

# 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.*]

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## 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 (16<sup>th</sup>)* by Brooks/Cole, Cengage Learning — Chapter 7
- *Campbell Biology (9<sup>th</sup>)* by Benjamin Cummings — Chapter 52