

Audience – Advanced environmental science

Time required – 15 minutes

**Activity** Explore abiotic factors associated with primary productivity.

**Science Standards** APES: I. Earth Systems and Resources

APES: II. The Living World

NGSS: LS2.A. Interdependent Relationships in Ecosystems

**Learning Outcomes** • Students will evaluate and describe how living and nonliving entities interact in ecosystem-level ecology.

**Map URL:** <http://esriurl.com/enviroGeoInquiry10>

## Engage

**How do we now use remote sensing to assess our planet's health?**

- Click the map URL link above to open the map.
- ? What are some major features of the earth that can be identified? *[Clouds, desert, water, and vegetation.]*
- ? Does this picture tell the whole story of what is happening on the earth's surface? *[No.]*
- ? What are some other ways to gain a more complete picture of the earth's surface processes? *[Pictures in different wavelengths of light.]*

## Explore

**How does vegetation type and distribution vary around the globe?**

- Click the Modify Map link.
- From the Details pane, click the button, Show Contents Of Map.
- Click the checkbox to the left of the layer name, Leaf Area Index March 2016.
- At the top right of the map, in the Find Address Or Place search field, enter your school address.
- Add a map note at this location. Hint: See the Add Map Notes section on page 2.
- ? What is the approximate leaf cover in your area? (You may need to zoom out.) *[Answers will vary.]*
- ? Continue zooming out. What patterns of vegetation do you notice on a larger scale? *[Answers will vary.]*

## Explain

**How are patterns of vegetation related to seasonal change?**

- Click the checkbox to the left of the layer name, Leaf Area Index September 2015.
- ? What differences do you notice compared to the March 2016 map? *[There is more leaf cover, specifically in the northern hemisphere.]*
- ? What are some generalizations that can be made regarding seasonal changes to vegetation? *[Increasing vegetation from spring into summer; reduced vegetation through fall and into winter.]*



## Elaborate

### How is vegetation related to abiotic factors like carbon dioxide?

- What is the relationship between vegetation and the amount of carbon dioxide in the atmosphere?  
*[More vegetation leads to lesser amounts of CO<sub>2</sub>.]*
- Net primary productivity is the difference in CO<sub>2</sub> absorbed by plants and CO<sub>2</sub> released by plants.
  - Click the checkbox to the left of the layer name, Net Primary Productivity.
  - Switch between this layer and the vegetation layer (September 2015).
- What generalizations about cause and effect can be made? *[More vegetation leads to higher net primary productivity.]*
- What are some potential questions that you might have about the relationship of vegetation to other abiotic factors? *[Responses will vary.]*



## Evaluate

### What factors affect the variance in net primary productivity?

- What factors may affect productivity? *[Rainfall, temperature, sunlight, and soil types.]*
- Select one factor and explain how it might positively or negatively affect net primary productivity.
- Using the remaining two layers, Forest Fires and Rainfall, what evidence do you have to support an explanation of a positive or negative impact on net primary productivity? *[Answers will vary.]*

#### VIEW A LAYER'S LEGEND

- In the Details pane, click the button, Show Contents Of Map.
- Click the layer names to display the legend for that layer only.

#### ADD MAP NOTES

- Click the button, Add.
- Choose Add Map Note.
- Type a name. Select a template from the drop-down list, and click Create.
- In the Add Features pane, choose a symbol and click in the map to place it.
- In the pop-up window, add the desired information.

## 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 organization subscription for schools, have students create a map of the relationship between primary production and atmospheric carbon dioxide.
- Also have students create a map with at least two abiotic factors illustrating correlations to vegetation or net primary productivity.



#### 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*
- Living in the Environment (15<sup>th</sup>) by Thomson — Chapter*
- Environment – The Science Behind the Stories (3<sup>rd</sup>) by Pearson — Chapter 7*