
Florida Agriculture and Non-native Species



Lesson plans and background information about non-native species, their use in agriculture and an introduction to invasives

Prepared by the Florida Department of Agriculture and Consumer Services
Division of Aquaculture
ADAM H. PUTNAM, Commissioner

An introduction to Florida Agriculture and Non-native Species

Teachers: this background information should help get you started

Non-native species are perceived by some to be bad for the environment. Recent press reports have led to this perception, but it is important to be clear on the terminology. While invasive species are non-native, and can cause harm, very few of the non-native species in Florida are invasive. There are a great number of benefits to using non-native species, the most economically important of which is probably agriculture. This unit is intended for third through fifth grade classes and will introduce students to terminology associated with non-native species, teach students about the value of non-natives in their lives and introduce topics related to invasive species. The text to follow is intended to give you, the teacher, an introduction to the topics in this unit.

Non-native species are organisms which did not originate in a specific area. The terms non-indigenous, alien or exotic are synonymous. None of these terms describes the value or lack of value of an organism, merely their origin. There are many uses for non-natives organisms such as food, fiber, aesthetic, pets, or sportfishing. The list of Florida's *Non-native and Native Species* included with this unit will show you just how many common organisms did not originate in Florida or the United States.

Agriculture

Agriculture is Florida's second largest industry (following tourism). While there are many species of

plants and animals raised by agriculturists that are native (strawberries, blueberries, tobacco, alligators, clams, etc.), the great majority of what is raised in Florida originated in other parts of the world.

This international origin of cultured crops began as far back as when Native American tribes, such as Florida's Apalachee and Timicuan Indians cultured corn, squash and beans. These crops came to North America via trade between natives of Central and North America, but actually originated in Central America.

During the 1400s Florida's first European settlers brought along crops and livestock of their homelands. Columbus' second voyage to the New World in 1493 brought wheat, melons, onions, sugarcane, cattle, horses, swine and many others to this part of the world. Hernando de

Soto is reported to have brought along 13 hogs to feed his men while exploring Florida in 1539. By 1542, the herd had multiplied to hundreds of animals. By 1579, the Spanish were raising oranges in St. Augustine.

Thus, many non-native agriculture crops have been in Florida for hundreds of years. Farmers continue to produce these crops while improving production with selective breeding, hybridization and other crop improvement techniques.

Today, Florida's farmers raise hundreds

Agriculture value

- An important goal of this lesson is that students realize the importance of non-natives in their lives
- Florida's 44,000 farmers grow hundreds of different crops
- 90% of Florida's over \$6 billion farm sales are from non-native species
- Because our farmers grow these crops, Floridians have a ready supply of inexpensive, nutritious food products.

of species on over 10 million acres of land. The state ranks eighth in the nation for agriculture cash receipts. With farmers in the United States able to efficiently grow crops (both native and non-native), food costs here are only about 10 percent of disposable personal income. This is the lowest rate in the world.

Invasive Species

Some species introduced to Florida, while with good intentions, have resulted in economic or environmental harm or cause harm to human health. These are referred to as invasive species. Invasives can be plants, animals or microbes that are introduced either intentionally (e.g., as ornamentals, pets or food) or unintentionally (e.g., as hitchhikers in plant shipments, in ballast water, or on boats that move between bodies of water).

Invasive species are of concern because they may alter habitat, reduce native diversity, exclude or cause disease in natives or beneficial non-natives, hybridize with natives, or be harmful to humans. Invasive species do not necessarily have all these impacts, but could have one or some of them. For example, kudzu can grow so heavily that it completely covers all the other plants in the area and kills them by blocking sunlight. The result is a reduction in native diversity in that area. Citrus canker, a bacterial disease, causes significant losses of fruit on citrus trees. The disease results in a large economic impact to commercial and residential growers.



Tens of thousands of plant and animal species have been introduced to Florida over the years. Of these, two thousand have become established and less than 150 are considered invasive. The ones that are invasive however, are costly. During 1999, Florida spent \$90 million on invasives (\$45 million of which was to protect agriculture). Invasive plants are considered to have the greatest impact of all invasives on natural areas.

A non-native species must possess certain qualities in order to become invasive in an area. Invasives will lack the natural controls that existed in their native homes such as predators and disease. Without a means to keep the organism in check, invasive species will have high survival rates.

Invasive species are able to produce many young through a variety of means. They are readily dispersed by humans, wind or water. Invasives are often habitat generalists and can tolerate a range of climate or other physical conditions. Invasives are able to outcompete natives and take up habitat that may have once been colonized by other organisms.

Invasive species are found throughout Florida, with some areas more heavily impacted than others. This transit of organisms is not a one-way exchange, though. There are examples of native Florida species that have

Florida Invasives

- West Nile virus
- Brazilian pepper
- Citrus canker
- Melaleuca
- Hydrilla
- Water hyacinth
- Kudzu

become invasive in other parts of the world. For example, the North American gray squirrel is considered a pest in Europe. Mosquitofish have colonized natural water bodies in Australia and are considered invasive.

In some cases, there is controversy about the value of species considered invasive. Some of these organisms are actually providing an ecological benefit. For example, feral pigs are important in the diet of the Florida panther and water hyacinth is consumed by manatees.

In recent years, resource managers have gone to great effort to educate the public about the risks of releasing non-native species. Research on control and elimination of these organisms continues, but getting rid of some species is extremely difficult.

There are means of controlling invasive species ranging from biological (using other organisms to eat, parasitize or otherwise inhibit the invasive), chemical (application of chemicals to kill or inhibit invasives), physical (physical removal of invasives) and ecological

(altering the habitat to inhibit or kill invasives) control. Another means to reduce populations of invasives is to allow commercial harvest of that species for food or other uses.

There are several ways for the average citizen to help control invasives.

- Plant native species to help restore natural areas.
- Home gardeners can safely use non-native plants as long as they have researched what they intend to plant to ensure it will not become invasive.
- Don't bring home unfamiliar plants or animals
- Never free pets into the wild
- Clean off boats and aquatic equipment
- When fishing, throw back any fish that won't be eaten
- Know the pathways of introduction and do your part to stop accidental release into the wild
- Be aware of laws related to non-native species
- Join a community group that restores habitat &

removes invasives

- Look at up-to-date information on new invasives and exotics
- Teach others about the benefits and risks of non-native species



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Introducing the Unit

Introductory Lesson

Objectives:

- Learn to differentiate non-native and invasive species.
- Learn the importance of non-natives to Florida agriculture.
- Learn how to prevent or control the spread of invasives.

The day before you introduce this lesson, have students take home the “Alien Quiz”. Have them test the adults in their household about non-natives. Save the quizzes until after they have completed the unit, then have them grade the tests and create report cards for the adults.

Go to the *Florida Invasive Species* web site and show your class the *Introduction to Non-native Species* slideshow. A script for the presentation is available, feel free to change it to meet your needs. A main goal of this lesson is to have students grasp the terminology. Introduce the class to these terms: native, non-native, alien, non-indigenous, and invasive. Pass out copies of the *Key Words* page for this unit before beginning the slideshow.

Based on what was included in the presentation (and whatever information you choose to add), encourage the students to talk about non-native species.

Have your class give examples of native and non-native species. Brainstorm lists of natives, non-natives and invasives in categories such as agricultural crops, livestock, landscape/garden plants, plants

used for building materials, and so on.

Think about agricultural products we use every day – are these native species? Are the crops and livestock grown and raised in Florida native? What about landscape plants around school grounds and yards? Does your class think of any other categories, such as pets? (Check out the *Florida Non-native and Invasive Species List* for hints)

Point out to your class how many of the plants and animals we observe every day are non-native. Very few agricultural species are native, many garden plants are non-native, most of our pets are non-native.

Of the invasive species your students listed, have them talk about what makes the organisms successful. How is it they are able to take over areas once colonized by natives? Can they think of reasons why the agricultural crops are not invasive?

Come up with a class list of what the public can do to eliminate or control invasive species.

For more materials:

- * www.FloridaAquaculture.com Click on Publications to find any of the items in this package in printable format.
- * See *Resources* page included with this unit for lots of web links, publications and contact information.

What next?

This unit on non-native species was developed to be flexible for the teachers using it. What follows are several activities and follow-up topics that complement the theme of non-native species. It is suggested that a class do at least three activities to reinforce the slide show and introductory lesson.

Each activity includes ob-

jectives, an introduction, detailed procedures, Sunshine State Standards and ideas for extending the topic. You will also find suggestions for evaluating the students and sources of additional materials such as web sites and publications.

Please use all you find here or use the ideas to create your own activities. We

would love to receive your comments and find out how your class reacted to the unit. Let us know if you come up with a great new activity concerning non-native species.

Once you have completed the unit, have students take the *Alien Quiz* and grade themselves.



Alien Quiz



Take home this quiz and test the adults in your household. Have them answer all the questions, in order. After learning about non-natives, your class will grade the quizzes and take home report cards for the adults.

1. All non-native species are a threat to Florida's native wildlife. True / False
2. Non-native species should be eliminated throughout Florida. True / False
3. Most of the invasive plants in Florida were released accidentally. True / False
4. Which is the most costly invasive species to Florida?
A. Kudzu B. Citrus Canker
C. Melaleuca D. Fire Ants
5. Florida has approximately how many alien plant species?
A. 1 B. 10
C. 100 D. 1,000
6. Florida has approximately how many invasive plant species?
A. 1 B. 10
C. 100 D. 1,000
7. Which non-native crop provides the most income to Florida?
A. Cattle B. Tomato
C. Orange D. Corn
8. Most of Florida's agriculture crops were developed by selectively breeding native species. True / False
9. Which of these native species is the most valuable to Florida agriculture?
A. Alligator B. Blueberries
C. Tobacco D. Strawberry
10. Which features make an organism more likely to invade an area?
A. Produces lots of offspring B. Long lived
C. Tolerates range of climate D. Coloration
11. Unwanted freshwater pet fish should be released in freshwater lakes. True / False
12. Which of the following will reduce the chances of spreading invasive species?
A. Clean fishing gear B. Eat only organic
C. Research what you plant D. Inform your friends
13. Invasive species are sometimes spread by which of the following?
A. Worldwide Shipping B. Gardeners
C. Recreational Boating D. Television

Answers will be sent home after your class has completed the

Non-native Species in Florida Agriculture unit.

Answers to Alien Quiz

1. True / False Some, not all, non-natives are harmful. Invasive species are the harmful ones.
2. True / False When used appropriately, non-native species provide important benefits.
3. True / False Most invasive plants were brought in intentionally for landscaping or other uses.
4. B. Citrus Canker Florida has spent over \$500 million to fight canker since 1995.
5. D. 1000
6. C. 100
7. C. Orange The value of oranges sold from farms was \$1.168 million in 2002.
8. True / False Most of our crops are non-native.
9. D. Strawberry The value of strawberries sold from farms was \$150 million in 2002.
10. A. Produces lots of offspring B. Long lived
C. Tolerates range of climate D. Coloration
11. True / False Aquarists, or any other pet owner, should never release pets into the wild.
12. A. Cleaning gear B. Eat Organic
B. Research what you plant D. Inform your friends
13. A. Worldwide shipping B. Gardeners
C. Recreational Boating D. Television

How did the adults do on the quiz? The answers are to the left. Grade the test and determine the percentage the adults you tested got correct. Cut out the cards below or make your own report cards. Get with your parents to talk about the correct answers if they scored less than 80 percent.

Alien Quiz Score

%

Correctly answered ____ questions on non-native species
and Florida agriculture

- Recommend follow-up reading
 Great job!

Alien Quiz Score

%

Correctly answered ____ questions on non-native species
and Florida agriculture

- Recommend follow-up reading
 Great job!

Non-natives on the Farm

Math, Social Studies

Introduction

Florida's farmers produce hundreds of different products. Of these, very few are native (some of the farmed natives have been hybridized with non-natives to produce crops with certain desired qualities). Even crops we typically think of as native such as corn, were actually introduced through trade between native tribes. The *Native and Non-native Species List* that is included in this unit lists some crops and their origins.

Objectives:

- Learn about the diversity of species in production in Florida.
- Learn that the majority of crops are non-native in origin.
- Think critically about ways to manage non-natives

Procedure

For this activity lead a class discussion about agricultural uses of non-native organisms. Go back to the list of native and non-native agricultural crops that the class developed earlier. Have your class explore Florida agriculture. Use reference materials from the library or search the internet, then rank Florida's agriculture products in order of value (The *Florida Agriculture Facts* brochure has a good listing of the leading farm crops and their value). Of the top items produced by Florida's farmers, only strawberries, blueberries and about 20% of aquaculture are native species.

Have your students find out how many jobs are derived from agriculture. Does your class feel that Florida farmers

should continue to culture non-native species? Ask your class to think about what they had for breakfast or lunch. Did any of the foods come from native species?

Have the students discuss why farmed non-natives have not taken over natural areas in Florida. How does a farmer ensure that his/her crops are not invasive? Point out that many farmed species are not adapted to survive outside cultivation.

What measures can you think of to reduce the risk of a species becoming a problem? For example, Florida's fish farmers are required to use screens and other barriers to keep eggs and young fish from escaping from farm ponds.



Sunshine State Standards

SS.B. 2.2 Understands the interactions of people and the physical environment

MA.A.1.2 Understands the different ways numbers are represented and used in the real world

LA.C.2.2 and **LA.C.3.2** Uses listening and speaking strategies effectively

MA.A.3.2 Understands the effects of operations on numbers and the relationships among these operations, selects appropriate operations, and computes for problem solving

Evaluation and Extensions

Evaluation: As an assignment, have students determine the percentage of farm income derived from non-native species.

Extensions: Get a copy of *Life from the Land* from Florida Ag in the Class-

room, Inc. (FAITC). This guide has lots of great information on Florida agriculture. FAITC distributes this to all fourth grade classrooms in the state, but if you don't have a copy, contact FAITC (see

Resource page).

Have the class check out the time line starting at the top of page 2 in *Life from the Land* to learn more about the introduction of agricultural crops and livestock to Florida.

Mapping Non-native Species

Geography

Introduction

Non-native species in Florida originated all over the world. Beginning with the Columbian Exchange in the fifteenth century when European colonists exchanged plants and animals between the Old and New Worlds and continuing to the globalization of trade and the wide array of shipment options today, organisms find new homes all the time.

Objectives:

- Learn the definition of the Columbian Exchange and think about its consequences.
- Learn the geographic origin of non-native species in Florida
- Learn about the methods of transfer of non-natives
- Practice mapping skills

Sunshine State Standards

SS.A.1.2 Understands historical chronology and the historical perspective

SS.A.4.2, SS.A.5.1, SS.A.5.1 Understands U.S. and Florida history to present day

SS.B.1.2 Understands the world in spatial terms

SS.B.2.2 Understands the interactions of people and the physical environment

MA.E.1.2 Understands and uses the tools of data analysis for managing information

Procedure

Provide a wall map for the class to work with or copy individual maps for the students. Introduce the idea of the Columbian Exchange and discuss some of the crops, livestock and diseases that were exchanged between the New World and Europe during the 1400s. Remind them that even prior to this time, native Americans moved plants between North and Central America.

Have your class identify the origin of several of Florida's non-native species (*Florida's Native and Non-native Species* list includes the origins of many agricultural crops and invasives). Consider making separate maps for agricultural crops and invasive species, or use different colors to denote the invasive species.

Have the students create a bar chart showing each of the continents and the



number of organisms introduced (two graphs for both agriculture and invasives). Your class will find that the greatest number of invasives originated in Asia. Can they think of a reason for this (large continent with lots of species, similar climate to Florida)?

Can your students find out how some of the species they have mapped were dispersed?

Evaluation and Extensions

Evaluation: Have your students complete the graphing exercise as homework and write a paragraph summarizing the results. In their summary, have them say something about the consequences of moving plants and animals around the world.

Extensions: Have the class research native Florida organisms that have been moved elsewhere. Can your class find out about any native Florida species that have become valuable agriculture commodities in other areas (turkeys, tobacco, etc)? What about invasives? Largemouth bass

are invasive in Japan and Mexico, Gray squirrels are invasive in Europe, mosquitofish are invasive in Australia, bullfrogs are invasive in Asia, Europe, South America and even the Western United States. Have the class find out what they can about these or other Florida natives.

Florida's 10 Most Wanted

Math, Social Studies

Introduction

Non-native species are Florida's most wanted—wanted to remain by agriculture for their positive value as crops and ornamentals and wanted locked up by resource managers who go to great expense to eliminate or control the invasive ones. Careful citizens can use non-natives to enrich their lives while protecting Florida's environment.

Objectives:

- Learn about positive and negative impacts of non-native organisms
- Learn about Florida's most valuable agriculture crops
- Learn about some of Florida's invasive species, how they arrived and their impacts
- Consider ways to control invasives

Procedure

Distribute the *Most Wanted* worksheet to students and have them use available reference materials to fill in the list and answer the questions.

The *Florida Agriculture Facts* brochure (see *Resources*) contains all the information students will need for agriculture questions. Information for the invasive species part of the worksheet can be found in some of the reference materials on the *Resources* page. Students could also do searches on the internet, but be aware that the information on invasives will not all be found in one place.

The worksheet lists a number of invasive species currently found in Florida. The students can break into groups to complete the worksheet or you can assign each group to complete 3 or 4 organisms

and have them present their results to the whole class. Students should use a variety of materials, reference books, periodicals, and the internet.

Have students consider whether each invasive organism has economic, environmental or human health impacts.



Sunshine State Standards

MA.E.1.2 Uses the tools of data analysis for managing information

MA.D.1.2 Describes, analyzes and generalizes a wide variety of patterns, relations and functions

SC.G.1.2 Understands the competitive, interdependent, cyclic nature of living things in the environment

SC.G.2.2 Understands the consequences of using limited natural resources

SS.B.2.2 Understands the interactions of people and the physical environment

Evaluation and Extensions

Evaluation: Students were able to complete the tables and answer questions.

Extensions: Have students contact local county or city government agencies to find out what is spent each year to control

invasive species. Have them also contact their county Farm Bureau or county extension office to find out which non-natives are grown or raised in the county or region and the value of those farm products.

Can you find out about any invasive organisms you might want to look out for that are not already in your area? What makes these species good invaders for your area: climate, life cycle. What can be done now to deter them?

Florida's Most Wanted Worksheet

Fill in the tables on both pages of this worksheet. Use the reference materials in your classroom to list the top non-native agriculture crops grown in Florida and many invasive species in Florida.

Non-native Agriculture Crops		
Name	Use	Farm Value

What percentage of Florida's agricultural sales are from the top ten species you listed? _____

Name two agricultural crops or livestock species that are native: _____

How many people in Florida are employed in agriculture jobs? _____

What type of invasive species control uses other organisms? _____

Name two ways average citizens can help control invasive species: _____

Invaders

Organism	Negative Impact*	Control Measures#	Method of Introduction	Year	Where in Florida?
fire ant					
kudzu					
melaleuca					
West Nile virus					
lionfish					
Brazillian pepper					
hydrilla					
Australian pine					
Mediterranean fruit fly					
Old World climbing fern					
water hyacinth					
citrus canker					

*Include specific information as well as whether the impact is environmental, economic or human health

#Give an example of a specific control method and state if control is biological, environmental, mechanical or chemical

Sample responses for *Most Wanted* worksheet. Some answers will vary depending on the reference used by students. Responses indicated in the key for control measures are only examples, for most species, a number of possible control measures exist.

Acceptable responses to questions:

- 100% of top ten agriculture commodities are from non-natives
- Strawberries, blueberries, some aquaculture crops, pecans and grapes are a few native crops
- Florida employs 87,000 people in agriculture jobs
- Biocontrol (biological control) uses other organisms as a means to control invasives
- There are too many possible responses to list here, accept any reasonable answer that has been covered in this unit.

Non-native Agriculture Commodities		
Name	Use	Farm Value
greenhouse/nursery	aesthetic	\$1,629 million
orange	food	\$1,168 million
sugarcane	food	\$517 million
tomatoes	food	\$508 million
dairy	food	\$356 million
cattle	food	\$333 million
peppers	food	\$218 million
potatoes	food	\$211 million
chickens	food	\$195 million
grapefruit	food	\$183 million

Organism	Negative Impact	Control Measures	Method of Introduction	Year	Where in Florida?
fire ant	Sting people & livestock, damage crops & equipment	Hot water, chemicals, parasitic biocontrol	arrived in soil used as ballast	1940s	statewide
kudzu	Outcompetes natives, intense shading	Overgraze, mow, chemical application	ornamental, erosion control and livestock feed	late 1800s	statewide
melaleuca	dense stands overtake natives	Insect biocontrol	ornamental	1900	South Florida
West Nile virus	human and animal disease	eliminate mosquito carriers	hitchhiker	2001	statewide
lionfish	Venomous spines	collect and sell or destroy fish	escaped or released pet	1990s	Atlantic Ocean
Brazilian pepper	dense stands displace natives, may inhibit natives	chemical application	ornamental	1840	South Florida
hydrilla	clogs waterways, alters distribution of native species	grass carp biological control	aquarium release	1960s	statewide
Australian pine	inhibits and displaces native plants	physical removal	landscaping	1890s	South Florida
Mediterranean fruit fly	damages crops	release of sterile males	hitchhiker	First infestation in 1929	South and Central Florida
Old World climbing fern	shades native plants	chemical application	ornamental	1950s	statewide
water hyacinth	clogs waterways, blocks light from submerged plants	chemical application, introduce insect predator (weevil)	ornamental	1880s	statewide
citrus canker	damages citrus crops	Safely dispose of infested trees	hitchhiker	1912	South Florida

Non-natives at Your School

Science

Introduction

Many plants used in landscaping are non-native in origin. Florida's farmers produce about \$800 million worth of foliage and floriculture crops each year. Many of these plants are non-native and are probably on your school grounds.

Objectives:

- Learn to use a field guide to identify plant species
- Determine where non-natives exist on school grounds
- Think about how non-natives are brought to a new area.

Sunshine State Standards

MA.E.1.2 Understands and uses the tools of data analysis for managing information

SC.D.2.2 Understands the need for protection of the natural systems on Earth

SC.G.1.2 Understands the competitive, interdependent, cyclic nature of living things in the environment

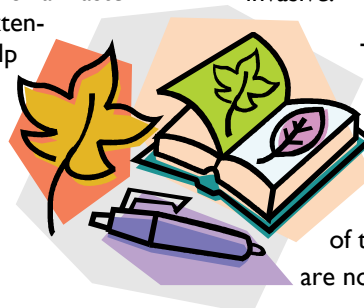
SC.H.1.2 Uses the scientific processes and habits of mind to solve problems

SS.B.2.2 Understands the interactions of people and the physical environment

Procedure

Locate a field guide or gardening book(s) (some publications showing invasives are listed on the *Resources* page). Bring in a few leaves or stems from plants around the school or collect some invasives from around town to teach the class to use the field guide.

See if you can arrange for a master gardener or county extension agent to come help your class with this exercise. Use this activity to introduce or reinforce the concept of scientific names (binomial nomenclature).



know they will find and a field guide they can take along. Have each group report back on their findings. They should develop a datasheet (or use the one included with this lesson) to track what they find. Be sure to tell the class that they do not have permission to remove any plants, even if they are considered invasive.

The groups should compare their lists and come to some conclusion about the frequency of non-natives on the school grounds. Emphasize to the class that a great deal of the plants used for landscaping are non-native, but not invasive.

Send groups of students out to different areas on the school grounds to locate non-native species. Start the students out with a short list of some species you

Did they find any invasive species? If so, discuss the characteristics of these plants that make them invasive and how they could have come to the school.

Evaluation and Extensions

Evaluation: Students were able to fill in the worksheet and discuss their work. They have an understanding of the frequency of non-natives and means by which invasives are spread.

Extensions: Check with the principal and see if your class can plan an eradication of any invasive species they find on campus. Use physi-

cal methods of removal rather than chemicals. Have the students monitor the site for regrowth.

Create an exotic herbarium (a collection of dried and pressed plants). Collect non-native species and put them in a flower press. Mount your specimens on heavy stock paper (special herbarium sheets are made

for archival use). If a plant press is not available, create a photographic collection with a digital camera. Be sure to label your specimens with the common and scientific name for each plant along with the date and area where the plant was collected and the name of the collector.



Schoolyard plant survey



Walk around the area of the school that your teacher designates and make a list of ten different plants you find. Look at trees, shrubs, vines and flowers. If your school grows any vegetables, check those out as well.

See if you can find at least three native and three non-native plants. If you find an invasive, check the appropriate box. For each plant, think about why you found it in that location.

Plant name	Location observed	Native/non-native?	Invasive?	Why is it there?

Acting Locally

Geography, Social Studies, Science

Introduction

Regardless of your location in Florida, your area has many non-native and some invasive species. Take some time on your trips around town to think about the origin of what you see.

Objectives:

- **Develop awareness of local non-native species**
- **Learn about agricultural commodities grown in your area.**
- **Become aware of prohibitions on certain species in Florida to prevent damage to the environment and agricultural crops.**

Sunshine State Standards

SS.B.1.2 Understands the world in spatial terms

SS.B.2.2 Understands the interactions of people and the physical environment

SS.A.6.2 Understands the history of Florida and its people

SC.G.1.2 Understands the competitive interdependent cyclic nature of living things in the environment

SC.G.2.2 Understands the consequences of using limited natural resources

Procedure

Discuss with your students where non-native species exist in your area. Have them consider plants and animals in natural areas, landscaped sites and on farms.

Get a map of your town or county and differentiate areas with native and non-

native plants and animals. You can use different colors to denote farms, residential, commercial and natural areas. Ask the students to keep an eye out for invasive species and put a symbol on the map indicating the location of those as well.

Use available resources to find out what crops and livestock are grown in your county. Are they native species?

Have your class find out how your community deals with invasive species. As a way of review, have them discuss what individuals can do to help control invasives.



Evaluation and Extensions

Evaluation: Have students summarize the status of organisms in the area. Give a quiz on what you've discussed. Ask them to list agriculture crops and invasives in your area.

Extensions: Research

laws prohibiting certain species. The Florida Department of Agriculture and Consumer Services and the Florida Fish and Wildlife Conservation Commission both have rules prohibiting certain agricultural pests and potential invasive species.

Find out if your class can participate in or plan a local field day to clean up invasives or plant native species.

Plan a field trip to a farm in your area.

What's for Lunch?

Health

Introduction

Can you create a lunch menu using only non-native species? What could you serve that follows the guidelines of the USDA food pyramid? Can you come up with a lunch of native species? Florida's farmers are grateful to have non-native species to raise for food products.

Objectives:

- Reinforce the beneficial uses of non-natives.
- Learn about nutrition and the USDA Food Guide Pyramid.
- Consider the ready availability of farmed products to consumers

Procedure

Divide the class into groups of 3-5 students. Assign each group a specific meal (i.e., breakfast, lunch or dinner). Give each group a copy of the USDA food guide pyramid plan* for a child their age. Groups should create a nutritious meal menu using only non-native organisms.

Next, ask them to create a menu of natives.

The meals must meet the guidelines of the USDA Food Pyramid and be available to your class from a retail store, local farm or legally harvested from the wild.



The class can use the list from *Florida's Native and Non-native Species* for help.

**MyPyramid.gov has educational resources and printable posters available to help teach the class about the pyramid. At this site, you can enter the age, sex and activity level of the students to come up with individualized plans.*

Sunshine State Standards

HE.B.1.2 Knows health-enhancing behaviors and how to reduce health risks

HE.B.2.2 Analyzes the influence of culture, media, technology, and other factors on health

SS.D.1.2 Understands how scarcity requires individuals and institutions to make choices about how to use resources

Evaluation and Extensions

Evaluation: Print out the MyPyramid food tracking worksheet. Have the students track their food intake for a day and answer questions about the proportion of their daily diet that comes from non-natives. Get the students

to think about what native Floridians would have eaten for a healthy diet. Have the students talk about the benefits of a healthy diet.

Extensions: Discuss the menus the students have created and come up with one to have your class prepare. Another option would be for the class to create a snack of natives one day and non-natives the next.

Describing Non-Natives

Science

Introduction

Reference materials provide information to help consumers make wise choices about what plants and animals to keep and what to avoid. A good species profile will cover all the relevant information about a plant or animal's life history and habitat requirements. The profile can include information about controlling the spread of an organism or methods to eliminate invasive species.

Objectives:

- Learn about features of invasive species
- Prepare a thorough species profile
- Discuss methods of control and management of invasives

Procedure

Divide the class into small groups and develop species profiles for non-native species. Be sure to include both beneficial and harmful non-natives. Species profiles should include headings of *species description*, *ecology*, *benefits*, *risks*, and *control*.

Tell the students to ask themselves these questions in their research:

- where does the organism originate?
- where has it been introduced?
- how does it move to new areas?
- what is the economic or ecological impact of this organism?
- what can be done to control or eradicate the invasive organism?

Students should include information about the ability of the organism to survive and reproduce outside human care.

You might want to find or create your own example using the reference materials on the *Resources* page.

Use this lesson to reinforce the characteristics of invasives. Remind the class that invasives are productive, readily dispersed, lack natural controls, are habitat generalists and can outcompete natives.

Each group should read their profile to the class. During the discussion talk about the control and management of invasives. Students should be prompted to think of physical, chemical, biological, and ecological controls and also commercialization as a means of control.

Sunshine State Standards

LA.A.2.2 Constructs meaning from a wide range of texts

LA.B.1.2 Uses writing processes effectively

LA.B.2.2 Writes to communicate ideas and information

LA.C.3.2 Uses speaking strategies effectively

SS.B.2.2 Understands the interactions of people and the physical environment

SC.F.1.2 Describes patterns of structure and functions in living things

SC.D.1.2 Understands the need for protection of the natural systems on Earth

Evaluation and Extensions

Evaluation: Determine whether students prepared accurate and thorough species profiles.

Extensions: Develop a class invasive species guide. Compile species

profiles for the invasives in your area.

Add this guide to the class or school reference collection. If you class profiled local invasive species, they could include a herbarium sheet (see “non-natives at

your school” page for instructions) or photograph in the species profile.



Planting Project

Science

Introduction

Both native and non-native plants and animals have value to our lives. Gardening is just one example of where individuals with some knowledge of the organisms they use, can raise native and non-natives with no risk to the environment.

Objectives:

- Learn that responsible gardening includes researching plants and their needs as well as ensuring they will not become invasive.
- Experience planting
- Observe growth of both native and non-native plant species

Procedure

Have your class think about two growing plots, one for native plants and one for agricultural crops. The class should walk the school grounds to select two spots to plant. Students should think about what the plants will require for light and water. The plants should not take space used for other activities. Be sure the plot isn't a spot that gets foot traffic. Your class might try to raise native wetland plants to be planted at the school's stormwater pond(s) and a fruit or vegetable crop in a vacant sunny spot. Tie this planting project in to Earth Day (April 22). Planting trees is America's favorite activity to celebrate that holiday.

fundraiser or ask for a plant or seed donation from a local nursery*. Celebrate your planting day and watch your plants grow.

Be sure to assign watering/weeding duties as necessary for the plants to thrive. If you choose to raise any vegetable plants, plan a harvest day and taste test for the class.



Once you find good locations, ask the principal for permission to plant. Hold a

Sunshine State Standards

SC.D.2.2 Understands the need for protection of the natural systems on Earth

SC.G.1.2 Understands the competitive, interdependent, cyclic nature of living things in the environment

SC.G.2.2 Understands the consequences of using limited natural resources

SC.H.1.2 Uses the scientific processes and habits of mind to solve problems

MA.E.1.2 Understands and uses the tools of data analysis for managing information

Evaluation and Extensions

Evaluation: Your students can successfully plan and carry out this planting project.

Extensions: Have students track the progress of their plants by measuring growth over time. If planting seeds, have them make observations about

germination rates as well.

***Note:** We have a limited supply of plant seeds available for this project. Teachers should make a written request to the Division of Aquaculture Education Project and we will send you seeds of

both a native and a non-native plant for this project. Contact information is found on the *Resources* page. Florida's Division of Forestry also is a good source of trees for reforestation (see *Resources* for contact information).

Create Your Own Invasive Species

Art, Science

Introduction

Certain characteristics make invasive species successful in habitats outside their native range. Imagine an alien from another planet, or one created in a laboratory. What characteristics might make this organism invasive?

Objectives:

- Consider the characteristics that make invasive species successful.
- Think about the structure of living organisms
- Consider the interactions of an organism with the environment.

Procedure



ers or goggle eyes or even create with clay. Alternatively, have the whole class or small groups create an invasive species as a verbal exercise.

Students should then think about where the organism comes from, what type of organism it is, how it spreads, what habitat it lives in, its temperature tolerance, how it feeds, and so on. Offer extra credit for students who turn in a drawing of the invasive organism.

Have students use whatever creative materials you choose and make their own invasive species. Tell each student to be prepared to explain the characteristics that make it a good invader to the class. Students can use paper and colored pencils or get more elaborate and glue on other elements like pipe cleaners, feath-



Sunshine State Standards

VA.A.1.2 Understands and applies media, techniques, and processes

SC.D.2.2 Understands the need for protection of natural systems on Earth

SC.G.1.2 Understands the competitive, interdependent, cyclic nature of living things in the environment

LA.C.3.2 Uses speaking strategies effectively

Evaluation and Extensions

Evaluation: Have each student write or orally explain what makes their creature a good invasive species. They should include what region it comes from and explain how can thrive in Florida's climate. Students should also dis-

cuss a way to control their invasive species.

Extensions: Make this a class art project. Have the entire class develop the design and come up with a larger-than-life invader.

Your students could use cardboard boxes, paper maché or other items (pine cones, seed pods, branches etc.) collected from the school grounds.

Spread the News

Language Arts, Social Studies, Science

Introduction

How did the adults do on the take home quiz at the beginning of the unit? Do they need some brushing up on non-native species? Do other students in the school know what an alien is?

Objectives:

- Create an informational piece on non-native organisms.
- Use writing skills to develop a skit, news article or hall poster
- Relate the lessons of this unit to peers and/or parents

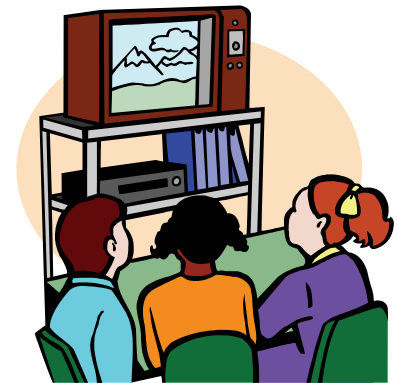
Procedure

Teach someone about non-native species. Dispel the popular notion that non-native species are all bad. Surprise people with the number of farmed species that started in other parts of the world. Tell your friends about invasives in your area and what to do about them.

school paper. The class can compile their work into a non-native species brochure and send it home to parents. Let the students include some of their own artwork as well.

Your class can break into groups and create a skit or news article on some of the topics they have learned. These topics might include:

- Florida's agriculture crops
- Benefits of using non-natives
- Risks associated with invasives
- What citizens can do to help control invasives



Students can videotape their skits and make the tape available to other classes. News articles can be submitted to the

Sunshine State Standards

LS.C.3.2 Uses speaking strategies effectively

TH.A.1.2 Acts by developing, communicating and sustaining character in informal productions

LA.B.2.2 Writes to communicate ideas and information effectively

Evaluation and Extensions

Evaluation: Grade the writing and content of the piece the students produce.

Extensions: Contact your county extension



office, county Farm Bureau or local chapter or an environmental group and see if your class can submit an article for their newsletter.

Resources

There are lots of great places for information about Florida agriculture as well as invasive species. Use these publications and web sites in your classroom to enhance the experience.

Internet

- Florida Ag In The Classroom <http://www.flagintheclassroom.com>
- Florida Department of Agriculture and Consumer Services <http://www.doacs.state.fl.us> (click on Kid's Corner for targeted information for children)
- Florida Department of Agriculture and Consumer Services plant pest information www.doacs.state.fl.us/pi
- Florida Department of Agriculture and Consumer Services Ag Facts Brochure www.florida-agriculture.com/pubs/pubform/publications2.aspx click on *Florida's Economic Engine: Agriculture Facts*
- Florida Native Plant Society <http://www.fnps.org>
- Florida Exotic Pest Plant Council <http://www.fleppc.org/>
- Habitatattitude <http://www.habitattitude.net/>
- Nab the Aquatic Invader game <http://www.sgnis.org/kids/>
- Nonindigenous species activities for youth—Mississippi State University Extension Service <http://msucares.com/pubs/publications/p2286.pdf>
- Scientific American Frontiers Alien Invasion episode <http://www.pbs.org/saf/1204/>
- Tampa Bay Estuary Program kid's page "Invaders" on <http://www.baysoundings.com/sum02/kids.html>
- United States Department of Agriculture Food Pyramid <http://www.mypyramid.gov>
- US Environmental Protection Agency invasive sites <http://www.invasivespecies.gov> and <http://www.protectyourwaters.net>
- University of Florida's Center for Aquatic and Invasive Plants page <http://aquat1.ifas.ufl.edu> The Center is a great resource and has some terrific publications, including posters of native and invasive plants.
- The Columbian Exchange: Plants, Animals, and Disease between the Old and New Worlds www.nhc.rtp.nc.us/tserve/nattrans/ntecoinian/essays/columbian.htm

Books, Magazine Articles, Videos

- *Discover Magazine* May 2005 The Truth About Invasive Species pp. 35-41
- *National Geographic Magazine* March 2005 Attack of the Alien Invaders. pp. 93-117
- *Smithsonian Magazine* February 2005. Invasion of the Snakeheads! pp. 62-70

Florida Agriculture and Non-native Species

- Identification and Biology of Non-native Plants in Florida's Natural Areas K. Langeland and K. Craddock Burks, editors. 1998. University of Florida press. 165 p.
- Nonnative Invasive Plants of Southern Forests. A Field Guide for Identification and Control. J. H. Miller. 2003 US Department of Agriculture, Forest Service, Southern Research Station. 93 p.
- Nonindigenous Species Activities for Youth. John Guyton, Dave Burrage and Rick Kastner. Mississippi State University Extension Service Publication 2286 MASGP-97-030. 56 p.
- Laminated wall posters depicting native aquatic plants and invasive aquatic and terrestrial plants are available from the University of Florida's Center for Aquatic and Invasive Plants. See <http://plants.ifas.ufl.edu/mural2.html> or call 1-800-226-1764.
- *Strange Days on Planet Earth* National Geographic Series of four films includes *Invaders*, which looks at issues related to invasive species. May be purchased from NationalGeographic.com.

Contacts:

Division of Aquaculture, 1203 Governor's Square Boulevard, 5th Floor, Tallahassee, FL 32301. 850-488-4033, fax 850-410-0893. www.FloridaAquaculture.com

Florida Ag in the Classroom, Inc. 2053 McCarty Hall, Gainesville, FL 32611. 352-846-1391, fax 352-846-1390. www.flagintheclassroom.com

Florida's Division of Forestry provides seedlings (for a fee) to support reforestation in the state. Contact your local Division of Forestry Field Office or the Division's Andrews Nursery and ask about seedling sales (phone 352-493-6096).

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Florida's Non-native and Native Species

Below is a very short list of some of the plants and animals in Florida, both native and non-native. It is by no means exhaustive. Origins of organisms are indicated in parentheses.

Non-native species in Florida agriculture

Citrus fruits (Indochina)
Tropical fish (all tropical regions)
Ferns (various origins)
Eggplants (Asia)
Lettuce (Southern Europe)
Sugarcane (Southeast Asia)
Peppers (Central and South America)
Cucumbers (India)
Tomatoes (Central and South America)
Watermelons (Africa)
House plants (various origins)
Gladioli (Africa)
Cotton (Central America)
Celery (Southern Europe)
Soy beans (China)
Potatoes (South America)
Cabbage (Europe)
Peanuts (South America)
Radishes (Middle East)
Honey (Europe)
Corn (Central and South America)
Beans (Central America)
Squash (Central and South America)
Chickens (India)
Cows (Near East, Northeast Africa)
Horses (Asia)
Hogs (Near East, East Asia)
Goats (Near East)
Shrimp (Pacific)
Aquatic plants (all tropical and temperate regions)

Landscape Plants

These plants originated in Florida and all over the world, there are too great a variety to provide a list here.

Forestry Species

Slash pine, longleaf pine, cypress, various oaks, tupelo and others (Florida natives)

North American native species in US agriculture (*raised in Florida)

sunflower
Blackberry*
Blueberry*
Cranberry
Strawberry*
Pecans*
Grape*
Tobacco*
Turkey
Alligator*
Catfish*
Clams*
Aquatic plants*

Invasive Species

Fire ants (South America)
Kudzu (Asia)
Cogon grass (Asia)
Formosan termite (Asia)
Honeysuckle (Asia)
Bamboo (Asia)
Old World and Japanese Climbing Fern (Africa and Asia)
Mediterranean Fruit Fly (Southern Europe)
Hydrilla (Asia)
Water Hyacinth (South America)
Maleluca (Australia)
Brazilian Pepper (South America)
Air Potato (Asia)
Tilapia (Africa)
Lionfish (Pacific)
Australian Pine (Australia)
Citrus canker (Asia)

Key Words

Agriculture: farming, producing crops and livestock

Aquatic: growing or living in water

Aquatic nuisance species: animal, and plant species that have been introduced into new ecosystems throughout the United States and the world and are having harmful impacts on the natural resources in these ecosystems and the human use of these resources

Ballast water: water used to balance a ship at sea (ships can intake and discharge water as the amount of cargo changes)

Biocontrol: method of eliminating or reducing populations of plants or animals using other living organisms

Biodiversity: the variety of plant and animal forms present in an ecosystem

Control: eliminate or reduce populations of an organism—also refers to things that keep populations down such as predators

Dispersal: the process of spreading organisms from one place to another

Economic: related to the production, distribution and consumption of goods and services

Ecosystem: system formed by the interaction of animals, microbes and plants with each other and their environment

Environmental: related to the physical, chemical and biological surroundings of an organism

Eradicate: to completely eliminate an organism

Established: an organism that grows and multiplies in an area

Generalist: an organism that is unspecialized—can thrive in many situations

Habitat: the place where a plant or animal normally lives and grows

Hitchhiker: an organism that uses another organism to get from one place to another—for example, seeds that stick to clothes and fur

Hybridize: to produce offspring of two different varieties or species of a plant or animal

Invasive: A species that is 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Invasive species can be plants, animals, and other organisms (e.g., microbes)

Juvenile: a young individual of a species, resembles the adult but not yet mature and capable of reproduction

Landscape: to modify or ornament by altering the plant cover

Larval: referring to the earliest stage of development of an animal, not in the form of the adult

Microbes: organisms of microscopic size, including bacteria that cause disease

Native species (Indigenous): plant or animal species that originate in the area under study. These species are adapted to local growing conditions.

Naturalized: plants or animals that have become established as part of an area other than their place of origin

Non-native (Alien, Nonindigenous or Exotic): foreign, not native, an organism introduced to an area

Outcompete: to grow or reproduce better or faster than others

Pest: plant or animal that is detrimental to humans or human concerns (agriculture, pets, gardens)

Productive: a plant or animal that has offspring in great abundance

Reproduction: the act or process by which plants and animals give rise to offspring

Species: a class of individuals having common attributes and designated by a common name (for example, *Homo sapiens*)

Terrestrial: living on or in or growing from land

Vector: an organism that transmits an invasive species

Weed: a plant growing where it is not desired

Reflections

Use this space to record your thoughts on this unit—what worked, what didn't. Save it for the next time you teach this unit. Include additional activities you found useful or other sources of information. Fax the page to us at 850-410-0893 and we will include your ideas in future updates.

LOCAL CONTACTS (EXTENSION PERSONNEL, FARMERS, NURSERIES,...):

- County extension agent _____ phone: _____ email: _____
- Master gardener _____ phone: _____ email: _____
- _____ phone: _____ email: _____
- _____ phone: _____ email: _____