ADVANCED ENVIRONMENTAL SCIENCE

Altered biomes

from the Esri GeoInquiries™ collection for Environmental Science

Audience – Advanced environmental science/biology **Time required – 15 minutes**

Activity	Investigate characteristics of major biomes and examine the impact of land-use changes as the result of human activities.
Science Standards	**APES:** IIA Ecosystem structure **NGSS:** HS-Life Science 2 Ecosystems: Interactions, Energy, and Dynamics
Learning Outcomes	• Students will investigate geographic distribution of biomes. • Students will evaluate the human impact on the prairie and its animals.

Map URL: http://esriurl.com/enviroGeoInquiry12

Engage

What is the geographic distribution of biomes?

→ Click the map URL link above to open the map.
? What colors cover the map? What are their associated land covers? *[Blue: water; green: forests; tan: desert]*
? What spatial patterns are visible? *[Dark green near the equator, and tan 30 degrees north and south]*
? Locate the equator. What climate conditions support this vegetation? *[Abundant rain and warm temperatures]*
? What is the role of solar radiation in regional climate? *[Warm rising air cools and water vapor condenses, causing rain. Convection cells form. Descending dry air at 30 degrees north and south.]*

Explore

What are other classifications of large ecoregions?

→ With the Details pane visible, click the button, Show Contents Of Map.
→ Click the checkbox to the left of the layer name, Biomes.
? What biome is most common across the continental U.S.? *[Temperate grasslands or prairies]*
→ Click the checkbox to the left of the layer name, N. American Ecoregions (III).
? What is the number of ecoregions in your state? *[Answers will vary.]*
? Do ecoregions extend across more than one state? *[Yes.]*
? Biomes focus on similar climate and general vegetation type. Ecoregions are based on similar ecosystems and incorporate humans as biotic components. What is the goal for ecoregions? *[Integrate holistic ecosystem monitoring and management between agencies.]*

Explain

How much prairie remains today?

→ Turn off the layer, N. American Ecoregions III.
→ Click the checkbox to the left of the layer name, N. American Grasslands.
– Grasslands are commonly broken down into tall, mixed height and short prairies .
? Why do differences in dominant vegetation within ecosystems matter? *[Vegetation is the basis of food webs and limits complexity.]*
? Click the checkbox to the left of the layer name, Prairie Loss.
? Tallgrass prairie has shown the largest decline. Which state has the most left? *[Kansas]*
? Why do more short and mixed-grass prairies remain? *[More arid prairies are grazed rather than plowed and planted. Grazing is less destructive.]*

more ▶

Elaborate

What human activities have led to the decline of prairies?

- → Turn off the layer, Biomes.
- → Turn on and off the layers, Global Human Footprint Index and N. American Grasslands.
- → Click the button, Show Map Legend.
- → Use the legend to identify areas of increased human modification.
- ? What patterns do you notice in the prairie ecoregions? *[The tallgrass region is much more heavily impacted than the mixed and shortgrass areas.]*
- ? What trends are visible across the U.S.? *[Increased modification & urbanization in the eastern half.]*
- → Turn off layer, Global Human Footprint Index.

Evaluate

Case study: how does land-use change impact endemic species?

- → Turn on the layer name, Original Range (Unoccupied).
- → Turn on the layers, Acquired Range (late 1800's) and Current Range (Occupied).
- → Click the regions to investigate occupied and unoccupied regions.
- ? Prairie chickens require uninhabited grasslands. What past human actions enabled prairie chickens to acquire more range? *[Forests were cleared, bison were removed, & nutrient-rich grains were planted.]*
- → Click the button, Bookmarks. Click a location and go to the remaining populations of prairie chickens.
- ? Why is the current range so limited? *[land use changes: increased urbanization, shift to irrigated farming from grazing]*

TURN A MAP LAYER ON OR OFF

- With Details pane visible, click the button, Show Contents Of Map.
- Click the check box next to the layer name.
- Hint: If a map layer name is light gray, zoom in or out on the map until the layer name is black. The layer can now be turned on.

ZOOM TO A BOOKMARK

- Click the button, Bookmarks.
- Select a bookmark name to zoom to its map location and scale.

Next Steps

DID YOU KNOW? ArcGIS Online is a mapping platform freely available to public, private, and home schools. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at http://www.esri.com/schools.

THEN TRY THIS...

- In an ArcGIS Online organizational account for schools, use the Summarize Within analysis tool to calculate the average area of low-impacted ecoregions in your county.
- Explore the story map, *Atlas for a Changing Planet*, at http://esriurl.com/Geo4192.

TEXT REFERENCES

This GIS map has been cross-referenced to material in sections of chapters from these texts.

- *Environmental Science for AP by W.H. Freeman and Company/BFW — Chapter 4*
- *Living in the Environment (16th) by Brooks/Cole, Cengage Learning — Chapter 7*
- *Campbell Biology (9th) by Benjamin Cummings — Chapter 52*

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