Bacteria to bluegills, fungi to flying squirrels, and wildflowers to wild turkeys

Biodiversity

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adaptations by
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Genetic Diversity *Nodding or Bent Trillium in white and maroon color variations.*

Aldo Leopold, the father of modern wildlife management, recognized the intricacies of nature when he wrote, "If the land mechanism as a whole is good, then every part of it is good, whether we understand it or not. If the biota, in the course of eons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering." These wise words written in the 1940's may help us "tinker" or manage our vast wild plant and animal resources or "nature's cogs and wheels" in a rapidly changing world.

Humans have tinkered with the land mechanism (we call it the ecosystem) throughout our existence. Agriculture, forestry, mining, and urban or industrial development have all impacted the amount of wild lands that native plants and animals need to survive. In the 1930's, we recognized some wildlife species numbers were declining. Sportsmen, natural resource managers, and scientists rallied together and began restoring populations and managing numerous game or endangered wildlife species such as the white-tailed deer, wild turkey, wood duck, bald eagle, and whooping crane. The Alabama Wildlife Federation was organized in 1935 in response to these needs.

What about the remainder of the "cogs and wheels" of the natural system? The largest percentage of native plants and animals does not fall into these categories. For example, less than 1% of all wildlife species are considered "game" animals. However, the survival of the other "cogs and wheels" is critical to the survival of "game" wildlife. How can we manage for all the "cogs and wheels" that keep the ecosystem healthy?

A What Is Biodiversity?

Before we can answer the question of managing for a healthy land mechanism, we must ask the question "What is this variety of life we are managing for?" The Alabama Natural Heritage Program was established in 1989 by The Nature Conservancy and the Alabama Department of Conservation and Natural Resources to identify elements of Alabama's natural diversity (i.e., plants, animals, and habitats) and to help establish management and protection priorities.

Is biodiversity the variety of unique genetic building blocks found among individuals of a representative species? Is it the variety of living organisms found in a particular area, such as the thousands of plants, mammals, birds, amphibians, reptiles, insects, and other less visible organisms at DeSoto State Park? Is it the variety of species and their interactions with each other and the environment? Is it a landscape mixed with wetlands, grasslands, forests, and meadows? The answer to all these questions is yes! What we are managing for is biological *diversity* or *biodiversity*. Managing for biodiversity is about conserving the full variety of life.

Professional biodiversity definitions can be complex and cumbersome statements. In 1987 the United States Congress, Office of Technology Assessment stated

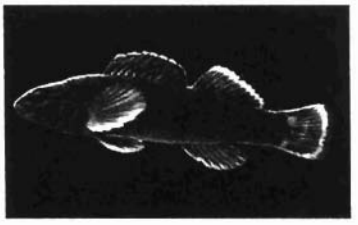
"Biological diversity refers to the variety and variability among living organisms and the ecological complexes in which they occur. Diversity can be defined as the number of different items and their relative frequency. Thus, the term encompasses different ecosystems, species, genes, and their relative abundance." The U.S. Forest Service says biodiversity is "the distribution and abundance of different plant and animal communities within the area covered by a land and resource management plan." The Keystone Center National Policy Dialogue on Biological Diversity adopted a simpler definition, "the variety of life and its processes." So, what really is biodiversity?

Broadly interpreted, biodiversity has two parts; 1) the rich and varied forms of life found around us, from bacteria to bluegills, fungi to flying squirrels, and wildflowers to wild turkeys; and 2) the various interactions, processes. and cycles found in nature that link these groups into populations, communities, and ecosystems.

Most of us inherently understand the first component. We are aware there are many different kinds of plants, animals, and other organisms that make up the living world around us. However, we often do not understand the sheer enormity of the numbers of living organisms. We have identified and described about 1.4 million living species on earth. Scientists estimate there are 5 to 30 million different kinds of organisms on this planet.

Habitat diversity produces species diversity, and Alabama's remarkably diverse geology, topography, and soils, combined with eight separate river systems, have resulted in a diversity of life far exceeding most other areas of North America (Table 1). The freshwater streams of Alabama support one of the richest assemblages of aquatic species, especially mussels and snails, found in the world. University of Alabama biologists Charles Lydeard and Richard Mayden have looked at the numbers, and they describe Alabama's freshwater ecosystems as North America's neglected "hotspot" of biodiversity. Alabama's freshwater ecosystems, relative to north America, support 303 **(38%)** of 792 fish species, 147 (43%) of breathing snails, 171 (60%) of mussels, and 23 (52%) of 44 aquatic turtle species. Of these, 7%, 66%, 5%, and 9%, respectively, occur in Alabama and no place else on earth. Many are threatened, endangered, or even extinct due to habitat modification and destruction.

While biologists have been studying nature for years, we still do not understand many of the complex interrelationships in any given ecosystem. Thus, many people without scientific training have difficulty understanding the second component of biodiversity. The best way to help explain this idea is by using an example.



Species Diversity
Greenbreast Darter

Alabama has more than 4,000 different plants, 145 reptiles and amphibians, 360 birds, 65 mammals, 303 freshwater fish, 171 mussels, and unknown numbers of insects.

Species Diversity
Yellow Lady-Slipper.Orchid

Imagine the ecosystem as a spider web. Each living organism has a unique position or role in an ecological community. This is the intersection point in the spider web. Each of these organisms is linked to another organism. just like the fibers that connect each point in a spider web. We cannot fully predict what will happen if we lose one point in that ecological spider web. As species disappear from ecosystems, other species which rely on it for its existence are weakened and ultimately threatened. Thus, the intricate web of life in which it survived becomes simpler.

Let's take the example of understanding ecological relationships one step further. When Europeans arrived in southern Alabama, they found a vast longleaf pine-dominated ecosystem that frequently burned. Fires were both naturally-occurring (ignited by lightning strikes) and set intentionally by Native Americans. Plants and animals native to this area had to be adapted to fire, and many became so "fire-specialized" that they cannot survive in the long run without the disturbance of occasional fire in their habitats. Beautiful remnant stands of pitcher plants still occur along seepage slopes in southern Alabama, but where fire is excluded, red maple, tulip poplar, and other fire-intolerant woody species quickly take their place. In Alabama, only a few dozen isolated populations of the rare Pine Barrens treefrog remain along the shrubby margins of these boggy places, and many are thought to have vanished in recent years as modem fire suppression has transformed their open shrubby habitat into thick shady woods. Are populations of the Pine Barrens

Species Diversity
Spotted Salamander

Table 1 - Number of known species on earth, in North America (excluding Mexico), and in Alabama.

	Plants	Freshwater Mussels	Freshwater Fish	Amphibians & Reptiles	Birds	Mammals
# species on earth	250,000	?	10,000±	9,100	8.600	4,100
# species in N. America	25,000	283	792	454	1,683	800
#species in Alabama	4,000±	171	303	155	360	65
%of North America	16%±	60%	38%	34%	21%	8%

Species Diversity
Pine Barrens Treefrog

Are populations of the Pine Barrens treefrog doomed to extinction because an ecological process was disrupted?

treefrog doomed to extinction because a natural process has been disrupted? Paradoxical as it may at first seem, natural resource managers are now setting fire to the habitat — mimicking disrupted natural processes — to preserve both the pitcher plants and the treefrogs.

Because biodiversity is so complex, it is useful to return to the original question "What is this variety of life we are managing for?" Biological diversity includes genetic diversity, species diversity, ecosystem diversity, and landscape diversity.

GENETIC DIVERSITY. This is the level of biodiversity most people have difficulty understanding. Each individual organism is a unique chemical and genetic factory unlike any other of its species. No two humans are alike, for example. This reservoir of information has taken centuries of time to develop and cannot be duplicated or retrieved once it has been lost. A diverse or varied gene pool provides a hedge against an unknown future. It allows a species to adapt to constantly changing environmental conditions.

SPECIES DIVERSITY. This is the level of biodiversity that usually receives the most attention. This is the many different kinds or varieties of plants, fungi, fish, amphibians, reptiles, mammals, birds, and other organisms that make up the living world around us. An important part of species diversity comes with understanding how species change from place to place and how they change over time at the same place.

ECOSYSTEM DIVERSITY. A group of the various species living in an area, the ecological processes that link them together, and the soil, air, and water that support the living organisms is called an ecosystem. There are many different kinds of ecosystems that occur in different physical settings. You know ecosystems as a hardwood forest, a wetland, a prairie, or a stream to name just a few.

LANDSCAPE DIVERSITY. Take a step back and look at the geography of Alabama. The political boundaries of Alabama capture a diverse topography containing many different ecosystems, from coastal beaches and dunes to Appalachian cove forests.

A Why is Biodiversity Important?

Why should you care about some nondescript, rarely seen snail? Would it make a difference if you knew this snail did not get cancer? Would it make a difference if scientists discovered why this happens and applied this knowledge to prevent or cure cancer in man? This is just a simple answer of why people should care about protecting and managing for a variety of living organisms.

Species Diversity
Swallowtail on Rough Blazing Star

Biologists contend that if the loss of biodiversity continues, many aspects of our quality of life will be lost. The diversity of life benefits us in infinite ways. The answer to why manage for biodiversity touches on ethical, esthetic, economic, and practical reasons that ultimately affect our quality of life.

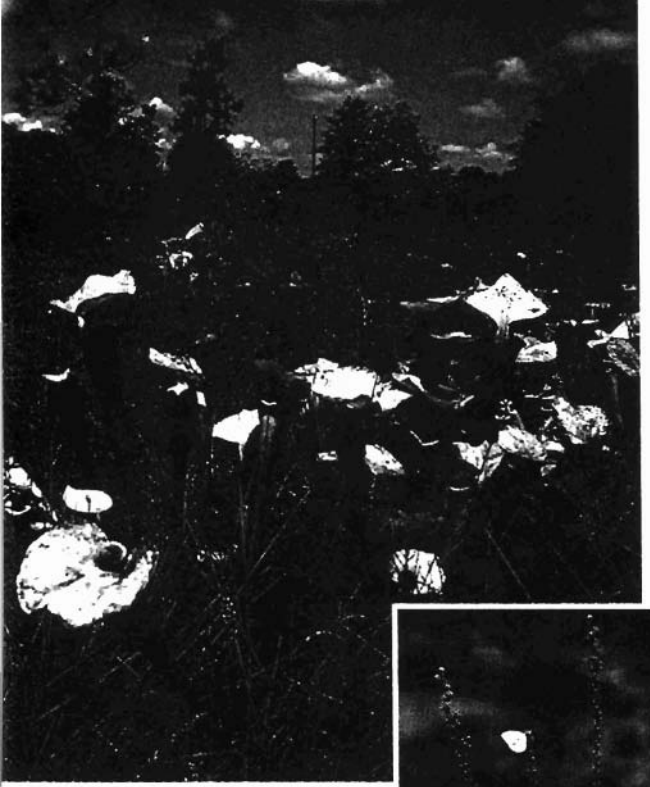
PRACTICAL REASONS. It is difficult to dispute the "practical" and potential economic reasons for protecting biodiversity. Are you aware that the world's food supply depends on about 20 different plant species that were derived from native or wild ancestors? Are you aware that 20 years ago blight wiped out about 1/5 of the corn crop in the United States? By crossing domestic varieties of corn with their wild cousin, scientists created a type of corn that resisted blight. One of our most important agricultural defenses against blight, pests, drought, and disease may be to invigorate domestic species by hybridizing them with their wild counterparts.

You have a cold or fever and take aspirin to relieve the symptoms. You have an infection and take penicillin to cure it. Are you aware that aspirin is derived from the willow and penicillin from a common fruit mold? Recently a compountl called cyclosporine was identified from a mushroom. Scientists discovered this chemical had the ability to suppress the rejection response in humans undergoing tissue transplants. Thousands of people undergoing heart, lung, liver, kidney, and bone marrow transplants are alive today since the introduction of this drug. It is surprising to many people that from 1/4 to 1/2 of all our medicines contain plant extracts.

Each "cog and wheel of the land mechanism" can be considered an encyclopedia of genetic information or a treasure chest of information that may be useful to humans. Because each species is unique, to lose a species is to deny future generations the opportunity to use the chemical and

Biodiversity Video

The Tennessee Conservation League (AWF's counterpart in Tennessee) recently produced a 14-minute video about songbirds and biodiversity. Titled "Threads in the Fabric of Life," the program looks at how changes in habitat are disrupting populations of neotropical migratory birds. To order a copy or for more information, contact TCL at 300 Orlando Ave., Nashville, Tenn,. 37209-3200; tel. (615)353-1133. □



Species Diversity
Pitcher Plant Bog

genetic secrets to improve their quality of life. The quest for identifying useful organisms that may improve the quality of our lives has just begun. Scientists have described less than 1/2 of all living things on this planet. Of all the plants and animals we do know, less than 1% have been tested for a possible benefit to humans. We have barely started to unlock the potential benefits of the world's plants and animals yet with the loss of each species we may be destroying the potentially important drug or agricultural commodity of tomorrow.

ECOLOGICAL REASONS. Biologically diverse communities of plants, and animals, provide indispensable ecological services. While scientists have been studying nature for years, we are still largely ignorant of the complex interrelationships in any given ecosystem. Remember the spider web and 'royal catchfly' examples? Another way of looking at ecological relationships is to think of each species as a brick in a house. Every brick contributes to the support of the house. What would happen if you slowly and randomly removed a few bricks? Perhaps nothing would happen at first. However, as more bricks were removed, cracks would develop in the walls, the roof would sag, and leaks would appear. At some point, the entire house would crumble.

No one knows how many of nature's "cogs and wheels" can be removed without turning an ecosystem into rubble. No one can predict if or when a catastrophe will strike. However, it is certain we are eroding the fabric of life with each species lost. Consider a simple example. There is one single wasp species that pollinates the majority of fig trees that grow in the tropics. What would happen if that wasp were eliminated from the ecosystem? Because figs are an important food source for many tropical birds and mammals during the dry season, losing the figs might mean losing bats, spider monkeys, peccaries, and other species dependent on the figs for food. Once these animals are gone, would we lose the jaguars and other predators? Once the bricks-begin to disappear from the house. how long before the ecosystem begins to crumble?

Ecosystem Diversity
Sandstone Outcrop

Species also serve as environmental barometers. They tell humans that something is wrong with the environment. Just as canaries warned miners of poisonous gases, so do some species warn us about unhealthy ecosystems. The same factors that cause more sensitive creatures to decline may ultimately affect the human population.

Take the freshwater mussels for example. Mussels feed by filtering their food from the water. Because of this type of feeding, mussels accumulate environmental pollutants in their tissues. When water pollution levels become too high, these animals die. The number of mussel species in a stream is a direct measure of the water quality of that stream. How long before these toxins accumulate in the people that depend on that water supply for their drinking water? In Alabama, many species of freshwater mussels are extinct, others are now rare or in danger of becom-

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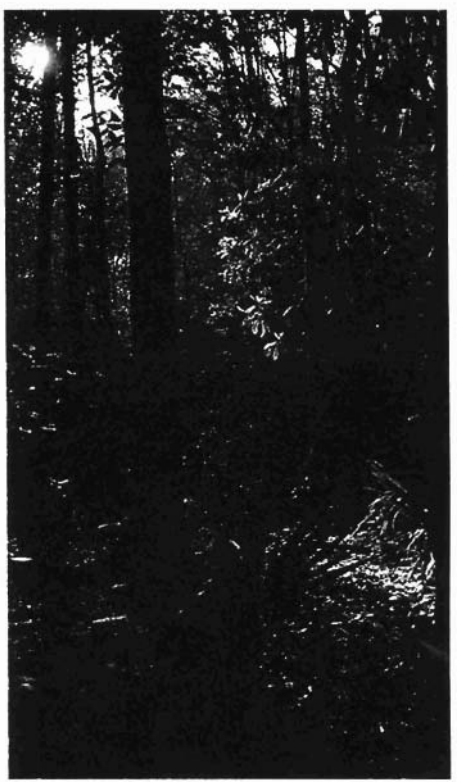
New Discoveries
Yellow Indian Paintbrush

Alabama's varied landscape supports plant and animal species found nowhere else in the world, and new ones are still being found. This yellow Indian paintbrush was first discovered on dolomite glades in Bibb County in 1991.



Species Diversity
Conecuh River Bottom

Forever Wild Update

By DR. JEFF MCCOLLUM
AWF President and Forever Wild Board Member

As a new member of the Forever Wild Board, I would like to update the AWF membership on its progress. The Forever Wild Land Acquisition Program recently completed its second year and its inaugural purchases.

After passing the necessary legislation in November '92, a diverse statewide board was established to administer this program. A mechanism for grading nominated sites in the four land use categories; nature preserve, wildlife management area, recreation area and state park, was established. Finally, a program was devised to begin inventorying unique and important natural areas in Alabama. A call for tract nominations began with passage of the amendment and the public has since been encouraged to nominate tracts for acquisition by the board. Purchases in 1994 include the 320 acre Coon Creek tract, 1500 acre Wehle tract and the Monsanto tract.

The initial tract acquired was donated by the Monsanto Corporation. It will provide an additional 210 acres adjacent to Guntersville State Park in Marshall County for public use.

The Wehle tract will provide land for WMA use, recreation, and a nature preserve in Bullock County. The seller made this a unique purchase in that he donated one million dollars of the value of the tract along with property and funds to establish a nature center on the property.

The last purchase was the Coon Creek tract in Tallapoosa County. It will provide recreational access to Yates Lake.

In all 1.3 million dollars were spent to secure and maintain these parcels as forever wild. The remaining funds for fiscal year '93-'94 have been carried over to this fiscal year. Presently 4.5 million dollars are available to purchase nominated sites.

Surprisingly, only a total of 200 sites have been nominated to date, with only 128 presently making it through the extensive evaluation process. This list of nominations is updated regularly by the State Lands Division. Nominations remain on the list until withdrawn by the owner or the state is able to negotiate purchase for the appraised fair market value.

Failure of a nominated tract to be purchased can occur because not all tracts achieve a high priority based on the evaluation process. The second reason for failure involves decisions of the landowner. Either the landowner withdraws the tract because the tract is not for sale or the landowner is unwilling to sell the tract for the appraised fair market value, such as Cathedral Caverns.

As a member of the Forever Wild Board representing consumptive user interests, I have been shocked by the paucity of consumptive user sites nominated in relation to the critical need for lands available for public hunting. Anyone can nominate any site by calling the state's Land Division at (334) 242-3484, or submitting a written nomination to State Lands Division, 64 N. Union Street, Montgomery, Al 36130. Remember it does not hurt to try. As evidenced by the Wehle and Monsanto tract acquisitions, large estates or holdings by major corporations could easily become public property under the right circumstances. So nominate a tract, we sportsmen need a place to go!

Many years of work went into bringing the Forever Wild idea to reality. It's impact on the consumptive user groups will depend on several factors. Nominations of appropriate sites, their availability, the financial and legal creativity to acquire them, and ultimately the determination of sportsmen and outdoor enthusiasts that their interests be addressed. □

BIODIVERSITY

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ing extinct. This information tells us we have severe water quality problems in many of our streams throughout the state.

Because these streams are a source of drinking water for many Alabamians, we should be concerned about the decline in water quality that supports the mussels and us.

Other examples of the ecological benefits provided by diverse biological communities include providing the oxygen we breathe, recycling wastes, maintaining the chemical composition of the atmosphere, and playing a major role in determining the world's climate.

OTHER REASONS. The beauty of the many other varied life forms with which we share the earth may be another reason for preserving biodiversity. As a society, we spend billions of dollars acquiring, protecting, and enjoying beautiful works of art, music, or architecture. We are outraged when vandals attack precious paintings, sculptures, or other works of art. Have you ever looked closely at a monarch butterfly, a lady-slipper orchid, a box turtle? Their beauty and intricacy rival the finest works of art. Shouldn't we protect these natural works of art?

Do you enjoy hiking in the lush forests of our state? Do you like to hunt or fish? Are you a photographer capturing a white-tailed deer or dwarf crested iris on film? Are you inspired to paint because of the beauty of nature surrounding you? These and many other esthetic and recreational activities depend upon healthy biologically diverse ecosystems.

Finally, many people believe we should manage for biodiversity because we have a moral or ethical responsibility to future generations and future generations are entitled to expect an environment as biologically rich as the one inherited by today's generation. □