Lesson Plan:
Biodiversity, Invasive Species, and Plant Biosecurity

BEFORE YOU GET STARTED: There is quite a bit of information found in these materials. Go through the presentation and the activities provided and decide what is or is not appropriate for your students. You may tweak the material found here to whatever level is appropriate for your students (i.e. what is appropriate for 9th grade vs. 11th grade).

Questions to be Answered:

1. What is biodiversity and why is it important?
2. What are invasive species and how can they affect biodiversity?
3. How are invasive species introduced?
4. Who monitors for invasive species?
5. What does plant biosecurity have to do with my pizza?
6. What is agroterrorism?

Presentation only:

- The main presentation consists of slides 1-22. It should take one to two, 50- minute class periods depending on the amount of discussion created by the discussion questions (should you incorporate them).
- The scripted presentation can be downloaded from www.protectingusnow.org.
    - Be sure to go over the text ahead of time, tweaking it as you need to for your audience. In addition, all 3 activities are included in the presentation, so be sure to remove the ones you do not wish to do.
    - You do not have to include the references slides in your presentation.
- Standards Covered:
    - National Science Education Life Science Standards Grades 9-12:
        - Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.
    - Sunshine state standards SC.912.L.17.8:
        - Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, **human activity**, and the **introduction of invasive, non-native species**.
    - The focus of this presentation is how invasive species affect natural ecosystems and agricultural systems and that there are several agencies and individuals that monitor for invasives species. Those that monitor invasive species that can harm

plants found in our natural ecosystems or those that we raise for agricultural purposes (ornamentals and floriculture) are involved in plant biosecurity.
    - The text provided at the bottom of the slide is meant to aid the presenter. It is not meant to be read verbatim. Please feel free to go into more detail or less detail as needed.
    - In addition, feel free to rearrange the slides, change the text on the slides, even use different regional examples.

Student Activities:

Activity #1 – Biodiversity Comparison:

- The presentation of activity #1 consists of slides 23-40. It should take one, 50-minute class period to go over these slides.
    - This introduces the activity and walks the students through handouts "How to Calculate Biodiversity" and "Biodiversity Worksheet".
- Two 50-minute class periods are needed to collect the insects for this activity from two different ecosystems.
- Identification of the insects collected (using the dichotomous key) should take one (maybe two) 50-minute class period(s).
- Total time period for activity – four to five 50-minute class periods.

Teacher preparation for Activity #1:

- The scripted presentation can be downloaded from www.protectingusnow.org.
    - Be sure to go over the text ahead of time, tweaking it as you need to for your audience. In addition, all three activities are included in the presentation, so be sure to remove the ones you do not wish to do.
- Download student handout "How to Calculate Biodiversity" and "Biodiversity Worksheet" from www.protectingusnow.org.
    - Make as many copies as you have students.

Materials for Activity #1:

- You will need empty plastic vials (enough for 8 vials per group, 4 vials for each ecosystem sampled).
    - You can go to your local pharmacy store and ask for plastic pill bottle donations (such as the ones seen in the video) or go to the photo development store and ask for donations of the clear film canisters.
    - You can also purchase them
        - http://www.bioquip.com/Search/DispProduct.asp?pid=8800 or http://www.bioquip.com/Search/DispProduct.asp?pid=8905
- You will need masking tape and pencil or marker (to identify the samples and the collectors).
- For one of the collecting methods, you will need three or four student sweep nets.
    - These work well and are fairly inexpensive. http://www.bioquip.com/search/DispProduct.asp?pid=7112NA.
- For another collecting method, you will need three or four white sheets and sticks or wooden dowels.

- In order to help preserve the insects while in the field, it is good to have a cooler with ice in which to put the samples. When you get back to the classroom, you will need to freeze the insects overnight to kill them.
- You should have hand lenses or stereo microscopes (enough for each group) and forceps or tweezers (enough for each group).
- You should have multiple sheets of white paper for sorting the insects.
    - It makes it easier to see the characteristics of the organisms against a white background if your desks or lab benches are dark or patterned.

Directions for Activity #1:

- Students need to be placed into groups of two or three.
- Have three or four groups do the visual search method, three or four groups do the beat sheet method, and three or four groups do the sweep net method.
    - Weblinks to videos on how to use the visual search, beat sheet, and the sweep net methods are found in the presentation.
    - Visual search
        - Have the students search under logs and rocks, on tree bark, and on surrounding vegetation.
    - Beat sheet
        - Have the beat sheet groups beat trees or shrubs ten times then stop and collect the insects that have fallen onto the sheet. This would be a single sample.
        - Have the groups take three to four samples in each area.
    - Sweep net
        - Have the sweep net groups sweep ten times then stop and collect the insects that are caught in the net. This would be a single sample.
        - Have groups do two to three samples in each area (it takes more time to go through the material collected in the net than on the beat sheet).
        - There will be more flying insects found here, so have your students be careful not to let too many escape.
        - Having one person open the net while the other person collects the insects (refer to video).
    - This activity can easily be done in a schoolyard, however, if you are short on time and can only take the students to one are to sample, you can always collect insects from a second site yourself and bring the insects back for them to identify. Be sure to use all three methods if you do this so the numbers will be comparable.
- The insects collected must be put in the freezer overnight to make sure they are dead for examination by the students.
- Each group should go through all their samples from both sites and fill out pages seven and eight of the handout. They can then complete the calculations for the Simpson and Shannon Indices and Sorenson Coefficient and answer the follow-up questions for homework (or during the next class period).

Additional Standards Covered:

- National Science Education Inquiry Standards Grades 9-12:

- Scientists conduct investigations for a wide variety of reasons. For example, they may wish to discover new aspects of the natural world, explain recently observed phenomena, or test the conclusions of prior investigations or the predictions of current theories.
- Mathematics is essential in scientific inquiry. Mathematical tools and models guide and improve the posing of questions, gathering data, constructing explanations and communicating results.

- Sunshine state standards SC.912.N.1.1:
  - Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:
    - pose questions about the natural world,
    - conduct systematic observations,
    - examine books and other sources of information to see what is already known,
    - review what is known in light of empirical evidence,
    - plan investigations,
    - use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),
    - pose answers, explanations, or descriptions of events,
    - generate explanations that explicate or describe natural phenomena (inferences),
    - use appropriate evidence and reasoning to justify these explanations to others,
    - communicate results of scientific investigations, and
    - evaluate the merits of the explanations produced by others.
- Sunshine state standards SC.912.N.1.6:
  - Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.
- Sunshine state standards SC.912.N.1.7:
  - Recognize the role of creativity in constructing scientific questions, methods and explanations.

Activity #2 – "Un-Wanted" Posters:

- The presentation for activity #2 consists of slides 41-44. It should take about 15 minutes to go through.
- This is a research project so times may vary depending on how much you want them to research outside the class period. Suggestions for completing the assignment in class include:
    - Library time – three to four 50-minute class periods
    - Computer time - three to four 50-minute class periods

Teacher preparation for Activity #2:

- The scripted presentation can be downloaded from www.protectingusnow.org.
    - Be sure to go over the text ahead of time, tweaking it as you need to for your audience. In addition, all 3 activities are included in the presentation, so be sure to remove the ones you do not wish to do.
- Download student handout "Un-Wanted" Poster from www.protectingusnow.org.
    - Make as many copies as you have students.
- Be sure to reserve the computer lab (with internet) and library space. Listed below are several good websites for your students to use. Make sure your school does not have the sites blocked.
    - The Global Invasive Species Database -
        - http://www.issg.org/database/welcome/
        - This website discusses invasive species found around the world.
    - The Select Agents and Toxins List
        - http://www.selectagents.gov/select%20agents%20and%20Toxins%20list.html
        - If you wish to keep the focus on invasive species that can affect biodiversity or our food supply, I would restrict this list to those found on the USDA plant protection and quarantine select agents and toxins list and the USDA Veterinary Services select agents list.
    - Watchlist of Potential Great Lakes Aquatic Invasive Species
        - http://www.glerl.noaa.gov/res/Programs/glansis/watchlist.html
        - NOAA maintains a list of potentially invasives species to the Great Lakes of which they want people to be aware.
    - Invasive Plant Atlas of the United States
        - http://www.invasiveplantatlas.org/index.html
        - Information on invasive plants (trees, shrubs, aquatics, and even grasses) can be found here.
    - Protect U.S.
        - www.protectingusnow.org
        - The presentation titled Overview of Invasives that Affect Plants have several potential invaders that are discussed.
    - Invasive and Exotic Species of North America
        - www.invasive.org
        - This website contains information on existing invasive species and potentially invasive species that have not been detected in the U.S. (yet).

- Pest Tracker
  - http://pest.ceris.purdue.edu/index.php
  - This is a database that allows the user to see where invasive species have been found and where they have been trapped for, but not found. They also maintain a pest watch list.
- USDA Invasive and Noxious Weeds
  - http://plants.usda.gov/java/noxiousDriver
  - This website allows the user to find information on invasive plants by state.

Materials for Activity #2:

- The students will need access to computers (with internet and PowerPoint) and the library to complete this activity.
- They will also need access to a printer (preferably a color one).

Directions for Activity #2:

- Given the websites provided, this should be a good start to answer the questions given in the student handout.
- Directions for making a poster are also given in the student handout. However, for more detailed directions, click here.
- If you want to have the students print a copy of their poster on 8.5 X 11 paper, have them click on scale to fit paper when the printer dialog box pops up.
  - With the font recommendations made in handout 2, you should be able to read all the text even at this scale.

Additional Standards Covered:

- Language arts and Technology standards can be applied to this activity.

Activity #3 – Computer Lab:

- The presentation for activity #3 consists of slide 45. It should take about five minutes to go through.
- This activity should only take one 50-minute class period though you can also assign it for homework.

Teacher preparation for Activity #3:

- The scripted presentation can be downloaded from www.protectingusnow.org.
  - Be sure to go over the text ahead of time, tweaking it as you need to for your audience. In addition, all 3 activities are included in the presentation, so be sure to remove the ones you do not wish to do.
- In addition, be sure to reserve the computer lab.
  - You will need to check that your school does not have the site blocked.
  - You will also need to make sure that the appropriate Flash plug-in is downloaded on the computers you intend to use. You may need to contact your IT person for help with this if it requires an administrator's password to download free software from the web.

Materials for Activity #3:

- The students will need access to a computer (with internet) and a printer for this activity.
  - The link to the module can be found at www.protectingusnow.org, under K-12 Lesson Plans. Choose "Click to take the e-learning module".
    - You can also access the log in page directly from here.
    - The module title is "Biodiversity, Invasive Species, and Plant Biosecurity" and is found under K-12 Modules.
- Students will need to have their own email address so that they can create an account to take the module.
  - If students at your school do not have their own email, they cannot create their own account. You can have them take the module using the teacher's username and password; however, they will not be able to print off a certificate of completion.
- To set up an account, have the students click on "Training Site Login" found on the left hand green navigation bar. They will need to create a new account (no user information is shared with anyone else) which requires their name, email address, state, county, crop specialty (use K-12 student), occupation (use "student"), Employer (enter "student"), and the creation of a username and password.
- We will send them an email notification (usually within a few minutes of the account being created) asking them to verify that they wish to set up an account. Once they click yes, then they can log in to the system, click on take the online training modules, scroll down to Protect U.S. and choose Biodiversity, Invasive Species, and Plant Biosecurity.

Directions for Activity #3:

- Follow the directions given in the module. When the student is ready to take the quiz, click EXIT from the module, then choose the "Take Module Quiz" icon which is located next to the module icon.
- If the student scores 70% or better on the 10 question quiz, they can download a certificate of completion, print it, and turn it in to you for a grade.

- They can take the quiz multiple times if they need to.
- If there is a problem printing off the certificate of completion, you can always have the students print the screen showing their test score.
- In addition, you can contact Stephanie Stocks at sstocks@ufl.edu if there are any other technical difficulties.

Additional Standards Covered:

- Technology standards can be applied to this activity.