Suggested Audiences

- Citizens
- Community Leaders
- Educators
- Students

Standard Categories

- Environment and Ecology
- Civics and Government

Standard Statements

4.7 Threatened, Endangered and Extinct Species

4.8 Humans and the Environment

4.9 Environmental Laws and Regulations

5.2 Rights and Responsibilities of Citizenship

Content Objectives

- Compare and contrast historical landscape changes with present day situations
- Analyze how land use needs relate to sustainability of natural resources
- Describe the value of habitat protection as it relates to sustainability of specific species of plants and animals
- Define threatened, endangered and extinct species and explain how human activities impact wildlife
- Research and develop strategies relating to deer management and land use
- Describe a minimum of eight ecosystem services relative to human beings
- Explain laws and tools for protecting land resources
- Analyze the conflicts of land choices and techniques to resolve them
- Calculate and evaluate cost comparisons between developments and protecting land
- Develop and describe a plan for implementing tools for land protection in a variety of situations

Instructional Strategies

- Analysis
- Compare and contrast
- Discussion
- Lecture
- Survey
- Data Analysis
- Problem Solving
- Presentation

Assessment Strategies

- Group presentations
- Group and individual discussions
- Successful completion of land protection worksheets
- Calculations and evaluation of cost analysis
- Post-lesson questions and response

Materials

Included:

- Copies of Animal and Plant Worksheet for each participant
- White-tailed deer Worksheet
- Problem Solving Worksheet
- Ecosystem Services Worksheet and Answer Sheet
- Thank You Trees Worksheet
- Economic Benefits of Ecosystems Information Sheet
- Pennsylvania Declaration of Rights
- Development vs. Preservation Worksheet
- Protecting Resources Tools
  - ~ Greenways Information Sheet
  - ~ Open Spaces and Natural Areas Information Sheet
  - ~ Farmlands Information Sheet
  - ~ Land Recycling Information Sheet
  - ~ Environmental Advisory Councils and Land Trust Information Sheet
- The Last Straw Artwork
- Lancaster County Farms Photo
- The Last Straw Worksheet
- Community Planning Worksheet
- Jonestown Map
- Protecting Land Bingo

Additional Materials:

- Poster Board for Each Group
- Flip Charts
- Markers
- Apples and Plastic Knife
- Transparency Sheet

Time

- 3.0 hours

The built environment has direct and indirect effects on the natural environment. The built environment affects wildlife habitats ecosystems, endangered species and water quality through land consumption, habitat fragmentation and replacement of natural cover with impervious surfaces. Certain patterns of development place little value on the importance of natural systems. As growth becomes a sprawl of roads and rooftops, there is a great need to plan and protect wildlife habitat and ecosystem services.

More than 25,000 species live in Pennsylvania's woods, fields and streams. Forests cover 17 million acres or about 60 percent of our total land area. As the patterns of sprawl and growth continue, natural systems are disrupted, destroyed or displaced by the unplanned spread of the built environment. In recent decades, habitat destruction has caused the loss of 56 percent of our wetlands, 156 plants and animals have disappeared

Protecting Land Resources

and other valuable habitats are being fragmented or destroyed. The wetlands and woodlands of Pennsylvania protect biological diversity and provide ecosystem services to the natural and human communities.

Planning allows us to guide growth while protecting valuable habitat. Educating people about land choices is a step toward protecting environmental resources. This lesson provides an overview of tools and strategies that help to protect the natural resources and green space. Participants will focus on habitats and organisms that tell a story about the impact of land choices. Participants will examine valuable ecosystem services and learn to apply the land use tools that help protect resources and open space.

Overview

Protecting Land Resources includes four activities:

Activity 1: *Wildlife and Land Use*
Activity 2: *Ecosystem Services*
Activity 3: *Tools to Protect Land Resources*
Activity 4: *Jonestown: A Case Study (Following the Greenway)*

"Green" is essential for community health, recreation and aesthetics. Protecting valuable green spaces, trees and other natural resources, should be a priority in community plans. It is important for communities to protect and manage their green space and parks in sustainable ways.

This lesson provides opportunities to discuss the value of environmental services, the impact of unplanned development and the strategies for protecting natural resources and green space. Participants will focus on the story of endangered and threatened species, discuss the values of trees and forests in urban and rural settings and apply land use tools that help protect resources and open space. They will develop a community plan proposing strategies for implementing tools and forming partnerships.

Participants will conduct a study of Jonestown, Pennsylvania and provide recommendations in the development of a greenway. A greenway is a corridor of green space that connects to nodes or destinations, drawing people and wildlife to move within this natural pathway. Participants will apply their knowledge and skills in helping Jonestown design their greenway.

Activity 1:
Wildlife and Land Use

Summary: Participants will discuss the changes in Pennsylvania's natural resources since the arrival of William Penn, reviewing the impact of development on endangered and threatened species as well as the challenges of managing white-tailed deer.

Questions: What historical events caused changes to Pennsylvania's natural resources? What organizations and agencies evolved to manage natural resources?

What are the main reasons for endangered and threatened species? Why is it important to manage white-tailed deer? Why is it important to remove invasive species and promote native plantings?

Preparation

- Prepare information sheets on threatened and endangered species for each participant (pp 141-144). Work groups can be organized by the organism. Each group should have a work space with poster board and markers.
- Prepare information on white-tailed deer (pp 145-147) for each participant.
- Prepare the Problem Solving Worksheet (pp 148) for each group.
- If using the lesson "Oh Deer," set up as directed by the lesson.

Procedure

1. What changes happened to the Pennsylvania environment over the past 250 years? List responses. Develop time line cards or a presentation of the following historic events that created environmental changes and ask participants to place them in chronological order.

Think back about 250 years ago to the land seen by William Penn. Here is a quote that Mr. Penn wrote in 1684, two years after he arrived on the west shore of the Delaware River. As it is read, compare the wildlife you see today with the animals highlighted by Mr. Penn.

"The food the woods yield is your elks, deer, raccoons, beaver, rabbets, turkeys, pheasants, heath-birds, pidgeons and partredge innumberably. We need no setting dogs to ketch, they run by droves into the house in cold weather. Our rivers have also plenty of excellent fish and waterfoul as sturgeon, roeshad, herring, cadfish, or flatheads, sheeps heads, roach and perch; and trout in inland streams. Of foule, the swan, white gray and black goose and brands, the best duck and teal I ever eate and the snipe and curloe with the snow-bird are also excellent."

If you were to design a travel brochure based on Penns Woods, it would be quite different than today. People impact their environment in many ways. The landscape changes as resources are removed or extracted. William Penn valued Pennsylvania's natural resources and promoted conservation in his original charter.

Mr. Penn directed the new colonists to preserve one acre of trees for every five acres cleared, setting a vision in the early colony for the protection of natural resources. He and many early colonists extolled the virtues of the wildlife, the forests and the abundance of natural resources.

Since that time, 56 percent of Pennsylvania wetlands have been lost. The Pennsylvania of William Penn had at least 156 more species of native vascular plants and vertebrates than we see today. Among the animals that are now extinct include the passenger pigeon, woods bison, blue pike, eastern tiger salamander and the small white lady's slipper.

Historical Background Information: (To be reviewed with students) What William Penn experienced was a great American wilderness filled with giant chestnut forests where wild turkey and deer thrived. Beech trees crowded the ridges where passenger pigeons fed on the nutritious nuts. Two hundred foot white pines and hemlocks loomed where elk and black bear meandered. Elk and wood bison herds summered on mountain meadows. Wetlands rich in biodiversity provided habitat for a host of other plant and animal species.

Pennsylvania did not stay wild for long. The first colonists enjoyed the fertile soils, climate and growing season.

Colonists grew in numbers. New farms needed fields for crops, wood for heat and lumber for houses, barns and tools. Iron furnaces that forged the iron plows and rifles needed charcoal to melt the ore. Each iron furnace consumed an acre of forest a day.

From 1850 to 1870, Pennsylvania produced more lumber than any other state. Forests disappeared and so did the wildlife. By 1750, deer and squirrels were scarce in many areas. Native elk disappeared and the original woods bison, wolves and mountain lions were extinct before the end of the 1800s. As the old-growth forests disappeared, forest birds such as grouse, wild turkeys, barred owls and pileated woodpeckers declined. (Today, only in remote areas of Pennsylvania, such as the Alan Seeger Natural Area in Huntingdon County, can we find evidence of what forests use to look like.)

The log boom moved west and provided relief to Pennsylvania forests. The American Chestnut, the dominant hardwood, was attacked by an introduced fungus which destroyed most of the remaining trees. Oaks siezed the vacant spaces and by the 1930s, new woodlands were taking hold. Deer thrived on acorn mast and herds increased.

Pennsylvania's mineral wealth was discovered early in its history as iron furnaces smelted iron ore, using the limestone resources and the forests for charcoal. Miners opened the coal fields and the demand for coal grew.

The Commonwealth contains the northern segment of the world's largest deposits of bituminous coal and the

world's greatest deposits of anthracite coal. By the late 1800s the appetite for coal caused intensive mining and the growth of dense communities of miners and workers. As coal was extracted, sulfur combined with water and air-forming sulfuric acid which flowed from the mines and poisoned streams.

Oil was first discovered in America at Titusville, Crawford County in 1859 and its discovery spread to other counties. Wooden oil pipelines burst and salt brine from wells seeped into streams, suffocating aquatic life.

Today, Pennsylvania's minerals continue to change the landscape, the environment and the economy. With new technologies, the Marcellus Shale, located deep in Pennsylvania's geology, has the potential to produce enormous quantities of natural gas. This discovery has created a "gold rush" mentality in Pennsylvania that will challenge today's communities, and those of the future.

People also found other ways to change Pennsylvania's environment by introducing exotic species imported from other parts of the world. The gypsy moth and the blights that threatened elms and chestnuts were the most famous. For example, in 1904, horticulturists imported the Asian chestnut tree into New England which carried a fungus under its bark. By the 1920s, the beneficial chestnut trees were nearly extinct. Invasive species continue to degrade natural native habitats and much effort is directed at removal of species that impact native wildlife.

In 1866, Governor Andrew G. Curtin established the Commissioner of Fisheries making the Pennsylvania Fish Commission one of the oldest fisheries and conservation agencies in the United States. In 1895, Pennsylvania Bureau of Forestry was established and in 1898, the first forest reserve was started which began the two million acre state forest system. In 1895, the Pennsylvania Game Commission was also organized to protect the remaining wildlife. In 1902, Pennsylvania established the first state park at Mont Alto, Franklin County. Setting aside land for wildlife, natural resources and recreation became a priority for many Pennsylvanians.

Because of the efforts of early conservationists, Pennsylvania today has a rich diversity of species and natural communities. More than 3,500 species of plants and animals have been documented in Pennsylvania. If you include the fungi, protista and nonvascular plants you could add 20,000 more species.

Unfortunately, land use change is the greatest threat to Pennsylvania's natural communities and biodiversity. Habitat loss and degradation are the greatest threats to native diversity. Some 156 species of vascular plants and vertebrates have disappeared and another 351 species have become endangered or threatened in Pennsylvania.

In 300 years following Penn's landing on the Delaware, three million acres of natural habitat have been converted to urban uses. In the past two decades 1982 to 2002, another million acres have been converted to development. In 1982, Pennsylvania was changing 100 acres per day from the natural environment to the built environment. Today, the rate is estimated to be more than 350 acres per day and it's accelerating. Pennsylvania has one of the highest per capita rates of land consumption in the country

2. Some species actually increase due to changing landscapes. Development is not always a one-way street for some animals and plants. Some species thrive, causing serious problems for other species. Invasive species threaten our native species. Define the terms "native species" and "invasive species." Using photos from brochures and websites, provide photos of native and invasive species and allow participants to categorize them. Information can be located at www.invasive.org, or on the DCNR website:

Activity 1

www.dcnr.state.pa.us/forestry/wildplant/index.aspx, www.dcnr.state.pa.us/forestry/wildplant/invasive.aspx, and www.dcnr.state.pa.us/forestry/wildplant/native.aspx.

Species of plants and animals that have existed in Pennsylvania prior to the arrival of the first settlers are considered native species. They have adapted to soils and conditions of the ecoregions in which they live. Invasive species are plants or animals that are not native to the region. Their proliferation causes harm or threatens habitat of native species.

Year after year, species are introduced to areas without knowledge or understanding of their potential powers to cause harm. Plant species such as purple loosestrife and Japanese knotweed, grow without natural controls and, in time, will become the dominant species, crowding out any native plants and thus diminishing native food sources for native animals. There are invasive insects, animals and pathogens as well. Forest pest insects include the hemlock woolly adelgid and gypsy moth which have destroyed native trees. Threats can be so severe that entire species have almost been obliterated.

Communities are encouraged to design parks and greenspaces utilizing native plants and avoid invasive species. *Creating Sustainable Community Parks, A Guide to Improving Quality of Life by Protecting Natural Resources* is an excellent resource produced by DCNR's Office of Conservation Science in partnership with Pennsylvania Recreation and Park Society, Inc. Information can be found at www.dcnr.state.pa.us/brc/GreeningPennsylvania.pdf.

Discuss: As communities grow, leaders should reflect on the impact that growth and development may have on environmental services and features. What are some of the consequences of unplanned development to wildlife and the environment?

- Removal and destruction of wildlife habitat
- Fragmentation of habitat: Breaking up forests or migratory routes
- Stormwater runoff impacts wildlife in streams and causes erosion
- Pavement and rooftops are hot in the summer, heating up rainwater before it enters waterways causing a form of thermal pollution
- Impervious surfaces impacts groundwater recharge
- Homeowners and commercial sites use fertilizers and pesticides that could impact water quality
- Increase in automobiles: Discharges from automotive fluids that wash into waterways
- Wildlife/Vehicular collisions (deer, toads, owls, etc.)
- Winter street maintenance increases salts into waterways
- Light pollution impacts migratory animals
- Windows in tall buildings block flight of birds and bats
- Wind turbines may be detrimental to migratory animals and birds

Communities should value their natural resources as an asset and a vital part of their character.

3. What impact does growth and development have on some of the state's wildlife species? In this activity we will discover some of the species impacted by destruction of their habitat and discuss ways to manage lands to protect sensitive species.

Write the following words on a flip chart: **"Extinct," "Endangered," "Threatened"** and **"Extirpated."** Define each of the words.

What do we mean by the word "extinct?"

"Extinct" refers to species that occurred in Pennsylvania but no longer exist across their entire range. There are 156 species of vascular plants and vertebrates known to have become extinct in Pennsylvania over the past 250 years. Today, more than 350 species are currently at risk in the Commonwealth.

"Endangered" refers to species in imminent danger of extinction or extirpation throughout their range in Pennsylvania

"Threatened" refers to species that may become endangered within the foreseeable future throughout their range in Pennsylvania.

"Extirpated" refers to species that have disappeared from Pennsylvania but still exist elsewhere.

4. Let's be wildlife detectives and find out the reason why some of our wildlife is in danger. We are going to study some animals and plants from Pennsylvania and learn what is happening to them, why it is happening and what we need to do about it.

Each participant will be in a work group of a plant or animal as designated by information sheets. Copy and distribute enough of each information sheet so that each student has one sheet. Have students form the following work groups based on the handouts:

- Short-Eared Owl
- Showy Lady's Slipper
- New Jersey Chorus Frog
- Bog Turtle

Participants read the handouts, research and develop a poster of the natural history and information on their plant or animal. Participants prepare a presentation and discuss strategies for habitat management for survival.

Discuss the importance of conducting natural resource inventories of the community. Organize a "bio-blitz" or large-scale inventory to determine the biodiversity of the community. Contact the Western Pennsylvania Conservancy (www.paconserve.org) for information on bio-blitzes. What are some strategies for communities to protect wildlife species?

5. Some species are successful in adapting to changing habitats. What are some of the birds, mammals and plants that are successful in surviving in urban/suburban areas and why?

The white-tailed deer was declared the state mammal of Pennsylvania in 1959. It is one of Pennsylvania's most influential species of wildlife. Deer are the most popular watchable wildlife as well as the most huntable resource, providing venison for countless families. Pennsylvania's rural, cultural heritage is linked to the white-tailed deer.

Deer management is a controversial topic. What are some of the impacts and effects of a growing deer population? As deer populations grow, deer are accused of over-browsing forests, attacking seedlings, shrubs and wildflowers, reducing the understory to ferns and invasive species. In southeastern Pennsylvania, deer have flourished and feed on ornamental gardens, crops and urban plants.

Deer densities over 20 per square mile impact forest regeneration, create greater potential for car accidents and increase Lyme disease. Deer management is essential for healthy forests and healthy communities. For additional information visit the Pennsylvania Game Commission at www.pgc.state.pa.us and the Bureau of Forestry at www.dcnr.state.pa.us.

Distribute copies of the white-tailed deer information and deer photos. Allow students to discuss what they

learn from the deer photos. Divide the report into sections. Assign groups to read sections of the information sheet and report to the large group. After learning about deer, each group is to complete the worksheet entitled Problem Solving Worksheet.

Discuss the Problem Solving Worksheet in a large group. Discuss the pros and cons of different deer management strategies. Discuss the concerns of different people from state forests, state parks, agricultural lands, hunters, animal rights activists and homeowners as deer populations encroach on resources. Discuss current strategies on management.

- Deer exclosures
- Hunting regulations
- Fertility control
- Trapping and transporting
- Repellants
- Fencing

Optional: Visit a deer exclosure area and demonstration plots that prevent deer from browsing in the understory.

Optional: Conduct the following activity:

Project Wild, *"Oh, Deer"*

www.projectwild.org

The activity involves participants assuming the role of deer while others become elements of the environment. The activity illustrates that limiting factors maintain populations at a predictable level.

- Good habitat is key to wildlife survival;
- A population will continue to increase in size until some limiting factors are imposed; limiting factors contribute to fluctuations in wildlife populations;
- Nature is never in balance but constantly changing.

Activity 2:

Ecosystem Services

Summary: The ecosystem provides valuable services that have great economic and environmental value. In this activity, participants will gain a perspective of the value of land and the services provided by environmental systems.

Questions: How valuable is productive land? What are the services provided by the environment? What would happen if the services were eliminated?

Preparation

- Earth is an Apple Activity: Apples, plastic knives and plates for each group.
- Copy and distribute Ecosystem Services Worksheets (p 149). Answer sheet on pp 150.
- Have flip chart and markers available.
- Prepare Thank You Trees Worksheet (pp 151-152).
- Review Economic Benefits of Ecosystems Information Sheet (p 153).

Procedure

1. We realize how important planning is for protecting habitats and considering the consequences to wildlife as habitats are altered. How valuable are Earth's services to us? What services does the ecosystems provide that we take for granted? What services do ecosystems provide for us that should be valued as we look at land use choices?

Brainstorm some ideas from students and write them on the board. We will discuss services in depth following the first demonstration.

2. Conduct Earth is an Apple activity to demonstrate the value of land for growing food and crops. Use one large apple or apples for each group and plastic knives.

Think of the earth as an apple. Slice an apple into quarters and set aside three of the quarters. What do these represent? Three quarters represent the oceans of the world. The remaining quarter represents the total land area of the world.

Slice the quarter that is land in half. Set aside one of the pieces. The portion set aside represents the land area that is inhospitable to people such as the polar areas, deserts, swamps and mountains. What fraction do we have left? (1/8.) The piece that is left is land where people live but do not necessarily grow foods we need.

Slice the 1/8 piece into four sections and set three aside. What fraction do we have left? (1/32). The 3/32 set aside represents the areas unsuitable for food or crops. Those contain the developed and built areas of our environment…the parking lots, highways, shopping centers and areas that are too steep or soil is too poor.

Carefully peel the 1/32 slice of earth. This represents the surface, the thin skin of earth's crust which we depend on for food. It is less than five feet deep.

Explain that protecting land resources is very important. There is a fixed land resource base. As we continue to develop and pave, we must plan for the services that land provides and protect land for those services such as growing food.

3. What are other services provided by ecosystems? Work in groups. Distribute the Ecosystem Services Worksheets to each group. This can be conducted on a trail walk or in a park. Look at each service and provide examples for each of the Ecosystem Services. Review in a large group. Write the responses on the flip chart. You can refer to the Economic Benefits of Ecosystems Information Sheet.

It is important to discuss the economic value of environmental services. What if price tags were placed on each of the services? Would we value the services more and be more inclined to protect the resources?

4. Trees provide many services and have great value to the community. Review photos of trees (not included) and make a list of the different services provided by trees. Refer to the worksheet "Thank you, Trees." Check off ways trees help in your community.

The North American Forestry Association estimates that a 50 year old urban tree annually yields $75 in soil erosion and storm water control, $75 in wildlife shelter benefits, $73.00 in air cooling services and $50 in air pollution control. Compounded at 5 percent interest over a tree's 50 year life, this adds up to $57,151."

Urban forestry is a major initiative throughout the country. Urban foresters in DCNR are available to provide information on trees and forests within communities. Tree Vitalize is a public/private partnership sponsored in conjunction with DCNR to encourage an increase in urban tree cover through community action volunteers. It started in Philadelphia and has expanded to other cities in Pennsylvania. Learn more at www.treevitalize.net.

Participants can encourage their community to conduct a tree inventory to determine the health of community trees and how to manage them. Some communities develop special tree ordinances that help communities protect trees. Some communities establish Shade Tree Commissions. Learn more about the city of Pittsburgh's Shade Tree Commission at www.city.pittsburgh.pa.us/cp/html/shade_tree_commission.html.

Study the benefits of tree cover. To evaluate the impacts of land cover change, develop a land cover

classification system with four classes: tree canopy, turf, bare soil and impervious surface.

When it rains, rank the four classes of land cover classification with respect to the amount of rainfall that would infiltrate into groundwater from "1" being the most infiltration to the least infiltration "4." (Answer, canopy cover, turf, bare soil, and impervious.)

Discuss the implications of recent land cover changes in a community. Has there been an increase in runoff? What are the consequences of increased runoff? (flooding, poor surface water quality from sediment, changes in stream temperatures, decrease in groundwater resources/levels, etc.)

Geographic Information System (GIS) and Global Positioning System (GPS) enables participants to use Forest Service software for evaluation purposes. Digital aerial photos from PA MAP (www.dcnr.state.pa.us/topogeo/pamap/index.aspx) or Google Earth (earth.google.com) image is used to identify trees. A software package quantifies the benefits of trees for carbon sequestration, air pollutant uptake, stormwater management, and local climate benefits.

Activity 3:

Tools to Protect Land Resources

Summary: Land is developed for housing, commercial and industrial needs. Roads, parking lots and other forms of transportation need space for the movement of people and goods. As land is developed, communities need to consider protection of natural space as a prime concern. Communities recognize the value of farmland, greenways and natural wild areas. There is an economic price tag that can be placed on protection of open space and must be part of the consideration as communities grow and develop. There is a way to develop sustainable communities, maintaining farmland, wilderness and unfragmented tracks of land for wildlife migration and human enjoyment. Protecting green space is critical to the health of future generations and for the health of the environment.

Questions: What is the value of protecting open space for a community? What are the tools that will protect land? How can they be implemented?

Preparation

- Divide participants in work groups, following procedures for working in groups.
- Prepare the Declaration of Rights (p 154) for each participant.
- Prepare "Development versus Preservation Worksheet" (p 155) for each group.
- Prepare copies or transparency of both The Last Straw artwork (p 156) and Lancaster County Farmland Photos (p 157).
- Prepare and distribute copies of the Last Straw Worksheet (p 158).
- Prepare information sheets on each area of land preservation:
  - Natural Areas (pp 159-160)
  - Farmlands (pp 161-162)
  - Land Trusts and Environmental Advisory Councils (pp 163-166)
  - Greenways (pp 167-169)
  - Land Recycling (pp 170-171)
- Prepare copies of Community Planning Worksheet (p 172).
- Prepare Land Bingo Sheets (p 173) for each participant.

Procedure

1. DCNR is entrusted to protect the natural resources of Pennsylvania. We are to manage them for the future generations. Read the Declaration of Rights from the Pennsylvania Constitution.

Discuss the importance of the Pennsylvania Constitutuion. Discuss the importance of the Declaration of Rights. What does it mean to different groups in a community?

In the natural world, everything is interdependent. As the landscape is changed to a network of roads, sewers, parking lots, and roof tops, many parts of the environment are affected. Nature's important cost-free services are taken for granted and abused, or destroyed. Local biodiversity is decreased. Air and water quality are diminished.

2. It is important to note that residential development costs a community much more in increased municipal and school district services than agricultural or open space uses. The following is a mathematical problem for you to compute and determine your own assessment.

We will compare the cost of converting a 100-acre farm to residential use versus the cost of protecting it from development through a conservation easement. A conservation easement is a permanent legal agreement between a landowner and government or a land trust which permanently restricts a property's uses to protect its conservation value. An individual continues to own the property but accepts money to restrict its use. Owners permanently give up agreed upon rights. Future owners would be bound by this agreement.

Distribute the Development vs. Preservation handout to each participant. The figures used are from the Upper Perkiomen School District in southeastern Pennsylvania. Allow participants time to do the mathematical exercise.

3. Analyze and discuss the results. The shortfall of the development is $322,311 per year. The cost of the easement purchase is $434,900 which has a 1.3 year break-even period. The shortfall is an ongoing, permanent expense that will tend to increase over time as education, energy, and transportation costs escalate. It does not reflect the capital costs of new school construction or increased municipal costs. By closely examining the true costs of development, community planners can save both money and quality of place.

A community could decide to purchase the property outright. When owners convey property in "fee simple" acquisition, they transfer all ownership rights. A fee simple acquisition of the farm would save the community money but it would take longer to break even on the purchase. Easements are less expensive because not all the ownership rights are being acquired.

4. Artists have captured the landscapes and communities throughout history. Pennsylvania artist Bruce Johnson, born in Allentown, currently resides in Dingman's Ferry, Pennsylvania. Bruce Johnson is highly recognized for his whimsical pen and ink "Statements." These humorous, often outlandish, and always penetrating statements about the human condition have quickly become the prized possessions of collectors everywhere. "Statements" are available in hundreds of galleries across the United States as well as several foreign countries.

Bruce Johnson has graciously and generously granted permission for "The Last Straw" to be used as an educational addition for PA Land Choices. We thank Mr. Johnson for granting permission with restrictions that it only be used for educational use and would not be used for any commercial venture. We respect this request. To learn more about Bruce Johnson and his work visit www.bjohnsonltd.com.

Participants will examine the artwork of Bruce Johnson called "The Last Straw." The activity provides an opportunity to identify the artist's rendition of the plight of agricultural lands and the invasion of sprawl and development. Participants are to work in groups, examining the artwork by Mr. Johnson's "The Last Straw" and discuss the questions outlined on the worksheet.

Participants are to share their comments in large group discussions. Compare the artwork to the Lancaster County farm photo. Describe the similarities. What are the possibilities of future land use surrounding the Lancaster County farm in the next 20 years? What choices could the community enact to protect the agricultural character of the area or to manage future community growth?

5. By maintaining patterns of large woodlands and wetlands (nodes) and protecting wooded stream valleys (corridors), significant natural functions are protected. Development doesn't have to destroy the valuable nodes and corridors. Planning and regulating can identify and protect these valuable areas. Tools such as the conservation easement we discussed previously and new terms that define different types of green space. Such tools will help communities and individuals protect valuable natural areas not only for wildlife but for the valuable services they provide, the increase in land value and the quality of human life for future generations.

6. In this activity we will look at some of the tools involved in specific areas of land protection. We will divide into five groups:

- Natural Areas
- Farmlands
- Land Trusts and Environmental Advisory Councils
- Greenways
- Land Protection/Land Recycling

Each group will review information sheets relating to land protection. The task is for each group to look at the map of their community or use the communities we addressed in Lesson 2: Keystone Township. Using your knowledge about land protection, each group will present recommendations describing the tools and terms they learned about in their group research. Each group will justify their recommendations. Use the Community Planning Worksheet.

Using as many tools as you find appropriate, you will present your recommendations to the Planning Commission through visual representation. Be creative in describing your implementation plan.

Groups will describe all tools included in their readings. Distribute Protecting Land Bingo Worksheet (included) to each participant. As the group is reviewing the strategies, participants can jot down descriptions of the different terms for future reference.

7. Discussion: What impact does unplanned development have on the natural resources and agricultural lands in Pennsylvania? How does unplanned development impact wildlife and future generations? What is an Environmental Advisory Council and how does it help a community? What planning tools did we use to protect land for future generations?

Assessment and Evaluation

1. What are the important values of natural resources?

2. Develop an action plan for your own community. What actions will protect land for future generations? What partners will help implement the plan? Develop an implementation strategy.

Activity 4:

Jonestown: A Case study

Summary: Participants will explore the community of Jonestown, Pennsylvania and apply their knowledge and skills as they help Jonestown develop a greenway.

Preparation

- Gather artifacts that reflect an important aspect of Jonestown history.
- Display maps of Jonestown (p 174).
- Prepare sets of photos from Jonestown website (www.jonestownpa.org).

Questions: Why is the greenway important to Jonestown? What tools and partners did they develop to implement a greenway? What were the challenges and success?

Procedure

1. Where is Jonestown? If we were zooming in from Google Earth, we'd begin with the solar system where eight planets circle the sun and one of those planets, the third from the sun, is planet Earth. The Earth and all its inhabitants are traveling at a speed of 66,705 miles per hour in orbit around the sun and rotating at approximately 1,037 mph at the equator. There are seven continents (Antarctica, Australia, Asia, Africa, Europe, South America and North America), 194 countries and over six billion people. Most of those six billion people live in communities that have some of the same qualities as Jonestown. But Jonestown is unique because it is your community.

This is Jonestown, Pennsylvania. Located in Lebanon County at the confluence of the Swatara Creek and the Little Swatara Creek, it is home to about 2,000 people and about 500 families. It is a borough governed by a mayor and a borough council.

2. What is history? You may think it is about famous wars, famous people and famous places. History is the story of everyday people and places. It's about your community, your house, and your school. You are making history. The objects you use are part of history. Objects like a microwave, a cell phone, an iPod, even a toothbrush are part of your history. History reflects the stories of people, events, places and things.

There is also natural history. Natural history is the study of the river, the forests, and the animals. The natural history helped to shape Jonestown. The Little Swatara and the Swatara provided power and transportation. Today, the rivers provide beautiful scenery and opportunities for healthy recreation.

History is a story that is passed down through people talking, writing or through objects left behind. Things written down make it easier for people of today to learn about the past. It's important to capture the history in the memories of people who have stories to share. Jonestown is fortunate to have a living history "book" in the memories of Evelyn Isele, a local historian. She continues to share her memories in the borough newsletter. Citizens of Jonestown, especially the children, benefit from visits with Evelyn, capturing interviews on tape and writing in journals. By demonstrating the importance of our historians, children develop the sense of pride and importance in their history.

3. Artifacts: Each group will be given an item that represents clues to the history of Jonestown. These objects will depict the culture, the manufacturing and lifestyle of the people during different periods of time.

Participants must look at their object and try to determine the following:

- What is the object?
- What is it made of?

- Who made it?
- What it was used for?
- Who would benefit from it?

Participants analyze the object and discuss when it might have been made or used in Jonestown.

The following is a list of objects representing aspects of life in Jonestown history.

- Arrowhead
- Animal pelts and traps
- Bricks, pottery
- Tobacco press
- Horse bits and hardware
- Ice tongs
- Shoemaker equipment
- Tools
- Leather water bucket
- Washboard
- Cotton coverlets

Group discussion will help analyze the different objects and how they relate to Jonestown. What do the objects tell us about the people and industries?

A brief history of Jonestown: Susquehannock Indians settled along the Swatara Creek. German settlers were the first Europeans who settled Lebanon County. In 1761 Jonestown was first named Williamsburg but it was changed to Jonestown because another community had already selected Williamsburg. Jonestown became a central location for many travel routes. With the opening of the Union Canal in 1828, much trade passed through Jonestown. Floods in 1862 wrecked the canal and ended the heyday of canal usage. A railroad from Pine Grove to Lebanon began operation in 1870 with a station in West Jonestown. Between 1870 and 1875 Jonestown was a booming town with many businesses including two drug stores, mills, boat builders, cigar makers, coachbuilders, brick and pottery kilns, and coverlet factories and blanket manufacturing.

4. Building a Borough. Participants will work in small groups. Each group will receive poster board. Participants will orient the poster board to north, south, east, and west. Look at a map of Pennsylvania and of Jonestown. Locate Jonestown on the Pennsylvania map and take note of major highways near their community. Note neighboring communities, state parks, and other special features.

After examining the large maps, participants will draw the Swatara Creek and the Little Swatara Creek on the west and south edges of the poster board, joining each river in the lower southwest corner of the poster board. Color and label the rivers.

Question: Why did people settle in Jonestown?

What were some of the natural resources that brought people to this area? Good soils and water are very important natural resources combined with a moderate climate. Food could grow on the land and water could also be used for power. It was a fairly level area without steep slopes so that people could farm and build on the land. If there were steep slopes, it would not be easy for early settlers to build a home or farm the land.

What is the source of surface water surrounding Jonestown? The Little Swatara Creek enters the Swatara Creek at Jonestown. A confluence of a river is a place where two rivers come together. Jonestown is at the confluence of these two rivers. (The place where a river begins is called the headwaters. The watershed of a river is the land surrounding that river that is "elevated" in a certain way that allows rainwater/surface water to drain into that specific river.) Why were rivers important to early settlement of

Jonestown? (i.e. waterpower for mills, transportation by boat or barge, movement of goods, water for people and livestock, fishing.)

Today, Jonestown is called a borough. Because it is a borough, it has a form of government led by a strong borough council and a mayor elected by the people. What are some of the services needed in Jonestown that the mayor and the borough council must address? Participants will discuss services, facilities and infrastructure that are necessary and those that are special to their community. List these aspects on a flip chart: safety, fire protection, water, sewer, roads and road maintenance, lighting, post office, schools, playground, park, wooded area, shops, parking, etc. Circle those aspects that are necessary and place a star next to those that are special to Jonestown.

Participants will think about their own community and layout a grid of main roads or side roads as best they can recollect or imagine. Participants will discuss some of the buildings and places they remember. They will examine the borough's zoning ordinances.

Participants will be given a set of photos of buildings in Jonestown from the borough's website (if available). They will place them on their poster board map where they think they belong. The photos include the school, post office, churches, firehouse, municipal building, stores, factories, playground, etc. They will develop symbols for special places such as their friends house, a place to skateboard, a picnic table.

Participants will use a green marker and color in green areas of their community. This is important to identify. (Be sure to color the area adjacent to the rivers as green space.)

People need places to live. Participants will add drawings of their homes and homes of their friends. Place the homes where you think they belong.

Look at your map. Are the stores clustered in one area? Are the factories or gas stations in another area? Are homes clustered together in certain areas? Sometimes this happens without rules to make it happen. If we decide to define each of those areas, we could develop rules for each area based on certain uses such as commercial uses, industrial uses and residential uses. This is called "zoning" if a community decides to label areas based on uses and create laws that restrict those uses. Jonestown has decided to officially zone the community. Look at the zoning map. What are the zones and what color are they? Did you place your buildings in the correct zone? Take different color markers and circle the zones. Develop a key for each color and the zone it represents.

Why do you think zoning is important to Jonestown? Why would another community choose NOT to zone? Communities have a right to choose whether they implement zoning or not. If they choose to develop laws for zoning, they must follow codes or regulations established by the state through the Municipalities Planning Code.

Communities are always changing. What are some of the things that have changed in your lifetime? What are things you like about your community? Have you noticed that something you liked is not there anymore (i.e. a tree, a patch of woods, a red barn, an ice cream shop)? If you want to keep something you like, you need to recognize why it is special and then work toward ways to keep it for the future. You have a right to express why you like something or don't like something.

How and where can you express your opinion about something happening to your community that you like or don't like? Discuss freedom of speech and freedom of press. Discuss the right to voice your opinion. Discuss the right to organize a group that shares similar opinions. Discuss different ways to voice an opinion (i.e.

write editorials, meet and present to officials, express your thoughts in a flyer, brochure or postcard, etc.).

5. What could we do to protect the land along the river? The rivers are still very special places for the people of Jonestown. There are some laws that can protect the river. The land along the river could become a park for everyone to enjoy. The borough is developing a greenway and trying to save the land. What are some things the community could do to make the area along the river an enjoyable place to visit?

- Plant native trees, bushes and plants along the greenway
- Develop a butterfly garden area
- Develop a brochure about the town and the river
- Develop a trail for other school children to use
- Study the water quality

6. Community of the Future. Communities change. It will happen to every community. Sometimes change will improve the community such as developing a waterfront park in a busy city and sometimes it will be a negative change such as an increase in abandoned stores and deserted lots. Some changes will require people to compromise on their expectations.

What if an industry wanted to build a factory (or shopping center) in Jonestown today? What positive impacts could result from that decision and why? (Record responses.) It could generate an increase in population, an increase in housing construction jobs and materials, additional jobs, improve the economy, benefit the local business community, increase funding toward community improvements such as a new borough hall or park, increase tax revenue to the borough, etc.

What problems could it bring? (Record responses.) Depending on the factory and its environmental ethic, it could increase pollution, noise, traffic, need for road expansion, demand for groundwater, wastewater treatment, unpleasant landscape, odors, dust, future brownfields, etc.

If the decision is inevitable, there are situations that are better than others. There are CHOICES that could be more appealing to the community and choices that may not be beneficial. Some people may think that a factory on the outskirts of the community is a good idea. Some would think that a factory should not be built near the school, or next to the river or on a favorite natural area.

It is the right of the community to envision the future, decide to protect what will maintain a character for the community and protect the natural areas, historic sites, farms and open space BEFORE something happens to them. Jonestown decided that the land along each of the rivers should be protected and enjoyed by future generations.

The community decided they wanted to protect the natural areas along the rivers. They decided they wanted a park for all to enjoy. If the land was developed for private homes or factories, then people could not access the land. It could destroy the beauty of the wooded stream. It was such a beautiful place for people of Jonestown to enjoy.

7. What did they decide to do? The Mayor and the Borough Council along with community leaders, researched grants that would give them money to buy the land or to buy the right to protect the land (conservation easements). They began by talking to people who owned the land and generating interest in the concept of saving the ribbon of "green" land that surrounds their town. They envisioned a park where all the community could walk, ride bikes, play and enjoy. It could be a place for wildlife and a place of beauty. It would protect the landscape along the river and allow people to access the banks for fishing and boating.

What is a "greenway?" A greenway is a corridor of open space. They vary in size and scale from narrow ribbons of green that surround an urban area to wide corridors of wilderness. Greenways can be land or water-based, running along stream corridors or wetlands. Many greenways provide healthy recreation by having a network of trails. Some are primarily recreation corridors. Some primarily provide corridors for wildlife travel. All greenways protect natural, cultural and scenic resources, enhance the natural beauty and improve the quality of life in the communities. The defining characteristic of greenways is connectivity. The purpose is to provide connections to other natural areas and/or connect communities. Greenway development is initiated by volunteers who share a vision with the community. They form a partnership with local, county and state officials.

8. What type of activities would you propose for the Jonestown Greenway? Brainstorm ideas in your group.

Before making any decisions, there is a process that will help you develop a proposal and guide the community to make the best decision. It is important to develop a plan. The plan must address many different considerations. It is important to have a committee because there is a lot of work to be done.

a. Conduct an inventory of the site using the Concept Map. It's important to know what you have. List plants, wildlife, historic sites, wetlands and soils. Note any litter problems, drainage pipes, bridges, etc. Create a map. Identify flood zones; sink holes, highway, noise, and other problems that will be important to the project.

b. Survey the community. Develop a survey and ask the community what they would like. Solicit help. Compile results and incorporate them into your proposal. Try to recruit a representative sampling of the community by asking different ages, careers, genders, businesses, scientists, etc.

c. Survey what services already exist in the surrounding area. You might have a canoe rental facility just upstream from your greenway. You might have a state park that you would like to eventually connect to your greenway. Remember, that the defining character of a greenway is connectivity.

d. Identify funding sources. DCNR's Bureau of Recreation and Conservation is a source for information on funding community projects. Propose sources for funding. Develop a proposal that addresses funding needs. Develop a funding campaign or propose a bond initiative.

e. Develop a vision statement. What do you envision for this greenway? Have group consensus.

f. Brainstorm ideas. What would you like to develop in your greenway to align to your vision statement?

Using a chart, make three columns. In the first column, write down the activity you would like to propose. In the second column, write down what is needed to allow that activity to happen. In the third column, write down what impacts that activity would have on the natural area and the community.

g. Design your greenway. As a group, decide which activities you would allow and where you would place them on your map. Draw or discuss the infrastructure needed for that activity. Develop a proposal based on the consensus of the group. Develop a sign about your project. Present your ideas to the class. Present your ideas to the Borough Council.

h. Help implement the ideas that are approved. Help plant trees and flowers. Help pick up litter. Help create

wildlife habitats and viewing areas. Help by enjoying and using the greenway.

*9. **Congratulations!*** You made a positive contribution to the community that will be enjoyed by all who live there today and in the future. Remember, the community is the result of the culmination of its past right up to the present. But the question now is "Who will shape the community of the future?" YOU will. What do you want your town to look like in 10 years? 50 years? What could happen if no one cared to make decisions that address future change? By protecting the Jonestown Greenway you took leadership in deciding what is important to the community character and made recommendations that will have a positive impact for today and for future families and businesses.

Assessment and Review

1. What are the services provided by a community?

2. What makes a community special?

3. Why is the history of a community important?

4. What did Jonestown do to make their community special?

5. What are some of the ideas proposed for the greenway?

6. Why is a greenway important to Jonestown?

7. Who will visit the greenway?

In the end, *our society will be defined not only by what we create but by what we refuse to destroy.*

John Sawhill (Conservation Advocate)

Activity 1: *Short-Eared Owl , Asio flammeus*

Identifying Characteristics

The short-eared owl received its name from its lack of "ear" tufts. It's about the size of a crow, 13 to 17 inches high, and has a 38 to 44-inch wingspan. Color is variable, from light to dark brown. The dark patches on undersides of wings, and large buff-color patches on upper sides are most distinctive. There are also dark patches around the eyes.

Biology/Natural History

Short-eared owls are birds of open country. They may be found in Pennsylvania throughout the year. They nest on the ground, sometimes in colonial groups. The nest is a slight depression, sparsely lined with grass and feathers, often at the base of a clump of weeds or grasses. A normal clutch consists of four to seven white eggs. Young hatch about three weeks after egg laying, and are able to fly in about a month. Unlike most other owls, the short-eared is active at dusk, dawn and—at times—even in mid-day; therefore, they are seen more often than other owl species.

Preferred Habitat

These owls have been nesting in the southeast corner of Pennsylvania, in the marshland and meadows around the Philadelphia International Airport. Recently, they have been found nesting on reclaimed strip mine sites in Clarion County. Short-eared owls are more likely to be encountered here in the winter when several may be seen together, hovering or flying low and in circles over agricultural fields in search of their main prey, meadow mice.

Threat

Suitable nesting habitat for the short-eared owl is extremely limited in Pennsylvania, and intensive agricultural practices make many potential habitats unsuitable.

Management Programs

In Pennsylvania, most open lands are farmlands and, therefore, subject to repeated disturbance. Accordingly, the welfare of grassland nesting birds is threatened. This may be why the only known nests of short-eared owls were discovered in extensive and low-disturbance open lands such as strip mine reclaimed to grass. Future management, based on the needs for safe nesting habitat for all grassland nesters, should include the creation of large, herbaceous reserves suitable for all grassland nesters. Such reserves might include airports, reclaimed strip mines and large pastures. Primary management of these areas must assure a disturbance-free nesting season.

State Status

Endangered

Source: Wild Resource Conservation Fund

Range

Showy lady's slippers have been found in swamps, bogs and wet woods extending from Newfoundland and Quebec to North Dakota and south through New Jersey, Pennsylvania, Ohio, Indiana, Illinois and Missouri to the Appalachian Mountains as far south as North Carolina and Georgia. Pennsylvania populations historically occurred in alkaline wetlands from northwest through central to southeast areas of the state, but can be found today only in the glaciated northwest.

Appearance

Showy Lady's slipper orchids are named for the inflated pouch formed by the lower petal. The single or paired, 1 to 2 inch white and rose-pink flowers are the largest of our native orchids. Plants stand one to two feet high with 8 inch oval leaves clasping the stems.

Biology/Natural History

This species is a member of the Orchid Family (Orchidaceae). Plants of this genus are perennial herbs. Flowers bloom in June and July.

Threats

Loss of habitat from recreational and housing development in addition to water pollution from mineral extraction have taken their toll. Although 29 populations have been documented by historical collections, only five are known to exist here today. Threats include collection by nurserymen and misguided gardeners.

The probability of showy lady's slippers surviving a transplant from their wetland habitat is poor. Even casual picking of the flowers destroys the plant's chances of reproducing.

Management

One showy lady's slipper population is protected in a natural area owned by the Western Pennsylvania Conservancy. A second is located on a state game lands. Owners of the three other sites must protect the sites.

State Status

Threatened

Source: Wild Resource Conservation Fund

Activity 1: *New Jersey Chorus Frog, Pseudacris feriarum kalmi*

Identifying Characteristics

This subspecies of the western chorus frog is similar in size (3/4 - 1 1/2 inches long), but is somewhat more robust. The outermost pair of the three dark stripes on the back start at the snout and continue backward through the eye and down each side. These may be variously broken. A prominent light line is present beneath each eye along the upper lip.

Biology/Natural History

New Jersey chorus frogs move to small, sometimes temporary, bodies of water to breed, anytime from February to June. Males may arrive at the ponds before females and call loudly from sedgy or grassy clumps in the open. The eggs are deposited irregularly in loose gelatinous masses on the stems of matted vegetation not far below the surface of the water. The 1 to 1.5-inch tadpoles are blackish to olive above with a bronzy belly. They transform to the adult stage within two months. Adults leave the breeding pools following mating and egg laying, and are only occasionally encountered in wooded areas.

Preferred Habitat

In Pennsylvania the New Jersey chorus frog breeds in small, relatively open bodies of water with a mixture of shrubby and herbaceous aquatic vegetation, or sometimes in the shallow backwater areas of larger bodies of water with similar vegetation.

Threats

The populations of the New Jersey chorus frog in Pennsylvania are small and threatened because of heavy

industrial use of the areas they inhabit. Many of the small breeding ponds and forested areas they require have been filled in or cleared. During breeding season, many amphibians are crushed by vehicles while crossing busy roads to get to breeding ponds.

Management Practices

The Fish and Boat Commission reviews projects in which possible threats to habitat of this small frog is concerned. The populations are monitored each spring.

State Status

Endangered

Source: Wild Resource Conservation Fund

Range

The historic bog turtle range runs from southern New England to northern Georgia. A 250-mile gap in Virginia separates the species into distinct northern and southern populations.

In Pennsylvania, the turtle is found mostly in the rapidly developing southeastern portion of the state. Turtle populations once found in the western part of the state are gone.

Appearance

The bog turtle is one of the smallest North American turtles with the adult shell measuring 3 to 4.5 inches in length. It is easily distinguished from other turtles by the large, conspicuous bright orange, yellow or red blotch on each side of its head. The upper shell is dark brown with yellow to orange markings and covered with ridged plates that are eventually worn smooth; the lower shell is dark brown or black, sometimes with scattered light markings.

Biology/Natural History

Bog turtles are active from spring to fall, and hibernate during the winter. They are most difficult to find in midsummer, possibly inactive during the hottest part of the year. When danger threatens, the turtle burrows rapidly into the mucky bottom. They eat a diet of beetles, insect larvae, snails, seeds and millipedes. Female bog turtles mature at 5 to 8 years of age. They mate in May and June, and in June or July the females deposit two to six white eggs on sphagnum moss or sedge tussocks that are exposed to sunlight. The eggs hatch after an incubation period of 42 to 56 days, and the young emerge in August or early September. Infertile eggs are common, and not all females produce egg clutches each year.

Preferred Habitat

Bog turtles live in wetlands which are shallow, spring-fed fen; sphagnum bogs; and swamps, marshy meadows and pastures with soft, muddy bottoms, slow-flowing water and open canopies.. They depend on this hydrologic mosaic, using shallow water in the spring and mud during winter hibernation. These wetlands gradually undergo succession and become a closed-canopy, wooded swamps unsuitable for bog turtle habitation. Historically, bog turtles probably moved from one open-canopy wetland patch to another, as succession closed wetland canopies in some areas and natural processes, such as fire, opened canopies in other areas.

Threats

The primary reason for the bog turtle's status is the draining or destruction of its habitat. Bog turtles have always been considered the rarest of North American turtles and are highly valued by turtle fanciers in this country, and possibly twice as much overseas. Many, therefore, have been illegally removed for commercial purposes. Because their habitats are widely separated, other turtles are not likely to move in and replace those removed.

State Status

Endangered

Federal Status

Considered for listing as a threatened species.

Source: Wild Resource Conservation Fund

Activity 1: *Whitetailed Deer - Page 1 (1/3)*

The white-tailed deer, *Odocoileus virginianus*, received its name from the white hair on the underside of its tail which it occassionally holds erect so that the white undersurface is visible. Whitetails belong to the Cervidae family, split hoof mammals with no incisor teeth in the upper jaw, which in North America includes the elk, moose, caribou and mule deer. They are classed as ruminant animals, meaning they have a four-chambered stomach and frequently chew a "cud." Adult male whitetails grow and shed a set of antlers each year. The northern woodland whitetail is the subspecies which occurs commonly throughout Pennsylvania.

In Pennsylvania the average adult buck weighs about 140 pounds live weight and stands 32 to 34 inches at the shoulder. He is about 70 inches long from the tip of his nose to the base of his tail. Does tend to average less in weight and body length than males of the same age from the same area. Hair color is alike in both sexes. Fawns are born with white spots in the upper coat. When a fawn is lying on the ground or in dry leaves its coat provides excellent camouflage for the fawns.

Deer can run at 40 miles per hour for short bursts and maintain speeds of 25 miles per hour for longer periods. They are also good jumpers capable of clearing obstacles up to nine feet high or 25 feet wide. The air-filled hairs of their coats enable them to swim easily. They mark trails with scent glands and have an excellent sense of smell.

Although antler growth is evident on male fawns, a buck's first set of antlers begins to grow when it's about 10 months old. Each year after the buck reaches this age, it will grow and shed a new set of antlers. If the yearling buck comes from an area with poor food conditions, his first set of antlers may be only "spikes" -- antlers consisting of single main beams only. Spikes are more common in yearling deer than older ones because antler growth starts at a time when the young buck's

body is still growing rapidly. But because antler development is tied in closely with the animal's nutritional status, older bucks might also carry spikes if they come from an area with poor food conditions.

Antlers generally begin to grow in March or April. Growing antlers are covered by a skin called "velvet." This velvet is covered with soft hairs and contains blood vessels which supply nutriments to the growing antlers. The solid bone-like substance which makes up the polished antler is secreted by cells on the inside of the velvet. By August or early September antler growth ceases and the velvet is shed or rubbed off by the buck as he rubs saplings or rocks with his antlers. Polished antlers are carried throughout most of the breeding season, which can last into late February. The antlers are shed at the end of this period, and a new set begins to grow in March or April.

Social Organization

The social organization of the whitetail is largely matriarchal. The most common social group is an adult doe, her fawns and her yearling female offspring.

Sources: Chuck Fergus, PA Game Commission, The Impact of Deer on the Biodiversity and Economy, Patriot News

Sometimes three or four generations of related does are present in a family group. When fawning season rolls around in late May, adult does leave the family group and remain alone to bear and rear their fawns.

Siblings tend to remain together throughout most of summer. Sibling groups with yearling bucks separate in September as the rut approaches. Yearling bucks tend to disperse from the mother's home range at this time. Yearling does remain in the mother's home range and generally rejoin their mother and her new fawns between September and October.

During the breeding season adult and yearling bucks tend to stay alone except when in pursuit of a female approaching estrus. After the breeding season in late January, yearling and adult bucks form loose associations of small groups, usually two to four animals, which remain together throughout most of the winter and summer months. These groups break up around September when the rut starts.

The mating season of white-tailed deer begins as early as September and can last into late January. Breeding activity reaches its peak in mid-November, and most adult females have been bred by the end of December.

Food Habits

Whitetails eat a wide variety of herbaceous and woody plants. In a Pennsylvania study, more than half the food eaten by deer were tree, shrub or vine species, the remainder, herbaceous plants. Whitetail food preferences are largely dependent on plant species occurring in an area and the time of year. Green leaves, herbaceous plants and new growth on woody plants are eaten in the spring and summer. In late summer, fall and early winter, both hard and soft fruits such as apples, pears and acorns are a major component of their diet. In winter, evergreen leaves, hard browse and dry leaves are eaten. Good supplies of a variety of natural foods at all times of the year are essential if an area is to carry a healthy deer population.

Habitat

Deer prefer to eat the buds, stems and leaves found in the forest understory. Young forests in the seedling/sapling stage especially provide an abundance of food and hiding space. These forests are created when a disturbance such as a fire, insect outbreak or timber harvest kills or removes mature trees, allowing space for new trees and plants to grow. Even-age forest management practices such as clear-cutting and shelterwood harvests help create these young forests that deer prefer. To ensure a sustainable forest, timber harvests should account for "regeneration," the young trees and plants that will make up the future forest. Also, snags, den trees, mast trees and unique tree species should be left behind to assure a good habitat diversity for an abundance of wildlife.

Management

Deer are not only part of our beautiful wildlife heritage but they are a valuable natural resource to Pennsylvania. They are at the heart of a rich hunting and wildlife-watching tradition for millions of Pennsylvanians. Hunting, fishing and wildlife-related recreation approaches $6 billion for the state's economy. Deer have adapted readily to the changes in land development. Without natural predators and hunting, they can quickly overpopulate the range they inhabit.

Since the early 1990s, the deer population has grown from 1.2 million to nearly 1.6 million. They occupy every habitat from forests, farmlands, wetlands, suburban neighborhoods and urban lands. When overpopulation occurs, deer strip their habitat of its life-supporting qualities, not just for deer, but for many woodland

Sources: Chuck Fergus, PA Game Commission, The Impact of Deer on the Biodiversity and Economy, Patriot News

wildlife species. Deer invade backyard gardens for food as well as regenerating forests. Crop damages and other farm property problems relating to deer have been increasing. Deer-vehicle collisions have escalated. Up to 100,000 deer-vehicle collisions occur each year. This translates into 3,200 to 5,000 human injuries and $220 million in vehicle damage.

Every three years more than 350,000 acres of rural and forested habitats are being converted to other uses in Pennsylvania. Deer herds are adapting to this changing landscape. Land development can sometimes offer additional food sources for deer and refuges to survive hunting season. This dynamic can lead to ballooning populations that can wreak havoc on surrounding forests. The dilemma must address the impact of land development on the deer herd, its impact on the surrounding forest, and efforts to control them through hunting. Foresters are concerned about the impact of deer on regenerating forests. Currently, less than 50 percent of Pennsylvania's forests are regenerating. Alleviating deer impacts will help ensure more forests regenerate to provide clean air, clean water, plant and wildlife habitat, and provide wood products to society through the state's $4 billion forest products industry.

In some areas, deer herds impact agricultural crops and gardens. Farmers report losing an estimated $9,000 a year to deer damage. The key to managing deer is keeping their populations at healthy levels. This essentially entails ensuring they don't exceed their range's ability to support them. As development occurs, the pressure on deer populations grow.

Managing the deer population brings controversy. In Pennsylvania, hunting is a primary tool to adjust deer populations. There are pros and cons to the issue of doe and buck seasons as well as to the success of hunting. Population control can be facilitated through a rationed harvest of female deer. Deer populations and density goals based upon habitat, along with hunter success rates, are used to gauge how many hunting permits should be issued. Public support of a sound management program which includes addressing habitat management is essential to maintaining the deer population as a public asset to be enjoyed by future generations of Pennsylvanians and visitors to Pennsylvania

Sources: Chuck Fergus, PA Game Commission, The Impact of Deer on the Biodiversity and Economy, Patriot News

Name _____

Title of Article_____ **Source of Article** _____

Read the article and answer the following questions. Share and discuss with others.

1. Identify the problem presented in the article.

2. Identify the issue(s).

3. Is this problem local, regional, national or international? Why?

4. Who are the different groups or individuals that are interested in or affected by the problem? Why are they concerned? What is their view?

Who?	**Why?/What?**

5. What factors are affecting the problem?

6. What are the possible solutions to the problem?

7. List three additional things you want to know and where would you find information.

Describe examples of the services provided by ecosystems.

- **Gas regulation**
- **Climate Regulation**
- **Energy**
- **Habitats**
- **Water Regulation**
- **Water Supply**
- **Erosion Control**
- **Soil Formation**
- **Nutrient Recycling**
- **Waste Treatment**
- **Pollination**
- **Biological Control**
- **Refuge**
- **Food Production**
- **Genetic Resources**
- **Recreation**
- **Cultural**
- **Carbon Sequestration**
- **Other**

Distribute this worksheet to groups. Participants are to discuss and describe many examples of the services provided by ecosystems. Discuss in large group.

- **Gas regulation:** Plants provide CO2 + O2 balance. ***For example:*** One tree produces enough oxygen for a family of four. For each ton of growing wood, an estimated 1.47 tons of carbon dioxide are removed from the air and 1.07 tons of oxygen are produced.

- **Climate Regulation:** Clouds, greenhouse gases, etc. ***For example:*** Forests are important sinks for greenhouse gases and provide natural barriers to wind, snow, rain and solar radiation.

- **Energy:** Provide thermal heat, wind, fossil fuels.

- **Habitats:** Regulate disturbances such as floods, drought, and winds.

- **Water Regulation:** Pervious surfaces allow for recharge, and transpiration.

- **Water Supply:** Drinking water for households, industry, and electric energy. ***For example:*** Forest soil absorbs runoff, filters water and traps/transforms contaminants.

- **Erosion Control:** Retention of soil within an ecosystem. ***For example:*** Trees and other plants reduce the impact of rain while root systems hold soil in place.

- **Soil Formation:** Weathering of rock and accumulation of organic material.

- **Nutrient Recycling:** Nitrogen fixation and cycling of nutrients.

- **Waste Treatment:** Detoxification by plants that absorb pollutants and decomposition.

- **Pollination:** Insects, bats, and birds allow for propagation of vegetation.

- **Biological Control:** Predator control of prey and vegetation control.

- **Refuge:** Refuge for nurseries and habitats for migratory species. ***For example:*** Forests provide a diversity of habitats over time.

- **Food Production:** Fish, game, and crops.

- **Genetic Resources:** Resources for medicine and breeding.

- **Recreation:** Hiking, hunting, fishing, etc.

- **Cultural:** Aesthetic values, artistic inspiration, and education. ***For example:*** Forests provide Christmas trees, artistic inspiration, and outdoor classrooms

- **Carbon Sequestration:** Carbon emissions that cause global warming are "stored" in forests and soils.

- **Other**

Activity 2: *Thank You Trees – Page 1 (1/2)*

Name_____

Draw a tree in your community. On each branch list a reason that trees are important.

List the benefits of trees:

Look at photos of trees and determine the benefits. Match these categories to the photos.

Pleasant Attractive Surroundings

- Screen unpleasant views.
- Frame attractive views.
- Cool the air and provide shade and lower average daily temperatures.
- Bring beauty and character to neighborhoods.
- Provide breaks for cold winter winds.
- Buffer and reduce traffic and other noise.
- Provide attractive habitat for desirable birds and wildlife.

Social Improvement

- Calm traffic.
- Separate pedestrians and traffic.
- Encourage walking.
- Reduce family and community crime and violence.
- Promote self discipline and reliance, exploration, and increased student concentration.
- Increase adult concentration and work levels.

Good Health

- One hundred trees remove 10,000 lbs of carbon dioxide and 400 lbs ozone.
- Clean pollutants out of the air and water.
- Improve health, reduce stress and disease, increased healing.

Create Pride in Your Community

- Help communities meet and work together and promote community interaction.
- Provide opportunity for personal renewal and restoration.
- Promote economic benefits.
- Save energy and cut heating and air-conditioning costs.
- Save costs of energy production.
- Reduce storm water runoff, erosion and damage to streams.
- Promote people involvement and spending in commercial sales.
- Increase property values and property tax revenues.

One large tree can provide the following benefits each year.

Planted on the west side of the home, a tree saves $29 in summertime air conditioning by shading the building and cooling the air (250 kWh). This is about 9 percent of a typical residential building's total annual air conditioning cost.

A tree absorbs 10 lbs. of air pollutants including 4 lbs. of ozone and 3 lbs. of particulates. The value of pollutant uptake by the tree is $45 using the local market price of emission reduction credits. Uptake of NO_2 by the tree (1.07 lb.) is equivalent to NO_2 emitted by a typical car driven 188 miles.

A tree intercepts an average of 760 gal. of rainfall in its crown, thereby reducing runoff of polluted stormwater and flooding. This benefit is valued at $6 based on local expenditures for water quality management and flood control.

Cleans 330 lbs. of CO_2 from the atmosphere through direct sequestration in the tree's wood and reduced power plant emissions due to cooling evergy savings. The value of this benefit is $5. The tree reduces the same amount of atmospheric CO_2 per year as released by a typical car driven 388 miles.

Adds about 1 percent to the sale of the property, or about $25 each year when annualized over a 40-year period.

Ecosystems provide economic benefits.

Corporate CEOs say quality of life for employees is the third-most important factor in locating a business, behind only access to domestic markets and availability of skilled labor. Owners of small companies ranked recreation/parks/open space as the highest priority in choosing a new location for their business (Economic Benefits of Open Space, Trust for Public Land, 1999). In the year 2000 alone, the economic value of insect-pollinated crops in the United States was estimated to be between $20 and $40 billion. Thus, the loss of pollinator species could lead to a series of devastating losses to our economy and food supply. (*Endangered by Sprawl: How Runaway Development Threatens America's Wildlife*, National Wildlife Federation, 2005—www.nwf.org)

"The real estate market consistently demonstrates that many people are willing to pay a larger amount for a property located close to parks and open space areas than for a home that does not offer this amenity," writes John L. Crompton, a professor at Texas A&M University who has published extensive research on parks and recreation. (*Why America Needs More City Parks & Open Space*, Paul Sherer prepared for Trust for Public Land, 2003—www.tpl.org)

American Forests (a conservation organization) estimates that trees in the nation's metropolitan areas save the cities $400 billion in the cost of building stormwater retention facilities. Yet natural tree cover has declined by as much as 30 percent in many cities over the last several decades. (*Why America Needs More City Parks & Open Space*)

A study of 27 water suppliers conducted by the Trust for Public Land and the American Water Works Association in 2002 found that more forest cover in a watershed results in lower treatment costs. According to the study, for every 10 percent increase in forest cover in the source area, treatment and chemical costs decreased approximately 20 percent, and approximately 50 to 55 percent of the variation in treatment costs can be explained by the percentage of forest cover in the source area. (*Protecting the Source: Land Conservation & the Future of America's Drinking Water*, Trust for Public Land, 2004—www.tpl.org)

Trees more effectively and less expensively manage the flow of stormwater runoff than do concrete sewers and drainage ditches. "By incorporating trees into a city's infrastructure, managers can build a smaller, less expensive stormwater management system," according to American Forests Urban Resource Center. (*Why America Needs More City Parks & Open Space*)

"The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic and aesthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustees of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people."

-Article 1, Section 27 of the Pennsylvania Constitution

Case Study of the Upper Perkiomen School District from "Saving Land Saves Money" (view publication at www.conserveland.org/lpr/library)—Montgomery County Lands Trust, 2002. Compare the one time purchase price cost of the easement to the shortfall per year. To determine the break-even period, divide the purchase price of the easement by the shortfall.

Development of the "100 Acre Farm."

A farmer is selling his 100 acre farm. A developer will buy the property and build houses on 1.42 acre lots with land set aside for roads, drainage area, and commons.

There will be 0.66 homes per acre. How many houses can be built on 100 acres? _____
(100 acres **x** 0.66 homes per acre **=** total homes per acre)

It is estimated that there are 0.8265 school-age children per home. How many children would be in the subdivision? _____
(Number of homes **x** 0.8265 **=** total children in the subdivision)

$7,995 is the cost of public school for each participant. How much does it cost to send the children of the subdivision to school? _____
($7,995 **x** number of children **=** public school costs/subdivision)

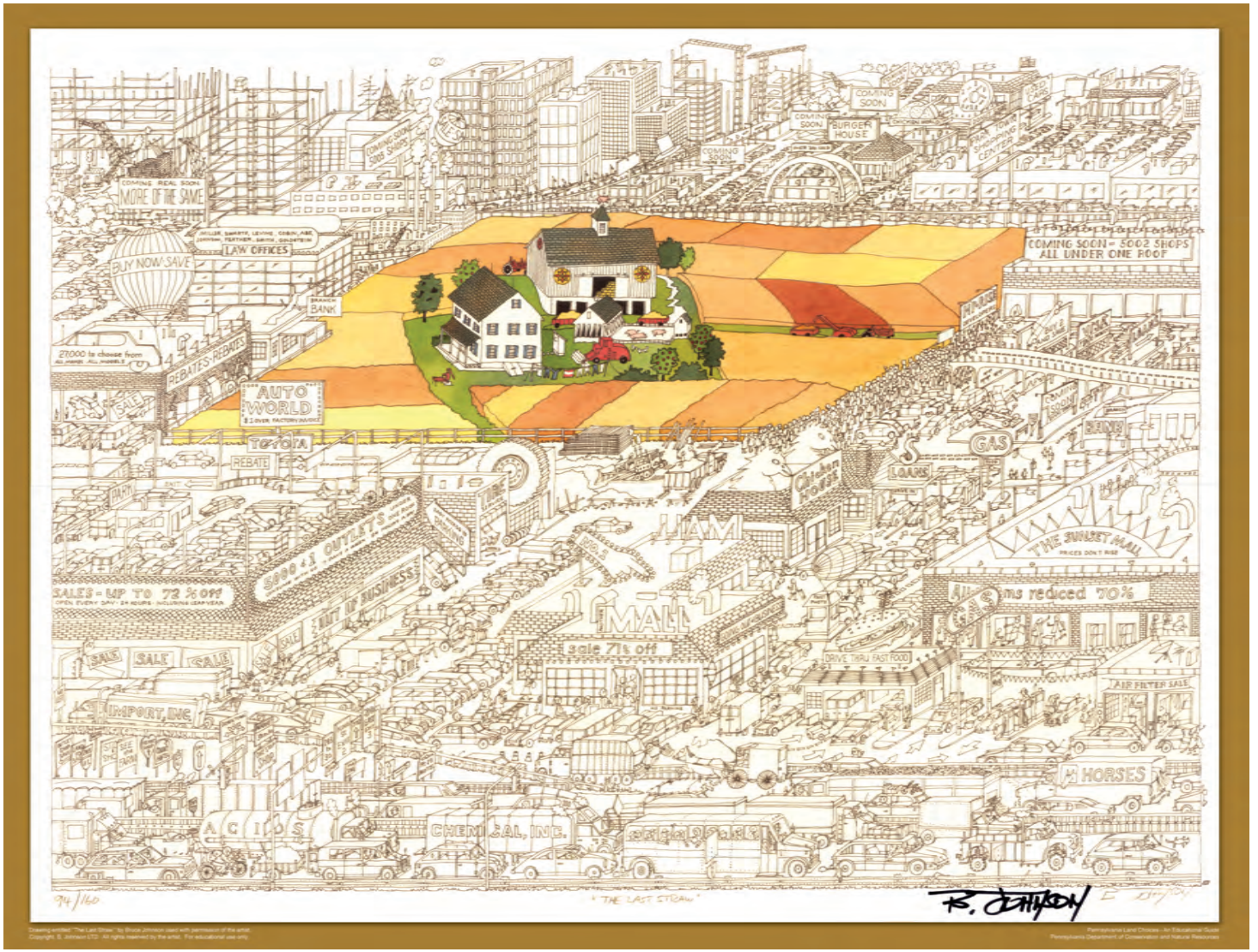
In this community, the average school-tax revenue per home is $1,779. Each home in the new subdivision must pay an average school tax of $1,779 a year. How much public school revenue will be collected from the homes in the subdivision each year? _____
($1,779 **x** number of homes **=** public school revenues/year)

What is the cost to the community for allowing the farm to be developed? _____
(Dollars of revenue/year **–** public school costs **=** dollars of shortfall)

Preservation of the "100 Acre Farm" by purchase of the Conservation Easement.

The average cost per acre for the easement purchase is $4,349. How much is the total purchase price of the easement? _____
(100 acres **x** $4,349 **=** one time purchase price cost of easement)

Activity 3: *The Last Straw by Bruce Johnson (www.bjohnsonltd.com)*



The Last Straw has been provided by Bruce Johnson solely for educational purposes in connection with PA Land Choices.

A larger version of this photo is located in back pocket.

While looking at the The Last Straw artwork by Bruce Johnson, answer the following questions.

1. What message is the artist, Bruce Johnson, expressing in this poster?

2. Why did the artist color the farm and not the rest of the poster?

3. Describe the emotional, social and political contrasts between the farm and the rest of the poster.

4. Make a list of the things people are doing in the poster.

5. What are the dominant types of services depicted throughout the poster?

6. Does this reflect aspects of real life in your community?

7. How do you think the artist feels about what is happening in "real life?"

8. Find 5 signs, slogans, words, and/or place names discuss the message behind their meaning.

9. What messages are repeated throughout the poster?

10. Find drawings (outside of the farm) that are connected to farm life.

11. Find items that demonstrate things that are potentially harmful.

12. Find some trees? What is happening to them?

13. Why is there a group of people lined up on the border of the farm?

14. Why did the artist name the painting "The Last Straw?"

15. What could the community have done to change the situation?

How much open space is needed?

Every environment has a carrying capacity for specific organisms that live there. The carrying capacity is a point at which it can no longer support additional members of species with the natural resources they need to survive.

Carrying capacity for each animal species depends upon the amount of natural resources available on a given area of land. For example, to raise one cow, you would need one acre (about the size of a football field) of very rich pastureland, or ten acres of rangeland, or 100 acres of scrub land.

How many acres of land do you think each wild animal requires to meet their needs for an entire life span? Remember an acre is about the size of a football field and the animal must get all of its needs from its habitat.

- How much does a cottontail rabbit need? (1 acre)
- How much does a chipmunk need? (1.2 acres)
- How much does a black bear need? (38,400 acres or 60 square miles if it is a male and 3,200- 12,800 acres or 5-20 square miles, if it is a female).

Each animal has different needs. Many species need large natural woodlands and wooded corridors for survival.

- Tree species need 10 acres (300 feet minimum width)
- Forest dwelling birds need 50–1,000 acres
- Owls and raptors need 600—1,000 acres
- Large mammals need 100 acres and up

From: Guiding Growth, Compiled by CH2M Hill

If you are asked how much land a human needs for survival, we don't often realize how much land is needed to provide food, fuel, shelter and textiles. How many acres of land would one person need to provide basic needs? That is difficult to answer since different lifestyles would determine how much land a human requires. American society creates demands on more land than any other society to meet its standard for consumer goods. Some societies need much less. According to Dr. Edward Passerini of the Univeristy of Alabama, a human needs 2.5 acres of land to basically survive.

Widely diversified ecosystems are much more likely to survive periods of environmental stress than are ecosystems with little diversification. Smaller isolated areas are more vulnerable than larger ones to extinctions due to disease, inbreeding and chronic disturbances of habitat. When wooded areas are fragmented into pieces, it is difficult for organisms to move from one habitat fragment to another.

According to Guiding Growth, habitats will lose between 30-50 percent of their species for each 90 percent reduction in area. Areas of less than 10 acres have little value for maintaining species diversity while areas of 50 –1,000 acres, may be very helpful in maintaining diversity. Areas less than 35 acres have significantly fewer species than areas of over 175 acres.

Depth is a consideration. A wooded area must be at least 300 feet wide if it is to provide a deep forest habitat. The extent of natural boundaries or edges between ecosystems is another consideration such as edges between forests and fields creating a diverse area which benefits some game animals and some common non-game animals such as raccoons and opossums.

Current strategies must recognize the need to protect regional ecosystem patterns and processes. One large forest is better than a medium forest but a medium forest is better than four adjacent forests, four adjacent forests are better than four separate smaller forests and a compact forest is better than a linear forest.

How to do we protect large natural areas? Land is protected in Pennsylvania by a variety of entities, including state agencies like DCNR and the PA Game Commission; federal agencies like the National Parks Service and the United States Department of Agriculture; local and county governments and private organizations such as land trusts and trail organizations.

Our state conservation agencies add an average of 10,000 acres every year to a 4-million acre system of public lands. The Bureau of Forestry manages 2.1 million acres of state forests. The Pennsylvania Game Commission manages 1.4 million acres of state game lands.

Another method of permanently protecting land involves acquiring the property or property rights through a land trust or conservancy. Landowners who wish to preserve a beloved place, make the decision to sell or donate their property rights or entire property to a land trust, which in turn ensures the safeguard of the property in perpetuity. As of the end of 2007, 476,550 acres of Pennsylvania have been protected by Pennsylvania land trusts.

Most land trusts are private charitable corporations. Some are governmental or quasi-governmental agencies that operate with much of the flexibility and freedom of a private land trust. Some land trusts own and operate preserves and recreation areas open to the public. Others own no land at all but hold conservation easements, which protect certain natural values on properties. Others work to acquire and then transfer critical land to government for use as parks, game lands, etc. Learn more by reading the fact sheet on land trusts or by visiting www.conserveland.org.

Municipal Tools: Municipalities are given some flexibility and control in determining where development is placed and which lands should be protected through zoning and planning tools.

Additional municipal tools may be found on the Land Recycling Fact Sheet. Visit www.conservationtools.org to learn more about additional resources available.

Conservation Subdivision Design: Conservation subdivision design allows communities to implement a subdivision and land development ordinance that requires a developer to dedicate a significant portion of land to permanent open space uses. This strategy allows developers to create open space buffers along boundaries of protected properties (e.g. a state park or forest) thus expanding the natural space.

Transfer of Development Rights: Transfer of development rights is a program set up either in a community or across several communities where a sending zone for development is established and a receiving zone for a development is established. Landowners in one area sell their development rights to landowners so developers may build in another area. Land from which development rights are sold is permanently protected while land where the sold rights are applied is enhanced in development value.

Open Space Plan: Open space plan identifies the critical lands and resources within a community that are worthy of protection. These areas may be comprised of farmland, water resources, wildlife habitat, scenic areas and may include cultural or historic resources. It is part of the comprehensive plan and is usually necessary for grant funding.

Open Space Referendum: Municipalities are authorized by PA Act 153 ("Open Space lands, Acquisition and Preservation") to purchase land or easements for the purpose of conservation. "Local governments may levy a tax on real estate or earned income above the existing limits of the Commonwealth's laws, but only if they first receive referendum approval from the voters. A plan to protect these resources is required prior to expenditures of open space tax revenue.

What is happening to farmlands?

Development is more likely to take place on farmland than on any other type of land. A study in the Philadelphia area indicates that of all developed land between 1970 and 1980, 67 percent had been used for farming before it was developed. Since 1954, the area of cropland in Pennsylvania has dropped from 7.3 million acres to about 5.4 million acres. Counties such as Adams, Cumberland, Northampton and Lancaster have faced the dilemma similar to York where in just 30 years, almost 30 percent of York County's farmland was lost to suburban development. Pennsylvania loses between one and six acres of agricultural land for each new household created. Once developed, the valuable soils are lost along with the entire service and character that agriculture provides to communities.

Despite the loss of farmland, the agricultural industry remains sizable and vigorous. Well managed farmland protects soil and water resources and can prevent flooding. Many farmers support conservation measures such as conservation tillage in their fields, building manure storage facilities and constructing stream bank fencing to protect water quality. Many farmers set aside land to return to its natural state.

The issue of farmland preservation has many aspects. It is an important economic industry for Pennsylvania. Farmers and their families are not the only ones benefiting from a successful agricultural industry. A multitude of industries are stabilized by a strong agricultural economy. It is part of the Pennsylvania culture, drawing tourists worldwide and providing a pastoral countryside for residents and visitors.

Agriculture is Pennsylvania's single largest industry. Farming costs municipal governments far less than other forms of development and pays more in property taxes than it receives back in services. Such low density development demands far fewer governmental services, placing fewer children in local schools, few roads, no sewers and usually no public water.

Today, Pennsylvania leads the nation in the total number of farms and acres preserved for agriculture. Pennsylvania is preserving more farmland than any other state.

What tools are available to protect farmland?

Agricultural Conservation Easements: Agricultural conservation easements are legal agreements that permanently protect farms from development. Landowners sell conservation easements to a government entity or land trust. The buyer pays the farmer for the value of the land for agricultural use and the value of the land for its "highest and best use" (which is usually a development). Farmers continue to own and manage the land. If they sell their land, it must remain agricultural. The first easement was purchased in December 1989 and to date, approximately 3,745 farms were approved for easement purchases totaling over 210,000 acres.

Farmers apply for selection and farms must meet several criteria to be accepted. They must have a minimum of 50 acres. Parcels as small as ten acres may be preserved if next to other preserved farmland. They must be part of an Agricultural Security Area.

Agricultural Security Area: An agricultural security area is a designation given by local government to at least 250 acres of farmland (owned by one or more farmers). It provides protection from local ordinances that restrict farm practices and nuisance ordinances. It limits taking of land by eminent domain.

Agriculture Protection Zoning (APZ): APZ ordinances designate areas where farming is the primary land use. It limits non-farm uses such as high-density development and restricts subdivision of land into parcels that are too small to farm. This stabilizes the land base by keeping large tracts of land free of development and reduces conflicts between farmers and their non-farming neighbors.

Transferable Development Rights (TDRs) and Purchase of Development Rights (PDRs): TDRs is a zoning tool that allows conservation and development to coexist within a municipality. Growth is directed to preferred locations through the sale and purchase of development rights. Development rights can be separated from the title of a property. These rights can be transferred to another location where development is desirable. A landowner can transfer the right to develop one parcel of land to a different parcel of land to protect farmland or open space. The farmer keeps possession of the land and right to farm it. It allows the purchaser of the development rights to develop another parcel more intensively than would otherwise be permitted, ideally in an area that is more suitable for intense development. The PDRs are the zoning tool that allows a person or an entity to buy the right to develop land from the landowner. A municipality could pass a bond issue to buy the rights and "bank" them. A developer may purchase the development rights from the municipality when he wishes to develop an area with high density. TDRs give substantial control to the municipality since it is the municipality that owns all the development rights. Municipalities need to locate revenues to purchase the development rights. TDR programs can only be used by a single municipality or among municipalities with a joint ordinance.

Clean and Green: PA Act 319 is called Clean and Green. It is designed to provide tax incentives to voluntary landowners who preserve land in agricultural use and/or forest reserve. It allows agricultural land to be taxed at its value for agriculture instead of its market value. It provides land protection by penalizing the farmer with rollback taxes and penalties if the farmer decides to sell and develop the land instead of maintaining it as farmland.

Land Trusts

The surest methods for permanently protecting land involve acquisition of property rights by land trusts. It is the use of conservation easements that most clearly defines a conservation organization as a land trust. Land trust efforts revolve around working cooperatively with landowners and crafting projects with win-win outcomes for communities.

As of the end of 2007, 476,550 acres of Pennsylvania have been protected by Pennsylvania land trusts.

Land trusts vary in character and priorities. Most land trusts are private charitable corporations. Some are governmental or quasi-governmental agencies that operate with much of the flexibility and freedom of a private land trust. Some land trusts are quite small, run entirely by volunteers, doing their work in just one municipality or small watershed. Some utilize large staffs of professionals and work region or nationwide.

Some land trusts own and operate preserves and recreation areas open to the public. Others own no land at all but hold conservation easements, which protect certain natural values on properties. Others work to acquire and then transfer critical land to government for use as parks, game lands, etc.

Land trusts may have one or more conservation priorities. They may conserve land to protect our rivers, streams and groundwater. They may protect community open space for new parks, scenic views, wildlife preserves or neighborhood gardens. They may conserve productive farmland or working forests. Some focus on protecting biodiversity while others preserve traditional hunting grounds.

More than 1,200 land trusts work in all fifty states, conserving land using a variety of techniques. Eighty of these organizations work to protect Pennsylvania's special places. Regardless of size, methods and priorities, land trusts share a commitment to conserving important lands for future generations. Land trusts can also work on land use planning, nature education, trail development, and other areas.

The three methods that land trusts protect land are conservation easement, fee simple ownership and reconveyance.

A Conservation Easement: A conservation easement is a legal agreement between a landowner and a conservation organization that limits certain specified uses on all or a portion of a property for conservation purposes while leaving the property in the landowner's ownership. Easements are almost without exception of perpetual duration. They are recorded at the county office where all deeds are recorded, and the easement's terms are binding on all future owners of the eased parcel.

Through the use of a conservation easement, landowners may still retain the right to use their property for many different purposes, subject to local zoning and public health and safety requirements. For example, an owner can plant trees or cut them down, build buildings or demolish them, grow crops or dig holes, allow public access or prohibit it, subdivide the property, etc. To understand the conservation easement concept, it is helpful to think of these rights as a bundle of rights. A landowner may donate or sell the whole bundle, or just one or two of the rights in the form of a conservation easement.

A conservation easement is a legal and permanent agreement between a landowner and a conservation organization that limits certain specified uses on all or a

portion of a property for conservation purposes while leaving the property in the landowner's ownership. Easements are recorded at the county office where all deeds are recorded, and the easement's terms are binding on all future owners of the eased parcel.

Every conservation easement is unique, the terms of the easement tailored to the particular property and to the particular needs and goals of the landowner and conservation organization. An easement might state, for example, that no building or road may be placed within 200 feet of a stream passing through a property but allow for a house to be built on another portion of the same property. Another easement might permit farming on a property but forbid residential, retail and industrial development. Yet another easement may prohibit all activities except for sustainable forestry and recreation. The flexibility and applicability of conservation easements is nearly endless.

A variety of model easements have been developed through DCNR and the Pennsylvania Land Trust Association for various types of conservation goals – these documents may be downloaded at conserveland.org and include:

Conservation Easement: Provides for a comprehensive level of protection with flexibility to customize for specific conservation needs.

Trail Easement: Provides specific language for developing a right of way agreement for public access of a linear tract of land for recreational purpose.

Riparian Forest Buffer Protection Agreement: A single-purpose document, designed for protecting a narrow ribbon of land along a waterway. The model could be used in combination with or independent of CREP.

Fishing Access Agreement: Model easement provides a framework for conservation organizations and governmental entities to build cooperative relationships with private landowners to ensure responsible fishing opportunities for the public while keeping properties in the control of the owners.

Water Quality Improvement Easement: Help secure long-term access through and to property for the purpose of remediating the effects of abandoned mine drainage.

Fee Simple Title Ownership: Fee ownership involves full acquisition of the land and enables the land trust to control all aspects of use and management of the property and its resources. With Fee simple ownership, a land trust may provide the strongest guarantee of long-term conservation. However, because fee ownership may be costly or require additional resources, it is not always the best option or even a viable one.

Reconveyance: At times a land trust may operate as a third party, first acquiring the land from the original owner and then transferring the ownership of the property to another entity for the sole purpose of conservation. Usually this entity is a governmental unit such as a state agency or municipality but sometimes it is another land trust.

According to the 2007 census data collected from the Pennsylvania Land Trust Association, 2,233 conservation easements are held by 62 land trusts across the state. Sixty percent of Pennsylvania's land trusts are operated entirely by volunteers. Half of the Pennsylvania land trusts that exist today were formed after 1989.

For additional information regarding land conservation, including current data on conserved lands in Pennsylvania, visit the Pennsylvania Land Trust Association's website at www.conserveland.org.

What is an Environmental Advisory Council?

An Environmental Advisory Council is a group of 3-7 community residents, appointed by local elected officials, that advises the local planning commission, park and recreation board and elected officials on the protection, conservation, management, promotion and use of natural resources within its territorial limits. Municipalities are authorized to establish EACs through Act 177 of 1996, originally Act 148 of 1973.

EAC members devote time and energy to assist elected and appointed officials in protecting the environment. They can act on a municipal or multi-municipal level.

For more information, review the EAC Handbook available at www.eacnetwork.org.

Why are EACs a priority for Pennsylvania?

Through the legislature, Pennsylvania has chosen to delegate much of its power to regulate land to the local government. As a result, the Commonwealth of Pennsylvania has over 2,560 local governing bodies. The decisions these governing bodies make on a variety of issues, from land use designations to stream corridor protection, have direct impacts on natural resources within individual municipalities and beyond. EACs, as part of local government, work directly with municipal officials to help them make environmentally sound decisions - and protect the health and quality of life of our communities.

Where are there other EACs in Pennsylvania?

As of 2008, there are over one hundred EACs in Pennsylvania and they are continuously being formed. To locate EAC's across the state, use the interactive map at www.eacnetwork.org/map.asp.

What do EACs do?

In accordance with Act 177, EACs are authorized to:

- Identify environmental problems and recommend plans and programs to protect and improve the quality of the environment;
- Make recommendations about the use of open land;
- Promote a community environmental program;
- Keep an index of all open space areas to determine the proper use of such areas;
- Review plans, conduct site visits, and prepare reports for municipal officials; and
- Advise local government agencies about the acquisition of property.

What don't EACs do?

- EACs do not regulate; they are advisory only.
- EACs do not take the place of or compete with planning commissions or park and recreation boards; they augment and work closely with them.
- EACs are not activist or extremist environmental groups—they are part of the local government and accomplish the most when they work well with local officials.
- EACs do not compete with local grass-roots organizations, such as watershed associations.
- They are contact points and local government liaisons for these groups.
- EACs do not add bureaucracy to the local government- they have an organized procedure for participating in land use decisions.

Why start an EAC?

- While municipal officials have a high demand for their time and attention, an EAC can devote their full attention to environmental protection. EACs help municipal officials make environmentally sound decisions.
- EACs serve as liaisons to represent both the community and decision makers.
- EACs are a focal point for funding and raise money for projects.
- EACs engage residents, community volunteers, and the private sector in natural resource protection.
- EACs work on a multi-municipal level to reflect natural rather than artificial municipal boundaries.

Source: www.eacnetwork.org

Activity 3: *Greenways Information Sheet – Page 1 (1/3)*

What is a greenway?

A greenway is a corridor of green space. It could be a narrow ribbon of woods in an urban or rural area or a wide corridor of diverse natural features.

It could be a railroad right of way converted to recreational use or a scenic road or a canal. It could function as a recreation area or function exclusively as a corridor for wildlife and environmental protection, linking parks and natural areas.

The PA Greenways Action Plan (2001) promotes establishing a statewide network of greenways. It advocates a greenway in every community by 2020. One of the primary goals is to identify a statewide network of greenway "hubs" (local/state parks, forest, communities) and establish connecting corridors of local and regional greenways called "spokes."

Learn more about greenways by visiting www.pagreenways.org.

What are the benefits?

If we think of the greenway system as infrastructure, the same way we think of roads, utilities and schools, we see many payoffs.

There are many benefits of greenways:

- To protect water resources by buffering non-point sources of pollution, reduce floods, and purify water
- Provide opportunities to protect and manage wildlife, forests and ecological systems
- Recharging and purifying underground aquifers that supply ground and surface waters including drinking water
- To provide recreational opportunities for people fostering health and wellness
- Alternative to automotive transportation
- Add to the economic value of the area
- Accentuate scenic beauty

What are some examples?

- A regional coordinated system of green space plays a critical role in managing water for the benefit of humans and wildlife. A riparian corridor is land adjacent to a stream or other waterway which supports a band of vegetation. Buffers can be either forested or herbaceous although forested buffers are preferable.
- A scenic corridor is associated with a highway, waterway or major hiking/biking trail that has a view of significant scenic value.
- A linear heritage area like the Schuylkill River Heritage Corridor is a multi-county region designated at the state and federal level to plan, conserve, develop and market the natural, historic and cultural resources of an area.

What tools help you to create greenways?

Greenway Planning: DCNR established the County Greenways and Open Space Network Planning Program to provide funding and technical assistance to counties to plan for a countywide greenway network.

One of the primary goals of this program is to establish a statewide greenways network of hubs/destinations and connecting linear corridors. Working in cooperation with their municipalities, each county is encouraged to develop a County Greenways and Open Space Plan which provides an inventory of existing natural and manmade resources, a vision for their county greenway network, and an action plan for realization that vision.

These plans are then adopted as a component of the County's Comprehensive Plan. Greenways are an important strategy for achieving land use management, recreation, open space protection and community revitalization goals. The plan should be used to guide greenway development within the county as well as provide a framework municipal greenway planning efforts.

View planning resources, including DCNR's guidelines for county and municipal Greenway Plans, at www.pagreenways.org/toolboxdocuments.htm, and all completed County Plans at www.dcnr.state.pa.us/brc/greenways/CountyGreenways.aspx.

Official Map: An ordinance that notifies the public and property owners of lands that the local government has designated for possible future acquisition for a public purpose and that gives the government a year to acquire the land for public grounds once a property owner expresses the written intent to develop that area.

Lands could be designated on the Official Map for potential use as future public streets; parks and playgrounds; schools, libraries, community centers, and open space; pedestrian/bicycle ways; public easements; floodways, floodplains and stream-courses, etc.

By showing the area on the Official Map, the local government puts the property owner on notice that the property has been designated for possible future acquisition for a public facility or purpose. Only those areas where the municipality is able and willing to purchase, or on which it can acquire an easement, should be entered into the Official Map.

Municipalities in Pennsylvania are granted the power to create Official Maps through the Pennsylvania Municipalities Planning Code (MPC). Additional information on this topic can be found at: www.conservationtools.org.

Public Dedication: Pennsylvania municipalities have the power under the state's Municipalities Planning Code ("MPC") to require developers to dedicate land to the municipality for public parks and recreation purposes. Called "public dedication" in the MPC, this tool is often referred to as "mandatory dedication" by those in the land use planning field.

Public dedication is based on the concept of impact fees: Development creates increased demand for municipal services or facilities. Requiring developers to provide amenities or funding for expanded or enhanced public amenities is an efficient and equitable way to offset some of the impacts of new development.

Before taking advantage of a public dedication provision, a municipality must first adopt a recreation plan and then pass a Subdivision & Land Development Ordinance (SALDO), which was discussed in the Planning Toolbox section of this book.

A collection of public dedication ordinances are available at the www.conserveland.org Library. Additional information on this topic is available at www.conservationtools.org.

Additional Resources:

Greenways Toolbox: An online resource at www.pagreenways.org/greenwaystoolbox.htm that provides a variety of guides, publications, sample materials to assist in the development and implementation of a statewide greenways network.

How-To Manual: *Creating Connections: The Pennsylvania Greenways and Trails How-To Manual,*

is a valuable resource that describes the process for creating, acquiring, constructing, and managing Pennsylvania Greenways. A copy can be found in the Greenways Toolbox.

Trail and Path Planning: A Guide for Municipalities, a publication by Chester County, is an excellent resource which describes how local governments can encourage the development of trails through planning and land use regulations. This can also be a resource for trail enthusiasts to better understand how they can urge their municipalities to advance trail development. www.dsf.chesco.org/planning/cwp/view.asp?a=3&q=631389.

A Resource Inventory Analysis Map: A community needs to map and inventory the natural, historical and scenic resources, building a geographic information system base map that identifies existing features. It should be coordinated with other municipalities, cooperating together for protecting the resources. A Resource Inventory Analysis map is an important tool. Every municipal comprehensive plan should contain a basic resource inventory to help protect the community's special resources.

Conservation Design: Conservation design is implemented through a municipality's subdivision and land development ordinance. The purpose is to preserve a larger amount of land for conservation use while still allowing development. Under this technique, subdivisions are required to dedicate a portion of their land to permanent open space uses. The open space or greenway is owned and managed by a homeowners association, land trust or municipality. Easements are placed on the land to ensure it will not be further developed. The open space in each new subdivision should ultimately join together to form interconnected systems. For more information on Conservation Subdivision Design, visit the Natural Lands Trust Growing Greener: Conservation by Design site at www.natlands.org/categories/subcategory.asp?fldSubCategoryId=26.

Conservation Easement: A conservation easement is a legal agreement between a landowner and a conservation organization that limits certain specified uses on all or a portion of a property for conservation purposes while leaving the property in the landowner's ownership. Easements are almost without exception of perpetual duration.

A variety of conservation easements exist for specific types of conservation goals, including creating greenways. Some of the easements that are beneficial for developing greenways include the Trail Easement, the Riparian Forest Buffer Protection Agreement and the Fishing Access Agreement. The Pennsylvania Land Trust Association and DCNR has developed samples or model documents of these easements and they are available at www.conserveland.org.

Acquisition or Reconveyance: Conservation organizations or government entities may decided to acquire the parcel of land that is being considered for the greenway and either maintain ownership or transfer ownership to another entity. More information on easements, and other tools used by land trusts are available on the land trust information sheet or online at conserveland.org.

Conservation Funding: There are a variety of funding sources available for conservation of greenways and other conservation properties. State and federal agencies provide grant funding for both private and public entitles to protect natural resources. Conservation organizations may rely on additional private sources of funding, including foundations, individual donors and/or membership dues. Government entities may also choose to establish funding sources by seeking tax increases or bond issues specifically for land conservation efforts.

Land Recycling and Other Specialized Techniques

Industrial development left wastelands in almost every community throughout Pennsylvania. These areas of abandoned industrial sites are called brownfields. Usually located along rivers and transportation corridors, these sites are a testimony to a rich industrial heritage. There are estimated 400,000 brownfield sites across the nation.

Selling land that had been contaminated and polluted by previous owners became a liability issue. Purchase of such property was avoided due to cleanup requirements and lack of funding. Such lands remained a challenge for redevelopment. The Land Recycling Program (Brownfields Law – Act 2) clarified liability issues and established health standards that made redevelopment of brownfield sites more attractive. It provided unprecedented opportunities to recycle abandoned and old industrial sites into productive properties that could strengthen the economic viability of our cities and towns and provide new areas for parks and green space.

The Land Recycling Program promotes redevelopment in sustainable communities. These communities feature a mixture of uses, provide a variety of housing choices, are pedestrian friendly, have access to public transportation and greenways.

By incorporating these qualities, the program acts as an incentive to improve cities and towns, making them more desirable places to live.

Brownfields reduce sprawl by reusing sites and focusing development where existing infrastructure exist instead of developing farmland or open space. It also cleans up hazardous sites. Sites can be obtained for $1.00 just to have them redeveloped. They are situated in prime locations near business districts, waterfronts and existing neighborhoods.

Once a brownfield is assessed, it must still be remediated before used. This is costly but state funds are available for assessment and implementation of a cleanup plan. Certain design strategies can be applied in dealing with contamination. For example, if contamination is localized to one portion of the site, this portion could be capped and used for parking.

Enterprise Zones are areas where property taxes are adapted for a specific period of time to encourage economic development. Keystone Opportunity Zones are examples of enterprise zones which are active in Pennsylvania from 1998 to 2010. Areas are usually depressed but infrastructure is available or nearby. Improving these areas for residential, recreation and commercial use allows development to occur on previously developed land thus protecting existing natural resources.

Compact Development: Design philosophy where the space needs of a population can be satisfied with less land area. Compact development can take various forms. From a regional perspective, it may limit development of land in cities and towns so that it does not extend into rural areas. The following are types of compact development:

> *Conservation Subdivision Design:* A technique that provides the developer flexibility in newly developed areas by clustering the development into concentrated areas that can protect natural habitat. Square footage of buildings may remain the same but compact clusters reduce dimensions of lot sizes and shorten road lengths. The open space protected could be more than half of the development and may be owned by a homeowner association or conservation organization. By building houses on smaller lot sizes and having the open space usable and visible, homeowners seem to be attracted to this concept. They not only preserve natural and cultural landscapes, they reduce construction costs and long-term maintenance due to the shorter streets.

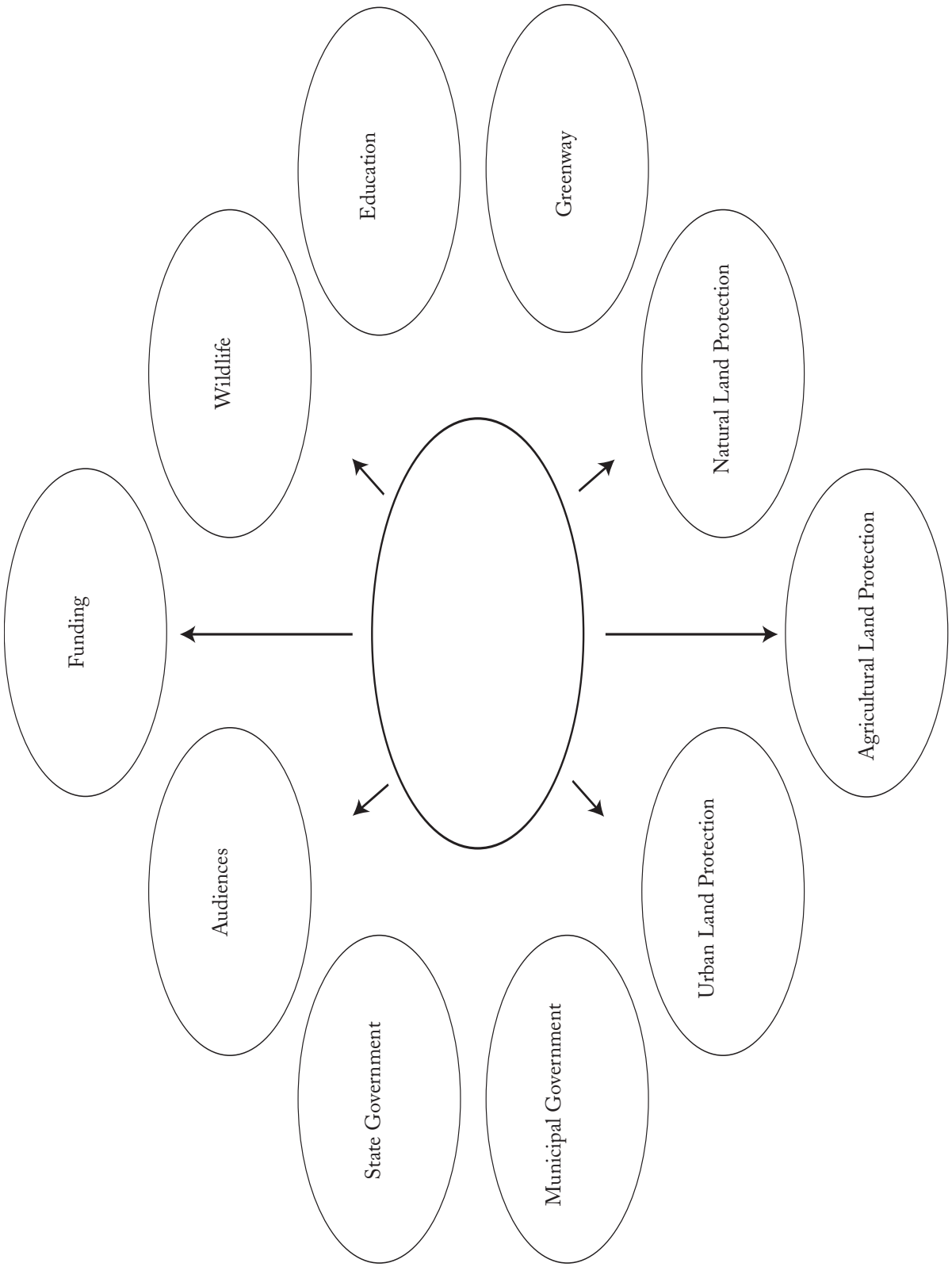
Mixed Use Development: A development that contains at least three different uses including residential. Mixed use development integrates the concept that a community is a place for people to live, shop and walk. Stores, homes, offices and public transportation are pedestrian oriented. Conventional zoning actually discourages this and segregates land uses. Conservation design features a balanced mix of land uses and compact development reminiscent of traditional Pennsylvania cities and towns. Traditional Neighborhood Development (TND) is a compact form of new development used to create a small town character as its primary goal. This is achieved by a number of aspects of community design such as sidewalks and narrow streets. It has a mixed-use core of community facilities, retail businesses and a variety of housing types. It requires a municipality to amend local zoning and subdivision ordinances.

Infill Development: Occurs in locations where some development has already taken place and the infrastructure is already there. In urban areas, infill development refers to the conversion of old buildings such as schools into new uses or by filling the space with new development. Abandoned lots could be replaced by housing or parks.

Urban Growth Boundary: A planning strategy by which a planning agency establishes a boundary line around a community within which urban infrastructure and development are to be encouraged. Outside the boundary, development would be discouraged and set as low density, open space and agricultural easements.

Reduce Impervious Surfaces: Groundwater recharge and surface water runoff are impacted by paved surfaces. A one-acre parking lot was found to produce a runoff 16 times as large as the runoff produced by a meadow. Reducing overall paved surfaces and utilizing pervious materials for paving will help reduce the problem.

Develop a "map" of all the community/regional resources, tools and appropriate partners or contacts that would apply to each of the headings. Write the name of the region or community in the center circle. Surrounding the center circle make ovals with these names in each oval.



Greenways	**Open Space Zoning/Conservation Design**	**Conservation By Design**	**Environmental Advisory Council**
Riparian Corridor	**Conservation Easement**	**Agricultural Conservation Easements**	**Infill Development**
Scenic Corridor	**Fee Simple Title**	**Agricultural Security Area**	**Brownfields**
Heritage Park	**Carrying Capacity**	**Agriculture Protection Zoning (APZ)**	**Urban Growth Boundary**
Resource Inventory Analysis Map	**Land Trusts**	**Transferable Development Rights (TDR's)**	**Traditional Neighborhood Development (TND)**

A larger version of this map is located in back pocket.