SPATIAL VARIATION OF PIÑON-JUNIPER VEGETATION ON THE CORONA RANCH

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A study was conducted at the Corona Range and Livestock Research Ranch (CRLRR) located in central New Mexico to determine the distribution and variation of ecological attributes within the piñon-juniper community of the ranch. To accomplish this, the piñon-juniper type was divided into 40 blocks and then 0.10 ha plots were randomly located within each block. An additional 10 plots of 0.10 ha each (to monitor piñon and juniper encroachment into the grassland community) were located in the transitional area between piñon-juniper woodland and the native grassland community. Tree overstory, herbaceous understory, and understory shrub characteristics were measured and analyzed to determine the distribution, relationship, and variation within each type.

Soil samples were collected and analyzed and topographical features were examined to determine how these features impact the variation and distribution of plant communities within the piñon-juniper type.

The Statistical Analysis System (SAS) was used for all data analysis including *t-tests*, general linear models (GLM), linear regression, and clustering to produce study area attribute dendrograms.

Distribution and structure of ecological attributes at the Corona Ranch piñon-juniper type is highly variable, showing ample evidence of past activities such as old fields, ax cuts, artifacts, and burns. Historical anthropogenic activity (i.e., agriculture and wood cutting) may have ben a major influence on the present landscape at the Corona ranch. The present spatial variation may be attributed to factors including edaphic, terrain, aspect, microclimate, and anthropogenic, but likely involves a combination of factors.

The piñon-juniper community at the Corona ranch is heterogeneous in stand structure, varying from stands of mature, stunted trees to mature vigorous stands of heterogeneous trees. Other stands were relatively young and even-aged. although piñon-juniper stand morphology was heterogeneous, species composition across the study area was not. Few other tree species were encountered on the study area. Apparently a few ponderosa pine (*Pinus ponderosa*) exist on the ranch and a tree form of oak was encountered on 1 study site. But generally the study area follows the same pattern of species composition as mature piñon-juniper woodlands do in other parts of the piñon-juniper region.

Soil attributes were not significantly different between the 2 community types except for N and OM which were greater on the woodland type versus the savanna type. Soil characteristics may explain why piñon and juniper trees exist on the study area but do not seem to explain the distribution and abundance of understory species. Topography, aspect, and slope are variable

across the study area and may influence the distribution and density of piñon and juniper trees.

Spatial variation of abiotic and biotic factors on the study area were significant at the scale being used. Heterogeneity in the piñon-juniper type was limited more to distributional characteristics rather than species composition. Piñon, juniper, blue grama, wolftail, prickly pear, cholla, and sumac were widely distributed on the study area but relative abundance and morphological characteristics of these species was variable. Some dominant shrub types (oak, algerita, and winterfat) formed discrete communities on the study area but others (sumac and cholla) were widely distributed.

Climate, topography, and edaphic features may be the most significant reasons why piñon and juniper occupy specific areas and exert ecological dominance in those areas. These habitat characteristics (climate, topography, and edaphic) are more favorable for woodlands than they are for grasslands. The blurring of range types by anthropogenic activities (i.e., fire suppression, range improvements, and grazing) has made separating these range types more difficult.

Recognizing the differences between range types may be important to developing appropriate management schemes for the piñon-juniper type. Areas that are likely to respond favorably to range improvements (ecologically and economically) must be carefully selected. Appropriate post improvement follow-up (removing seedlings released by removal of overstory) must be done to ensure economic success of range improvement practices.

The study at the Corona ranch showed that significant fine scale variation exists across the piñon-juniper type for most of the attributes tested (overstory, understory, and some edaphic factors). Managing this heterogenous area may require fine scale separation of ecological units. The different ecological types include rocky ridges with coarse soils and broken terrain, dune areas with sandy soils, gently sloping areas with fine shallow soils, and large swale areas with relatively deep fine soils.

Mapping the piñon-juniper type with the aid of a GIS (Geographical Information System) would provide a visual presentation of the geographical location and size of individual ecological units. GIS information could be made available in a series of map overlays, each displaying information on separate ecological attributes including soils, topography, overstory, and understory. Individual sites (ecological units) could be rated for their best use or best uses. For example, it may be determined that only swale areas, receiving additional moisture in the form of runoff, would be suitable for range improvements such as clearing or burning. As the landscape changed through natural and anthropogenic processes the GIS system could be updated to monitor the changes. This system may provide the level of management necessary to maximize economic and ecological returns on areas where significant fine scale variation exists. Additional discussion on possible GIS management applications for the piñon-juniper type is contained in the next section on research considerations.