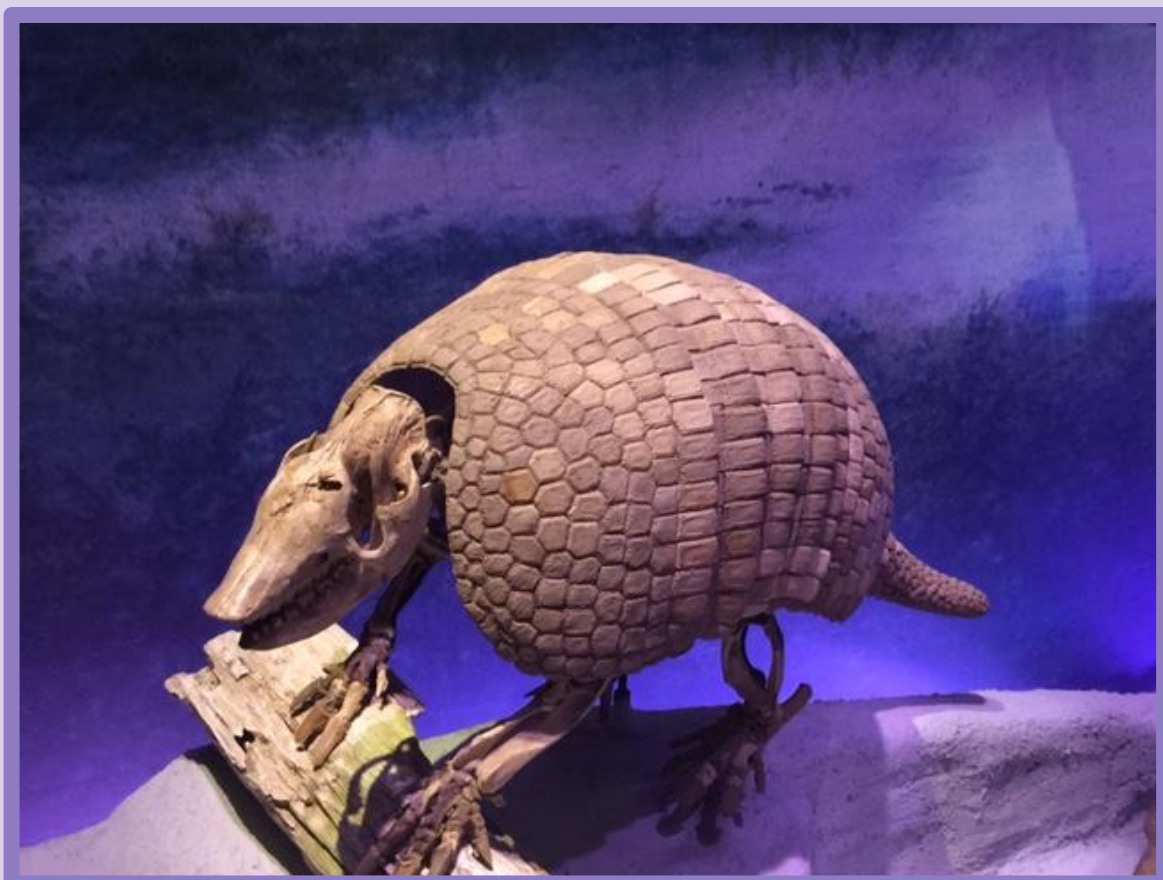


Paleo Invasions: For Better or For Worse?

A Philosophical Debate

Stephanie Killingsworth, Jen Bauer, and Aaron Woodruff



Lesson Objective

A subject of intense study in the scientific community today is invasive species. Nearly every continent has experienced some form of invasion. Today’s cases are mostly attributed to anthropogenic means, and typically carry a negative connotation. But what of ancient species and their environments? Did invasions exist and what were the consequences?

This lesson is intended to introduce students to alternate forms of flora and fauna invasion through a series of activities involving the paleo record and a number of fossils that are connected to invasion, or “biotic immigration events”. Specifically, students will engage in philosophical chairs to debate whether these events were positive or negative phenomena.

Materials and Methods

Materials for this lesson include the pictured fossils (courtesy of The FOSSIL Project), NPR podcast, several articles (referenced), computer access for research and Slides/Spark presentation.



Glyptodontidae

Key Academic Language

Invasive species, native species, biotic, abiotic, population density, resources, range, specialists, generalists, brachiopod, paleo environment, symbiotic relationships, competition, anthropogenic, diversity, adaptations, natural selection, environmental pressures; additional terms dependent on articles selected for reading.

5E Lesson Outline

Engage:

Invasive species fossils randomly spread throughout small groups and students asked driving question: What do all of these fossils have in common? Student generated answers to this question are shared on a community Spark slide and discussed. (15 minutes)
Podcast on a modern and local invasive species: the Burmese Python in the Everglades - <http://bit.ly/invasivepython> (4:07)

Explore:

Students work in small groups and investigate the labeled fossil species to determine their history/story, and make a connection with species invasion or biotic immigration. (Students will have had prior knowledge of the Great American Biotic Interchange-GABI-from a previous content related lesson). (20 minutes)
Students model this process through a quick game entitled “Survival” that is based on the Richmondian Invasion around 250 million years ago- (20 minutes)
<http://bit.ly/ordovicianatlassurvivorgame> (20 minutes)

Explain:

Students given any of the following articles referencing occurrences of invasion and tasked with making a claim and citing evidence from the texts about invasion as a positive or a negative phenomena: (homework)

- “When is an invasive not an invasive? Macrofossil evidence of doubtful native plant species in the Galápagos Islands” - <http://bit.ly/coffeyetalarticle>
- “Biotic immigration events, speciation, and the accumulation of biodiversity in the fossil record” - <http://bit.ly/stigalletalarticle>
- “T Rex was likely an invasive species” - <http://bit.ly/geggelarticle>
- “Invasive species have been around much longer than believed” - <http://bit.ly/fitchettetalarticle>
- “Controls on niche stability in geologic time: congruent responses to biotic and abiotic environmental changes among Cincinnati (Late Ordovician) marine invertebrates” - <http://bit.ly/brameetalarticle>

Elaborate:

Students participate in a philosophical chairs to debate the idea of biotic invasion both past and present. (45 minutes)

Evaluate:

Students assessed by their demonstration of the concepts and their ability to cite evidence from the text supporting their claim. This portion of the assessment occurs during the philosophical chairs debate. Students pairs will then be given a modern species (flora or fauna) and be asked to consider/predict the survival potential of this group given modern invasive species existent in their habitat range, population density, limited resources, and effects from climate change. Pairs will create a Spark slide outlining their findings and present to the class. (45 minutes)

Literature cited

All sources are mentioned in the 5E Lesson Outline section.

Expected Outcomes

Students should have a clearer understanding of contraction and expansion of species’ ranges, and the potential positive and negative impacts that can occur. By looking at paleo environments and interactions, students should be able to compare those to modern day invasions, to include the expansion of *Homo sapiens*, and their encroachment on other species’ habitats and the ultimate effects.

NGSS Standards

MS-LS4-1: Biological Evolution: Unity and Diversity-

Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.

MS-LS4-4: Biological Evolution: Unity and Diversity-

Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals’ probability of surviving and reproducing in a specific environment.

MS-LS2-2: Interdependent Relationships in Ecosystems

Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

Science and Engineering Practices:

- Analyzing and Interpreting Data
- Obtaining, Evaluating, and Communicating Information

Disciplinary Core Ideas:

- Natural Selection
- Adaptation
- Interdependent Relationships in Ecosystems
- Ecosystem Dynamics, Functioning, and Resilience

Crosscutting Concepts:

- Cause and Effect
- Stability and Change

Acknowledgments

- The FOSSIL Project collaborators
- National Science Foundation
- Florida Museum of Natural History, University of Florida

Special thanks to Dr. Bruce MacFadden

