East Texas Bottomlands

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Winter in the Big Woods – flooded bottomlands of the Trinity River. TWA Director Dr. Robert F. McFarlane took this shot. He is a cardiologist in East Texas and owner/operator of the BigWoods on the Trinity River Hunting Resort.

Our bottomland hardwood forests are among East Texas' special places. In pre-settlement times, these forests were part of the vast ecological system of southern timberlands. They were part of the high-quality wildlife habitat that supported now-extinct species such as the ivory-billed woodpecker, Carolina parakeet, red wolf, and the original genetic populations of black bears and mountain lions. Driven by the subtropical climate, soils and water flows over time formed the foundation for the diversity of plants and animals that thrived in these forests.

Originally, trees dominated the floodplain landscapes in soils fertile from the accumulated nutrients and constantly available water. Plants are "primary producers" and the foundation for food chains, making these bottomland forests the domain of many types of animal life. Today, "the bottoms" still are the destination for many outdoor recreationists because of this natural diversity, even after a couple centuries of substantial alteration of quality and acreage loss.

Native Americans living here relied considerably on agriculture in addition to hunting, fishing, and gathering. Early European settlers took their cue from them and quickly adopted lifestyles that incorporated the abundant resources of bottomland hardwood forests. Their demands and extractions led to degradation and/or destruction of ecological quality.

Earth sciences gradually revealed the natural assets in functioning bottomland forests. Modern society now has increased appreciation for the wild places of the Sabine, Neches, Sulphur, Cypress, San Jacinto, Trinity and their many tributaries.

We now understand that bottomland forests reduce flood peaks by slowing the downstream rush of collected rainfall runoff, improve water quality through deposition of sediments, prevent soil erosion, provide renewable timber resources, and serve as habitats for a multitude of fish and

photo by Carl Frentress

Catfish Creek on Dr. McFarlane's BigWoods Resort, a few miles from its confluence with the Trinity.

wildlife species we value for recreational or commercial purposes. And there is an often-overlooked connection between these bottomlands and the welfare of finfish and shellfish in downstream coastal bays and estuaries.

Here are two examples of the many complex relationships of wildlife species with these special environments.

Winter Ecology of Mallards

Mallard reproduction is a complex web of year-around events, the story of the union of biology and ecology. In a sense, it is a grand "ecological dance" in which Texas bottomland hardwood forests are an important part of the rhythm.

Many mallards establish pair-bonds in our bottomland hardwood forests. Winter sex ratio data of mallards in the Central Flyway suggest these birds come here for that function. Survey data from the 1980s indicate that the proportion of males to females is about 1:1 in Texas, while flocks wintering farther north may be as much as 7:1 in favor of males. Perhaps the balanced sex ratios more likely reflect pair establishment. Certainly, high-quality habitat in bottomland hardwood forests provides what's necessary for successful pair-bonding and subsequent events.

In late winter, pre-breeding adults begin to molt their body feathers. Drakes develop striking color and look as if they are polished. Hens change into feather patterns better suited to camouflage on the nesting grounds. This is noticeable in more streaked body plumage. The whitish bellies in hens also become brownish and streaked. To produce these new feathers, mallards must eat high-protein diets of invertebrates abundant in flooded bottomland hardwood forests.

The leaf detritus decaying on the wet forest floor provides the food base for these invertebrates. Winter floods spreading across the bottomlands are essential to these processes. In addition to the appearance of feather patterns, these dietary changes can be seen in the vivid colors on legs, feet, and bills. The consumption of invertebrates results in bright orange colors in soft tissues. The "red-legged mallards from Kansas" simply are winter-resident birds preparing for the breeding season by feeding heavily on invertebrates.

These plumage changes are vital to production. Without abundant invertebrate foods, hens cannot promptly undergo the late-winter molt. Unless hens complete these molts, they will not mate: no eggs, no ducklings and the fall flight is reduced.

The overbanking of rivers and streams and direct rainfall during winter months is critical for shallow flooding of forested wetlands. Without sufficient water, the habitat functions vital for supporting invertebrates will not develop. The circle linking mallards with this process would not close. In this way, the conditions in winter habitats are connected to the success of production on the breeding grounds.

With successful completion of this body molt, mallards are fully paired and depart northward. Upon immediate arrival on the nesting grounds, they rapidly progress into egg-laying, incubation, and brood-rearing.

Less-than-ideal habitat on Texas wintering grounds can result in reduced reproduction on the breeding grounds. Attention to habitat quality and quantity

photo by David Sams

Our East Texas bottomlands are especially important to waterfowl, such as mallards. Here they establish pair bonds and feed on the invertebrates abundant in the shallow, flooded forests.

must be viewed with the "big picture" in mind. All habitats used by mallards are important and worthy of conservation.

Squirrels and Oaks

Some say that beavers are the only animals (other than men) capable of modifying the environment to suit their needs. However, other animals affect their surroundings in profound ways also. Such is the relationship between squirrels and oaks in bottomland hardwood forests.

Fox squirrels and gray squirrels are the two primary squirrel species in Texas. Generally, fox squirrels are found in upland forests with more open structure. Gray squirrels prefer bottomland hardwoods and associated stream corridors characterized by vines and a well-developed mid-story.

As a rule, gray squirrels are more abundant per unit of habitat than fox squirrels. Populations of both species exhibit a "shadow effect" in relation to the pattern of annual acorn production. That is, when acorns are abundant one fall, squirrels likely are abundant the following year, a signal of the strong ecological connections among squirrels and their habitats.

The capability of squirrels to influence the forest is related to squirrel food habits. When seed crops are abundant, squirrels feed heavily on acorns. However, all acorns are not treated equally. Within this variety of acorn handling is the story of squirrels' influence on oak forests.

Oak species are divided into two basic groups: the white oak group, and the red oak group. Some Texas examples of species of white oaks include post, overcup, white, and swamp chestnut oak. Red oaks include water, willow, Shumard, cherrybark, and southern red oak.

Acorns from white oaks begin germination soon after they fall. Red oak acorns, on the other hand, require a period of dormancy during the cold winter months before germination. Nutrients in the acorns also differ. White oak acorns are lower in fat content and tannin concentrations than red oak acorns, which have high amounts of lipids and tannins. These acorn characteristics are important to squirrels.

Squirrels handle white oak acorns differently than red oak acorns. This likely is influenced by a number of factors including the biology, chemistry, and shape of the respective acorns. When acorns of the white oak group begin to fall, squirrels usually eat them immediately. By burying, they cache only a small portion

photo by Kathy Adams Clark

Gray squirrels prefer bottomland hardwoods and their food habits play a large role in perpetuating the forest's oaks.

photo by Ben Koerth

of white oak acorns. In doing so, they first chew away the end of the acorn containing the embryo, which prevents the acorn from germinating after it is buried. Without "de-germinating" the white oak acorns, squirrels would find their cached supplies spoiled by germination and seedling growth.

White oak acorns contain considerably less tannin and fats than acorns from red oaks. Squirrels are believed to be able to detect this difference in chemical composition of acorns in the two oak groups. Acorns from the red oak are handled with more intricacy and complexity, which seems to be related to lipid and tannin content. The relationship is especially strong between gray squirrels and red oaks.

Generally, squirrels cache red oak acorns when they fall. In addition to contributing to future food stores, this caching also may serve to leach some of the tannins from buried acorns. This tannin reduction makes the acorns more palatable. Red oak acorns also have a period of winter dormancy allowing them to be buried without germination until spring.

However, in two circumstances, gray squirrels may feed heavily on red oak acorns as soon as they ripen. Studies show that gray squirrels distinguish between sound acorns and those that are infested with insect larvae. They immediately eat insect-infested acorns, frequently consuming the larvae also. They store sound acorns.

In the second circumstance, gray squirrels seem to optimize food availability in years of excellent production of red oak acorns. As soon as these acorns ripen, squirrels feed profusely, chewing away a portion of the basal end, the end highest in lipid content and lowest in tannin. By contrast, the tip end containing the embryo is lowest in lipids and highest in tannins. (Tannins tend to repulse feeding because of their bad taste.) Squirrels can feed on the high-energy end of the acorns without damaging the embryos. Squirrels seem to detect the appropriate end for feeding by the acorn's shape. If these partially eaten acorns later are cached but not recovered by squirrels, they will germinate after dormancy. In fact, squirrels bury many of these acorns and some do germinate to produce seedlings that ultimately become trees.

Squirrels do not recover some cached red oak acorns, finally leading to establishment of new trees. In this way, squirrels directly affect species composition in forests. Also in their caching behavior, squirrels may carry acorns some distance from the parent tree. Squirrels become acorn planters for oaks, especially in the red oak group.

Because they eat most white oak acorns as soon as they fall, squirrels do not move these as far from the parent tree. Also, some rapidly germinating white oak acorns will take root before being located by squirrels. These acorns fall, germinate in place and ultimately produce trees close to the parent tree with only a few being cached by squirrels. Forest surveys confirm this: white oak seedlings and saplings are found close to the parent tree and red oak seedlings and saplings are distributed farther from the parent tree. Based on their feeding and caching behavior, squirrels offer an explanation for this different distribution of tree species.

If gray squirrels, particularly, are modifying their environment through behavior that favors red oaks, why are red oaks the privileged group of species? Perhaps it's because red oak acorns offer a more reliable and durable food supply. Red oak acorns are more nutritious than white oak acorns. Also, these acorns can be eaten partially then stored or stored whole for later retrieval in a more palatable condition. Either way, germination still is possible. In the long run, squirrels have a better chance of prospering in for-

photo by Russell Graves

ests dominated by red oaks than in white oak forests. The respective population densities of the two squirrel species reflect this.

Squirrels also are animals capable of modifying the environment to their benefit: they help perpetuate oak forests.

Hardwood Conservation and Silviculture

Conservation of forests calls for management methods useful to producing timber revenues while retaining wildlife habitat. An assortment of practices can be devised to benefit squirrels, ducks, and other wildlife species common to bottomland hardwood forests. Landowners in general have diverse goals for their hardwood forests, usually in the form of wildlife, recreation and timber plans.

It's a good idea to write out a plan that considers these and any other pertinent aspects of land management. A management plan helps the landowner achieve goals, check progress, and schedule tasks to meet these goals and objectives. Management plans are also inventories, summarizing the current land conditions and its resources that may be of interest to the landowner. This inventory "snapshot" can contain topographic, timber volumes, species composition and wildlife features. Often the plan includes information on more than just trees, such as understory plants, soil types, and water resources. Land management of any form is a changing condition and a good plan will serve as a reference point to measure success.

In a mature bottomland hardwood forest, landowners and managers tend to forget how the vegetation, drainage, and subsequent wildlife values came to be. It's been said that hardwoods take some 50 years to grow, and another 50 years to die. Large, "old-growth" forests didn't get that way overnight and go through many successions to reach a level of maturity.

As a forest develops, landowners and managers may lose sight that many trees must die for the forest to advance from seedling to sapling, then to a mature stand. All forms of wildlife benefit from these differing stages of succession.

To optimally manage a forest habitat and include wildlife, there are three main approaches to follow. One approach is to maintain and protect any or all natural communities. The inventory should include the features and vegetation types currently on a tract, and study ways to protect or maintain any outstanding communities. For example bays, fens, or forested wetlands may be kept as is, with minimal interference or harvesting.

A second approach is to incorporate and encourage diversity. This may include favoring uncommon species or creating irregular boundaries (edge effect) within the landscape. Nothing in nature is straight, or a perfect geometric shape. Use this approach when incorporating harvest areas or stand access into your management plan.

A third item to keep in mind for forest habitat management is to manage featured species. Let nature show you what species to manage for and stick with it. Don't try to force species to thrive where they are out of their natural range or lack the proper nutrients or elements to survive. This is important for both flora as well as fauna on a particular piece of property.

When a harvest operation is part of the plan, there are several options to maximize and enhance a piece of property to meet objectives and goals that can work in unison. We have seen how squirrels and oaks can complement each other in a mature forest ecosystem. In much the same way, harvest operations can benefit timber quality, water quality, as well as wildlife values in any system.

Landowners can steer normal plant succession by thinning, clean-cutting or, in some cases, doing nothing at all for a time. When thinning a forest for wildlife objectives there are really no simple rules.

photo by David Sams

This is what makes managing for timber and wildlife such a challenge. In a hardwood ecosystem, there are many pieces and parts to consider that can seemingly complicate the whole process.

The important thing is to consider all potential wildlife values and incorporate them into existing timber yields. Timber harvests using small group selection or single-tree selection techniques in uneven-age forests produce timber revenue while also retaining many forms of wildlife habitat. Older den trees, for example, and some non-commercial species that produce fleshy fruit can also be retained for birds, squirrels, and deer, among others.

Clean-cutting in bottomland hardwood systems where appropriate (particularly in East Texas) is an excellent way to naturally regenerate a stand. The wildlife benefits can be amazing, though relatively short lived. Clean-cutting involves the removal of all stems two inches and larger at the base and is a good way to naturally establish oak and mixed pine-hardwood stands. These clean-cut areas will increase browse for deer and allow hunting areas/opportunities for reptiles and birds of prey that may not be available in a mature, closed-canopy stand.

Sometimes no entry into a stand may be beneficial to accomplish certain management goals and objectives. Nature has ways to heal ecosystems over time; however, they may not always be the most aesthetically pleasing nor match our timely goals and wildlife objectives. We as land managers can use timing to coincide with nutritional needs of wildlife, as well as improve the quality of the timber component and the overall aesthetics of the forest.

Interested in conservation and management of bottomland hardwood forests? Contact the authors at Advanced Ecology Ltd, 2557 State Highway 7 East, Center, Texas 75935, (936) 598-9588 or www.advancedecology.com.

Trinity L.A.N.D.S.

This past year, TWA's Conservation Legacy Program launched the Trinity River L.A.N.D.S. (Learning Across New Dimensions in Science) Project, partnering with the Trinity Basin Conservation Foundation and the Texas Parks and Wildlife Department. In this pilot initiative, fourth-graders from Blooming Grove Elementary in Navarro County and St. John's Episcopal School in Dallas had the opportunity to learn about science, math, and social studies by participating in class and field studies about water. Studies included the water cycle, decision-making about water use, riparian areas (including bottomland hardwood forests), water quality parameters in an urban environment, and how private lands are affected downstream. By showing students the importance of understanding water, they can become better land stewards through conservation, both now and in the future. Other partners include the Texas AgriLife Extension Service, Natural Resources Conservation Service, and the Texas A&M Institute of Renewable Natural Resources.

If we want children to flourish, to become truly empowered, then let us allow them to love the Earth before we ask them to save it. Perhaps this is what Thoreau had in mind when he said, "the more slowly trees grow at first, the sounder they are at the core, and I think the same is true of human beings." David Sobel, "Beyond Ecophobia," Education for Life, Winter 1999.

photo by Koy Coffer

St. John's students learn how urban water decisions affect private lands while visiting TWA members Gary and Sue Price's Ranch near Blooming Grove, TX.

Conservation Legacy is a TWAF-supported program.