

Land Use Activity Lesson Plan

Students examine possible correlations between land use patterns and water pollution.

Lesson Summary: In this lesson, students will investigate some of the negative environmental impact that is created from land use changes. Students will be able to draw scientific conclusions from their observations of topographic maps of different areas. Students will be able to explain some of the negative impact that results from land use activity.

Grade Level: 9th-12th

Time Allotted: Approximately 4 class periods of 50 minutes each

Performance Objectives

References are to the Next Generation Sunshine Standards (2007).

Science

- SC.912.N.4.2 Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.
- SC.912.E.7.4 Summarize the conditions that contribute to the climate of a geographic area, including the relationships to lakes and oceans.
- SC.912.L.17.8 Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.
- SC.912.L.17.16 Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.

Language Arts

- LA.910.6.2.1 The student will select a topic and develop a comprehensive but flexible search plan, and analyze and apply evaluative criteria (e.g., objectivity, freedom from bias, topic format) to assess appropriateness of resources.
- LA.910.6.2.2 The student will organize, synthesize analyze and evaluate the validity and reliability of information from multiple sources (including primary and secondary sources) to draw conclusions using a variety of techniques, and correctly use standardized citations.
- LA.910.6.2.3 The student will write an informational report that integrates information and makes distinctions between the relative value and significance of specific data, facts, and ideas.

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LA.910.6.3.2 The student will demonstrate the ability to select print and nonprint media appropriate for the purpose, occasion, and audience to develop into a formal presentation.

Social Studies

SS.912.G.1.4 Analyze geographic information from a variety of sources including primary sources, atlases, computer, and digital sources, Geographic Information Systems (GIS), and a broad variety of maps.

SS.912.G.2.4 Use geographic terms and tools to analyze case studies of how selected regions change over time.

SS.912.G.2.5 Use geographic terms and tools to analyze case studies of debates over how human actions modify a selected region.

SS.912.G.3.3 Use geographic terms and tools to explain differing perspectives on the use of renewable and non-renewable resources in Florida, the United States, and the world.

SS.912.G.4.5 Use geographic terms and tools to analyze case studies of the development, growth, and changing nature of cities and urban centers.

SS.912.G.4.6 Use geographic terms and tools to predict the effect of a change in a specific characteristic of a place on the human population of that place.

Prior Knowledge: No prior knowledge necessary.

Topic Overview: Land use changes over time are a result of human needs. People depend on the environment for several different things. For example, we adopt and modify our environment to suit our needs for things such as food, water, shelter and transportation to name a few. The clearing of land for urban development does provide homes and places for people to work, but it also alters physical environment and affects wildlife habits and vegetation.

Human activities on Earth's surface have intended and unintended consequences. For example, cutting own portions of forest to obtain valuable wood for export to other countries and dumping up a wetland habitat to build shopping malls and housing developments may mean wealth for the different companies that are involved in such practices. However, this may result in unintended consequences such as altering Earth's climate, pollution of wetlands and other negative environmental impact.

In this lesson, students will investigate some of the negative environmental impact that is created from land use changes.

Key Vocabulary

Bioretention

A method of removing pollutants from stormwater runoff by using landscaped depressions or shallow basins to slow the progress of rainwater on its way to lakes, rivers, and estuaries, thereby permitting it to be filtered and cleaned by vegetation and soil.

Exploitation

Use of natural resources, especially that which is strictly for short-term human benefit or financial profit, without considering factors such as long-term environmental damage, cost to taxpayers for municipal services, resource depletion, or other important considerations.

Land use

The primary or primary and secondary uses of land, such as cropland, woodland, pastureland, urban residential/commercial, transportation and utility infrastructure, etc. The description of a particular land use conveys the dominant character of a geographic area, and thereby establishes for land planners the types of activities that are most appropriate and compatible with existing primary uses.

Population density

The number of individuals of a species in a particular area.

Remediation

The process by which a contaminated site is brought to an environmental condition that is not a threat to the health of humans or other living things.

Restoration

The process by which a site is returned to as environmentally pristine a state as is possible.

Sustainable development

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Topography

The general configuration of a land surface, including its relief and the position of its natural and man-made features.

Urban planning

A profession that integrates architecture, land use planning and transportation planning to improve the built, economic and social environments of communities.

Urbanization

The increase over time in the population of cities, in relation to the region's rural population, with a commensurate change in land use from undeveloped categories to "urban/built-up."

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Materials

- Computer with internet access

References

These references are available in the [Water Atlas Digital Library](#):

[Florida Land Use, Cover and Forms Classification System](#). 1999. Florida Department of Transportation.

[Our Built and Natural Environments](#). 2001. United States Environmental Protection Agency.

Leone de Nie, Karen, and Jason Barringer. [A Time for Leadership: Growth Management and Florida 2060](#). 1000 Friends of Florida.

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Strait, Randy, and Maureen Mullen, Bill Dougherty, Andy Bollman, Rachel Anderson, Holly Lindquist, Luana Williams, Manish Salhotra, and Jackson Schreiber. 2008. [Final Florida Greenhouse Gas Inventory and Reference Case Projections 1990-2025](#). Center for Climate Strategies (produced for Florida Department of Environmental Protection).

Other references:

[1000 Friends of Florida](#) website. Accessed June 2011.

[Aerial Photography: Florida Collection](#). George A. Smathers Libraries, University of Florida.

Carriker, Roy R. 2006. [Florida's Growth Management Act: An Introduction and Overview](#). University of Florida Institute for Food and Agricultural Sciences.

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Mormino, Gary R. 2005. *Land of Sunshine, State of Dreams: A Social History of Modern Florida*. Gainesville: University Press of Florida.

[Orange County Green PLACE Program](#). Website. Accessed July 2011. Orange County Board of County Commissioners.

[The Trust for Public Land](#) website. Accessed July 2011.

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Procedure

Engage/Elicit

1. What development changes to your city/community have you seen during your lifetime?
2. Which of these changes would you say are positive? Which are negative?
3. Would you say the overall state of the environment in your community is getting better or worse? Why?
4. If you could wave a magic wand and make your city/community a better place to live, what changes would you make in the areas of land use and development?

Explore

1. How has Orange County changed since 1947? To find out, have students browse [Aerial Photography: Florida Collection](#), images from 1947 to 1993 that have been digitized and are accessible online. Ask students to make notes about their observations, and think about these questions:
 - a. Over the entire period, what changes in topography, land use, and land cover are evident in the photographs?
 - b. How do you think the way people made their living in Orange County has changed through the years? How is this reflected in the aerial photographs?
 - c. What milestones in Orange County's history have impacted its economic development? What changes in land use do you see in the photos that occurred as a result?
 - d. What changes in land use related to population increase do you see?
 - e. When did Orange County's major transportation corridors/infrastructure come into being? For example, when were the airport, interstate, toll/expressways constructed? How did these additions impact the surrounding land use?
 - f. Can you find photographs of the immediate area where you live or go to school? What was it like in 1947? 1963? 1980? 1994?
2. What is Orange County land use like today? What might it be in the future? Have students use the Orange County Water Atlas [Advanced Mapping Tools](#) to explore this question. Enable/disable the map layers showing land use classifications, aerial photography, and natural areas. Use the zoom and pan tools to look at different areas of the map. Students may also wish to review the watershed pages on the Orange County Water Atlas. The Geography and Land use tab has population and land use trend data. Questions to consider:
 - a. What were the most common land uses in Orange County in 2000? How do you think land use has changed since that time?
 - b. Do you see land use change reflected in differences between the 1995 and 2000 map years? Overall, which land uses have increased? Decreased?
 - c. Over the whole period, from 1947 to 2000, what changes have you observed related to Orange County wetlands, water bodies and their watersheds?

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- d. How might future climatic changes affect watersheds and water resource availability?
- e. How might future population changes affect watersheds and water resource availability?
- f. What areas have been set aside for preservation, and where are they located? Do adequate wildlife corridors exist that connect them to each other, or to other green space?
- g. If the current trends of increasing urbanization and population continue, what impacts might be expected on climate?

Explain

Have groups of students work together to develop a report for the class on some aspect of land use, growth management, private property rights, etc. It can be a statewide or countywide problem, or one in their particular community or neighborhood. Their report should state the problem, challenge, or question, and propose one or more solutions to address it. Questions they should address in their proposal:

- What has been the history of the particular issue? Is it a recently-created problem, or one that has been developing slowly over time?
- What will happen if no change is made?
- What is the best possible outcome? What is the worst?
- Who are the stakeholders in the issue? How will they be affected? Which of them might support the proposed solution(s)? Which would oppose it? How could objections be countered or addressed?

Extend

The trend of rising population density is expected to cause more urbanization. The "urban heat island effect" occurs when buildings and paved surfaces absorb and retain heat during daylight hours, slowly releasing it over time and nudging average temperatures upward. One two-year study in downtown Orlando concluded that the effect produced at least an 8-degree increase in temperature as compared to more rural areas located nearby. In summer the urban heat island effect results in higher energy use for air conditioning, increasing greenhouse emissions and contributing to climate change—a vicious cycle.

Another impact of surface urban heat islands is degradation of water quality, mainly by thermal pollution. Pavement and rooftop surfaces that reach temperatures 50 to 90°F higher than air temperatures transfer this excess heat to stormwater. Field measurements from one study showed that runoff from urban areas was about 20-30°F hotter than runoff from a nearby rural area on summer days when pavement temperatures at midday were 20-35°F above air temperature. Water temperature affects all aspects of aquatic life, especially metabolism and reproduction. Rapid temperature changes in aquatic ecosystems resulting from warm stormwater runoff can be particularly stressful. Bioretention is one solution to this phenomenon.

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1. Do an audit of your school and create a proposal for energy conservation. Create a diagram of the grounds and suggest any/all of the following: areas where additional trees might be planted to shade impervious surfaces and air conditioning equipment; building(s) where a green roof might be practical; energy-saving devices and their cost, as well as projected savings in kilowatt-hours and dollars; buildings (or their roofs) that might be painted a lighter color to reflect heat.
2. Examine the stormwater system on your school grounds. Where does rainwater go after it leaves the downspout? Does it enter a retention pond or nearby lake? If so, how could its potential for thermal pollution of nearby water bodies be reduced? Do an analysis, make a plan and report your findings to the class. Possible ideas:
 - a rain garden
 - additional berms and swales to slow water flow
 - replacement of pavement with permeable surfaces
 - increased vegetation along existing ditches/swales

Exchange/Evaluate

1. Students should share their proposals with the entire class.
2. Teacher should evaluate students' presentations for accuracy and completeness of information gathered and the strength of the arguments presented.

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