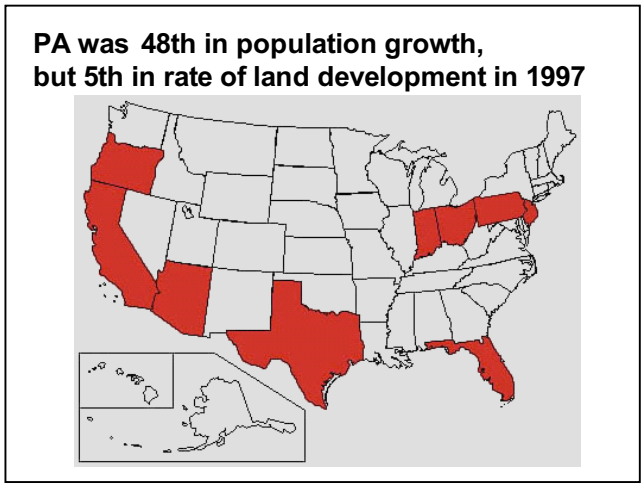
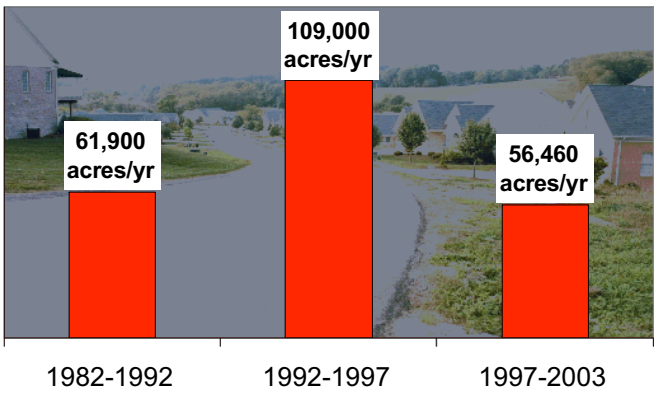
Major Natural Resource Issues Facing Pennsylvania

Urbanization in the form of "sprawl" type development, climate change, loss of biodiversity, and impaired water quality represent the major natural resource challenges facing Pennsylvania. These problems often have a significant effect on environmental quality and the state of our natural resources that provide us with the many outdoor recreational opportunities in Pennsylvania. Solutions to these problems may put additional stress on the outdoor environment.

Urbanization and Urban Sprawl

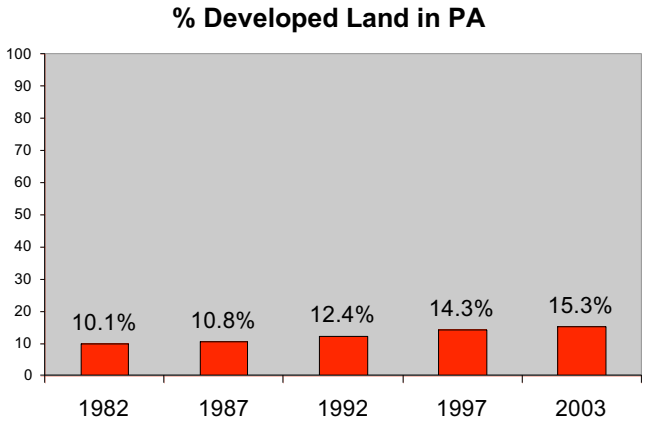
Pennsylvania has one of highest rates of land development in the U.S., but has had comparably much lower population increases than other top states (Florida, Texas, Arizona, California, etc.). In 1997, PA was 5th in rate of land converted to development, but 48th in population growth. Much of the development in Pennsylvania is low-density sprawl that occurs far outside traditional urban centers, resulting in the loss of prime farmland and forestland, inefficient transportation systems— with commuters traveling longer distances to work, less investment in urban renewal, non-point source pollution, and other negative effects. Poor development and land use practices on urban and residential land degrade water quality and fragments natural habitats and increase greenhouse gas emissions.



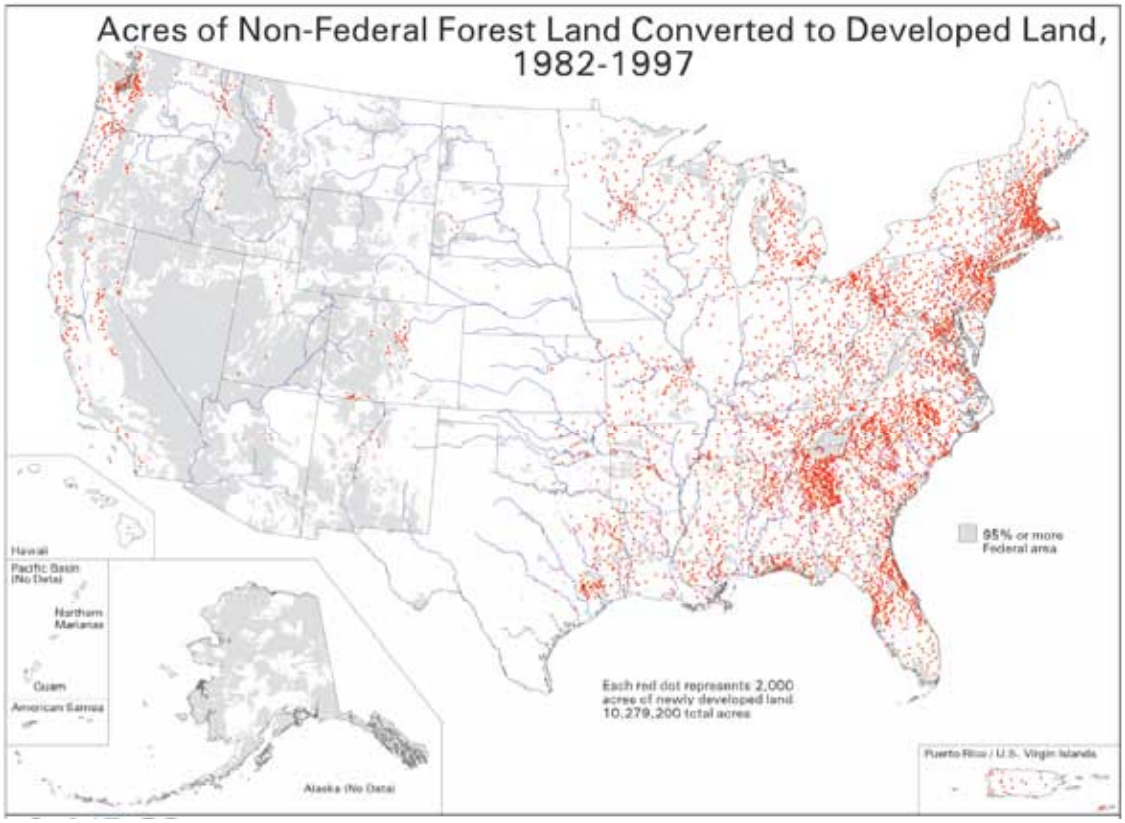


The rate of land conversion to development has slowed somewhat in recent years. Pennsylvania is experiencing land development rates seen in the 1980s, after a peak in 1992-1997. However, development is still spreading out as about 56,000 acres of land per year were converted to development in the period between 1997 and 2003. Developed land covered about 15.3% of all the land in Pennsylvania in 2003, as compared to 10.1% in 1982—an increase of more than 50%.

The challenge for Pennsylvania is not to prevent further development, but to promote smart growth that mitigates environmental impacts and takes advantage of the benefits of greenspace in development planning.



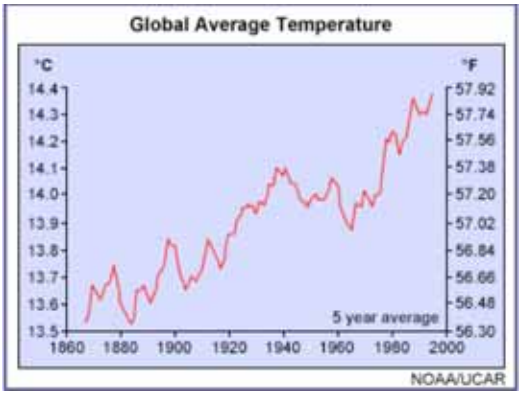
Source: Statistics from NRCS National Resource Inventory, http://www.nrcs.usda.gov/TECHNICAL/NRI



Source: 1997 USDA NRCS National Resource Inventory

Climate Change Impacts: Recreation Shifts and Forest-based Solutions

Climate change is a global issue that has local impacts and will require local solutions. Climate change is likely to create a warmer and wetter Pennsylvania with more extreme and variable weather. Like most of the world, Pennsylvania has already seen an increase in average annual temperature. Climate models predict that the temperatures will increase again by between 4 and 8 º F by 2050, assuming that no thresholds are encountered that trigger more abrupt climate change.



Recreation shifts due to climate change is a major issue for long-term viability of recreational industry. Regional shifts in recreational activity as people make trade-offs in terms of the type, location, and season of their activities. Overall warming and changes in the seasonal characteristics of precipitation are likely to have substantial impacts on recreation in the Northeast, including reduced winter recreation and increased warm season activities.

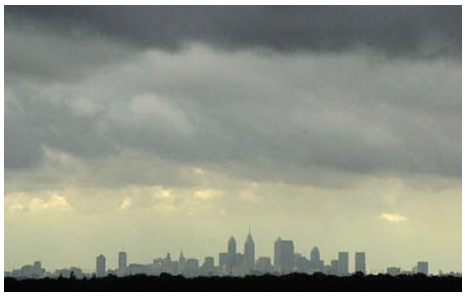
Winter minimum temperatures are likely to warm substantially, as recent winter warm spells have demonstrated. This may result in the inability of ski areas to maintain a winter snow pack and a shortening of the skiing season, but will have a more dramatic impact on opportunities for cross-country skiing and ice-skating on natural water bodies.

Inability to maintain winter snowpack?

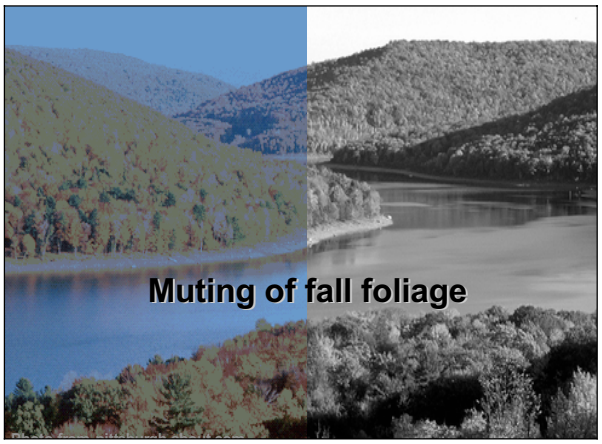
Photo by Whitetail Resort

The summer heat index is expected to increase. This will likely worsen ground-level ozone pollution problems in urban areas, perhaps detracting from urban tourism. Increased summer heat may increase insect populations. Warming fall temperatures may result in muted fall foliage colors.

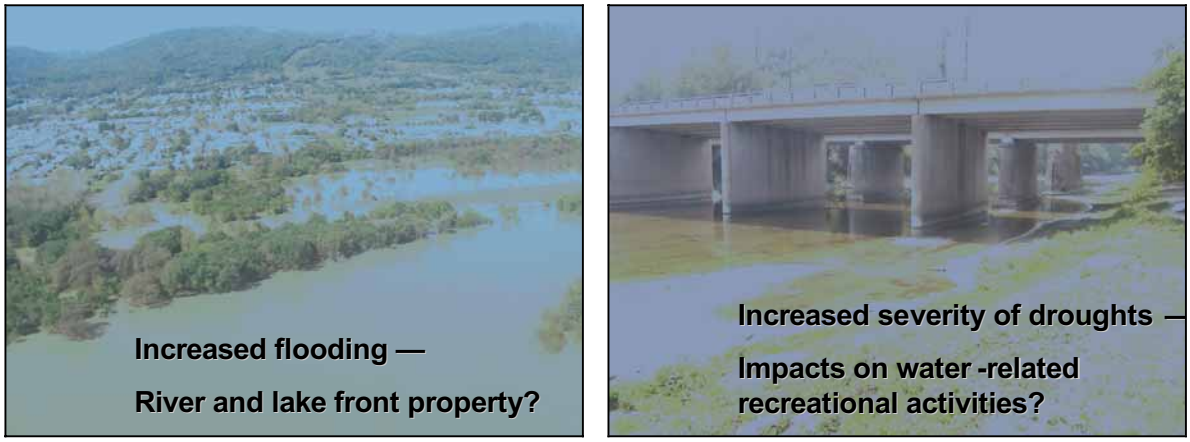
Worsening ground -level ozone pollution problems —affects on urban tourism?



© AP Photo/Jacqueline Larma , Forbes.com



Summer recreational activities involving beaches or freshwater reservoirs will have extended seasons and more demand as havens from increasing summer heat. On the other hand, the increased intensity and frequency of floods and droughts may put water-related recreation activities at risk.



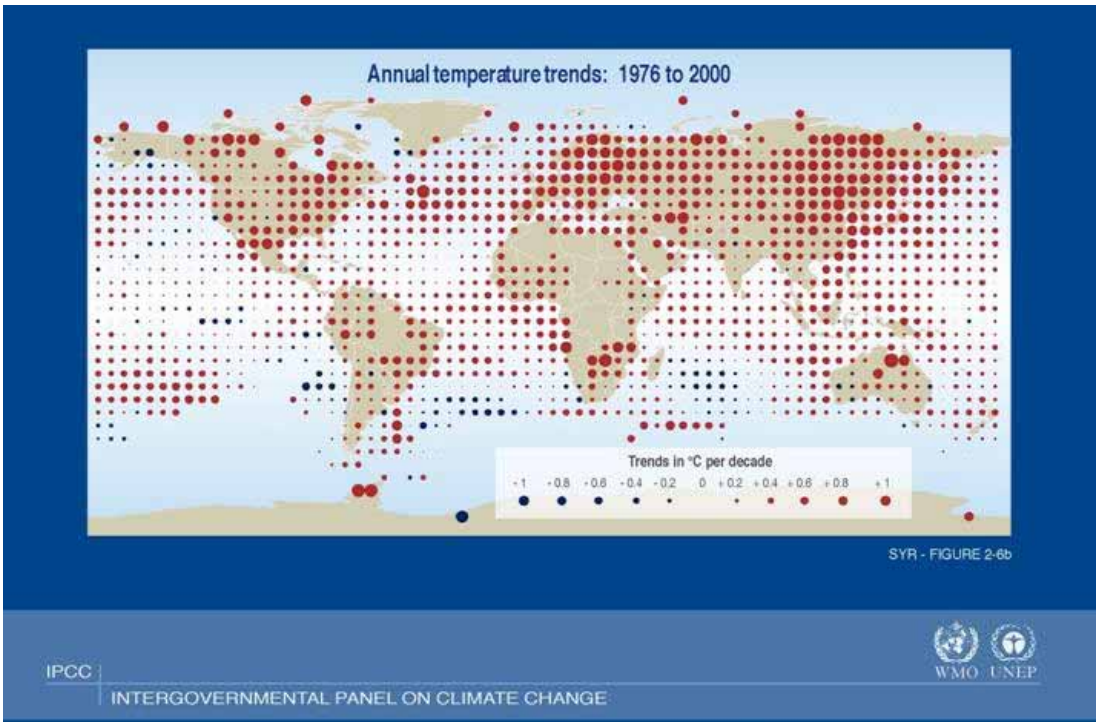
Photos: DEP, North Susquehanna flooding (left) and drought on Conodoguinet River (right)

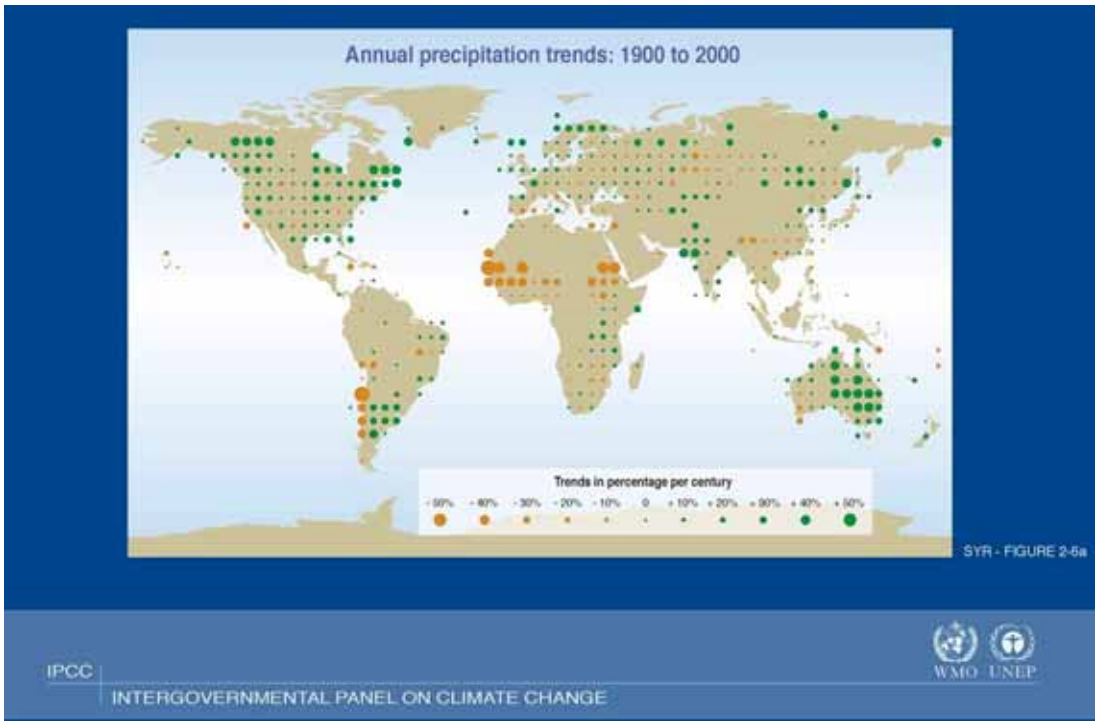
Climate change is likely to have many consequences for Pennsylvania's forests, indirectly affecting the recreational opportunities that these forests provide. Forest types in Pennsylvania have already begun to shift in many areas, from maple-beech-birch to oak-hickory-pine, resulting in major socioeconomic impacts on the hardwood industry and other forest-based industries in Pennsylvania, such as the reduction in valuable black cherry stock. Climate change presents particular threats to Pennsylvania cold water fisheries, many of which will be converted to warm water fisheries.

Climate change is also likely to affect forest productivity and the frequency of natural disturbances (fire and drought), and to reduce biodiversity. Warm-weather invasive species are expanding their range into Pennsylvania. Change in climate will likely present opportunities for the expansion of invasive species.

The proposed solutions to climate change will also have a significant impact on Pennsylvania's forests. The push for alternative energies will create new demands on Pennsylvania's forests for the production of wood-based energy and as sites for wind turbines on PA public forest lands. The burgeoning carbon credit and trading market has added new value to forests for carbon storage or sequestration. These new interests can be balanced with the continuing use of Pennsylvania's forests for recreational purposes and their biodiversity, but attention must be paid to these issues in planning.

Sources: Intergovernmental Panel on Climate Change, www.ipcc.ch, and *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change in the Northeast*, National Assessment Synthesis Team, US Global Change Research Program, 2000, http://www.usgcrp.gov and http://epa.gov/climatechange/effects/usregions.html





From Intergovernmental Panel on Climate Change, www.ipcc.ch

Biodiversity: Maintaining Healthy Ecosystems

Biodiversity is the variety of species, their genetic make-up, and the natural communities in which they occur. It includes all of the native plants and animals in Pennsylvania and the processes that sustain life on Earth (ecosystems). Threats to biodiversity, which helps maintain healthy ecosystems, arise from urbanization and climate change. The major threats to biodiversity in the report of the Pennsylvania Biodiversity Partnership include habitat loss and fragmentation due to urbanization and other consumptive land uses, deer over-browsing, invasive species, and pollution.

Pennsylvania is home to over 25,000 known species of organisms. More than 800 of these are rare, threatened, or endangered, and at least 150 species have been lost from Pennsylvania in recent history. We still do not have a complete inventory of Pennsylvania's plants and animals, although Pennsylvanians consistently place a high value on protecting plants, animals, and their habitats according to survey research.

We depend on valuable ecosystem services, and biodiversity is critical to maintaining ecosystem stability and productivity. Wetland ecosystems filter out toxins, clean the water, and control floods. Forest ecosystems supply fresh water, provide oxygen, control erosion, and remove carbon from the atmosphere.

Biodiversity, by helping maintain healthy ecosystems, plays a major role in the economy of Pennsylvania and, particularly, its outdoor recreation industry:

- The forest products industry in Pennsylvania provides 90,000 jobs in 2,500 firms and contributes more than $4.5 billion to the economy.
- In 1996, activities associated with watching, feeding, or photographing wildlife generated $1.8 billion to Pennsylvania's economy, including more than $236 million contributed by visitors to the state.
- Nearly 20 percent of Pennsylvanians hunt, trap, or fish, spending more than $1 billion annually in pursuit of these outdoor sports
- Thousands of Pennsylvanians and visitors to our state spend many hours enjoying our natural wonders through hiking, biking, cross-country skiing, and other outdoor recreation.

Source: Adapted from PA Biodiversity Partnership at
http://www.pabiodiversity.org/whatisbiodiversity.html

Biodiversity is directly linked to recreation, because the over-browsing of deer is one of the most significant impacts on forest regeneration and the establishment of an understory of diverse native species in Pennsylvania—and the primary control on the deer population in Pennsylvania is deer hunting.

The numbers of hunters and so deer kills have a direct relationship to biodiversity, as the Pennsylvania Game Commission has recognized in recent years by partnering with the DCNR to structure their hunting license regulations according to forest management needs throughout the state. As many areas of Pennsylvania have seen declining participation in hunting, the Game Commission may have to help establish programs to increase hunting participation, in order to maintain hunting as a viable mechanism of deer management, or develop new ways to control deer populations in those areas. This is particularly a problem in the southeastern part of the state where hunting has declined and deer populations are putting pressure on increasingly scarce natural areas amid an urbanizing landscape.

Water Quality and Supply

Pennsylvania's streams and lakes provide habitat for aquatic life, as well as an adequate supply of source water for human consumption and provide many recreational opportunities. Pennsylvania has more miles of rural impaired streams than other states. Acid mine drainage has rendered many streams lifeless or nearly lifeless. Many streams are impaired by urban and agricultural runoff. Excess nutrients from Pennsylvania are a significant contributor to environmental degradation in the Chesapeake Bay.

The streams and lakes of Pennsylvania provide unique and precious recreational opportunities for fishing, boating, swimming, and other activities. Especially around urban areas, these resources require intensive management in order to provide for these uses.

Restoration of impaired waters can promote outdoor recreational activities such as swimming, boating and fishing, in a variety of ways. Many of the most impaired streams are those most accessible to urban and suburban populations. Restoration will make water based activities more accessible. Creating vegetated buffers along streams and "daylighting" of urban streams can improve water quality while providing urban populations with access to a natural environment.

Acid Air Pollution

Although great strides have been made in improving the quality of the air in Pennsylvania, air pollution (in addition to emissions of greenhouse gases) remains a major problem that can impair Pennsylvanians' ability to enjoy nature. Many areas of Pennsylvania have failed to achieve compliance with the National Ambient Air Quality Standard for ozone, which can cause asthma, particularly in children. Emissions of mercury and acids from coal-burning power plants and acids from automobiles have had major adverse impacts on streams and forest soils in

Pennsylvania. Nitrate and sulfate emissions from fossil fuels power plants and automobiles cause acid rainfall deposition that acidifies streams, lakes and soils in Pennsylvania. This acidification has stressed native brook trout populations that were already weakened by AMD and urbanization. As a result, acid deposition has impacted cold water fishing opportunities, especially in popular wilderness areas such as in the Pennsylvania Wilds. Acid deposition has also adversely affected forest soils, causing stress and exacerbating problems with regeneration caused by deer over-browsing. Although regulation of acid rain precursors under the 1990 Amendments to the Clean Air Act has improved the quality of rainfall, nitrates still contribute to acidification. Moreover, many coal fired power plants have reduced acidity by switching to low sulfur coal from the West, which is high in mercury, leading to increases in mercury levels in rainfall and, consequently, streams and lakes. Elevated levels of mercury have resulted in fish advisories being issued, recommending limits on consumption of fish from those water bodies. The Pennsylvania Department of Environmental Protection has recently taken action to limit emissions of mercury from Pennsylvania plants, but without more aggressive action by upwind states or an effective federal program, these emissions will continue to adversely affect fishing and health in Pennsylvania.

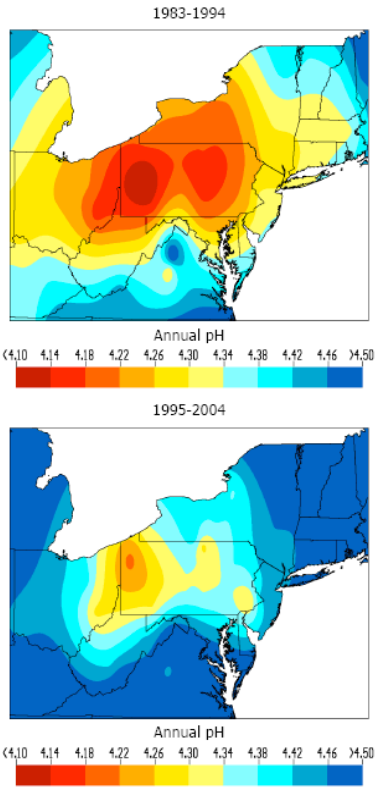


Figure 10. Mean annual pH across Pennsylvania and neighboring states before (1983-1994) and after (1995-2004) implementation of Title IV of the Clean Air Act Amendments of 1990.

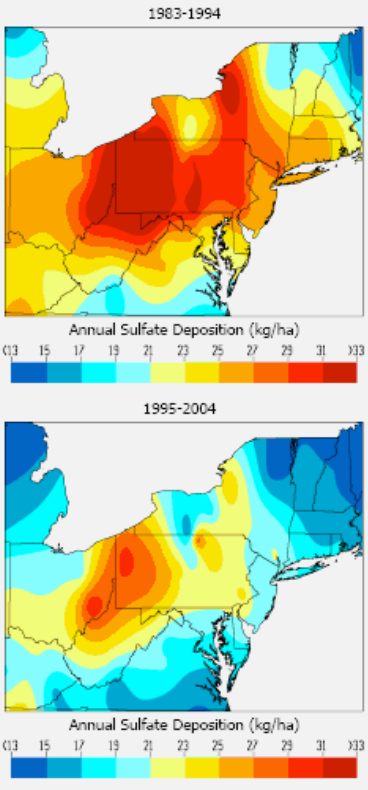
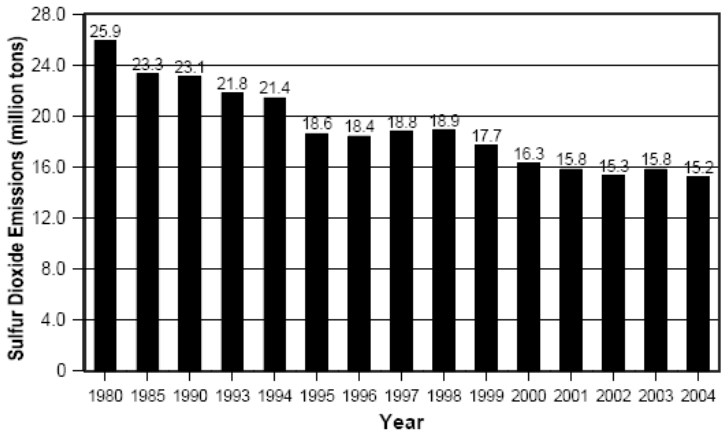


Figure 7. Mean annual sulfate deposition across Pennsylvania and neighboring states before (1983-1994) and after (1995-2004) implementation of Title IV of the Clean Air Act Amendments of 1990.

From *Reductions in Acidic Wet Deposition Following Implementation of the Clean Air Act Amendments of 1990 (Sharpe et. al 2006)*

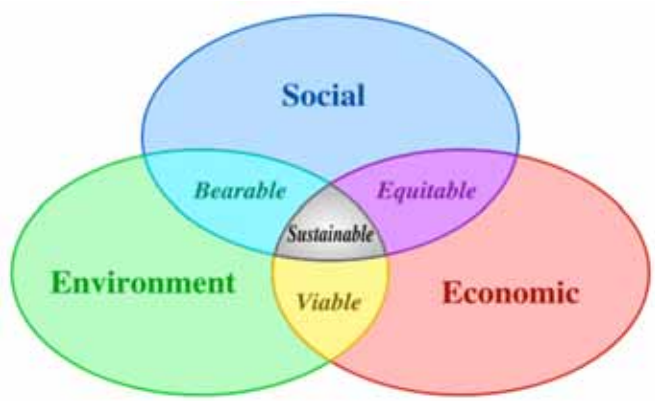


Reductions in sulfur dioxide emissions trend from all point and area sources in the United States (EPA AirData, http://www.epa.gov/airmarkets/emissions/index.html) (Lynch et al. 2005).

Solutions

The challenge for environmental management in Pennsylvania is to remedy remedying the degradation caused by past natural resource exploitation and pollution, and to mitigate and manage future risks. To do so, Pennsylvania will need to embrace a culture of sustainable development. Internationally, "sustainable development" has been defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland 1987). For Pennsylvania, this is not a new concept, being one that was embraced by the Commonwealth's first Secretary of Environmental Resources, Maurice "Doc" Goddard. Doc recognized that economic development, social well being, and environmental quality were inextricably interrelated.

The model of sustainability, proposed by the United Nations Commission on Sustainable Development, whereby governance balances social, economic, and environmental interests inorder to provides equitable, viable, and bearable, *sustainable* development reflects Doc Goddard's vision:



The importance of the natural environment is exemplified by recent studies establishing the value of various ecosystem services. Most of the natural resources essential to our welfare and economy, such as the provision of clean air and water, the decomposition of our waste, and other "services," are not valued by traditional economics like the market of human goods and services. While the value of ecosystem services have been calculated as a theoretical exercise for global environment, exceeding trillions of dollars, there are many local studies of ecosystem services and resource valuation that can be used to justify and develop taxes or usage fees based on the cost of maintaining environmental quality for a particular community. For instance, a study of Monongahela River in Pennsylvania found that recreation values are $6 per trip to keep water quality boatable, $13 per trip to improve to fishable, and $51 per trip to improve to swimmable (1997 dollars, travel cost method) (Smith and Desvouges 1986 and Smith et al. 1986 via Wilson and Carpenter 1999). In another example, for the entire United States, Conservation Reserve Program land provides $443.8 million per year in small-game hunting benefits (Young and Osborn 1990 via Feather et al. 1999), $175.2 million per year in waterfowl hunting benefits (John 1993 via Feather et al. 1999), $347 million per year in wildlife viewing benefits (Feather et al. 1999) and $80 million per year in pheasant hunting benefits (Feather et al. 1999).

Pennsylvania needs to integrate the concept of sustainable development into the management and integration of its state government. It has taken many steps to do so, but more is needed, including the establishment of a sustainability council to integrate programs across state government.

Addressing the challenge of climate change will require the integrated efforts of state, local, federal and international bodies. Many states have developed climate change plans that have involved stakeholders and identified a range of measures that improve their economies while limiting greenhouse gas emissions. Pennsylvania has begun steps in that regard with the Alternative Energy Portfolio Standards Act, DEP's energy policies, the Governor's announced energy initiative, DCNR's carbon management advisory group planning process, the development of a climate road map and Montgomery County's establishment of a county climate planning process. The state needs to integrate these programs into a statewide planning process.

Addressing sprawl and biodiversity losses requires and integrated state approach. The Pennsylvania Biodiversity Partnership has begun to establish a statewide biodiversity plan. However, it lacks the sanction of state sponsorship and spacially explicity policies that link urban redevelopment with conservation of spaces important to biodiversity. Maryland, Massachusetts, New Jersey and Florida have adopted statewide plans with land use components that can serve as a model for Pennsylvania action.

The state needs to continue and expand its efforts to improve water and air quality. There are a variety of enterprising market based solutions that can assist in this effort. Assuring that those

adversely affecting ecosystems services pay for those effects is an important element of the solution to these problems.

Pennsylvania faces the challenge of preventing the over-usage of resources and to harmonize sometimes conflicting demands. This is particularly the case in the PA Wilds as we encourage development of alternative energy resources and tourism recreational opportunities. The state needs to identify the inevitable conflicts and problems, recognize them and, thereby be able to minimize adverse impacts and maximize the benefits to be achieved.

Source: Hawkins, Katherine. 2003. *Examples of Studies on the Valuation of Recreational Ecosystem Services. University of Minnesota.* Available from www.regionalpartnerships.umn.edu/public/Valuation%20of%20Ecosystems.pdf