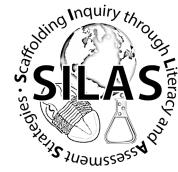




## Survival Game 5E Unit



**Description:** Students consider invasion dynamics during an invasive species event 450 million years ago as an analog to the modern invasive species problem.

**Standards Targeted:**

- LS4: Earth's Living History –*Using fossil evidence and living organisms to observe that suitable habitats depend on a combination of biotic and abiotic factors*
- LS4: Earth's Living History – *Fossils can be compared to one another and to present day organisms according to their similarities and differences*
- LS5: Interactions within Ecosystems – *Organisms perform a variety of roles in an ecosystem*
- LS7: Cycles of matter and flow of energy- *Matter is transferred continuously between one organisms and another and between organisms and their physical environments*
- LS7: Cycles of matter and flow of energy- *In any particular biome, the number, growth and survival of organisms and populations depend on biotic and abiotic factors*
- LS8: Species and Reproduction- *Diversity of species occurs through gradual processes over many generations. Fossil records provide evidence that changes have occurred in number and types of species*
- LS8: Species and Reproduction- *Reproduction is necessary for the continuation of every species*
- LS8: Species and Reproduction- *The characteristics of an organism are a result of inherited traits received from parent(s)*

**Skills Targeted:** Observe patterns of species extinction and survival; assess relationship between species ecology and survival

**Goals:**

1. To encourage students to make predictions about species persistence during changing environmental conditions
2. To demonstrate that paleontological data is relevant to understanding the modern environment
3. To demonstrate that co-occurring species have different ecological niches
4. To demonstrate the importance of competition in generating community structure

**Objectives**—By the end of this activity, students will be able to:

1. Explain the relationship between species persistence and generalist vs. specialist ecology
2. Explain the impact of invasive species on ecosystem structure
3. Explain the relationship between speciation and niche breadth

**Time Needed:** One 45-60 minute class period or longer; activity can be adjusted for shorter or longer class times.

**Materials:**

- Set of cards; print in four distinct colors: (1) native specialists, (2) native generalists, (3) invasive specialists, (4) invasive generalists

### Structure of the 5E Unit

5E Phase	Description
Engage	<ul style="list-style-type: none"> <li>Introduce students to modern invasive species. Examples: kudzu, zebra mussels, dandelions, house sparrows, etc.</li> <li>Explain that many of the fossils used in their fossil ID set [Oceans of Ohio] were invasive!</li> <li>Introduce context of Richmonidian Invasion Hand out species cards to students. Explain that will be exploring what it takes to survive in an invasive world. Will their species survive???</li> </ul>
Explore	<ul style="list-style-type: none"> <li><b>Set the scene:</b> Have students raise their cards if their organism falls within these categories: <ul style="list-style-type: none"> <li>-Native</li> <li>-Invasive</li> <li>-Specialists</li> <li>-Generalist</li> <li>-Brachiopod</li> <li>-Horn Coral</li> <li>-Trilobite</li> <li>-Clam</li> <li>-Gastropod</li> </ul> <p>(Note: All taxa are within all combos of native and niche breadth; survival is not taxonomically based)</p> </li> <li><b>Explore survivorship:</b> <ul style="list-style-type: none"> <li>Pre-Invasion: All native species raise their cards <ul style="list-style-type: none"> <li>Specialists go extinct, put cards down</li> <li>Generalists survive, keep cards up</li> </ul> </li> <li>Invasion: examine specialist/generalist distribution of invaders</li> <li>Post-invasion: Survivors plus invaders <ul style="list-style-type: none"> <li>Specialist invaders go extinct, all others survive</li> </ul> </li> </ul> </li> </ul>
Explain	<ul style="list-style-type: none"> <li>Ask students to identify the survivorship patterns observed. What traits were related to survivorship: taxonomic, ecological niche, incumbency?</li> </ul> <p><b>Introduce Terminology:</b></p> <ul style="list-style-type: none"> <li><i>Ecological Generalists:</i> Species able to survive and flourish in a variety of environmental conditions.</li> <li><i>Ecological Specialists:</i> Species that require a specific set of environmental conditions to survive.</li> <li><i>Native species:</i> Species that have evolved, developed, and established a sustainable population in a given region.</li> <li><i>Invasive species:</i> Species characterized by broad ecological tolerances, broad geographic ranges, and higher-than average survival potential through crisis intervals.</li> <li><i>Ecological niche:</i> A set of environmental tolerances within which a species can maintain a viable population</li> </ul> <p>Explain how ecological specialists have difficulty maintaining viable populations levels when faced with direct competition to generalist species; this results in extinction of specialists and development of a generalist dominated ecosystem.</p>
Elaborate	<ul style="list-style-type: none"> <li>Present students with a set of modern species and ask them to consider the survival potential of this group given modern invasive species, habitat fragmentation, and climate change.</li> <li>Examples: polar bear, cheetah, white-tailed deer, cockroach, Jordan's salamander, spotted owl, cottontail rabbit, zebra mussel, rat</li> </ul>

Evaluate	<ul style="list-style-type: none"> <li>• Various activities</li> <li>• <b>RAFT</b> essay--encourages students to synthesize information and perspectives:           <ul style="list-style-type: none"> <li>○ <b>Role of the Writer:</b> Who are you as the writer? A science journalist? An invasive species? A native species?</li> <li>○ <b>Audience:</b> To whom are you writing? The public? A conservation agency? A government official?</li> <li>○ <b>Format:</b> In what format are you writing? A diary entry? A news article? A letter?</li> <li>○ <b>Topic:</b> What are you writing about?</li> </ul> </li> </ul>
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#### **Key Web References for Survival Game**

**Video lecture of Dr. Alycia Stigall using the Survival Game in outreach setting with detailed explanation of pattern:** <http://new.livestream.com/ohiocas/events/2494298>

**Basic information about the Richmondian Invasion from Ordovician Atlas website:**  
<http://www.ordovicianatlas.org/geology-2/richmondian-invasion/>