Nonnative Species
Definitions:

- **native/indigenous** – living naturally in a given area prior to colonization by humans
- **exotic/nonindigenous/alien** – introduced outside its native range (generally implies human involvement)
- **naturalized** – non-native species that is established (implies acceptance of species in new area by humans)
- **nuisance** – species that has adverse impacts on human activities (does not imply that it is exotic)
- **invasive** – spreading rapidly in numbers and in space

An exotic species becomes invasive when it becomes established in its new environment and out-competes native species
How many invasive species are there in the U.S?

Out of roughly 50,000 non-native species, about 4,300 have been considered invasive species.

About 42% of the species on the Threatened or Endangered species lists are at risk primarily because of alien-invasive species.
Invasive species in Louisiana

Invasive Terrestrial Plants
- Chinese Tallow Tree (*Sapium sebiferum*)
- Cogon Grass (*Imperata cylindrica*)
- Purple Loosestrife (*Lythrum salicaria*)
- Catclaw Vine (*Macfadyena unguis-cati*)
- Privet Hedge (*Ligustrum spp.*)
- Kudzu (*Pueraria spp.*)
Invasive species in Louisiana

Invasive Aquatic Plants

- Alligator Weed (Alternanthera philoxeroides)
- Brazilian Waterweed (Egeria densa)
- Common Salvinia (Salvinia minima)
- Giant Salvinia (Salvinia molesta)
- Eurasian Watermilfoil (Myriophyllum spicatum)
- Parrot Feather (Myriophyllum aquaticum)
- Hydrilla (Hydrilla verticillata)
- Water Lettuce (Pistia stratioides)
- Water Hyacinth (Eichhornia crassipes)
- Wild Taro (Colocasia esculenta)
Invasive species in Louisiana

Invasive Aquatic Animals

Mammals

- Nutria (Myocaster coypus)

Fish

- Bighead Carp (Hypophthalmichthys nobilis)
- Black Carp (Mylopharyngodon piceus)
- Common Carp (Cyprinus carpio)
- Grass Carp (Ctenopharyngodon idella)
- Silver Carp (Hypophthalmichthys molitrix)
- Rio Grande Cichlid (Cichlasoma cyanoguttatum)
- Tilapia (Oreochromis spp.)
- Lionfish (Pterois volitans)
Invasive species in Louisiana

Invasive Aquatic Animals

Mollusks
• Asian Clam (Corbicula fluminea)
• Brown Mussel (Perna perna)
• Apple Snails (Pomacea spp.)
• Green Mussel (Perna viridis)
• Zebra Mussel (Dreissena polymorpha)

Other
• Australian Spotted Jellyfish (Phyllorhiza punctata)
• Chinese Mitten Crab (Eriocheir sinensis)
• Daphnia
• Green Crab (Carcinus maenas)
Invasive species in Louisiana

Invasive Insects
• Africanized Honeybee (Apis mellifera scutellata)
• Asian Tiger Mosquito (Aedes albopictus)
• Formosan Termite (Coptotermes formosanus)
• Mexican Boll Weevil (Anthonomus grandis)
• Red Imported Fire Ant (Solenopsis invicta)

Invasive Mammals
• Norway Rat (Rattus norvegicus)
• Feral Hogs
Invasive species in Louisiana

Invasive Birds
• Monk Parakeet (Myiopsittamonachus)
• European Starling (Sturnus vulgaris)
• Cattle Egret (Bubulcus ibis)

Invasive Reptiles
• Brown Anole (Anolis sagrei)
• Mediterranean gecko

Invasive species resources:
http://www.eddmaps.org/
http://www.eddmaps.org/tools/statereport.cfm?id=us_la
http://www.invasivespeciesinfo.gov/unitedstates/la.shtml
http://invasive.btnep.org/invasivesvsnatives/invasivesinla2list.aspx
The problem with invasive species

• Displace or cause extinction of native organisms
• Cause environmental change
• Threaten agriculture
• Endanger the health of plants and animals
The Economic Impacts of Invasive Species

• The estimated total costs of invasive species in the United States amount to more than $123 billion each year.
• More than 40 percent of endangered or threatened species lists are at risk primarily because of non-indigenous species.
• Damage to agriculture, forestry, fisheries and infrastructure - Expenditures to combat invasives in the U.S. total approximately $137 billion annually.
• Zebra mussels and Asian clams clog utility pipes, irrigation pipes and boat engines. A recent calculation estimated zebra mussel damage at $5 billion annually.
• Control of residential pests such as cockroaches and rats, both of which are invasive, costs about $6 billion annually.
• Damage to ecosystem services is more difficult to estimate economically, because no one can put a price on the loss of a species or the destruction of a water source.
What makes a good invader?

- tend to be generalists – have broad diets and habitat tolerance
- tend to have high reproductive potential
- vegetative or clonal reproduction
- ability to spread rapidly – high dispersal rates
General principles of invasions

Invaded habitats tend to be disturbed or depauperate
- low native species diversity
- empty niches – esp. after disturbance
- absence of predators and disease for invader
- stable ecosystems with many species are less vulnerable to invasion
- overharvested systems are particularly vulnerable
General principles of invasions

Most invasions fail – probably less than 10-40% succeed

Hard to predict what species will be invasive

Not all successful invaders cause problems
  brook silverside in Lake Champlain
Types/routes of introductions

Deliberate introductions
as harvestable species – plants, fishes, rabbits in Australia, terrestrial plants (crops)

Nile perch introduced into Lake Victoria
- to compensate for loss of natives due to overfishing
- responsible for loss of over 200 species of cichlids
Types/routes of introductions

Deliberate introductions

domesticated species
Types/routes of introductions

Deliberate introductions

to have 'familiar' species around
Types/routes of introductions

Deliberate introductions

For control of other nonnatives:
- rosy wolfsnail introduced from US to Pacific and Indian Ocean islands to control African snail, which was introduced as a food resource; now eliminating endemic snails

- mosquitofish (Gambusia) predaceous on native fish eggs and other invertebrates; not very effective in controlling mosquitoes

- black carp suggested as control for zebra mussels
Types/routes of introductions

Deliberate introductions

ornamentals – garden plants, fishes, water hyacinth

bait (fishes)
Types/routes of introductions

Accidental introductions

international commerce
- on board ships (rats)
- in solid and liquid ballast (seeds, spores)
- with cargo (insects, frogs, lizards, spiders)
- on hulls (barnacles, shipworm)
- passive spread through navigation channels (many aquatic spp.)
- on vehicles, boat trailers, airplanes
- on clothing and in luggage (insects and seeds particularly)
- packing material (plants)
- in other cargo (Chestnut blight, longhorn beetle in wood imports)
Types/routes of introductions

Accidental introductions

*introduced accidentally with deliberately introduced species*

whirling disease of salmonids
fleas on cattle, rats
– bubonic plague on fleas on rats…
Types/routes of introductions

Accidental introductions

*escapes* - aquarium trade, pet trade, bait, experimentation
Types/routes of introductions

Accidental introductions
- mistakes
- pink salmon
- sea lamprey
Effects of exotics

predation on natives

brown tree snake in Guam
introduced from Australia, probably via military, after WWII
birds began to disappear in 1960s, nearly all natives gone by 1986
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competition

plants that have affected rangeland; kudzu
aquatic plants (milfoil, water chestnut) – shade out natives
round goby – competes with most similar species, mottled sculpin
Effects of exotics

habitat alteration

rabbits in Australia – 20 introduced for food; several million 3 years later (7 offspring, 3 x/yr), decimated local herbiage
Effects of exotics

trophic alteration

zebra mussels alter pelagic to benthic food web
Effects of exotics

parasites/diseases

- **whirling disease** of fishes
- **rinderpest virus** (RPV) introduced into E. Africa with cattle
  - effects widespread, mortality up to 90% in wild ungulates
  - loss of herbivores changed plant communities
- **rats** carried by sailing vessels brought fleas, with bubonic plague
  - may hybridize with native species
Effects of exotics

secondary effects – goats and pigs reduced native plants in Hawaii, induced loss of endemic birds dependent on them

same effect in reverse may occur if single pollinator is lost; loss of plant will follow
Effects of exotics

other effects
- biofouling
- interference competition