

HIGHLIGHTS FROM RECENT NEWS ON MISSISSIPPI'S ECONOMY

See the website of the Mississippi Development Authority, www.mississippi.org, for more information about recent economic developments in the state, or contact Scott Hamilton, Communications Division, at 359-3041.

New Businesses and Expanded Facilities

Investments in new and expanded facilities of **\$650 million** have been announced for the January through April period of 2004. Although this amount represents about half the total for the same period in 2003, the number of facilities and the estimated number of new jobs are both greater. This year, the facilities announced are expected to provide 3,195 jobs – a 36% increase compared to last year's total for the same period.



The two largest investments, at \$70 million and \$65.6 million, will be in **shopping centers**, namely, Lakeland Commons and Dogwood Promenade, both in Rankin County. The largest manufacturing investments announced were a \$50.8 million plant for Trex Company, DeSoto County, which will produce plastic products, and a \$38 million facility for EI Dupont DeNemours & Co., Harrison County, which will produce inorganic pigments.

The **top jobs creator** among the investments listed was the \$35 million facility that Textron Fastening System will construct in Washington County. It is expected to provide 500 jobs. Other investments include \$18 million by Rolls Royce Naval Marine, in Jackson County, and \$9.5 million by Biodiesel of Mississippi, in Quitman County.

Mississippi Moves

The Atlanta Braves will move its **Double-A franchise** to Pearl, Mississippi, beginning with the 2005 season. The team will be known as the “Mississippi Braves”. The Atlanta Braves has been Major League Baseball’s “winningest” franchise since 1991, earning a record 12 consecutive



division championships, five National League pennants, and a World Series title. The Braves are a division of Turner Broadcasting System, Inc.

VT Halter Marine Inc., a subsidiary of Vision Technologies Systems Inc., will relocate its **corporate office** to its Pascagoula Operations location in Jackson County as of July 1, moving from Gulfport. The company currently owns six shipyards in Mississippi, two of which are fully operational. The firm is a leader in the design and construction of small- to medium-sized ships in the U.S., including patrol vessels, oil recovery vessels, ferries, logistic support vessels and research ships.



The U.S. Department of Energy’s Million Solar Roof Initiative is moving the country towards greater use of solar energy. The Initiative will finance the installation of 500 **solar technology systems** in Mississippi, along with required training. The Energy Division of the Mississippi Development Authority is overseeing the initiative in the state. The Town of Coahoma received the first award of funds, \$18,300, to install two thermo siphon passive systems in the town’s administrative and dormitory buildings.



Mississippi and the Nation

Three cities in Mississippi are home to **Top Twenty-Five** U.S. business projects, according to the May edition of *Plants Sites and Parks*. The cities and projects are: 1. Olive Branch, where FedEx Ground has decided to build a package distribution hub as part of its \$1.8 billion plan to build nine hubs. The expected number of jobs is 385. 2. Gulfport,



which will be home to two new facilities for Future Pipe Industries, which will employ 300 workers. The first phase of the three-stage project involves a \$15 million investment. 3. Cleveland. The French automotive supplier Faurecia will open a manufacturing facility to assemble seat frames. The plant will employ 250 persons by mid-2005.

The Defense Energy Support Center, Missile Fuels Division, Lackland AFD, San Antonio has awarded **SpaceChem LLC** a 20-year contract



with an estimated value of \$89 million to produce hydrazine (rocket fuel) and perform related services. The facility, which will be constructed for this job, will take three years to build, and will be located in Iuka, Tishomingo County.

Readers of the *Toronto Sun* voted Mississippi the “Favorite Travel Destination of the Year” in the paper’s third annual Golfers’ Choice Awards competition. The new **Magnolia Golf Trail** contributed to the state’s win. Readers also cited the state’s other attractions and its weather.

SUSTAINABLE DEVELOPMENT: MISSISSIPPI AND THE ENVIRONMENT

Marianne Hill

The protection of natural resources vital to the state's future is a basic issue in long-range economic development planning. Two key questions confront policymakers planning for future resource needs: 1 -- which resources will be needed, exactly? and 2 -- how can those resources best be protected?

These questions are not easily answered. Natural resources that will be required in the future include water, land and minerals, of course, but there is increasing awareness that, at an even more basic level, protection of the critical biological systems that sustain life (termed ecosystems) are required for the state economy to be vibrant and dynamic well into the next century.¹ Planning and intervention are required since the goods and services provided by the environment are freely available, while the costs of environmental damage are typically not borne by those producing it.

However, while there is agreement that healthy ecosystems are desirable, there is little agreement on what this means or how this can be assured. Striking differences of opinion are common when environmental questions are raised. What may be a beautiful site for an intact wilderness park to one person may be the perfect location for a shopping mall to another. How can such differences of opinion be resolved?

A starting point for making decisions regarding the use of natural resources is the premise that economic development should be sustainable. Sustainable development is defined as "meeting the needs of the present generation without compromising the ability of future generations to meet their own needs".² There is general consensus that this is a basic goal.

What does sustainability entail? It is clear that there is a close connection between economic development and the environment. At one level, the production of goods and services requires the input of natural resources, such as water and fuels. If those resources become scarce or unavailable, production will suffer. Although new inputs, different techniques of production, and even new products may reduce the need for particular resources, some resources, such as water, will remain irreplaceable.

Some industries, such as agriculture and fisheries, make greater demands on the

environment than others. Agriculture requires fertile soil, the adequate amounts of water and light, a proper balance within the insect population, means of controlling diseases and pests that do not adversely affect human consumption, and more. Outdoor recreations, from hunting to bird-watching, make other demands of the environment. Many activities from fishing through gardening to biogenetics depend on the preservation of native animal and plant species. Both rural and urban populations, along with industry and agriculture, depend on the quality and quantity of water bodies, from the Pearl River to reservoirs, and on the quality of the air.

For most persons, sustainability also includes the preservation of special places: the quality of life of future generations will certainly be enhanced if scenic areas, such as Ship Island, and habitat for wildlife including the black bear, fireflies and the Gulf sturgeon, are protected. Sustainability of economic activity into the future requires that all these demands on the environment can continue to be met. And, most basically, the quality of air and water must be maintained for the health and well-being of both human and nonhuman inhabitants.

Beyond what takes place in Mississippi, the overall quality of water, air and land here is linked to global trends. Short



Table 1. **MISSISSIPPI'S RANKINGS IN SEVERAL POLLUTION INDICATORS**
 (Data for 2001 unless otherwise indicated)

	<u>Rank (50 is cleanest/best)</u>
TRI chemicals released to the environment ¹ (69.2 million lbs.)	23
Health risks from hazardous air pollutants (HAP) ²	
Average individual's added cancer risk (.32 per 1,000 persons)	41
Noncancer cumulative hazard index	38
Health risks from criteria air pollutants ³	
Person-days in exceedance of NAAQS ⁴	36
Number of superfund sites (5)	46
Percent of housing units with high risk of lead hazards (2%)	28
Total animal waste (12 million tons, 1997)	30

¹TRI = Toxic Release Inventory. The Toxics Release Inventory (TRI) collects information about chemical releases and waste management reported by major industrial facilities in the U.S. The TRI database was established by Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986. Under EPCRA, industrial facilities in specific sectors are required to report their environmental releases and waste management practices annually to the Environmental Protection Agency. Covered facilities must disclose their releases of approximately 650 toxic chemicals to air, water, and land, as well as the quantities of chemicals they recycle, treat, burn, or otherwise dispose of on-site and off-site.

²The noncancer cumulative index value (1.4 for Mississippi) represents the sum, over all HAPs of the index value of each HAP. A value of 0.9 for one HAP would indicate, for example, that the concentration of that HAP was at 90% of the (presumably safe) reference concentration.

³The six criteria air pollutants are carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter and sulfur dioxide.

⁴National Ambient Air Quality Standard.

SOURCE: Environmental Defense Funds Scorecard Data, which are derived largely from EPA public data release. See Pollution Rankings at www.scorecard.org.

articles on pressures on global ecosystems, climate change and disappearing species accompany this article. These global trends affect the quality of shared resources, and also impact the political context in which state policy is formulated.

Mississippi and the Environment

Economic development is, at its heart, about raising the quality of life. While jobs and income are the major focus of economic development efforts, the reality is that the environment is critical to our quality of life. The air and water in Mississippi are cleaner

than in many places, but still, our environmental resources require protection or carefully planned use; and several animal and bird species are at risk. An overview of data from the U.S. Environmental Protection Agency (EPA), the Mississippi Department of Environmental Quality (DEQ) and other sources follows.

It should be kept in mind that attempts to measure the health of the environment are in many ways in their infancy, both here and elsewhere. The data that are available can be characterized as scattered and incomplete. However, much

solid and useful information does exist that can aid in the crafting of policies to protect the ecosystems of the state, which in turn will provide the base for long-term sustainable improvements in the quality of life.

State Environmental Quality – National Rankings

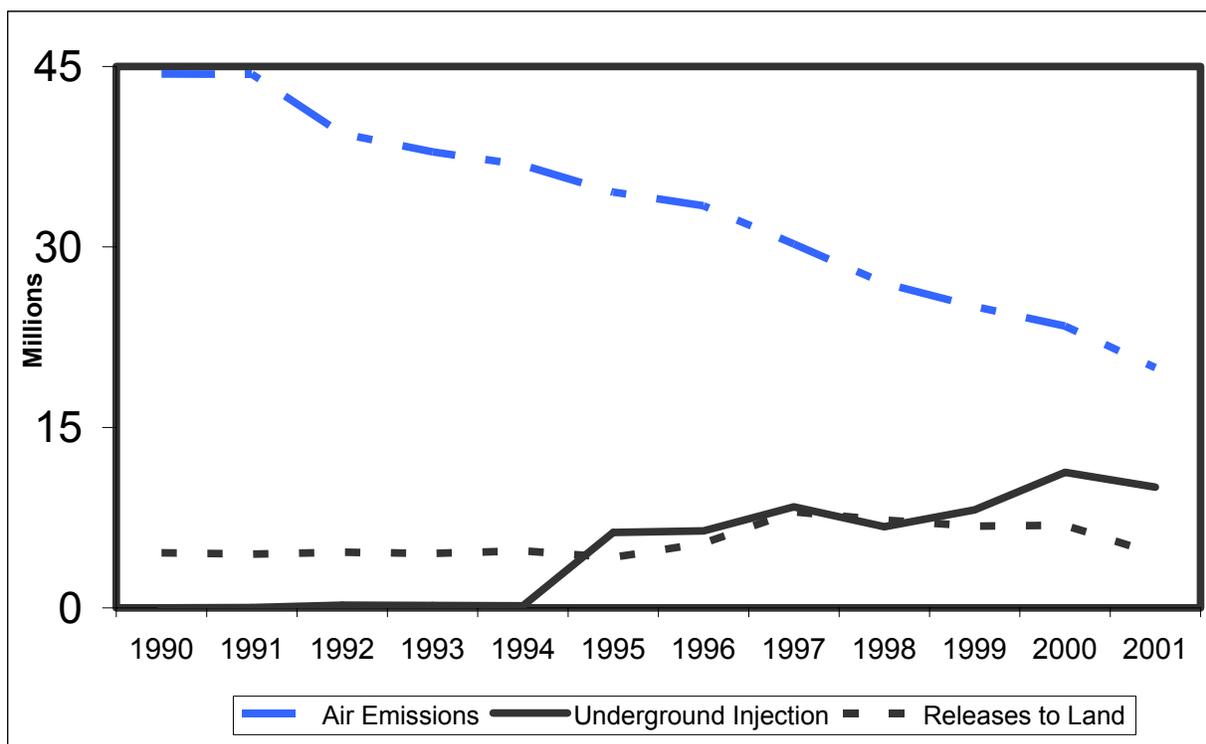
Mississippi ranks better than most states in the indicators of environmental quality shown in Table 1. Where a rank of 50th is best, Mississippi ranks 41st in added cancer risk from air pollutants, 46th in the number of Superfund sites, and 28th in the percent of housing with high risk of lead hazards.³ The state doesn't fare as well in terms of toxic chemicals released to the environment, where it stands 23rd.⁴



The EPA maintains a Toxic Release Inventory (TRI) database of chemical releases that industrial facilities in certain sectors are required to report. There are about 650 toxic chemicals on this list, but the list changes. To show trends over time, the same chemicals need to be considered and the 1988 list is used for this. Since there are hundreds of chemicals being tested and new ones being developed, data are limited in their ability to capture the extent of the problem. In any case, the overall release of TRI chemicals on the 1988 list has been trending downwards in Mississippi, as shown in Figure 1.

Total TRI releases in 2001 in Mississippi for all chemicals were 69.2 million lbs., or about 33 million lbs. greater than the total for the 1988 list alone. The drop in 1988 TRI chemicals, in any case, is

Figure 1. ON-SITE AND OFF-SITE REPORTED RELEASES OF TOXIC CHEMICALS BY MANUFACTURING FACILITIES IN MISSISSIPPI AS REPORTED TO THE EPA, 1990-2001



SOURCE: EPA TRI database at www.epa.gov/triexplorer. See text.

Table 2. EPA WATER QUALITY INDICATORS, MISSISSIPPI AND U.S.

EPA Indicator	Current water quality conditions Percent of watersheds							
	More Serious		Less Serious		Better		Insufficient Data	
	MS	US	MS	US	MS	US	MS	US
	MS	US	MS	US	MS	US	MS	US
Overall Assessed Use Attainment	48	39	48	22	4	21	0	18
Fish and Wildlife Consumption Advisories	18	30	16	12	5	4	61	55
Source of Drinking Water	0	11	5	16	29	30	66	42
Contaminated Sediments	2	2	5	3	73	59	20	36
Ambient Water Quality: Four Toxic Pollutants	0	0	21	9	34	27	45	63
Ambient Water Quality: Four Conventional Pollutants	14	14	46	27	9	23	30	36
Wetlands Loss Index	5	22	95	72	0	1	0	5

Percentages may not add to 100 due to rounding.

NOTE: Although Mississippi is listed as having 0 insufficient data in two categories, in fact that percentage should be higher, which would affect the numbers shown.

Assessed Use Attainment: States and tribes adopt water quality standards that designate the uses of a waterbody and specify criteria to protect those uses. Typical uses of a water resource include drinking water supply, aquatic life use support, fish and shellfish consumption, primary and secondary contact recreation (e.g., swimming and boating), and agriculture. Biannually, states and tribes are required to report to EPA whether their water resources fully support, partially support, or fail to support their designated uses.

For MS, it should be noted that most of the information used in this tabulation was not based on monitoring data. DEQ relied heavily on evaluated assessments using land use survey information for the 1998 WQI assessment. DEQ has since monitored most of these

waters and will be providing the results of this information in its 2004 water quality assessment report.

Fish and Wildlife Consumption Advisories: Fish consumption advisories are a good indicator of the condition of a watershed because they are issued when the concentration of toxic substances in fish and shellfish exceed safe levels.

Source of Drinking Water: The condition of watersheds effects their suitability as a source for drinking water. The EPA uses the Safe Drinking Water Information System (SDWIS) to identify situations where water systems have taken or may take actions because of actual or threatened source water problems.

Contaminated Sediments: Certain chemicals in water tend to bind to particles and collect in bottom sediments. When present at elevated levels in sediments, chemicals can kill or harm bottom dwelling organisms. Pollutants in sediments can also accumulate in aquatic organisms and move up the food chain to fish, shellfish and eventually humans.

Ambient Water Quality: Four Toxic Pollutants: This indicator describes the degree to which monitoring of ambient concentrations of selected toxic pollutants (copper, nickel, zinc, and hexavalent chromium) show exceedances of national ambient water quality criteria. (Note that state water quality standards may differ from these EPA criteria.) The Mississippi assessment was based on only a few samples collected and analyzed using screening techniques.

Ambient Water Quality: Four Conventional Pollutants: This indicator describes the degree to which monitoring of ambient concentrations of selected conventional pollutants (ammonia, phosphorus, ph, and dissolved oxygen) show exceedances of national reference levels developed by EPA. At this time, Mississippi does not have water quality standards for ammonia and phosphorus.

Wetlands Loss Index: Wetlands make important contributions to the health of aquatic systems by purifying water, filtering runoff, abating floods, and decreasing erosion. In addition, wetlands provide habitat for countless numbers of plants and animals (including over 40% of all federally listed threatened or endangered species). Many are combined with historic loss rates to form an index. The combined index is a more robust indicator of watershed condition than either loss rate used independently.

SOURCE: The data used are based on the EPA's Index of Watershed Indicators, which utilizes 1990-99 data, recent available. EPA data presented can be found at www.scorecard.org under watershed indicators. The definitions are from www.scorecard.org/env-releases/def/iwi_wqi.html.

welcome news. The upward trend in underground injection, on the other hand, raises some concerns. Where water-soluble chemicals are involved, such injections may only be delaying contamination of water supplies: it can take a generation or more for water-soluble chemicals to percolate through the soil and reach aquifers (Brown (2001):114).



When the data on TRI chemicals is broken down further, for example in terms of the risks from specific chemicals or by individual counties, the state's rankings can be dramatically different. For example, in 2000, Lee County reported more recognized carcinogens released to the air than any other U.S. county (the situation has since improved).⁵ And, in 2001, Mississippi reported more releases of dioxin and dioxin-like compounds than any other state (all but seven states reported less than 2 pounds released - Mississippi reported 41 pounds).⁶

'PBT' Chemicals

While all TRI chemicals are considered toxic, the release of dioxin-like compounds is of particular concern since dioxins belong to a class of chemicals designated by the EPA as "persistent, bioaccumulative and toxic" (PBT). PBT chemicals are not only toxic but also remain in the environment for long periods of time, are not readily destroyed, and build up or accumulate in body tissue.⁷ Dioxin and dioxin-like compounds are one of four such compounds on the EPA list, and the one with the lowest reporting threshold -- releases over 0.1 grams (1/28 of an ounce) of dioxin-like compounds must be reported. The other three compounds are lead compounds, mercury compounds and polycyclic aromatic compounds. (Dioxin, in the form TCDD, was the major carcinogen of concern in Agent Orange, the defoliant widely used by U.S. military forces in Vietnam.)

Mercury is another very common PBT chemical - fish consumption advisories in



Mississippi are often due to the presence of mercury. Mercury is a by-product of coal-fired electrical utilities, which are the largest single source of mercury emissions to the air, accounting for about 40% of mercury from human activities. Mercury becomes a hazard to humans and wildlife when it enters water through atmospheric deposition, where biological processes transform it into a highly toxic form that builds up in fish and animals that eat fish. An estimated two-thirds of mercury released to the air reaches the global atmosphere, where it remains from an estimated 1.1 to 1.4 years (Slemr, 1996).⁸ Only about one-third of mercury emissions released in or near the state fall within the region.

In Mississippi, high mercury levels in fish are the primary reason behind advisories warning against the consumption of too much fish from several rivers and creeks. The DEQ provides a listing of its current fish tissue advisories and commercial fishing bans at its website. Ten of the 12 water bodies having consumption advisories are listed due to findings of mercury. Fishing is banned in two other areas due to DDT, toxaphene or PCBs. (The consumption advisories warn consumers not to eat more than a certain amount of certain fish, e.g. children under the age of seven should eat no more than one meal of large catfish from the Bogue Chitto River every two months.) According to the Center for Disease Control, levels of mercury in the human body have now reached the point where an estimated one out of six women of childbearing age in the U.S. has levels of mercury in her blood that are not considered safe for a fetus.⁹



State Water Resources

The EPA nationally, and the DEQ in the state, track data related to water quality and watershed vulnerability to a variety of problems. As shown in Table 2, for most water bodies in the state and in the U.S., water quality is not adequate for its assessed use,

Wetlands occupy more than 13% of Mississippi. Bottom-land forests, swamps and freshwater marshes account for most of Mississippi's wetland acreage; coastal marshes also are extensive. These wetlands are a key part of the Lower Mississippi Valley Joint Venture program of the USGS for the restoration of Mississippi Flyway waterfowl populations. Wetlands continue to be a source of timber. The Natural Heritage Program of the U.S. Geological Survey identifies and inventories priority wetlands. See the following internet site: <http://wetlands.fws.gov>.

Wetlands have received greater attention in recent years as understanding of their functions has increased. Wetlands improve water quality, store water and so provide protection against flooding, and provide fish, plant and wildlife habitat. An acre of wetland can store 1-15 million gallons of floodwater. Up to one-half of North American bird species nest or feed in wetlands, and wetlands are home to 31% of U.S. plant species, although they occupy only about 5% of the continental U.S. land surface minus Alaska. They are among the most biologically productive natural ecosystems.

based on the most recent data available (1990-1999). Standards vary for different water uses within each state.¹⁰ While Mississippi had a better showing than the U.S. as a whole in two areas – namely, a lower percentage of water bodies with more serious consumption advisories and a lower percentage of drinking water sources with serious problems – it did worse than the U.S. average in two other areas: 21% of assessed watersheds were reported to have a level of toxic pollutants exceeding national quality standards, and 60% were reported to have levels of conventional pollutants above national reference levels. Both of these percentages, however, are based on very limited monitoring data. In fact, 1998 much of the water quality information submitted to EPA by Mississippi was information taken from questionnaires that indicated suspected pollution and was not based on actual monitoring data.

Since 1998, however, stream quality data are available from significant monitoring conducted by DEQ. These data indicate that about 41% of the state's monitored streams

(about 500 major streams in the state's 11-digit watersheds set by the Natural Resources Conservation Service) meet state water quality standards. Another 17% often meet state water quality standards; while 42% do not routinely meet water quality standards.



The wetlands loss index for the state showed serious problems in all watersheds, a condition prevailing in 94% of the country's watersheds as well (another 5% of watersheds lacked sufficient data).¹¹ A worsening condition of wetlands indicates likely impairment of their ability to purify water, filter runoff, store water and abate floods, decrease erosion and provide habitat.

The watershed vulnerability indicators in Table 3 measure both actual and potential problems, based again on 1990-1999 data. The fact that most of Mississippi's watersheds contain aquatic or wetlands species at risk can be seen as an indication that areas of high water quality exist throughout the state. As the Environmental Defense Fund notes, many species persist only in areas of

Table 3. EPA WATERSHED VULNERABILITY INDICATORS, MISSISSIPPI AND U.S.

EPA Indicator	Future vulnerability Percent of watersheds:							
	High		Moderate		Low		Insufficient Data	
	MS	US	MS	US	MS	US	MS	US
Aquatic/Wetland Species at Risk	45	19	38	33	14	19	4	29
Pollutant Loads Discharged Above Permitted Limits: Toxics	5	2	5	2	82	50	7	46
Pollutant Loads Discharged Above Permitted Limits: Conventional	4	1	0	0	91	60	5	39
Urban Runoff Potential	4	5	11	10	84	73	2	13
Agricultural Runoff Potential	59	23	41	47	0	23	0	7
Population Change	18	29	27	14	55	54	0	3
Hydrologic Modification	9	21	59	43	32	23	0	15
Estuarine Pollution Susceptibility	0	3	7	4	2	0	91	93
Atmospheric Deposition	0	7	98	34	2	51	0	7

NOTE: Although Mississippi is listed as having "insufficient data" in very few categories, relative to the U.S., these percentages should be higher, which would affect the numbers shown.

Aquatic/Wetland Species at Risk: This indicator provides information about the presence of species at risk in a given watershed. This indicator represents the number of aquatic or wetland-dependent species documented in a watershed that are classified by the Heritage Network as critically imperiled (identified by TNC as G1), imperiled (G2), or vulnerable (G3), or that are listed under the federal Endangered Species Act (ESA) as threatened or endangered. The presence of rare or endangered species in a watershed is not necessarily an indication of poor watershed conditions. Indeed, it more likely indicates the opposite: in many instances these species persist only in areas of exceptionally high quality habitat. The presence of species at risk in a watershed indicates, however, that these watersheds are especially vulnerable to future water quality or habitat degradation, which could jeopardize the maintenance or recovery of these organisms.

Pollutant Loads Discharged Above Permitted Limits: Toxics: The Clean Water Act requires that EPA or states set permit limits on the amount of pollutants that facilities such as sewage treatment or industrial plants may discharge into a water body. Effluent limits established under the National Pollutant Discharge Elimination System (NPDES) are set according to national technology-based standards. This indicator adds up the total amount of toxic pollutants allowed to be discharged through NPDES permits into each watershed, and compares this to the total amount of pollutants actually discharged. Watersheds with pollutant loads greater than the total permit limits of all facilities are considered vulnerable to future declines in aquatic health. Such toxic pollutants include cadmium, copper, lead, and mercury.

Pollutant Loads Discharged Above Permitted Limits: Conventional: This indicator adds up the total amount of conventional pollutants allowed to be discharged through NPDES permits into each watershed, and compares this to the total amount of pollutants actually discharged. Watersheds with pollutant loads greater than the total permit limits of all facilities are considered vulnerable to future declines in aquatic health. Conventional pollutants include biochemical oxygen demand, total suspended solids, and nutrients.

Urban Runoff Potential: This indicator estimates the potential magnitude of runoff from urban areas. Regional rainfall characteristics are combined with measures of urbanization and imperviousness (lack of penetrability of surface). Studies have linked the amount of imperviousness to changes in the hydrology, habitat structure, water quality and biodiversity of aquatic ecosystems. (Research on permeable roads and roadbeds is being done.)

Agricultural Runoff Potential: A composite index was constructed to show which watersheds had the greatest potential for possible water quality problems from combinations of pesticides, nitrogen, and sediment. Watersheds with the highest composite score have a greater risk of water quality impairment from agricultural sources.

Population Change: The growth of human populations can result in increased pollution of our waters as land cover and land uses change. These changes include construction impacts, increased impervious surfaces, loss of wetlands, and increased sewage flows.

Table 3. **EPA WATERSHED VULNERABILITY INDICATORS, MISSISSIPPI AND U.S.**
(Continued)

Hydrologic Modification: The health of the aquatic system in a watershed can be compromised by extensive impoundment or hydrologic modification of water resources. This index shows the relative dam storage capacities in watersheds, which provides a picture of the relative degree of modification of hydrologic conditions in a watershed. The index is constructed from a Federal Emergency Management Agency database which inventories U.S. dams. It contains information on 75,187 dams throughout the U.S. and its territories.

Estuarine Pollution Susceptibility: This measures an estuary's susceptibility to pollution based on its physical characteristics and its propensity to concentrate pollutants. The National Oceanic and Atmospheric Administration (NOAA) developed the Coastal Assessment Framework (CAF), which identifies all watersheds associated with the coast. NOAA quantified susceptibility to pollution by combining information about dissolved concentration potential and particle retention efficiency with estimated loadings and predicted concentrations of nitrogen and phosphorus.

Atmospheric Deposition: This measures the atmosphere loading of nitrogen compounds onto a watershed, which can result in acidification or nutrient imbalances. The information is derived from the National Atmospheric Deposition Program.

SOURCE: The data used are based on the EPA's Index of Watershed Indicators, which utilizes 1990-99 data, the most recent available, EPA data presented can be found at www.scorecard.org under watershed indicators. The definitions are from www.scorecard.org/env-releases/def/iwi_wqi.html.

exceptionally high quality habitat. The high vulnerability ratings (83% of the state's assessed watersheds contain species at risk), however, mean that several species in the state face the threat of extinction. The accumulation of sediment significantly reduces the habitat necessary to sustain a diverse ecosystem. In addition, excessive nutrients in agricultural runoff, under the right environmental conditions, may result in depressed levels of oxygen either short- or long-term. A region in the Gulf of Mexico near the mouth of the Mississippi River is currently suffering from anoxia, or a lack of oxygen needed for survival of fish and other aquatic life, due to agricultural run-off. Mississippi, as one of the states whose watersheds drain into the river, is one of many contributors to this problem.¹²

The percentage of watersheds dealing with pollutant discharges above permitted levels is low, as in the rest of the nation, and urban runoff potential is low for 84% of the state's watersheds. There were, however, discharges of pollutants into water above the limits in several cases.



Hydrologic modifications via dams affected 68% of Mississippi watersheds, a condition which often adversely affects the health of an aquatic system.¹³

The discharges and runoffs noted above affect beaches. There were 17 beach closings in the state in 2003, most frequently due to high bacteria levels from undetermined sources and from some identified sources such as sewage spills and one ruptured sewage main.

One surprising number in Table 3 is that for atmospheric deposition. Atmospheric deposition refers to the presence in precipitation of chemicals and particles that result largely from human activities. Acid rain prompted global monitoring of the atmosphere decades ago, and mercury and nitrogen compounds are now monitored as well. Based on data gathered in the Mississippi cities of Clinton, Newton and Coffeerville for the National Atmospheric Deposition Program (NADP), the content of monitored substances in the precipitation in the state puts at risk 98% of the 56 watersheds in the state. (The NADP tracks



precipitation for hydrogen (acidity as pH), sulfate, nitrate, ammonium, chloride, and base cations -- such as calcium, magnesium, potassium and sodium -- and under a separate program, mercury.) The comparable percentage of watersheds in the U.S. that were affected by atmospheric depositions was 41%, with much of the difference apparently due to the mineral content of soils in the West, which can neutralize much acidity.¹⁴

The NADP also keeps data on mercury (another by-product of coal burning power plants) in precipitation. The 2002 map of the U.S., presented in its annual report, shows that the state is in the lower mid-range in the content of mercury in precipitation, but in the higher part of the range for total wet deposition, that is, the total mercury deposited through precipitation, as measured by the one station in the southern part of the state (a level of 15.1 was reported, compared to a

maximum value of 16+ for total wet deposition). The relatively high level of annual rainfall here (almost twice the U.S. average) helps to account for the high level of total wet deposition, despite the lower concentration.

Other Water-Related Issues

The extraction of water from deep aquifers in the state has been exceeding the rate at which this water is replaced. Withdrawals from state groundwater, surface freshwater and surface saline water sources have grown rapidly in recent decades. Total withdrawals in 1990 were estimated to be 20% higher than in 1985 by the U.S. Geological Survey (Open-File Report 93-375:8), and water usage continues to increase.¹⁵

Currently, over 93% of the drinking water supply in the state is derived from groundwater resources, a major advantage for the state that is made possible by the

“Mississippi is leading not only the U.S. but the entire world” in using plants to solve wastewater treatment problems. “Aquatic plants systems, known as constructed wetlands, are being used across the state to purify wastewater from municipalities and individual homes. In fact, Mississippi may have more individual home and municipal treatment systems of this kind than the rest of the country put together.” reports the *Mississippi Native Plant Quarterly*. They cost less than half as much as conventional mechanical treatment systems, and are far more energy efficient.

There are more than 150 such treatment systems in the U.S., and Mississippi is a leading role in this area is due in large part to the influence of Dr. Bill Wolverton, formerly with the Stennis Space Center here. Wolverton developed these treatment systems as an outcome of his work on the problem of recycling polluted water in future space colonies. Union, MS, is one city where the constructed wetland alternative has proved a boon, saving the city an estimated \$110,000 per year, as well as an estimated \$750,000 in initial construction costs. More information is available from the Southeast Mississippi Resource Conservation and Development Area in Hattiesburg.

SOURCE: Becky Gillette, “The New Green Revolution”, in *Mississippi Native Plant Quarterly*, October 1993.

extensive groundwater resources available here. In most other states, surface water is the usual source of drinking water.

However, as aquifers are drawn down, it becomes necessary to drill more, often deeper, wells to extract the same quantity of water, thus increasing the cost of water. Water shortages have already occurred for the users of surface water: in the late 1990s, when droughts occurred two years in row, a few firms in the state were on brink of being forced to shut down operations until the water shortage eased. In fact, the DEQ has issued cease and desist orders to surface water permit holders on several occasions. Increased conservation of water is a possible solution to this emerging problem, as is the construction of more reservoirs to increase the amount of surface water available. Some



experts warn that a significant increase in surface water will be needed within 30 years at the present rate of growth of groundwater use. Mississippi's high annual rainfall makes increased use of surface water an attractive alternative to some.

A 1997 Mississippi statute calls for the development of a comprehensive state water management plan by the DEQ, along with detailed studies of several water-related issues. According to the DEQ (FY2002 Annual Report), progress has been made in characterizing and quantifying the existing groundwater resources of the state. The DEQ is monitoring aquifers throughout the state for developing problems, and recognizes that the development of other sources for industrial and irrigation water supply in certain areas of Mississippi may be required.

Endangered Species in the State

The U.S. Fish and Wildlife Service (FWS) of the Department of the Interior maintains the federal list of animals and plants in each state that are considered "threatened and endangered" in its "Threatened and Endangered Species system" or TESS. The Mississippi Museum of Natural

Science maintains the state list of endangered species at its website. The state's list includes 76 animals, including 15 freshwater fish, 5 amphibians, 14 reptiles, 12 birds, and 5 mammals (exclusive of whales and dolphins) as well as 23 freshwater mussels, one crayfish and one insect. Forty-three federally listed threatened and endangered species occurring, or formerly occurring, in Mississippi are included on the state list.



An endangered species is one that is in danger of extinction throughout all or a large portion of its range. A threatened species is one that is likely to become endangered in the foreseeable future. The leatherback sea turtle, the Mississippi sandhill crane and the red-cockaded woodpecker are among the endangered species, shown in Table 4, while the Louisiana black bear, the Gulf sturgeon and the bald eagle are threatened. Loss of habitat due to human activities is the major culprit. Information is available on each species at the FWS website. The customized protections available to some of these species are also described there, as section 4(d) rules.

The Mississippi Department of Wildlife, Fisheries and Parks keeps track of nonthreatened as well as threatened wildlife populations in the state. The numbers show a mixed picture: some wildlife, such as turkeys and deer, are doing well in some parts of the state, while habitat loss threatens wildlife in other areas. Quail populations, here and in Louisiana, have been hard-hit over the past 25 years, with their numbers dropping 90%. There has been a decrease in ducks in the South Delta region compared to the long-term average.



The Environment and the Economy: The Challenge

Economic analysts point out that the market alone cannot assure adequate protection of shared environmental resources. The benefits provided by the environment are provided free of charge. But the cost of

**Table 4. PARTIAL LISTING OF ENDANGERED AND THREATENED SPECIES
IN MISSISSIPPI (Federal List)**

T	Louisiana black bear
E	Mississippi sandhill crane
T	Bald eagle
E	Leatherback sea turtle
T	Gulf sturgeon
T	Ringed map turtle
E	Humpback whale
E	Red-cockaded woodpecker
E	Pondberry (one of four plants)

E = endangered (a higher level of threat than threatened)
T = threatened

SOURCE: U. S. Wildlife and Fisheries. See <http://endangered.fws.gov> for federal list. For full state listing, along with more recent additions to federallist, see www.mdwfp.com/museum/html/research. Go to downloads.



preventing or remedying environmental damage, and of treating the health effects of pollution, is borne by individuals, governments and firms. Typically, producers do not incur the environmental costs arising from their production activities. Intervention is needed to balance the costs versus the benefits of activities that affect the environment. And it is critical that the cost-benefit analysis that is done brings to bear the best scientific information available. This is particularly important when the damage will accumulate over time and become irreversible.

The challenge facing Mississippi is that facing the rest of the nation: how to generate economic growth and attain a higher quality of life in a way that is economically and environmentally sound. A century ago, crop rotation and the use of fertilizers were innovations introduced in response to erosion and soil depletion, the environmental problems of the time. Today, new practices and technologies are needed to prevent the over-stressing of ecosystems.

Mississippi and Environmental Policy Questions

As part of the world community, Mississippi is affected by, and contributes to,

global environmental trends. As pointed out above, a considerable part of the mercury found in precipitation here may originate from other continents. On the other hand, as an industrialized power, the state is adding to the concentrations in the air of pollutants and gases such as carbon dioxide, which are affecting the planet's atmosphere.

As part of the U.S., Mississippi has a voice in the national response to global environmental concerns, and will be part of any international accord the U.S. signs. The state also sets its own environmental agenda. This article has focused on air quality, water quality and endangered species. There are other environmental issues, as well, all of which will increasingly require the attention of policymakers and the public. University research centers across the state and across the nation have a vital role to play in informing these policy debates, as do educators and the media. As nations react to environmental stresses, new opportunities, involving millions of new jobs, will open up in the development and use of alternative energies, in biodegradable chemicals and products, in recycling of materials, and in the



development and implementation of processes and products that reduce pollution and emissions.

Among policy changes being discussed are changes in tax codes. There is interest in reducing subsidies to oil producers and in increasing subsidies to alternative energy. Restructuring of taxes and fines to achieve environmental goals is on the upswing.

Concluding Remarks

The EPA, the leading U.S. environmental agency, tackles its mission of protecting human health and safeguarding the natural environment with a heavy reliance on education, corporate cooperation, and the involvement of the public. The publication of lists of TRI chemicals released by corporations, for example, has been an effective tool in the reduction of these releases, involving relatively few penalties for firms who comply. The Mississippi DEQ plays a similar role within the state. Information on the DEQ – its mission, size and structure, is provided in Appendix I.



In addition to the vital role of the DEQ, other structures are needed within the state government and the private sector to ensure that studies of the environmental impact of projects are undertaken as appropriate. Long-term planning for the preservation of natural resources, from water supplies to scenic attractions, is needed as well.

The private sector and consumers have critical roles to play also.¹⁶ This January, Citigroup, the largest funder of the oil and gas industry worldwide and also the world's largest financial corporation, announced a series of reforms that will monitor the impact of the investments it finances, and that will set up “no-go” zones in sensitive ecological areas, effectively barring industrial development. DuPont is among



several companies with a commitment to make major reductions in greenhouse gas emissions.

Consumer education makes a difference, as the support for recycling shows.¹⁷ When consumers become aware that the brightest white paper is obtained through chemicals that are bioaccumulative and toxic, they may be satisfied with a less bright white, and respond to environmental labeling.

There is much to do. But with appropriate practices, our ecosystems can assure a continuing supply of clean air and water, and provide an environmental quality that will raise the standard of living for both current and future generations.



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Appendix I

The Mississippi Department of Environmental Quality has as its mission “to safeguard the health, safety, and welfare of present and future generations of Mississippians by conserving and improving our environment and fostering wise economic growth through focused research and responsible regulation.”

The Department has four major Offices: Pollution Control, Land and Water Resources, Geology, and Administrative Services. The DEQ staff of about 544 persons in FY2002 is listed at its website, along with job titles. It is possible to search the staff page using a phrase such as “construction and agriculture” to find out the number of persons in compliance and enforcement in construction

and agriculture (four, in this case) or in chemical manufacturing (three). Underground storage tanks, one of the larger divisions, has 20 persons.

DEQ expenditures in FY2002 totaled \$98.5 million, of which \$26.3 went to construction grants (largely wastewater treatment), and \$59.5 million to pollution control. That year, about \$34.3 million of its funding was from fees, payments on its revolving loan fund, and penalties (about \$1.9 million from fines and penalties). The remaining funds required came from the federal government \$21.9 million and state appropriations \$15.1 million.

The DEQ issued 39 enforcement orders in FY02 (Annual Report:7), based on on-site inspections: 282 inspections for compliance with air pollution permits/regulations; 119 for compliance with hazardous waste permits; 740 for compliance with solid waste permits and 1018 for compliance with water pollution permits. This means that 2,159 of over 15,000 sites were inspected; several of these inspections are carried out in response to complaints (1,634 complaints were received that year). There are also 1262 uncontrolled sites (sites contaminated with hazardous substances). Oversight and remediation was provided at 83 of these sites, in FY2002.

Notes

1. An ecosystem is a biological system, encompassing air, water, and land, and the habitats supporting plant, animal, and aquatic life in a given place. Source: EPA website - Ecosystems.
2. 1987 U.N. World Commission on Environment and Development.) In other words, the state, in the long-term, should be able to sustain or increase the quality of life of its residents.
3. Clarion-Ledger, B1, 3/9/04. Nationally, there are 900 Superfund hazardous waste sites where the EPA has completed clean-up, and another 1,240 whose clean-up has yet to be completed.
4. The plant listed as the largest single source of TRI chemicals released to the environment in Mississippi in 2001 was the DuPont plant in Pass Christian (13.9

million pounds released), followed by Vicksburg Chemical Co. (5.8 million pounds) and Mississippi Power Plant, Gulfport (4.0 million pounds).

5. Emissions in Lee County were greatly reduced in 2001, due to new Maximum Achievable Control Technology (MACT) criteria, according to the DEQ.

6. Most (97%) of the 41 pounds released were from the DuPont plant in Pass Christian, which released the dioxins to land. This plant is also listed as the largest single source of TRI chemicals released to the environment in the state. The U.S. EPA, in its Envirofacts Report on this DuPont plant for 2000 and 2001, reported "no waste management activities for Dioxin and Dioxin-like Compounds". The Detailed Facility Report, available through ECHO at the EPA website, reports that there was a violation (not specified) at the plant within the past two years, but none currently. However, the MDEQ issued a statement 3/31/04 that the DEQ and DuPont have reached an agreement regarding the exceedences of several permit air emission limits and two procedural violations. The company will pay a \$60,000 fine. The releases of dioxin compounds to land were not cited. To get the EPA reports, go to www.scorecard.org and search at right under "Your Community" for zipcode 39571, Harrison County. Or see the news releases at the DEQ website. The Agency for Toxic Substances and Disease Registry (ATSDR) of the Center for Disease Control (CDC) found at the following site: (www.atsdr.cdc.gov/statefactsheets) is currently providing a health consultation about health risks related to contamination of groundwater and releases to the air at the site: the ATSDR notes that "past groundwater sampling data indicate that metals such as arsenic, barium, beryllium, and lead, and volatile organic compounds, such as tetrachloroethane, have been detected". Rachel Carson's *Silent Spring* (1958, chapter 14) was one of the first works to attempt to link the fourfold increase in the incidence of death from malignant growths since the turn of the century to environmental changes. Numbers for 2000, showing an increased incidence of cancer since 1970, can be found at www.nci.nih.gov.

7. DDT, the banned pesticide which was the target of Rachel Carson's *Silent Spring*, is also a persistent, bioaccumulative, and toxic chemical.

8. Mercury is a naturally occurring element, which can be released to the atmosphere by natural sources, as well as human (anthropogenic) activities. The 1997 "Mercury Study: Report to Congress" by the U.S. EPA, and available at their website, cites a 1994 study (Figure 3-1) by Mason, Fitzgerald and Morel which estimates that about 77 percent of the total annual mercury input

to the atmosphere from all sources is due to human activity -- either to current human activities (57%) or to the increased emission of mercury from the ocean since the Industrial Revolution (past human activities) (20%) (see p. 3-2). Natural sources include volcanic and geothermal activities, forest fires, the weathering of rocks, and some of the emissions from the ocean (emissions/vaporization of mercury from the ocean are considered to be of natural, not anthropogenic sources in this report, although these emissions have more than tripled since the industrial revolution).

See also Table 3-1 of the U.S. Environmental Protection Agency "Mercury Study: Report to Congress, Volume I, Executive Summary," 1997 and the U.S. Geological Survey, "Mineral Commodity Summaries: Mercury," February 2000. According to the Environmental Protection Agency's 1999 [National Emissions Inventory](#), coal-fired electrical utilities accounted for 40 percent of the anthropogenic mercury, followed by industrial boilers (5 percent), hazardous waste incinerators (5 percent), and chlorine production (5 percent). Combustion of medical waste is no longer a significant source. Mercury is released into the atmosphere from combustion points in gaseous form and is deposited back into soils and surface waters from the atmosphere. Estimates are that 30% of the mercury released is quickly redispersed within a local or regional area, and the remainder into the atmosphere where the residence time is estimated to be between 1.1 and 1.4 years (Slemr, 1996). This means that there is a relatively homogeneous concentration in the atmosphere around the world leading to long-range (global) transportation.

9. Joan Lowy, "Mercury Threatens 630,000 Kids", Scripps Howard News Service, 2/05/04. This means that about 630,000 children annually are at risk for lowered intelligence and learning problems due to mercury exposure. (About 75% of mercury in the atmosphere is due to current or past human activities, while the remainder is from such sources as volcanic activity, forest fires and the weathering of rocks).

This number is up substantially from that of a 2000 study cited in Brown 2001:132. On the positive side, new technology exists that would greatly reduce mercury emissions. According to Senator Byron Dorgan (ND), "We are nearing a point where we could have near-zero emissions with new clean coal technology at coal-fired electric generating plants". More detail on new technologies is available in the *Mississippi Sierran*, Spring 2004.

10. At www.scorecard.org, go to "Clean Water Act Status." A national watershed is an 8-digit hydrologic reporting unit.

11. According to the Clean Water Act, the term wetlands means "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Swamps, marshes, bogs and similar areas are considered wetlands.

12. Mississippi's contribution to the annual flux of nitrogen to the Gulf of Mexico is on the order of about 2% of the total annual nitrogen load carried by the Mississippi River. See Coupe (1998).

13. Hydrologic modifications are often associated with sedimentation. The accumulation of sediment affects many of the state's waterways, adversely impacting the habitat of several aquatic species, and also causing problems for the humans who use the waterways. For example, Mill Creek at the Reservoir, after a \$300,000 dredging three years ago, again requires clearing.

14. The high acid content of acid rain is due to the hydrochloric and sulfuric acids formed as sulfur dioxide (largely from coal-burning power plants) interacts with nitrogen oxides (largely from motor vehicles, utilities and fertilizer production). Acid rain, that is, rain with a pH of less than 5.6, has been taking a heavy toll on water bodies in the northern part of the globe. Canada now counts 14,000 dead lakes, and one-quarter of Europe's forests are damaged (Brown (2001):52). The Atmospheric Nitrogen Deposition Program of the NADP focuses on the effects of nitrogen in precipitation on aquatic systems.

15. Withdrawals in 1990 were used as follows: 1,900 million gallons/day for irrigation, 700 million gal/day thermoelectric power, 400 million gallons/day aquaculture, 320 million gal/day public supply, 270 million gal/day industrial and mining, 33 million gal/day domestic, 16 million gal/day commercial, and 16 million gal/day livestock.

16. The private sector is contributing innovative solutions to environmental problems. The design firm, McDonough Braungart Design Chemistry (MBDC), offers several examples of environmentally-friendly product and process design alternatives that also result in substantial cost-savings to firms (see this internet site: www.mdconough.com). For example, in some cases, biodegradable chemicals may be substituted for those currently in use, thus eliminating the need for costly filters and waste treatment.

17. When consumers become aware that the brightest white paper is obtained through chemicals

that are bioaccumulative and toxic, they may be satisfied with a less bright white, and respond to environmental labeling.

Recycling is a basic solution to a more efficient use of the earth's resources. It has the effects of both reducing the release of toxins into the environment and of preserving natural resources from trees to oil. Backyard burning of plastics is a major source of dioxin emissions, second only to emissions by municipal solid waste incineration, according to the EPA. Other methods of disposing of plastics would reduce this problem.

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Lower Pearl Partnership
Mississippi Association of Resource Conservation and Development: www.msrgcd.org
Includes links to member organizations across the state. Contact southwest@msrgcd.org
Natural Resource Initiative
Pascagoula River Basin Alliance

Sources

Mississippi Organizations With Environmental Focus

Nonprofits with websites:

Audubon Mississippi: www.msaudubon.com

Black Bear Conservation Committee: www.bbccc.org

Catch A Dream: www.catchadream.org

Mississippi 2020: www.mississippi2020.org

Mississippi Wildlife Federation, www.mswildlife.org

Nature Conservancy of Mississippi:

www.nature.org/Mississippi.

Sierra Club, Mississippi:

<http://Mississippi.sierraclub.org>

Wildlife Mississippi: www.wildlifemiss.org

Other Nongovernmental Groups:

Crow's Neck Environmental Center:

www2.nemcc.edu/Webmaster/CrowsNeck.

Lower Delta Partnership

Scruggs Institute for Compatible Development (Moss Point.)

TARA Wildlife: www.tarawildlife.com

State Departments With Environmental Projects or Oversight

Mississippi Department of Archives and History

Mississippi Division of Tourism (in Mississippi Development Authority)

Mississippi Department of Environmental Quality

Mississippi Department of Transportation, Environmental Division

Mississippi Department of Wildlife, Fisheries, and Parks

Mississippi Museum of Natural Science

Mississippi Forestry Association

Mississippi Forestry Commission

Mississippi State University Extension Service

Mississippi University Centers

Most state universities include centers addressing some environment-related issue. These include: the Center for Water and Wetlands Resources at the University of Mississippi Field Station at Bay Springs (www.olemiss.edu/depts/umbfs)

U.S. Government Agencies With Environmental Focus

(All accessible through the agencies directory at www.us.gov).

Army Corps of Engineers (US Army)
www.usace.army.mil
Department of Agriculture (USDA) (www.usda.gov)
U.S. Forest Service (www.fs.fed.us)
National Resources Conservation Service
www.nrcs.usda.gov (which includes the National
Water and Climate Center)
Wildlife Services (www.aphis.usda.gov/ws)
Department of the Interior (Interior)
(www.interior.gov)
Fish and Wildlife Service – its listing of threatened and
Endangered Wildlife and Plants can be found at
http://ecos.fws.gov/tess_public/TESSWebpage.
U.S. Geological Survey www.usgs.gov

Environmental Protection Agency (EPA). Some
subsites are of special interest:
Compliance and Enforcement at: www.epa.gov/echo
Global Warming at:
[//Yosemite.epa.gov/oar/globalwarming.nsf](http://Yosemite.epa.gov/oar/globalwarming.nsf)
National Atmospheric Deposition Program (NADP):
<http://nadp.sws.uiuc.edu> and the
Atmospheric Nitrogen Deposition Project:
[www.marine.unc.edu/Paerllab/research/atmospheric/
adn_opening.html](http://www.marine.unc.edu/Paerllab/research/atmospheric/adn_opening.html)

Other Sources on the Environment

American Enterprise Institute: www.aei.org
Environmental Defense Fund: www.scorecard.org
Greenpeace: www.greenpeaceusa.org
The Heritage Foundation: www.heritage.org
RAND Corporation: www.rand.org
Union of Concerned Scientists: www.ucsusa.org