16120

Western North American Boreal Dry Grassland

BpS Model/Description Version: Nov. 2024

Reviewer: Lindsey Flagstad, Robin Innes

Vegetation Type

Herbaceous

Map Zones

70, 71, 73, 74

Geographic Range

This Biophysical Setting (BpS) occurs across the boreal and sub-boreal regions of AK. Today, dry grassland communities in AK are relatively uncommon (Edwards and Armbruster 1989; Lloyd et al. 1994), but during the late Pleistocene these were more common (Edwards and Armbruster 1989). Steppe associations are considered analogues of vegetation that was widespread across Beringia during the colder and drier conditions of the late Pleistocene (Kassler 1979; Lipkin and Tande 1991; Murray 1981; Murray et al. 1983; Walker et al. 1991), where dry grasslands represent glacial refugia that may support distinctive flora characterized by a high diversity of Beringian and endemic plant species (Edwards and Armbruster 1989; Murray et al. 1983; Roland 1996).

Biophysical Site Description

Soil conditions in boreal regions are frequently conducive to dry grasslands (Redmann and Schwarz 1986). Soils are well drained to excessively drained, and permafrost is absent. This system typically occurs on dry sideslopes or bluffs. Some slopes may have steep, unstable soil (NatureServe 2008). Dry grasslands typically develop on steep, south-facing slopes where a warm and dry microclimate is thought to exclude trees (Boggs et al. 2019). The topography of steppe bluffs has implications for microclimate in so far that surfaces undergo great daily and annual fluctuations in temperature and moisture (Edwards and Armbruster 1989; Lewis 1998; Roland 1996; Walker et al. 1991). Moisture of steppe soils is strongly limited by exposure to wind, low accumulation and residence of snow, drainage across steep slopes, and high soil evaporation and transpiration caused by the slopes’ direct orientation to the low-angled sun (Bliss et al. 1973; Lewis 1998; Lloyd et al. 1994; Kassler 1979; Roland 1990; Wesser 1991).

Steppe soils are well-drained silty loams to loams with low organic matter content (Roland 1996). Permafrost is typically absent due to warm soil temperatures in the summer and poor insulation in the winter (Boggs and Sturdy 2005). Soil pH ranges from 6.2 to 8.0 with a mean of 7.0 and is often elevated by input of calcium carbonate-rich loess (Kassler 1979; Marsh et al. 2006; Roland 1996; Walker et al. 1991). Bare soil is characteristic of developing steppe (Howenstein et al. 1985; Lewis 1998; Murray et al. 1983; Shacklette 1966). The presence of biological soil crusts has been noted in several mature steppe bluffs (e.g. Dickson 2000; Marsh et al. 2006; Walker et al. 1991; Zazula et al. 2002).

Vegetation Description

These sites are typically dominated by grasses, though forbs and shrubs may be common, but shrub cover is less than 25%. Common graminoids include *Festuca altaica, F. rubra, Calamagrostis purpurescens, Elymus inovatus, Pseudoroegneria spicata, Bromus pumpellianus,* and *Poa glauca*. Shrubs include the low shrubs *Artemisia frigida, A. arctica, Amelanchier alnifolia, Elaeagnus commutata, Shepherdia canadensis,* and *Juniperus communis*, and the dwarf shrub *Arctostaphylos uva-ursi*. Common forbs are *Artemisia arctica, Bupleurum americanum,* and *Saxifraga tricuspidata* (Lipkin and Tande 1991).

BpS Dominant and Indicator Species

Species names are from the NRCS PLANTS database. Check species codes at http://plants.usda.gov.

Disturbance Description

Little is known about the successional dynamics of this community, but it is assumed to be relatively stable over time (Viereck et al. 1992). Large scale disturbances affecting dry grasslands include fire and mass wasting for systems developing on slopes (Lewis 1998); smaller scale disturbances include burrowing and/or grazing by rodents and ungulates (Vetter 2000). Fire is thought to favor grassland development by removing more competitive forest taxa (Lewis 1998; Roland 1990). Similarly, landslides are thought to favor grassland development by removing forest taxa, exposing mineral soil for colonization by seedlings, and altering the competitive balance in favor of faster growing, more readily dispersed plants (Roland 1990; Roland 1996).

Dry grasslands are thought to be seral to *Populus tremuloides* (quaking aspen) woodlands with dry understory species such as *Arctostaphylos uva-ursi,* *Rosa acicularis* and *Sheperdia canadensis* (Vetter 2000; Boggs and Sturdy 2005). Where there is sufficient moisture, *Betula neoalaskana* and *Picea glauca* are able to colonize the *Populus tremuloides* woodland; a xeric *Picea glauca* forest may eventually establish (Chapin 2006; Lewis 1998). Following fire, *Populus tremuloides* woodlands may revert to grassland (Lewis 1998).

LANDFIRE National modelers assumed that the fire regime for this system would be similar to that of the adjacent BpS. Starfield and Chapin (1996) estimated a 40-year fire return interval for dry grasslands assuming that Alaskan boreal dry grasslands burn more frequently than other ecosystem types in the region.

Because this system is often found on loose, dry mineral soils on unstable slopes, shifting slopes are an ongoing disturbance. Grazing is probably an important factor in shaping this system, as this is important Dall sheep habitat. Grazing and erosion were not included as disturbances in the model because these are long-term, ongoing phenomena.

Fire Frequency

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

Small to large patch

Adjacency or Identification Concerns

Adjacent systems may include Western North American Boreal Dry Aspen-Steppe Bluff - Higher Elevations or Western North American Boreal Dry Aspen-Steppe Bluff - Lower Elevations. This system does not encompass the coastal Leymus-forb meadows that occur in Aleutians, SW, SC and SE Alaska (NatureServe 2008).

Issues or Problems

Native Uncharacteristic Conditions

Research suggests that dry grasslands are likely to increase as a result of climate change (Rupp et al. 2000a and 2000b).

Comments

More information on this and similar vegetation types can be found in the Fire Effects Information System Synthesis: [Fire regimes of Alaskan dry grassland communities](http://www.fs.fed.us/database/feis/fire_regimes/AK_dry_grassland/all.html). (Innes 2014).

For LANDFIRE National, the fire intervals in this model were adapted from the Boreal Subalpine Steppe Bluff model, also by Boucher and Ryan. During the 2021 review, Kori Blankenship revised the model to include an early herbaceous state (as originally modeled) and a later state where shrubs may be present. Blankenship also eliminated mixed fire (because the dominant species in this BpS are top killed by fire) and changed the replacement fire frequency to 100 years. The more frequent fire interval was based on Starfield and Chapin (1996) but retains the relationship between the adjacent BpS. Lacking data, Blankenship assumed that fire frequency did not vary between states.

Suggested reviewers for this system include Carl Roland and Dalia Vargis-Kretzinger for information on grazing.

Succession Classes

**Mapping Rules**

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

**Description**

Class A 2 Early Development 1 - Open

Indicator Species

Description

This class represents the post-fire grass community. Grasses, sedges and/or forbs dominate the site.

*Maximum Tree Size Class*  
None

Class B 98 Late Development 1 - All Structures

Indicator Species

Description

Grass cover reaches pre-fire levels within two to three years following fire (Tirmenstein, 2000). Shrub cover up to 25% is possible (Viereck et al. 1992).

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

Probabilistic Transitions

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