

13310

Eastern Great Plains Tallgrass Aspen Parkland

BpS Model/Description Version: Aug. 2020

Update: 4/9/2018

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Vegetation Type

Forest and Woodland

Map Zones

39, 40, 41

Geographic Range

This system is found primarily on the Glacial Lake Agassiz plain in northwestern Minnesota, ranging into Canada. The main distribution of the system forms an arch from northern Montana northeastward along the foothills of the Rocky Mountains in southern Alberta, then curving through central Saskatchewan into southwestern Manitoba and northwest Minnesota. However, the tallgrass portion of the aspen parklands occurs in only a portion of this - from Winnipeg to northwest Minnesota (Archibold 1999 in Anderson et al. eds.). In map zone (MZ) 41 the system occurs in ECOMAP subsections 212 Mb and 222 Na (Cleland et al. 2007). In MZs 39 and 40, this system would have been on the eastern edge in the MN area.

The tallgrass aspen parkland Biophysical Setting (BpS) extends roughly from Red Lake Falls, Minnesota to Winnipeg, Manitoba, encompassing 1.2m acres (Sather and Dana 1999).

Biophysical Site Description

The Tallgrass Aspen Parkland (TAP) system occurs as an ecotone or transitional community between mixed or tallgrass northern prairie to the south and east and mixed hardwood-conifer forests to the north and west. This community occurs on the shoreline and lakeplain of Glacial Lake Agassiz. This landform is level to gently rolling and featureless.

Soils are sandy with occasional loam deposits. In Minnesota, soils are a complex; loams predominate, from clay loams to silt loams and sandy loams. Some outwash also occurs in the region, along with sandy soils, the result of a lacustrine sorting process. Clay veneers occur in some areas, and paludification has created many shallow peat deposits, some rather extensive. Soils underlying forested portions of the landscape are predominantly sandy.

The climate of the region supporting this community type is cold and dry. The Minnesota Department of Natural Resources (DNR) reports that the TAP Province in northwestern Minnesota has a mean annual precipitation of 20-22in (51-56cm) and minimum temperatures that reach -43C. In this region, evapotranspiration exceeds precipitation with deficits of -2 to -6 inches (MN DNR 2007).

Calcareous glacial drift overlain with lacustrine soils ranging from loamy to gravelly is characteristic of the lakeplain within the range of this system. Historically this system included a mosaic of tallgrass prairie, wet prairie, brush prairie and aspen-oak woodlands (NatureServe 2007).

The TAP occupies a very low-relief landscape of smooth ground moraine further subdued during inundation by Glacial Lake Agassiz. Beach ridges formed along longer-lived shorelines of Lake Agassiz are the most prominent topographic features. As a legacy of the period of submergence soils are a complex mosaic of water-modified till (often very stony), sands, silts and clays. Localized sand blankets were formed by outwash or streams draining into the lake and winds have modified some of these into dune formations. Shallow veneers of sedge peat are common in more poorly drained areas (Dana 2000).

Vegetation Description

The TAP is a dynamic matrix system that occurs at the transition from northern prairie to hardwood-conifer forests. The vegetation described here represents the woodland portion of the mosaic and corresponds with the Northwestern Mesic Aspen-Oak Woodland, Minnesota DNR Fire Dependent Forest/Woodland System Type [Minnesota DNR 2007]. Vegetation is also briefly described in the successional class descriptions at the end of this document.

Trembling aspen and balsam poplar are the dominant tree species, and bur oak is usually present, dominating in dry sites and occasional jack pine. Bur oak barrens occupy the driest sites. Woodland patches tend to be small, composed mostly of juvenile trees because of the historically high fire frequency. Abundant shrubs are a striking feature of this community; in the case of the prairie, this results in a distinctive community type, brush-prairie, in which shrubs may form up to 70% of the cover. Rich fen, dominated by fine-leaved sedges, is a common wetland type in the parkland, occurring on moderately decomposed peat. High local concentrations of mineral salts in these peats support an unusual assemblage of plant species.

A number of rare or uncommon plants are part of the parkland ecosystem. The hoary fruited willow, *Salix maccalliana*, is common in the Minnesota parkland but quite rare elsewhere in the state. A major population of the western white-fringed orchid, *Platanthera praeclara*, occurs in Manitoba with a smaller satellite population a few miles south in Minnesota. The sedge *Carex garberi*, known from only a single record in Minnesota outside the parkland, occurs in some abundance in rich fens here (Dana 2000).

This Biophysical Setting (BpS) is dominated by trembling aspen and bur oak with occasional jack pine. Paper birch occurs infrequently, mainly in riparian areas. Black spruce, tamarack and northern white cedar occur in small pockets on eastern/northern borders as the transition occurs or the microclimate is favorable. Conifers and paper birch are rare in the Minnesota part of the range, mainly occurring near the transition to eastern forests. The subcanopy is sparse to absent and composed of the same species as the canopy layer.

The shrub layer ranges from 50-100% and may include junberries (*Amelanchier* spp.), gray dogwood which is very common, chokecherry (*Prunus virginiana*) hazelnuts (*Corlyus*

americana, *C. cornuta*), Bebb's willow (*Salix bebbiana*), roses (*Rosa woodsii*, *R. blanda*), and meadowsweet (*Spiraea alba*).

The dominant tallgrass species is *Andropogon gerardii* often associated with *Sorghastrum nutans*, *Calamagrostis* spp. and *Sporobolus heterolepis* (NatureServe 2007). Ground layer varies in cover and also includes grasses and sedges such as mountain ricegrass (*Oryzopsis asperifolia*), Pennsylvania sedge (*Carex pensylvanica*), bluejoint (*Calamagrostis canadensis*), big bluestem (*Andropogon gerardii*) fringed brome (*Bromus ciliatus*), poverty grass (*Danthonia spicata*) and interrupted wild rye (*Elymus diversiglumis*). Typical forbs include American vetch (*Vicia americana*), Canada mayflower (*Maianthemum canadense*), Lindley's aster (*Aster ciliolatus*), northern bedstraw (*Galium boreale*) veiny meadow-rue (*Thalictrum venulosum*) tall meadow-rue (*Thalictrum dasycarpum*), wild sarsaparilla (*Aralia nudicaulis*), white sage (*Artemisia ludoviciana*) and harebell (*Campanula rotundifolia*). (Minnesota DNR 2007, Archibold 1999 in Anderson et al.)

Associations:

- *Betula papyrifera* / *Corylus cornuta* Forest (CEGL002079, G2G3)
- *Populus tremuloides* - *Populus balsamifera* / *Calamagrostis canadensis* Forest (CEGL002097, G3G4)
- *Populus tremuloides* - *Quercus macrocarpa* - *Salix* spp. / *Andropogon gerardii* Shrubland (CEGL002182, G2G3)
- *Populus tremuloides* / *Corylus americana* Forest (CEGL002063, G5)
- *Populus tremuloides* / *Corylus* spp. / *Andropogon gerardii* Woodland (CEGL005205, G4G5)
- *Quercus macrocarpa* - *Populus tremuloides* / *Corylus* spp. Woodland (CEGL002139, G4?)
- *Salix petiolaris* - (*Betula pumila*) / *Spartina pectinata* - *Carex pellita* Shrubland (CEGL002434, G3)

Alliances:

- *Betula papyrifera* Forest Alliance (A.267)
- *Populus tremuloides* - *Quercus* spp. - *Salix* spp. Shrubland Alliance (A.903)
- *Populus tremuloides* Forest Alliance (A.274)
- *Populus tremuloides* Temporarily Flooded Forest Alliance (A.300)
- *Populus tremuloides* Woodland Alliance (A.610)
- *Quercus macrocarpa* Woodland Alliance (A.620)
- *Salix petiolaris* - *Salix* spp. Temporarily Flooded Shrubland Alliance (A.949) (NatureServe 2007).

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
POTR5	<i>Populus tremuloides</i>	Quaking aspen
QUMA2	<i>Quercus macrocarpa</i>	Bur oak
PIBA2	<i>Pinus banksiana</i>	Jack pine
SABE2	<i>Salix bebbiana</i>	Bebb willow
COAM3	<i>Corylus americana</i>	American hazelnut
AMELA	<i>Amelanchier</i>	Serviceberry
ARLU	<i>Artemisia ludoviciana</i>	White sagebrush
ANGE	<i>Andropogon gerardii</i>	Big bluestem

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

Disturbance Description

Most generally described, it is a mosaic of prairie and aspen woodland where drought and fire are frequent enough to prevent succession to forest but not so frequent as to eliminate trees altogether (Dana 2000).

Tree and shrub establishment in this community is limited by climatic factors such as severe cold, low precipitation, summer drought, and desiccating westerly winds from the Great Plains. These climatic variables, combined with the level topography of the Glacial Lake Agassiz lake plain, create a fire-prone landscape that historically experienced frequent fires. An analysis of Public Land Survey records conducted by the Minnesota DNR indicates that catastrophic fires occurred with an approximate return interval of 90yrs. The 90yr interval was questioned by some reviewers, based on the relatively young age of existing aspen following nearly a century of fire suppression. Some of the oldest trees are the smallest oaks in the sand prairies. The life span of aspen in Minnesota ranges from 70-100yrs. Many are <90yrs, and older trees are almost always associated with settlement (farmstead, church, cemetery, etc., where they were protected). Severe fires were probably more common, while moderate and low intensity fires were very common.

Catastrophic windthrow was estimated at a 290yr return interval (Minnesota DNR 2007). Due to model review, this interval was lowered. The land survey notes and bearing tree data for Kittson county, Minnesota suggest that there was very little forest at that time – the descriptions for wooded areas repeatedly refer to “burnt-over aspen” or the equivalent. The distances to bearing trees, and their diameters at breast height, are consistent with frequent disturbance (Robert Dana, personal communication 2007).

Woody vegetation regenerates quickly following stand-replacing fires. Fire generally does not destroy roots, and aspen suckers, oak grubs, and shrubs survive and resprout immediately. By the second year following a fire, the vegetation resembles a shrub thicket more than a grassland. Several years of fire in quick succession are required to suppress the woody component such that herbaceous species dominate.

Grazing by large herbivores such as bison and elk also influenced vegetation patterns across the landscape, restricting tree and shrub establishment and promoting prairie regeneration and the regeneration of aspen suckers.

Fire is the most important natural dynamic in this system and helps maintain the open parkland or brush nature of this system. Wind and grazing are also important dynamics (NatureServe 2007).

Elk were likely one of the major historic TAP herbivores. Over-hunting in the late 1800's, combined with agricultural development, may have decimated herds so greatly that the species was extirpated from the area. Local habitat characteristics suggest that elk and moose may have been the major ungulates of the Tallgrass Aspen Parkland prior to European settlement, with bison making occasional forays into the area from the open prairie of the Red River Valley (Hamel et al. 2006).

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	16	35		
Moderate (Mixed)				
Low (Surface)	8	65		
All Fires	6	100		

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

This community type is part of a matrix system that would include northern tallgrass prairie, wet prairie, brush prairie, and aspen-oak woodland.

The parkland ecosystem is expressed only on a fairly large scale in continuous blocks of 100s, or better, of 1,000's of acres (Dana 2000).

Adjacency or Identification Concerns

It is the northernmost expression of the transition between tallgrass prairie and forest ecosystems. In Minnesota it is sandwiched between the conifer forests and peatlands north of Red Lake and the croplands in the former rich prairies of the Red River valley (Sather and Dana 1999). In the Minnesota part of the range, the prairie is west, the forest east of the parkland. This BpS is part a matrix system that would include or be adjacent to 1420 Northern Tallgrass Prairie, 1421 Central Tallgrass Prairie, and 1488 Eastern Great Plains Wet Meadow, Prairie, and Marsh.

Large portions of the aspen parkland have been converted to agricultural land for wheat and barley, small grains, corn, soybean production. Other areas have been seeded within pasture grasses for grazing purposes (Archibold 1999 in Anderson et. al).

Additionally, the removal of large grazers such as bison might have altered the dynamics of the aspen parkland system, particularly the grassland portions of this system. However, this statement was questioned by a reviewer, as there is currently plenty of grazing with cattle, and bison may not have influenced this region the way they did the mixedgrass and sandhills regions of the Great Plains. Elk were a common and permanent part of the grazing/browsing in Tallgrass Aspen Parklands.

Conversion to agriculture and fire suppression have decreased the range of this system and allowed more shrubs and trees to establish (NatureServe 2007).

Incompatible grazing practices also occur in this system.

All of the successional classes would be constantly shifting with drought, high precipitation, fire and grazing. Tree canopy ranges from 25-75% currently but not historically. There has been encroachment currently with fire suppression.

There would be more mature, dense forest than there was historically, although how much is difficult to say. Since settlement of the TAP area by Europeans, the fire regime of the landscape has been altered. Fires have been reduced in size, frequency and intensity, contributing to encroachment by aspen of the prairie and oak savanna communities. Other factors may have contributed to this trend, such as climate changes and the extirpation of major grazers, such as

bison (Campbell and Campbell 2000). What was once an open prairie dotted with oak savannas and small clones of aspen is changing to an aspen forest with sporadic patches of tallgrass prairie and savanna. In a quick analysis of conservation lands within ten randomly selected subsections of eastern Kittson County, Hamel (2004) compared current conditions with those of the original land survey and found that on conservation lands aspen woodlands have increased in cover by 75% over the last century. More thorough analyses are needed to determine a range of variability for the target condition, but the message is clear: land managers need effective management tools to reverse aspen encroachment in the TAP. (Hamel et al. 2006)

Of all the threats to this system, exotics were rated “low,” especially compared to altered fire regimes and hydro regimes. Some degree of invasion by alien and aggressive native species can be found in portions of all TAP communities. Without continued, and perhaps intensified, control efforts these species have the potential to rapidly expand across the landscape and seriously degrade natural areas. In addition to directly reducing native biodiversity, plant invasions can alter key local and landscape-scale ecological processes such as fire (e.g. Brooks et al. 2004). The most affected system is the riparian portion of the rivers and riparian system. Increased exposure to invasive species from adjacent agricultural lands, combined with regular disturbance due to flooding and increased subcanopy light levels due to the decline of diseased American elm has allowed invasive species such as burdock (*Arctium lappa*) to dominate at many locations (TAP Planning Team observations). Dense stands of reed canary grass dominate many stream banks, especially in disturbed areas.

In the upland mosaic, leafy spurge and St. John’s wort (*Hypericum perforatum*) have the potential to spread and disrupt large portions of the landscape. At the Manitoba Tall Grass Prairie Preserve, leafy spurge is present at about 50 locations, with new patches appearing each year and increasing in area about five percent per year (Laura Reeves, Manitoba Tall Grass Prairie Preserve, personal communication). Current control methods at the Preserve include hand-pulling at key locations and the experimental application of herbicides. Biological control has been attempted; leaf-tier moths were released in 1997 but have not halted spurge spread. Flea beetles (*Aphthona* spp.) have also been released but populations have not survived TAP winters. Spurge patches on The Nature Conservancy lands are chemically treated and then reseeded. This method has been largely successful, although new patches are still establishing. Burning is not an effective leafy spurge control. St. John’s wort established at the Manitoba Tall Grass Prairie Preserve when hay bales were shipped in from western Canada in the dry year of 1987. Since then it has spread rapidly and now dominates much of four quarter-sections. Without effective control, this species has the potential to seriously degrade the diversity of upland areas. Hand-pulling and fire stimulate its spread. Other upland exotics such as red top grass (*Agrostis stolonifera*) increase due to disturbance and/or overgrazing but decline with proper management.

Spotted knapweed (*Centaurea maculosa*) and birdsfoot trefoil (*Lotus corniculatus*) are additional species of concern in upland areas. Spotted knapweed seeds are readily transported in hay and on vehicle undercarriages and can remain viable in the soil for up to 5yrs (Lym & Zollinger 1992). The species has been known to remain in confined areas for several years and then rapidly spread to adjoining areas (ibid.). Widely planted as a forage crop, birdsfoot trefoil has spread to many of the TAP’s roadsides and trails and has invaded the edges of some native upland sites. The species tends to establish dense colonies that exclude other species (Hilty 2006).

The invasion of beach ridge and lake plain wetlands by reed canary grass and purple loosestrife is currently limited. Where invasions occur, they tend to occur in roadsides adjacent to wetlands, or at wetland edges. Small patches of purple loosestrife up to 1.2ha (3ac) can be eradicated via hand-pulling or the use of a glyphosate herbicide (NatureServe 2003). Eradication of larger patches may be difficult or impossible with currently known methods; containment may be the only option. (Hamel et al. 2006).

Similar Ecological Systems:

- Northwestern Great Plains Aspen Forest and Parkland (CES303.681) -- biogeography and understory species separate. Northwest Great Plains system has a more mixed understory with *Stipa*, *Bouteloua* and *Festuca*. *Festuca* would be a good differential genus.

Adjacent Ecological Systems:

- Northern Tallgrass Prairie (CES205.686)
- Northwestern Great Plains Aspen Forest and Parkland (CES303.681)

Issues or Problems

Native Uncharacteristic Conditions

Comments

Succession Classes

Mapping Rules

Upper Layer Lifeform	Height (m)	Canopy Cover (%)									
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Herb	0-0.5	A	A	A	A	A	A	A	A	A	A
Herb	0.5-1.0	A	A	A	A	A	A	A	A	A	A
Herb	>1.0	A	A	A	A	A	A	A	A	A	A
Shrub	0-0.5	B	B	B	B	B	B	B	B	B	B
Shrub	0.5-1.0	B	B	B	B	B	B	B	B	B	B
Shrub	1.0-3.0	B	B	B	B	B	B	B	B	B	B
Shrub	>3.0	B	B	B	B	B	B	B	B	B	B
Tree	0-5	C	C	C	C	C	UN	UN	UN	UN	UN
Tree	5-10	C	C	C	C	C	UN	UN	UN	UN	UN
Tree	10-25	C	C	C	C	C	UN	UN	UN	UN	UN
Tree	25-50	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	>50	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN

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	16	Early Development 1 - All Structures
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
CAST36	<i>Calamagrostis stricta</i>	Slimstem reedgrass	Lower
CACA4	<i>Calamagrostis canadensis</i>	Bluejoint	Lower
ORAS	<i>Oryzopsis asperifolia</i>	Roughleaf ricegrass	Lower
CAPE6	<i>Carex pensylvanica</i>	Pennsylvania sedge	Lower

Description

This is the wetter, grass stage with little shrub component and mostly sedge.

This class represents a tall grass (with only occasional mixedgrass prairie grasses) stage dominated by grasses, sedges, and forbs such as big bluestem, bluejoint, Pennsylvania sedge, Mountain rice grass, white sage, harebell and alumroot. *Andropogon gerardii* is not prominent in this community, and after a fire *Calamagrostis canadensis* (and often *C. stricta*, which is hard to even detect before a fire) and *Schizachne purpurascens* are commonly the most apparent graminoids, though *Oryzopsis* is common, just not as tall. Often it is forbs that are the most abundant herbaceous species, *Aster ciliolatus* especially, along with *Fragaria virginiana*, *Thalictrum* spp., *Solidago canadensis*, *Aralia nudicaulis* and *Sanicula marilandica*. Alum root is rather rare.

This class would result from class C following a catastrophic disturbance such as a replacement fire or wind event. Otherwise, this class has a prairie disturbance regime where the replacement fires are frequent due to fire, grazing and changing of the seasons.

This class would be maintained by low, moderate and high surface fire (modeled as a replacement fire with the probability of occurring every 5-10yrs as it would result in greater than 75% top-kill), similar to the adjacent tallgrass prairie and native grazing by bison and elk. Severe drought, modeled as wind/weather/stress would also limit tree and shrub establishment and maintain this class.

This class lasts for the estimated time it would take for shrubs to become the dominant lifeform, although they are still present in this stage. Shrubs and aspen suckers would most likely establish during this stage if there is a nearby seed source or aspen grove. However, shrubs are nearly always a component as aspen establishes. It is noted, however, that woody vegetation instantly is an important component following a fire. Aspen suckers, oak grubs and shrubs survive and resprout immediately. Note that it would take a long time for prairie species to invade an area that had developed to this forest type if somehow fire would become frequent enough to prevent the regrowth of the forest. The situation would be different for areas that were open woodland; the prairie grasses, etc., are usually fairly common in these, and stand-removing fire results in a luxuriant growth of these.

For this class combined with class A encompassing the open sedge, prairie and brush prairie communities and classes, they both encompassed probably approximately 60-70% of the historical landscape. This class B itself as the prairie/brush prairie and oak savanna would encompass approximately 55-65% of the landscape.

Maximum Tree Size Class

None

Class C

27

Late Development 1 - All Structures

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
POTR5	Populus tremuloides	Quaking aspen	Upper
QUMA2	Quercus macrocarpa	Bur oak	Upper
PIBA2	Pinus banksiana	Jack pine	Upper

Description

This class represents a woodland stage with a patchy canopy of trembling aspen with bur oak; there are a very few areas of jack pine and white spruce associates.

Large, mature aspen would occur in this stage, but even these are not the dense forests we often see now, but rather more open woodland with herbaceous and shrub layers. They seemed to be small in size with large mature trees of the clone radiating out with suckers and trees of dwindling stature. These trees are fairly short-lived and individuals seldom reach more than 60yrs today. The clone, on the other hand, can have a very long life.

Fire can also set this class back to a form of class B or maintain this class C. This was modeled as replacement fire half the time causing a transition to B, and surface fire half the time maintaining this stage, occurring with an overall interval of 6yrs. This replacement fire is modeled as setting this stage back to B and not A because the regen on aspen is almost immediate, and three foot saplings the growing season following a fire are common. These will often be more abundant than would be found at the encroachment zone and would have much more energy in the root reserves from which to draw. After a stand replacement fire in aspen or willow, there is immediate regrowth often with increased stem density. It would take multiple fires at short intervals to set things back to the grass shrubs. Replacement fires would occur and would change stature but wouldn't revert the class back to class A with just one fire. It would take 3-5 replacement fires in a 10-15yr period to revert this class back to class A. Since percentage probabilities cannot be modeled in LANDFIRE, this was converted to an approximate every 40yrs this type of replacement fire would occur. However, it is noted that even such an event would still leave some shrubs reduced in stature and less abundant.

Oaks are very difficult to set back, and they were probably fairly abundant here. There were probably quite a few scattered savannas and open woodlands while aspen clones were smaller in size and much more likely to shift due to disturbance over a shorter timeframe.

Catastrophic wind would set the system back to the early seral stage, and drought maintain this system in this class although it could also lead to some aspen die-back.

(Some felt that Insect/disease such as a canker fungus could infect an entire aspen grove; however this was questioned by review and therefore removed from the model).

It is thought that aspen would hardly reach 70yrs before die-off, but oaks might persist for longer.

The GLO and historical references indicate few trees, most small and stunted; therefore, it is thought that this stage would occupy approximately 15-30% of the landscape historically, although it might occupy more currently due to encroachment.

Maximum Tree Size Class

Large 21-33"DBH

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:ALL	3
Mid1:ALL	4	Late1:ALL	19
Late1:ALL	20	Late1:ALL	100

Probabilistic Transitions

Disturbance Type	Disturbance occurs In	Moves vegetation to	Disturbance Probability	Return Interval (yrs)	Reset Age to New Class Start Age After Disturbance?	Years Since Last Disturbance
Wind or Weather or Stress	Early1:ALL	Early1:ALL	0.01	100	Yes	0
Replacement Fire	Early1:ALL	Early1:ALL	0.125	8	Yes	0
Native Grazing	Early1:ALL	Early1:ALL	0.2	5	Yes	0
Wind or Weather or Stress	Mid1:ALL	Mid1:ALL	0.01	100	No	0
Replacement Fire	Mid1:ALL	Early1:ALL	0.025	40	Yes	0
Surface Fire	Mid1:ALL	Mid1:ALL	0.1667	6	No	0
Wind or Weather or Stress	Late1:ALL	Early1:ALL	0.003	333	Yes	0
Wind or Weather or Stress	Late1:ALL	Late1:ALL	0.01	100	No	0
Replacement Fire	Late1:ALL	Early1:ALL	0.025	40	Yes	0
Replacement Fire	Late1:ALL	Mid1:ALL	0.083	12	Yes	0
Surface Fire	Late1:ALL	Late1:ALL	0.083	12	No	0

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