Teacher Background

Invasive Species

The US Department of Agriculture recognizes different types of non-native species classifications. While the classification of each species varies between states, all can be categorized into two groups:

- **Naturalized**–A non-native species that is controlled by certain factors in the environment (predators, climate, reproductive patterns, etc.)

- **Invasive**–An invasive species is defined as any non-native organism that causes harm to the environment, economy, or human health. It can take over the habitat of native species, forcing the native species to decline in population or to disappear from their natural environment. Invasive species tend to be highly competitive, highly adaptive, and successful at reproducing (Washington Invasive Species Education: wise.wa.gov).

    - Invasive species can negatively impact an environment in many ways. The most common is increased competition for a particular food source. This may only impact a few species or it can impact the entire food web. Invasive species also compete for water resources (especially important in desert and some freshwater habitats) or for space within the habitat (available sunlight for plants, space for burrows, etc.). All invasive species have adaptations that help them survive the environment more effectively than native species.

    - In addition to environmental impacts, invasive species also cause economic damage by clogging waterways, damaging infrastructure, and threatening fisheries that many people depend on as a source of livelihood. In the Great Lakes, these damages cost over $100 million dollars each year to fix ("Detecting and Monitoring Aquatic Invasive Species.")

Many invasive species can be found in the Great Lakes region and beyond.

- A number of invasive crayfish species outcompete natives for food and space, such as:

    - Red swamp crayfish (*Procambarus clarkii)*
    - Rusty crayfish *(Faxonius rusticus)*
    - Allegheny crayfish (*Faxonius obscurus)*

An invasive rusty crayfish, *Faxonius rusticus; Photo: Lake County AIS CC0*

A few crayfish species are invading freshwater ecosystems around the world at an alarming rate. This negatively impacts countless species, including many native crayfish species, which have become one of the most threatened groups of organisms in the world. In fact, an estimated "48 percent of North American crayfish species are at risk of extinction" (Larson & Olden 2010: jstor.org/stable/40864210) Invasive crayfish are believed to be the leading cause of this decline, and humans have played a significant role in their spread, through release of classroom science organisms, live fishing bait, etc.

- Sea lamprey (*Petromyzon marinus*)–native to the Atlantic Ocean basin; responsible for declines in some fish populations

- Round goby (*Neogobius melanostomus*)–native to Eurasia; released into the lakes by ocean ships discharging their ballast waters

- Zebra mussel (*Dreissena polymorpha*)–native to Eastern Europe; negatively impacts some native species of invertebrates and fish

- Common reed (*Phragmites australis autralis*)–native to Europe; similar to a native reed species, but this non-native species crowds out other native plants

Native (Indigenous) Crayfish

Northern clearwater crayfish *(Faxonius propinquus)* are one of the most common native crayfish species in the Great Lakes region.

Additional information and visuals about invasive and native crayfish are found in this educator's guide and in the "Expand Knowledge + Skills" section listed at the end of the lesson.

Other concepts that can be incorporated into the game:

- **Adaptation**

  This is an evolutionary advantage of a particular species. Adaptations allow individuals to thrive in their environment and alter their physiology or behaviors to survive certain changes to that environment. There are numerous examples of adaptations in all organisms including fungi, protists, bacteria, and archaebacteria.

- **Carrying capacity**

  The carrying capacity of an environment is the maximum number of organisms a habitat can support without collapsing. Typically, carrying capacity is expressed as a logarithmic function. There are two major carrying capacity patterns, each of which begins with a sharp population increase due to a high level of available resources (food, shelter, water) and limited disease. These two major patterns continue as follows:

- **K-selected species**

  An initial population increase slows as resources become limited. As the rate of population growth approaches zero, the population reaches a stable number with a death-to-birth ratio of 1:1.
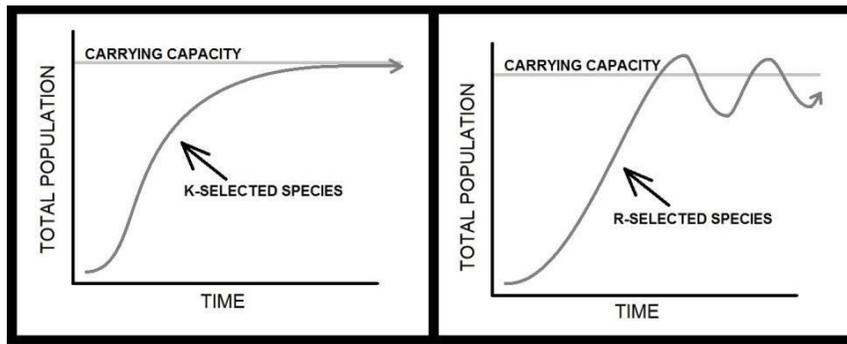
- **R-selected species**

  An initial population increase does not slow as resources become limited. The population eventually exhausts its resources. The death rate increases dramatically and the population total drops sharply. As resources renew, the population increases again. This pattern continues in a boom/bust cycle.

- **Endemic species**

  An endemic species or taxonomic group is unique to a particular area. Its geographic region is restricted because of factors such as isolation or response to soil or climatic conditions. Some are only found in one small area, such as the dwarf lake iris *(Iris lacustris)*, which grows along the northern shores of Lakes Huron and Michigan. These species are often protected because they have the highest risk of extinction due to habitat loss, competition from invasive species, etc.

- **Extirpated/Locally Extinct**

  The population of a species may become extinct in an area, but other populations survive elsewhere. The species is considered locally extinct or "extirpated." One of the most infamous examples of extirpation is the beaver. During the fur trade, beaver pelts were highly prized. Trappers nearly hunted the beavers to extinction in both Europe and North America, but small pockets of beavers remained. Today, beaver populations have recovered and have re-colonized most of their former extent.

- **Indigenous species**

  An indigenous species occurs naturally in an area; it is a synonym for native species. Many schools have a high population of Native Americans/American Indians so you may choose to use "indigenous" in place of "native" species for culturally sensitive reasons or to highlight a personally relevant link between indigenous peoples and indigenous species.

- **Kleptoparasitism**

  When animals steal food from other animals it is called kleptoparasitism: it is not a common trait in species suggested for this game, but is for species such as gulls, eagles, foxes, and coyotes.

Materials

- One-gallon bag of three different dried beans; we suggest pinto bean, red kidney bean, and lima beans
- 60-foot (or longer) section of rope