from the following topics: Introduction to Entomology; Topics in Florida Agriculture; Invasive Species that Affect Plants; and Plant Biosecurity – Local and Global Perspectives. Outreach was conducted to a total of 900 students in 2016/17 and 2017/18 school years combined, and 868 in 2018/19. Results presented are for the 2018/19 academic year.

Presentations

The PowerPoint presentations were modified from currently existing Protect U.S. scripted lectures to fit the target audience. Interactive materials were also provided including live, caged agricultural pests, preserved insects, and thought provoking discussion questions. Candy was used as incentive for students to engage throughout the presentation.



Consent

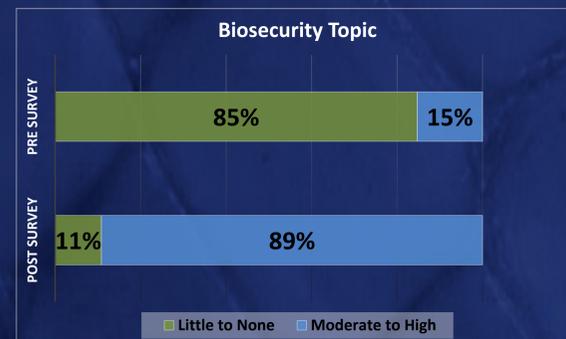
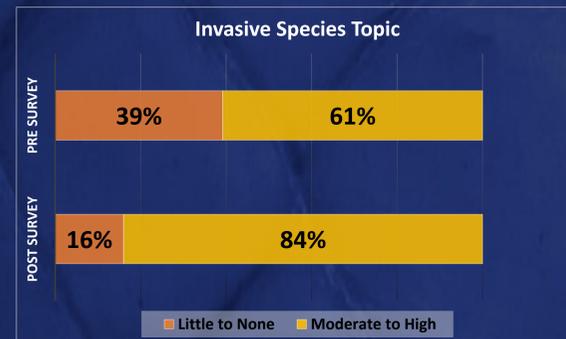
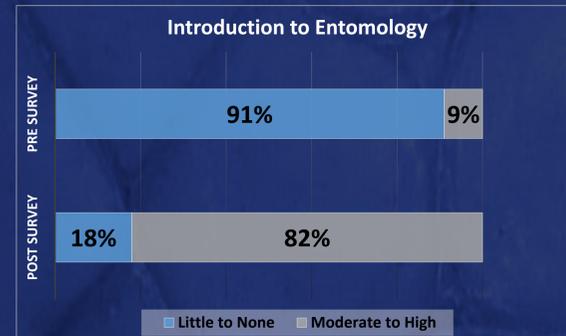
All surveying was approved by the University of Florida, Institutional Review Board. As part of the evaluation process, all students were given an informed consent document to take home. For students under 18 years of age, their parent or legal guardian was required to sign the document and return the signed form to their teacher prior to the presentation. If students were over 18, they could sign the paper and give consent themselves. Informed consent forms were all collected and retained prior to giving the survey to students.

Surveys

Surveys were designed similarly for both topics. The first question asked students to rate their confidence level with the topic. Another asked students to rate their interest in entomology or agriculturally related field. The remaining six questions were directly based on content presented in the lecture, and were evaluated for the knowledge-based results. All surveys were numbered with a class specific and student specific code, so that pre- and post-surveys could be paired upon collection. Packets were given to the students at the beginning of class and the pre-survey was completed prior to the lecture and collected. At the end of the interactive presentation, students completed the post-survey.

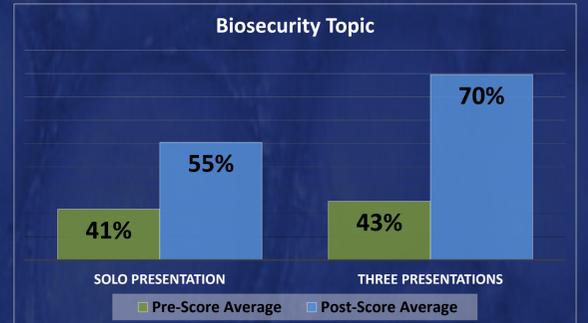
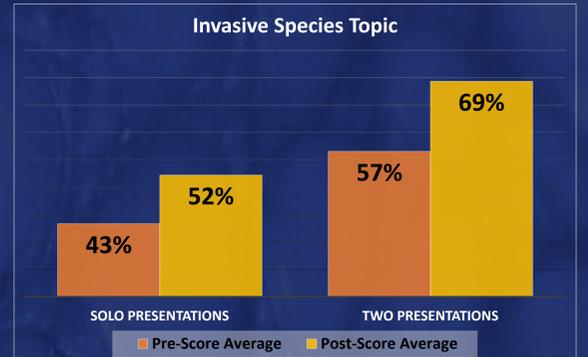
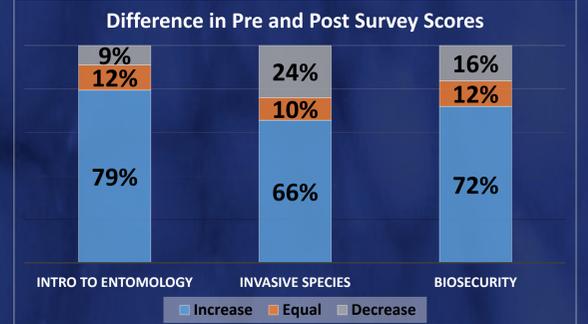
Results and Discussion

Confidence Levels



Initially, students were not confident in their understanding of the topics. In the pre-survey, students were less confident about entomology than the others, but this appeared to be related to their lack of understanding of the term 'entomology' and not their confidence in the subject of insects. Student confidence was greatest in the topic of invasive species. The confidence level increased in all subjects following the outreach program, demonstrating the success of the youth outreach program. Results for Topics in Florida Agriculture were not presented due to low student counts.

Knowledge Levels



Outreach events were analyzed by comparing pre- and post-survey. Improvement was considered an increase in score on the post-test from the pre-test, which was paired for each student in all classes. More than two-thirds of the students increased their score for each topic, demonstrating the effectiveness of the youth outreach program, with students demonstrating the greatest improvement in the Introduction to Entomology topic.

Interestingly, students who engaged in the Introduction to Entomology outreach event prior to the Invasive Species event demonstrated their score-improvement was 44% greater than the score-improvement of students who had the Invasive Species outreach event as a stand-alone presentation. Moreover, students who had both the Introduction to Entomology and Invasive Species events prior to the Biosecurity outreach event had score-improvements 90% greater than students who had the Biosecurity topic as a stand-alone outreach event. These results imply that providing a foundation through the Introduction to Entomology outreach event enhances student engagement in the more advanced topics.

Future Implications

In the future, this program will continue at more middle and high schools throughout Florida, with the intent to conduct multiple outreach events in each classroom. A website is currently under development to help facilitate communications with teachers and students. The website can be found at:

<http://dpm.ifas.ufl.edu/outreach/>