

Module 3 ~ Why Manage Invasive Plants? (UE/MS/HS)

Why Manage Invasive Plants? Audio/Visual Presentation Guide

Audio-visual presentation and all related activities, including answer keys with NG SSS, can be found on this website:
<http://plants.ifas.ufl.edu/education>



Overview: This audio-visual presentation is the core lesson for Module 3, upon which all other activities and lessons are based. Presented in a folksy graphic novel-style format with music, sound effects, and narration, plant management specialist Otto P. Stump-jumper provides an overview of the invasive plant situation in Florida. Students review the concept of native, non-native and invasive plants and learn what it means to 'manage' plants and the reasons for doing so. Photographs taken in the field by real-life invasive plant managers clearly illustrate the challenges they face every day as they struggle to keep invasive plants from taking over our waterways, lakes, wetlands and uplands.

After reviewing the ecological and economic damage done by invasive plants, three natural resource management strategies are introduced: **increased awareness**, **maintenance control** and **prevention**. Integrated plant management is also discussed along with four main methods used for removing invasive plants (biological, mechanical, chemical and physical control). Graphs and basic math are used to illustrate and compare management efforts and results. A summary and review of Guiding Questions is provided. **Concepts are related to Big Ideas of Interdependence and Practice of Science, to name a few.**



Essential Questions:

- What is the difference between non-native and invasive plants?
- Why is plant management necessary?
- Why is plant management challenging?
- What are the four main methods used to control invasive plants?
- Why is maintenance control important?
- What is prevention and why is it important?

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

Grade Level: upper elementary – *advanced* (UE), middle school (MS), and high school (HS)

Time Estimate: 45 minutes – 10 minute review of keywords (vocabulary); 20 minute presentation; 15 minute discussion

Learning Objectives:

- Identify the difference between non-native and invasive plants.
- Be able to discuss the necessity of plant management. (Why do we need to manage plants?)
- Define “maintenance control” and “crisis management” and the difference between the two.
- Identify three main strategies needed for invasive plant management.
- Identify main methods used to control invasive plants (biological, mechanical, chemical and physical control).

Science and Language Arts Standards: See suggested state standards at the end of this document.

Vocabulary: (Note: Keyword chart and definitions provided in separate document.)

aquatic plants, beneficial, biological control, chemical control, crisis management, environmental, flood control, habitat, herbicide, hydrilla, infestation, invasive plant, maintenance control, mechanical control, native, native habitat, native plant, non-native plant, physical control (or physical removal), plant management, prevention, public awareness, recreational, restoration, submersed plant, water hyacinth, weed

Lesson Summary: Distribute Guiding Questions and review keywords and definitions before viewing the 20-minute 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 for the teacher/instructor, providing additional background knowledge.



Florida Invasive Plant Education Initiative • <http://plants.ifas.ufl.edu/education>

A Collaboration of the UF/IFAS Center for Aquatic and Invasive Plants
and the Florida Fish and Wildlife Conservation Commission / Invasive Plant Management Section

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Materials Needed: Classroom computer/projector with internet access to the website or computer with DVD of presentation, available from the Florida Invasive Plant Education Initiative (caip-education@ufl.edu)

Additional Resources: All other activities and lessons for Module 3 are designed to compliment this presentation. Lessons and Activities are available for download as PDFs from the <http://plants.ifas.ufl.edu/education>

- **PART 1 – Introduction to the concept of plant management** and discussion of native, non-native and invasive plants. (Slides 1-13)
 - Keywords:** beneficial, habitat, native, native plant, non-native plant, invasive plant, weed
 - Key Points:**
 - Keeping invasive plants "under control" is a tough job with many challenges.
 - Aside from the technical difficulties of controlling thousands of acres of invasive plants, there are also conflicts that arise between user groups (people) who don't understand why we need to "manage" invasive plants.
 - Suggested Resources:**
 - See Plant Management in Florida Waters: Section 1 – native, non-native and invasive plants and *Why Manage Plants*: <http://plants.ifas.ufl.edu/manage>

- **PART 2 – A brief history of plant management problems in Florida** (Slides 14-22)
 - Keywords:** chemical control, hydrilla, mechanical control, physical control (or physical removal), recreational, submersed plant, water hyacinth
 - Key Points:**
 - Floridians have had to learn how to manage non-native, invasive plants since the late 1800s.
 - If we don't manage invasive plants, they are capable of doing tremendous harm to Florida's native habitats, flood control, water quality, transportation, recreational opportunities and our economy.
 - Suggested Resources:**
 - See Plant Management in Florida Waters: Section 1, *It's the Law*: <http://plants.ifas.ufl.edu/manage>

- **PART 3 – "Maintenance control" is an important strategy for managing invasive plants.** (Slides 23-41)
 - Keywords:** crisis management, environmental, flood control, infestation,* maintenance control, native habitat, restoration
 - *Note: The term "infestation" is not in the main presentation but is found throughout the module.)*
 - Key Points:**
 - After years of research, plant managers found it's much easier in the long run to keep or "maintain" invasive plants at low levels to prevent them from becoming a problem (similar to mowing a lawn on a regular basis or weeding a garden).
 - It's extremely expensive to get invasive plants back under control, once they grow into large infestations.
 - Suggested Resources:** <http://plants.ifas.ufl.edu/manage>
 - See Plant Management in Florida Waters: Section 4 – *Maintenance Control Strategy*

- **PART 4 – Integrated Plant Management: Four management methods used to keep invasive plants under control** (Slides 42-53)
 - Keywords:** aquatic plants, biological control, herbicide, plant management, prevention, public awareness
 - Key Points:**
 - There are four types of management techniques used: biological / chemical / mechanical / physical. They are all part of a strategy known as "integrated plant management."
 - Prevention is the best way to fight invasive plants but it's also important to get involved and learn more about invasive plants and help by explaining to others that plant management is crucial to protecting Florida's natural areas and wild places.
 - Suggested Resources:** <http://plants.ifas.ufl.edu/manage>
 - See Plant Management in Florida Waters: Section 4 – *Integrated Plant Management*
 - See Plant Management in Florida Waters: Section 5 – Citizens: *You Can Help*





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Background Information

Invasive plants must be controlled; ignoring them is not an option. Because it's unlikely an established invasive plant species can be eradicated from natural areas, we often have to settle for the goal of "maintenance control." This means using all appropriate tools (integrated plant management) to control or keep the plants at the lowest level possible while conserving or enhancing native plants. There are several control methods used to achieve maintenance control, depending on the plant and habitat. See this website for more information; <http://plants.ifas.ufl.edu/manage/control-methods/introduction>

Note: For video clips illustrating several of these invasive plant control methods and discussion of why we need to manage aquatic invasive plants, see this video gallery page: <http://plants.ifas.ufl.edu/manage/videos>

Biological control is the use of imported insects, fish and other organisms which eat or infect or otherwise keep the invasive plants at low levels indefinitely. Before releasing such organisms, the USDA and the Florida Department of Agriculture and Consumer Services must verify that insect biological control agents have proven to be host-specific.

Like all natural ecosystems, Florida's native habitats have developed a complex system of checks and balances that prevents the overpopulation of plant and animal species and maintains a healthy natural environment. Every native plant in Florida has evolved with specific population regulating factors that include environmental restraints such as water levels, as well as natural enemies including herbivores and pathogens. These natural enemies play an important role in keeping the the native plant population in check.

When a non-native plant is introduced into a Florida habitat, it may have a competitive advantage over native plant populations because the natural factors that regulated the introduced plant in its native range may not exist in Florida. As a result, the non-native plant often flourishes and out-competes Florida's naturally controlled native plants. One way to manage invading non-native plants in Florida's aquatic systems is to use biological control agents such as insects, fish and pathogens. Biological control agents are used to decrease the invasive plants' competitive advantages over native plants, and to weaken the invading population by increasing leaf mortality, decreasing plant size, reducing flower and seed production, and/or limiting population expansion. For more than fifty years, non-native biological control agents have been deliberately introduced or have arrived from elsewhere on their own to combat non-native invading plant populations in Florida. A total of eighteen biological control agents have been studied since the 1960s.

Chemical control is the use of specially formulated herbicides (registered with the U.S. EPA and the Florida Department of Agriculture and Consumer Services) to kill plants. The United States Environmental Protection Agency (**EPA**) defines a pesticide as "a substance or mixture of substances intended for the prevention, destruction, repulsion, or mitigation of any pest," including weeds. The term pesticide sometimes causes confusion as it covers a broad range of substances including herbicides (which target plants), insecticides (which target insects), fungicides (which target fungus) and others. Under United States Law, a pesticide is also a substance intended for use as a plant growth regulator, defoliant or desiccant. Managing invasive plants very often requires the use of herbicides. A herbicide is a type of pesticide which has been specifically formulated to control weeds. In Florida, invasive aquatic plants such as hydrilla, water hyacinth, water lettuce, and torpedo grass are managed with herbicides specifically registered and approved for use in aquatic environments.

Mechanical control is the use of specially-made machines to "harvest" invasive plants by cutting and collecting them and transporting them to a place to decompose. Mechanical harvesters are designed to cut, shear, shred, crush, press, lift, convey, transport, and remove aquatic plants and associated organic material from waterbodies. Mechanical controls range from small cutting boats to 90-foot long harvesters, and from shredders that slurry plants to track hoes and draglines stationed on shorelines or mounted on barges that lift plants and debris out of the water.

Physical control in aquatic plant management refers to the physical manipulation of plants or their habitat. This approach is sometimes referred to as cultural control and includes a number of different techniques such as pulling plants out of the water by hand; hand-netting floating plants and plant fragments; cutting them with a hand-held blade; or controlling them with environmental alterations such as water level manipulation, bottom barriers, dyes, prescribed fire, nutrient manipulation, and aeration. Physical control is sometimes confused with mechanical control. Mechanical control involves machinery that is used to cut, shred, or remove plants from aquatic systems. A constant consideration with both methods is how and where to dispose of the controlled plants. At times, aquatic plant managers have found that one or more of these physical control methods is sufficient for managing certain plant species or they may be combined with other methods such as chemical or mechanical control.





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The following is a list of suggested standards that pertain to this activity. The list is provided as a reference to incorporate and expand upon as needed.

Next Generation Sunshine State Standards

4th Grade

- SC.4.N.1.4: Recognize ways plants and animals, including humans, can impact the environment.
- SS.4.C.2.1: Discuss public issues in Florida that impact the daily lives of its citizens.

7th Grade

- SC.7.E.6.6: Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.
- SC.7.L.17.2: Compare and contrast the relationships among organisms such as mutualism, predation, parasitism, competition, and commensalism.
- SC.7.L.17.3: Describe and investigate various limiting factors in the local ecosystem and their impact on native populations, including food, shelter, water, space, disease, parasitism, predation, and nesting sites.
- SS.7.C.2.13: Examine multiple perspectives on public and current issues.

8th Grade

- SS.8.G.5.1: Describe human dependence on the physical environment and natural resources to satisfy basic needs in local environments in the United States.
- SS.8.G.5.2: Describe the impact of human modifications on the physical environment and ecosystems of the United States throughout history.

9th - 12th Grades

- SC.912.L.17.6: Compare and contrast the relationships among organisms, including predation, parasitism, competition, commensalism, and mutualism.
- 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.
- SC.912.L.17.15: Discuss the effects of technology on environmental quality.
- SC.912.L.17.16: Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.
- SC.912.N.4.1: Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.

Common Core State Standards

4th Grade

Common Core Code	FL Common Core Code	Common Core Standard
SL.4.1	LAFS.4.SL.1.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.
SL.4.2	LAFS.4.SL.1.2	Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
L.4.3	LAFS.4.L.2.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
L.4.3a	LAFS.4.L.2.3a	Choose words and phrases to convey ideas precisely
L.4.4	LAFS.4.L.3.4	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	LAFS.4.L.3.6	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).



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5th Grade

SL.5.1	LAFS.5.SL.1.1	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	LAFS.5.SL.1.2	Summarize written a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
L.5.3	LAFS.5.L.2.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
L.5.4	LAFS.5.L.3.4	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.
L.5.6	LAFS.5.L.3.6	Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal contrast, addition, and other logical relationships (e.g., however, although, nevertheless, similarly, moreover, in addition).

6th Grade

SL.6.1	LAFS.6.SL.1.1	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.
SL.6.2	LAFS.6.SL.1.2	Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.
L.6.3	LAFS.6.L.2.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
L.6.4	LAFS.6.L.3.4	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	LAFS.6.L.3.6	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	LAFS.68.RST.2.4	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	LAFS.7.SL.1.1	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.
L.7.3	LAFS.7.L.2.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
L.7.4	LAFS.7.L.3.4	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.
L.7.6	LAFS.7.L.3.6	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	LAFS.68.RST.2.4	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	LAFS.8.SL.1.1	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.
L.8.3	LAFS.8.L.2.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.



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L.8.4	LAFS.8.L.3.4	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	LAFS.8.L.3.6	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	LAFS.68.RST.2.4	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.

9th – 10th Grade

SL.9-10.1	LAFS.910.SL.1.1	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.9-10.3	LAFS.910.L.2.3	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
L.9-10.4	LAFS.910.L.3.4	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	LAFS.910.L.3.6	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	LAFS.910.RST.2.4	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.

11th – 12th Grade

SL.11-12.1	LAFS.1112.SL.1.1	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.11-12.3	LAFS.1112.L.2.3	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
L.11-12.4	LAFS.1112.L.3.4	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	LAFS.1112.L.3.6	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.11-12.4	LAFS.1112.RST.2.4	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 11–12 texts and topics.

