NATURAL RESOURCES

What are Natural Resources?

Natural resources are sources of wealth or health produced by the earth's natural processes. They include soil, water bodies, the deeper layers of the earth's crust and the air surrounding earth. Natural resources also include the earth's organisms, from viruses through mammals.

Resources can be classified as abiotic or biotic. Oxygen, water, nitrogen, rocks and soil are all abiotic components. The organisms in the environment are the biotic component.

Some resources are essentially limitless on a human time scale. Solar energy, wind, flowing water and tides are examples of these perpetual resources. A potentially renewable resource is normally replenished through natural processes. White-tailed deer and trees are potentially renewable resources. Sometimes these resources are used or polluted at a rate greater than the earth's ability to replenish them. In such an instance, the supply of that resource may then be considered nonrenewable.

A nonrenewable resource is available in a fixed amount. Supplies of nonrenewable resources may be exhausted because they cannot be replaced by natural processes or at a rate to match the demand. Nonrenewable resources often become economically depleted before supplies are actually exhausted. As a rule, after 80 percent of the total estimated supply has been removed and used, it becomes too expensive to harvest the remainder. Coal, oil and fluorite are examples of nonrenewable resources in Illinois.

The species classification category contains organisms that resemble each other in appearance and behavior. Members of a species can reproduce and produce fertile offspring. Species diversity is the number of species present in a defined area. The species diversity on earth is estimated to be between 40 and 80 million. Of that total, only 1.5 million species have been classified by scientists.

All organisms are potentially renewable resources. When a particular species' population has difficulty renewing itself, it may declared an endangered or threatened species. An endangered species is in danger of extinction. The harlequin darter and tube beardstongue are among the state endangered species. The Indiana bat and leafy prairie clover are federally endangered species that also live in Illinois. A threatened species is one that is likely to become endangered in the foreseeable future. Decurrent false aster is a plant that is both state and federally threatened. Species are classified as endangered or threatened by two laws, the Illinois Endangered Species Protection Act of 1972 and the U.S. Endangered Species Act of 1973. A third category is not controlled by law but by decisions made by state and federal regulatory agencies. Species are placed on a watch list for a variety of reasons: when there is insufficient data on the population; when the population was endangered or threatened but now seems to have regained stability; or when the population is threatened or endangered in one area but seems stable elsewhere. The eastern bluebird is a watched species in Illinois.

Animal species can also be classified as either game or nongame. A game species is hunted for sport, food, fur or another intrinsic value. The white-tailed deer is a game species. A nongame species is not hunted. The northern cardinal is a nongame species. Some game species are protected from hunting because the species is threatened or endangered. The greater prairie-chicken is a game species that is protected in Illinois due to its endangered status.

What is an Ecosystem?

The place an organism lives is its habitat. However, no single species occupies a habitat in isolation. Habitats overlap. The species that interact within their respective habitats make up a community. An ecosystem includes a community or communities with the chemical and physical factors that comprise its nonliving environment. All ecosystems must exchange energy with their surroundings. The sum of the earth's ecosystems makes up the ecosphere.

Many complex processes contribute to the maintenance of an ecosystem. Nutrients, elements and compounds necessary to sustain life, are recycled through the ecosystem by a process known as the nutrient cycle. Nutrients can be organic compounds (sugars and proteins), inorganic materials (water, carbon dioxide, oxygen, nitrate ions) and elemental ions (iron, calcium). Many chemicals do not naturally occur in the form required by organisms. Chemicals are constantly recycled through the living and nonliving components of the ecosphere. These cycles include the carbon, oxygen, nitrogen, phosphorus, sulfur and water cycles that are driven directly or indirectly by energy from the sun.

A chemical may be part of an organism at one moment and part of its nonliving environment at another moment. One oxygen molecule you just inhaled may have been inhaled previously by you or your grandmother. Similarly, a carbon atom in you may previously have been part of a plant, a mastodon or a piece of coal.

A food chain is the path that nutrients take from a producer (plant) to a primary consumer (herbivore) to a secondary consumer (predator of herbivore) to a tertiary consumer (predator of predator). A simple food chain cannot accurately portray the interrelationships in an ecosystem. Another process vital to the ecosystem is the food web. A food web, made up of many interconnecting food chains, is a closer approximation of the natural process. As organisms interact in food webs to use and transform energy, they form an energy pyramid.

Each link in the food chain or level of an energy pyramid is called a trophic level. All organisms that fulfill the same role in the food web are part of the same trophic level. For example, all producers are on one level and all tertiary consumers are on another level. Less total energy is available for the consumers at each succeeding level because it has been consumed and some has been released to the environment. Many species operate at several trophic levels. A bass eating an insect may be a secondary consumer. The same fish, minutes later, may eat a bluegill, thus acting as a tertiary consumer.

Carrying capacity refers to the greatest number of individuals of a particular species that an ecosystem can sustain over time. The carrying capacity of an ecosystem is not static but may vary from year to year or season to season. During a drought or severe winter, the number of organisms an ecosystem can support will decrease. When food supplies are plentiful, an ecosystem may support more individuals than the previous season. The single factor in an ecosystem that limits growth, abundance or distribution of the population of a particular organism is the limiting factor.

Why Manage Natural Resources?

A population includes all members of a species living in a defined area at a particular time. Many things can be learned about a species by studying an entire population rather than a single organism. For example, populations possess density, natality, mortality and an age structure, none of which can be studied in an individual organism.

Population density is the number of animals per unit of area. Natality, or the population birth rate, refers to the annual number of births per number of individuals. Mortality, or the population death rate, refers to the annual number of deaths per number of individuals. The population age structure is the distribution of individuals across various ages.

All living things have a reproductive instinct for insuring their survival. Ecologists call this a reproductive plan. Each organism, no matter how big or small, can be classified as a pioneer, climax or transition species.

Organisms with a reproductive plan for a high rate of population growth are called r-planners. They mature quickly, mate often and produce large numbers of weak offspring. These strategies, along with little or no care from parents, usually result in few young surviving to reproduce while many young die. Bacteria, algae, most insects, annual plants, many fishes, some game birds, many song birds, rodents and many small mammals are r-planners. Some fishes, for example, can lay between 1,000 and 1 million eggs, but have a 99.9 percent mortality.

Not only do bacteria inhabit live tissue, but they are the first to invade dead tissue. Annual grasses are usually the first plants to grow in freshly plowed fields. Algae reproduce in puddles, ponds and swimming pools. For these reasons, these and other organisms that are the first to colonize an area are called pioneer species.

At the other end of the spectrum are organisms whose numbers are controlled by competition, predation and the amount of space in their habitat. They are called K-planners because "K' is the symbol for carrying capacity. Carrying capacity refers to the number of individuals in a given population that the habitat can support. K species have only a few large offspring that are nurtured until they reach reproductive age. These species include wolves, bears, cougars, wapiti, bison, most medium to large mammals and some large perennial plants. Humans are K-planners who have, with the use of science, learned to speed population growth. Since they evolved from and depend on

ecosystems changed by pioneer and transition species, K-planners are also called climax species.

Because the natural world is in a constant state of change, most living things are transition species. They fall somewhere in the range between r- and K-planners in the number of young they bear. Their mortality rate is lower than r-planners but higher than K-planners. In other words, some connection between reproductive and mortality rates may occur, but no clear pattern exists. For example, some kinds of waterfowl have a 50 percent mortality rate in the first year, but others can live up to 20 years. White-tailed deer have a high reproductive rate but also experience a high mortality rate.

A limiting factor is any single factor that limits the growth of a population in a given ecosystem. Usually, factors such as predation, competition and disease keep a species? birth rate and death rate in balance, thus maintaining a stable population that the ecosystem can support. Extreme weather conditions can be a limiting factor. In 1984, severe and prolonged cold weather and snow resulted in the deaths of many animals. With fewer animals surviving winter, the number available to mate and reproduce the following year was considerably less.

Changes in conditions can increase or decrease an ecosystem's carrying capacity. As a population's size reaches or exceeds its capacity in the ecosystem, its death rate increases. If this correction occurs suddenly, a population crash occurs. The carrying capacity for a given population is not a fixed number, but may change as the quality of the habitat improves or lessens.

Ecosystems are altered by species immigration and emigration. Immigrating species are those entering an ecosystem. Emigrating species leave an ecosystem. Both immigrating and emigrating species may indicate ecosystem degradation.

Alien, or exotic, species may be introduced to an ecosystem by immigration or deliberate or inadvertent introduction by humans. Introduction may simultaneously have positive and negative effects on the ecosystem. The ring-necked pheasant is one such exotic species. A native of Asia, the pheasant has established itself as a member of Illinois' grassland ecosystem and is a popular game bird. On the down side, pheasants compete with the native prairie-chicken for nesting space, parasitize their nests and harass chickens on the "booming" grounds where males call to females. The prairie-chicken is an Illinois endangered species. The European starling is another example of an exotic species that competes with native species for scarce resources. Without natural predators, starlings have become successful to the point of being a nuisance.

In natural, stable ecosystems, prey species are controlled by competition between and among species and the number of predators. Manipulation of many of Illinois' natural ecosystems has disturbed this balance. Consequently, fish and wildlife management is necessary to control population levels.

EXOTIC SPECIES ADVANTAGES AND DISADVANTAGES

SPECIES	ADVANTAGES	DISADVANTAGES
ring-necked pheasant	popular game bird	nest parasite
Scotch pine	Christmas tree	disease and dispersal
coho salmon	human food source	competes with native species
common carp	human food source	competes with native species
rusty crayfish	bait	displaces native crayfish, disturbs walleye spawn
European starling	seed dispersal	displaces native species, alters natural habitat
spongy moth	bird food source	forest defoliation
house sparrow	seed dispersal	displaces eastern bluebirds and cliff swallows
zebra mussel	food source for diving ducks	kills native mussels, encrusts water intake pipes and other objects in water
garlic mustard	ground cover	invades forests excluding native species
Japanese honeysuckle	ornamental vine	dominates forest understory growth
winter creeper	ground cover	dominates forest understory growth
purple loosestrife	food source for shore and wading birds	dominates wetland plant communities