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| <b>Activity</b>          | Explore deforestation trends and patterns.  |
| <b>Science Standards</b> | <b>APES: IV. Land and Water Use (Feeding a Growing Population and Rangelands; deforestation)</b><br><b>NGSS: HS-ESS3-3.</b> Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. |
| <b>Learning Outcomes</b> | <ul style="list-style-type: none"><li>• Students will identify and describe the locations most affected by deforestation.</li></ul>   |

Map URL: <http://esriurl.com/enviroGeoInquiry6>



## Engage

### What is deforestation?

- Click the map URL link above to launch the map.
- ? Where is this odd landscape? What are all the squares and rectangles? [*Brazil; patches of fragmented forest and areas of deforestation.*]
- Click the left yellow marker to display a pop-up window. Click the image in the window.
- ? Describe the image that you see? What do the colors represent? [*Forest change over time: the light color means little change, while red signifies severe damage.*]
- ? What is the relationship between the original green image and the red image? [*Areas where the brown patches are present are the same as the red areas.*]



## Explore

### How has tropical forest cover changed over time?

- With the Details pane visible, click the button, Contents.
- Click the checkbox to the left of the layer name, Forest Loss (by year).
- Describe the general patterns that you observe.
- ? What generalization can be made about forest loss by year, dating from 2001 to 2014? [*Deforestation seems to have slowed in since 2010, with most taking place in the early 2000's.*]



## Explain

### What are some causes and effects of deforestation?

- ? What are some possible causes of deforestation? [*Population growth, logging/lumber, agriculture, and ranching*]
- ? What are some possible effects of deforestation? [*Social conflict, loss of habitat and biodiversity, release of CO<sub>2</sub>, and excess erosion*]
- ? Using the evidence provided from the map layer, what is a possible outcome — positive or negative — of increased deforestation? [*Answers will vary.*]

## Elaborate

### Where is deforestation most severe today?

- Click the checkboxes (on and off) to the left of the three layers named, Rondonia Fragmentation, Brazil Satellite Image 2000, 2004, or 2008 .
- Record notes of the patterns that you observe from the satellite images over time.
- ? What are some possible causes of these patterns? [*Construction of roads and transportation access*]
- What are some possible methods of deforestation? What evidence can you gather from the satellite images? [burning, clear cutting]
- ? How much land has been consumed by deforestation? Using the 2008 Rondonia image, measure a rough estimate of the deforested area. [*Answers will vary, ~130,000 sq. km.*]

## Evaluate

### Why should we care about the loss of tropical forests?

- ? What are some ecological advantages provided by established tropical forests? [*Increased biodiversity, stabilize soils, a regulated local hydrological cycle, and carbon sink creation*]
- Click the checkbox to the left of the layer name, Biomes.
- Describe the locations that you feel demonstrate the greatest number of species over a given region. [*Answers will vary.*]
- Click the checkbox to the left of the layer name, Biodiversity Hotspots.
- Refine the previous answers using information about locations of biodiversity hotspots.
- ? What are some possible benefits of biodiversity? [*Medicines and other toiletry items, and chemicals for pesticides*]

### USE THE MEASURE TOOL

- Click the button, Measure. Click the Distance button. Choose a unit of measurement.
- On the map, click once to start the measurement, click again to change direction, and double-click to stop measuring.
- Hint: Position the area of interest on the map so that it is not obscured by the Measure window.

### IDENTIFY A MAP FEATURE

- Click any feature on the map, and a pop-up window will open with information.
- Links and images in the window are often clickable.

## 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...

- Using an ArcGIS Online organizational subscription for schools, expand your analysis of deforestation to regions outside Brazil. Create a map layer, highlighting critical areas of focus for sustainable solutions.
- Explore the story map, *Brazil's People of the Forest*, at <http://esriurl.com/Geo4202>.



### TEXT REFERENCES

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

- *Environmental Science: A Global Concern (12<sup>th</sup>)* by McGraw-Hill — Chapter 12
- *Living in the Environment (15<sup>th</sup>)* by Thomson — Chapter 12
- *Environment: The Science Behind the Stories (3<sup>rd</sup>)* by Pearson — Chapter 12