STREAM CHANNEL EVOLUTION DISCUSSION

Background

The form and function of these mountain and foothill valleys were shaped and characterized by beaver. Broad, essentially flat, valley bottoms with fine textured soil and high water table (such as several in Spotted Dog WMA) are the result of historic ponding by beaver. Now, with the beaver mostly eliminated, they no longer maintain the dams that once retained water in the drainages. Without the elevated water table that was previously maintained by the beaver dams, these fine textured valley bottom soils are drying out and being exposed to trampling by livestock. The result is that these riparian soils are being eroded away in flood flows, now unrestrained by beaver dams. Broad, tremendously productive, wet meadows of willows and sedges quickly become transformed into incised gullies serving only a single function: to efficiently carry away water and soil.

The riparian wet meadows that form in these foothill valleys as a succession of beaver ponds fill with sediment and peat over millennia are well represented in Spotted Dog WMA, but are rapidly being diminished, as few beaver remain to maintain dams or build new ones, and as livestock and large hooved wildlife trample the fragile soils and initiate erosion (Photo 141 through Photo 147). The sequence of photos below illustrate the process of degradation that is occurring on several sites in Spotted Dog WMA. This process profoundly reduces the productivity and ecologic function of these sites, thereby greatly diminishing habitat value.

Photo 141. A *Carex utriculata* (beaked sedge) dominated riparian wet meadow on the site of an old beaver pond along West Fork Spotted Dog Creek (Record ID 2024179), with a stable E stream type that does not erode, even under the largest flood (2011 photo)

Photo 142. Livestock trampling and damage to streambanks and wet soil along an Unnamed Tributary to West Fork Spotted Dog Creek (Record ID 2024180) triggers the process of destabilizing the system (2011 photo)

Photo 143. Vertical erosion cutting through an old buried beaver dam in a wet meadow along an Unnamed Tributary to South Fork Spotted Dog Creek (Record ID 2024178) (2011 photo)

Photo 144. Erosion (downcutting) through a wet meadow on a filled-in old beaver pond along an Unnamed Tributary to South Fork Spotted Dog Creek (Record ID 2024178) lowers the water table and drains the wet meadow (2011 photo)

Photo 145. Eroding through sediments in historic beaver ponds along Spotted Dog Creek (Record ID 2024165), where no beaver are present to maintain or create new dams that would prevent this situation (2011 photo)

Photo 146. View downstream along Spotted Dog Creek (Record 2024166), showing the typical result of a lack of deep binding rootmass and the resulting streambank erosion and channel incisement (2011 photo)

Photo 147. A view along Trout Creek (Record ID 2024162), showing the result of transformation from a once highly productive, beaver maintained riparian willow and sedge community, to what is now little more than a conduit for rapid discharge of water from the drainage (2011 photo)

HABITAT TYPES AND COMMUNITYTYPES DISCUSSION

Plant Community Classification

Vegetation in Spotted Dog WMA consists of a wide variety of habitat types and community types reflecting the complex pattern of site potential and disturbance history. Interacting factors such as elevation, slope aspect, soil type, and moisture availability, combine to determine the vegetation potential on each site. Table 58 provides a list of habitat types and community types recorded on Spotted Dog WMA, along with the acres and percent of the total area represented by each. Dichotomous keys used for habitat type and community type identification, as well as management information pertaining to each habitat type and community type, are provided in the classification and management documents of Pfister and others (1977) for forested upland sites, Mueggler and Stewart (1980) for upland sites with grassland and shrubland communities, and Hansen and others (1995) for riparian and wetland sites.

Table 58. Habitat types/community types[1] on Spotted Dog WMA (number = 192 [128 upland and 64 riparian/wetland]; study area = 33,748.49 acres)

Habitat Type/Community Type	Acres	Percent of Area
Riparian/Wetland (Lotic/Lentic) Types		
Poa pratensis community type (Kentucky bluegrass community type)	209.97	0.62%
Salix geyeriana community type (Geyer willow community type)	103.15	0.31%
Carex rostrata habitat type (beaked sedge habitat type)	95.60	0.28%
Salix geyeriana/Carex rostrata habitat type (Geyer willow/beaked sedge habitat type)	70.27	0.21%
Picea/Cornus stolonifera habitat type (spruce/red-osier dogwood habitat type)	38.77	0.11%
Pseudotsuga menziesii/Cornus stolonifera habitat type (Douglas fir/red-osier dogwood habitat type)	35.02	0.10%
Picea/Equisetum arvense habitat type (spruce/common horsetail habitat type)	23.99	0.07%
Populus tremuloides/Cornus stolonifera habitat type (aspen/red-osier dogwood habitat type)	22.51	0.07%
Alnus incana community type (thin-leaved alder) community type	15.91	0.05%
Juncus balticus community type (Baltic rush community type)	13.79	0.04%
Carex nebrascensis community type (Nebraska sedge community type)	8.99	0.03%
Populus balsamifera/Cornus stolonifera community type (black cottonwood/red-osier dogwood community type)	8.90	0.03%

Table 58. (cont.)

Habitat Type/Community Type	Acres	Percent of Area
Salix bebbiana community type		
(Bebb willow community type)	5.46	0.02%
Salix drummondiana/Carex rostrata habitat type		
(Drummond willow/beaked sedge habitat type)	4.89	0.01%
Pinus ponderosa/Cornus stolonifera habitat type		
(ponderosa pine/red-osier dogwood community type)	4.48	0.01%
Potentilla fruticosa/Deschampsia cespitosa habitat type		
(shrubby cinquefoil/tufted hairgrass habitat type)	3.56	0.01%
Prunus virginiana community type		
(chokecherry community type)	2.00	0.01%
Calamagrostis canadensis habitat type		
(bluejoint reedgrass habitat type)	1.84	0.01%
Typha latifolia habitat type		
(common cattail habitat type)	0.74	0.00%
Carex aquatilis habitat type		
(water sedge habitat type)	0.63	0.00%
Eleocharis palustris habitat type		
(common spikesedge habitat type)	0.23	0.00%
Upland Types		
Festuca scabrella/Festuca idahoensis habitat type		
(rough fescue/Idaho fescue habitat type)	10,750.10	31.85%
Festuca idahoensis/Agropyron spicatum habitat type		
(Idaho fescue/bluebunch wheatgrass habitat type)	6,642.65	19.68%
Agropyron spicatum/Poa sandbergii habitat type		
(bluebunch wheatgrass/Sandberg's bluegrass habitat type)	2,913.92	8.63%
Pseudotsuga menziesii/Calamagrostis rubescens habitat type		
(Douglas fir/pine grass habitat type)	2,893.12	8.57%
Festuca scabrella/Agropyron spicatum habitat type		
(rough fescue/bluebunch wheatgrass habitat type)	1,818.62	5.39%
Purshia tridentata/Agropyron spicatum habitat type		
(antelope bitterbrush/bluebunch wheatgrass habitat type)	1,678.78	4.97%
Purshia tridentata/Festuca idahoensis habitat type		
(antelope bitterbrush/Idaho fescue habitat type)	1,408.29	4.17%
Pseudotsuga menziesii/Symphoricarpos albus habitat type		
(Douglas fir/white coralberry habitat type)	1,319.27	3.91%
Pseudotsuga menziesii/Carex geyeri habitat type		
(Douglas fir/elk sedge habitat type)	689.86	2.04%
Picea/Linnaea borealis habitat type		
(spruce/twinflower habitat type)	630.53	1.87%

Table 58. (cont.)

Habitat Type/Community Type	Acres	Percent of Area
Pseudotsuga menziesii/Festuca scabrella habitat type (Douglas fir/rough fescue habitat type)	572.26	1.70%
Pseudotsuga menziesii/Festuca idahoensis habitat type (Douglas fir/Idaho fescue habitat type)	555.75	1.65%
Agropyron spicatum/Agropyron smithii habitat type (bluebunch wheatgrass/western wheatgrass habitat)	422.64	1.25%
Picea/Vaccinium cespitosa habitat type (spruce/dwarf huckleberry habitat type)	193.10	0.57%
Pinus contorta/Linnaea borealis habitat type (lodgepole pine/twinflower habitat type)	143.69	0.43%
Pseudotsuga menziesii/Vaccinium globulare habitat type (Douglas fir/globe huckleberry habitat type)	133.73	0.40%
Pseudotsuga menziesii/Arctostaphylos uva-ursi habitat type (Douglas fir/kinnikinnick habitat type)	131.68	0.39%
Pseudotsuga menziesii/Arnica cordifolia habitat type (Douglas fir/heart-leaf arnica habitat type)	104.96	0.31%
Picea/Smilacina stellata habitat type (spruce/starry Solomon-plume habitat type)	61.18	0.18%
Picea/Galium triflorum habitat type (spruce/sweet-scented bedstraw habitat type)	50.38	0.15%
Pseudotsuga menziesii/Agropyron spicatum habitat type (Douglas fir/bluebunch wheatgrass habitat type)	27.98	0.08%
Purshia tridentata/Festuca scabrella habitat type (antelope bitterbrush/rough fescue habitat type)	27.66	0.08%
Pseudotsuga menziesii/Spiraea betulifolia habitat type (Douglas fir/shiny-leaf spiraea habitat type)	4.27	0.01%

[1]Upland habitat types and community types were identified using the work of Mueggler and Stewart (1980) and Pfister and others (1977); Hansen and others (1995) was used for riparian and wetland sites.

Major Riparian/Wetland Habitat Types and Community Types in Spotted Dog WMA

Riparian/wetland areas (lotic and lentic wetlands) comprise a small fraction of the Spotted Dog WMA total area (approximately 483 acres, or only 1.4 percent). However, this small fraction is vitally important to the ecological function of the entire area. It receives concentrated use by virtually all animals in the area, both livestock and wildlife. Long term concentrated livestock use in the riparian zone has resulted in severe impacts to the vegetation and physical site conditions on most of the lower elevation, easily accessible, riparian sites in Spotted Dog WMA. For this reason, much of the riparian area is in some earlier seral, disturbed, stage of plant community development. Sensitive indicator species have been much reduced, or removed, and replaced with weedy,

disturbance increasers and exotic species that provide less ecologic function. Some stream channels have been downcut, changing the local hydrologic regime to a drier state with altered vegetation potential.

***Salix geyeriana* (Geyer willow) Community Type**—The *Salix geyeriana* (Geyer willow) community type is an early-to-mid seral grazing disclimax of the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type that results from long term grazing disturbance that converts the native sedge and grass dominated understory to mostly introduced and weedy herbaceous increaser species (Hansen and others 1995). The community type occurs primarily along streams, due to its requirement for saturated soils during the growing season. Stands of this community type inventoried in Spotted Dog WMA represent approximately 103 acres, and are all substantially altered from their original site potential. Domination of the overstory has now been converted mostly to *Salix boothii* (Booth willow), a less preferred browse species; and the understory has become dominated by a wide variety of introduced and grazing-increaser herbaceous species (e.g., *Poa pratensis* [Kentucky bluegrass], and *Phleum pratense* [timothy]) (Photo 148). These introduced herbaceous understory species provide less ecological function (such as bank stability) than of those they have replaced. Often on sites where the conversion from a *Salix geyeriana* (Geyer willow) dominated habitat type to a disturbed community type has occurred, the willow overstory has been open up to some degree, providing diminished wildlife habitat values, particularly for hiding and nesting cover.

Photo 148. A stand of *Salix geyeriana* (Geyer willow) community type with the floodplain dried out due to stream incisement, so *Carex utriculata* (beaked sedge) is no longer supported, and where the less palatable *Salix boothii* (Booth willow) has replaced most of the *Salix geyeriana* (Geyer willow) (Record ID 2024164) (2011 photo)

***Carex rostrata* (beaked sedge) Habitat Type**—The *Carex rostrata* (beaked sedge) habitat type occurs on very wet sites, mostly around edges of beaver ponds, on low point bars, and right along the channel edge (Hansen and others 1995) (Photos 149 and 150). Stands of this habitat type represent approximately 96 acres in Spotted Dog WMA, and although this does not represent a large portion of the WMA, it is an ecologically important vegetation type in riparian areas.

NOTE: The species name, *Carex rostrata*, was long misapplied to the commonly occurring wetland sedge in Montana and the Intermountain West, known as beaked sedge. The correct name is *Carex utriculata* (beaked sedge) (Lesica 2012). The old incorrect name is used here in reference to habitat types, because site classification manuals use that nomenclature.

Photo 149. A stand of *Carex rostrata* (beaked sedge) habitat type in an Unnamed Tributary to Trout Creek (Record ID 2043405) (2014 photo)

Photo 150. A disturbed stand of *Carex rostrata* (beaked sedge) habitat type on an Unnamed Tributary of Spotted Dog Creek with most of the *Carex utriculata* (beaked sedge) now displaced by *Juncus balticus* (Baltic rush) and *Carex nebrascensis* (Nebraska sedge) (Record ID 2024158) (2011 photo)

The *Carex rostrata* (beaked sedge) habitat type occurs on many sites with landform characteristics shaped by beavers, even though currently there are few remaining beaver. Stands of the *Carex rostrata* (beaked sedge) habitat type are extremely important for maintenance of streambank and floodplain stability, for trapping and holding entrained sediment, and as forage for wildlife. Livestock often utilize *Carex utriculata* (beaked sedge) in late season, when upland forage has dried, or when other forage is depleted. It is common for narrow bands of the species along moist stream edges to be heavily utilized, resulting in severe damage to the streambank integrity, as well as depletion of the stand. Typically, the result of such overuse is conversion of the stand to introduced grazing-increasers and invaders (e.g., *Juncus balticus* [Baltic rush], *Poa pratensis* [Kentucky bluegrass], *Cirsium arvense* [Canada thistle], etc.).

***Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) Habitat Type**—The *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type occurs primarily along streams, due to its requirement for saturated soils during the growing season (Hansen and others 1995). This important habitat type is a climax community common in the region, that will occupy a site indefinitely, in the absence of major disturbance or alteration to site potential (e.g., hydrologic change). Stands of this habitat type represent approximately 70 acres in Spotted Dog WMA. This habitat type is extremely important to wildlife (from large mammals to small mammals and songbirds) for food, cover, and nesting (Hansen and others 1995). Several stands in Spotted Dog WMA remain in a relatively undisturbed state because the sites are extremely wet, and livestock are generally inhibited from access, except on the driest years (Photos 151 and 152).

Photo 151. A large stand of the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type along Spotted Dog Creek (***NOTE:*** Such a broad flat valley bottom was formed by repeated filling of beaver ponds over millennia) (Record ID 2024164) (2011 photo)

Photo 152. The last open ponded water remaining from an old abandoned beaver pond, surrounded by the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) and the *Carex rostrata* (beaked sedge) habitat types along a tributary to West Fork Spotted Dog Creek (Record ID 2024179) (2011 photo)

The *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type is closely associated with the broad wet areas created around beaver ponds. The recent elimination of beaver from most of Spotted Dog WMA poses a serious threat to the remaining intact stands of this important habitat type. As unmaintained beaver ponds drain, the willow and sedge stands become dried out and extremely vulnerable to alteration by livestock. These stands then become converted to the *Salix geyeriana* (Geyer willow) community type described above, and if disturbance is severe and long enough, these sites can eventually be converted to much less productive upland sites.

***Picea/Cornus stolonifera* (spruce/red-osier dogwood) Habitat Type**—The *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type occurs on moist sites on alluvial benches and terraces along streams (Hansen and others 1995). Stands of this habitat type represent approximately 39 acres in Spotted Dog WMA. This is one of several forested riparian habitat types differentiated by the species of tree dominating the overstory. Understory shrub cover is usually abundant on these habitat types and characterized by wetland species (e.g., *Salix* spp. [willows], *Alnus incana* subsp. *tenuifolia* [thin-leaved alder] *Cornus sericea* subsp. *sericea* [red-osier dogwood], etc.) (Photo 153).

NOTE: The species name, *Cornus stolonifera*, that was previously applied to the commonly occurring wetland shrub, red-osier dogwood, has been replaced by the now preferred *Cornus sericea* (Lesica 2012). The old non-preferred synonym is used here in reference to habitat types, because site classification manuals use that nomenclature.

Photo 153. A stand of the *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type along Fred Burr Creek (Record ID 2024159) (2011 photo)

In Spotted Dog WMA, the *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type is found mostly along the higher elevation, smaller headwater tributary streams (e.g., Fred Burr Creek and the upper reaches of Spotted Dog Creek and its tributaries). Livestock use of these habitat types is somewhat limited by a general lack of herbaceous forage and by difficulty of access. However, the shrub *Cornus sericea* subsp. *sericea* (red-osier dogwood) is often sought after by livestock, as well as wildlife. It is considered an "ice cream" plant, and high use tends to reduce or eliminate its presence on a site (Hansen and others 1995). Moose in particular focus on this species.

***Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) Habitat Type**—The *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type occurs on well drained alluvial benches and terraces along streams (Hansen and others 1995). In Spotted Dog WMA, stands of this habitat type were recorded on mid-elevation reaches of Jake Creek, Trout Creek, and Spotted Dog Creek (Photos 154 and 155). Stands of this habitat type represent approximately 35 acres in Spotted Dog WMA.

Photo 154. A stand of the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type (Record ID 2024160) (2011 photo)

Photo 155. A more disturbed stand of the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type (Record ID 2043402) (2014 photo)

Due to their easily accessible positions, these stands tend to have very disturbed understories, with high amounts of introduced herbaceous species and very little *Cornus sericea* subsp. *sericea* (red-osier dogwood) remaining present. Undisturbed stands tend to have very dense and diverse understories of shrubs (e.g., *Cornus sericea* subsp. *sericea* [red-osier dogwood], *Amelanchier alnifolia* [Saskatoon serviceberry], and *Prunus virginiana* var. *melanocarpa* [chokecherry]). Long term heavy grazing disturbance will reduce the cover of those taller, more palatable, shrubs; and promote the cover of shorter, less palatable shrub species (e.g., *Rosa* spp. [rose], *Symphoricarpos* spp. [snowberry], etc.).

***Picea/Equisetum arvense* (spruce/field horsetail) Habitat Type**—The *Picea/Equisetum arvense* (spruce/field horsetail) habitat type occurs on generally flat, moist sites with poor drainage adjacent to lakes, fens, and wet meadows along low gradient streams (Hansen and others 1995). In Spotted Dog WMA this habitat type is found on suitable sites along the higher elevation streams (e.g., the upper reaches of Spotted Dog Creek and its tributaries) (Photo 156). Stands of this habitat type represent approximately 24 acres in Spotted Dog WMA. The high water table and wet soils can be severely damaged by concentrated livestock trampling (Hansen and others 1995).

Photo 156. A stand of the *Picea/Equisetum arvense* (spruce/field horsetail) habitat type along an Unnamed Tributary to South Fork Spotted Dog Creek (Record ID 2024176) (2011 photo)

***Populus tremuloides/Cornus stolonifera* (quaking aspen/red-osier dogwood) Habitat Type**—The *Populus tremuloides/Cornus stolonifera* (quaking aspen/red-osier dogwood) habitat type occurs in the mountains and foothills of Montana on alluvial terraces adjacent to streams, or near springs and seeps (Hansen and others 1995). In Spotted Dog WMA, this habitat type occurs on Jake Creek, Freezeout Creek, and a few spots in the forks of Spotted Dog Creek, however in most stands there is very little *Cornus sericea* subsp. *sericea* (red-osier dogwood) remaining (Photo 157). Many stands are also lacking younger *Populus tremuloides* (quaking aspen) size classes because the sprouted shoots are all consumed (Hansen and others 1995). Stands of this habitat type represent approximately 23 acres in Spotted Dog WMA.

Photo 157. A stand of the *Populus tremuloides/Cornus stolonifera* (quaking aspen/red-osier dogwood) habitat type along Freezeout Creek (Record ID 2024156) (2011 photo)

Major Forest and Woodland Habitat Types in Spotted Dog WMA Uplands

***Pseudotsuga menziesii/Calamagrostis rubescens* (Douglas fir/pine reedgrass) Habitat Type**—The *Pseudotsuga menziesii/Calamagrostis rubescens* (Douglas fir/pine reedgrass) habitat type is common in Montana, occurring on dry mountainsides and upper slopes (Pfister and others 1977). At lower elevations, the habitat type occupies northerly aspects, shifting to southerly slopes at higher (cooler and more moist) elevations. Four phases are described for the habitat type, each one representing a slight shift in understory composition, and indicating slight differences in site moisture and temperature. This habitat type was observed on15 sample polygons and occupies approximately 2,893 acres, or 8.6 percent of Spotted Dog WMA.

Stands on seven of the 15 polygons having the *Pseudotsuga menziesii/Calamagrostis rubescens* (Douglas fir/pine reedgrass) habitat type are in the *Agropyron spicatum* (bluebunch wheatgrass) phase, which is the driest of the four phases (Photo 158). Stands on another seven polygons are in the *Calamagrostis rubescens* (pine reedgrass) phase, which is slightly higher, cooler, and more moist than the other phases of the habitat type (Photo 159). A stand in one polygon is in the *Arctostaphylos uva-ursi* (kinnikinnick) phase, which generally occupies warm, dry, benches on gentle slopes (Photo 160). Timber productivity of these phases of this habitat type is low to moderate. Forage production also is low, but deer and elk make use of these sites in fall, winter, and spring (Pfister and others 1977).

Photo 158. A stand of the *Pseudotsuga menziesii/Calamagrostis rubescens* (Douglas fir/pine reedgrass) habitat type in the *Agropyron spicatum* (bluebunch wheatgrass) phase (Record ID 2024219) (2011 photo)

Photo 159. A stand of the *Pseudotsuga menziesii/Calamagrostis rubescens* (Douglas fir/pine reedgrass) habitat type in the *Calamagrostis rubescens* (pine reedgrass) phase (Record ID 2024270) (2011 photo)

Photo 160. A harvested stand of the *Pseudotsuga menziesii/Calamagrostis rubescens* (Douglas fir/pine reedgrass) habitat type in the *Arctostaphylos uva-ursi* (kinnikinnick) phase (Record ID 2043382) (2014 photo)

In Spotted Dog WMA lands, most of these conifer forest stands have recently had their merchantable timber harvested. The tree canopy has been opened, and the shrub and herbaceous understory layers have responded with great vigor. Most of the harvest was total removal of all merchantable trees, leaving few if any trees as a source of seed. However on most harvested sites, regeneration of conifer tree seedlings and saplings is progressing well.

***Pseudotsuga menziesii/Symphoricarpos albus* (Douglas fir/white coralberry) Habitat Type**—The *Pseudotsuga menziesii/Symphoricarpos albus* (Douglas fir/white coralberry) habitat type is a common habitat type in Montana, usually found on moderately warm slopes and benches (Pfister and others 1977). The dominant undergrowth species is *Symphoricarpos albus* (white coralberry), but earlier seral stands can contain significant amounts of *Pinus ponderosa* (ponderosa pine) (Pfister and others 1977). This habitat type was recorded on six polygons, representing approximately 1,319 acres, or 3.9 percent of the project area. Five of the six polygons are in the *Agropyron spicatum* (bluebunch wheatgrass) phase (Photo 161), which is at the drier end of the moisture range for the habitat type. The sixth polygon is in the *Symphoricarpos albus* (white coralberry) phase (Photo 162). Timber productivity of this habitat type is low to moderate. Deer and elk make moderate use of these sites (Pfister and others 1977).

Photo 161. A disturbed stand of the *Pseudotsuga menziesii/Symphoricarpos albus* (Douglas fir/white coralberry) habitat type in the *Agropyron spicatum* (bluebunch wheatgrass) phase (Record ID 2043451) (2014 photo)

Photo 162. An early successional stand of the *Pseudotsuga menziesii/Symphoricarpos albus* (Douglas fir/white coralberry) habitat type in the *Symphoricarpos albus* (white coralberry) phase, with the overstory dominated by *Populus tremuloides* (quaking aspen) (Record ID 2043446) (2014 photo)

In Spotted Dog WMA, most of these conifer forest stands have recently had their merchantable timber harvested. The tree canopy has been opened, and the shrub and herbaceous understory layers have responded with great vigor. Most of the harvest was total removal of all merchantable trees, leaving few if any trees as a source of seed. However on most harvested sites, regeneration of conifer tree seedlings and saplings is progressing well.

***Picea/Linnaea borealis* (spruce/twinflower) Habitat Type**—The *Picea/Linnaea borealis* (spruce/twinflower) habitat type is found on cool, well-drained benches and gently northeast slopes (Pfister and others 1977). These sites are generally higher, cooler, and more moist, than sites dominated by *Pseudotsuga menziesii* (Douglas fir) habitat types. Seral progression (developing usually after wildfire) on this habitat type proceeds over time from dominance by *Pinus contorta* (lodgepole pine), to *Pseudotsuga menziesii* (Douglas fir), to *Picea* (spruce). In Spotted Dog WMA, four polygons have stands of this habitat type (Photo 163), which represents approximately 631 acres, or 1.9 percent of the project area.

NOTE: In this document, *Picea* (spruce) trees are not identified to species, because most *Picea* (spruce) populations in Montana result from hybridization of *Picea engelmannii* (Engelmann spruce) and *Picea glauca* (white spruce), and display intermediate characteristics of both species.

Photo 163. A stand of the *Picea/Linnaea borealis* (spruce/twinflower) habitat type heavily impacted by insect infestation (Record ID 2043430) (2014 photo)

The *Picea/Linnaea borealis* (spruce/twinflower) habitat type has moderate timber productivity. According to Pfister and others (1977), elk and deer use was conspicuous on most stands sampled for their work. Stands of this

habitat type on all four sampled polygons have recently had timber harvested, and are generally in a severely disturbed, early seral, state. However on most harvested sites, regeneration of conifer tree seedlings and saplings is progressing well.

***Populus tremuloides* (quaking aspen) Dominated Communities**—Neither Pfister and others (1977), nor Mueggler and Stewart (1980), included stands of the ecologically important *Populus tremuloides* (quaking aspen) in their habitat type classification work. This means that for upland sites, we are lacking description of any habitat types or community types dominated by this tree species. While *Populus tremuloides* (quaking aspen) groves are known to contribute very important wildlife habitat values, stands dominated by it are few and quite small in Spotted Dog WMA (Photo 164). Three relatively small polygons currently dominated by the species were sampled in Spotted Dog WMA that represent approximately 99 acres, or only 0.3 percent of the project area.

Photo 164. A small stand currently dominated by *Populus tremuloides* (quaking aspen), but with *Pseudotsuga menziesii* var. *glauca* (Douglas fir) coming in (Record ID 2043446) (2014 photo)

It is apparent from the amount of young conifer trees coming into these stands beneath the *Populus tremuloides* (quaking aspen) canopy (Photos 165 and 166), that the *Populus tremuloides* (quaking aspen) communities present are early seral to one of the conifer habitat types described by Pfister and others (1977). Each of the three *Populus tremuloides* (quaking aspen) stands keys out, using Pfister and others (1977), to a different conifer tree dominated habitat type, reflecting the diversity and ecological breadth of the species.

Photo 165. An interior view of a site currently dominated by *Populus tremuloides* (quaking aspen), but with young conifers coming in (Record ID 2043425) (2014 photo)

Photo 166. A stand of healthy, chest high *Populus tremuloides* (quaking aspen) seedling/sapling regeneration released by forest overstory removal and intense browse pressure (Record ID 2043424) (2014 photo)

Livestock herbivory can be a major factor in reducing *Populus tremuloides* (quaking aspen) recruitment because the young shoots are highly palatable to livestock, and livestock tend to spend a high proportion of time in areas with *Populus tremuloides* (quaking aspen) (Beschta and others 2014). Beschta and others (2014) conclude that where *Populus tremuloides* (quaking aspen) recruitment is impaired or lacking, eliminating or minimizing the effects of livestock may be required to improve recruitment.

Shrubland Habitat Types in Spotted Dog WMA Uplands

***Purshia tridentata/Agropyron spicatum* (antelope bitterbrush/bluebunch wheatgrass) Habitat Type**—The *Purshia tridentata/Agropyron spicatum* (antelope bitterbrush/bluebunch wheatgrass) habitat type is a semiarid habitat type found primarily in the 10 to 15 inch precipitation zone, that typically occurs in fairly small patches (less than 20 acres) on rather specialized environments on steep slopes (40 to 75 percent) with southerly exposures at elevations 3,500 to 5,500 ft (Mueggler and Stewart 1980) (Photo 167). Stands of this habitat type occupy approximately 1,679 acres, or 5.0 percent, of Spotted Dog WMA. Significant stands of this habitat type in Spotted Dog WMA occupy a band along the western portion of Spotted Dog WMA with southwesterly slope aspects. These stands exhibit a range of condition, with greatest degree of disturbance and heaviest level of browse use on the northern end of the distribution, generally north of Freezeout Creek, with the very worst conditions on stands north of O'Neil Creek. These stands are very heavily browsed, highly disturbed, infested with invasive plant (weed) species, and showing excessive dead and decadent material (Photo 168). In addition to the browsing and competition from weeds, these shrubs were at the time of this survey also infested with caterpillars. Plots sampled at the southern end near Jake Creek and Fred Burr Creek are in much better, less disturbed, condition.

Photo 167. A stand of the *Purshia tridentata/Agropyron spicatum* (antelope bitterbrush/bluebunch wheatgrass) habitat type (Record ID 2024227) (2011 photo)

Photo 168. Heavily browsed and decadent *Purshia tridentata* (antelope bitterbrush) (Record ID 2024211) (2011 photo)

Purshia tridentata (antelope bitterbrush) is a preferred browse species for all classes of livestock, and especially for deer and elk in fall and winter (Mueggler and Stewart 1980). The species is a key winter range browse source for deer and elk. Mueggler and Stewart (1980) report that early to mid summer utilization of *Purshia tridentata* (antelope bitterbrush) is more detrimental to the plants than the same amount of winter use, because carbohydrate reserves are at their lowest from May through July, and part of the energy demand for plant growth is being drawn from the root reserves during that time. Given the several cumulative stresses recently coming to bear on this population of such an important shrub, and judging by the excessive amount of dead and decadent material, it appears that these stands may be in decline.

***Purshia tridentata/Festuca idahoensis* (antelope bitterbrush/Idaho fescue) Habitat Type**—The *Purshia tridentata/Festuca idahoensis* (antelope bitterbrush/Idaho fescue) habitat type is infrequently found in Montana, but is recorded northeast of Deerlodge, Montana (Mueggler and Stewart 1980). It is found on steep southerly exposures where moisture is sufficient to support *Festuca idahoensis* (Idaho fescue). Stands occur primarily in the 20 to 30 inch precipitation zone. In Spotted Dog WMA, this habitat type occupies approximately 1,409 acres, or 4.2 percent of the project area. In general in Spotted Dog WMA, stands of *Purshia tridentata* (antelope bitterbrush) are highly browsed, disturbed, infested with invasive plant species, and full of dead and decadent woody material (Photo 169). In addition to the browsing and competition from weeds, these shrubs were at the time of this survey also infested with insect caterpillars.

Photo 169. A highly browsed stand of the *Purshia tridentata/Festuca idahoensis* (antelope bitterbrush/Idaho fescue) habitat type (Record ID 2024221) (2011 photo)

Purshia tridentata (antelope bitterbrush) is a preferred browse species for all classes of livestock, and especially for deer and elk in fall and winter. The species is a key winter range browse source for deer and elk (Mueggler and Stewart 1980). Mueggler and Stewart (1980) report that summer utilization of *Purshia tridentata* (antelope bitterbrush) is more detrimental to the plants than the same amount of winter use, because carbohydrate reserves are at their lowest from May through July, and part of the energy demand for plant growth is being drawn from the root reserves in early to mid summer. Given the multiple cumulative stresses recently coming to bear on this population of the shrub, and judging by the excessive amount of dead and decadent material, it appears that these stands may be in decline.

Major Grassland Habitat Types in Spotted Dog WMA Uplands

***Festuca scabrella/Festuca idahoensis* (rough fescue/Idaho fescue) Habitat Type**—The *Festuca scabrella/ Festuca idahoensis* (rough fescue/Idaho fescue) habitat type is the single most abundant type in Spotted Dog WMA, representing approximately 10,744 acres, or nearly one third of the WMA.

NOTE: The species name, *Festuca scabrella*, that was previously applied to this important intermountain bunch grass, has been replaced by the now preferred *Festuca campestris* (Lesica 2012). The old non-preferred synonym is used here in reference to habitat types, because site classification manuals use that nomenclature.

Spotted Dog WMA lies near the southern extremity of *Festuca campestris* (rough fescue) range along both sides of the Continental Divide. The habitat type occurs on relatively cool and mesic sites on mountain slopes along both sides of the Continental Divide on any exposure, but generally confined to slopes less than 30 percent (Mueggler and Stewart 1980). This habitat type occurs primarily within the 20 to 30 inch precipitation zone, and is one of the most productive grassland communities in western Montana (Mueggler and Stewart 1980) (Photo 170). According to Mueggler and Stewart (1980), this habitat type produces at least one-half ton of air-dry vegetation per acre, mostly palatable grasses. Vegetation in this habitat type is usually dominated by the two fescues, but the habitat type is extremely diverse with a long list of forb species typically present in small amounts. Two phases are described within this habitat type that further describe stands by the presence of *Stipa richardsonii* (Richardson's needlegrass) on slightly drier sites, and *Geranium viscosissimum* (sticky geranium) on slightly more mesic sites (Mueggler and Stewart 1980).

Photo 170. A productive stand of the *Festuca scabrella/Festuca idahoensis* (rough fescue/Idaho fescue) habitat type (Record ID 2024214) (2011 photo)

The importance of *Festuca campestris* (rough fescue) habitat types cannot be overstated regarding wildlife habitat values. *Festuca campestris* (rough fescue) is heavily used by elk (*Cervus canadensis*) throughout the year in the northern Intermountain West (Tirmenstein 2000), and with *Festuca idahoensis* (Idaho fescue) provides critical wintering habitat. These extensive *Festuca campestris* (rough fescue) habitats on Spotted Dog WMA also provide important nesting and foraging habitat for several bird species, including long-billed curlew (*Numenius americanus*), western meadowlark (*Sturnella neglecta*), Brewer's blackbird (*Euphagus cyanocephalus*), horned lark (*Eremophila alpestris*), savannah sparrow (*Passerculus sandwichensis*), and vesper sparrow (*Pooecetes gramineus*) (Clarke and Smucker 2014, Smucker and Fylling 2010). These habitats also provide important

wintering habitats for northern shrike (*Lanius excubitor*), gray-crowned rosy-finch (*Leucosticte tephrocotis*), American pipit (*Anthus rubescens*), and rough-legged hawk (*Buteo lagopus*) (DuBois, pers. com. 2015).

As they age, bunch grass plants typically form basal crown rings that are often hollow or dead in the center. Conflicting theories exist to explain this phenomenon. One explanation theorizes that plants with hollow crowns need to be grazed to stimulate rejuvenation. Another explanation theorizes that the hollow crowns are due to overgrazing by domestic livestock. However, most plant ecologists, agronomists, and naturalists believe that the hollow crown growth form is natural, and is a normal development stage of a bunch grass plant as it expands outward by tillering to reach additional nutrients and moisture (Strickland 1983).

Bunchgrass grasslands on Spotted Dog WMA provide nesting and foraging habitat for several grassland songbird species, including long-billed curlew, western meadowlark, Brewer's blackbird, horned lark, and savannah and vesper sparrow (Clarke and Smucker 2014, Smucker and Fylling 2010).

***Festuca idahoensis/Agropyron spicatum* (Idaho fescue/bluebunch wheatgrass) Habitat Type**—The *Festuca idahoensis/Agropyron spicatum* (Idaho fescue/bluebunch wheatgrass) habitat type (Mueggler and Stewart 1980) is the second most abundant vegetation community in Spotted Dog WMA, but it is perhaps the most common mountain grassland habitat type in southwestern Montana (Mueggler and Stewart 1980) (Photo 171). This habitat type occupies approximately 6,673 acres, or 19.8 percent of Spotted Dog WMA, and occurs on sites at elevations from 4,500 to 7,500 ft on all exposures and slope gradients, primarily within the 14 to 20 inch precipitation zone. Productivity on sites of this habitat type varies widely between sites and with annual variation in climate conditions (Mueggler and Stewart 1980). A wide variety of other graminoids may be present, but *Agropyron spicatum* (bluebunch wheatgrass) is always more abundant than rhizomatous wheatgrasses. The amount of forbs present can range from 10 to 60 percent of canopy cover in a stand (Mueggler and Stewart 1980). This habitat type generally has a greater proportion of forbs to graminoids than other *Festuca* (fescue) dominated habitat types (Mueggler and Stewart 1980). A *Stipa occidentalis* (western needlegrass) phase is described by Mueggler and Stewart (1980) on slightly more moist sites where *Stipa occidentalis* (western needlegrass) is more abundant than *Stipa comata* (needle-and-thread). This phase is generally especially rich in forbs (Mueggler and Stewart 1980).

Photo 171. An impaired stand of the *Festuca idahoensis/Agropyron spicatum* (Idaho fescue/bluebunch wheatgrass) habitat type with reduced cover of *Agropyron spicatum* (bluebunch wheatgrass) and inadequate litter cover (Record ID 2024216) (2011 photo)

As they age, bunch grass plants typically form basal crown rings that are often hollow or dead in the center. Conflicting theories exist to explain this phenomenon. One explanation theorizes that plants with hollow crowns need to be grazed to stimulate rejuvenation. However, most agronomists and naturalists counter that the hollow crown growth form is natural, and is a normal development stage of a bunch grass plant as it expands outward by tillering to reach additional nutrients and moisture (Strickland 1983).

Bunchgrass grasslands on Spotted Dog WMA provide nesting and foraging habitat for several grassland songbird species, including long-billed curlew, western meadowlark, Brewer's blackbird, horned lark, and savannah and vesper sparrow (Clarke and Smucker 2014, Smucker and Fylling 2010).

***Agropyron spicatum/Poa sandbergii* (bluebunch wheatgrass/Sandberg bluegrass) Habitat Type**—The *Agropyron spicatum/Poa sandbergii* (bluebunch wheatgrass/Sandberg bluegrass) habitat type (Mueggler and Stewart 1980) (Photo 172) occupies approximately 2,917 acres or 8.6 percent of Spotted Dog WMA.

> **NOTE:** The species name, *Poa sandbergii* (Sandberg bluegrass), that was previously applied to this common rangeland indicator bunch grass, has been replaced by the now preferred *Poa secunda* (Lesica 2012). The old non-preferred synonym is used here in reference to habitat types, because site classification manuals use that nomenclature.

Photo 172. An impaired stand of the *Agropyron spicatum/Poa secunda* (bluebunch wheatgrass/Sandberg bluegrass) habitat type that has reduced vegetation structure, altered community composition, and invasive plant species *Centaurea maculosa* (spotted knapweed) present (Record ID 2024210) (2011 photo)

This moderately arid habitat type occurs at generally lower elevations than the *Festuca idahoensis/Agropyron spicatum* (Idaho fescue/bluebunch wheatgrass) habitat type, but may be found on any aspect or slope gradient, and on a wide variety of soils at elevations between 3,000 ft and 6,000 ft on loamy soils derived from a wide variety of parent materials (Mueggler and Stewart 1980). The habitat type occurs primarily in the 14 to 20 inch precipitation zone. The habitat type is dominated by *Agropyron spicatum* (bluebunch wheatgrass), while *Poa secunda* (Sandberg bluegrass) and *Koeleria macrantha* (prairie Junegrass) are constant species of secondary importance. A *Stipa comata* (needle-and-thread) phase is recognized, where either *Stipa comata* (needle-and-thread) or *Stipa spartea* (porcupine grass) share dominance with *Agropyron spicatum* (bluebunch wheatgrass). The habitat type supports a wide variety of forbs, which sometimes comprise 30 to 40 percent of the canopy cover, yet no single forb constantly shares dominance.

Productivity on good condition stands in this habitat type is expected to range from 300 to 500 lb/ac of air-dry vegetation per acre. Approximately 70 to 80 percent of this production will consist of good to excellent palatability grasses (Mueggler and Stewart 1980). *Agropyron spicatum* (bluebunch wheatgrass) is the principal species here to decrease under heavy use (Mueggler and Stewart 1980). In this habitat type, large amounts of, or a marked increase of, *Artemisia frigida* (fringed sagewort), *Gutierrezia sarothrae* (broom snakeweed), and/or *Balsamorhiza sagittata* (arrowleaf balsamroot) also indicate historic long term intense use by livestock. *Bromus tectorum* (cheatgrass) and *Centaurea maculosa* (spotted knapweed) often invade stands of this habitat type (Mueggler and Stewart 1980).

As they age, bunch grass plants typically form basal crown rings that are often hollow or dead in the center. Conflicting theories exist to explain this phenomenon. One explanation theorizes that plants with hollow crowns need to be grazed to stimulate rejuvenation. However, most agronomists and naturalists counter that the hollow crown growth form is natural, and is a normal development stage of a bunch grass plant as it expands outward by tillering to reach additional nutrients and moisture (Strickland 1983).

Bunchgrass grasslands on Spotted Dog WMA provide nesting and foraging habitat for several grassland songbird species, including long-billed curlew, western meadowlark, Brewer's blackbird, horned lark, and savannah and vesper sparrow (Clarke and Smucker 2014, Smucker and Fylling 2010).

***Festuca scabrella/Agropyron spicatum* (rough fescue/bluebunch wheatgrass) Habitat Type**—The *Festuca scabrella/Agropyron spicatum* (rough fescue/bluebunch wheatgrass) habitat type represents approximately 1,820 acres, or 5.4 percent of the WMA. Spotted Dog WMA lies near the southern extremity of *Festuca campestris* (rough fescue) range along both sides of the Continental Divide (Mueggler and Stewart 1980).

> **NOTE:** The species name, *Festuca scabrella*, that was previously applied to this important intermountain bunch grass, has been replaced by the now preferred *Festuca campestris* (Lesica 2012). The old non-preferred synonym is used here in reference to habitat types, because site classification manuals use that nomenclature.

In late seral to climax state, this habitat type is usually conspicuously dominated by *Festuca campestris* (rough fescue) (Mueggler and Stewart 1980). *Festuca campestris* (rough fescue) is very sensitive to high grazing pressure, and consequently is the primary species to be reduced in stands of this habitat type. Mueggler and Stewart (1980) report that, even under complete protection from grazing, improvement of stands from poor condition to good condition usually took 30 years. In those studies, *Agropyron spicatum* (bluebunch wheatgrass) recovered much more rapidly than did the *Festuca campestris* (rough fescue). This suggests that long term livestock grazing would over time cause a shift from *Festuca campestris* (rough fescue) to *Agropyron spicatum* (bluebunch wheatgrass) in a stand previously dominated by the former (Photo 173). Heavy grazing by livestock jeopardizes fescue grassland ecosystem sustainability, and even light grazing causes *Festuca campestris* (rough fescue) to decline (Anderson 2006).

Photo 173. A stand of the *Festuca scabrella/Agropyron spicatum* (rough fescue/bluebunch wheatgrass) habitat type (Record ID 2024215) (2011 photo)

Older stands of *Festuca campestris* (rough fescue) often contain large diameter (up to 20 inches in Alberta) (Tirmenstein 2000). These clumps expand radially with age, leaving a central area of old culms and leaf sheath stubble. This old material in the central area of the clump is not itself an indicator of declining plant health. This grass is very susceptible to damage from heavy grazing, especially during early spring. It is grazed during all seasons by elk, and is a key species on elk winter range. It retains a considerable amount of nutritive value after maturity. This grass does not tolerate excessive trampling, and because of its overall palatability, is very susceptible to overgrazing damage (MSU Extension Service 2015).

As they age, bunch grass plants typically form basal crown rings that are often hollow or dead in the center. Conflicting theories exist to explain this phenomenon. One explanation theorizes that plants with hollow crowns need to be grazed to stimulate rejuvenation. However, most agronomists and naturalists counter that the hollow crown growth form is natural, and is a normal development stage of a bunch grass plant as it expands outward by tillering to reach additional nutrients and moisture (Strickland 1983).

Bunchgrass grasslands on Spotted Dog WMA provide nesting and foraging habitat for several grassland songbird species, including long-billed curlew, western meadowlark, Brewer's blackbird, horned lark, and savannah and vesper sparrow (Clarke and Smucker 2014, Smucker and Fylling 2010).

ECOLOGICALLY IMPORTANT PLANT SPECIES DISCUSSION

Background

The following is a discussion of noteworthy or ecologically important plant species recorded in the Spotted Dog WMA. Discussed are species that occupy major portions of the study area, or unique or ecologically important landscape positions. Species considered include the following:

- *Agropyron spicatum* (bluebunch wheatgrass);
- *Festuca campestris* (rough fescue);
- *Festuca idahoensis* (Idaho fescue);
- *Purshia tridentata* (antelope bitterbrush);
- *Populus tremuloides* (quaking aspen); and
- *Bromus tectorum* (cheatgrass), an invasive species.

***Agropyron spicatum* (bluebunch wheatgrass)**—*Agropyron spicatum* (bluebunch wheatgrass) is one of the most valuable native grasses on western rangelands for livestock and wildlife (Zlatnik 1999) (Photo 174). The species was recorded on 113 of 128 (88.3 percent) upland polygons sampled in Spotted Dog WMA. This species provides forage for elk, and deer (Johnson and Larson 1999). Its forage production varies, depending on landscape setting, soils, and precipitation zone; but it is typically the most palatable and productive of associated grasses (Monsen and others 2004).

Photo 174. A stand of *Agropyron spicatum* (bluebunch wheatgrass) on a southwest aspect infested with *Centaurea maculosa* (spotted knapweed) (Record ID 2043394) (2014 photo)

Agropyron spicatum (bluebunch wheatgrass) is a native, cool-season, perennial grass with densely tufted culms, 12 to 30 inches (30 to 100 cm) tall. It is among the most drought resistant of native bunchgrasses, but the plants do not flower and produce seed every year. Seedling establishment is generally poor, and the species usually reproduces vegetatively by tillers (Zlatnik 1999). It is moderately tolerant of grazing during its non-growing period, but lightly grazed plants produce taller growth than ungrazed plants. However, the species is very sensitive to timing and intensity of use, and is extremely sensitive to defoliation during active growth (Zlatnik 1999). Spring grazing, when apical meristems are elevated, is particularly stressful. Repeated grazing during the spring, even at a moderate level, can harm the plants. Heavy grazing may degrade or kill the stand, and the species is considered a grazing decreaser (Zlatnik 1999).

Many sites historically dominated by *Agropyron spicatum* (bluebunch wheatgrass) have been altered by intense livestock use (Monsen and others 2004). Stands of the species produce good forage, with production fluctuating less during drought than other grasses (Zlatnik 1999). Due to its extensive root systems, *Agropyron spicatum* (bluebunch wheatgrass) is an excellent soil binder. It is planted for soil protection in watersheds where erosion is a problem, and is widely used in restoration of native plant communities (Monsen and others 2004). Invasive species, such as *Bromus japonicus* (field brome) and *Bromus tectorum* (cheatgrass), must be controlled to allow successful re-establishment of *Agropyron spicatum* (bluebunch wheatgrass).

Agropyron spicatum (bluebunch wheatgrass) usually survives fire, and generally has a natural fire interval of less than 30 years (Zlatnik 1999). Monsen and others (2004) agree that it is fire tolerant, but suggest that frequent or intense fire may reduce or eliminate the species from a site. Light to moderate intensity burning may remove most of its above-ground material, but does not usually kill the plant. When burned, the species is generally favored over its competitors, except for the invasive *Bromus tectorum* (cheatgrass) and *Bromus japonicus* (field brome) (Zlatnik 1999). The buds are well protected from fire by dense foliage, or are protected underground. However, season of burning does affect mortality. *Agropyron spicatum* (bluebunch wheatgrass) has coarse stems and little leafy material; therefore the tops burn quickly, with little heat being transferred down to the meristem tissue. The species probably suffers less damage if burned while dormant, and most damage if burned while actively growing. Frequent burning in these stands favors annual grasses over perennial species (Zlatnik 1999).

As they age, bunch grass plants typically form basal crown rings that are often hollow or dead in the center. Conflicting theories exist to explain this phenomenon. One explanation theorizes that plants with hollow crowns need to be grazed to stimulate rejuvenation. However, most agronomists and naturalists counter that the hollow crown growth form is natural, and is a normal development stage of a bunch grass plant as it expands outward by tillering to reach additional nutrients and moisture (Strickland 1983).

Bunchgrass grasslands on Spotted Dog WMA provide nesting and foraging habitat for several grassland songbird species, including long-billed curlew, western meadowlark, Brewer's blackbird, horned lark, and savannah and vesper sparrow (Clarke and Smucker 2014, Smucker and Fylling 2010).

***Festuca campestris* (rough fescue)**—*Festuca campestris* (rough fescue) is an important bunchgrass species throughout the intermountain region, and extending eastward onto the plains that slope away from the Continental Divide. Mueggler and Stewart (1980) state that the species is widespread in Montana only north of approximately 46° latitude, which crosses near the city of Butte. Spotted Dog WMA lies slightly north of 46° latitude. The

species often occurs as nearly monospecific grassland stands, as well as a major constituent of many other grassland, shrubland, and open canopy forested communities throughout its range (Photos 175 and 176). On grassland sites it often is the climax dominant, although many stands have been converted by long term over grazing to dominance by less palatable and more grazing-tolerant native and/or introduced grasses. In Spotted Dog WMA several near pristine grassland stands of the species were sampled.

Photo 175. A healthy stand of *Festuca campestris* (rough fescue) near the northeast corner of Spotted Dog WMA (Record ID 2043373) (2014 photo)

Photo 176. *Festuca campestris* (rough fescue) bunches in the understory of a harvested forest stand near the east edge of Spotted Dog WMA (Record ID 2043383) (2014 photo)

Commonly occurring grassland types include *Festuca scabrella/Festuca idahoensis* (rough fescue/Idaho fescue) habitat type and *Festuca scabrella/Agropyron spicata* (rough fescue/bluebunch wheatgrass) habitat type (Mueggler and Stewart 1980). Shrubland habitat type series having this grass as the understory indicator species include *Artemisia tridentata* (big sagebrush), *Purshia tridentata* (antelope bitterbrush), and *Dasiphora floribunda* (shrubby cinquefoil) (Mueggler and Stewart 1980). Forested habitat types where *Festuca campestris* (rough fescue) dominates the understory have been described in the *Pinus flexilis* (limber pine), *Pinus ponderosa* (ponderosa pine), and *Pseudotsuga menziesii* (Douglas fir) series (Pfister and others 1977). Common associates of rough fescue include *Agropyron spicatum* (bluebunch wheatgrass), *Danthonia intermedia* (timber oatgrass), *Festuca idahoensis* (Idaho fescue), *Koeleria macrantha* (prairie Junegrass), *Poa* (bluegrass) species, and *Lupinus* (lupine) species (Tirmenstein 2000). *Festuca campestris* (rough fescue) is a cool-season grass well adapted to a short growing season. It typically initiates growth immediately after snowmelt and completes growth before the onset of summer drought.

Festuca campestris (rough fescue) occurs in early seral, as well as climax communities. It is characteristic of many climax and late-successional mountain grassland and fescue prairie communities. In rough fescue prairie foothill communities of Alberta, succession to a near climax state requires more than 20 years of rest after disturbance by intense grazing. Complete recovery following light grazing in southwestern Alberta has taken approximately 14 years of rest. The species is often a component of early seral communities after fire, due to residual plant survival (Tirmenstein 2000).

Festuca campestris (rough fescue) is important forage throughout its range. The species is very productive and highly palatable to wildlife (Tirmenstein 2000). Plants are used throughout the growing season by a number of big game species including bighorn sheep, mule deer, and elk (Tirmenstein 2000). It is used extensively by elk on winter ranges in Montana, and is a preferred winter range grass in west-central Montana. Jourdonnais and Bedunah report that it is the most preferred forage for wintering elk on the Sun River Game Range of Montana (Tirmenstein 2000).

Festuca campestris (rough fescue) plants are well adapted to periodic burning. The dense, tufted habit makes the plant resistant to light fire (Tirmenstein 2000). The primary fire survival strategies of the species are sprouting of top killed plants and reestablishment from off-site wind-dispersed seed (Tirmenstein 2000). Although plants may be initially top-killed, recovery to prefire coverage and herbage production is usually attained in 2 to 3 years (Tirmenstein 2000).

Susceptibility of the specie to burning is related to fire severity, frequency, and season of burn. Plant crowns tend to have persistent coarse stems that can insulate the perennating buds located near the ground surface. Reduction of plant vigor is greater from burns that occur during the growing season than from those during the dormant season. Reduced fire frequency tends to produce larger bunches with heavier litter accumulation. Survival of burns on such stands may be severely reduced, as crowns burn more hotly and continue burning long after passage of the flame front. Fire frequencies in the range of five to 10 years may best maintain stands of *Festuca campestris* (rough fescue) (Tirmenstein 2000). Despite burning at high temperatures, the species may initiate conspicuous green shoots within a week after the fire. The plants are usually unharmed by fire when dormant. Fall burns appear to have no effect on seed production. Elevated soil moistures associated with fall burns may explain the reduced damage (Tirmenstein 2000).

As they age, bunch grass plants typically form basal crown rings that are often hollow or dead in the center. Conflicting theories exist to explain this phenomenon. One explanation theorizes that plants with hollow crowns need to be grazed to stimulate rejuvenation. However, most agronomists and naturalists counter that the hollow crown growth form is natural, and is a normal development stage of a bunch grass plant as it expands outward by tillering to reach additional nutrients and moisture (Strickland 1983).

Bunchgrass grasslands on Spotted Dog WMA provide nesting and foraging habitat for several grassland songbird species, including long-billed curlew, western meadowlark, Brewer’s blackbird, horned lark, and savannah and vesper sparrow (Clarke and Smucker 2014, Smucker and Fylling 2010).

***Festuca idahoensis* (Idaho fescue)**—*Festuca idahoensis* (Idaho fescue) is one of the most common and widely distributed grasses in the western states. It is a climax indicator or dominant species in numerous habitat types of grassland, shrubland, forest, alpine, and riparian ecosystems. This species is recorded on 87 percent of all upland polygons sampled in Spotted Dog WMA, and is the second most abundant grass species recorded on the WMA (Photo 177 through Photo 179).

Photo 177. Close up of a healthy stand of *Festuca idahoensis* (Idaho fescue) in Spotted Dog WMA (Record ID 2043350) (2014 photo)

Photo 178. The *Festuca scabrella/Festuca idahoensis* (rough fescue/Idaho fescue) habitat type on a broad grassland bench between Spotted Dog Creek and Trout Creek (Record ID 2043353) (2014 photo)

Photo 179. Heavily grazed stand of *Festuca idahoensis/Agropyron spicatum* (Idaho fescue/bluebunch wheatgrass) habitat type on a dry ridge in the southwest part of Spotted Dog WMA (Record ID 2043442) (2011 photo)

Festuca idahoensis (Idaho fescue) provides important forage for several wildlife species. It is a major livestock forage species in western Montana, and is generally preferred over its frequent codominant, *Agropyron spicatum* (bluebunch wheatgrass) (Zouhar 2000). The *Festuca idahoensis/Agropyron spicatum* (Idaho fescue/bluebunch wheatgrass) habitat type in southwestern Montana is widely used by big game animals (Mueggler and Stewart 1980). The species is an important component in elk diets throughout the Rocky Mountain region. Elk and deer use the type as low-elevation winter range, and pronghorn use it year round. It is particularly important in late season as it retains nutritive value longer than associated species (Stubbendieck and others 1997). It cures moderately well, and may provide fair fall and winter feed (Monsen and others 2004). It is valuable to deer in spring, while elk use it year-round (Monsen and others 2004). Associated plant communities provide excellent cover and feed for a wide variety of birds and small mammals.

Festuca idahoensis (Idaho fescue) is slow to establish, but once established, it puts on abundant growth of fine leaves that provide effective ground cover, and high yields of tough, fine, fibrous roots that control erosion and improve soil structure. Presence of a good stand retards or prevents the invasion of weeds. The competitive influence of invasive plant species such as *Centaurea maculosa* (spotted knapweed) and *Bromus tectorum* (cheatgrass) can impede re-establishment of slower growing, native perennials. *Festuca idahoensis* (Idaho fescue) was one of the perennial grasses that, once established, suppressed established annual plants (Zouhar 2000).

Intense fire will decrease *Festuca idahoensis* (Idaho fescue), but low intensity burns may benefit it, and increase its protein content in the short term (Zouhar 2000). The species produces dense fibrous roots excellent for binding

the soil, and is used for stabilizing soil on disturbed sites (Monsen and others 2004). The dense roots help to prevent or slow the entry of invasive species and to provide ecological stabilization in semiarid environments (Sheley and Petroff 1999). Rapid tillering occurs after fire, if root crowns survive and soil moisture is adequate. Plants may re-establish from seed after fire if temperatures are low enough that seeds survive. Maintenance of grasslands in the Intermountain West is dependent, in part, on periodic fires to remove dry matter and suppress encroaching shrubs and trees (Zouhar 2000).

Festuca idahoensis (Idaho fescue) grows in a dense, fine leaved tuft. Fires tend to burn the accumulated fine leaves at the base of the plant, and may get hot enough to kill some of the root crown. Mature plants are often severely damaged by fire in any season. This species is considered more sensitive to fire than *Agropyron spicatum* (bluebunch wheatgrass). Burning usually reduces density and basal area of the species. Recovery to prefire levels may require more than 25 years (Zouhar 2000). The presence of any annual brome species also warrants very careful consideration of the use of fire on sites with significant *Festuca idahoensis* (Idaho fescue) cover.

As they age, bunch grass plants typically form basal crown rings that are often hollow or dead in the center. Conflicting theories exist to explain this phenomenon. One explanation theorizes that plants with hollow crowns need to be grazed to stimulate rejuvenation. However, most agronomists and naturalists counter that the hollow crown growth form is natural, and is a normal development stage of a bunch grass plant as it expands outward by tillering to reach additional nutrients and moisture (Strickland 1983).

Bunchgrass grasslands on Spotted Dog WMA provide nesting and foraging habitat for several grassland songbird species, including long-billed curlew, western meadowlark, Brewer's blackbird, horned lark, and savannah and vesper sparrow (Clarke and Smucker 2014, Smucker and Fylling 2010).

***Purshia tridentata* (antelope bitterbrush)**—*Purshia tridentata* (antelope bitterbrush) is the principal shrub species present in Spotted Dog WMA. This important species occurs primarily on the west and southwest facing slopes along the western portion of the WMA. These stands are, for the most part, heavily utilized and vegetatively disturbed (Photos 180 and 181). One small stand, intensely browsed was observed in the northeastern portion of the WMA (Photo 182) on a disturbed, southwest-facing slope.

Photo 180. A heavily browsed *Purshia tridentata* (antelope bitterbrush) plant in Spotted Dog WMA (Record ID 2024267) (2011 photo)

Photo 181. Heavily browsed *Purshia tridentata* (antelope bitterbrush) in Spotted Dog WMA with the understory community composition moderately altered and depleted (Record ID 2024221) (2011 photo)

Photo 182. A small, heavily browsed stand of *Purshia tridentata* (antelope bitterbrush) on a disturbed, southwest-facing slope in the northeastern portion of Spotted Dog WMA (Record ID 2043394) (2014 photo)

Purshia tridentata (antelope bitterbrush) is a preferred browse species for all classes of livestock, and especially for deer and elk in fall and winter. The species is a key winter range browse source for deer and elk (Mueggler and Stewart 1980). Mueggler and Stewart (1980) report that summer utilization of *Purshia tridentata* (antelope bitterbrush) is more detrimental to the plants than the same amount of winter use, because carbohydrate reserves are at their lowest from May through July, and part of the energy demand for plant growth is being drawn from the root reserves in early to mid summer. Given the multiple cumulative stresses recently coming to bear on this population of the shrub, and judging by the excessive amount of dead and decadent material, it appears that these stands may be in decline. Apparent recent stresses, that taken together, jeopardize the population of *Purshia tridentata* (antelope bitterbrush) in Spotted Dog WMA are:

- Summer and fall browse utilization by livestock;
- Winter browse utilization by wildlife;
- Competition from invasive species *Centaurea maculosa* (spotted knapweed) and *Bromus tectorum* (cheatgrass);
- Increased potential for wildfire, due to the invasion of *Bromus tectorum* (cheatgrass); and
- Infestation of caterpillars.

Purshia tridentata (antelope bitterbrush) is not well adapted to wildfire and is very susceptible to fire kill (Zlatnik 1999). After spring season fire, or burns occurring when soil moisture is high, the species may resprout, but recovery from fire is usually slow (Zlatnik 1999). The species is considered a weak sprouter and is often killed by hotter burning summer or fall fire (Zlatnik 1999). *Bromus tectorum* (cheatgrass) invasion is increasing the amount

of fine fuels in *Purshia tridentata* (antelope bitterbrush) shrublands, and *Purshia tridentata* (antelope bitterbrush) is not adapted to the more frequent, high severity fires that result from the increased fuel loads (Zlatnik 1999).

***Populus tremuloides* (quaking aspen)**—*Populus tremuloides* (quaking aspen) is widespread across Spotted Dog WMA on suitably moist sites, but it does not occur here in large stands, nor as stands without potential for conifer tree dominance, except in a few riparian bottoms at lower elevations. Most of the *Populus tremuloides* (quaking aspen) in Spotted Dog WMA are scattered trees and small groves along riparian corridors (Photos 183 and 184), but there are also a few fairly sizable upland stands marking sites with enough additional moisture (Photo 185).

Photo 183. A riparian stand of the *Populus tremuloides/Cornus stolonifera* (quaking aspen/red-osier dogwood) habitat type along Freezeout Creek (Record ID 2024181) (2011 photo)

Photo 184. A young stand of *Populus tremuloides* (quaking aspen) along O'Neil Creek showing the browse line, and a cohort of new sprout shoots that emerged since livestock were present (Record ID 2043385) (2014 photo)

Photo 185. This stand of *Populus tremuloides* (quaking aspen) along Jake Creek was eliminated by the combination of beaver cutting and ungulate herbivory of resprout shoots (Record ID 2024182) (2011 photo)

Sites with significant *Populus tremuloides* (quaking aspen) presence provide tremendous habitat value for a wide variety of wildlife as cover, feeding, nesting, and hiding sites (Hansen and others 1995). Livestock and wildlife browse young shoots as soon as they are available, often with the potential to eliminate the species from a site (Photo 186).

Photo 186. An upland grove of *Populus tremuloides* (quaking aspen) with emergence of young conifer trees that indicate climax potential for the site, with a lack of *Populus tremuloides* (quaking aspen) regeneration due to browse consumption of all young shoots (Record ID 2043425) (2014 photo)

Populus tremuloides (quaking aspen) forests provide important breeding, foraging, and resting habitat for a variety of birds and mammals. Wildlife and livestock utilization of *Populus tremuloides* (quaking aspen) communities varies with species composition of the understory and relative age of the stand. Young stands generally provide the most browse. Crowns can grow out of reach of large ungulates in 6 to 8 years. Although many animals browse the species year-round, it is especially valuable during fall and winter, when protein levels are high relative to other browse species. Elk browse *Populus tremuloides* (quaking aspen) year-round in much of the West, feeding on bark, branch apices, and sprouts (Howard 1996). *Populus tremuloides* (quaking aspen) is important forage for mule and white-tailed deer. Deer consume the leaves, buds, twigs, bark, and sprouts. New growth on burns or clearcuts is especially palatable to deer. Deer in many areas use *Populus tremuloides* (quaking aspen) year-round, although in some western states, deer winter below the *Populus tremuloides* (quaking aspen) zone (Howard 1996).

Populus tremuloides is easily top killed by fire, but the species often benefits from fire due to its propensity to prolifically sprout from surviving roots, and by the removal of competitive conifer trees (Howard 1996). Root

sprouting is the most common method of regeneration of the species. Saplings may begin producing root sprouts at one year of age. Sprout development is largely suppressed by apical dominance. Closed stands produce few sprouts each season, and these usually die, unless they occur in a canopy gap that receives sunlight. The best sprout production follows either a fire that kills all parent trees and brush, or other kind of complete clearing (Howard 1996), such as a timber harvest clearcut (Photo 187).

Photo 187. A large, dense stand of *Populus tremuloides* (quaking aspen) sprouts that have emerged since the conifer canopy was removed by logging and the stand was released from livestock browse pressure (Record ID 2043424) (2014 photo)

***Bromus tectorum* (cheatgrass)**—This introduced annual grass (i.e., invasive plant species) is a highly adaptable, vigorous, and opportunistic invader of rangelands disturbed by overgrazing, abandoned farmlands, burned sites, road/utility corridors, and other disturbances (USDA Natural Resources Conservation Service 2013) (Photos 188 and 189). It is adapted to many soil types, but does best on deep, loamy, or coarse textured soils (Zouhar 2003). *Bromus tectorum* (cheatgrass) is common on dry, sandy or gravelly soils, and can tolerate alkalinity (USDA Natural Resources Conservation Service 2013). It is highly competitive with native vegetation for available soil moisture (Zouhar 2003, Young and others 1987, Cox and Anderson 2004). Its seeds can germinate during spring and fall low temperatures, enabling it to deplete soil moisture at those critical growing season periods (Cox and Anderson 2004), thereby inhibiting native bunchgrass success (Young and others 1987). *Bromus tectorum* (cheatgrass) was recorded on 82 of 192 polygons sampled in Spotted Dog WMA (42.7 percent of sample sites).

Photo 188. A dense stand of *Bromus tectorum* (cheatgrass) along the unnamed tributary to Fred Burr Creek (Record ID 2043402) (2014 photo)

Photo 189. A stand of *Purshia tridentata* (antelope bitterbrush) on the west side of Spotted Dog WMA with a severe infestation of *Bromus tectorum* (cheatgrass) (Record ID 2024223) (2011 photo)

There are a variety of management schemes and combined control/restoration measures for *Bromus tectorum* (cheatgrass) (Monsen and others 2004, Zouhar 2003). Prevention is the best option for combatting the invasion (Zouhar 2003). Well-managed, functional native systems that lack severe disturbance are generally resistant to invasion. Disturbances that damage native vegetation composition and/or vigor, and create undesirable soil conditions (e.g., bare ground), allow *Bromus tectorum* (cheatgrass) to invade. Disturbances that increase available soil nitrogen, such as cultivation, benefit the species as well. Recently abandoned cultivated areas often have high available nitrogen (Paschke and others 2000). The authors demonstrated that limiting available soil nitrogen (by carbon saturation in their study) will negatively affect *Bromus tectorum* (cheatgrass), possibly allowing native bunchgrasses and shrubs to succeed. McLendon and Redente (1991) found that nitrogen application promotes annual brome species and impedes succession, and that perennial vegetation began replacing annual brome species after only four years on control plots that had no nitrogen added.

Once established, *Bromus tectorum* (cheatgrass) is difficult to eliminate. On large stands, and/or rough terrain, this may be impractical or not economically feasible (Zouhar 2003). Such stands may have crossed a threshold to now represent a vegetation disclimax. Where active control is practical, live plants must be eliminated, seed-set must be prevented, and new seedlings must be eliminated. Where such intense manipulation is impractical, the combination of time, proper grazing management, and prevention of fire and other disturbance may allow perennial native vegetation to regain dominance and effectively sequester soil nitrogen and thereby reduce annual bromes (Rittenhouse, pers. comm. 2008).

Bromus tectorum (cheatgrass) can provide nutritious forage for livestock and wildlife early in the grazing season (Howard 1994), but becomes essentially useless to livestock by seed set time (Stubbendieck and others 1997). In addition, early season grazing may cause deterioration to some rangelands due to moist soils which are susceptible to compaction. During summer months, grazing *Bromus tectorum* (cheatgrass) awns can cause mouth infections and damage eyes, especially with sheep (Stubbendieck and others 1997, Zouhar 2003).

Bromus tectorum (cheatgrass) may provide limited value for wildlife, when other forage sources are lacking, but does not provide better forage value than the displaced native plant species. The conversion of native vegetation communities to stands of annual brome can have dramatic effect on wildlife. Bird and small mammal species dependent upon specific vegetation communities are particularly affected by the alteration or loss of native vegetation. These negative effects ripple through the food web, affecting key forms, such as snakes, predatory mammals, and raptors (Zouhar 2003).

Fire has a complex and important inter-relationship with *Bromus tectorum* (cheatgrass). Fire appears to benefit the species (Zouhar 2003), although viable seeds may be reduced immediately after a burn. However, seedbank levels usually return to pre-fire level within three years. *Bromus tectorum* (cheatgrass) can produce significant flammable biomass in herbaceous/shrub communities that it invades, thereby greatly increasing fine fuel load and shortening the interval between fires. Species such as *Agropyron spicatum* (bluebunch wheatgrass) may decrease with burning, giving further competitive advantage to *Bromus tectorum* (cheatgrass) (Sheley and Petroff 1999). The species is opportunistic on sites opened by fire, and can quickly garner available resources before other plants can access them. Once it is established, the risk of fire greatly increases, effectively creating a cyclic disclimax of monospecific *Bromus tectorum* (cheatgrass) stands (Sheley and Petroff 1999).