Classification And Description Of Terrestrial Vegetation Ecosystems Of The Thunder Basin Area

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The vegetation of the Thunder Basin Prairie Ecosystem is highly complex and contains many species commonly found in prairie ecosystems further east, as well as species and vegetations typical of the Great Basin vegetation, including extensive areas of sagebrush and other shrub steppe and some areas dominated by salt desert shrub species. In addition, ponderosa pine forests occur on the Rochelle Hills and plains cottonwood forests occur along the rivers. Because the area is the meeting place for plant species from both the Great Plains and the Great Basin vegetation, some rather unusual combinations of plant species occur.

Thilenius et al. (1995) described and classified the vegetation of the semi-arid rangelands in the Cheyenne River Basin and this classification will be the basis for much of my presentation. Benkobi and Uresk (1996) described the seral stages for the big sagebrush shrub steppe, a major vegetation type in the area described by Thilenius et al. (1995). Dr. Daniel Uresk (personal communication), a range scientist with the Rocky Mountain Research Station of the U.S. Forest Service at Rapid City, SD, has developed models for the seral stages of several other major vegetation types including, needleandthread grassland, greasewood and Nebraska sedge. These models have not yet been published but some of the information has been tested by the Forest Service on the

Thunder Basin National Grasslands, in cooperation with Dr. Uresk, and some mapping has been done.

Description Of Vegetation Types

Grassland Vegetation Types

Thilenius et al. (1995) described five distinct grassland types. Needleandthread (*Stipa comata*) is the dominant or co-dominant species on moderately coarse soils (silty to sandy loams) and on sandy soils. Western wheatgrass (*Agropyron smithii*) becomes more prevalent on fine textured (clayey) soils.

Needleandthread-Blue Grama Sodgrass Steppe Vegetation Type—

This is the dominant grassland type on the uplands. It occurs on deeper soils with coarse to medium texture. The average total cover is 11% for needleandthread and 10% for blue grama (*Bouteloua gracilis*). A large number of other grass and forb species occur in this Type. Plains prickly pear (*Opuntia polyacantha*) has an average cover of 2%. Scattered plants of big Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and yucca (*Yucca glauca*) occur.

Uresk (personal communication) has described the seral stages of this vegetation type. As succession proceeds from early through early-intermediate, late-intermediate to late seral stages, the amount of needleandthread steadily increases. Blue grama has about equal importance with needleandthread in the early seral stages, peaks in the early-intermediate stage and becomes less abundant in the late seral stage. Western wheatgrass is quite low in the early seral stage, peaks in the late-intermediate stage and then is much less important in the late seral stage. Based on this model, the average stand described by Thilenius et al. (1995) would be in the early-intermediate/late-intermediate seral stage.

Blue Grama Sodgrass Steppe Vegetation Type—

This type is typical of the shortgrass prairie common to the western Great Plains or eastern Colorado and areas further south. It occurs on level uplands on moderately deep, medium-textured soils. The dominant species is blue grama with 42% cover. As in the shortgrass prairie, western wheatgrass is quite common with 14% cover. A great many other grass species are also present. Plains pricklypear occurs in patches where the blue grama sod is broken.

Blue Grama-Threadleaf Sedge Sodgrass Steppe Vegetation Type—

This upland grassland type occurs in the eastward-sloping plains of the Cheyenne River Basin. It is found on medium to coarse soils that are almost free of stones. Average cover of the two dominant species is 20% for blue grama and 17% for threadleaf sedge (*Carex filifolia*). Scattered shrubs of big sagebrush, yucca, silver sagebrush (*Artemisia cana*) and Douglas rabbitbrush (*Chrysothamnus viscidiflorus*) occur.

Western Wheatgrass Sodgrass Steppe Vegetation Type –

This type occurs on internal drainage basins (playas) with impeded soil permeability. Runoff water collects in these areas and may remain ponded. Western wheatgrass has an average cover of 43% with sandberg bluegrass (*Poa secunda*), needleandthread, June grass (*Koeleria cristata*) and a number of forb species commonly present. Stock ponds are often excavated in these sites. On the banks of these ponds, foxtail (*Hordeum jubatum*) and dullseed polygonum (*Polygonum convolvulus*) grow and slender spikerush (*Eleocharis acicularis*) may be emergent in ponds.

Little Bluestem Bunchgrass Steppe Vegetation Type—

This is an unusual grassland vegetation type that brings together Great Plains and Great Basin vegetation species. It occurs on well-drained soils on exposed uplands on

the Rochelle Hills and also on some areas outside the Hills. The predominant grass is little bluestem (*Schizachyrium scoparium*) with an average cover of 26%. This species is common to the mixed grass Prairie of the Great Plains and it is present as tussocks more than 5 dm tall. Blue grama, a species indicative of the shortgrass Prairie is the next most common grass with an average cover of 4%. This type has very scattered shrubs of big sagebrush, a Great Basin species and bluebunch wheatgrass, also a Great Basin species, is one of the minor grass species. Ponderosa pine occurs at a very low density on the Rochelle hills but does not form a well-defined tree stratum.

Big Sagebrush-Dominated Shrub-Steppe Vegetation Types

Thilenius et al. (1995) described 5 different vegetation types dominated by Wyoming big sagebrush. The different vegetation types typically have a grass-dominated understory that closely matches one of the grassland vegetation types.

Big Sagebrush/Blue Grama- Western Wheatgrass Vegetation Type—

This is the most widely distributed sagebrush type which occurs on level to gently rolling, wind-exposed, upland slopes and ridges both east and west of the Rochelle Hills. It has a well-developed shrub stand of Wyoming Big Sagebrush plants that are 4-6 dm tall and had average canopy coverage of 22%. The main grass is blue grama which forms sod mats several meters across; average cover is 9%. Western wheatgrass is also quite abundant with an average cover of 6%. All other grass species have an average total cover of 14% and forbs have an average of 10% cover. I will discuss the seral stages of this vegetation type and their implication to management later.

Big Sagebrush / Western Wheatgrass Vegetation Type—

This somewhat similar sagebrush dominated type occurs in the floodplains and lower slopes of small, natural drainage ways rather than on the uplands. Because of the

greater occurrence of moisture events, this type has more western wheatgrass with 22% cover and considerably less blue grama with 2% cover than the previously described Type.

Big Sagebrush / Blue Grama-Bluebunch Wheatgrass Vegetation Type—

This variation of the big sagebrush type occurs on coarse-textured, gravelly ridges and uplands. The sagebrush forms an open stand (5% cover) with blue grama (15% cover) and bluebunch wheatgrass (*Agropyron spicatum*) (7% cover) the dominant grasses. Cover of other grasses is only 8% and forbs have a total average cover of about 11%.

Big Sagebrush / Bluebunch Wheatgrass Vegetation Type—

This Type is similar to the Great Basin big sagebrush types and occurs on porcellanite and sandstone buttes. It has an open stand of sagebrush (7% cover) with an understory dominated by bluebunch wheatgrass (17% cover). Other grasses have only a 4% cover and forbs have an average cover of 7%.

Big Sagebrush / Green Needlegrass Vegetation Type—

This somewhat limited shrub-steppe type is one example of Great Basin (big sagebrush) and Great Plains (green needlegrass) species coming together in the Thunder Basin area. The sagebrush forms an unevenly distributed canopy with an average cover of 14%. The green needlegrass (*Stipa viridula*) dominates the understory with 24% cover. However, blue grama is also quite common with a 9% cover. Other grasses have an average total cover of 14% and forbs have an average cover of only 7%.

Other Shrub-Dominated Vegetation Types

A number of other shrub-dominated vegetation types occur in the area but most are located on very specific topographic or soil situations. Some of these types are

dominated by Great Basin Shrub species while other have shrubs more common to the Great Plains.

Birdsfoot Sagebrush Dwarf-Shrub Vegetation Type--

This minor type dominated by a Great Basin Shrub species, occurs on concave pans and other upland areas with thin soils overlying a fine-textured subsurface which impedes drainage. The major shrub is birdsfoot sage (*Artemisia pedatifida*) with an average of 18% cover but seldom reaches 1 dm in height. Western wheatgrass is the dominant grass with 3% cover and with several other grass and forb species present.

Fourwing Saltbush Shrub Vegetation Type—

This type dominated by a salt desert shrub species, is present on steep side slopes in badlands terrain. The main shrub is fourwing saltbush (*Atriplex canescens*), which forms a poorly developed shrub stratum. Western wheatgrass and Louisiana sagewort (*Artemisia ludoviciana*) are the major herbaceous species. At the ground surface, bare ground averages almost 90%.

Silver Sage / Blue Grama – Prairie Sandreed Shrub – Steppe Vegetation Type—

This vegetation type occurs on sand dunes, mainly associated with river drainages. Silver sage forms a well-defined shrub stratum 5 dm or higher and an average cover of 20%. Blue grama and prairie sandreed (*Calamovilfa longifolia*) are the dominant grasses with 12% and 11% cover respectively. Cheatgrass (*Bromus tectorum*), needleandthread, and western wheatgrass are also common grasses.

Silver Sage / Blue Gram Shrub – Steppe Vegetation Type—

This type occurs on the alluvial terraces at least 1 meter above the floodplain that border the larger creeks and rivers of the Cheyenne River Basin. Silver sage has an

average cover of 8%. Blue grama is the dominant grass with 17% cover and western wheatgrass has 8% cover.

Yucca / Needleandthread Shrub Steppe Vegetation Type—

This limited type occurs on outcrops of sandstone but not on sand dunes or ridge tops. Yucca is the dominant shrub with 10% cover. Needleandthread (16% cover), prairie sandreed (9% cover), blue grama (8% cover) and threadleaf sedge (7% cover) are the dominant grasses.

Greasewood/Western Wheatgrass – Blue Grama Shrub Steppe Vegetation Type

This type occurs on level to gently sloping, seasonally flooded, river benches with relatively high levels of sodium in the substratum. Greasewood (*Sarcobatus vermiculatus*), mainly a Great Basin shrub, forms a well-defined shrub stratum of evenly distributed, relatively widely spaced individual shrubs with an average cover of 13%. Western wheatgrass and blue grama are the dominant grasses with 28% and 21% cover respectively. Saltgrass (*Distichlis stricta*) and alkali sacaton (*Sporobolus airoides*) occur in areas with more sodium in the soil. Uresk (personal communication) has classified the seral stages of this type. Greasewood increases progressively from early to mid to late seral stages. Western wheatgrass increases from early to mid seral but then declines again in the late seral stages.

Rabbitbrush Shrub Vegetation Type—

This type occurs on level upper slopes and ridges in outcrops of badlands terrain. The dominant shrub, Douglas rabbitbrush forms an evenly distributed, open shrub stratum with an average cover of 18%. The understory is species poor with the dominant species being prairie sandreed with 4% cover.

Forest Vegetation Types

Thilenius et al. (1995) described four main forest vegetation types, two upland forest types dominated by Ponderosa Pine, one upland type dominated by juniper and a riparian forest type.

Ponderosa Pine / Rocky Mountain Juniper Vegetation Type--

This type with closed canopy of ponderosa pine (*Pinus ponderosa*) occurs on the east face of the Rochelle Hills. The trees are 4-6 dm in basal diameter and the understory is almost absent except for Rocky Mountain juniper (*Juniperus scopulorum*), which is present as a second overstory tree and as an understory shrub.

Ponderosa Pine / Bluebunch Wheatgrass Vegetation Type—

This open type of ponderosa pine stand occurs on the steep upper slopes and flat ridges of the Rochelle Hills. The pine trees are shorter (lest than 15 m tall) and smaller (less than 6 dm basal diameter) than in the previous type. The understory consists of a large number of grasses and forbs and the dominant species is bluebunch wheatgrass (6 % cover).

Rocky Mountain Juniper Vegetation Type—

This tall shrub community occurs on the steep, side slopes of draws at the base of the Rochelle Hills and consists of a thick stand of juniper with a poorly developed understory consisting of scattered big sagebrush plants and a number of species of grasses and forbs.

Plains Poplar / Western Snowberry Vegetation Type—

This deciduous forest type occurs on the floodplains of the major rivers. The plains poplar (*Populus sargentii*) forms open, linearly distributed stands of mature trees. The prevalent shrub in the understory is western snowberry (*Symphoricarpos*

occidentalis). Western wheatgrass is the most common grass but a large number of other grasses and forbs are present.

Seral Stage Classification For Big Sagebrush

Benkobi and Uresk (1996) developed a model for classification of the big sagebrush / western wheatgrass type in the Thunder Basin area based on canopy cover and frequency of occurrence for big sagebrush, western wheatgrass and blue grama. This model does not require a determination of a "climax" plant community and more accurately describes what changes in plant composition take place as a stand progresses from Early Seral through Early Intermediate and Late Intermediate to the Late Seral stage which has a very dense stand of big sagebrush.

This process is more realistic than the NRCS model which assumes that the "climax" or pre-settlement of sagebrush were a result of disturbance. The model of Benkobi and Uresk (1996) more accurately portrays that, in the absence of fire, the sagebrush canopy progressively thickens and this occurs regardless of treatment such as grazing disturbance. Grazing and other disturbances can influence the kind and number of species in the understory but do not change the successional tendency for sagebrush canopy to thicken. Only fire, or some other factor that causes sagebrush mortality, can reduce the sagebrush crown cover.

	SERAL STAGES (coverage)			
	Early	Early Intermediate	Late Intermediate	Late
Sagebrush	17%	7%	22%	55%
Western Wheatgrass	7%	8%	20%	8%
Blue Grama	12%	30%	14%	6%
Total Grasses*	48%	58%	51%	34%
Total Forbs*	14%	16%	18%	8%

* Figures from personal communication, Uresk (2001)

	SERAL STAGES (number of species)			
	Early	Early Intermediate	Late Intermediate	Late
Shrubs	11	7	9	5
Grasses	30	17	20	18
Forbs	74	48	45	10
Total	115	72	74	33

The amount of blue grama peaks in the early intermediate stage and western wheatgrass peaks in the late intermediate stage. The number of species, i.e., species richness, declines drastically from the early to intermediate to late successional stages. Benkobi and Uresk (1996) further point out that "Managers concerned with biological diversity must maintain all defined seral stages." Natural fires prior to settlement maintained this landscape diversity. The only way to maintain all seral stages now is a clearly defined program of burning or other sagebrush removal treatments systematically carried out over a period of many years. As Perryman and Laycock (2000) point out, fire suppression in the Thunder Basin has been quite effective for many decades. This has

resulted in far greater areas covered with late intermediate and late successional stages of sagebrush than probably was ever present prior to settlement.

The effect this has had on wildlife populations is not clearly understood. However, it is known, that certain stages of the life cycle of sage grouse (e.g. brood rearing) require more open areas with forbs and insects for food. One forbs objective that has been proposed is that forbs should make up 40% of the total herbaceous composition. None of the sagebrush vegetation types described by Thilenius have more than 26% composition of forbs. Likewise, none of the seral stages described by Benkobi and Uresk (1996) have more than 26% composition of forbs. From these figures and the table above, it is clear that this brood habitat is not going to be provided if the majority of the sagebrush stands are in late seral condition because the sagebrush is too thick and there are too few forbs. However, the predominance of the late seral stage is exactly the situation we currently have. Yet we have a great many managers who are opposed to any sagebrush burning because they feel burning is detrimental to sage grouse. In fact, carefully planned burning is essential for sage grouse. The original Thunder Basin National Grassland Plan called for an average of only 500 acres to be prescribed burned every year. The revised plan does not include any prescribed burning acreage.

In addition to the effect that the current presence of an inordinate amount of late seral sagebrush has on sage grouse habitat, it also seems clear that the increase in sagebrush canopy since settlement has fragmented the sharp-tail grouse habitat in the Thunder Basin area, but that is a topic for another discussion.

How do you get higher percentage forbs composition after a burn, either prescribed or accidental? Normal agency policy is to prohibit the grazing on the burned

area for two growing seasons. What does this produce? – A great grassland without many forbs. To get more forbs, you need to graze the burned area the first year; but this seems to be management heresy. After burning you need to clearly define your objective. If you want grassland, rest it for two years. If you want more forbs and possibly the sagebrush to return more quickly, graze it the first year and thereafter.

Another consideration of the whole picture of sagebrush succession in the Powder River Basin is that of reclamation of lands strip-mined for coal. Current laws and regulations require replanting of sagebrush on at least part of many or most reclaimed areas; success is often limited and expensive. If the presence of any substantial amount of sagebrush on the site prior to mining was due to an advanced seral stage of the sagebrush type because of lack of fire, then the requirement to replant sagebrush may be ecologically unsound and completely misguided from a management point of view. The establishment of an earlier seral community without sagebrush on these reclaimed mine sites would add to overall landscape-level diversity; probably more beneficial to most species of wildlife than requiring sagebrush to be planted. Benkobi and Uresk's (1996) model clearly shows that sagebrush will reenter the community and gradually increase, even to a stage where it is too thick, given a long enough time. The relatively short time frame of our management perspective often is far too short to effectively treat areas in the most favorable way in the long term.

References

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