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Editorial

Water, Soil, and Plant Diversity in Oklahoma

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In 1963 John Shed and William Penfound did a study on legume distribution. They found a general relationship between soils and vegetation types. Sand deposits generally became forests while limestone and clay deposits generally became prairie (Proc. Okla. Acad. Sci. 44:2-6). But soil-to-plant relationships are not always that simple. Tropographic effects such as slope and solar and wind exposure as well as precipitation rates can override the characteristics of the various soils making it difficult to determine specific soil types based on vegetation.

In 1964 Dr. Paul Buck wrote "Relationships of the Woody Vegetation of the Wichita Mountains Wildlife Refuge to Geological Formations and Soil Types (Ecology 45:2). He had found that when it rains, soil type and topographic features, together, control the movement of water. Granite formations at the Refuge erode to make a cobbly soil at the foot of the mountains that drains quickly, making it difficult for some plants to become established. Different amounts and patterns of precipitation can also interact with soil type producing gradients of moisture availability for plants with different moisture requirements. Some species can live only at certain positions across the moisture gradient. Others are more tolerant of variable moisture availability. Sugar Maple is able to dominate some of the more mesic, cobbly patches near streams, while Black-jack Oak dominates the less mesic, cobbly upland patches in this newly formed soil.

In places like the Carolinas bountiful precipitation on limestone soils can actually make soil very poor in nutrients. Organic acids from the abundant vegetation react with calcium, sodium, and magnesium ions in the soil The abundant rainfall then leaches them from the soil and washes them into the groundwater below the reach of roots. However, this is not usually the case in Oklahoma. Oklahoma actually loses more water to evaporation than it gets in precipitation. Rivers and groundwater from the Rocky Mountains make up the difference. Here, precipitation is not sufficient to leach all the minerals from our limestone soils. Dense stands of forbs and grasses grow in the Tallgrass Prairie Preserve where these mineral-rich formations are not leached by excess precipitation.

Southwest of the Refuge the precipitation rate is so low that much of the water evaporates before it gets very deep into the soil. In those soils, the calcium ions accumulate at the lowest level of water penetration, sometimes, just inches from the surface and form a calcium carbonate. Known as "caliche", this layer restricts root growth, so fewer species grow on caliche. Gypswn, mostly calcium sulfate, was formed long ago in a similar manner when the seawater evaporated from the plains. In Oklahoma Mesquite and mixed grass are associated with "gyp soil".

Soil and water relations alone do not explain why plants grow where they do in Oklahoma. Other variables like humus, micro-organisms, nematodes, grazing animals, fire, ice, windstorms, and human influence all work on a smaller scale and are responsible for much of the physical heterogeneity and resultant biodiversity. This small-scale heterogeneity is what actually accounts for our having more species than other continental United States, except California, Florida, and Texas.

Ironically, plant diversity in Oklahoma has been woefully understudied. With the promise of improved medical treatments based on genetic engineering, we need to know where species are in Oklahoma that might be beneficial. We are, therefore, obliged to preserve as much of our diversity as we can. But we will need to save it on the landscape level, because it is our diverse landscape that supports our diverse biota. Indeed, researching and preservmg Oklahoma's landscape-to-species relationships is worth researching and preserving twice as much elsewhere.

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