

Ecological Transitions in Arizona's Subalpine and Montane Grasslands

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Abstract.—Important components of Southwest forest ecosystem are subalpine and montane grassland communities. Grassland communities provide habitat diversity for wildlife, forage for domestic livestock and wildlife, and contribute to the visual quality of an area. The objectives of this research were to determine if: 1) vegetation attributes and soil-surface cover variables of interest have changed, or if they have maintained equilibrium relative to conditions in 1913 through 1915; and 2) a correlation exists between the ecological diversity-stability hypothesis (Huston 1979, Pimm 1984, McNaughton 1994, Tilman 1994). The hypotheses tested were: 1) subalpine and montane grasslands have changed since 1913 through 1915, specifically, relative native species richness has declined and relative species composition has shifted, while annual and exotic species richness has increased with concurrent increases in exposed soil surface area; and 2) shifts in species composition and increases in species richness and exposed soil surface are not evidence of ecological community stability.

The vegetation attributes of interest are individual species and total plant cover, plant frequency, relative species composition, perennial and annual species richness, alpha and beta diversity, life form, keystone species, and relative abundance of indigenous and exotic species. The soil surface cover variables of interest are total ground cover provided by plants, litter, and rock, and amount of exposed soil surface area.

The years 1913 through 1915 were used as baseline years for comparison with current conditions. These years were chosen because of the availability of a historic data set. This data set was collected during the first range reconnaissance survey conducted on the Apache National Forest and contains quantitative information on vegetation cover and soils surface conditions. Although this information is not pre-EuroAmerican, the question can still be asked, "How does 1913 compare to 1998?" Because this information was collected before livestock management under systematically planned, intensive grazing systems and before organized fire suppression. Using 1913 through 1915 as controls, spatial and temporal changes can be evaluated for the last 85 years. A modification of Daubenmirre's (1959) sampling methodology (Medina 1987) was used to collect vegetative cover data. The covariates were herbivory, fire suppression, and annual precipitation. Statistical analysis included measures of central tendency, Mann Whiney U test, Wilconon paired sample test, Spearmans rank correlation, fitting of resistant lines, canonical correlation, analysis of variance, covariance, and multivariate analysis.

This research related to primary (human) use of Southwestern subalpine and montane grasslands on public lands; domestic livestock grazing. It also provides some needed scientific information concerning structural, functional, and compositional changes in these grasslands over time. This research project provided valuable information about the role of domestic livestock grazing, fire suppression, climatic variations on succession retrogression, validity of intensive grazing management systems, and diversity-stability hypothesis. All of these items provide useful information to help develop judicious and ecologically-oriented management plans.