

LOOK, WONDER AND TRY TO UNDERSTAND

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INTRODUCTION

Dendroecology uses tree rings to study ecological problems and the environment. It includes dendroclimatology, dendrohydrology, dendrogeomorphology, dendroglaciology, fire history, forest stand dynamics and anthropogenic effects. The purpose of our group was to survey as many dendroecological topics as could be encountered in the local area and explore a subset of these topics in detail. Our approach was to use wood samples to reconstruct the ecological history of trees.

METHODS

Our first morning Fritz Schweingruber led the group in a dendroecological exploration of the woodpile behind the kitchen which turned out to be a treasure trove of wood containing information on past ecological events. That afternoon we explored the ecology of the riparian woodland across the stream. There we took core and stem samples of various species including many that are not used in standard ecological studies. We also investigated the potential for dendroecological topics in the oak woodland on the south-facing slope south of the research station. Finally, we extended our playground and drove up to the pine-oak belt near Onion Saddle and collected samples from species not found at lower elevation.

VEGETATION

The Southwestern Research Station is located in the Chiricahua Mountains of southeastern Arizona at an elevation of 1,620 m. The surrounding mountains reach elevations of over 2,000 m. Thus there are belts of vegetation up the slopes. Around the research station the vegetation is an oak woodland consisting primarily of emory oak (*Quercus emoryi*) with alligator juniper (*Juniperus deppeana*). The Mexican pinyon pine (*Pinus cembroides*) and the Apache pine (*Pinus engelmannii*) occasionally are found within the community. Willow (*Salix* sp.), Arizona walnut (*Juglans major*) and box elder (*Acer negundo*) are present in the deciduous riparian woodland. The pine-oak belt is found at higher elevations and includes Apache pine, Mexican pinyon pine, ponderosa pine, Chihuahua pine (*Pinus leiophylla*) and southwestern white pine (*Pinus strobiformis*). It also includes gambel oak (*Quercus gambelii*), emory oak and silverleaf oak (*Quercus hypoleucoides*),

time consuming. We applied this method to Apache pine but found in this slow-growing species, the scars remain visible up to 22 years after needle loss, thus making it improper for this method.

The needle trace method is particularly relevant to forest health inventories in Europe in the context of forest decline.

DENDROECOLOGICAL QUESTIONS

We know that this area has a highly variable abiotic and biotic environment, both spatially and temporally, and therefore provides a wide range of opportunities for dendroecological investigations. We studied the following dendroecological topics:

WOODPECKERS AND TREES

We noted two types of woodpecker damage to trees in this area. **Acorn woodpecker** (*Melanerpes formicivorus*) make big holes in wood and push acorns into these holes to keep them for the winter. If they make holes in dead wood, this cannot be dated. If they make holes in living wood, then healing and scarring results, and this can be dated in tree species that crossdate.

Sapsuckers drill evenly spaced rows of small holes in living trees, and visit these "wells" for sap and insects attracted to it. These holes cause scars in the bark and sometimes in the wood. The **red-naped sapsucker** (*Sphyrapicus nuchalis*) is the only sapsucker common to this area, so it likely caused the damage we observed. Damage occurs at the boundary between latewood and earlywood. As time passes, the scar in the xylem is separated from the hole in the bark by additional growth rings. We observed sapsucker damage during four of the eleven years in Arizona cypress (*Cypripinus arizonica*), a crossdatable species, and five generations of scars between 1969 and 1990 in alligator juniper (*Juniperus deppeana*), a species that is difficult to date because of false rings and wedging rings.

MISTLETOE DYNAMICS

Mistletoe affects growth by the formation of haustoria. With tree rings in the host and the semiparasite, it is possible to date the establishment and death of mistletoes.

Phoradendron sp. probably forms annual rings on *Quercus emoryi*. We found 8-year-old specimens. At lower elevations, *Q. emoryi* forms growth zones rather than annual rings.

Arceuthobium sp. on *Pinus ponderosa* has no annual rings. The age of the mistletoe can be derived from the distinct number of rings which overgrew the haustoria. We found 14-year-old living haustoria.

After the death of the mistletoe, the cambium grows over the dead mistletoe shoot.

In addition, we recognized the following topics:

Climate

Table 1. Species characteristics and tree-ring formation

OAK WOODLAND				
species	elevation	habitat	anatomy	evidence of growth May 24, 1994
<i>Quercus emoryi</i>	1,000 - 2,700 m	dry foothills moist canyons	ring-porous but mostly with growth zones, not annual rings	not sampled
<i>Juniperus deppeana</i>	1,500 - 2,700 m	dry hills and mesas	conifer with annual rings that have a narrow band of latewood	NO
<i>Pinus cembroides</i>	1,700 - 2,500 m	dry hills and mesas	conifer with annual rings	not sampled
<i>Pinus leiophylla</i> var. <i>chihuahuana</i>	1,700 - 2,500 m	dry slopes and benches	conifer with annual rings	not sampled
<i>Pinus engelmannii</i>	1,700 - 2,750 m	dry sandy ground	conifer with annual rings	not sampled
<i>Robinia neomexicana</i>	1,350 - 2,850 m	canyons streambanks	ring-porous distinct ring boundaries	one layer of vessel cells
RIPARIAN AREA				
species	elevation	habitat	anatomy	evidence of growth May 24, 1994
<i>Acer negundo</i>	1,150 - 2,850 m	stream banks	diffuse-porous with somewhat apparent growth rings	NO
<i>Rhamnus betulaeifolia</i>	1,350 - 2,350 m	stream banks	diffuse-porous	in portions around the stem
<i>Juglans major</i>	670 - 2,350 m	stream banks	diffuse-porous with annual growth rings	NO
<i>Salix sp.</i>	1,350 - 3,200 m	stream banks	diffuse-porous with annual growth rings	one layer of vessel cells