UPLAND HARDWOOD HABITAT TYPES IN SOUTHWESTERN NORTH DAKOTA[1]

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Abstract.-- The Daubenmire habitat type method was used to classify the upland hardwood draws of southwestern North Dakota. Preliminary data analysis indicates there are four upland habitat types: Fraxinus pennsylvanica/Prunus virginiana; F. pennsylvanica-Ulmus americana/P. virginiana; Populus tremuloides/Prunus virginiana, and Quercus macrocarpa/P. virginiana.

INTRODUCTION

As the pressures of resource development, livestock grazing, and recreation on our rangelands continue to increase, the need for comprehensive multiple-use management plans becomes more urgent. In order to develop these management plans, basic knowledge of the resources is of primary importance. The first step is an assessment of the vegetation, its relation to environmental influences, and its biotic potential. Assimilation of this information into a classification system is then necessary to make it useful to the resource manager.

Native woodlands occur as isolated islands, pockets or stringers throughout the Great Plains. These conifer and hardwoods compose about 1% of the vegetation of the Northern High Plains (Bjugstad 1977), and form 5-7% of the vegetation of southwestern North Dakota (Hopkins 1983). Upland hardwoods alone occupy less area. While the distribution of these woodlands is extremely limited, their value both economically and ecologically is quite great. They provide critical habitat for a number of wildlife species, shade and shelter for livestock, stabilization of the soil and a source of firewood. Their value for wildlife and firewood production has been estimated to be several million dollars annually (Bjugstad and Sorg, In Press).

Previous studies on the woodlands in general of western North Dakota have briefly described their composition, ecology, production, and soils. This included the description of the structure and position of 4 woody vegetation types in North Dakota Badlands: 1) Fraxinus pennsylvanica; 2) Juniperus scopulorum; 3) Populus deltoides; and 4) Artemesia cana (Nelson 1961) and the vegetation-environment relationships between woodland and shrub communities and soil algae in western North Dakota (Wali et al. 1980). These latter communities were: 1) Populus deltoides, 3 subtypes; 2) P. tremuloides-Betula papyrifera, 6 subtypes; 3) F.pennsylvanica-Ulmus americana, 9 subtypes; 4) Quercus macrocarpa, 5 subtypes; 5) J.scopulorum, 3 subtypes; 6) Pinus ponderosa; 7) A.cana, 2 subtypes; 8) Symphoricarpos occidentalis, 3 subtypes; and 9) Sheperdia argentea. Additional research has investigated the relationship of grazing and topographic influences on F. pennsylvanica communities in the North Dakota Badlands (Butler 1983) Hansen et al, (1984) described 4 woodland habitat types for Theodore Roosevelt National Park, North Dakota: 1) F. pennsylvanica/Symphoricarpos occidentalis; 2) F. pennsylvanica/Prunus virginiana; 3) Populus tremuloides/Betula occidentalis; and J. scopulorum/Oryzopsis micrantha.

This paper describes 4 of the upland hardwood habitat types in southwestern North Dakota. The Daubenmire habitat type method was used to classify the woodlands. A habitat type is a collective area composed of similar edaphic, climatic, and topographic variables capable of supporting a certain and relatively homogeneous plant community Daubenmire 1952).

STUDY AREA

The study area was located in southwestern North Dakota in the counties of Billings, Bowman, Dunn, Golden Valley, McKenzie and Slope. This area has been commonly referred to as the Badlands or Little Missouri National Grasslands. Most of the area has been described as unglaciated except for the northeast portions of McKenzie County.

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This area is located on the Missouri Plateau physiographic region which is subdivided into: 1) Badlands; 2) unglaciated; and 3) glaciated with drift remains (Omodt et al. 1968). Geological material consists primarily of sedimentary layers of shales, silts, clays, sandstone, and lignite veins of the Tongue River, Golden Valley, and Sentinel Butte Formations of the Fort Union Group (Bluemle 1980). The Little Missouri River and its tributaries dissected the soft strata of the Missouri Plateau forming an intricate network of ravines, gullies, and valleys interwoven among stark buttes and ridges. The Badlands form a band following the river for approximately 300 km of its length, while the width varies from 13-24 km (Omodt et al. 1968). Rolling prairie characterizes areas to the east and west of the River.

Most of the soils have developed from residium (material weathered from rocks in place), and some of the soils have been the result of glacial action. They range from Mollisols under the well developed grasslands to Entisols and Inceptisols where less development had occurred (Omodt et al. 1968).

The climate of southwestern North Dakota is classified as cool temperate, semi-arid and characterized by wide daily fluctuations in temperature and erradic precipitation (Omodt et al. 1968). The number of frost-free days ranges from 120-130 per year. Precipitation usually occurs in late spring and early summer as intense thundershowers of short duration. The long term precipitation average is 35-41 cm annually and the average temperatures range from approximately 21 C in July to -12 C in January (Omodt.et al. 1968).

METHODS

Site Selection

Selection of sites was based on naturally occurring, ecological vegetation associations. Within these associations, areas were selected which exhibited near biotic potential. The upland hardwood sites studies were considered to be in good to excellent condition. They may have been lightly utilized but were relatively undisturbed, exhibited high vigor and homogeneous distribution of vegetation. Results of studies conducted by Nelson (1961), Wali et al. (1980), and Hanson et al. (1984) in western North Dakota were used to aid in site selection for determination of representative species composition and density.

General Site Information

The following information was recorded for stands selected for analysis: legal description, general location, topography, slope, exposure, drainage, plot location, species list, and a general description of the stand.

Vegetation Sampling

The habitat type method (Daubenmire 1952) was used to classify the upland hardwood draws of southwestern North Dakota. A habitat type is a collective area composed of similar edaphic, climatic, and topographical variables capable of supporting a certain and relatively homogeneous plant community (Jorgenson 1979).

Vegetation sampling methods were modified from Bjugstad et al. (1980) and Mueggler and Stewart (1980). A 20 m x 20 m macroplot was established within a stand where vegetation was most homogeneously distributed. Within this macroplot vegetation was divided into 4 strata: herbaceous, shrub, sapling, and tree. These strata were defined on the basis of size as follows:

Herbaceous. The Daubenmire (1959) canopy coverage system, was used to ocularly estimate canopy coverage for herbaceous vegetation. With this method, all species less than 1 m tall, litter and bare ground with coverage in a 20 cm x 50 cm macroplot were estimated. A total of 40 frames were read, 20 along each of 2 evenly spaced transects (Figure 1).

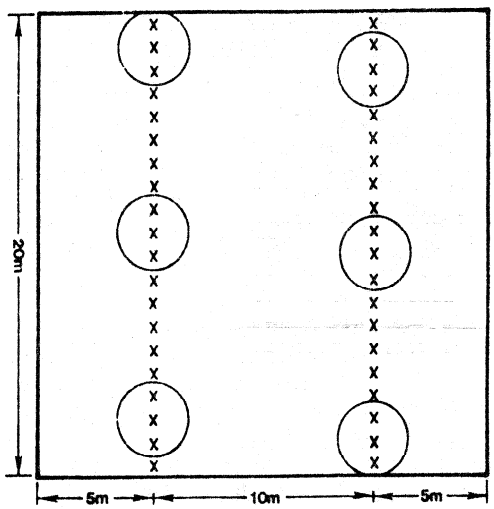

Figure 1. An illustration of the 20 x 20 m macroplot used to sample woodland vegetation. The X's indicate 20 x 50 cm herbaceous sampling plots. The circles illustrate the milacre shrub sampling plots. All saplings and trees in the macroplot were sampled.

Shrub. All shrubs, (woody vegetation less than 2 m but more than 30 cm tall), were measured in 6 circular milacre plots, 3 along each transect (Figure 1). Species, height, crown, and number of stems were measured for each shrub rooted within. the plot. Maturity, vigor and degree of browsing were visually estimated.

Sapling. A sapling was woody vegetation more than 2 m tall, but with a diameter at breast height (DBH) of less than 10 cm. Height, crown, vigor, DBH, and origin were recorded, Origin refers to whether the sapling is a single stem, multiple stem, or a root sprout, whenever possible to visually determine. Any pertinent information such as damage, disease, nests, or forks, etc., were also noted. All saplings rooted in the 20 m x 20 m macroplot were measured.

Trees. Trees were greater than 2 m tall with a DBH of more than 10 cm. Methods for collecting tree data was identical to that for saplings.

Strata were defined solely on the basis of height and/or DBH. Therefore, a tree species such as Fraxinus pennsylvanica, may be sampled in the herbaceous, shrub, sapling, or tree layer. Low growing, spreading woody species such as Juniperus communis and J. horizontalis were sampled only in the herbaceous Layer.

RESULTS AND DISCUSSION

Vegetation sampling was conducted during the summers of 1981 through 1983. Preliminary statistical analysis has been conducted on these data; however, the final division and naming of the habitat types has not yet been determined. The following results are based on preliminary information and are subject to change with further refinements in the data analysis.

There were 4 upland hardwood habitat types recognized for southwestern North Dakota. The habitat types were: Fraxinus pennsylvanica/Prunus virginiana, Fraxinus pennsylvanica-Ulmus americana/P. virginiana, Populus tremuloides/Prunus virginiana, and Quercus macrocarpa/P. virginiana. As is shown by the habitat type names, all types had P. virginiana as an understory dominant, regardless of the dominant tree species. These types also had several other species in common: Amelanchier alnifolia, Carex spp. (primarily C. sprengelii), F. pennsylvanica, Galium boreale and Symphoricarpos occidentalis were the most predominant.

A shrubby border characterized the woodland/grassland interface at most sites, which formed a stairstep pattern from the shorter species of the grassland, to shrubby species of Symphoricarpos occidentalis, Rosa woodsii, Rhus trilobata and Sheperdia argentea; to the sapling species of Prunus americana, P. virginiana and Amelanchier alnifolia. This graded into the taller tree overstory of the woodland. The width varied from 1-3 m. This border was not sampled because it was an ecotone, but it was an important, integral part of the woodlands.

Topo-position was another feature that these woodlands had in common. Upland hardwood habitat types were located in draws as isolated pockets and stringers, on north-facing slopes and following intermittent streams and drainageways. The establishment and survival of upland hardwood draws apparently was closely linked to areas of increased moisture. The majority of these woodlands occur on convergent landforms (Richardson 1979) which were more mesic due to one or a combination of the following factors: run-in from adjacent uplands, springs or seeps resulting from through-flow from upper topo-positions, interception of the water table, and/or increased snow catch.

Fraxinus pennsylvanica/Prunus virginiana Habitat Type.

The Fraxinus pennsylvanica/Prunus virginiana habitat type occupied uplands where it formed long, often narrow, stringer draws. Its distribution followed the intermittent drainageways along draws, coulees and valley bottoms. The most homogeneous plant distribution occurred in the more level portions of the draws which was also where the communities tended to be the widest. Therefore, most plots were located in these areas. Most of these larger draws have a number of small tributary, finger-like draws which join it.

There were 2 tree species present in this habitat type. F. pennsylvanica was dominant with 119% mean cover, Acer negundo had 27%. There were 4 sapling species: F. pennsylvanica was the dominant of this strata with 40% mean cover, followed by P. virginiana with 37%. P. virginiana was also significant in the shrub canopy having 53% mean cover and Symphoricarpos occidentalis composed 22%. There were 7 shrub species recorded. The number of species in the herbaceous layer totaled 48. Poa pratensis, 20% mean cover; S. occidentalis, 15%; and Prunus virginiana, 7.8% were dominant.

Fraxinus pennsylvanica-Ulmus americana/Prunus virginiana Habitat Type.

The Fraxinus pennsylvanica-Ulmus americana/Prunus virginiana habitat type was similar to the F. pennsylvanica/P. virginiana habitat type in many respects, but was easily distinguished by the presence U. americana. U. americana was a codominant in all 3 woody strata, therefore, it has been included in the habitat type name and has been made a distinct habitat type. This habitat type was most prevalent in McKenzie County and in northern Golden Valley County. These sites appeared to be more mesic than the F. pennsylvanica/P. virginiana habitat to the south.

Another difference was the variety of topo-positions occupied by this habitat type. It was found in uplands along intermittent drainageways, streams and intermittent streams, and several stands occupied north-facing slopes.

The tree canopy had 5 species present. Dominants were F. pennsylvanica, 93% mean cover; and U. americana, 44%. F. pennsylvanica was also dominant in the sapling strata having 18% mean cover, followed by P. virginiana, 17%. There were 12 species present in the sapling canopy, 14 in the shrub canopy. P. virginiana, 51% mean cover and Symphoricarpos occidentalis, 16% were the dominant shrubs. Of the 80 species encountered in the herbaceous canopy the dominants were Carex spp. (primarily C. sprengelii) with 19% mean cover; P. virginiana, 10%; and S. occidentalis, 5.7%.

Populus tremuloides/Prunus virginiana Habitat Type.

The distribution of the Populus tremuloides/Prunus virginiana habitat type ranged throughout southwestern North Dakota, but was much more common in McKenzie County than in the southern counties. A frequent topo-position was the uplands at the crown of the F. pennsylvanica-U. americana/P. virginiana habitat type. Another less common topo-position was on upland drainageways where Populus tremuloides lined the erosive banks.

This crown was usually on gentle 0-30% slopes, but could be as steep as 45%. Grasslands occupied the summit and shoulder topo-positions and graded into the Populus tremuloides/Prunus virginiana habitat type on the backslope. Downslope the drainage was more defined, becoming a draw or coulee and often classified as the F. pennsylvanica-U. americana/P. virginiana habitat type. The grassland/crown border was often composed of densely packed saplings of Populus tremuloides, the lower draw/crown border showed a mixture of F. pennsylvanica and P. tremuloides in the tree canopy, and many similar shrub and sapling species.

There were 5 tree species present in the tree canopy and 12 in the sapling layer. P. tremuloides dominated both canopies, 80% total cover in the tree canopy, 33% in the saplings. F. pennsylvanica was the second dominant having 15% mean cover in the tree canopy, and 28% in the sapling canopy. There were 17 shrub species encountered. Prunus virginiana dominated with 28% mean cover, followed by Amelanchier alnifolia, 13%. In the herbaceous canopy there were 71 species. S. occidentalis, 15% mean cover; P. virginiana, 12%; and Rhus radicans, 6.6%, were dominant.

Quercus macrocarpa/Prunus virginiana Habitat Type.

The Quercus macrocarpa/Prunus virginiana habitat type was located in upland situations on gentle slopes (13%) following intermittent streams. The distribution of this habitat type was limited to the northeastern portions of McKenzie County, few Q. macrocarpa trees were found outside this area. While their distribution was more limited than the other types, the size of the individual communities tended to be more extensive.

Q. macrocarpa dominated the tree canopy with 135% mean cover followed by F. pennsylvanica with 37%. There were 3 species present. In the sapling layer there were 7 species. It was dominated by Q. macrocarpa, 23 % mean cover, and A. alnifolia had 8%. In the shrub canopy, 9 species were recorded. A. alnifolia was dominant, 22% mean cover, followed by P. virginiana 19%. There were 44 species in the herbaceous canopy. Dominants were: Carex spp., 19% (predominantly C. sprengelii); F. pennsylvanica, 15%; and P. virginiana, 15%.

CONCLUSIONS

There were 4 upland hardwood habitat types recognized in southwestern North Dakota. They were **F. pennsylvanica/Prunus virginiana, F. pennsylvanica-U. americana/P. virginiana, Populus tremuloides/Prunus virginiana and Q. macrocarpa/P. virginiana.**

The greatest diversity of tree and sapling species was in the F. pennsylvanica-U. americana/P. virginiana and populus tremuloides/Prunus virginiana habitat types, both of which had 5 tree and 12 sapling species. The Populus tremuloides/Prunus virginiana habitat type also had the greatest diversity of shrubs, 17 species. The inter- and intrastand variability of herbaceous layer was high in all types. Diversity ranged from a total of 44 species in the Q.macrocarpa/P.virginiana habitat type to 80 species in the F. pennsylvanica U. americana/P.virginiana habitat type.

These upland hardwood habitat types contribute to the species richness of the flora and fauna of the grasslands, form critical habitat for a number of wildlife species, and constitute a potential source of income. Many of these woodlands are in a state of decline or decay due to a number of factors. These factors need to be identified and their impact quantified in order to develop management and rehabilitation techniques. The value of the upland hardwood habitat types, both ecologically and economically also needs to be recognized in the formulation of comprehensive management plans.

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