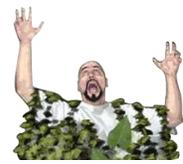


Module 1 ~ Silent Invaders – National Version

Teacher Guide – *Silent Invaders* Audio-Visual Presentation



Audio-visual presentation and all related activities can be found at: <http://plants.ifas.ufl.edu/education>

Overview: *Silent Invaders (National Version)* is a 16-minute video presentation that provides a basic introduction to invasive plants, along with the key concepts of aquatic versus terrestrial and also native, non-native and invasive plant species. Students will learn how some invasive plants spread, and how they are impacting our waterways, lakes, rivers, wetlands and natural areas such as parks, wildlife refuges and other public lands. The lesson ends with positive actions we can all take to help prevent the spread of invasive plants in our own neighborhoods.



Essential Questions:

- What is the difference between aquatic and terrestrial plants?
- What is the difference between native, non-native and invasive plants?
- How do non-native plants get here?
- Why are some plants invasive?
- What can I do to help protect the environment from invasive plants?

Subject: Biology, Life Science, Environmental Science, Social Studies, Language Arts

Grade Level: elementary (LE/UE), middle school (MS), and high school (HS)

Time Estimate: 36 minutes – 5 minute review of vocabulary; 16 minute presentation; 15 minute discussion

Learning Objectives:

- Identify differences between aquatic and terrestrial plants.
- Describe the differences between native, non-native and invasive plants.
- Identify economic and ecological impacts of invasive plants.
- Explain positive actions students can take to help prevent invasive plant problems.

Standards: See suggested Next Generation Science Standards and Common Core standards at the end of this document.

Vocabulary: Keyword Chart and Definitions are provided in a separate document available for download at plants.ifas.ufl.edu/education.

Lesson Summary: Distribute Guiding Questions and review keywords and definitions before viewing the video presentation. Depending on grade level and available class time, the video can be shown in segments. (Refer to outline on next page.) Guiding questions are provided to students for reference while watching the video. Answers are checked at the end as part of the discussion. Talking Points are also available, providing additional background knowledge for the teacher/instructor and suggestions for supplemental activities.

Materials Needed:

1. Classroom computer/projector with internet access to plants.ifas.ufl.edu/education
2. Keyword chart and definitions, available to download at plants.ifas.ufl.edu/education
3. Guiding Questions, available to download at plants.ifas.ufl.edu/education



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■ Part 1 – Introduction to native plants

Keywords: aquatic, biodiversity, competition, emersed, evolve, floating-leaved, native, submersed, and terrestrial plants

Key Points:

- Plants are essential to life as we know it.
- Definitions of aquatic and terrestrial plants.
- Aquatic plants are often classified as: emersed; floating-leaved; submersed.
- Definition and benefits of native plants.

Suggested Resources:

- See Plant Management in Florida Waters: <http://plants.ifas.ufl.edu/manage> for more about native plants
- Plant information and images: <http://plants.ifas.ufl.edu>

■ Part 2 – Introduction to non-native plants; how they are introduced to new areas.

Keywords: agricultural, ballast water, biodiversity, non-native

Key Points:

- Definition of non-native plants.
- Describe the ways that non-native plants may get here.
- Non-native plants may grow faster and displace native plants, reducing biodiversity.

Suggested Resources:

- See "Why Manage Plants?" at Plant Management in Florida Waters: <http://plants.ifas.ufl.edu/manage> for information on the differences between native, non-native, and invasive plants

■ Part 3 – Introduction to invasive plants; why we should be concerned

Keywords: contaminant, economic harm, environmental or ecological harm, invasive, outcompete, reservoirs

Key Points:

- When a non-native species is able to spread on its own causing environmental or economic harm, it's considered invasive.
- Learn the economic and ecological impacts of invasive plants.
- Learn examples of invasive plants and be able to name their environmental and/or economic impacts.

Suggested Resources:

- See "Why Manage Plants?" at Plant Management in Florida Waters: <http://plants.ifas.ufl.edu/manage>

■ Part 4 You Can Help: Positive actions we can take and conclusion

Keywords: compost, dispose, inspect, landscape, prohibit, volunteer

Key Points:

- Actions we can take to help solve the problem include:
 - Learn how to identify invasive plants
 - Never empty aquarium plants into waters such as lakes, rivers, ponds, or streams
 - Tell family and neighbors about invasive plants and the problems they can cause
 - Inspect your yard, woods, gardens, school or boats for invasive plants
 - Put invasive plants in household trash – DO NOT COMPOST
 - When gardening, landscape with native or non-invasive plants
 - Volunteer to help remove invasive plants
- Not all non-native plants are invasive. Many non-native plants are beneficial.

Suggested Resources

- See Research and Outreach at Plant Management in Florida Waters: <http://plants.ifas.ufl.edu/manage> for information on how citizens can become stewards



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Background Information

There are more than 50,000 species of plants in the United States. The vast majority of these are native plants, or non-invasive non-native plants.

NATIVE Plants

Native plants have evolved within their own ecological niches, and are not invasive within their own native ranges. Native plants provide food and shelter to animals of all sorts, stability to shorelines and fields, and natural beauty. Because a native plant species usually does not take over its home range, there is biodiversity – a number of species growing in balance. Biodiversity exists when species are constrained in their growth by natural factors so they can't overrun their neighboring species. Natural growth restraints include competition with other native species for common resources, diseases, being fed upon by insects and other animals, and other natural factors.

Unfortunately, almost every place on Earth is being invaded by plants from other places. Native Florida "coontail" plants are invading South Africa. Southeast Asia's aquatic "hydrilla" species are invading many parts of the United States.

By definition, native plants are not invasive. However, when a habitat or site becomes "disturbed," (i.e., from construction, digging, water level fluctuations from drainage or pumping systems, or excessive fertilizer), certain native plants have been known to cause problems. For example, native cat-tails (*Typha* species) are famous for quickly filling in wet areas that have been disturbed or altered. It is believed that alterations in water level fluctuations as well as nutrient input have given an advantage to cat-tail over other plants in certain areas. Usually, however, native plants are in balance with their environment.

NON-NATIVE Plants

A non-native plant is defined as a species present in a region outside its original, historic range due to intentional or unintentional introduction. IMPORTANT: Non-native plants are not necessarily invasive. Non-native plants are also referred to as *non-indigenous* or *exotic*. Another common definition: plants introduced following European contact with North America (after the year 1513) are considered non-native. (Source: Richard P. Wunderlin, © 2006 Institute for Systematic Botany).

The term "non-native" usually refers to plants from other countries or continents. However, the term can also apply to plants from another region within the same country. For example: smooth cordgrass (*Spartina alterniflora*), a desirable native plant on the U.S. Atlantic coast, is considered invasive on the Pacific coast, covering oyster beds and other vital habitat.

Not all non-native plants are problematic. A wide variety of agricultural plants, such as tomatoes, citrus trees and other economically important crops, are obviously "good" and essential to human health and our economy. These plants are well managed by the farmers who plant and sell them. Rarely do non-native food crops spread as weeds. (As far as we know, there aren't any forests being threatened by tomato plants.) Some ornamental non-native plants (roses, tulips, poinsettias, caladiums, etc.) also are benign. Genetics, climate, soil, disease, and insects prevent some cultivated plants from being able to spread on their own; they simply will not survive unless humans take care of them. As a result, they generally don't cause any significant problems in the wild.

INVASIVE Plants: What's the problem?

Under the right conditions, some non-native plants can become invasive. An invasive plant is a non-native plant species that has escaped cultivation, is spreading on its own and causing environmental or economic harm.

Invasive non-native plants can outgrow, replace, and otherwise destroy our native plants. That's because non-native plants usually do not have natural enemies – the diseases, insects and other environmental stresses – that keep them in check in their native ranges. The destruction and replacement of our native plants has several significant consequences:

- natural biodiversity is altered or destroyed;



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- native plants can be eliminated;
- wildlife that has evolved to rely on native plants may not be able to thrive on non-native plants. As a result, they may leave the area or die off;
- Invasive plants can completely fill the water or cover the surface so fish and other aquatic wildlife are driven from the area.
- Swimming, boating, fishing, hiking and other uses of natural areas can be negatively impacted or even dangerous.

How Do Non-Native Plants Get Here?

Non-native plants arrive here in a variety of ways. Any of us could have accidentally introduced them:

- as seed and plant contaminants in imported nursery plants and soils;
- as misidentified plants sold to or by aquarium keepers, water gardeners, landscapers and friends;
- as whole plants or fragments in ballast water from foreign ships coming to our ports;
- on those fruits and flowers you brought home in your vacation luggage;
- and as hitchhikers on boat trailers, props, dive gear, or in fishing bait wells.

How Do Plants Spread?

Plants reproduce and spread by several means. All flowering plants produce seeds – some even grow flowers and are pollinated under water. Depending on the plant, its location and other circumstances, plants may spread when:

- their seeds are dispersed by wind, water, or birds and other animals;
- vegetative “propagules” such as stems, leaves, tubers or roots fall off and form new plants;
- the plant is fragmented (such as by a boat propeller) and the plant parts re-grow into new plants;
- yard waste is taken elsewhere and dumped;
- the root system expands and gives rise to new plants.

STEWARDSHIP: What Can We Do?

When buying plants, choose a licensed nursery, and confirm that the vendor is aware of what species are restricted, both regionally and federally. Be sure to verify the correct plant identification and common names. After purchasing aquatic plants, rinse them in a bucket of tap water to remove unwanted sediments and/or bugs.

When disposing of plants that have the potential to spread into nearby woods or waterbodies, completely dry or freeze the plants to kill them, and then add them to household garbage that will not be composted. Incineration is another possible alternative, although burning in a backyard trashcan is not hot enough to kill some seeds).

Learn how to identify invasive non-native plants, as well as our native plants. It's not so difficult to learn a few plants that are interesting or important to you.

For more about non-native invasive plants see Why Manage Plants at: <http://plants.ifas.ufl.edu/manage>



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The following is a list of suggested Next Generation Science Standards and Common Core Standards that pertain to this activity. This list is provided as a reference to incorporate and expand upon as needed.

Next Generation Science Standards

5th Grade

5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

6th – 8th Grades

MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

9th – 12th Grades

HS-LS2-6 Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Common Core State Standards

2nd Grade

Common Core Code	Common Core Standard
L.2.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 2 reading and content, choosing flexibly from an array of strategies.
SL.2.1	Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
SL.2.3	Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.

3rd Grade

L.3.4	Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.
SL.3.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.
SL.3.3	Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.

4th Grade

RI.4.4	Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area.
RI.4.7	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.
RF.4.3	Know and apply grade-level phonics and word analysis skills in decoding words.



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SL.4.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.
SL.4.2	Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
L.4.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
L.4.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies.
L.4.6	Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal precise actions, emotions, or states of being (e.g., quizzed, whined, stammered) and that are basic to a particular topic (e.g., wildlife, conservation, and endangered when discussing animal preservation).

5th Grade

RI.5.4	Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.
RF.5.3	Know and apply grade-level phonics and word analysis skills in decoding words.
SL.5.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
SL.5.2	Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
L.5.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
L.5.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 5 reading and content, choosing flexibly from a range of strategies.

6th Grade

RI.6.7	Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.
SL.6.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.
L.6.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
L.6.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 6 reading and content, choosing flexibly from a range of strategies.
L.6.6	Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.
RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

7th Grade

SL.7.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.
SL.7.2	Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.
L.7.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
L.7.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 7 reading and content, choosing flexibly from a range of strategies.
RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

8th Grade

SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
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L.8.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
L.8.4	Determine or clarify the meaning of unknown and multiple-meaning words or phrases based on grade 8 reading and content, choosing flexibly from a range of strategies.
L.8.6	Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.
RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

9 – 10th Grade

SL.9-10.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
L.9-10.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 9–10 reading and content, choosing flexibly from a range of strategies.
L.9-10.6	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression
RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

11 – 12th Grade

RI.11-12.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text.
SL.11-12.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
L.11-12.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies.
L.11-12.6	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.



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