Science at the Cienega
Background Information for Teachers

Leonora Curtin Wetland Preserve

The Leonora Curtin Wetland Preserve is a 35-acre nature preserve located on the I-25 frontage road south of Santa Fe. The preserve is adjacent to El Rancho de las Golondrinas in La Cienega. This rare natural cienega, or "marsh" in Spanish, hosts a bountiful diversity of plants and wildlife.

The Preserve contains three distinct plant communities or zones. They are: riparian/wetland, transitional, and dry uplands.

The Leonora Curtin Wetland Preserve is named for Leonora Scott Muse Curtin who first came to New Mexico from New York in 1889. She was an avid naturalist, who spoke fluent Spanish, and became interested in plants with medicinal and nutritional values used by Native Americans and early Spanish settlers. She quickly became fascinated with the healing skills of the curanderas, who used naturally growing herbs to treat the sick and injured. *Healing Herbs of the Upper Rio Grande* compiles Curtin's research from time spent in the mountain villages of Northern New Mexico.

Wetland Ecology

What is a Wetland?

A wetland is an area of land that is covered by or saturated with water either seasonally or year around. A wetland may be a small backwater beside a stream, a salt water marsh, a seasonal pond or spring, or a marshy cienega. Sometimes the water is very obvious with a large pond full of fish and ducks. Sometimes the water is just below ground and not obvious at all. As the name implies however, it is the presence of water that makes a wetland what it is.

There are many different kinds of wetlands worldwide. All wetlands exhibit three primary characteristics: the soils are saturated, water-loving plants are present, and water occurs there. These conditions do not need to be year-around or constant. Some wetlands change dramatically through the seasons or even (in the case of intertidal marshes) through the day. There may be periodic flooding or drying-up. Some places are considered "seasonal wetlands" and only exhibit

wetland conditions during certain times of the year. Wetlands are influenced by such things as topography, climate and geography.

Wetland Functions
Wetlands serve several very important roles in the environment. Scientists call these "wetland functions." Wetland functions contribute to the physical, chemical, or biological health of the environment. Wetlands also have aesthetic and economic value to humans.

Wetlands play an important role in the water cycle. They naturally help slow and control flooding and they contribute to groundwater recharge. They also trap sediments which might otherwise impede the water cycle. Wetland plants are able filter pollutants out of the water. Wetland plants also help settle toxic residue into the wetland soil where they may become chemically neutralized over time. Some pollutants are processed by the bacteria which thrive in wetlands. Wetlands are also very productive habitats; they are so full of resources and nutrients that life abounds there. The biological functions of wetlands are their value as habitat – both as nurseries for abundant productivity and as home to a myriad of species, including many that are endangered.

Wetlands also have value to humans. Foods such as rice and cranberries are grown in wetlands. In some countries, wetland plants such as peat, reeds and trees are harvested for fuel, fiber or timber. People also value wetlands as places for recreational activities such as bird watching, canoeing, or fishing. While humans benefit from these economic functions of wetlands, they also benefit from all the other functions wetlands perform.

Overview of Ecology

Ecosystems
Ecology is a field of study that looks at the interrelationships between living things and their environment. All of the living and non-living things in a given area, and their interactions, make up an ecosystem. Thus, ecology can also be defined as the study of ecosystems. Ecosystems can be as large as the entire planet (or larger perhaps) or a small as a drop of pond water. Size is unimportant, the definition is based on the existence of both living and non-living factors interacting in a given space. The interactions of living things with non-living things in an ecosystem include such activities as breathing, holding on (as roots in soil or lichen on rocks), keeping cool, keeping warm, drinking, obtaining nutrients, bathing, finding shelter, etc. In other words, living things rely upon and are influenced by the non-living things in their ecosystem. The environment is the medium (or living conditions) created by the combination of the non-living factors of the ecosystem.

Biotic Factors
The living things in an ecosystem are called the biotic factors. Living things are relatively easy to identify: birds, plants, mammals, insects, reptiles, fish, etc. Living things are classified by a very organized system that takes into account the evolutionary relationship between the organisms. A group of closely related organisms which can breed to produce similar offspring is called a **species**. A species is the smallest level of classification in which animals or plants are grouped (although sub-species do exist). A group of organisms of the same species living in a specific area is called a **population**. In a given ecosystem there may be a large variety of different kinds of plants and animals or there may only be a few. The measure of the number of different kinds of

plants and animals is called **biological diversity (aka biodiversity)**. Biological diversity not only refers to the number of different kinds of species (which is more accurately termed species diversity), it may also refer to ecosystem diversity (a measure of the variety of ecosystems in a given area) or to genetic diversity (a measure of the variety of genetic material within a species). All biotic factors rely on an appropriate habitat for their survival. A **habitat** is the place or type of place where an organism lives. It includes all of the necessary abiotic and biotic factors (food, water, shelter, etc.) for an organism to survive.

Abiotic Factors

The non-living things in an ecosystem are called abiotic factors. Abiotic factors are things such as sunlight, temperature, parent rock (the non-living part of the soil), and moisture. Abiotic factors provide the conditions for life but also set the limits for living things in the environment. For example too much heat and not enough moisture can cause some plants to wither and die. Freezing temperatures may encourage some animals to migrate. The primary abiotic factors that influence life and dictate living conditions can be grouped and summarized as follows:

- Climate (including temperature, sunlight, moisture, seasonal changes, photoperiod (duration of daylight), and wind)
- Substrate (including parent rock and soil characteristics such as particle size, texture, pH, and chemical composition)
- Geography (including latitude, longitude, and altitude--all of which influence climate)
- Topography (including north - south exposure, steepness of slope, and general terrain)
- Nutrient Cycles (including carbon, oxygen, nitrogen, sulfur, and phosphorous as atmospheric gases and soil minerals)

Phenology

What Is Phenology?

Phenology is simply nature's calendar—when the cherry trees bloom, the robin builds its nest, and the leaves turn color in the fall. Phenology is derived from the Greek word phaino , meaning to show or appear. Phenology refers to recurring plant and animal life cycle stages, such as leafing and flowering, maturation of agricultural plants, emergence of insects, and migration of birds. It is also the study of these recurring plant and animal life cycle stages, especially their timing and relationships with weather and climate.

Why Is Phenology Important?

This schedule of seasonal events is critical for plants and animals, and people too. When a caterpillar emerges, it needs developing leaves to eat. When a chick hatches, it needs caterpillars and other food to eat. For many people, allergy season starts when particular flowers bloom—earlier flowering means earlier allergies. Farmers and gardeners need to know when to plant to avoid frosts, and they need to know the schedule of plant and insect development to decide when to apply fertilizers and pesticides. In fact, phenology affects nearly all aspects of the environment, including the abundance and diversity of organisms, their interactions with one another, their functions in food webs, and their seasonal behavior, and global-scale cycles of water, carbon, and other chemical elements.

How Does Phenology Relate to Climate Change?

Phenology records can help us understand plant and animal responses to climate change. Changes in phenological events like flowering and bird migrations are among the most sensitive biological responses to climate change. Across the world, many spring events are occurring earlier—and fall events are happening later—than they did in the past. However, not all species are changing at the same rate. The phenology of some species is changing quickly, while for others it is changing slowly or not at all. These different shifts in timing are shaking up ecosystems and altering interactions and processes. Phenology has been described by the White House and many government agencies as a key indicator of climate change.

Visit the National Phenology Network Website: *http://www.usanpn.org/home*

Using Aquatic Macroinvertebrates as Indicators of Wetland Health

The term "macroinvertebrate" means an organism without a spine (invertebrate) that can be seen without the aid of a microscope or can be seen by the unaided eye. The word "benthic" means bottom dwelling and refers to organisms that live on the bottom (substrate) of a river, stream, pond or lake. The term "aquatic" means they occur, for at least a portion of their life cycle, in a water environment.

Aquatic macroinvertebrates are excellent long-term **indicators** of wetland, stream, and watershed health. Because these macroinvertebrates must live in the water all year long (in their larval stages at least), they reflect the impacts on the watershed. The use of aquatic macroinvertebrates as "indicators" of water quality has been occurring for many years. This is because in general, some macroinvertebrates are found more often, and in larger amounts, in waters that are generally clean or unpolluted. For example, stoneflies are often considered to be indicators of clean water. Worms and midges however, are often viewed as indicators of dirty water, especially in rivers and streams. Studies have shown that watersheds that have been overgrazed or that drain urban areas with over 25% paved surfaces tend to have less diverse aquatic macroinvertebrates. They also tend to have more pollution-tolerant macroinvertebrates. Sampling an aquatic environment over time using macroinvertebrates as water quality indicators can provide information about the health and integrity of the ecological community. Because these insects play an important role in the food chain, their health is important to the entire riparian community.

Aquatic macroinvertebrates make good indicators of watershed health because they:

- live in the water for all or most of their life
- stay in areas suitable for their survival
- are easy to collect
- differ in their tolerance to amount and types of pollution
- are easy to identify in a laboratory
- often live for more than one year
- have limited mobility
- are integrators of environmental conditions