

AN ECOLOGIC STUDY OF THE HABITAT TYPES OF
THEODORE ROOSEVELT NATIONAL MEMORIAL PARK, NORTH DAKOTA

Paul L. Hansen
Ricky Hopkins
George R. Hoffman

University of South Dakota
Vermillion, South Dakota

79013

Objectives

The objectives of this study, initiated in May, 1978, were to study and delimit the habitat types of Theodore Roosevelt National Memorial Park (TRNMP), North Dakota, to collect and tabulate the vascular plants, to determine the edaphic characteristics of the habitat types, and to collect animal species of the habitat types. There have been few studies of habitat types in grassland areas; this one is the first in western North Dakota. The habitat type concept was developed to assess the ecologic status of forest vegetation of the Northern Rocky Mountains (Daubenmire 1952, Daubenmire and Daubenmire 1968). Later Daubenmire (1970) used the same concepts in an analysis of steppe vegetation of eastern Washington. This basic ecologic concept has been used since in a number of studies throughout the Rocky Mountain region (Pfister et al. 1977, Reed 1971, 1976, Wirsing and Alexander 1975, Hoffman and Alexander 1976). The basic nature of this ecologic concept permits wide usage in vegetation studies. Additionally, following the basic habitat type delimitation, follow-up studies can relate the habitat types to other aspects of the biotic community. Examples include studies on primary productivity, disease susceptibility of tree species, potential for wildlife, soil moisture regimes, small mammal distributions (Daubenmire 1973, Hoffman 1960, Layser 1974, Mackee 1970, Rickard 1960).

The present study at TRNMP will delimit the habitat types and will provide data on vegetation and soils of the habitat types and major animal components present. Future ecologic studies on the renewable resources of TRNMP should be correlated to the habitat types distinguished.

Methods

In 1978 we conducted a preliminary survey of the entire Park to determine the range of possible habitat types present, to collect both plants and animals, and to tentatively identify sites suitable for intensive sampling the following summer. Some preliminary sampling techniques were also tried to determine suitable ones for bird populations assessments in the Park. In 1979 intensive sampling was done from May through August on both the vegetation (and soils) and animal components.

Vegetation sampling.---Before the Park was officially designated, and even since then, a considerable amount of grazing has occurred in the area. In studying vegetation there, however, we attempted to locate the least disturbed and, in the case of forests, oldest stands for sampling. We followed the sampling technique described by Daubenmire and Daubenmire (1968) for forest stands and by Daubenmire (1970) for steppe vegetation. Our sampling provided percent canopy coverage estimates for shrub and herbaceous species, and diameter size classes and basal area data for tree species. From the field data obtained we calculated frequency and constancy values for all shrub and herbaceous species, and density and constancy values for tree species. Voucher specimens were collected for deposit at both the University of South Dakota and TRNMP.

Soil sampling.---In each stand studied we collected at random 25 soil cores representing the upper 1 dm of the mineral soil. We composited the 25 samples into one sample for each stand, air-dried them in the field, and brought them to the laboratory for analysis. In the laboratory we determined organic matter using a modified Walkley-Black technique, Kjeldahl nitrogen content, pH of the soil paste, cation exchange capacity and readily exchangeable Ca, Mg, K, and P, and percent base saturation. Finally mechanical analyses, using a hydrometer technique, were done on each sample to determine the percentages of sand, silt, and clay.

Breeding bird sampling.---A survey of breeding birds was made in both the North and South Units of the Park. Additionally, using methods of Colquhoun (1940) and Bond (1957), more intensive sampling was done at 14 sites in the South Unit. For each of the 14 sites we determined number of species, density of territorial males, diversity, number of ecological guilds (Willson 1974) and biomass. For this part of the study we also estimated vertical foliage distribution (Karr 1968, Karr and Roth 1971, Willson 1974) and canopy coverage for all strata from the herbaceous layer to the tree layer (Karr 1968, Wilson 1974, Emlen 1967).

Small mammal sampling.---We assessed small mammal populations within various habitat types. To assure even sampling over the stand we used a grid pattern described by Rickard (1960) and Hoffman (1960). Skins of representative specimens were made.

Amphibian and reptile sampling.---We collected amphibians and reptiles as we encountered them in the field. A number were collected on the main roads in the Park and are not clearly related to a particular habitat type.

Results

A brief description of each habitat type (ht) of TRNMP follows:

Artemisia tridentata - Agropyron smithii ht.--- This ht is scattered throughout the Park occurring on river terraces and narrow ledges

10 - 100 m above the Little Missouri River. A. tridentata has 30% and Agropyron smithii has 69% canopy coverage in this ht. Both are constant species. Other important species of this ht are Agropyron caninum, Carex filifolia, Achillea millefolium.

Artemisia cana - Symphoricarpos occidentalis ht.---This habitat type occurs on alluvial fans, and on low terraces along the Little Missouri River and its tributaries. In this ht Artemisia cana has a canopy coverage of 33%, Symphoricarpos occidentalis and Agropyron smithii have canopy coverages of 46% and 49% respectively. Other important species of this ht are Lactuca oblongifolia, Agropyron caninum, and in places Poa prantensis and Poa palustris.

Artemisia cana - Agropyron smithii ht.---This ht is located along alluvial flats and flood plains where flooding occasionally occurs. The canopy coverage of Artemisia cana in this ht is 34%, that of Agropyron smithii is 82%. In this ht the Agropyron smithii union is less rich than in the A. tridentata-A smithii ht. and Agropyron represents considerably more of the canopy coverage. Stipa viridula and Poa interior also are important species in some stands of this ht.

Agropyron smithii - Carex filifolia ht. --- This habitat type occurs on substrates having considerable clay content and located in areas below buttes where erosion can add substrate to that already present. Agropyron smithii dominates the vegetation; it has a canopy coverage of 91%. Carex filifolia has a canopy coverage of 14%. Other species of some importance in this ht are Lactuca oblongifolia, Stipa viridula, Bouteloua gracilis and Stipa comata.

Stipa comata - Carex filifolia ht.---This habitat type occurs on substrates having high sand content and are thus well drained. All stands of this ht have considerably more species than any of the stands of the previous ht. The canopy coverage of Stipa comata in this ht is 40%; that of Carex filifolia is 29%. Other species that are relatively important in this ht are Artemisia frigida, Agropyron smithii, Koeleria pyramidata, Chrysopsis villosa, Lactuca oblongifolia, and Selaginella densa. In this dry climate the coarse-textured substrate here results in a more mesic habitat than normal for the region. It is not unexpected that the species richness would also be greater than normal.

Andropogon scoparius - Carex filifolia ht.---This ht also occupies coarse-textured substrates. Most stands occur on relatively steep slopes and near the tops of buttes. Andropogon scoparius has a canopy coverage of 77%, Carex filifolia has a canopy coverage of 9%. Species richness is high in this ht also; other relatively important species of the ht are Bouteloua curtipendula, Calamovilfa longifolia, Helianthus rigidus and Symphoricarpos occidentalis. Lactuca oblongifolia, and Koeleria pyramidata are relatively important in some of the stands.

Juniperus horizontalis - Andropogon scoparius ht.---This ht occupies thin soils near the tops and on north facing sides of buttes. This ht overlaps much area where scoria beds have been exposed. The prominent characteristic is the abundance of Juniperus horizontalis

which has a canopy coverage of 81% in this ht. Both the Andropogon scoparius and Carex filifolia unions are present. As in the previous ht, with which there is considerable similarity, this ht has many species present.

Juniperus scopulorum - Oryzopsis micrantha ht.---This habitat type occurs on very steep north-facing slopes and ravines and is especially well-developed in the more rugged parts of the badland topography. The tree layer is dominated by the low-growing Juniperus scopulorum with fewer Fraxinus pennsylvanica occurring in most of the stands. The undergrowth is a rich mixture of shrubs and herbaceous species with Oryzopsis micrantha the most abundant undergrowth plant. Prunus virginiana, Symphoricarpos occidentalis, Rhus aromatica, Smilacina stellata and Galium boreale are additional important undergrowth species.

Fraxinus pennsylvanica - Prunus virginiana ht.---Stands of this habitat type occur in ravines and range from 10m to 100 m wide. In general these stands occur on more gentle slopes than those of the Juniperus - Oryzopsis ht. While Fraxinus pennsylvanica is the dominant tree species other trees also occur including Ulmus americana, Juniperus scopulorum, and Acer negundo. The undergrowth is a rich mixture of shrub and herbaceous species important among which are Prunus virginiana, and Symphoricarpos occidentalis.

Fraxinus pennsylvanica - Symphoricarpos occidentalis ht.---This ht. is characteristic of flood plains and low river terraces along the Little Missouri River. Currently the stands are dominated by Populus deltoides but it is not reproducing and will be replaced by Fraxinus. The undergrowth is again a rich mixture of species important ones of which are Symphoricarpos occidentalis, Toxicodendron rydbergii, Rosa woodsii, Muhlenbergia racemosa, Poa pratensis, and Elymus canadensis. Most stands of this ht still show signs of heavy grazing intensity.

Populus tremuloides - Prunus virginiana ht.---This ht is not widespread in the Park and occurs mainly on steep slopes near the upper ends of drainage ways above stands of the Fraxinus-Prunus ht. In addition to Prunus virginiana, other important undergrowth species are Toxicodendron rydbergii, Symphoricarpos occidentalis, and Betula occidentalis.

Other plant communities.---There are other plant communities that we do not consider to be habitat types. These may be restricted in terms of geographic extent or they may be long-term seral communities.

1. Symphoricarpos occidentalis forms rather extensive clones through much of the steppe matrix. These are climax and are recognized to be important in this region. While Symphoricarpos is dominant, many of the same species are present that also occur in the surrounding vegetation matrix.

2. Typha latifolia - Phragmites australis community. This hydrophytic community occurs as a long-lived seral community around permanent ponds in the North Unit. Other species present include Phalaris arundinacea, Poa palustris, Sagittaria latifolia, and

Verbena stricta.

3. Typha latifolia - Salix amygdaloides community. This community is not widespread though appears to be stable. It occurs near springs in the South Unit. Other species present are Cornus stolonifera, Ribes americanum, and Scirpus americanum.

Most of the remaining communities are either very minor in extent or are seral to one or more of the habitat types. Complete analyses of the vegetation and soils data are not yet finished. A comprehensive description of habitat types and edaphic characteristics will follow.

Results of the animal sampling are summarized as follows:

Breeding bird census.---During 1978 and 1979, 86 species were found to be breeding in the North and South Units of the Park. Twelve species were not recorded that normally breed here and seven new species were recorded. Birds representing 11 orders were recorded with the Passeriformes most abundant with 56 species (65.1%). Four species classified as threatened, special interest or status undetermined are found in the Park (McKenna and Seabloom 1976). The primary breeding habitats vary considerably with nine species (10.5%) typical of marsh and temporary wetlands, 54 species (63.8%) inhabit shrub steppe, 21 species (24.4%) are characteristic of the woodlands interior and two species (2.3%) nest near human habitation.

Forty-eight species and 385 pairs were recorded on the 14 study areas in the South Unit. When numerical values of importance are examined birds of the grasslands and brushy habitats generally rank highest. Similarity indexes indicate that avifaunal composition is very similar on areas of similar vegetation. Although the statistical analysis has not been completed, foliage height diversity and percent vegetative cover appear to be positively correlated with number of species, density of territorial male bird species diversity, number of guilds and standing crop biomass.

Small mammal survey.---Trap nights for all areas totaled 4500, with 105 small mammals taken. A total of six species were captured. The number of species taken on a study area ranged from 0 to 4, with a mean of 1.6. Mean diversity calculations for the various habitats shows that diversity was lowest in the steppe and highest in the floodplain forest. Other diversity values are as follows: shrub steppe (Artemesia) .1441, shrub steppe (Symphoricarpos) .2394, upland deciduous forest (Fraxinus) .1734, and coniferous forest (Juniperus) .1801.

Distribution of amphibians and reptiles.---During 1978 and 1979 we collected 130 specimens of amphibians and reptiles, distributed among 13 species. Seven species were found primarily in steppe, four species were restricted to areas with water and two species showed no preference, being found in a wide range of habitats. Three species classified as special interest species are found in the Park (McKenna and Seabloom 1976).

Conclusions

This study has provided an analysis and delimitation of the habitat types at Theodore Roosevelt National Memorial Park. We have documented certain edaphic characteristics of each habitat type and the animal components of several habitat types. This study is a basic ecologic approach to classification of renewable resources and the results will provide an ecologic basis upon which future studies can be planned.

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