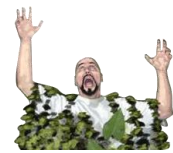


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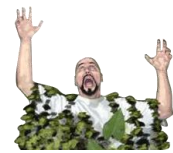


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For more about native, non-native and invasive plants in Florida: <http://plants.ifas.ufl.edu/manage/>

Recommended by fellow teachers to be used as additional background information and/or for class discussion, if time permits.	
Time Code	Notes
0:20	This is a good time to introduce/discuss the keywords; consider using them as a pre-test exercise for the classroom to assess familiarity with these terms BEFORE the lesson. Use <i>Keyword Chart and Definitions</i> for Module 1 located on our website.
1:11	Discuss things we can do to learn more about plants. Discuss some of the ways we can tell one plant from another, including the interesting patterns and structures found on leaves, flowers, etc. Consider going to this website to do a quick review of the myriad of plants found in Florida: http://plants.ifas.ufl.edu/photocat.html Contact our office for magnifying glass sets available for teachers: caip-education@ufl.edu
1:19	Consider introducing some of these new science words by explaining the Latin/Greek root and how it translates into English. This can be an especially effective tool for upper elementary because it is like learning a second language and this age is the prime group for second language acquisition. It's also beneficial for middle and high school students. It is particularly useful as they continue on in future science classes. e.g. 'terr' means 'pertaining to or living on the land or ground surface'....so terrestrial plants are found on the land. Ask students to think of other words that begin with 'terr'...like terrarium, which is a simulated little ecosystem of plants found on earth/land. A website for learning more about origin of words: http://www.wordinfo.info/
1:19 - 1:44	Discuss what kinds of 'dry land' habitats are available for terrestrial plants (not just in Florida) e.g. Forests, pastures, desert, tundra, rainforest, prairies, etc. Introduce "adaptations" to explain how and why these plants live in terrestrial habitats. EXAMPLES: trees in the rainforest have very shallow roots because there is plenty of water; some trees on land have very big leaves to capture sunlight; pine trees (or trees with needles) keep some of their leaves all year to continue making food year round; some vines maximize the sunlight they get by climbing up other plants, trees, telephone poles, etc. Also, the shape of a leaf often tells us whether or not the plant is designed to live in shade or sun (e.g. ferns have lots of surface area because they tend to live under forest canopies; they use their many leaflets for gathering as much light as possible for photosynthesis). For older students , an entire lesson can be integrated about adaptations of terrestrial plants and how they compete with others in the same habitat for space, light, water, nutrients, etc.

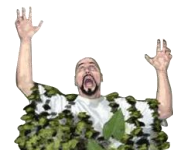
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<p>2:00</p>	<p>When introducing aquatic plants be sure to mention that: ‘aqua’ means ‘water’; so this gives a clue that aquatic plants are found in the water. Ask students to think of other words that begin with ‘aqua’ (aquarium -- is a man-made home for animals and plants that live in the water; aquanaut -- a person who explores or lives underwater for a period of time).</p> <p>A website to search for root meanings of words: http://www.wordinfo.info/</p>
<p>2:18</p>	<p>Ask students to think of places/habitats where they have seen aquatic plants: Drainage ditches, rivers, streams, ponds, lakes, marsh, ocean, estuary, etc.</p> <p>This would be a good time to discuss these different types of aquatic habitats. Aquatic is usually used to describe freshwater systems only, but this may vary depending on the curriculum and teacher preference.</p> <p>Introduce “adaptations” to explain how and why these plants live in these aquatic habitats. e.g. plants that live rooted at the water vs. those on the shoreline; little bladders on the stems of some plants to allow them to float; etc.</p> <p>For more information: http://plants.ifas.ufl.edu/manage/why-manage-plants/aquatic-and-wetland-plants-in-florida</p> <p>For older students, an entire lesson can be integrated about adaptations of aquatic plants and how they compete with others in the same habitat for space, light, water, nutrients, etc.</p>
<p>2:36</p>	<p>Discuss the big picture: what makes each of these types of plants critical to these environments? What wildlife might use them, etc? For example: Do all of them provide oxygen to the water column through photosynthesis?</p> <p>Emerged – plant roots provide shelter and hiding places for juvenile fish, insects, grow near shoreline, prevent/reduce shoreline erosion, etc.</p> <p>Floating-leaved – good hiding place for fish and other animals, provide shade for animals living beneath.</p> <p>Submersed – good hiding place for fish and small animals, food for some creatures, prevent shoreline erosion, etc.</p> <p>Detritus from dead plants provide food for organisms (bacteria, zooplankton, benthic worms)</p> <p>MS and HS students: This is a good place to integrate a lesson on photosynthesis and respiration, and then discuss how each of these types of plants produces oxygen to various places within the water column, their susceptibility to sunlight (depending on where they live in the waterbody), nutrient uptake, what limits their distribution (depth, etc.)</p> <p>SEE “A FISH TALE” PPT (a lesson about plants and oxygen in freshwater environments). TEACHER PREFERENCE: Consider using adaptations supplement here (instead of slide #7)</p>
<p>3:46</p>	<p>Discuss how plants are producers and animals are consumers.</p> <p>Introduce food chains and food webs here using Florida plants and animals that are familiar to students. Illustrate the importance that plants have on keeping higher order consumers alive – even those that may not live in the water.</p>

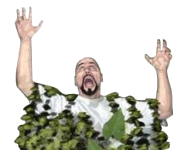
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	<p>Discuss some of the more common wildlife species found in Florida (deer, bear, snakes, birds, alligators, and fish) and how they've adapted to Florida's climate, plant life, soils, water, etc.</p> <p>Use examples of keystone species to show what happens when one part of the food chain is removed (e.g. a classic example is the sea urchins, kelp, and sea otters in the Pacific; when sea otters were hunted for their pelts, the sea urchin populations grew out of control with no predators around to eat them...as a consequence, the kelp forests of the Pacific became endangered).</p>
4:20-4:48	<p>Provide examples of ways that populations are controlled:</p> <p>Natural – Discuss biological controls such as predators, various reproductive strategies (i.e., the concept whereby animals have a small number of offspring and provide lots of parental care OR they have many offspring and offer little to no parental care). Other controls such as disease, fire, storms, periodic flooding, etc.</p> <p>Human induced (anthropogenic) – urbanization and development, introduction of disease and parasites by exotic species, chemicals (pesticide, algacide, herbicide, etc.), agriculture, deforestation, etc.</p>
5:15	<p>Prompt students to see if they can suggest ways that native plant communities might change (e.g. transport of seeds, etc.) or see if they can offer examples of communities that they have seen change in and around their neighborhood from development, population growth, etc.</p> <p>EXAMPLES: The discussion might include weeds introduced to ditches that are created for roadways; or cattails filling in their favorite lake/pond; or an old forest near their house that has become an apartment complex, etc. (Note: cattails are native plants but they can become problematic in disturbed areas or when excess nutrients are introduced to a waterbody, etc.)</p> <p>Ask how these changes may influence the plant communities.</p>
7:05	<p>What can we do to prevent this in current times? e.g. careful farming or horticulture practices: regular inspection of fields/crops to make sure we know what's growing, abiding by import/export laws and rules etc.</p>
7:30-8:06	<p>This is a great place to have students stop and do an activity. Give everyone a non-native plant and ask them to research it...find its home range, uses or value in its native ecosystem, what eats it or what depends on it, how it affects other plants (e.g. does it put out inhibitors in the soil or water, etc.?)</p>
8:37-8:41	<p>Discuss how we use these plants for food, medicine, shade, landscaping, decoration, wildlife habitat, prevent erosion/stabilize land, textiles, etc.</p>

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<p>9:03</p>	<p>How did this happen? Some plants may be thought of as beneficial in their home range, but plants grow differently when introduced to new areas; they are not predictable. In new areas, they have no natural enemies (insects, bacteria, animals that may eat them, environmental conditions) and so they can grow faster and more aggressively than native plants.</p> <p>Example 1: Cold weather may keep a plant “in check” in its home range by killing it back each winter, but in Florida, the warm climate may allow it to grow out of control.</p> <p>Example 2: Kudzu benefits from disturbed areas and human activity (e.g. nutrients and runoff from paved areas; a high population density means more fertilizers available, etc.)</p> <p>IDEA: This is a good place to introduce “disturbance” and how plants take advantage of these areas. EXAMPLES: natural vs. human – storms/hurricanes/sinkholes/fires/etc. vs. development/construction sites/clearing of land/road building/etc.</p> <p>WHY? – maximum amount of sunlight available here, plenty of nutrients because no competition with other plants, may secrete chemicals that inhibit other plants from growing, establishing, etc.</p>
<p>9:29-9:53</p>	<p>Many plants are introduced accidentally because people are not aware of what can happen as a result. The popular story about this plant (water hyacinth) is that it was introduced at the world’s fair in New Orleans in the late 1890s. Someone brought it home to Florida for their pond near the St Johns River. After it filled up their pond, they threw it in the river to dispose of it. Soon, it had grown into such thick "rafts" or islands of plants that it became impossible to travel by boat down sections of the St Johns River. Things were so bad that a division of the US Army Corps of Engineers was created to deal with this very plant.</p> <p>Economic damage – invasive plants prevent boats from traveling on the waterbodies and therefore no transport of goods or mail back in the day when rivers and lakes were the main ‘highway.’ Today, it can limit navigation for recreational boaters (anglers, water skiers, swimmers); clog motors and propellers; clog flood control structures, causing flooding during heavy rains.</p> <p>Hydrilla, introduced to the south Florida area (Tampa and Miami) as a result of the aquarium trade. It’s cost Floridians many, many millions of dollars. It spreads to new waters mainly as fragments on boats and trailers.</p> <p>This is a good place to also discuss the introduction of invasive animal species that are causing problems in Florida and elsewhere: http://www.habitattitude.net/ See Florida Wildlife Conservation Commission for more about invasive animal species in FL.</p>
<p>10:22</p>	<p>Many plants are introduced accidentally because people have not been taught what can happen as a result. For example, this non-native tuberous sword fern is proving to be very efficient at spreading through areas, displacing our native ferns.</p> <p>Point out to students: even though these two species “look” the same, they have different needs in terms of nutrients, water, sunlight, etc. and end up competing for these same resources – including habitat.</p> <p>When native plants are replaced, wildlife that depend on these plants for food begin to starve. This, obviously, causes negative effects all the way up the food chain.</p> <p>Also, many non-native plants have no natural predators and so are difficult to control unless humans actively go after them with chemicals (herbicides) and removal by hand (harvesting).</p>

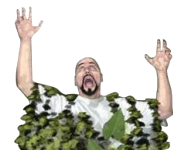
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<p>10:53</p>	<p>Hydrilla absorbs all of the nutrients available that would otherwise be available for other plants. It starts off as an invisible menace; invisible that is, until it fills the lake or river that it infests, "topping out" at the surface. Hydrilla can grow an inch a day. When hydrilla invades, ecologically-important native submersed plants such as pondweeds (<i>Potamogeton</i> spp.), tapegrass (<i>Vallisneria americana</i>) and coontail (<i>Ceratophyllum demersum</i>) are shaded out by hydrilla's thick mats, or are simply outcompeted, and eliminated. Dense hydrilla infestations can alter water chemistry and oxygen levels.</p> <p>Why is this a problem? Environmental – 100% coverage prevents sunlight from being transported down through the water column, thus plants below the surface cannot photosynthesize and no oxygen is produced. This can result in a massive fish kill; when this many plants do die off, the massive quantity of decaying/decomposing plants further removes any available oxygen from the water (as bacteria and other animals consume oxygen during decomposition). Note: Ask students to think about how much oxygen they consume while walking vs. exercising, etc.). They can also prevent other animals, such as birds, etc. from being able to access the water.</p> <p>For MIDDLE and HIGH school students: Discuss photosynthesis vs. respiration and oxygen consumption (day vs. night), etc. RECOMMENDED: See <i>A Fish Tale Presentation</i>, Module 2 on our website.</p>
<p>1:11– 11:31</p>	<p>Some invasive plants can grow so thick that it's difficult for people or animals to move through them. We're finding some evidence that animals are getting tangled and are not able to escape. Recently, one researchers / field technician found a deer carcass wrapped in an invasive climbing fern (<i>Lygodium</i>). It's not definitive, but the vine appeared to have wrapped around the animal's leg before it died.</p> <p>When only one food source is available, think about effects on the consumers. What if humans only had one food source to eat? What would happen to us? How hard/easy would it be to provide food to your offspring/young? What about needing a variety of foods for nutritional needs?</p>
<p>12:21- 12:29</p>	<p>Environmental vs. economic damage can be introduced here.</p> <p>Make the connection between these two words: Invasive = Invade</p>
<p>13:11- 14:01</p>	<p>Ask students: What do you think these plants are "climbing on"? The trees and plants beneath have been killed or severely harmed. The forest canopy is gone. Any animals living in the trees (owls, etc.) will not be able to get out. The fern has completely covered the tree leaves and so the trees can no longer make food for themselves.</p> <p>Discuss how <i>Lygodium</i> (pictured in the slide) and other invasive climbing ferns can grow over the tops of the trees, creating pathways for fire to get to tree tops -- when it usually is not capable of doing so. This can be devastating to tree populations in areas, like the Everglades, that depend on naturally occurring, periodic fires in the understory.</p>

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14:34	Without being alarming, it is important for people to know that a number of swimmers have drowned from becoming entangled in hydrilla. This is a good time to discuss swimmer safety. (Remind students: It's not a good idea to swim in areas with large amounts of submersed plants that are growing up to the surface.)
15:06	Discuss ways that flood control structures might be prevented from operating properly. Have they seen ditches in their neighborhood full of plants? Were they native or non-native? Have they seen these ditches fill up with a heavy rain?
15:38	Discuss why educating ourselves is one of the best things we can do to help our environment and to become good environmental stewards in the future. It's not that hard and it can be fun!
16:11	<p>SUGGESTED ACTIVITY: Have students write and present a 'biography' of a native (or a non-native) plant. Depending on student age, a variety of presentations can be done about the plant's life: newspaper article book w/pictures; obituary w/ tombstone (for older kids: highlight what made this plant 'famous' and why); commercial for television or radio; advertisement for movie</p> <p>This is particularly valuable for students as they learn the plant origin, ecological significance (or impact), its associated wildlife, life history (where it grows, how it reproduces, ancient uses, etc.), current uses or economic importance, methods of control (natural and human mechanisms), etc</p> <p>For images and some information on plants, see http://plants.ifas.ufl.edu</p> <p>** Another fun activity to do about animals and/or famous scientists: you could have some students do plants, some animals, and some research the famous historical Florida ecologists/botanists and you would have the whole picture!</p>
16:31	See Slide 43 and do the same for INVASIVE PLANTS. For images and some information on plants, see http://plants.ifas.ufl.edu
17:00-17:47	<p>NEVER empty aquariums in lake/pond/ditch, etc.: This is one of the single most important things that we want students to learn and practice.</p> <p>ALERT activity: Have students take a "survey" of their family members, friends, school community (other teachers and students) and see who knows what. Students are often enthusiastic about doing this, and when results are compiled, it gives them a visual of just how many people don't know about problems associated with non-native species. This provides a great opportunity for students to be the 'teachers' and educate their peers and family members.</p>

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<p>18:06</p>	<p>INSPECT activity: Discuss ways in which the class (as a whole) or individuals can inspect the local school yard or neighborhood or how they can make a difference in their own backyard or local park. Discuss the importance of knowing for sure whether or not a plant is native, non-native or invasive.</p> <p>Remember to offer the CAIP website as a resource: http://plants.ifas.ufl.edu</p> <p>Other resources: USF Plant Atlas http://www.plantatlas.usf.edu/ (students need to know scientific name) Florida Native Plant Society: http://www.fnps.org/pages/plants/enjoy.php For info on plants in other states: see http://plants.ifas.ufl.edu/seagrant/invlists.html</p>
<p>18:26</p>	<p>DISPOSE activity: Discuss the difference between household garbage and composting. Discuss the ways that composting is a good practice for household biodegradable waste (vegetable scraps, table non-meat scraps, etc.) ...but NOT for invasive plants and explain why (seeds can still escape from compost piles, etc.)</p>
<p>19:04</p>	<p>LANDSCAPE activity: Consider having students mapping out sections of the schoolyard and documenting native plants and non-native plants and invasive plants that may be there. (Break the school yard into quadrants and have students do different sections. Then all the maps can be pieced together to get a picture of the whole area.</p> <p>Be sure to discuss the meaning of 'NON-INVASIVE' plants versus non-native or invasive plants.</p>
<p>19:15</p>	<p>VOLUNTEER activity: Ask how many students help work in their own yard or in an area park, etc. See if any would be interested in helping out at a local park or schoolyard.</p> <p>Contact your local native plant organization or FLEPPC* chapter, or state park to see if there are opportunities for students to help remove invasive plants.</p> <p>Consider having students making a map of their yard or area park and developing a management plan for removing invasive plants or replanting natives.</p> <p>For a map of Florida State Parks: http://www.floridastateparks.org/images/DistMapAll.cfm</p> <p>* Florida Exotic Pest Plant Council (http://www.fleppc.org/)</p>
<p>20:51-23:29</p>	<p>Discussion questions (and answers) are available here to discuss with students. These are the same questions that are available on-line as "Guiding Questions."</p>