

Pinyon-Juniper

by Ben Haggard

Pinyon-juniper (PJ) forests in northern New Mexico are frequently impoverished landscapes, susceptible to erosion and with a minimum of understory species. Frequently, the poor condition of the land is blamed on the pinyon. But based on my observations, I suspect it is the result of larger historical trends in the region. Many of these forests are a recent successional stage, having followed logging and sheep grazing, two highly destabilizing influences in the desert southwest. The junipers, followed by the pines, have colonized eroded and eroding sites and are in some instances the only vegetative cover serving to prevent further soil loss. I believe that the process of desertification is caused primarily by human activity, not by trees.

Most natural systems depend on cooperation and mutually beneficial association for their function. Stability derives from the diversity of connections among members of natural communities. A web of mutually beneficial connections among species, usually organized around one or two significant elements (such as trees), is defined as a guild. In general these webs or guilds will include nutrient accumulators, such as nitrogen fixers. They will include insectary species and insects. Fungi, bacteria, and other microorganisms serve as nutrient translators. Animals garden the system, turning the earth, pruning, planting, fertilizing.

Pinyons and junipers form the backbone of a classic guild system. Although the PJ forests in the state are generally fairly barren landscapes, a number of healthy situations can still be found, especially in favored or inaccessible sites. In one instance I am familiar with in Santa Fe, a large juniper (*J. monosperma*) grows in a small basin, fed by a drainage of several square yards. Growing up through its branches, on the north side where they are usually found, is a sapling pinyon (*P. cembroides*) of perhaps twelve feet. In the shade of these trees grow Fendler's bluegrass (*Poa fendleri*), prickly pear (*Opuntia* sp.), cholla (*O. imbricata*), wolfberry (*Lycium pallidum*), mullein (*Verbascum thapsus*), fleabane (*Erigeron* sp.), sage (*Artemisia* sp.), lamb's quarters (*Chenopodium* sp.), and a variety of other annual grasses and weeds. At the edges of this grouping, where the sun is stronger, can be found rabbitbrush (*Chrysothamnus nauseosus*), Apache plume (*Fallugia paradoxa*), dropseed (*Sporobolus* sp.), blue grama (*Bouteloua gracilis*), soapweed yucca (*Y. glauca*), and other hardy native shrubs, grasses, and forbs. Mistletoe sprouts from many of the juniper's limbs and lichen can be found on the bark of its main trunk. Taken together, this one grouping of plants is like a template, a shopping list for anyone wishing to nurture the PJ forests of the high desert back to health.

Within this same guild, evidence of animal activity is plentiful. Ant hills and gopher burrows appear under or at the edge of the trees. Bird droppings add fertility to the soil. Bees visit the flowering species. Towhees spread the mistletoe seeds when they eat its sticky fruits. Jays and squirrels visit the pinyon. Coyotes eat the juniper fruits, leaving behind a characteristic, crumbly scat filled

with acid treated seed ready to germinate. Rabbit droppings are common, and occasionally the feces of an animal (perhaps fox) who has been eating rabbits. Beetles and other insects are everywhere.

This partnership of plant and animal life results in a rich black layer of duff, shot through with fungal mycelia. In the wet months, mushroom fruiting bodies appear—another source of protein for the community. Microphytic crusts cover the ground between plants. A carpet of organic material holds moisture, recycles nutrients, and resists erosion. The soil is continually enriched by a rain of dust and pollen, bits of plant material, and animal and insect feces and bodies.

I have seen many such PJ guilds—hunting for them is a hobby of mine. They can include all of the plants listed above, as well as wax and golden currants (*Ribes cereum* and *R. aureum*), silver lupine (*L. argenteus*), New Mexico locust (*Robinia neomexicana*), Gambel's oak (*Quercus gambellii*), wavy leaf oak (*Q. undulata*), shrub oak (*Q. turbinella*), 3 leaf sumac (*Rhus trilobata*), mountain mahogany (*Cercocarpus montana*), banana yucca (*Y. baccata*), wild four o'clock (*Mirabilis multiflora*), blue gilia (*Gilia longiflora*), scarlet bugler (*Penstemon barbatus*), Crandall's penstemon (*P. crandallii*), wandbloom penstemon (*P. virgatus*), claret cup (*Echinocereus triglochidiatus*), wild buckwheat (*Eriogonum jamesii*), and on and on and on.

At slightly higher elevations or in moister microclimates, the pinyon and juniper blend into the ponderosa pine/Gambel's oak/Rocky Mountain juniper guild (*P. ponderosa*, *Q. gambellii*, *J. scopulorum*.) At these transitions, the weave becomes particularly rich, with all of the species listed above mixing it up with chokecherry (*Prunus virginiana*), wild grape (*Vitis arizonica*), mountain spirea (*Ceanothus fendleri*), creeping Oregon grape (*Mahonia repens*), and mockorange (*Philadelphus microphyllus*.) Finding such a guild is a pretty good indication of a favorable microclimate.

Functional guilds are characterized as much by diverse connections between species as by the numbers of species themselves. Gophers till soil, creating ideal sites for establishment of seedlings. The juniper is the nurse for many of these seedlings, providing a toehold against wind and water erosion, suitable soils, and protection from browsing. Towhees introduce mistletoe into the maturing juniper, helping to pave the way for its eventual succession. The juniper and other woody plants provide food, scaffolding, and nesting sites for a variety of animals. All of the plant species serve to create microclimates, and gradually shift the type and variety of microclimates available. Animals serve as mobile components of the guild, planting, fertilizing, dispersing seed and plant material, and extending the edge of the forest.

A number of species found in this guild are nitrogen fixers: mountain mahogany, apache plume, New Mexico locust, mountain spirea, lupine, and microphytic crusts. Nitrogen fixers are common in desert climates, where nutrients are scarce, and they introduce this important element into the whole system to be cycled by other microorganisms, plants, and animals.

Fungi and bacteria break down organic material and serve as translators, providing nutrients in assimilable form to plants and soil fauna. These in turn translate nutrients into assimilable form for other animals. Rodents eat the fruiting bodies of fungus, combining

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Guild Associations

spores with sugars from plants and depositing them in favorable locations in neatly packaged "nutrient bundles." Predators may also assist in distributing fungal spores by harvesting rodents and converting them into even larger nutrient bundles. In this way, animals are not only responsible for distributing seeds, but also for distributing fungi and nutrients essential for healthy plants. Bill Isaacs, a Santa Fe mycologist and native plant expert, has observed rabbits eating mushrooms under pinyons, then defecating into the grasses a few feet out from the trees.

In places where guild systems survive, a healthy diversity of plant and animal species is the norm. Soils are productive and rich in organic content. Total biomass is high, particularly since guilds based on woody species are layered, using available space very efficiently. Nutrient cycling is optimized due to concentration of species, habitats, and niches. Guilds make excellent use of available flows of nutrients and energies in the landscape. They represent an evolutionary strategy of cooperation among species.

Many of the plants associated with the PJ guild are edible and have been harvested by people for millennia. Pine nuts and acorns are delicious high protein perennial crops. Currants, sumac, wolfberries, yucca, Oregon grape, wild grape, and juniper all produce edible fruits. (Wolfberries are often used by archaeologists as indicator plants for finding ancient settlements.) These fruits are also forage for wild turkeys—an important, though no longer common, source of food for indigenous people. Other plants are harvested as potherbs. Many have medicinal uses. This prevalence of useful species may indicate human intervention in the ecosystem in selecting for preferred plants.

The usefulness of wild species points the way to possible sustainable commercial yields from the PJ forest. Currently, pinyon is cut and sold for firewood and the remaining grass grazed by cattle at very low rates of stocking. Junipers are chained off with bulldozers and burned as trash. This is a poor use of the energy, genetic resource and biomass represented by such a system. Many of the species in

this guild have a potentially higher dollar value per acre than any of the uses (except, perhaps, real estate development) to which this ecosystem is currently put. Pine nuts were once an important cash crop in New Mexico. Acorn flour is delicious, highly nutritious, and only requires appropriate packaging and marketing to establish new commercial opportunities. Wild four o'clock is a highly valued medicinal herb for which demand continually outstrips supply. Wild fruits are enjoyed by connoisseurs and command high prices in gourmet markets and restaurants.

Healthy PJ woodlands are aesthetically appealing and form the basis for a growing demand for native plants. The market for seeds and live plant material continues to be greater than growers can supply. A single major revegetation project can seriously deplete stock of most of the native plant growers in the southwest, and more and more landscape architects are including natives in their specifications. The single most valuable harvest of a landscape could well be its seeds.

The uses I have described for products of a PJ ecosystem are consistent with the concept of sustainable yield. Products can be harvested without damaging the living guild. In fact, if these products are demonstrably important commercial crops, they could form the basis for broadscale investment in stabilizing and revitalizing this ecosystem. Nor do they necessarily preclude careful extraction of firewood, grazing, and other harvests, so long as such management supports and furthers the health of the ecosystem.

Priority needs to be placed on the intrinsic value of natural systems, rather than on their exploitation for economic ends. If we are to realize a healthy land-based economy, we must do so by doing it smarter—by diversifying and spreading the risk of crop failure over a multiplicity of potential yields. This way of life was familiar to our ancestors. Our failure to pay

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