

Human Decisions and Landscape Change



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Time: Two - 45 minute class periods
Grade Level: 9-12

Background:

This lesson is designed to connect the lessons learned in the Medland Project with current issues facing various regions around the world today. The Medland project uses archaeological data (human settlement, plant, climate, etc...) along with modern rates of human calorie and land requirements to model how humans modify regions through agriculture and animal herding. Scientists are able to measure how farming and herding has changed landscapes and how these changes have affected human populations during the Neolithic Period in Spain and Jordan. This lesson presents current issues associated with landscape change and how it affects human populations today.

Objective(s):

- 1- Student will be able to locate regions on a map.
- 2- Students will be able to explain connections between human land use, landscape change, and impacts on the environment and human populations.
- 3- Students will use land use maps of Maricopa County to view changes in land use patterns around Phoenix since 1913.
- 4- Students will use maps containing agricultural output and drought information to identify potential threats to food production.

Advanced Preparation:

- There are three stations. Duplicate each station to accommodate a class of 18. Make additional duplicates for larger class sizes. Stations are:
 - Station 1: Laminated "Agricultural Output" and "Drought Recordings" maps
 - Station 2: Computers with access to Ecology Explorers Land Use Changes 1912-2000.
 - Station 3: Mapping global cases of excessive soil erosion
- Print out two sets of station 1 maps. Laminate if preferred.
- Check access to <http://caplter.asu.edu/explorers/protocol/landuse/menu.html> on your classroom computers, or print out maps and information from the website if necessary.
- Print out one world map and one set of student pictures per student. Print out two one-sided copies of the station 3 picture description sheet. Have a world atlas available to aid students in identifying countries on the world map handout.

Materials:

Quantities are for a class of 18 students working in groups of three. Duplicate stations for larger class sizes. Materials for stations:

- 2 sets of station 1 maps
- 2 computers with access to the internet
- 2 sets of station 3 worksheets
- World Atlas

Materials for students:

- One copy of the world map and one set of pictures per student
- Station worksheets

Procedure:

Day 1

1. Ask students what countries supply the food we find in the grocery store. (Think of the sticker labels on fruit or bring in a variety of labels from packaged foods.) Do all countries produce enough food to feed their residents? Do all countries have equal access to food?
2. Ask: "Is food production in any region a stable part of life or does it change over time?" Briefly take some ideas but do not discuss them at this point.
3. Divide the class into groups of three. Have groups begin at one of the stations and move freely around the stations until they have completed the four assignments.
4. Check maps from station 3 for correct locations as each group finishes .

Day 2

1. Finish rotating students through stations if they weren't able to finish.
2. Review answers from stations 1 and 2 from Day 1.
3. Questions to discuss include:
 - a. Were you surprised to see the top food producing countries are also experiencing drought?
 - b. Population growth and urbanization in Phoenix have had impacts on the landscape. What kinds of impacts do you think we have had? How do you think these impacts might affect our future sustainability?
 - c. What do you think you could do to help make our food supply more sustainable?

Evaluation:

See student worksheets and answer key

Extensions:

- Read the article "Our Good Earth" by Charles C. Mann, published in *National Geographic* September 2008. Available at: <http://ngm.nationalgeographic.com/2008/09/soil/mann-text/1>. This article covers the worldwide problem of desertification and the depletion of soils.
- Students can also explore the Food and Agricultural Organization of the United Nations website's section on "Desertification." Available at: <http://www.fao.org/desertification/default.asp?lang=en>

References and Image Credits:

Station 1:

Catastrophic Fall in 2009 Global Food Production
February 12th, 2009 by Eric_deCarbonnel
<http://www.energyefficienthomedesign.com.au/?p=218>

Station 2:

<http://caplter.asu.edu/explorers/index.htm>
Phillips, S. J., Comus, P. W., & Arizona-Sonora Desert Museum. (2000). *A Natural History of the Sonoran Desert*. Tucson: Arizona-Sonora Desert Museum Press.

Station 3:

World map located at: http://www.traveldir.org/images/world/world_map_political.jpg

Picture 1: Namibia

Taken by Miriam Kashia; located at: <http://www.organicgreenandnatural.com/tag/solar-ovens/>

Picture 2: Brazil

The Clean Energy Scam by Michael Grunwald. 3/27/08
<http://www.time.com/time/magazine/article/0,9171,1725975,00.html>

Picture 3: China

<http://news.nationalgeographic.com/4/10/06> Photo in the news: Severe Sandstorm Blasts China

Picture 4: Dust bowl, Central U.S.

<http://commons.wikimedia.org/wiki/File:Dust-storm-Texas-1935.png>

Picture 5: Madagascar www.wildmadagascar.org

Picture 6: SE US <http://www.hiltonpond.org>

Picture 7: Australia

Australian Actions to Combat Desertification and Land Degradation

National Report by Australia on Measures Taken to Support Implementation of the United Nations Convention to Combat Desertification

Commonwealth Intergovernmental Working Group for the UNCCD, April 2002

<http://www.environment.gov.au/land/publications/actions/domestic1.html>

Picture 8: Spain

Photo by: El Mundo located at: <http://www.iberianature.com/spainblog/category/desertification/>

Spain turns to dust. 11/17/05. MIRIAM O'REILLY

http://www.bbc.co.uk/radio4/science/costingtheearth_2005117.html

Arizona Standards

Social Studies

World History

C1 HS PO1

C1 HS PO6

C1 HS PO7

C9 HS PO4

C9 HS PO5

Geography

C1 HS PO2

C1 HS PO3

C1 HS PO4

C2 HS PO3

C2 HS PO6

C4 HS PO5

C4 HS PO6

C4 HS PO7

C5 HS PO3

C5 HS PO4

Science

Inquiry Process

C1 HS PO1

Personal and Social Perspectives

C1 HS PO1

C1 HS PO3

C1 HS PO4

C2 HS PO4

C3 HS PO2

C3 HS PO3

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Station 1 and 2 Answer Key



Station 1:

1. India, China, U.S.
2. Negative sales, either invest more than they earn or import more food than they sell
3. Yes, all three
4. Drought would reduce crop yields, causing rise in global food prices and hunger rates.
5. Russia, Nigeria, Japan, France, Indonesia, New Guinea (answers may vary– colors may be hard to read)

Station 2:

1.

	1912	1934	1955	1975	1995	2000
Agriculture	9%	16%	14%	16%	11%	9%
Urban	<1%	<1%	3%	7%	18%	22%
Desert	91%	83%	82%	74%	66%	64%
Recreation	0%	1%	1%	3%	4%	5%

2. Reliable water source and first railroad service

3. Agriculture

4. Converting to urban land

5. Recreation; answers may vary, but the point is to realize that once land is used for something (agriculture), it may not be suitable for other purposes (wildlife habitat). Agriculture does create long term changes in soil chemistry.

6. Answers will vary according to student. If people stay in the city it can be for economic reasons– save on gas by not driving your car to work everyday or environmental– less cars mean less pollution. If people move out of the city it can be for aesthetic reasons– preferring to live in the “country.”

7. Changes from irrigated fields or desert to impermeable, heat retaining surfaces such as concrete and pavement cause an urban heat island effect.

8. Increasing temperatures increases water demand because of greater evapotranspiration of plants to stay cool, pools evaporate out more water, energy plants use more water generating more energy for air conditioning, people experience more heat stress.

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Station 3 Picture Answer Key



Namibia:



Brazil:



China:



Central U.S.



SE U.S.



Madagascar



Australia



Spain





Station 2 Agriculture in Phoenix

- Go to <http://caplter.asu.edu/explorers/protocol/landuse/menu.html>
- Click on **Land Use Changes 1912-2000**
- Click on **next** to view all the maps from 1912-2000
- Answer the questions below:

1. View all the land use maps from 1912-2000. Fill in the percentages of land use for the following:

	1912	1934	1955	1975	1995	2000
Agriculture						
Urban						
Desert						
Recreation						

2. View the map of 1912. Click on the **history** button. What two major developments allowed people to settle and make a living in Phoenix?

3. On the 1912 map, the majority of natural desert land is being converted to _____

4. Click **next** to view the map of 1934. Click on the **history** button. After just 60 years of agriculture being the dominant land use, what is beginning to happen to agricultural land?

5. Did you spot the new land use type in the 1934 map? What is it? _____ If you click **next** through all the maps, you will see all large parks were created on desert and not agricultural land. Why do you think this is?

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Station 2 Student Worksheet



6. Click **back** to view the map of 1955. For the first time, urban land is expanding into desert land. This is also at the time when more people were able to afford family cars and move outside of public transportation lines. Do you think people living in Phoenix will continue to move outside of areas serviced by public transportation routes or stay close to them and within the city? Why?

7. Look at the 1955 and the 2000 maps again. What changes to land use would make one time period hotter than the other?

8. Explain how you think this could affect people (e.g. health, water use, energy use, economy, etc..)?

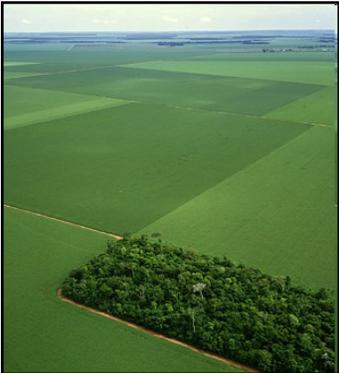
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Station 3 Picture Description Sheet



Directions: Take one set of pictures. Read each description from the table below. Then, cut out pictures from your copy and attach to the squares surrounding the world map. Draw a line from each impact picture to the country it is occurring in.

	<ul style="list-style-type: none"> • The Manambolo River looks red because of the high amount of soil that washes in from the surrounding land. • Rainforests are cleared for planting rice or for timber to support the poor economy. • The thin soils are eroded away after two or three cycles of planting and fallowing. Then, they are invaded by shrubs or nonnative grasses. • Erosion is the island's biggest problem and is greatly impacting the economy. • This island, which is the fourth largest island in the world, is located off the east coast of Africa. It is home to more than 250,000 species, 70% are unique to the island.
	<ul style="list-style-type: none"> • The red clay of this area is one of the most startling and memorable sights for visitors. • Historically, however, Piedmont land was among the richest in North America covered by six feet or more of black, rich topsoil. • Today a farmer is exceptionally lucky if he has any land with SIX INCHES of fertile soil above the clay. • Amazingly, less than 300 years of intensive corn and cotton farming have eliminated soil that took tens of thousands of years to form. • This region of the United States borders both the Gulf of Mexico and the North Atlantic Ocean.
	<ul style="list-style-type: none"> • This is the second driest continent. • The government encouraged agriculture by offering subsidies to farmers. Farmers cleared more land than could be planted to receive more money. • This exposed soils to increased erosion. • Sheep and cattle herding also damaged the thin, dry soils of this country. • This country is its own continent between the Indian and South Pacific Oceans.
	<ul style="list-style-type: none"> • Thirty-six percent of this country is threatened by desertification. • This is due to intensive agriculture, deforestation, overdevelopment of urban projects, tourist communities, overgrazing, and aquifer depletion. • This country is located on the western coast of the Mediterranean Sea.

	<ul style="list-style-type: none"> • The people living here use wood burning stoves for cooking. • They use trees and brush for fuel. • Removing these plants reduces the soil's ability to hold water in an already dry area increasing the rate of desertification. • Solar ovens are being promoted to reduce the need for clearing brush. • This country is located on the west coast of Africa, just north of South Africa.
	<ul style="list-style-type: none"> • Farmers slash-and-burn large parcels of rainforest to convert to grazing and crop lands. • This area has nutrient-poor soil that is not suited for agriculture, and within a year or two, the farmers move on and clear more land. • World demand for crops raised for making biofuels for fueling cars and trucks is driving this deforestation. • Rainforests store carbon helping to reduce global greenhouse gas emissions. • This country is the largest country in South America.
	<ul style="list-style-type: none"> • Drought and unsustainable farming practices are turning cropland into desert at an alarming rate. • The "yellow dust" blows east from the Gobi desert onto productive cropland and turns it into desert. • Millions of acres of land are lost each year to desertification. • The government considers desertification to be its biggest environmental challenge holding back sustainable development. • This Asian country is south of Russia and has a long coastline on the Pacific Ocean.
	<ul style="list-style-type: none"> • Drought and poor agricultural practices in the 1920's and 30's dried out much of the soil in five states causing the dust bowl. • Soil was carried by wind in large dust storms, ruining millions of acres of farmland and making over 500,000 people homeless. • This led to the development of the Soil Conservation Service (now known as the Natural Resource Conservation Service), a successful campaign to get farmers to adopt better farming practices. • This region in the United States is referred to as the Great Plains and lies between the Mississippi River and the Rocky Mountains.

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Station 3 Cut-Out Pictures



Copy the pictures below, so each student will have one set.

