

Primary productivity

from the Esri GeoInquiries™ collection for Environmental Science

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	<ul style="list-style-type: none">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 CO₂.]
- Net primary productivity is the difference in CO₂ absorbed by plants and CO₂ 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 (12th)* by McGraw Hill — Chapter
- *Living in the Environment (15th)* by Thomson — Chapter
- *Environment – The Science Behind the Stories (3rd)* by Pearson — Chapter 7