

## Indian River Lagoon Wildlife Guide

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## Section 1. Ecological Concepts

### Wildlife Study Guide

This packet starts with ecology lessons and finishes with accounts of individual species or groups of animals. It is our hope that students will study the ecology lessons first to learn:

- why ecosystems are important to people;
- the patterns that occur in ecosystems, for example the patterns of species abundance, or the patterns in food webs and what groups of animals are most important in keeping food webs working; and
- how we use our knowledge of ecological patterns to design conservation plans?

An important part of conservation planning is to account for people, and try to design plans considering human pressures on ecosystems.

After studying the ecology lessons, students should read the species accounts and think of each species in an ecological context. For example, when you read about bald eagles, think about the food webs they participate in and how that contributes to their vulnerability to long-lived pesticides. When you read about panthers, think about their large territory size, the restricted areas they live in, their vulnerability to inbreeding depression, and you will see why they are so endangered (and why all large carnivores are a conservation challenge). When you read about gopher tortoises, or alligators, notice the role they play in ecosystem function for many other animals you'll know why we call them "keystone" species and see examples of how ecosystems are linked together. Neotropical migrant birds fly between North and South America. You can begin to realize how landscapes are linked by this migration and you will get an idea of how difficult it is for us to figure out just what their worst problems are. Once problems are identified, how can we address such large scale problems? Over all, think of each animal and the roles it may play in ecosystem services.

You will notice that many of the issues in the other Envirothon packets relate to wildlife. Forestry is important to wildlife. Soils are critical in creating plant communities that support wildlife. Water is vital to all living things. Perhaps most of all, the Indian River Lagoon section pulls together all these sections. The Lagoon, like all ecosystems, is affected by all the things around and within it. A final study note, you should understand all the terms in the glossary.

### Ecosystem Services (Or, We never miss things until they are gone)



Pollination by a bumblebee,  
a type of ecosystem service

The May 15, 1997 edition of the journal *Nature* had an article that estimated the value of ecosystem services in the world. The authors estimated that the 'goods delivered to humans, by earth's ecosystems, had a value of about 33 trillion dollars per year. That estimate dwarfs the estimated human produced gross economic product of 18 trillion dollars. The implication is that if we damage our ecosystems too much, this 33 trillion dollar service will not be there for us to use, and we will be poorer in many ways. (see

[http://en.wikipedia.org/wiki/Ecosystem\\_services](http://en.wikipedia.org/wiki/Ecosystem_services)).

The Ecological Society of America lists the many examples of ecosystem services; things we often take for granted. It aims to build public understanding of the importance of the products and services provided by the environment to society. See [http://www.esa.org/science\\_resources/issues.php](http://www.esa.org/science_resources/issues.php)

The moral of this story is that humans live off ecosystem services. If we destroy the ability of ecosystems to perform these functions, we will destroy ourselves. We should not be alarmed--it is within our abilities to protect ecosystem services, but that protection will not happen unless planned. The Envirothon is all about ecosystem services. This section is about the role of wildlife in ecosystem services.

As you read this section, and all sections of the Envirothon packet, you should keep ecosystem services in mind and relate each topic to the role they play in ecosystems.

Conservation of Biodiversity--the building blocks of ecosystems  
One way to help conserve ecosystem services is to conserve biodiversity--the total of all species, subspecies, and gene pools  
([http://en.wikipedia.org/wiki/Conservation\\_biology](http://en.wikipedia.org/wiki/Conservation_biology)).

Populations of plant and animal species separated into smaller and shrinking ecosystems, offering fewer or limited ecosystem services, have high extinction rates. This idea is often called **Island Biogeography Theory** because it was first described from oceanic islands--smaller islands had fewer species  
([http://en.wikipedia.org/wiki/Island\\_biogeography](http://en.wikipedia.org/wiki/Island_biogeography)).

So what else can we do? One successful strategy in Florida is establishing **wildlife corridors**: If we can have a corridor of suitable habitat connecting our naturally intact lands, parks and reserves, species can travel and replenish areas where local extinctions have occurred, keep gene flow going, and ultimately, make our other reserves functionally larger. Corridors do not need to be pristine--just good enough for safe travel--which makes private land important. Corridors work for some species (e.g., large carnivores) but not all (e.g., species with low dispersal abilities)(county highways are corridors for city people to travel). Small reserves often can serve as "corridors" between larger reserves. "Buffer areas" are like corridors in that they border our core reserves and often only need to be semi-natural to help. For example, land around bat caves needs to have healthy bug populations so we might try to prevent heavy pesticide use in the buffer zone.

(see Florida Department of Environmental Protection [Office of Greenways & Trails](http://www.dep.state.fl.us/gwt/) program, <http://www.dep.state.fl.us/gwt/> The Office of Greenways & Trails is continuing its efforts to establish a statewide system of greenways and trails for recreational and conservation purposes. Florida's vision for the statewide system will help conserve wildlife and protect Florida's native biological diversity. The system also offers multi-use trails the length and breadth of the state, promoting appreciation of the state's natural and working landscapes, providing routes for alternative transportation and protecting cultural and historical sites).



<http://www.fgcu.edu/CAS/WingsofHope/postercontest.html>

**Land Acquisition** is another successful ecosystem services and biodiversity strategy in Florida (see Department of Environmental Protection [Florida Forever Program](http://www.dep.state.fl.us/lands/fl_forever.htm) [http://www.dep.state.fl.us/lands/fl\\_forever.htm](http://www.dep.state.fl.us/lands/fl_forever.htm)).  
[http://www.dep.state.fl.us/mainpage/programs/florida\\_forever.htm](http://www.dep.state.fl.us/mainpage/programs/florida_forever.htm))

All the focus on species and biodiversity might not work, we might need to concentrate on Ecosystem Processes And Landscapes. The ecosystem services listed earlier are not performed by single species, but rather by ecosystems. To make ecosystems work we must concentrate on ecosystem processes and landscapes. (see **Landscape Ecology**, [http://en.wikipedia.org/wiki/Landscape\\_ecology](http://en.wikipedia.org/wiki/Landscape_ecology)).

The factors mentioned above relate mostly to abiotic processes, but ecosystems have biotic processes as well. Competition for resources, predation, and decomposition are examples of processes that function within ecosystems and help them create the ecosystem services we need. For example, scientists at Isle Royale National Park, Michigan, have learned that when there are low wolf populations, certain trees grow slower. It seems the process of 'wolves eating moose,' decreases so much at low wolf populations that moose numbers increase and begin the process of heavily grazing on the trees. In this example, changes in a carnivore population ultimately affect plants--which carnivores do not eat. A similar example was detected in Missouri where scientists put bird-proof cages around trees. The trees inside the cages had no birds using them and



suffered slower growth than trees exposed to birds. The insect grazers inside the cages had large populations and slowed tree growth; outside the cages the birds were eating harmful insects and accelerating tree growth. These are ecosystem processes.

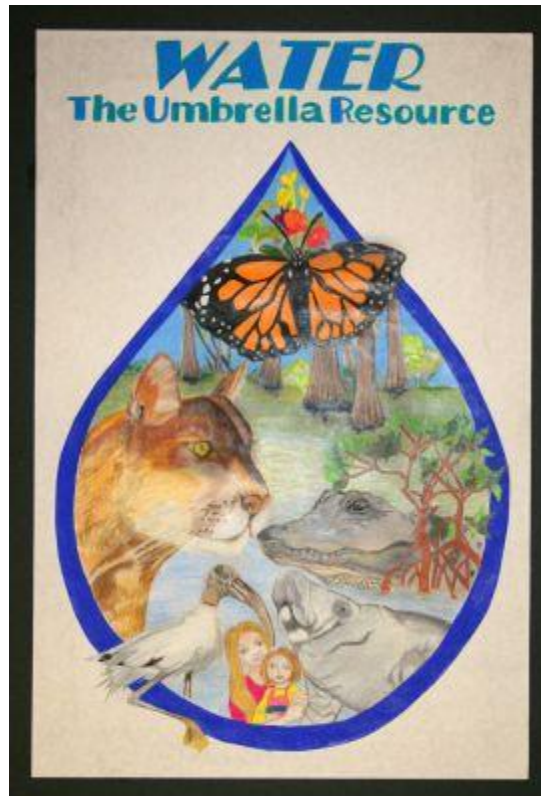
Look again at the list of ecosystem 'services.' These are all ecosystem 'processes. When we manage or protect ecosystems we try to insure these processes operate effectively. As you read those services, consider which, if lost, we could restore easily [we can restore drained wetlands fairly easily, which helps with flood abatement], and which are difficult, if not impossible to restore [we cannot restore biodiversity once lost].

Biodiversity is important for human foods too!

About one half of all the calories eaten by humans come from just 3 plants--corn, wheat and rice. Crop geneticists are working to create varieties of these crops that are resistant to disease, that can tolerate a variety of soil types and climates, and that will produce more efficiently. This type of biodiversity--that of having a large, diverse genetic stock--will be critical if we are to meet the increasing food demands of our increasing populations. Conservationists welcome the idea that if we can efficiently grow more food on the presently farmed land--we can leave more land in conservation.

**(see A biodiversity hotspot is a biogeographic region with a significant reservoir of biodiversity that is threatened with destruction.**

[http://en.wikipedia.org/wiki/Biodiversity\\_hotspot](http://en.wikipedia.org/wiki/Biodiversity_hotspot)).



<http://www.fgcu.edu/CAS/WingsofHope/waterconservation.html>

## Food Webs

Plants capture energy from the sun during photosynthesis, and that energy fuels almost all our ecosystems. Plants pass their energy through ecosystems when consumed. Some animals get this energy directly by consuming plants, either through grazing or during decomposition. The various carnivorous animals must 'wait' to get their energy, by eating animals that consumed plants. Animals do not produce energy, they only consume it. A rule of thumb in food webs is that the consumers have a much smaller biomass than the producers, otherwise the consumers would eat all the producers, and then go extinct. (see **Ecosystem models, or ecological models**, are mathematical representations of ecosystems. [http://en.wikipedia.org/wiki/Ecosystem\\_model](http://en.wikipedia.org/wiki/Ecosystem_model)).

Further references about Florida ecosystems:

**Florida Wildlife Habitats, Florida fish and Wildlife Conservation Commission.**  
<http://myfwc.com/WILDLIFEHABITATS/index.htm#>

### **Species Information**

Read and learn about Florida's amazing assortment of birds, mammals, reptiles, fish, and more.

### **Imperiled Species**

View rules and regulations along with other information on species currently listed as Endangered, Threatened, or Species of Special Concern by the FWC.

### **Living with Wildlife**

Florida's wildlife and human population are encountering each other more often than ever before. Learn how both can live in harmony.

### **Nonnative Wildlife**

Read about Florida's nonnative and invasive species, and learn how you can help prevent their introduction.

### **Invasive Plants**

Read about what is being done to manage Florida's nonnative and invasive plants, and learn how you can help prevent their introduction.

### **Wildlife Legacy**

Florida's Wildlife Legacy Initiative is our opportunity to conserve Florida's wildlife and their habitats.

### **Habitat Information**

Read and learn about the highly productive natural habitats of Florida, and the programs the FWC is using to help protect and maintain them.

### **Wildlife Assistance**

Human activities can attract certain wildlife species looking for an easy high-calorie meal or shelter under a convenient structure. Unfortunately this can bring them into conflict with the interests of people, and the wildlife can be considered to be a nuisance.

## *Electronic Wildlife Guides*

The above references will give you overall ecosystem services concepts. To learn more about specific plants and animals, there are many good field guides to mammals, birds, reptiles, amphibians, fish, insects, spiders, and almost everything else in the nature section of most book stores. These books make useful references for identifying the plants and animals around you. <http://www.enature.com/fieldguides/>

***FWC Wildlife Conservation Guide –***

Issue: Biologists within FWC's Habitat Conservation Sciences Services (HCSS) section developed the Florida Wildlife Conservation Guide to provide assistance for planning purposes. It can be a useful tool to use while evaluating environmental resources permit applications. FWC staff will explain what information the Guide provides and how it should be used by agency permitting staff. The Guide can be accessed via <http://myfwc.com/conservation/fwcg.htm>

**SCIENCE APPLICATION: Wildlife, Ecosystem Services And The Kissimmee-Okeechobee-Everglades (K-O-E) Watershed**

***The Kissimmee River*** arises in Osceola County as the outflow from East Lake Tohopekaliga, passing through Lake Tohopekaliga, Lake Cypress, Lake Hatchineha and Lake Kissimmee. Below Lake Kissimmee, the river forms the boundary between Osceola County and Polk County, between Highlands County and Okeechobee County, and between Glades County and Okeechobee County before it flows into Lake Okeechobee. The river was originally 134 miles (216 km) in length, 103 miles (166 km) of which was between Lake Kissimmee and Lake Okeechobee. It drains a watershed of 3,000 square miles (7,800 km<sup>2</sup>) and ***forms the headwaters of the Kissimmee River-Lake Okeechobee-Everglades (K-O-E) ecosystem.***



A stretch of the straightened and channelized Kissimmee River in central Florida

**Key Concept:** *The floodplain, or watershed of the river supports a diverse community of waterfowl, wading birds, fish, and other wildlife, extending from the headwaters of the Kissimmee River to the Florida Everglades and Florida Bay.*

**REVIEW** [http://en.wikipedia.org/wiki/Kissimmee\\_River](http://en.wikipedia.org/wiki/Kissimmee_River)

**ACTIVITY:** Explore the website, define terms "floodplain" and "watershed" and examine the issues regarding changes in the connectivity and ecosystem services that the Kissimmee-Okeechobee-Everglades naturally provides.



**Apply what you learn about the K-O-E watershed and how does it influence the ecosystem structures found in the estuaries of the Indian River, Loxahatchee River, the Everglades, and Florida Bay:**

- 1. How have changes in the K-O-E watershed affected nature's ecosystem services throughout South Florida, and to its wildlife?**
- 2. What are the effects on the groundwater by urban and agricultural activities?**
- 3. What kinds of environmental planning are being implemented to restore the K-O-E natural ecosystem services?**
- 4. How does the K-O-E watershed influence the Indian River lagoon? What changes have occurred in the lagoon due to activities within the K-O-E watershed?**
- 5. What measures are being taken today to restore the K-O-E watershed, and save the Indian River Lagoon? Do you think these will restore the ecosystem services that naturally occurred before the environmental impacts were initiated? Why or why not?**

## **Section 2 Rare and Endangered Species**

### **U.S. Fish & Wildlife Service - Endangered Species Act (ESA) Basics**

Introduction - Over 25 years of protecting endangered species

When the Endangered Species Act (ESA) was passed in 1973, it represented America's concern about the decline of many wildlife species around the world.

It is regarded as one of the most comprehensive wildlife conservation laws in the world. The purpose of the ESA is to conserve "the ecosystems upon which endangered and threatened species depend" and to conserve and recover listed species. Under the law, species may be listed as either "endangered" or "threatened". Endangered means a species is in danger of extinction throughout all or a significant portion of its range. Threatened means a species is likely to become endangered within the foreseeable future. All species of plants and animals, except pest insects, are eligible for listing as endangered or threatened.

The list covers mammals, birds, reptiles, amphibians, fishes, snails, clams/mussels, crustaceans, insects, arachnids, and plants. Groups with the most listed species are (in order) plants, mammals, birds, fishes, reptiles, and clams/mussels. The law is administered by the Interior Department's U.S. Fish and Wildlife Service (FWS) and the Commerce Department's National Marine Fisheries Service. The FWS has primary responsibility for terrestrial and freshwater organisms, while the National Marine Fisheries Service's responsibilities are mainly for marine species such as salmon and whales.

#### **Background**

Congress passed the Endangered Species Preservation Act in 1966. This law allowed listing of only native animal species as endangered and provided limited means for the protection of species so listed. The Departments of Interior, Agriculture, and Defense were to seek to protect listed species, and insofar as consistent with their primary purposes, preserve the habitats of such species. Land acquisition for protection of endangered species was also authorized. The Endangered Species Conservation Act of 1969 was passed to provide additional protection to species in danger of "worldwide extinction". Import of such species was prohibited, as was their subsequent sale within the U.S.

A 1973 conference in Washington led to the signing of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which restricted international commerce in plant and animal species believed to be actually or potentially harmed by trade.

Later that year, the Endangered Species Act of 1973 was passed, which combined and considerably strengthened the provisions of its predecessors, and broke some new ground.

For a review of the history of the Endangered Species Act, click on:  
<http://www.fws.gov/endangered/esasum.html>, and the details of its principal provisions.  
Key Applications provided under the Endangered Species Act include:

### Habitat Conservation Plans —Section 10

<http://www.fws.gov/endangered/factsheets/hcp.pdf>

This provision of the ESA is designed to relieve restrictions on private landowners who want to develop land inhabited by endangered species. Private landowners who develop and implement an approved “habitat conservation plan” providing for conservation of the species can receive an “incidental take permit” that allows their development project to go forward.

### Definition of “Take” —Section 9

<http://www.fws.gov/endangered/factsheets/permits.pdf>

Section 9 of the Endangered Species Act makes it unlawful for a person to “take” a listed species. The Act says “The term take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct.” The Secretary of the Interior, through regulations, defined the term “harm” in this passage as “an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.”

### Compliance with Other Laws - Florida Fish and Wildlife Conservation Commission

<http://www.myfwc.com>

The Endangered Species Act is not the only law to protect species of wild mammals, birds, reptiles, amphibians and fishes, clams, snails, insects, spiders, crustaceans, and plants. There are many other laws with enforcement provisions to protect declining populations of rare species and their habitat, such as the Marine Mammal Protection Act, the Migratory Bird Treaty Act, and the Anadromous Fish Conservation Act. The Lacey Act makes it a federal crime for any person to import, export, transport, sell, receive, acquire, possess, or purchase any fish, wildlife, or plant taken, possessed transported or sold in violation of any Federal, State, foreign or Indian tribal law, treaty, or regulation.

### For More Information

For additional information about threatened and endangered species and current recovery efforts, contact the local U.S. Fish and Wildlife Service at the address below. Additional materials and the current U.S. List of Endangered and Threatened Wildlife and Plants are also available over the Internet at <http://endangered.fws.gov>.

*Chief, Endangered Species*

U.S. Fish and Wildlife Service

1875 Century Blvd., Suite 200

Atlanta, GA 30345

<http://www.fws.gov/southeast/es/>

### SCIENCE APPLICATION: Florida's Imperiled Species

[http://www.myfwc.com/WILDLIFEHABITATS/imperiledSpp\\_index.htm](http://www.myfwc.com/WILDLIFEHABITATS/imperiledSpp_index.htm)

Florida currently updated its imperiled species listing, public comments were accepted through November 6, 2009. Review the draft rule summary changes at the above website link.

Did you know?

Under [Article IV, Section 9 of the Florida Constitution](#), the Florida Fish and Wildlife Conservation Commission has constitutional authority to "exercise the regulatory and executive powers of the state with respect to wild animal life and



fresh water aquatic life, and shall also exercise regulatory and executive powers of the state with respect to marine life..." However, whales, manatees, and sea turtles are managed under statutory authority granted by the Florida Legislature.

On this site you will find rules and regulations along with other information pertaining to these animals. Thank you for your interest and support for listed species recovery in Florida.

Review the [List of imperiled species](#) (190KB) document, entitled *FLORIDA'S ENDANGERED SPECIES, THREATENED SPECIES, AND SPECIES OF SPECIAL CONCERN*, at the weblink:

[http://www.myfwc.com/docs/WildlifeHabitats/Threatened\\_Endangered\\_Species.pdf](http://www.myfwc.com/docs/WildlifeHabitats/Threatened_Endangered_Species.pdf)

### SCIENCE APPLICATION: Ecosystem Services and Species Biodiversity

**Science concept activity:** After researching the weblinks provided throughout the previous sections, respond to the following inquiry:

- What keystone species in Florida are now listed species?
- Create a list of how changes in Florida's Landscape Ecology are effecting the survival of these species?
- How does loss of these keystone species affect the survival of other species? Name some of these other species.
- What similarities are you discovering?
- What programs in both the government and private sectors are available to sustain species survival in our state? How successful are they?

## Section 3 Aliens in Florida! The non-native species invasion!

Did you know aliens are among us, and many are powerfully forcing their way into our native habitats, displacing "locals"?

The Florida Fish and Wildlife Conservation Commission's Nonnative Species website <http://www.myfwc.com/WILDLIFEHABITATS/Nonnativeindex.htm> seeks to provide information and minimize the impacts non-native species have on Florida's native fish, wildlife, and marine life.

### SCIENCE APPLICATION: Florida's Non-native Species

Review the above website and the following:

<http://www.eddmaps.org/florida/species/> to learn more how non-native wildlife species in our state, and what kinds of Florida programs are working overtime towards minimizing the impacts nonnative species have on local native fish, wildlife and marine life.

**Science concept activity:** After researching the above weblink, respond to the following inquiry:

- What is a non-native species? How does it get here?
- What type of species are causing problems in our State?
- How do non-native species affect the native species; why can't native species compete with them?
- What can I do to help?
- What are the rules and regulations that govern bringing in non-natives, and how are they implemented?
- Do you have a non-native pet, and how are you managing it?
- Identify one alien mammal, amphibian, reptile, bird and fish species. Explain how they are impacting other species. What program is in place to control them?
- How do humans factor into the "alien" species concept? Do we affect the ecosystem similarly? How?



Did you know that there also non-native plant species changing native habitats?  
Review the following website: <http://www.floridainvasives.org/>

**Respond to these questions:**

- Can you list non-native plant species in our area? How are they affecting native habitats and ecosystem services?
- Hint: how about Brazilian pepper? Melaleuca? any others?
- What can I do at home to protect our native plant communities? Hint: Are you familiar with this program? check it out: <http://www.floridayards.org/>



## Section 4 - Florida's Wildlife

SCIENCE APPLICATION: Florida's Native Species

Now that you have mastered basic ecosystems science concepts, time to put it all together. Review the following Florida wildlife representative entries, and respond to these inquiries:

- what is the life history and ecological role of each representative, and
- how are they maintaining their ecological roles in terms of the ecosystem services, biodiversity and conservation, landscape ecology processes?
- what programs are in place to sustain their roles and survival within Florida's environment?
- what can you do to help Florida's wildlife survive, while balancing human needs, too?

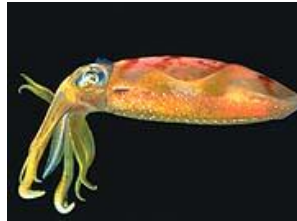
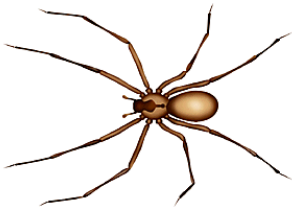
To help you review Florida's wildlife, you will be referred to the following Florida Fish and Wildlife Conservation Commission website:

[http://www.myfwc.com/WILDLIFEHABITATS/SpeciesInfo\\_index.htm](http://www.myfwc.com/WILDLIFEHABITATS/SpeciesInfo_index.htm)

Click on the **Featured Species**, and for each species represented, review the information provided, keeping the above questions in mind. The below sections provides additional supplemental information.

### Invertebrates, Bacteria, Protozoans, and Fungi

This is the most important section in the wildlife chapter in understanding ecological systems. It is ironic that the organisms in this section form such an integral part of ecosystems but are often overlooked. **Invertebrates** are animals that lack a backbone. Invertebrates include insects, mollusks, spiders, scorpions, millipedes, worms, and myriad marine animals. There are more than one million described species of invertebrates in the world and this number may be less than 10% of those in existence. Bacteria are minute, unicellular plant organisms that are important agents of fermentation, putrefaction, and decay. Protozoans are single-cell organisms that get nutrition from other tiny animals, decaying plant material, and from inorganic nutrients.



All of the biomass in ecosystems ends up as detritus, or dead organic material. As was pointed out earlier, the majority of plant mass in terrestrial ecosystems is not consumed by grazers, but usually dies and falls to the ground. Sustained productivity of an ecosystem depends on recycling the nutrients from detritus. Bacteria, invertebrates, protozoans and fungi are the chief consumers of this dead material and thus are hugely important in

recycling nutrients in a system. For example earthworms feed on dead leaves and soil that pass through their bodies where they digest some of its organic matter, leaving the rest for other detritivores. Termites consume dead wood. The little things progressively break dead material down until it reaches a condition where plants will use it again. Eventually this process releases inorganic nutrients and energy back into the environment to feed the entire cycle.

Protozoans are found wherever life exists and they make up a large part of the biomass of many ecosystems. They form a large part of floating plankton that helps to feed large fish and mammals. Their skeletons have formed gigantic ocean and soil deposits. In some animals they play a role as parasites and in others they live in some mutually beneficial relationship.

Invertebrates make up a large part of an ecosystem's biomass, hence are integral in food chains. As we have seen, many vertebrates feed on invertebrates including snakes, birds, frogs, bats, and many others. Many invertebrates also play invaluable roles as pollinators of plants. Invertebrates are predators as well; ants make up the greatest biomass of predators in many ecosystems. Because these ecosystem functions are so important and because invertebrate biomass is so great, they perform more ecosystem functions than vertebrates. [http://myfwc.com/CONSERVATION/fwcg/index\\_files/textonly/slide32.html](http://myfwc.com/CONSERVATION/fwcg/index_files/textonly/slide32.html)

Please review the list of ecosystem functions at the beginning of the chapter and consider the many functions invertebrates help with, such as decomposition cycles and food chains. These “little things” are the major drivers of ecosystem functions.

#### Oysters and Habitat - Keystone Species in our Estuaries

The estuaries of southeast Florida are becoming “impaired” due to the effluents of stormwater run off from pollutants created by agricultural and urban activities. One invertebrate in particular, the American oyster, a filter feeder, is an important biological resource that can clean and purify the water quality.

To learn more about the biology of the oyster see:  
[http://www.chesapeakebay.net/american\\_oyster.htm](http://www.chesapeakebay.net/american_oyster.htm)  
and its role in the St. Lucie estuaries, go to:  
<http://oysterrestoration.com/>

Would you like to grow oysters for a science project? Check this out:  
[http://www.ehow.com/how\\_5918187\\_grow-oysters.html](http://www.ehow.com/how_5918187_grow-oysters.html)

#### SCIENCE APPLICATION: What is a “living shoreline”?

Review the website: <http://www.cbf.org/Document.Doc?id=60>, and then consider the following question: Why would oysters be an important element in a living shoreline? How?

## Mammals

### Florida Manatee (*Trichechus manatus latirostris*)

A Florida treasure, manatees have lived along the Florida coast for millions of years. Since 1978, the State of Florida has increased protection for these animals and citizens have embraced them, in part because of their gentle nature, immense size and surprising vulnerability. The successful recovery of the manatee population ultimately relies on people learning to respect them and the habitat needed for their survival.

To review the life history of the manatee, its habits and habitats, go to:  
<http://fl.biology.usgs.gov/Manatees/manatees.html>

Review the weblink: [http://www.myfwc.com/WILDLIFEHABITATS/manatee\\_index.htm](http://www.myfwc.com/WILDLIFEHABITATS/manatee_index.htm) and the following topics regarding manatee environmental problems and issues, and the programs being implemented in Florida to resolve them.



### Florida Panther (*Felis concolor coryi*)

The Florida panther is the most spectacular and most endangered of Florida's large mammals. The Florida panther is a subspecies of cougar, which formerly ranged throughout most of the U.S. but is now only found in mountainous western states and Florida. The panther is a large, powerfully built cat with a long heavy tail. The upper parts of the body are tawny colored while the underparts are dull white. The head is broad and the ears small and rounded. The sides of the muzzle are black as well as the top part of the tail. Kittens exhibit black spots until they are about 9-12 months. The male panther can weigh between about 110-160 pounds while the female will weigh between 70-100 pounds.



To examine the life history of the panther, its habits and habitats, and threats and programs to protect the panther population, go to:  
<http://www.floridapanther.net.org/>

Florida Black Bear (*Ursus americanus floridanus*)

The Florida black bear is a subspecies of the American black bear. It is one of three subspecies of bears recognized in the southeastern United States.

Check out the following weblink:

[http://www.myfwc.com/WILDLIFEHABITATS/Bear\\_index.htm](http://www.myfwc.com/WILDLIFEHABITATS/Bear_index.htm)



and the topics regarding the black bear environmental problems and issues, and the programs being implemented in Florida to resolve them.

Florida Black Bear

Key Deer

This is the smallest race of North American deer. Adults measure 25 to 30 inches at the shoulder and have an average weight of 55 to 75 pounds for males and 45-65 pounds for females. The body is stockier, legs shorter, and skull wider than other races of white-tailed deer. The coat varies from a deep reddish brown to a grizzled, gray color. Bucks



Key Deer (*Odocoileus virginianus clavium*)

usually have antlers by their second year, and eight points by the fifth. The Key deer's primary food source is the red mangrove (*Rhizophora mangle*), but approximately 60 other plants are also known to form part of its diet. Possibly most of the available plant species



are used at one time or another. The selection of some food plants changes seasonally, probably reflecting availability and nutritional needs. Other plants are browsed almost

Review the weblink:

[http://www.myfwc.com/WILDLIFEHABITATS/SpeciesInfo\\_KeyDeer.htm](http://www.myfwc.com/WILDLIFEHABITATS/SpeciesInfo_KeyDeer.htm)

regarding environmental problems and issues affecting the survival of Florida's Key Deer,, and the programs being implemented to resolve them.

### Reptiles and Amphibians

*Amphibian* means "living double lives", meaning that they live two lives: one in water with gills and the other on land by growing lungs as they age. They are **vertebrates** and cold blooded (ectothermic). Early amphibians, a crucial link from fish to terrestrial reptiles, were the first **animals** to leave the sea and venture onto the land.

*Reptiles* (meaning "to creep stealthily under cover of darkness") are a group of animals that have scales (or modified scales), breathe air, and usually lay eggs. Most reptiles live on land and reproduce by laying eggs. Crocodiles, snakes, lizards, and turtles are all examples of reptiles.

*Reptiles and amphibians* are in fact distantly related to each other and they do have lot of similarities, but still there are a few differences between the two. They can be distinguished from each other by their physical appearance and different stages of life.

<http://www.enature.com/fieldguides/intermediate.asp?curGroupID=7>

SCIENCE APPLICATION: What is the Difference Between a Reptile and an Amphibian?

Review and Study the Table at the following website:

[http://www.diffen.com/difference/Amphibian\\_vs\\_Reptile](http://www.diffen.com/difference/Amphibian_vs_Reptile)

### Reptiles

#### Florida's Snakes

Florida is home to 44 species of snakes. These are found in every conceivable habitat, from coastal mangroves and salt marshes, to freshwater wetlands and dry uplands, and many species thrive in residential areas.



Snakes are strictly carnivorous, which means they must find, subdue and eat other animals to survive. Snakes cause few problems and are beneficial in reducing populations



of rodents and other pests, which can damage agricultural crops. However snakes have encountered problems with human beings. In one year, from July 1990 to June 1991, 20,180 individuals of 32 species were reported collected from the wild in Florida and sold in the pet trade. Another 3,000 snakes were killed for their skins. The species most often taken for their skins were eastern diamondback (2,561) and timber rattlesnakes (265). These are only the legally reported cases so the numbers are an underestimation. It is unknown how many snakes are killed "just because they are snakes. Snakes are reptiles like lizards, turtles and crocodilians. They are covered with hard, dry scales. Their complex set of ribs, muscles, and broad belly scales propel them. Many snakes are specialists, preferring specific foods or habitats. They also exhibit various defenses when confronted. About half of Florida's snakes give birth to live young while the other half lay eggs. Here we introduce several snakes coming from two broad categories: venomous and non-venomous (the venom is poisonous but the snakes aren't-you can eat them). [http://www.wildflorida.com/florida\\_snakes.php](http://www.wildflorida.com/florida_snakes.php)

### Sea Turtles

Sea turtles are large air breathing reptiles. They live in most of the world's oceans but nest only on tropical and subtropical beaches where the sand is warm enough to incubate their eggs. Sea turtles lay from 40,000 to 70,000 nests along Florida coasts annually. Five of the eight species of sea turtles in the world are found in Florida. These include the Hawksbill Turtle, Kemp's Ridley, Loggerhead Turtle, Green Turtle, and the Leatherback Turtle. All five of these turtles are threatened or endangered. List the threats to the sea turtle population. [http://www.wildflorida.com/florida\\_turtles.php](http://www.wildflorida.com/florida_turtles.php)

### Gopher Tortoise *Gopherus polyphemus*

The gopher tortoise is considered a "keystone" species because so many other species depend on it for their survival. The burrow of the gopher is used by dozens of vertebrate animals and hundreds of invertebrates. These species are called commensal species, which means they get benefit from the gopher but apparently give nothing in return. Some of these animals use the burrows occasionally to escape predators, adverse weather conditions, or fire and include things like skunks, opossums, rabbits, quail, sparrows, armadillos, burrowing owls, snakes, lizards, frogs, toads, and many invertebrates.



Gopher Tortoise *Gopherus polyphemus*

Some animals depend on the burrows for their survival. Animals that use the burrows for year-round shelter include the indigo snake, gopher frog, and Florida mouse. A recent study used very small cameras to investigate the gopher burrows and found the gopher frog was the most common commensal in the burrows.

[http://www.wildflorida.com/wildlife/turtles/Gopher\\_Tortoise.php](http://www.wildflorida.com/wildlife/turtles/Gopher_Tortoise.php)

#### American Alligator *Alligator mississippiensis*

The ancestors of the alligator roamed the earth 150 million years ago with the dinosaurs, and the modern species have remained virtually unchanged for 65 million years. The alligator is a very large reptile that is closely related to the American Crocodile. The crocodile is an endangered species restricted to coastal areas while the alligator is listed as a threatened species and chiefly uses fresh water. The maximum length recorded for the alligator was 19 feet, but today an animal only half of that size is considered large.

The highest populations of alligators in the U.S. are in Florida and Louisiana, however many are found in other southeastern states. The highest populations in Florida are in the central and southern part of the state. Alligators can use saltwater but cannot spend much time there because they lack the salt-extracting glands that crocodiles have. Alligators often build dens in lake-banks or in heavily vegetated marshes. The area around the den is usually deepened into a pond referred to as a "gator hole". In times of drought these holes serve as a water source and foraging area for other species such as wading birds and even cattle. In turn the alligators may forage on some of the visitors to the hole. Alligators are often called keystone species because of their holes.

### **Amphibians**

#### Frogs and Toads

Frogs and toads are amphibians that have very thin, permeable skin. This skin helps them regulate their body temperature, water balance, and to breathe. However this skin also makes them susceptible to accumulating pollution in their bodies from water sources. Their skin is also vulnerable to ultraviolet radiation due to loss of atmospheric ozone. Scientists think that this increased ultraviolet radiation could also damage their eggs. The eggs are gelatinous, translucent, lack the protection of a shell, and are often laid at the surface of the water.

Amphibians must rely on their environment and their movements to regulate their body temperature. Amphibians are most active at temperatures of 40-83 degrees Fahrenheit, which in summer is most commonly at night. When temperatures become too low, amphibians become inactive at the bottom of a body of water, or underground in wet areas. When the temperature becomes too warm, they become inactive and retreat to cooler damp places.

In many ecosystems of Florida, frogs and toads, (or salamanders in some forests) make up the greatest biomass of vertebrates. That is, if you weighed all of the frogs and toads per acre, they would outweigh the mammals, birds, snakes, lizards, turtles, or any of the other vertebrates. Frogs and toads are solely carnivorous, preying mostly on insects.

Frogs and toads also are prey to many animals including birds, reptiles, and small mammals. When you consider frogs and toads can be the abundant predator, and a very abundant prey for higher level carnivores, you can appreciate how important frogs and toads can be in ecosystem functioning.

**SCIENCE APPLICATION:** Florida's Endangered, Threatened, Rare, and Species of Special Concern FL Frogs: Review the following website to learn about them:  
[http://www.wildflorida.com/florida\\_frogs\\_toads.php](http://www.wildflorida.com/florida_frogs_toads.php)

### Global Declines in Amphibians

There is considerable concern that global amphibian populations, including frogs and toads, have been declining drastically over the last 20 years. Declines and even complete loss of species have been reported from all over the world. There is a lack of long-term data and research to explain these population declines. While habitat loss is certainly partially responsible, there is also concern about amphibians' high susceptibility to pollution and other environmental factors such as ultraviolet radiation. Recently, a fungus has been found that apparently wiped out many species of frogs and toads. The cause of this fungus, and whether humans can do anything to prevent catastrophic loss of frogs and toads, is unknown at present. Population declines have even taken place on many protected reserves. These losses are of great concern because of the role amphibians play in ecosystems.

**SCIENCE APPLICATION:** Reptiles and amphibians that are threatened in the State of Florida. What are the reasons, and what can be done to reduce these risks?

### Birds

Florida is a birders paradise. Nearly 500 native species as well as established exotics like the red-whiskered bulbul and the monk parakeet can be seen in the state. You can easily see cranes, pelicans, caracara, swallow-tailed kites, tropical seabirds and many other species. To learn more about Florida's Birding Program and forty featured birds of Florida, go to <http://floridabirdingtrail.com/>. Below are some featured birds of Florida; for a comprehensive study, please review the following weblink featuring Florida's birds:  
[http://www.wildflorida.com/florida\\_birds.php](http://www.wildflorida.com/florida_birds.php)

### Southern Bald Eagle

Bald Eagles are the sole representative of the genus *Haliaeetus* ("sea eagle") regularly found in the Western Hemisphere. The southern subspecies of the Bald Eagle is a bit smaller than the northern subspecies. The Southern Bald Eagle is the largest raptor that breeds in Florida, with a length of close to a meter and a wingspan of nearly two meters. Their white head and tail, brown wings and body easily identifies adults. Young eagles are mostly brown until about four or five years old.

Proximity to water is a critical habitat characteristic for the Southern Bald Eagle. This is because the main source of food for the eagle is fish. They also eat birds, smaller mammals, and carrion. Nesting habitat generally requires trees with an unimpeded view of the surrounding area. Due to the fact that water edges are also a favorite habitat for

humans, there has been a great loss of Southern Bald Eagle habitats to urban and recreational development in Florida.



Southern Bald Eagle *Haliaeetus leucocephalus leucocephalus*

#### Florida Scrub Jay

The Florida Scrub Jay is the only bird species completely restricted to Florida. These Jays became isolated from their western cousins thousands of years ago, and since then have developed enough different characteristics to achieve full species status. The Florida Scrub Jay exists in scrubby habitats of central Florida with the largest populations existing in the Ocala National Forest, Merritt Island National Wildlife Refuge plus adjacent areas, and in scattered patches along the Lake Wales Ridge in Polk and Highlands County. The Florida Scrub Jay is an intelligent and bold bird that quickly learns to accept handouts of peanuts or other foods. Why is the Florida Scrub Jay called a “keystone species”?



**Florida Scrub Jay** *Aphelocoma coerulescens coerulescens*

#### Wood Stork

The Wood Stork is a large long-legged wading bird, with a head to tail length of 35-45 inches and a wingspread of 60-65 inches. Their plumage is white except for black primary and secondary feathers and a short black tail. The rough dark grayish head and neck appear unfeathered, but actually have scale-like feathers. The legs are dark and the feet are flesh-colored. The bill color is blackish. Immature storks have a paler head and neck and a yellow bill. Like all storks, the Wood Stork flies with its neck and legs extended.





**Wood Stork** *Mycteria americana*

Wood Storks are dependent on Florida's natural **hydrologic cycle**. Wood Storks capture their prey by sweeping their bill through shallow water and snapping the bill shut on any prey item that comes in contact with it. They literally feel around in the water for fish. Obviously, this feeding technique requires a high density of prey. As inefficient as “feeling around for a fish” sounds, it has worked for Wood Storks because of Florida’s dry season. During the dry season, wetlands start drying down and the remaining fish get concentrated into smaller and smaller areas. The dry season concentration of fish works so well, that storks nest during the dry season when foraging is best and they can feed their young.

How would human activities effect the wood stork and other wading birds? Why?

#### Migratory Waterfowl of Florida

Migratory waterfowl are those that breed in northern North America and migrate to or through Florida during the fall and winter. Approximately 20 species of waterfowl regularly winter in Florida. Wintering areas, such as Florida, are important in the annual cycle of migratory waterfowl. Habitat conditions during this non-breeding period affect survival and subsequent reproduction. Ducks must maintain or improve their body condition during winter to avoid mortality during the spring migration and to meet the physiological demands of the nesting season (i.e., egg laying, incubation).







**Florida's Mottled Duck** *Anas fulvigula fulvigula*

Florida mottled ducks are commonly seen using small prairie wetlands, flood plain marshes of the St. Johns and Kissimmee rivers, and coastal impoundments. Rapid changes in the landscape of south Florida, attributed mostly to agricultural and urban development, raise concerns about the status of these wetland habitats and the wildlife that depend on them. Moreover, the continued existence of the Florida mottled duck is threatened by feral mallards, with which mottled ducks are interbreeding. Florida mottled ducks have an intrinsic aesthetic value and are highly prized as a gamebird. They also are a defining member of the unique suite of species characteristic of the prairie ecosystem of south Florida.

It will take an effort by not only the Fish and Wildlife Conservation Commission, but the people of Florida, to ensure the continued existence of the Florida mottled duck.

The Waterfowl Management Program (WMP) of the Florida Fish and Wildlife Conservation Commission (FWC) devotes considerable resources to monitoring and managing Florida's residents and migrant birds, and providing quality habitat.

Review [http://myfwc.com/WILDLIFEHABITATS/Duck\\_index.htm](http://myfwc.com/WILDLIFEHABITATS/Duck_index.htm) to learn about nonnative invasive animal and plant species that effect Florida's birdlife.

## **Fish**

Fish are wildlife, but often overlooked in relation to their significance in ecosystem function, in our culture, and in our economy. Commercial and recreational fishing is extremely important to Florida. Fish also are an integral part of many of Florida's ecosystems and provide many benefits to human beings.

Fish are cold-blooded vertebrates that live in water, breathe with gills, and have fins rather than legs. Cold-blooded means their surrounding environment largely regulates their body temperature. There are 3 classes of fishes, the jawless fishes (lampreys and hagfishes), the cartilaginous fishes (sharks, skates, rays, and related fishes), and the bony fishes, which comprise 97% of the species. Fish are the most diverse vertebrate class with about 20,000 described species worldwide. There are three million acres of freshwater lakes and 12,000 miles of rivers and streams in Florida. From these water bodies, more

than 250 species of fish have been collected. Of those, 73 were non-native species. Saltwater species are more numerous.

See the following websites to learn more about Florida's freshwater and saltwater fishes:

[http://myfwc.com/WILDLIFEHABITATS/Freshwater\\_Fish\\_ID.htm](http://myfwc.com/WILDLIFEHABITATS/Freshwater_Fish_ID.htm)

<http://myfwc.com/WILDLIFEHABITATS/SaltFishID.htm>

[http://www.wildflorida.com/florida\\_fish.php](http://www.wildflorida.com/florida_fish.php)

Some fish migrate, often between marine and freshwater environments. The eel in Florida is an example of a fish that will migrate from a marine environment to a freshwater environment to spawn. Other species live in freshwater but go to marine environments to spawn.

Fishes feed on every trophic level. The carnivores eat flesh, some fish filter feed, which means they strain plankton or other small organisms with their gills. Others are bottom feeders who use their mouths to suck up organic material from the bottom. Others are "cleaners" that eat debris and parasites from scales of larger fish. The mosquito fish is an important insectivore in Florida because it feeds on mosquito larvae and provides an effective control on these insects.

Fish are good indicators of ecosystem health and water quality. Some commercially important fish, such as bass and sunfish, are killed by nutrient enrichment. Altering flow patterns of rivers affects fish, as demonstrated when the channelization of the Kissimmee River caused the decline of desirable fish such as bass and sunfish, and an increase in unpopular species such as gar and bowfin.

Pollutants such as heavy metals, pesticides and fertilizers not only can directly kill fish, but some can be passed up food chains, even affecting terrestrial animals. Many lakes, stretches of rivers, and other bodies of water have such unsafe pollution levels, especially mercury, that the fish have been declared unsafe to eat by health agencies. As you can predict, predator fish have more bioaccumulation of mercury than other fish. Siltation is also a problem. Siltation intensifies when we disturb soils for agriculture, forestry, housing developments, roads, or other human activities.

Another problem Florida's fish face is the introduction of exotic species that out compete the native populations. Introduction of an exotic fish species, such as Tilapia, out-compete native fish for food in the Indian River Lagoon. Also, introduced species have caused population declines of the Okaloosa Darter in freshwater. The opossum pipefish in the Indian River lagoon is in trouble because, among other reasons, herbicides are used in its breeding areas. The shoal bass has been greatly depleted due to siltation and the building of dams on the Chatahoochee River. The freshwater habitats of the bigmouth sleeper along southeast Florida coasts have experienced major declines in water quality due to increased human development. Lake Apopka, Florida's fourth largest lake, has lost its bass populations due to nutrient loading, a massive chemical spill, and other problems. Fish with lesions were recently found in the St. Lucie estuary perhaps as a result massive freshwater flows into the estuary.



Florida's Most Wanted Invasive Fish – Lionfish  
Go to <http://www.reef.org/lionfish>

It is important to protect fish populations. The state depends heavily on the revenue generated by commercial and recreational fishing. The health of our ecosystems is reflected through fish populations.

#### SCIENCE APPLICATION: WILDLIFE IN FLORIDA, WHAT'S AT STAKE?



You have reviewed many facets of wildlife and how they are integral in the overall ecosystem services and landscape ecology of our state, Florida. Now, as a wrap up, consider the future of wildlife in Florida.

Go to website [http://www.myfwc.com/Conservation/FWC2060\\_index.htm](http://www.myfwc.com/Conservation/FWC2060_index.htm) and review the following links provided:

- [What's at stake?](#)
- [Habitat loss](#)
- [Habitat isolation](#)
- [Coastal challenges](#)
- [Water quality & quantity](#)

- [Wildlife/Human interactions](#)
- [Access to land & water](#)
- [Florida's future & you](#)

Discuss with your classmates the environmental problems our wildlife is coping with for survival. What issues require resolution by Floridians in order to maintain balance in their uses of ecosystem services and the landscape, in order to sustain Florida's wildlife? Without sustainable programs, how would Floridians themselves fare in the future?

To help you with your discussion, remember the main weblink:

<http://myfwc.com/WILDLIFEHABITATS/index.htm>

and examine more about native vs. non-native species in Florida, living with Florida's wildlife, and how humans can live in harmony with our wildlife.

## Wildlife and Ecology Glossary

**Abiotic** – non-biological natural process such as fire. Floods, droughts, ambient nutrient levels, and similar processes.

**Adaptation** – the long term process of evolutionary change by a species.

**Bioaccumulation** – the additive accumulation of substances in the tissues of organisms in food chains (e.g accumulation of mercury in fish, then in raccoons that eat many fish, then in panthers that eat many raccoons).

**Biomass** – the total mass of all biological organisms.

**Buffer** – a region of transition around a valuable habitat (e.g. a semi-natural area between a preserve and an urban area).

**Carnivore** – an animal or plant that eats animals.

**Carrion** – a dead body or dead decaying flesh.

**Carrying capacity** – the maximum number of species a given area of habitat will support at any given time (e.g. deer populations can exceed carrying capacity if not kept in check by natural predators or humans; when they exceed the carrying capacity the available food will be summed and there will be a large die-off of deer).

**Commensal** – a term to describe a species that lives in close association and gets some benefit from another species but does not return any benefit (e.g. gopher frogs live in gopher tortoise burrows but provide no benefit for the gopher tortoise).

**Conservation easement** – the development rights on a piece of property which will restrict the activity on that piece of property (e.g. owning a conservation easement on a ranch that says the ranch cannot be developed for citrus or subdivisions, but can continue ranching. We often use conservation easements to maintain a status quo on land).

**Corridor** – a term to describe habitat between reserves or other valuable habitat areas.

**DDT** – one of a family of organo-chloridine pesticides that was banned in the United States because of environmental concerns, particularly associated with bioaccumulation leading to egg-shell thinning and egg breakage in birds such as the Bald Eagle, Brown Pelican and Peregrine Falcon.

**Domesticated** – a plant or animal that has been selectively bred by humans to enhance certain characteristics. Domesticated organisms are called 'breeds' or 'varieties' and are roughly equivalent to human-created subspecies. Wild animals simply raised in captivity are not domesticated.

**Ecosystem** – a community of organisms and their physical environment interacting as a unit.

**Endangered** – species in danger of extinction or extirpation if the harmful factors affecting their populations continue to operate (compare with lesser risk categories of threatened or species of special concern).

**Endangered Species Act of 1973** – a federal law that protects species that are endangered or threatened from disturbance, and also mandates recovery plans for these species.



**Endemic** – restricted to a particular region or locality; unique and native.

**Estuary** – a semi-enclosed water body that has free connection to the open seas and within which seawater is measurably diluted with freshwater.

**Exotic** – an organism that is not native in the area where it occurs; introduced.

**Extirpate** – elimination of a species from a given area; local extinction.

**Feral** – domesticated animals that have gone wild (e.g. hogs, dogs, cats).

**Food chain** – a sequence of feeding types, on successive levels within a community through which energy and biomass is transferred (e.g. plants are eaten by rodents that are eaten by snakes that are eaten by hawks).

**Food web** – the network of interconnected food chains of a community (in the food chain example, plants are eaten by many herbivores, who are eaten by many carnivores).

**Forage** – vegetation taken naturally by herbivorous animals(n); the act of searching for and eating vegetative materials(v).

**Gene pool** – the total genetic information that a population has; the sum of all genes.

**Habitat succession** – the natural progression of habitat types over time (e.g. the first community to replace a deforested area is a weedy grassland, then it grows to a shrub community, and eventually back to a forest). Different ecosystem types have different successional paths and endpoints depending on soils, climate, topography, ongoing disturbance, fire frequency and other factors.

**Herbivore** – an animal that feeds on plants or plant material.

**Hibernation** – the act of passing all or part of winter in a dormant state where body functions is greatly slowed.

**Hydrologic cycle** – the natural movement of water through the environment, including rain, runoff, and evapotranspiration.

**Hydroperiod** – the duration and timing that water is present in an area (e.g. different wetlands have standing water for different periods of time and the plants and animals present are adapted to this amount of time).

**Inbreeding depression** – caused by repeated mating of successive generations of closely related individuals. This occurs especially in small or isolated populations and becomes problematic when deleterious genes (e.g. birth defects) are present-they spread quickly through the remaining population and are a great extinction threat (e.g. the Florida Panther).

**Invertebrate** – animal lacking a spine or backbone.

**Island biogeography theory** – the theory that says smaller areas will have fewer species (e.g. a small park in the middle of an urban landscape is like an island and will lose more species over time than a larger park).

**Keystone species** – a species that other species depend upon for survival (e.g. gopher tortoise, alligator).

**Landscape** – large areas of connected ecosystems. (i.e wetlands, forests, agricultural areas, and water bodies are all part of the landscape).

**Migration** – the movement of animals to and from feeding or reproductive and nesting areas.

**Molt** – to shed hair, feathers, shell, horns or an outer layer periodically.

**Mortality** – death rate.

**Nutrient loading** – the addition of nutrients from human activity to a water body, especially phosphorous and nitrogen.

**Omnivore** – an animal that feeds on both plants and animals.

**Parasitic** – a relationship in which one organism is dependent upon another living organism (the host) and which is typically detrimental to the host.

**Prescribe burn** – fires that are set by humans to restore a natural fire cycle to ecosystems.

**Range** – the geographic area or areas normally inhabited by a species.

**Rare** – species that are uncommon, and usually potentially at risk because of their restricted geographic area or habitat.

**Ruminant** – an even-toed hoofed mammal with a stomach of four chambers that swallows its food un-chewed, then regurgitates it, chews it thoroughly, and re-swallows it. Common ruminants are the camel, giraffe, deer, pronghorn, and cattle. Bacteria in the gut digest the cellulose in the food.

**Scrub** – a type of habitat dominated by woody vegetation composed principally of shrubs or shrub-like trees and having deep, very well drained, sandy soils.

**Species of Special Concern** – species that are considered vulnerable to large-scale population declines. This category is not as severe as endangered or threatened.

**Taxonomy** – the arrangement of plants and animals into groups based on their natural relationships. Standard classifications are into 7 groups listed below, but are subdivided for different taxa.

**Kingdom** – the two dominant kingdoms are plant and animal.

**Phylum** – vertebrates and invertebrates are the most recognized phyla.

**Class** – vertebrate classes include birds, mammals, fish, amphibians, and reptiles, there are multitudes of invertebrate classes, and fish often are broken into many classes).

**Family** – examples of families in the order carnivore include Canidae (dogs, wolves) Felidae (cats), Mustelidae (weasels, skunks, badger), and others.

**Genus** – the genus of dogs is *Canis* (genus names are always capitalized and either underlined or italicized).

**Species** – closely related individuals which actually or potentially interbreed, the domestic dog species is *familiaris*, the coyote is *latrans*, and the wolf is *rufus*, all in the genus *Canis*. Species names are underlined or italicized, but NOT capitalized.

**Territory** – the concept of dominance over a unit of habitat; an area defended by an animal against others of the same species, or sometimes other species; can be defended for breeding, feeding, courtship, or other reasons.

**Threatened** – a designation given to species that are likely to become endangered in the foreseeable future if current trends continue. This is the intermediate category between endangered and species of special concern.

**Toxin** – any of various poisonous substances produced by certain plant or animal cells.

**Ultraviolet radiation** – radiation from the sun that is normally blocked by the ozone layer in the atmosphere. This radiation is composed of photons in the “ultraviolet wavelength” and can be damaging to humans and animals.

**Upland** – elevated, well drained areas.

**Vertebrates** – an animal that has a backbone.

**Wetland** – land periodically flooded by water or where water is a dominant factor affecting the characteristics of soil; and supporting distinct plant and animal communities. The concept that wetlands are land that is often inundated separates them from lakes that are continuously inundated.

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