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Packrat Midden Research in the Grand Canyon

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The Spread of Maize to the Colorado Plateau

Where Have All the Grasslands Gone?

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Impacts of Cattle Ranching in NE Arizona

Ecology and Mormon Colonization

Contribution of Roads to Forest Fragmentation

Fire-Southern Oscillation Relations in the Southwest

ResearchRestoring Ecosystem Health in Ponderosa Pine Forests of the Southwest (page 1 of 2)

Adapted from: Covington, W. Wallace, Fule, Peter Z., Moore, Margaret M., Hart, Stephen C., Kolb, Thomas E., Mast, Joy N., Sackett, Stephen S., and Wagner, Michael R. 1997. Restoring ecosystem health in ponderosa pine forests of the Southwest. Journal of Forestry 95: 23-29.

oldponderosa(57a).jpg (101687 bytes)

Forest ranger marking forest timber for timber sale, early 1900s. Note open structure and herbaceous understory. Photo NAU.PH.136 by A.G. Varela courtesy of Cline Library Special Collections, Northern Arizona University.

Previous research has established that forests of ponderosa pine in the Southwest were much more open before Euro-American settlement. Until the late 1870s, light surface fires every two to five years, along with grass competition and regular drought, maintained an open and parklike landscape dominated by grasses, forbs, and shrubs with scattered groups of predominantly large ponderosa pine trees. These presettlement forests had evolved over thousands of years. After Euro-American settlement, heavy livestock grazing, fire suppression, logging disturbances, and climatic events began to alter the pine forests of the region. Dense ponderosa pine regeneration followed these environmental changes, quickly closing the lightly forested parklands and dramatically changing the nature of the forests.

Various authors have described the unhealthy characteristics of postsettlement ponderosa pine ecosystems, including increases in tree density, forest floor depth, and fuel loading. Studies indicate that tree density has increased from an approximate presettlement average of from 17-20 pines per acre to an average of about 800 pines per acre seen today, and the size class of these trees has changed dramatically as well (see table below).

Table 1. Comparison of stand structure of pine forest at Fort Valley, Arizona study area in 1876 (reconstructed) and 1992 (dbh=diameter of tree at breast height in inches). [Note: In the original publication the 'Trees per acre 1876' data was in error. In Table 1 below these figures have been corrected by the authors, and rounded to the nearest tenth of an acre by us.]

dbh class (in)

Trees per acre 1876

Trees per acre 1992

0-4

0.9

945

4-8

2.6

243

8-12

2.8

46

12-16

3.6

6.7

16-20

5.1

1.6

20-24

3.7

2.5

24-28

3.2

2.4

28-32

1.2

4.1

32-36

0.4

1.7

36-40

0.6

0.3

40-44

0.3

0.2

Total

24.6

1253.5

As a result of these changes in forest composition and structure, there has been a significant decrease in 1) soil moisture and nutrient availability, 2) growth and diversity of both herbaceous and woody vegetation, and 3) stream and spring water flows due to less soil absorption of precipitation. There has also been a marked increase in mortality of old-growth trees and in the severity and size of wildfires in these forest ecosystems due to the aforementioned mostly human-induced changes.

Restoration of ecosystem structure and reintroduction of fire are necessary for restoring rates of decomposition, nutrient cycling, and net primary production to natural, presettlement levels. The rates of these processes will be higher in an ecosystem that approximates the natural structure and disturbance regime. Reestablishing presettlement stand structure alone (thinning a majority of the postsettlement trees) would be less beneficial than a restorative treatment consisting of thinning, forest floor manipulation, and prescribed burning.

Next Page