



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"> • Introduce students to modern invasive species. Examples: kudzu, zebra mussels, dandelions, house sparrows, etc. • Explain that many of the fossils used in their fossil ID set [Oceans of Ohio] were invasive! • Introduce context of Richmondian 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???
Explore	<ul style="list-style-type: none"> • Set the scene: Have students raise their cards if their organism falls within these categories: <ul style="list-style-type: none"> -Native -Invasive -Specialists -Generalist -Brachiopod -Horn Coral -Trilobite -Clam -Gastropod <p>(Note: All taxa are within all combos of native and niche breath; survival is not taxonomically based)</p> • Explore survivorship: <ul style="list-style-type: none"> ○ Pre-Invasion: All native species raise their cards <ul style="list-style-type: none"> ▪ Specialists go extinct, put cards down ▪ Generalists survive, keep cards up ○ Invasion: examine specialist/generalist distribution of invaders ○ Post-invasion: Survivors plus invaders <ul style="list-style-type: none"> ▪ Specialist invaders go extinct, all others survive
Explain	<ul style="list-style-type: none"> • Ask students to identify the survivorship patterns observed. What traits were related to survivorship: taxonomic, ecological niche, incumbency? <p>Introduce Terminology:</p> <ul style="list-style-type: none"> • <i>Ecological Generalists:</i> Species able to survive and flourish in a variety of environmental conditions. • <i>Ecological Specialists:</i> Species that require a specific set of environmental conditions to survive. • <i>Native species:</i> Species that have evolved, developed, and established a sustainable population in a given region. • <i>Invasive species:</i> Species characterized by broad ecological tolerances, broad geographic ranges, and higher-than average survival potential through crisis intervals. • <i>Ecological niche:</i> A set of environmental tolerances within which a species can maintain a viable population <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"> • 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. • Examples: polar bear, cheetah, white-tailed deer, cockroach, Jordan’s salamander, spotted owl, cottontail rabbit, zebra mussel, rat

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