

READ ME!!

BACKGROUND

This is a draft revision of the 2008 Fuel Model Guide to Alaska Vegetation, with edits made as of March 2016. The Fuel Model Guide to Alaska Vegetation was developed by an interagency team of fire practitioners and vegetation mappers/specialists in 2008. It crosswalked vegetation types described in the Alaska Vegetation Classification (Viereck et al. 1992) with three fuel model sets:

- 40 Fire Behavior Fuel Models (FBFM40; Scott and Burgan 2005)
- 13 Fire Behavior Fuel Models (FBFM13; Anderson 1983)
- Canadian Forest Fire Behavior Prediction System (CFFBPS; Taylor et al. 1997)

The 2008 Fuel Model Guide provided an excellent foundation for understanding fuels and vegetation in Alaska, but it was felt that an update was needed for several reasons. Scott and Burgan's (2005) 40 Fire Behavior Fuel Models were relatively new when the original Guide was being developed, and since then we have more experience working with them in Alaska. Likewise, we have improved our use and understanding of the CFFBPS. Advances in spatial fire behavior modeling on a landscape level have enabled us to more readily compare modeled to actual fire behavior under different conditions, allowing us to better assess fuel model assignments. The advent and use of the LANDFIRE landscape in modeling applications has resulted in the need for crosswalks to LANDFIRE parameters, which will be available in the final revision or as an online resource. When complete, the revised guide will include better photo documentation, more fire behavior comments, suggestions for alternate fuel models to use under different conditions, and help with characterizing post-fire habitats. A table summarizing changes to fuel models between the original Guide and the revision is included at the beginning of the document.

YOUR INPUT IS NEEDED

We hope to finalize the revision in winter 2016-2017. We are looking for feedback from people familiar with fire in Alaska and from those who have an opportunity to observe fire behavior during the 2016 fire season, particularly in Closed Black Spruce and Open Black Spruce forest types.

The original guide is posted at <https://www.frames.gov/partner-sites/afsc/partner-groups/fire-behavior-modeling-group/modelingproducts-guides/#FuelModelGuide>. For reference, the Alaska Vegetation Classification by Viereck et al. can be found at: <http://137.229.141.57/wp-content/uploads/2012/05/Viereck-et-al.-1992-AlaskaVegetation-Classification.pdf>.

HELPFUL HINTS FOR USING THE GUIDE:

1. The Alaska Vegetation Classification (Viereck *et al* 1992) groups communities into the following classes based on canopy cover:
 - a. Woodland: 10 – 24% canopy cover
 - b. Open: 25 – 59% canopy cover
 - c. Closed: ≥60% cover
2. The Canadian Forest Fire Behavior Prediction System (CFFBPS) includes conifer, mixedwood, deciduous and openland fuel types. Mixedwood, deciduous, and openland types are categorized by seasonality as follows:
 - a. Mixedwood fuel types include a seasonal component: M-1 for leafless or M-2 for green. They also include a modifier that describes the percentage of conifers in the stand. Two additional mixedwood fuel types describe forests with dead conifers in the leafless state (M-3) and dead conifers in the green state (M-4)
 - b. The Deciduous fuel type includes a seasonal component: D-1 for leafless, D-2 for green
 - c. The Openland fuel type includes matted grass (O-1a) and standing grass (O-1b)
3. Primary fuel model assignments represent average conditions, which is also the case for the LANDFIRE landscape. Alternative fuel models are suggested for milder or more extreme situations may be found in the Fire Behavior Comment section.

4. We assigned fuel models/types so that rate of spread would be similar among the three different classification systems. FBFM40 is designed to represent average conditions, but FBFM13 is intended to represent conditions during the severe portion of the fire season. Therefore, the FBFM13 assignments may represent lower fire behavior than what people might be used to. Attention was focused on fire behavior rather than whether a vegetation type fit into grass, shrub, timber, or slash groups.

5. FBFM13 and FBFM40 simulate surface fire behavior at the flaming front, assume homogeneity and continuity for the fuelbed, and should not be used for predicting fuel consumption, smoke production, or crown fire.

6. Most vegetation descriptions have not been edited and will likely be revised for the final version.

For questions or comments, please contact:

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Scott, J.H.; Burgan, R.E. 2005. Standard fire behavior Fuel models/types a comprehensive set for use with Rothermel's surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153. Fort Collins, CO: USDA, For. Serv., Rocky Mountain Research Station. 72 p.

Taylor, S. W.; Pike, R. G.; Alexander, Martin E. 1997. Field guide to the Canadian Forest Fire Behavior Prediction (FBP) System. Special Report 11. Canadian Forest Service, Northern Forestry Centre. Edmonton, Alberta. 64 pp.

Viereck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. The Alaska Vegetation Classification. Gen. Tech Rep. PNW-GTR-286, Portland, OR: USDA, Pacific NW Res. Stn. 278 pp.

Table 1. Crosswalk from Viereck et al (1992) Alaska vegetation classes to fuel models in the original 2008 fuel model guide (designated as “old”) and this draft revision (designated as “new”).

Guidebook Group	Fuel Type Name	Old 40	Old 13	Old FBP	New 40	New 13	New FBP	Alternate Models (See text for usage)
1	Sitka Spruce – Hemlock Forest	TL1	8	C-6	TL1	8	C-5 (closed) C-7 (open)	
2	Closed White Spruce Forest	TU1	10	C-3	TU2 upland TU1 riparian	9	C-3	TU3, FM10
3	Closed Black Spruce Forest Closed Black Spruce – White Spruce Forest	TU3	9 (adj.)	C-2	TU3/TU4 (test)	9 adj	C-2	TU1, SH5
4	Open White Spruce Forest	TU5	10	C-7	TU5	10	C-3	TU4, TU1
5	Coastal Boreal Transition Open White Spruce – Lutz Spruce Forest	New			TU1	8	D-1/D-2 or M-1/M-2 w/ low conifer	TU1, TU3, GR4 , FM9
6	Open Black Spruce Forest / Open Mixed Black Spruce – White Spruce Forest	TU4	9 (adj.)	C-1	TU4/TU3 (test)	9 ADJ	C-2	TU5, SH5
7	Black Spruce – Tamarack Forest	TU5	10	C- 1	TU2	10	C-1	
8	Coastal Woodland Rainforest	TL1	8	M-2	TL1	8	M-2 w/low conifer % or D-2	
9	White Spruce Woodland with Shrubs	TU5	10	C-1	SH2	10	M-2/25% conifer	GR
10	Black Spruce Woodland with Tussocks	GR2	1	O-1	GS2	5	C-1	GS3, O-1a/b
11	Black Spruce Woodland with Lichen	TU4	9 (adj)	C-2	TU4	9 adj	C-1	GR2
12	Black Spruce Woodland with Sphagnum Moss	TU4	9 (adj)	C-2	TU2	10	C-1	TU1, SH2, TU4
13	Closed Black Cottonwood or Balsam Poplar Forest / Closed Red Alder Forests	TL2	8	M-2	TL2	8	D-1/2	
14	Closed Paper Birch Forest / Closed Quaking Aspen Forest	TU1	8	M-2	TU1	8	D-1/2	
15	Open Paper Birch Forest	TU1	9	M-2	TU1	8	D-1/2	M-1, M-2, TU3

Fuel model guide to Alaska vegetation

Guidebook Group	Fuel Type Name	Old 40	Old 13	Old FBP	New 40	New 13	New FBP	Alternate Models (See text for usage)
16	Open Quaking Aspen Forest	TL2	8	D-1	TU1	8	D-1/2	
17	Open Balsam Poplar (Black Cottonwood) Forest	TL2	8	M-2	TL2	8	D-1/2	TU1
18	Woodland Paper Birch / Woodland Balsam Poplar	GR1	1	O-1A	SH1	8	O-1a/b	GR1, SH2
19	White or Black Spruce with Paper Birch and/or Aspen	TL6	8	M-2	TU5	10	M-2/50% conifer	TU5, M-1/2
20	White Spruce with Balsam Poplar and Paper Birch	TU1	8	M-2	TU1	8	M-2/25% conifer	M-1, 9
21	Dwarf Tree Mountain Hemlock Scrub / Dwarf Tree Spruce Shrub	SH1	10	M-2	SH1	8	O-1a/b	
22	Dwarf Tree Black Spruce Scrub	TU4	9	C-2	GS1	9	C-1	C2, GS2
23	Closed Tall Alder / Closed Tall Willow	TU1	5	D-1/D-2	TL2	8	D-1/2	TU1, SH2, M-1/2
24	Closed Tall Shrub Birch	SH3	6	M-1	SH3	9	M-1/M-2	SH2
25	Tall Shrub Swamp	SH1	4	O-1A	SH1 same	8	O-1a/b	-
26	Open Tall Alder and/or Willow Shrub	TU1	5	M-2	TU1	8	D-1/D-2	M-1, GS1
27	Open Tall Shrub Birch / Open Tall Shrub Birch-Willow	SH3	5	M-1	SH3	9	M-1/M-2	TU4, GS1
28	Closed Low Shrub Birch / Closed Low Shrub Birch-Willow / Closed Low Ericaceous Shrub	SH2	5	M-1	SH2	9	D-1/D-2	TU4
29	Closed Low Willow / Closed Low Alder-Willow	TU1	6	M-2	SH2	9	D-1/D-2	TU1, M-1
30	Open Low Mixed Shrub-Sedge Tussock Tundra / Open Low Mixed Shrub – Sedge Tussock Bog	GR2	1	O-1	GR4	1	O-1a/b	GR5
31	Open Low Mesic Shrub Birch - Ericaceous Shrub	GR3	1	O-1	GR2	5	O-1a/b	SH7
32		GR2	1	O-1	GS2	5	O-1a/b	
33	Open Low Willow / Open Low Sweetgale	GR1	1	O-1A	SH1	8	O-1a/b	GR1
34	Open Low Alder / Open Low Alder-Willow	GS1	1	O-1	GS1	1	O-1a/b	SH2

Fuel model guide to Alaska vegetation

Guidebook Group	Fuel Type Name	Old 40	Old 13	Old FBP	New 40	New 13	New FBP	Alternate Models (See text for usage)
	Shrub							
35	Sagebrush-Juniper	SH2	8	O-1A				Combined with Sagebrush-Grass
35	Sagebrush-Grass / Grass -Juniper	GS1	2	O-1	GR1	8	O-1a/b	FM10
36	Dwarf Shrub Tundra	GR1	1	O-1A	GS1	1	O-1a/b	
37	Elymus	SH4	8	O-1A	GS2	5	O-1a/b	
38	Grass-Shrub	GR2	1	O-1	GS2	5	O-1a/b	GS1
40	Grass-Herb	GR1	1	O-1A	GS1	5	O1	Grouped with Mesic Sedge-Grass-Meadow or Tundra, #42
39	Bluejoint (<i>Calamagrostis</i>) Meadow	GR4	3	O-1	GR4	2	O-1a/b	GR7, FBFM13 3
40	Bluejoint-Shrub /Bluejoint- Herb	GR2	1	O-1	GR2	6	O-1a/b	GR1
41	Tussock Tundra	GR3	3	O-1	GR4	1	O-1a/b	
42	Mesic Sedge-Grass Meadow or Tundra /Mesic Sedge-Herb Meadow or Tundra	GR2	1	O-1	GS1	5	O-1a/b	
43	Sedge Willow Tundra / Sedge-Dryas Tundra	GR1	1	O-1A	GR1	1	O-1a/b	
44	Sedge-Birch Tundra	GR2	1	O-1	GR2	6	O-1a/b	GR4, GS3
45	Wet Meadow Tundra	GR1	1	O-1A	GR1	10	O-1a/b	NB6
46	Wet Sedge-Grass Meadow-Marsh	GR1	1	O-1A	GR1	1	O-1a/b	NB6
47	Wet Sedge Meadow or Bog / Wet Sedge-Shrub Meadow or Bog	GR1	1	O-1A	GR1	9	O-1a/b	NB6, FBFM13 2
48	Dry Species – Non Burnable	NB7*	99		NB7*	99		
49	Wet Species – Non Burnable	NB6**	99		NB7*	99		
50	Mesic Forb Herbaceous	GR1	1	O-1A	GR1	1	O-1a/b	
51	Foliose and Fruticose Lichen	GR1	1	O-1A	GR1	2	O-1a/b	GR2, GR3
52	Crustose Lichen	NB9	99		NB9	99		
53	Aquatic Herbaceous	NB8	99		NB8	99		
56	Downed Beetle-killed spruce	SB1	11	M4	Replaced			

Fuel model guide to Alaska vegetation

Guidebook Group	Fuel Type Name	Old 40	Old 13	Old FBP	New 40	New 13	New FBP	Alternate Models (See text for usage)
54	Standing Dead Beetle Kill Spruce Forest				SB2/SB3	12	M-3	
55	Heavy Stem Breakage/Downed & Jack-Straw Spruce and Aged Post-Mortality Beetle-Kill Forest				SB3	13	C-3	
56	Closed Spruce Forest with Moderate Downed Beetle Kill/ Mixed Spruce & Hardwood Forest with Moderate Beetle Kill				TU5	10	M-3	
57	Post-Timber Harvest Areas with Bluejoint Grass and Logging Slash Fuel Beds				GR7	3	O-1a/b	

Notes:

- The FMFB 13 fuel model "9 ADJ" refers to Norum's (1982) calibration for Alaska Black Spruce. Rate of spread is 1.2 times that predicted for fuel model 9 (Albini 1976, Anderson 1982), and flame length is that predicted for fuel model 5.
- NB6 is a custom fuel model referring to areas covered by hydric vegetation types that do not carry fire; NB7 refers to upland (dry species) vegetation types that do not carry fire.

Alaska fuel model guidebook (Original text)

This section of the document is the guidebook to Alaska fuel models. It contains fuel and fire behavior information gleaned from workshop participants, and vegetation characteristics taken from Viereck and others (1992). The fuel type name was taken from the common characteristics of the individual IVth-level classification names in the Viereck and others classification. Up to three illustrative photos are included for each Alaska fuel type, if available. More photos can be added as they become available. The caption of each photo lists the 4th level *Viereck et al (1992)* class and the source of the photo, if available.

Next, the most appropriate fuel models identified by the participants are listed. The primary carrier of fire is listed next, followed by any comments regarding fire behavior noted by the participants.

In the next section, a description of vegetation characteristics identified by compiling descriptions from the Viereck and others classification. This section describes the common characteristics of all 4th level classes in the fuel type.

The next section lists the individual 4th-level Viereck and others classes included in the fuel type. See Viereck and others (1992) for a detailed description of vegetation characteristics and distribution of each class.

Finally, the last section lists fuel types of similar characteristics. See the guidebook page in this document for information regarding each fuel type listed here.

(1) Sitka Spruce – Hemlock Forest



1A1A. Closed Sitka Spruce Forest (Photo Courtesy of M. Fleming, SAIC)



1A1A. Closed Sitka Spruce Forest (Photo Courtesy of M. Fleming, SAIC)



1A1C. Closed Sitka Spruce Forest – Western Hemlock Forest (Photo Courtesy of J. Koltun, GRS)



1A2A. Open Sitka Spruce Forest (Photo Courtesy Lake Clark National Park & Preserve)



1A2A. Open Sitka Spruce Forest (Photo Courtesy US Forest Service)



1A1C. Closed Sitka Spruce – Western Hemlock Forest (Photo Courtesy of Alaska Center for Conservation Science)

Fuel models/types

- FBFM40 – TL1
- FBFM13 – 8
- CFFBPS – C-7 in open or C-5 for closed

Primary carrier of fire:

- Moss and shrubs
- Litter if alder is present
- Litter and shrub mix in open forest

Fire behavior comments:

- Rarely burns except under extreme drought conditions
- Live fuels seldom contribute to fire behavior

Vegetation characteristics:

Overstory is dominated by Sitka spruce, western hemlock, and mountain hemlock. Other species, such as western red cedar, Alaska-cedar, sub-alpine fir, and Pacific silver fir may be present and may dominate the overstory. Canopy cover ranges from 25-100%. The shrub layer is often well-developed ranging in height from 1 – 1.5 m (3 – 5 ft). Cover may be as high as 50%. *Vaccinium* species and rusty menziesia are present at many sites. Some open stands may have taller alders and devil's club, providing more leaf litter. Herbs, ferns, and some grasses may be present with less than 30% cover in closed stands, but may be present with cover up to 80% in open stands. Moss is usually abundant. Hummocks and hollows may be present at some sites.

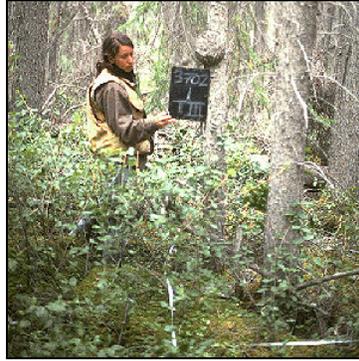
Viereck et al (1992) vegetation classes:

- 1A1A Closed Sitka Spruce Forest
- 1A1B Closed Western Hemlock Forest
- 1A1C Closed Sitka Spruce-Western Hemlock Forest
- 1A1D Closed Western Hemlock-Sitka Spruce-(Western Redcedar) Forest
- 1A1E Closed Western Hemlock-Alaska-Cedar
- 1A1F Closed Mountain Hemlock Forest
- 1A1G Closed Western Hemlock-Western Redcedar Forest
- 1A1H Closed Silver Fir-Western Hemlock Forest
- 1A1I Closed Subalpine Fir Forest
- 1A2A Open Sitka Spruce Forest
- 1A2B Open Western Hemlock-Sitka Spruce Forest
- 1A2C Open Mountain Hemlock Forest
- 1A2D Open Mixed Conifer Forest
-

(2) Closed White Spruce Forest



1A1J. Closed White Spruce Forest (Photo Courtesy of Wrangell – St. Elias National Park & Preserve)



1A1J. Closed White Spruce Forest (Photo Courtesy of the National Park Service)



1A1F. Closed White Spruce Forest (Photo Courtesy of Denali National Park & Preserve)



1A1J. Closed White Spruce Forest (Photo Courtesy of Kanuti National Wildlife Refuge)



1A1J. Closed White Spruce Forest (Photo Courtesy of Koyukuk National Wildlife Refuge)



A1J. Closed White Spruce Forest (Photo Courtesy of the National Park Service)

Fuel models/types

- FBFM40 – TU2 upland
TU1 riparian
- FBFM13 – 9
- CFFBPS – C-3

Primary carrier of fire:

- feathermoss, litter, duff

Fire behavior comments:

- In riparian areas-fire will tend to smolder, with occasional torching
- Immature stands in both riparian and upland areas will exhibit fire behavior similar to Closed Black Spruce Forest (#3)
- For FBFM13, use FM10 if significant live fuel curing has occurred
- Relatively high CBH results in lower crown fire initiation.
- Consider changing to TU3 in uplands for more extreme conditions, depending on observed fire behavior

Vegetation characteristics:

The closed white spruce forest type represents the most productive site in the Alaska taiga. Some scattered paper birch or balsam poplar maybe present. Canopy cover ranges from 60-100%. Shrubs exist as a sparsely developed layer of alders and willows with little cover. Mosses such as the feathermosses are well-developed. Herbs are sparse.

Canopy WS 02 in photo fuel guide is a good example. Has canopy characteristic data.

Viereck et al (1992) classes:

- 1A1J Closed White Spruce Forest

Similar fuel types:

- (3) Closed Black Spruce Forest
- (5) Open White Spruce Forest

(3) Closed Black Spruce Forest / Closed Black Spruce – White Spruce Forest



1A1K. Closed Black Spruce Forest (Photo Courtesy of Yukon – Charley Rivers National Preserve)



1A1L. Closed Black Spruce–White Spruce Forest (Photo Courtesy of Wrangell – St. Elias National Park & Preserve)



1A1K. Closed Black Spruce Forest (Photo Courtesy of BLM Alaska Fire Service)



1A1K. Closed Black Spruce Forest, Kenai Peninsula (Photos Courtesy of US Fish and Wildlife Service)



1A1K. Closed Black Spruce Forest, Kenai Peninsula (Photo Courtesy of Alaska Division of Natural Resources)



1A1K. Closed Black Spruce Forest with stringers of hardwood forest (Photo Courtesy of Alaska Center for Conservation Science)

Fuel models/types

- FBFM40 – TU3/TU4***??
- FBFM13 – 9 (adjusted) / 5***?
- CFFBPS – C-2

Primary carrier of fire:

- feathermosses

Fire behavior comments:

- In areas without feathermosses, such as riparian areas, consider using TU1
- Consider SH5 for dry conditions (low 30's RH), as input in fire behavior models using Finney Crown Fire Method
- Canadian FBP system works best for more active fire behavior predictions, Behave Plus is better for less active conditions

*****This is a proposed change. Needs testing in models (perhaps retrospectively) and during fires summer 2016.***

Vegetation characteristics:

The overstory is dominated by black spruce with low productivity, high tree density with low volume, and abundant regeneration of black spruce, primarily from layering of lower branches. Tree cover is greater than 60%. White spruce and paper birch may be present. Alder may grow several meters tall and mix with the black spruce. Low shrubs such as rose, Labrador tea (*Ledum palustre*), blueberry (*Vaccinium uliginosum*), cranberry (*V. vitis-idaea*), and willow (*Salix spp.*) are common in the understory. Feathermosses are usually present. The moss layer varies from patchy to continuous and ranges from 20 – 100 cm (8 – 39 in) thick. *Sphagnum* species exist on wetter sites.

Viereck et al (1992) classes:

- 1A1K Closed Black Spruce Forest
- 1A1L Closed Black Spruce-White Spruce Forest

Similar fuel types:

- (6) Open Black Spruce Forest
- (7) Open Black Spruce-Tamarack Forest

(4) Open White Spruce Forest



1A2E. Open White Spruce Forest (Photo Courtesy of Yukon – Charley Rivers National Preserve)



1A2E. Open White Spruce Forest (Photo Courtesy of Nowitna National Wildlife Refuge)



1A2E. Open White Spruce Forest (Photo Courtesy of National Park Service)



1A2E. Open White Spruce Forest (Photo Courtesy of M. Fleming)



1A2E. Open White Spruce Forest, northern Cook Inlet (Photo Courtesy of Alaska Center for Conservation Science)

Fuel models/types

- FBFM40 – TU5
- FBFM13 – 10
- CFFBPS – C-3

Primary carrier of fire:

- Shrub and litter
- Feathermoss

Fire behavior comments:

- For sites with more deciduous shrubs (alder, willow, rose) use TU5.
- For sites with feathermosses and ericaceous shrubs, use TU4.
- Use TU1 in riparian areas
- Can have dramatic crown fire behavior

Vegetation characteristics:

Overstory is composed of stands dominated by white spruce, ranging in cover from 25–60%. Black spruce, paper birch, and aspen may be present with little cover. Alder and willows may be present on

wetter sites; and some low shrubs may be present on lowland sites. Ground cover is composed of herbs or feathermosses (beneath tall shrubs).

Viereck et al (1992) classes:

- 1A2E Open White Spruce Forest

Similar fuel types:

- (6) Open Black Spruce Forest
- (19) Spruce-Paper Birch-Aspen
- (20) White Spruce-Paper Birch-Balsam Poplar

(5) Coastal Boreal Transition Open White Spruce – Lutz Spruce Forest



Coastal Boreal Transition Forest. *Picea x lutzii*/*Menziesia ferruginea* community on Kenai Peninsula. Viereck et al. (1992) did not describe *P. x lutzii* types. Dominants at this site include: Lutz spruce (60% cover), rusty menziesia (40%), crowberry (10%), and bunchberry (10%). Photo courtesy of Chugach National Forest Ecology Program.



Coastal Boreal Transition Forest (Photo Courtesy of Kenai National Wildlife Refuge)

Fuel models/types

- FBFM40 –TU1
- FBFM13 - 8
- CFFBPS - D-1/D-2 or M1/M2 with low conifer

Primary carrier of fire:

- Grass in more open sites
- Shrub and herb litter with more tree cover

Vegetation characteristics:

The Coastal Boreal Transition Forest occurs on the Kenai Peninsula and is transitional between Sitka spruce-hemlock rainforests of the south-coastal region and the white spruce boreal forests of the interior. Common tree species include white spruce, Lutz spruce (hybrids between white and Sitka spruce), paper birch, black cottonwood, quaking aspen, and mountain hemlock. Sitka and black spruce are sometimes present. Species common in the undergrowth are bluejoint reedgrass, rusty menziesia, early blueberry, devil's club, Labrador tea, soapberry, prickly rose, Sitka mountain ash, salmonberry, wood fern, lowbush cranberry, crowberry, splendid feathermoss, and Schreber's feathermoss.

Viereck et al (1992) classes *May Need Editing:*

- 1A2E Open White Spruce Forest

Similar fuel types:

- (6) Open Black Spruce Forest
- (19) Spruce-Paper Birch-Aspen
- (20) White Spruce-Paper Birch-Balsam Poplar

(6) Open Black Spruce Forest / Open Mixed Black Spruce – White Spruce Forest



1A2F. Open Black Spruce Forest (Photo Courtesy of Yukon – Charley Rivers National Preserve)



1A2F. Open Black Spruce Forest (Photo Courtesy of Ducks Unlimited)



1A2G. Open Black Spruce-White Spruce Forest (Photo Courtesy of Yukon – Charley Rivers National Preserve)



1A2F. Open Black Spruce Forest (Photos Courtesy of Kanuti National Wildlife Refuge)



1A2F. Open Black Spruce Forest (Photo Courtesy of M. Fleming)



1A2F. Open Black Spruce Forest (Photo Courtesy of Koyukuk National Wildlife Refuge)



1A2F. Open Black Spruce Forest (Photo Courtesy of Kanuti National Wildlife Refuge)



1A2F. Open Black Spruce Forest, Tetlin area (Photo Courtesy of Ducks Unlimited)

Fuel models/types

- FBFM40 – TU4/TU3???
- FBFM13 – 9 (adjusted)
- CFFBPS – C-2

Primary carrier of fire:

- Feathermosses
- Ericaceous shrubs

Fire behavior comments:

- Dwarf birch/Labrador tea understory will have higher fire behavior than sites with alder/willow understory.
- If site has a lot of Sphagnum, it will have lower fire behavior (TU5)
- Consider SH5 for dry conditions (low 30's RH), as input in fire behavior models using Finney Crown Fire Method

*****This is a proposed change. Needs testing in models (perhaps retrospectively) and during fires summer 2016.***

Vegetation characteristics:

Stands are dominated by either black spruce or black/white spruce as co-dominants, ranging in cover from 25–60%. Tree sizes are small (dbh 5 – 10 cm / 1.5 – 4 in). Other species present are paper birch, tamarack, and quaking aspen. A well-developed shrub layer composed of birch, 1 – 2 m (3 – 7 ft) tall, may reside near the tree line. Alder and willows may be present on moist sites. Low shrubs, 10 – 100 cm (4 – 39 in) tall and nearly continuous in cover, are present. The ground layer is dominated by feathermosses. Lichens may be present. Grasses and sedges may be common in younger stands. Herbs are scarce.

Viereck et al (1992) classes:

- 1A2F Open Black Spruce Forest
- 1A2G Open Black Spruce-White Spruce Forest

Similar fuel types:

- (3) Closed Black Spruce Forest
- (5) Open White Spruce Forest
- (7) Open Black Spruce-Tamarack Forest
- (10) Black Spruce Woodland with tussock
- (11) Black Spruce Woodland with lichen-moss
- (19) Spruce-Paper Birch-Aspen
- (22) Dwarf Tree Black Spruce Scrub

(7) Open Black Spruce – Tamarack Forest



1A2H. Open Black Spruce – Tamarack Forest
(Photo Courtesy of Gates of the Arctic National Park & Preserve)



1A2H. Open Black Spruce – Tamarack Forest
(Photo Courtesy of Gates of the Arctic National Park & Preserve)



1A2H. Open Black Spruce – Tamarack Forest
(Photo Courtesy of Alaska Center for Conservation Science)

Fuel models/types

- FBFM40 – TU2
- FBFM13 – 10
- CFFBPS – C-1

Primary carrier of fire:

- Shrub and shrub litter

Fire behavior comments:

- Availability for burning depends on drought conditions.
- *Sphagnum* moss generally present; *Sphagnum* has lower fire spread than feathermoss
- Microtopography can dictate whether *Sphagnum* or feathermosses dominate

Vegetation characteristics:

These stands are dominated by open (less than 60% cover), small, and stunted black spruce and tamarack. Low shrubs, nearly continuous in cover, 10 – 100 cm (4 – 39 in) tall, are characteristic of this stand type. This type is found on wet lowlands in interior Alaska with shallow active layer above permafrost.

Viereck et al (1992) classes:

- 1A2H Open Black Spruce-Tamarack Forest

Similar fuel types:

- (6) Open Black Spruce Forest

(8) Coastal Woodland Rainforest



1a3b. Sitka Spruce Woodland (Photo courtesy of Chugachmiut)



1a3b. Sitka Spruce Woodland, foreground (Photo courtesy of Chugachmiut)



1a3a. Lodgepole Pine Woodland (Photo Courtesy of Alaska Center for Conservation Science)

Fuel models/types

- FBFM40 – TL1
- FBFM13 – 8
- CFFBPS – M-2 with low conifer % or D-2

Primary carrier of fire:

- Litter and low shrub

Fire behavior comments:

- Fire is infrequent in this forest type
- Shore pine (*Pinus contorta*) woodland is different than its counter-part lodgepole pine woodlands in drier climates (like Montana), despite being the same species

Vegetation characteristics:

The overstory is dominated by stunted shore pine, mountain hemlock, Alaska yellow-cedar, or Sitka spruce with cover ranging from 10–25%. Other species that may be present are western redcedar, and western hemlock. Shrubs ranging in height from 1 – 2 m (3 – 7 ft) provide little cover or may be absent and rooted on mounds at the bases of trees. Low/dwarf shrubs are common, providing up to 15% cover. Herbs are well represented. Mosses are abundant.

Viereck et al (1992) classes:

- 1A3A Lodgepole Pine Woodland
- 1A3B Sitka Spruce Woodland

Similar fuel types:

- (4) Sitka Spruce Forest – Hemlock forests

(9) White Spruce Woodland with Shrubs



1A3C. White Spruce Woodland,
(Photo Courtesy of M. Fleming)



1A3C. White Spruce Woodland (Photo
Courtesy of US Fish and Wildlife Service)



1A3C. White Spruce Woodland (Photo Courtesy of
Alaska Center for Conservation Science)

Fuel models/types

- FBFM40 – SH2
- FBFM13 – 10
- CFFBPS – M-2, 25%
conifer

Primary carrier of fire:

- Feathermoss and
shrub

Fire behavior comments:

- If grass understory, use
GR model
- Highly variable; fuel
model may be different
depending on understory
- If lichens dominate the
understory, see Fuel
Type 11

Vegetation characteristics:

Overstory is dominated by white spruce ranging from 10–25% cover. Paper birch, black spruce, and occasionally some aspen may be present with little cover. Open, low/dwarf shrubs such as resin birch are common and may behave as a carrier of fire. Feathermosses and lichens reside beneath and within the shrub layer. These stands are most common at tree-line.

Viereck et al (1992) classes:

- 1A3C White Spruce Woodland

Similar fuel types:

- (5) Open White Spruce Forest
- (6) Open Black Spruce Forest
- (31) Open Low Birch-Ericaceous Shrub/Bog
- (37) Dwarf Shrub Tundra

(10) Black Spruce Woodland with Tussocks



1A3D. Black Spruce Woodland with tussock
(Photo Courtesy of the Steese-White Mountains
Recreational Area - BLM)



1A3D. Black Spruce Woodland with tussock
(Photo Courtesy of BLM Alaska Fire Service)



1A3D. Black Spruce Woodland with tussock (Photo
Courtesy of Koyukuk National Wildlife Refuge)

Fuel models/types

- FBFM40 – GS2
- FBFM13 – 5
- CFFBPS – C-1

Primary carrier of fire:

- Tussocks, low shrubs

Fire behavior comments:

- Change to GS3 under drier conditions
- If spruce canopy cover <15% consider O-a/b for CFFBPS

Vegetation characteristics:

Stands are dominated by black spruce ranging in cover from 10 – 24 %. Tall shrubs consist of scattered clumps of alder, birch, and some willow. Low shrubs are common, composed primarily of *Vaccinium spp.* and dwarf birch. Sedges are common, primarily tussock cotton grass (*Eriophorum vaginatum*) or Bigelow's sedge (*Carex bigelowii*). Mosses and lichens are common.

Viereck et al (1992) classes:

- 1A3D Black Spruce Woodland

Similar fuel types:

- (6) Open Black Spruce Forest
- (11) Black Spruce Woodland with lichen-moss
- (22) Dwarf Tree Black Spruce Scrub
- (30) Open Low Mixed Shrub-Sedge Tussock Tundra/Bog
- (31) Open Low Birch-Ericaceous Shrub/Bog

(11) Black Spruce and/or White Spruce Woodland with Lichen



1A3D. Black Spruce Woodland with lichen (Photo Courtesy of Ducks Unlimited)



1A3D. Black Spruce Woodland with lichen (Photo courtesy of Koyukuk National Wildlife Refuge)



1A3D. Black Spruce Woodland with lichen (Photo Courtesy of Gates of the Arctic National Park)



1A3C. White Spruce Woodland, Kvichak. (Photo Courtesy of Ducks Unlimited)



1A3D. Black Spruce Woodland with lichen (Photo Courtesy of Kanuti National Wildlife Refuge)



1A3D. Black Spruce Woodland with lichen (Photo Courtesy of Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – TU4
- FBFM13 – 9 (adjusted)
- CFFBPS – C-1

Primary carrier of fire:

- Feathermoss and lichen

Fire behavior comments:

- Includes lichen and feathermoss types. If *Sphagnum* moss is common, see Fuel Type 12
- Can switch to GR2 at more open canopy, drier conditions

Vegetation characteristics:

Stands are dominated by black spruce ranging in cover from 10 – 25%. Tall shrubs consist of scattered clumps of alder, birch, and some willow. Low shrubs are common composed primarily of *Vaccinium* species (blueberry, lowbush cranberry). Herbs range from sparse to dense. Mosses and lichens are nearly continuous, with lichens being the dominant ground cover, resulting in a white to pale green appearance. Mosses are comprised of feathermoss and other species not in the *Sphagnum* genus.

Viereck et al (1992) classes:

- 1A3D Black Spruce Woodland
- 1A3E Black Spruce-White Spruce Woodland

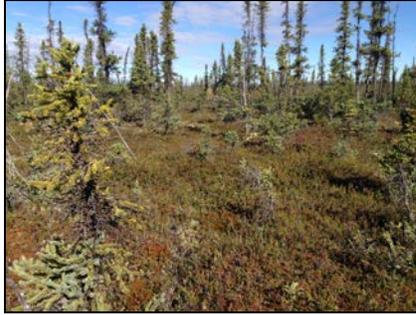
Similar fuel types:

- (6) Open Black Spruce Forest
- (22) Dwarf Tree Black Spruce Scrub
- (30) Open Low Mixed Shrub-Sedge Tussock Tundra/Bog
- (31) Open Low Birch-Ericaceous Shrub/Bog

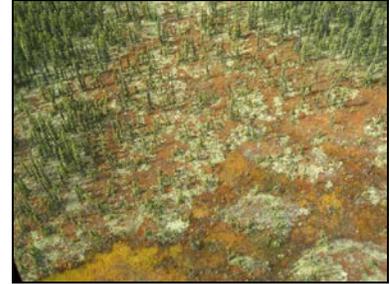
(12) Black Spruce Woodland with *Sphagnum* Moss



1A3D. Black Spruce Woodland with Sphagnum moss
(Photo Courtesy of Kanuti National Wildlife Refuge)



1A3D. Black Spruce Woodland with Sphagnum moss
(Photo courtesy of Kanuti National Wildlife Refuge)



1A3D. Black Spruce Woodland with Sphagnum moss and lichen
(Photo Courtesy of Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – TU2
- FBFM13 – 10
- CFFBPS – C-1

Primary carrier of fire:

- Shrubs

Fire behavior comments:

- Similar to fuel type 11, but *Sphagnum* moss, which retains moisture and mitigates fire behavior, dominates the ground cover rather than lichens and feathermoss
- Fire behavior will be highly dependent on the amount of shrubs in the understory and dryness of *Sphagnum*. Use TU1 or SH2 to slow ROS, TU4 to increase it.
- Fire can smolder in dry *Sphagnum* for extended periods

Vegetation characteristics:

Stands contain black spruce ranging in cover from 10 – 25% with *Sphagnum* moss dominating the ground cover with at least 50% cover and are often nearly continuous under the shrub layer. Tall shrubs consist of scattered clumps of alder, birch, and some willow. Low shrubs are common composed primarily of *Vaccinium* species (blueberry, lowbush cranberry). Herbs range from sparse to dense. Lichens may be present, often occurring in scattered clumps, but do not dominate the site.

Viereck et al (1992) classes:

- 1A3D Black Spruce Woodland
- 1A3E Black Spruce-White Spruce Woodland

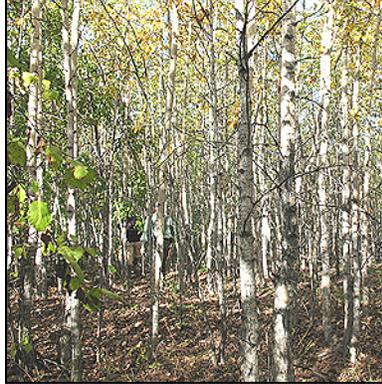
Similar fuel types:

- (6) Open Black Spruce Forest
- (22) Dwarf Tree Black Spruce Scrub
- (30) Open Low Mixed Shrub-Sedge Tussock Tundra/Bog
- (31) Open Low Birch-Ericaceous Shrub/Bog

(13) Closed Black Cottonwood or Balsam Poplar Forest / Closed Red Alder Forest



1B1B. Closed Black Cottonwood Forest (Photo Courtesy of M. Fleming, SAIC)



1B1C. Closed Balsam Poplar Forest (Photo Courtesy of Yukon Flats National Wildlife Refuge)



1B1C. Closed Balsam Poplar Forest (Photo Courtesy of Yukon Flats National Wildlife Refuge)



1B1A. Closed Tall Alder Forest with Willow. (Photo Courtesy of Nowitna National Wildlife Refuge)



1B1A. Closed Tall Alder Forest. (Port Graham, Photo courtesy of Chugachmiut)



1B1A. Closed Red Alder Forest (Photo Courtesy of USDA Forest Service)

Fuel models/types

- FBFM40 – TL2
- FBFM13 – 8
- CFFBPS – D-1/D-2

Primary carrier of fire:

- Leaf litter

Fire behavior comments:

- In floodplains, this type rarely burns due to heavy silt on litter.
- Red Alder type is not common.
- If more fire behavior observed in balsam poplar, see Fuel Type #14.

Vegetation characteristics:

Stands are dominated by either black cottonwood or balsam poplar with greater than 60% canopy cover. In young stands, shrubs may be sparse due to the closed canopy. As overstory ages, shrubs such as alder, willow, and rose become more common. Bluejoint is common in the herb layer along with some mosses and lichens when flooding is infrequent. More commonly, mosses and lichens are absent due to high leaf litter and frequent flooding.

The red alder type may have cover greater than 60%. This type has only been described from the Stinkine area in SE Alaska. Woody plants other than alder are rare. Grasses, sedges, and herbs are present.

Viereck et al (1992) classes:

- 1B1B Closed Black Cottonwood Forest
- 1B1C Closed Balsam Poplar Forest
- 1B1A Closed Red Alder Forest

Similar fuel types:

- (17) Open Balsam Poplar (Black Cottonwood) Forest
- (19) Spruce-Paper Birch-Aspen
- (23) Closed Tall Alder Willow Shrub
- (26) Open Tall Willow Alder Shrub

(14) Closed Paper Birch Forest / Closed Quaking Aspen Forest



1B1D. Closed Paper Birch Forest (Photo Courtesy of J. Koltun, GRS)



1B1D. Closed Paper Birch Forest (Photo Courtesy of Yukon – Charley Rivers National Preserve)



1B1E. Closed Quaking Aspen Forest (Photo Courtesy of the National Park Service)



1B1D. Closed Paper Birch Forest, foreground (Photo Courtesy of Kanuti National Wildlife Refuge)



1B1D. Closed Paper Birch Forest, (Photo Courtesy of Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – TU1
- FBFM13 – 8
- CFFBPS – D-1/D-2

Primary carrier of fire:

- Leaf litter and sparse grass

Fire behavior comments:

- Use a dynamic fuel model, dependent on green up
- Leaf litter and some grass in the understory.
- During drought, may get increased fire behavior
- May have some spruce in understory that will increase fire behavior

Vegetation characteristics:

Paper birch, aspen, or balsam poplar dominate the overstory with greater than 60% cover. Leaf litter may be heavy. Stands may be associated with white and black spruce. A discontinuous, tall shrub layer several meters tall made up of alder and/or willow is present in most stands. A broken to nearly continuous shrub layer 1 – 2 m (3 – 7 ft) is present when alder is less abundant. Some open, low shrubs are present. Bluejoint and other herb species are common to scattered in the understory. Mosses and lichens are sparse to rare.

Viereck et al (1992) classes:

- 1B1D Closed Paper Birch Forest
- 1B1E Closed Quaking Aspen Forest
- 1B1F Closed Paper Birch-Quaking Aspen Forest
- 1B1G Closed Quaking Aspen-Balsam Poplar Forest

Similar fuel types:

- (15) Open Paper Birch Forest
- (16) Open Quaking Aspen Forest
- (17) Open Balsam Poplar (Black Cottonwood) Forest
- (19) Spruce-Paper Birch-Aspen
- (20) White Spruce-Paper Birch-Balsam Poplar
- (23) Closed Tall Alder-Willow Shrub
- (26) Open Tall Alder-Willow Shrub

(15) Open Paper Birch Forest



1B2A. Open Paper Birch Forest (Photo Courtesy of Yukon – Charley Rivers National Preserve)



1B2A. Open Paper Birch Forest (Photo Courtesy of Kanuti National Wildlife Refuge)



1B2A. Open Paper Birch Forest (Photo Courtesy of Kanuti National Wildlife Refuge)



1B2A. Open Paper Birch Forest (Photo Courtesy of Kanuti National Wildlife Refuge)



1B2A. Open Paper Birch Forest (Photo Courtesy of M. Fleming)

Fuel models/types

- FBFM40 – TU1
- FBFM13 – 8
- CFFBPS – D-1/D-2

Primary carrier of fire:

- Leaf litter and grass

Fire behavior comments:

- Use a dynamic fuel model, dependent on green up
- Leaf litter and some grass in the understory.
- Use M-1, M-2, or TU3 if spruce component in understory nearing 25% or if observing increased fire behavior due to understory characteristics

Vegetation characteristics:

These stands are dominated by paper birch with cover ranging from 25–60%. Scattered white or black spruce may be present. Birch, 1 – 2 m (3 – 7 ft) may be present between trees on moist sites. Alder and willows may be present. Ericaceous shrubs form an open dwarf shrub layer beneath taller shrubs. A nearly continuous layer of feathermosses are present. Drier sites may have some lichen between trees instead of shrubs. Over-mature birch stands, occurring on upland slopes, lack spruce understory to

replace birch as they die. Understory is composed of low shrubs and herbs such as bluejoint and horsetail.

Viereck et al (1992) classes:

- 1B2A Open Paper Birch Forest

Similar fuel types:

- (14) Closed Paper Birch-Quaking Aspen Forest
- (18) Woodland Paper Birch-Balsam Poplar

(16) Open Quaking Aspen Forest



1B2B. Open Quaking Aspen Forest (Photo Courtesy of Wrangell - St. Elias National Park & Preserve)



1B2B. Open Quaking Aspen Forest (Photo Courtesy of Gates of the Arctic National Park & Preserve)



B2B. Open Quaking Aspen Forest (Photo Courtesy of National Park Service. Silvery hue of aspen is caused by Aspen Leaf Miner)



1B2B. Open Quaking Aspen Forest with shrub understory.(Photo Courtesy of Kanuti National Wildlife Refuge)



1B2B. Open Quaking Aspen Forest with shrub understory.(Photo Courtesy of Kanuti National Wildlife Refuge)

1B2B. Open Quaking Aspen Forest with shrub understory.(Photo Courtesy of Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – TU1
- FBFM13 – 8
- CFFBPS – D-1/D-2

Primary carrier of fire:

- Leaf litter, grass, shrub,

Fire behavior comments:

- Sites often very dry, steep, south-facing slopes along rivers in interior and south-central Alaska
- Slope may be important for significant spread
- During drought, may get increased fire behavior. May have some spruce in understory that will increase fire behavior

Vegetation characteristics:

These stands are dominated by small aspen trees ranging from 10–60% cover. Prickly rose, 1 – 2 m (3 – 7 ft) may be present. Low buffaloberry shrubs may be present, with kinnikinnick as a ground cover. Herbs are present. Mosses and lichens are present but do not provide significant cover.

Viereck et al (1992) classes:

- 1B2B Open Quaking Aspen Forest

Similar fuel types:

- (14) Closed Paper Birch-Quaking Aspen Forest
- (19) Spruce-Paper Birch-Balsam Poplar

(17) Open Balsam Poplar (Black Cottonwood) Forest



1B2C. Open Balsam Poplar Forest, Kincaid Park, Anchorage (Photo Courtesy of L. Saperstein)



1B2C. Open Balsam Poplar Forest, Chugach State Park (Photo Courtesy of L. Saperstein)



1B2C. Open Black Cottonwood Forest, Chugach National Forest. (Photo Courtesy of USFS)



1B2C. Open Balsam Poplar Forest (Photo courtesy of Koyukuk National Wildlife Refuge)

Fuel models/types

- FBFM40 – TL2
- FBFM13 – 8
- CFFBPS – D-1/D-2

Primary carrier of fire:

- Leaf litter

Fire behavior comments:

- Uncommon, but when it occurs often found on flood plains and occasionally on slopes
- Use TU1 if dynamic fuel model is desired

Vegetation characteristics:

These open stands, ranging from 25–60% cover, are dominated by balsam poplar or black cottonwood. Other tree species are usually absent. Variable understory composition exists with a scattered, tall shrub layer of willow and alder. Low shrubs are present. Herbs and common bryophytes are present.

Viereck et al (1992) classes:

- 1B2C Open Balsam Poplar (Black Cottonwood) Forest

Similar fuel types:

- (14) Closed Black Cottonwood-Balsam Poplar Forest
- (18) Woodland Paper Birch-Balsam Poplar

(18) Woodland Paper Birch / Woodland Balsam Poplar



1B3A. Paper Birch Woodland (Photo Courtesy of Kobuk Valley National Preserve)



1B3A. Paper Birch Woodland (Photo Courtesy of Kanuti National Wildlife Refuge)



1B3A. Paper Birch Woodland (Photo Courtesy of Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 –SH1
- FBFM13 – 8
- CFFBPS – O-1a

Primary carrier of fire:

- Lichen or grass & leaf litter

Fire behavior comments:

- May be found in 10 – 20 year old burns
- Fires may slow when hitting this fuel type, but under high winds and very dry live and dead fuel moistures, fire will readily move through it
- Consider GR1 or SH2 as alternate fuel models, depending on observed fire behavior

Vegetation characteristics:

These stands are composed of open grown paper birch and/or balsam poplar with 10–25% cover. Birch is often multi-stemmed and stunted. Alder and willow are tall shrubs in balsam poplar stands. Lichens or herbs (blue joint, fireweed, bluebells, & wintergreen) may be present, especially in the Balsam Poplar Woodland class.

Viereck et al (1992) classes:

- 1B3A Paper Birch Woodland
- 1B3B Balsam Poplar Woodland
- 1B3C Paper Birch-Balsam Poplar Woodland

Similar fuel types:

- (27) Open Tall Birch/Birch-Willow Shrub

(19) White or Black Spruce with Paper Birch and/or Aspen



1C1D. Closed Quaking Aspen – Spruce Forest
(Photo Courtesy of Wrangell – St. Elias National Park & Preserve)



1C2A. Open Spruce – Paper Birch Forest (Photo Courtesy of Wrangell – St. Elias National Park & Preserve)



1C2B. Open Quaking Aspen – Spruce Forest
(Photo Courtesy of Denali National Park & Preserve)



1C2B. Open Quaking Aspen – Spruce Forest (Photo Courtesy of Kanuti National Wildlife Refuge)



1C1A. Closed Spruce–Paper Birch Forest
(Photo Courtesy of Kanuti National Wildlife Refuge)



1C1A. Closed Spruce–Paper Birch Forest, pre-greenup (Photo Courtesy of Kanuti National Wildlife Refuge)



1C1A. Closed Spruce–Paper Birch Forest
(Photo Courtesy of Kanuti National Wildlife Refuge)



1C1A. Closed Spruce–Paper Birch Forest
(Photo Courtesy of Kenai National Wildlife Refuge)



1C1A. Closed Spruce–Paper Birch Forest
(Photo Courtesy of Kenai National Wildlife Refuge)

Photo

Fuel models/types

- FBFM40 – TU5
- FBFM13 – 10
- CFFBPS – M-2/50% conifer

Primary carrier of fire: Fire behavior comments:

- leaf litter
- Amount of spruce in stand increases rate of spread; understory spruce may not be detected from air. Can adjust herbaceous and live woody moistures to account for amount of spruce within TU5
- Use M-1 for leafless period, M-2 during green period
- Occurs on flood-plain terraces; slopes; uplands; or warm, dry sites

Vegetation characteristics:

Includes open and closed stands (>25% tree cover). These stands are composed of paper birch and/or aspen with white or black spruce or a mixture thereof. Small quantities of balsam poplar may be present. Moderately dense to scattered tall alder or willow may be present, along with an intermittent to closed low shrub present. Herbs, mosses, lichens, and ferns may be found, depending on dominant stand type. Cover of feathermosses ranges from dominant to patchy.

Viereck et al (1992) classes:

- 1C1A Closed Spruce-Paper Birch Forest
- 1C1C Closed Spruce-Paper Birch-Quaking Aspen Forest
- 1C1D Closed Quaking Aspen-Spruce Forest
- 1C2A Open Spruce-Paper Birch Forest
- 1C2B Open Quaking Aspen-Spruce Forest
- 1C3A Spruce-Paper Birch Woodland

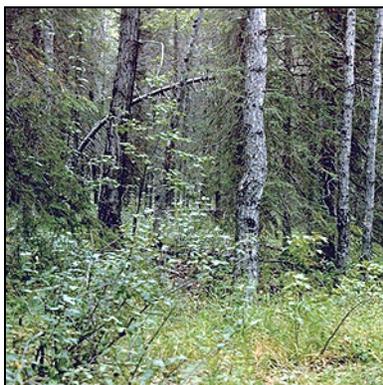
Similar fuel types:

- (15) Open Paper Birch Forest
- (16) Open Quaking Aspen Forest
- (20) White Spruce-Paper Birch-Balsam Poplar
- (22) Dwarf Tree Black Spruce Scrub

(20) White Spruce with Balsam Poplar and Paper Birch-



1C1B. Closed White Spruce-Paper Birch-Balsam Poplar Forest (Photo Courtesy of Wrangell - St. Elias National Park & Preserve)



1C1E. Closed Balsam Poplar-White Spruce Forest (Photo Courtesy of Lake Clark National Park & Preserve)



1C2D. Open Spruce-Balsam Poplar Forest (Photo Courtesy of Wrangell - St. Elias National Park & Preserve)



1C2C. Open White Spruce-Paper Birch-Balsam Poplar Forest (Photo Courtesy of Nowitna National Wildlife Refuge)

Fuel models/types

- FBFM40 – TU1
- FBFM13 – 8
- CFFBPS – M-2/25% conifer

Primary carrier of fire:

- leaf litter & herbaceous plants

Fire behavior comments:

- Use M-1 during the leafless period
- Consider vegetation type 19 if more upland site

Vegetation characteristics: *Need photos- showing riparian character*

Occurs on flood-plains; creek bottoms; areas with low shrubs at tree line; or high elevation streams. These stands are dominated by white spruce, balsam poplar or black cottonwood, paper birch, or a mixture of these species, with tree cover greater than 25%. Tall shrubs like alder or willow, often greater than 2 m (7 ft) tall, are present along with lower shrubs. Herbs are present. Ferns and mosses may be present.

Viereck et al (1992) classes:

- 1C1B Closed White Spruce-Paper Birch-Balsam Poplar (Black Cottonwood) Forest
- 1C1E Closed Balsam Poplar-White Spruce Forest
- 1C2C Open Paper Birch-Balsam Poplar-Spruce Forest
- 1C2D Open Spruce-Balsam Poplar Forest

Similar fuel types:

- (17) Open Balsam Poplar (Black Cottonwood) Forest
- (19) Spruce-Paper Birch-Aspen

(21) Dwarf Tree Mountain Hemlock Scrub / Dwarf Tree Spruce Scrub



2A1A. Closed Mountain Hemlock Dwarf Tree Scrub
(Photo Courtesy of J. Koltun, GRS)



2A1. Closed Dwarf Tree Shrub, spruce is dominant species. (Photo Courtesy of USFS)

Fuel models/types

- FBFM40 – SH1
- FBFM13 – 8
- CFFBPS – O-1a

Primary carrier of fire:

- Sparse moss & shrub

Fire behavior comments:

- Fire unlikely, high foliar moisture, low rate of spread
- Occurs in areas highly exposed to wind
- Use low curing for O-1a

Vegetation characteristics:

Generally higher elevation sites. These stands are dominated by mountain hemlock less than 3 m (10 ft) tall at maturity. Dwarf stands may be only 15 – 30 cm (6 – 12 in) tall, with greater than 25% cover, where exposed to severe wind. Sitka spruce may be present. Tree cover is less than 10% for trees taller than 3 m (10 ft). A sparse low shrub cover along with a well developed dwarf shrub layer is present. Herb cover is low. Mosses are present.

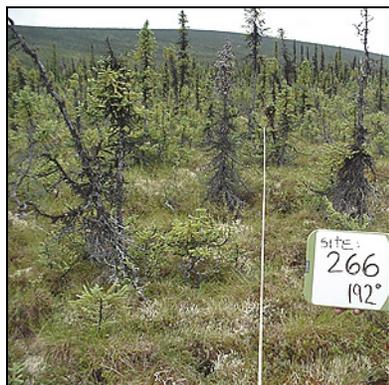
Viereck et al (1992) classes:

- 2A1A Closed Mountain Hemlock Dwarf Tree Scrub
- 2A1B Closed Subalpine Fir Dwarf Tree Scrub
- 2A2B Open Mountain Hemlock Dwarf Tree Scrub

Similar fuel types:

- (1) Sitka Spruce- Hemlock Forest
- (37) Dwarf Shrub Tundra

(22) Dwarf Tree Black Spruce Scrub



2A2A. Open Black Spruce Dwarf Tree Scrub
(Photo Courtesy of the Steese - White Mountains
Recreational Area - BLM)



2A3A. Black Spruce Dwarf Tree Woodland (Photo
Courtesy of Ducks Unlimited)



2A3A. Black Spruce Dwarf Tree Woodland (Photo
Courtesy of Kobuk Valley National Preserve)



2A3A. Black Spruce Dwarf Tree Woodland (Photo Courtesy of the
Alaska Center for Conservation Science)



2A2A. Open Black Spruce Dwarf Tree Scrub, Dalton
Highway area (Photo Courtesy of Ducks Unlimited)

Fuel models/types:

- FBFM40 – GS1
- FBFM13 – 9
- CFFBPS C-1

Primary carrier of fire:

- shrub

Fire behavior comments:

- Similar to open and woodland black spruce forests, difference is with tree height
- Change to C2/GS2 when canopy cover is in open canopy range (25-60%)

Vegetation characteristics:

Stands are dominated by black spruce, less than 3 m (10 ft), with cover ranging from 10–60% for dwarf trees and less than 10% for trees greater than 3 m (10 ft). Dwarf tamarack and paper birch may be present. A well-developed shrub layer, 1 – 2 m (3 – 7 ft) tall composed of birch, may be present in areas near the tree-line. Alder and willows may be present on moist sites. Low shrubs, nearly continuous in cover, 10 – 100 cm (4 – 39 in) tall, are present. The ground layer is dominated by feathermosses. Lichens may be present. Grasses and sedges may be common in younger stands. Herbs are scarce.

Viereck et al (1992) classes:

- 2A2A Open Black Spruce Dwarf Tree Scrub
- 2A3A Black Spruce Dwarf Tree Woodland

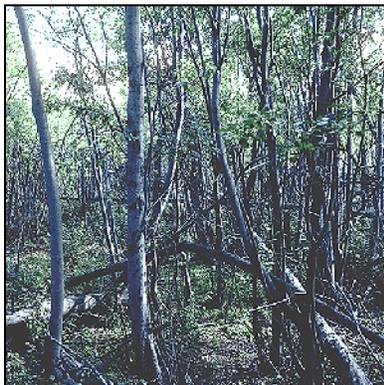
Similar fuel types:

- (6) Open Black Spruce Forest
- (11) Black Spruce Woodland with lichen-moss
- (30) Open Low Mixed Shrub-Sedge Tussock Tundra/Bog
- (32) Open Low Birch-Ericaceous Shrub/Bog

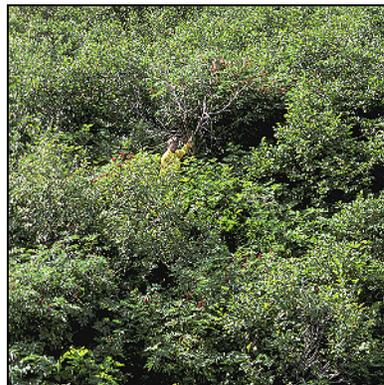
(23) Closed Tall Alder / Closed Tall Willow



2B1A. Closed Tall Willow Shrub (Photo Courtesy of Wrangell – St. Elias National Park & Preserve)



2B1A. Closed Tall Willow Shrub (Photo Courtesy of Yukon – Charley Rivers National Preserve)



2B1A. Closed Tall Alder Shrub (Photo Courtesy of M. Fleming, SAIC)



2B1B. Closed Tall Alder Shrub, along old road (Photo courtesy of Chugachmiut)



2B1B. Closed Tall Alder Shrub, Innoko area (Photo Courtesy of Ducks Unlimited)

Fuel models/types

- FBFM40 – TL2
- FBFM13 – 8
- CFFBPS – D-1/D-2

Primary carrier of fire:

- Leaf litter & woody debris

Fire behavior comments:

- High fuel moisture, most likely to burn in spring
- Use TU1 or M1/M2 to ramp up fire behavior; consider using SH2 for extreme conditions.

Vegetation characteristics:

Some taller alders and willows, scattered balsam poplar or black cottonwood are present in the overstory. Spruce, paper birch, and cottonwood may be present with cover less than 10%. Shrubs of willow or alder taller than 1.5m (5 ft) are present with 75% or greater cover. Spruce, paper birch, and cottonwood may be present with cover less than 10%. Low shrubs are restricted to openings or maybe be absent altogether. Mosses and some grass (in open stands) may be present.

Viereck et al (1992) classes:

- 2B1A Closed Tall Willow Shrub
- 2B1B Closed Tall Alder Shrub
- 2B1D Closed Tall Alder-Willow Shrub

Similar fuel types:

- (25) Tall Shrub Swamp

- (26) Open Tall Alder-Willow Shrub
- (29) Closed Low Willow/Alder-Willow Shrub

(24) Closed Tall Shrub Birch



2B1C. Closed Tall Shrub Birch Shrub (Photo Courtesy of the Fish and Wildlife Service)



2B1E. Closed Tall Shrub Birch-Willow Shrub (Photo Courtesy of Wrangell - St. Elias National Park & Preserve)



2B1C. Closed Tall Shrub Birch Shrub. (Photo Courtesy of Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – SH3
- FBFM13 – 9
- CFFBPS – M-1/M-2

Primary carrier of fire:

- Shrub litter

Fire behavior comments:

- Primary carriers of fire are shrubs, not grasses
- Resin in birch **may** enable shrub birch to burn more readily than willow; birch has higher moisture of extinction.
- SH3 has a high moisture of extinction, consider using SH2 for lower moisture of extinction
- SH2 has faster rate of at low fuel moistures compared to SH3 and SH2 has lower moisture of extinction. Use SH3 if this type is burning under moist conditions

Vegetation characteristics:

A few tall willows or alder or occasional trees may be present. Willows or shrub birches 1.5 m (5 ft) or taller are present with greater than 75% cover. Resin and paper birch or hybrids less than 1.5 m (5 ft) are present. Low shrubs are sparse or absent. Herbs and moss may be present.

Viereck et al (1992) classes:

- 2B1C Closed Tall Shrub Birch Shrub
- 2B1E Closed Tall Shrub Birch-Willow Shrub

Similar fuel types:

- (24) Closed Tall Birch Shrub
- (27) Open Tall Birch/Birch-Willow Shrub
- (28) Closed Low Birch/Birch-Willow/Ericaceous Shrub
- (32) Open Low Birch-Willow/Ericaceous Shrub/Bog

~~(25) Tall Shrub Swamp~~

We are considering deleting this fuel type. We need pictures, and suspect it may burn like other shrub types if dry enough to burn at all. This type is described as being similar to an ericaceous shrub bog, but with a tall shrub component, usually alder or alder-willow.

This may be mapped as Existing Vegetation Type 2777 in LANDFIRE

It has been suggested to group this under (23) Closed Tall Alder / Closed Tall Willow with TL2 – 8 – D-1/D-2 fuel model classifications

Fuel models/types

- ~~FBFM40 – SH1~~
- ~~FBFM13 – 8~~
- ~~CFFBPS – O1A/B~~

Primary carrier of fire:

- ~~Graminoid and leaf litter~~

Fire behavior comments:

- ~~Standing water is common~~
- ~~Usually has standing water and will be a barrier to fire spread unless dry, dead shrubs, and windy conditions.~~

Vegetation characteristics:

Scattered trees may be present with less than 10% cover. This type is dominated by alder or willows, 1.5 m (5 ft) or taller with 25-75% cover, in standing water. Some low shrubs may be present. Hydrophobic mosses or a dense herb layer may be present. Lichens are sparse. The substrate is usually hummocky with water in the depressions throughout much of the growing season.

Viereck et al (1992) classes:

- ~~2B1F – Closed Tall Shrub Swamp~~
- ~~2B2F – Open Tall Shrub Swamp~~

Similar fuel types:

- ~~(23) Closed Tall Alder-Willow Shrub~~
- ~~(34) Open Low Alder/Alder-Willow Shrub~~

(26) Open Tall Alder and/or Willow Shrub



2B2A. Open Tall Willow Shrub (Photo Courtesy of Wrangell – St. Elias National Park & Preserve)



2B2B. Open Tall Alder Shrub (Photo Courtesy of Cape Krusenstern National Monument)



2B2B. Open Tall Alder Shrub (Photo Courtesy of Ducks Unlimited)

Fuel models/types

- FBFM40 –TU1
- FBFM13 – 8
- CFFBPS – D-1/D-2

Primary carrier of fire:

- Grass and shrub litter

Fire behavior comments:

- Use M-1 during the shoulder seasons
- Use GS1 if more grass/grass litter to increase fire behavior.
- If shrub canopy more closed, select slower fuel model due to less grass cover

Vegetation characteristics:

Scattered white spruce and balsam poplar maybe present with less than 10% cover. The overstory canopy is dominated by alders and/or willows about 1.5 meters (5 ft) high or higher with cover of 25-75% cover. Low shrubs may be absent or common. Herbs, grasses (bluejoint) and mosses may be sparse or dense. Lichens are rare.

Viereck et al (1992) classes:

- 2B2A Open Tall Willow Shrub
- 2B2B Open Tall Alder Shrub
- 2B2D Open Tall Alder-Willow Shrub

Similar fuel types:

- (23) Closed Tall Alder Willow Shrub
- (25) Tall Shrub Swamp
- (27) Open Tall Birch/Birch-Willow Shrub
- (29) Closed Low Willow/Alder-Willow Shrub
- (33) Open Low Willow/Sweetgale

(27) Open Tall Shrub Birch / Open Tall Shrub Birch-Willow



2B2C. Open Tall Shrub Birch Shrub (Photo Courtesy Wrangell – St. Elias National Park & Preserve)



2B2E. Open Tall Shrub Birch-Willow Shrub (Photo Courtesy of Yukon – Charley Rivers National Preserve)



2B2E. Open Tall Shrub Birch-Willow Shrub (Photo Courtesy of Yukon – Charley Rivers National Preserve)



2B2E. Open Tall Shrub Birch-Willow Shrub (Photo Courtesy of Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – SH3
- FBFM13 – 9
- CFFBPS – M-1/M-2

Primary carrier of fire:

- Shrub litter and shrub

Fire behavior comments:

- Use TU4 to increase ROS
- If more graminoids and high ROS observed, use GS1

Vegetation characteristics:

Tree species like spruce may overtop shrub canopy with less than 10% cover. Shrubs are dominated by willows and birch 1.5 m (5 ft) or more with 25-75% cover. Low shrubs may be present. Grasses, mosses, and lichens may be present. This may exist near tree line in the Alaska Range.

Viereck et al (1992) classes:

- 2B2C Open Tall Shrub Birch Shrub
- 2B2E Open Tall Shrub Birch-Willow Shrub

Similar fuel types:

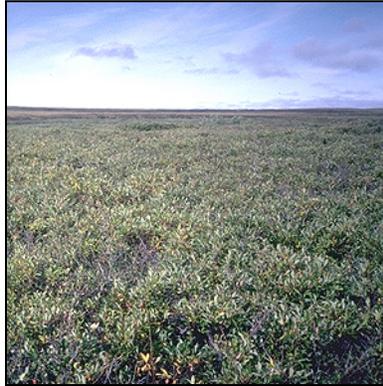
- (24) Closed Tall Birch Shrub
- (26) Open Tall Willow Alder Shrub

- (32) Open Low Birch-Willow/Ericaceous Shrub/Bog

(28) Closed Low Shrub Birch / Closed Low Shrub Birch – Willow / Closed Low Ericaceous Shrub



2C1A. Closed Low Shrub Birch Shrub (Courtesy of Bering Land Bridge National Preserve)



2C1C. Closed Low Shrub Birch-Willow Shrub (Courtesy of Bering Land Bridge National Preserve)



2C1C. Closed Low Shrub Birch-Willow Shrub (Courtesy of Bering Land Bridge National Preserve)

Fuel models/types

- FBFM40 – SH2
- FBFM13 – 9
- CFFBPS – D-1/D-2

Primary carrier of fire:

- Shrub litter and shrubs

Fire behavior comments:

- Consider TU4 for ROS under drought conditions
- Can be wind driven

Vegetation characteristics:

Trees provide less than 10% cover. These communities have at least 75% of their cover by shrubs at least 20 cm (8 in) tall, dominated by birch, willow or ericaceous shrubs. Shrubs over 1.5 m (5 ft) provide less than 25% cover. Low shrub canopy is dominated by shrub birch. Some scattered willows may be present in the overstory. Ericaceous shrubs form dense communities. Feathermosses may form a continuous mat. Lichens may be common. Herbs are scarce.

Viereck et al (1992) classes:

- 2C1A Closed Low Shrub Birch Shrub
- 2C1C Closed Low Shrub Birch-Willow Shrub
- 2C1D Closed Low Ericaceous Shrub

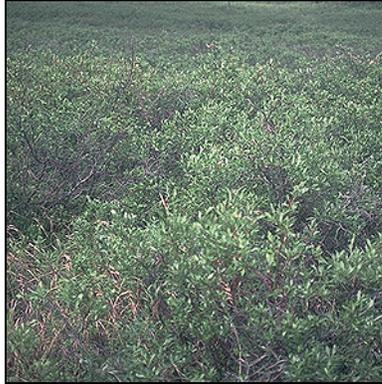
Similar fuel types:

- (24) Closed Tall Birch Shrub
- (29) Closed Low Willow/Alder-Willow Shrub
- (32) Open Low Birch-Willow/Ericaceous Shrub/Bog

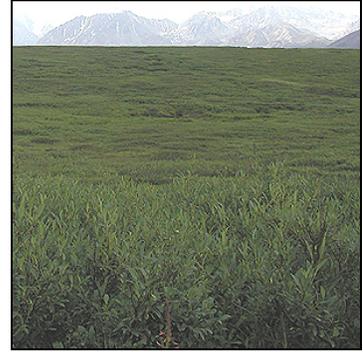
(29) Closed Low Willow / Closed Low Alder – Willow



2C1E. Closed Low Alder-Willow Shrub, Goodnews Bay
(Photo Courtesy of Ducks Unlimited)



2C1B. Closed Low Willow Shrub (Photo
Courtesy of Kobuk Valley National Preserve)



2C1B. Closed Low Willow Shrub (Photo
Courtesy of the Denali National Park &
Preserve)

Fuel models/types

- FBFM40 – SH2
- FBFM13 – 9
- CFFBPS – D-1/D-2

Primary carrier of fire:

- Shrub litter possibly grass in more open canopies
-

Fire behavior comments:

- TU1 could be used to moderate fire spread under extreme dry conditions
- Use M-1 in the shoulder seasons

Vegetation characteristics:

Trees provide less than 10% cover. These communities have at least 75% cover of willow or alders at least 20 cm (8 in) tall. Shrubs 1.5 m (5 ft) tall provide less than 25% cover. Dwarf ericaceous shrubs may be common in the understory. Feathermosses are common. Herbs and grasses are present.

Viereck et al (1992) classes:

- 2C1B Closed Low Willow Shrub
- 2C1E Closed Low Alder-Willow Shrub

Similar fuel types:

- (23) Closed Tall Alder Willow Shrub
- (32) Open Low Birch-Willow/Ericaceous Shrub/Bog
- (34) Open Low Alder/Alder-Willow Shrub

(30) Open Low Mixed Shrub – Sedge Tussock Tundra / Open Low Mixed Shrub – Sedge Tussock Bog



2C2A. Open Low Mixed Shrub-Sedge Tussock Tundra (Photo Courtesy of the National Park Service)



2C2B. Open Low Mixed Shrub-Sedge Tussock Bog (Photo Courtesy of the Arctic National Wildlife Refuge)



2C2B. Open Low Mixed Shrub-Sedge Tussock Bog (Photo Courtesy of Gates of the Arctic National Park & Preserve)



2C2B. Open Low Mixed Shrub-Sedge Tussock Bog (Photo Courtesy of the Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – GR4
- FBFM13 – 1
- CFFBPS – O-1a/b

Primary carrier of fire:

- Tussocks, low shrubs

Fire behavior comments:

- Shrub component dampens fire behavior
- Smoke visible from interior of fire indicates difficulty to control; no smoke- can generally be beaten out
- Can be wind driven
- Backing fire can be very active
- If high fuel moistures and still seeing active fire and/or low moisture of extinction is causing problems, try FBFM40: GR5

Vegetation characteristics:

Trees, if present, are usually stunted black spruce with less than 10% cover. These communities have 25% shrub cover and are dominated by tussock-forming sedges. Scattered alders and willows 1 m (3 ft) tall are sometimes present. Low shrubs may be present, with at least 25% cover. Mosses and dwarf shrubs on tussocks and in intertussock spaces – Mosses and lichens are scarce to common.

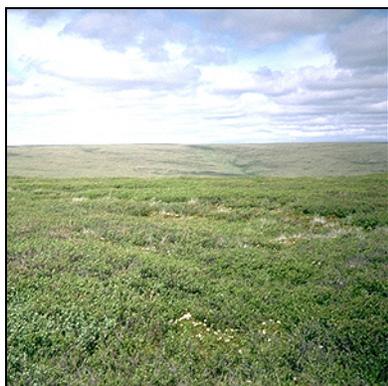
Viereck et al (1992) classes:

- 2C2A Open Low Mixed Shrub-Sedge Tussock Tundra
- 2C2B Open Low Mixed Shrub-Sedge Tussock Bog

Similar fuel types:

- (10) Black Spruce Woodland with tussock
- (22) Dwarf Tree Black Spruce Scrub
- (31) Open Low Birch-Ericaceous Shrub/Bog
- (43) Tussock Tundra

(31) Open Low Mesic Shrub Birch – Ericaceous Shrub



2C2C. Open Low Mesic Shrub Birch–Ericaceous Shrub (Courtesy of Bering Land Bridge National Preserve)



2C2C. Open Low Mesic Shrub Birch–Ericaceous Shrub, Dalton Highway area (Courtesy of Ducks Unlimited)



2C2C. Open Low Mesic Shrub Birch–Ericaceous Shrub (Courtesy of Gates of the Arctic National Park & Preserve)



2C2D. Open Low Shrub Birch–Ericaceous Shrub Bog (Courtesy of Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – GR2
- FBFM13 – 5
- CFFBPS – O-1a/b

Primary carrier of fire:

- Ericaceous shrub and birch

Fire behavior comments:

- Low moisture of extinction.
- Could use SH7 if greater ROS is observed

Vegetation characteristics:

Scattered white or black spruce trees provide less than 10% cover. These communities have 25–75% cover of shrubs at least 20 cm (8 in) tall. Tall shrubs provide less than 25% cover. Other ericaceous shrubs may be present. Shrub birch, 0.5 – 1.5 m (2 – 5 ft) tall, forms an overstory layer with the ericaceous shrubs. Herbs are present under or between the taller shrubs. A moss mat is usually present under the shrubs. Lichens are common to abundant. Tussocks and sedges may be present. Seral type in interior; climax and more subalpine in western part of state

Viereck et al (1992) classes:

- 2C2C Open Low Mesic Shrub Birch-Ericaceous Shrub

Similar fuel types:

- (10) Black Spruce Woodland with tussock
- (11) Black Spruce Woodland with lichen-moss

- (22) Dwarf Tree Black Spruce Scrub
- (30) Open Low Mixed Shrub-Sedge Tussock Tundra/Bog
- (32) Open Low Birch-Willow/Ericaceous Shrub/Bog

(32) Open Low Shrub Birch – Ericaceous Shrub Bog / Open Low Shrub Birch – Willow



2C2E. Open Low Ericaceous Shrub Bog (Photo Courtesy of Kobuk Valley National Preserve)



2C2E. Open Low Ericaceous Shrub Bog (Photo Courtesy of Gates of the Arctic National Park & Preserve)



2C2F. Open Low Shrub Birch-Willow Shrub (Photo Courtesy of Gates of the Arctic National Park & Preserve)



2C2D. Open Low Ericaceous Shrub Bog (Photo Courtesy of Kanuti National Wildlife Refuge)



2C2D. Open Low Ericaceous Shrub Bog (Photo Courtesy of Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – GS2
- FBFM13 – 5
- CFFBPS – O-1a/b

Primary carrier of fire:

- Grass & shrub

Fire behavior comments:

- *Sphagnum* and willow dampen fire behavior, even with birch present

Vegetation characteristics:

For both habitats, cover of shrubs at least 8 inches tall ranges between 25-75%, with trees proving less than 10% cover and tall shrubs (>5 ft) less than 25% cover. For Open Low Shrub Birch-Ericaceous Shrub Bog, dominant shrub species include shrub and dwarf birch (*Betula glandulosa*, *B. nana*), *Vaccinium* spp., crowberry (*Empetrum nigrum*), and bog rosemary (*Andromeda polifolia*). Willows may be common locally. Stunted scattered black or white spruce trees may be found in this community. In maritime climates, scattered lodgepole pine, Alaska-cedar, mountain hemlock, Sitka spruce, and western hemlock may be present with less than 10% cover. A wide variety of sedges and herbs may be present, and lichens may be present on mounds. Open Low Shrub Birch-Willow Shrub Communities are similar but willows are co-dominant with shrub birch. Mosses at these sites tend to be feathermosses rather than *Sphagnum*, and scattered cottongrass tussocks (*Eriophorum vaginatum*) may be present.

Viereck et al (1992) classes:

- 2C2E Open Low Ericaceous Shrub Bog
- 2C2F Open Low Shrub Birch-Willow Shrub
- 2C2D Open Low Shrub Birch-Ericaceous Shrub Bog

Similar fuel types:

- (31) Open Low Birch-Ericaceous Shrub
- (32) Open Low Birch-Willow/Ericaceous Shrub/Bog
- (37) Dwarf Shrub Tundra

(33) Open Low Willow / Open Low Sweetgale



2C2G. Open Low Willow Shrub (Photo Courtesy of Bering Land Bridge National Preserve)



2C2H. Open Low Willow-Sedge Shrub Tundra (Photo Courtesy of Bering Land Bridge National Preserve)



2C2J. Open Low Sweetgale-Graminoid Bog (Photo Courtesy of Lake Clark National Park & Preserve)

Fuel models/types

- FBFM40 – SH1
- FBFM13 – 8
- CFFBPS – O-1a

Primary carrier of fire:

- Graminoids or shrub litter

Fire behavior comments:

- Willow will dampen fire behavior
- Graminoids will increase fire behavior –use GR1
- Wet sites dampen fire behavior

Vegetation characteristics:

Trees overtopping shrubs provide less than 10% cover. Scattered birch or spruce may be present. These communities have 25-75% cover of primarily willows or sweetgale (*Myrica gale*) at least 20cm (8 in) tall. Shrubs less than 1.5 m (5 ft) provide less than 25% cover. Dwarf shrubs may be present in the understory. Scattered individuals of shrub birch may be present. Forbs and sub-shrubs may be present, sometimes located in the flooded hollows between hummocks. Sedges are often present. Mosses may form patchy to continuous mats. Lichens are scarce. This type is found on terraces, bluffs, dune complexes, moist uplands and slopes, terraces, pond margins, stream banks, drained lake basins, wet stream bottoms and lowland depressions.

Viereck et al (1992) classes:

- 2C2G Open Low Willow Shrub
- 2C2H Open Low Willow-Sedge Shrub Tundra
- 2C2I Open Low Willow-Graminoid Shrub Bog
- 2C2J Open Low Sweetgale-Graminoid Bog

Similar fuel types:

- (26) Open Tall Alder-Willow Shrub
- (28) Closed Low Birch/Birch-Willow/Ericaceous Shrub
- (29) Closed Low Willow/Alder-Willow Shrub
- (32) Open Low Birch-Willow/Ericaceous Shrub/Bog
- (34) Open Low Alder/Alder-Willow Shrub
- (45) Sedge Willow Dryas Tundra
- (49) Wet Sedge Meadow-Bog-Shrub

(34) Open Low Alder / Open Low Alder – Willow



2C2K. Open Low Alder-Willow Shrub (Photo Courtesy of Bering Land Bridge National Preserve)



2C2L. Open Low Alder Shrub (Photo Courtesy of M. Fleming, SAIC)



2C2L. Open Low Alder Shrub (Photo Courtesy of Yukon - Charley Rivers National Preserve)

Fuel models/types

- FBFM40 – GS1
- FBFM13 – 1
- CFFBPS – O-1a/b

Primary carrier of fire:

- Grass & low shrubs

Fire behavior comments:

- Low shrubs will have more active fire behavior than the tall alder-willow shrubs
- Understory component varies by location in the state (e.g. arctic, interior, south central or south east) or location on landscape (riparian vs upland) and may influence fire behavior
- GS1 designated for this type in tundra shrublands or drier upland sites. Use SH2 for riparian or if there is a moist herbaceous understory

Vegetation characteristics:

Tree canopy cover is less than 10%. These communities have willows and alders with 25-75% cover, at least 20 cm (8 in) tall. Shrubs greater than 1.5 m (5 ft) provide less than 25% cover. Herbs/sedges are present in the understory. A continuous mat of feathermosses or sphagnum is often present. Lichens are present locally.

Viereck et al (1992) classes:

- 2C2K Open Low Alder-Willow Shrub
- 2C2L Open Low Alder Shrub

Similar fuel types:

- (26) Open Tall Willow Alder Shrub
- (29) Closed Low Willow/Alder-Willow Shrub
- (30) Open Low Mixed Shrub-Sedge Tussock Tundra/Bog

(35) Sagebrush-Grass / Grass – Juniper



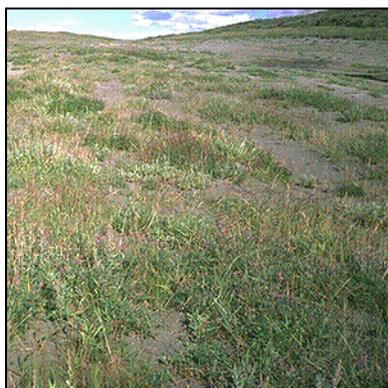
2C2M. Sagebrush-Juniper (Photo courtesy of Koyukuk National Wildlife Refuge)



2C2M. Sagebrush-Juniper (Photo courtesy of Yukon Charley Rivers National Park)



2C2N. Sagebrush-Grass (Photo Courtesy of the Yukon-Charley Rivers National Preserve)



2C2N. Sagebrush-Grass (Photo Courtesy of Gates of the Arctic National Park & Preserve)



2C2N. Sagebrush-Grass (Photo Courtesy of the Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – GR1
- FBFM13 – 8
- CFFBPS – O1

Primary carrier of fire:

- Grass & shrub

Fire behavior comments:

- Grass will increase rate of spread
- Amount of bare ground or continuity of fuel bed will impact fire behavior
- FBFM13 fuel model 8 will likely under-predict ROS, could use fuel model 10 up to 6 mph mid-flame winds

Vegetation characteristics:

Aspen is present with less than 10% cover. Sagebrush, taller than 20 cm (8 in), is present with 25-75% cover. Shrubs taller than 1.5 m (5 ft) contribute less than 25% cover. Grasses and herbs are present. Mosses are scarce and lichens are scattered.

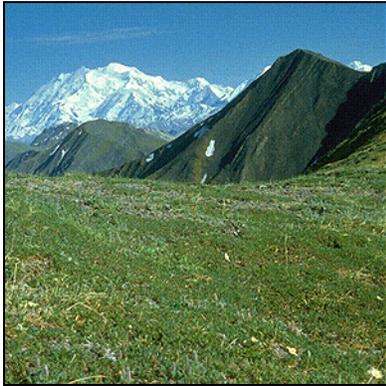
Viereck et al (1992) classes:

- 2C2N Sagebrush-Grass
- 2C2M Sagebrush-Juniper
-

Similar fuel types:

-
- (39) Grass-Shrub
- (16) Open Quaking Aspen Forest

(36) Dwarf Shrub Tundra



2D1A. Dryas Dwarf Shrub Tundra (Photo Courtesy of Denali National Park & Preserve)



2D1B. Dryas-Sedge Dwarf Shrub Tundra



2D3A. Willow Dwarf Shrub Tundra (Photo Courtesy of the Arctic National Wildlife Refuge)



2D1A. Burned Dryas Dwarf Shrub Tundra (Photo Courtesy of Kanuti National Wildlife Refuge)



2D3A. Willow Dwarf Shrub Tundra, Alaska Peninsula/Becharof (Photo Courtesy of Ducks Unlimited)



2D1A. Dryas Dwarf Shrub Tundra (Photo Courtesy of Ducks Unlimited)

Fuel models/types

- FBFM40 – GS1
- FBFM13 – 1
- CFFBPS – O-1a/b

Primary carrier of fire:

- Herbs & low shrubs

Fire behavior comments:

- Low fire behavior
- Fires backing into wind tend to burn faster than headfires

Vegetation characteristics:

Trees are absent or have less than 10% cover. This type is dominated by dryas, fruticose lichens, bearberry, *Vaccinium* species, crowberry, mountain heath, cassiope, or dwarf willows, which form mats a few centimeters (1 in) thick. Other dwarf or ericaceous shrubs may be present. Shrubs taller than 20 cm (8 in) range from 0-25% cover. Patterns, commonly steps or stripes, may be present. Forbs, mosses, and lichens are usually present. Sedges and other herbs, if present, may grow 10 – 30 cm (4 – 12 in) above the mat. Cover ranges from 2–100%. Mosses are commonly intertwined in the mat of ericaceous shrubs, if present. This type occurs primarily in the northern two thirds of Alaska.

Viereck et al (1992) classes:

- 2D1A Dryas Dwarf Shrub Tundra
- 2D1B Dryas-Sedge Dwarf Shrub Tundra

- 2D1C Dryas-Lichen Dwarf Shrub Tundra
- 2D2A Bearberry Dwarf Shrub Tundra
- 2D2B Vaccinium Dwarf Shrub Tundra
- 2D2C Crowberry Dwarf Shrub Tundra
- 2D2D Mountain Heath Dwarf Shrub Tundra
- 2D2E Cassiope Dwarf Shrub Tundra
- 2D3A Willow Dwarf Shrub Tundra

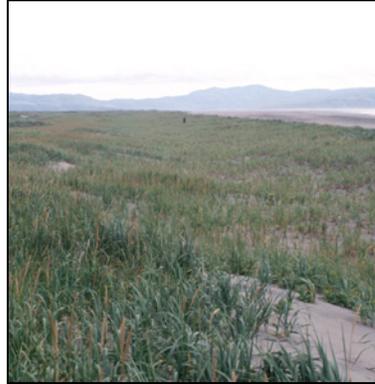
Similar fuel types:

- (30) Open Low Mixed Shrub-Sedge Tussock Tundra/Bog
- (31) Open Low Birch-Ericaceous Shrub/Bog
- (32) Open Low Birch-Willow/Ericaceous Shrub/Bog

(37) Elymus



3A1A. Elymus (Photo Courtesy of M. Fleming, SAIC)



3A1A. Elymus (Photo Courtesy of M. Fleming, SAIC)



3A1A. Elymus (Photo Courtesy of M. Fleming, SAIC)



3A1A. Burning Elymus (Photo Courtesy of Katmai National Park)

Fuel models/types

- FBFM40 – GS2
- FBFM13 – 5
- CFFBPS – O-1a/b

Primary carrier of fire:

- grass

Fire behavior comments:

- Grass only burns pre-green up or after cured and has a low moisture of extinction
- High fuel load with this type, but doesn't have the rate of spread of a grass model.

Vegetation characteristics:

Woody plants are scarce. This type is dominated by Elymus, which grows in dense pure stands, but can mix with other grasses or forbs. Elymus communities range in height from 20 cm (8 in) to over 1 meter (3 ft). Cover ranges from sparse to complete.

Viereck et al (1992) classes:

- 3A1A Elymus

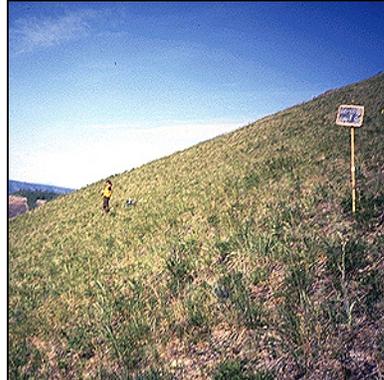
Similar fuel types:

- (39) Grass-Shrub
- (40) Grass-Herb
- (48) Wet Sedge-Grass Meadow-Marsh

(38) Grass – Shrub



3A1C. Midgrass-Shrub, Alaska Peninsula/Becharof
(Photo Courtesy of Ducks Unlimited)



3A1C. Midgrass-Shrub (Photo Courtesy of
Yukon – Charley Rivers National Preserve)



3A1C. Midgrass-Shrub (Photo Courtesy of
Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – GS2
- FBFM13 – 5
- CFFBPS – O-1a/b

Primary carrier of fire:

- Short grass

Fire behavior comments:

- Use GS1 to lower
ROS and flame length

Vegetation characteristics:

Scattered low ericaceous shrubs or willows, may be present with less than 25% cover. Sagebrush may be present on dry slopes. Communities are dominated by either fescue mixed with other grasses and forbs, medium height grasses (30 – 70 cm; 12 – 28 in) tall, or hair-grasses (40 – 80 cm; 16 – 32 in) tall. Feathermosses range from common to absent. Lichens range from sparse to common. Broad-leaved herbs may be present.

Viereck et al (1992) classes:

- 3A1B Dry Fescue
- 3A1C Midgrass-Shrub
- 3A1E Hair-Grass

Similar fuel types:

- (35) Sagebrush-Juniper
- (36) Sagebrush-Grass
- (38) Elymus
- (40) Grass-Herb
- (41) Bluejoint Meadow
- (42) Bluejoint Shrub Herb

(39) Bluejoint (*Calamagrostis*)



3A2A. Bluejoint Meadow (Photo Courtesy of Bering Land Bridge National Preserve)



3A2A. Bluejoint Meadow (Photo Courtesy of BLM Alaska Fire Service)



3A2A. Bluejoint Meadow (Photo Courtesy of Yukon Flats National Wildlife Refuge)

Fuel models/types

- FBFM40 – GR4
- FBFM13 – 2
- CFFBPS – O-1a/b

Primary carrier of fire:

- grass

Fire behavior comments:

- This type includes *Calamagrostis* species (reed grass); and post-fire, human disturbance.
- Can use GR7 or FBFM13 fuel model 3 if very heavy fuel loads on South Central (excluding Copper River Basin)
- Seasonality and percent curing will have a dramatic effect on rate of spread. Use 30% herbaceous moisture for pre-greenup, transition to 120% at full green-up (May 25 – June 30 depending on location), then back to 30% by late August

Vegetation characteristics:

Woody plants are rare or absent, but a mosaic pattern of bluejoint meadow and tall shrubs like alder may be present. These communities are dominated by bluejoint reedgrass (0.8 – 1.4 m; 32 – 55 in) tall. Cover is usually complete with very dense vegetation. Other grasses and herbs may be present. Mosses are often absent, but feathermosses may be present in more open stands. Wetter sites may have hummocks.

Viereck et al (1992) classes:

- 3A2A Bluejoint Meadow

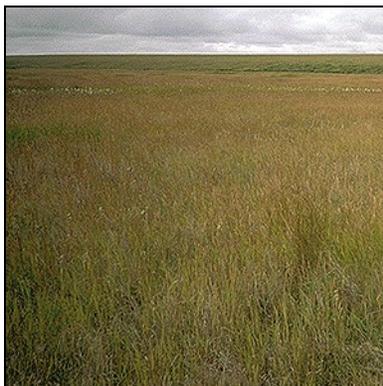
Similar fuel types:

- (40) Grass-Herb
- (42) Bluejoint-Shrub/Herb

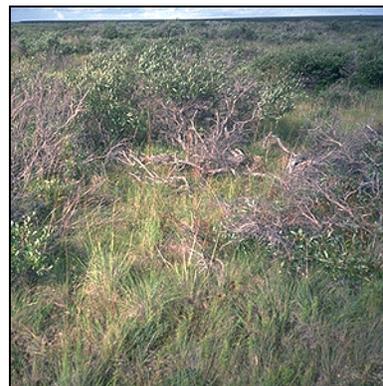
(40) Bluejoint – Shrub / Bluejoint – Herb



3A2B. Bluejoint-Herb (Photo Courtesy of M. Fleming, SAIC)



3A2B. Bluejoint-Herb (Photo Courtesy of Bering Land Bridge National Preserve)



3A2C. Bluejoint-Shrub (Photo Courtesy of Cape Krusenstern National Monument)



3A2b. Bluejoint-Herb (Photo Courtesy of Kenai National Wildlife Refuge)

Fuel models/types

- FBFM40 – GR2
- FBFM13 – 6
- CFFBPS – O-1a/b

Primary carrier of fire:

- Grass

Fire behavior comments:

- Fire occurrences will be more common pre-green up. During peak green-up GR1 may be more representative of fire behavior

Vegetation characteristics:

Shrubs, like alder, may be tall or short with less than 25% cover growing intermixed with bluejoint. Willow and sweetgale may also be present. These types are dominated by equal amounts of bluejoint and herbs and shrubs, usually 0.8 to 1.5 m (32 – 59 in) tall. Sedges and other grasses may be present. Feathermosses may be absent or common; *Sphagnum* species are present in small quantities on wetter sites, which may be hummocky. Lichens are rare.

Viereck et al (1992) classes:

- 3A2B Bluejoint-Herb
- 3A2C Bluejoint-Shrub

Similar fuel types:

- (38) Elymus
- (40) Grass-Herb
- (41) Bluejoint Meadow

(41) Tussock Tundra



3A2D. Tussock Tundra (Photo Courtesy of Noatak National Preserve)



3A2D. Tussock Tundra (Photo Courtesy of Selawik National Wildlife Refuge)



3A2D. Tussock Tundra (Photo Courtesy of Arctic National Wildlife Refuge)



3A2D. Tussock Tundra, June 17 (Photo Courtesy of Kanuti National Wildlife Refuge)



3A2D. Tussock Tundra (Photo Courtesy of M. Fleming)

Fuel models/types

- FBFM40 – GR4
- FBFM13 – 1
- CFFBPS – O-1a/b

Primary carrier of fire:

- tussocks

Fire behavior comments:

- Fire growth is often associated with backing and flanking fire after the initial head fire event
- There is a relative humidity threshold where fire growth is significantly hampered, around 30%

Vegetation characteristics:

Low shrubs often grow between tussocks, usually shorter than the sedges, but sometimes taller. Cover is less than 25%. These communities are dominated by sedges in a tussock growth form, which are commonly 10 – 60 cm (4 – 24 in) tall, spaced 30 – 60 cm (12 – 24 in) apart. Mosses and lichens are common. *Sphagnum* species may be locally abundant, but are often absent.

Viereck et al (1992) classes:

- 3A2D Tussock Tundra

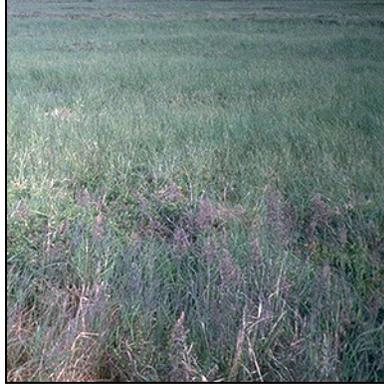
Similar fuel types:

- (30) Open Low Mixed Shrub-Sedge Tussock Tundra/Bog
- (31) Open Low Birch-Ericaceous Shrub/Bog
- (32) Open Low Birch-Willow/Ericaceous Shrub/Bog

(42) Mesic Sedge – Grass Meadow or Tundra / Mesic Sedge – Herb Meadow or Tundra



3A2G. Mesic Grass-Herb Meadow Tundra (Photo Courtesy of M. Fleming, SAIC)



3A2G. Mesic Grass-Herb Meadow Tundra (Photo Courtesy of Cape Krusenstern National Monument)



3A2G. Mesic Grass-Herb Meadow Tundra (Photo Courtesy of Cape Krusenstern National Monument)



3A1D. Midgrass-Herb (Photo Courtesy of Gates of the Arctic National Park & Preserve)



3A1D. Midgrass-Herb (Photo Courtesy of Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – GS1
- FBFM13 – 5
- CFFBPS – O-1a/b

Primary carrier of fire:

- Grass & herb

Fire behavior comments:

- N/A

Vegetation characteristics:

These communities are dominated by middle-height grasses and broad-leaved herbs. Sedges may be present. This type does not include bluejoint grass, *Calamagrostis*. Woody plants are absent, scattered, or common but with less than 25% cover. Lichens and non-sphagnaceous mosses may be sparse to common. Canopy heights are under 70 cm (28 in) and plant cover ranges from variable to complete. This type occurs on mesic sites ranging from alpine and subalpine meadows and slopes to lowland meadows and coastal areas. Plant cover is usually high.

Viereck et al (1992) classes:

- 3A1D Midgrass-Herb
- 3A2E Mesic Sedge-Grass Meadow Tundra
- 3A2F Mesic Sedge-Herb Meadow Tundra
- 3A2G Mesic Grass-Herb Meadow Tundra

Similar fuel types:

- (40) Grass-Herb
- (44) Mesic Sedge-Grass-Herb Meadow Tundra
- (45) Sedge Willow Dryas Tundra
- (47) Wet Meadow Tundra
- (48) Wet Sedge-Grass Meadow-Marsh
- (51) Wet Species – Non Burnable

(43) Sedge – Willow / Sedge – Dryas Tundra



3A2H. Sedge Willow Tundra (Photo Courtesy of Yukon – Charley Rivers National Preserve)



3A2H. Sedge Willow Tundra (Photo Courtesy of Alaska Center for Conservation Science)



3A2J. Sedge Dryas Tundra (Photo Courtesy of Cape Krusenstern National Monument)

Fuel models/types

- FBFM40 – GR1
- FBFM13 – 1
- CFFBPS – O-1a/b

Primary carrier of fire:

- Grass and herbs

Fire behavior comments:

- N/A

Vegetation characteristics:

Willows are easily noticed, with cover less than 25%. Other shrubs may be present. Shrubs may be concentrated on low micro relief ridges, hummocks, or solifluction lobes, which are often present. This community is dominated by sedges with dryas or willows. Mosses are common and may form a continuous mat. Non-sphagnaceous mosses are often common, while *Sphagnum* species and lichens are generally rare, but abundant at some sites. Canopy height is 15 – 50 cm (6 – 20 in), while cover ranges from open to complete. This type is common on alpine slopes throughout Alaska, except the southeast.

Viereck et al (1992) classes:

- 3A2H Sedge-Willow Tundra
- 3A2J Sedge-Dryas Tundra

Similar fuel types:

- (33) Open Low Willow/Sweetgale
- (44) Mesic Sedge-Grass-Herb Meadow Tundra
- (47) Wet Meadow Tundra

(44) Sedge – Birch Tundra



3A2I. Sedge-Birch Tundra (Photo Courtesy of Yukon – Charley Rivers National Preserve)



3A2I. Sedge-Birch Tundra (Photo Courtesy of Yukon – Charley Rivers National Preserve)



3A2I. Sedge-Birch Tundra (Photo Courtesy of Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – GR2
- FBFM13 – 6
- CFFBPS – O-1a/b

Primary carrier of fire:

- Herbs & shrubs

Fire behavior comments:

- If more active fire activity is observed could use GR4 or GS3 for higher moisture of extinction (longer burn period)

Vegetation characteristics:

Shrub birch comprise less than 25% cover and are often located on hummocks. This type is dominated by sedges with shrub birch. Mosses, including feathermosses and *Sphagnum* species may be common.

Viereck et al (1992) classes:

- 3A2I Sedge-Birch Tundra

Similar fuel types:

- (30) Open Low Mixed Shrub-Sedge Tussock Tundra/Bog
- (44) Mesic Sedge-Grass-Herb Meadow Tundra
- (47) Wet Meadow Tundra

(45) Wet Meadow Tundra



3A3A. Wet Sedge Meadow Tundra (Photo Courtesy of Bering Land Bridge National Preserve)



3A3A. Wet Sedge Meadow Tundra (Photo Courtesy of Bering Land Bridge National Preserve)



3A3A. Wet Sedge Meadow Tundra (Photo Courtesy of Bering Land Bridge National Preserve)

Fuel models/types

- FBFM40 – GR1
- FBFM13 – 10
- CFFBPS – O-1a/b

Primary carrier of fire:

- Herbs

Fire behavior comments:

- Dependent on water table, otherwise if submerged, will be NB6

Vegetation characteristics:

Woody plants are usually absent, but some prostrate willows may be present. This type is dominated by sedges, grasses, and/or broad-leaved herbs. Mosses and lichens may be absent to common. Cover ranges from open to complete. This type occurs in arctic lowlands, tundra areas, and near the arctic coast.

Viereck et al (1992) classes:

- 3A3A Wet Sedge Meadow Tundra
- 3A3B Wet Sedge-Grass Meadow Tundra
- 3A3C Wet Sedge-Herb Meadow Tundra

Similar fuel types:

- (44) Mesic Sedge-Grass-Herb Meadow Tundra
- (47) Wet Meadow Tundra
- (48) Wet Sedge-Grass Meadow-Marsh
- (49) Wet Sedge Meadow-Bog-Shrub
- (51) Wet Species – Non Burnable

(46) Wet Sedge – Grass Meadow-Marsh



3A3H. Halophytic Grass Wet Meadow (Photo Courtesy of Bering Land Bridge National Preserve)



3A3D. Fresh Sedge Marsh (Photo Courtesy of M. Fleming, SAIC)



3A3D. Fresh Sedge Marsh (Photo Courtesy of M. Fleming, SAIC)

Fuel models/types

- FBFM40 – GR1
- FBFM13 – 1
- CFFBPS – O-1a/b

Primary carrier of fire:

- grass

Fire behavior comments:

- Dependent on water table, otherwise if submerged, will be fuel model NB6

Vegetation characteristics:

Trees are absent. Low shrubs may be present, but are likely absent. These types are dominated by tall, emergent sedges (ranging in height from 3 – 100 cm; 0.1 – 36 in) tall; grasses growing in deep water; and halophytic (salt-tolerant) grass species such as *Puccinellia* species. Halophytic forbs may be present. Marine algae and aquatic mosses are present at some sites. Lichens are absent. Plant cover ranges from sparse to dense but less than complete because the dominant plants do not have leaves.

Viereck et al (1992) classes:

- 3A3D Fresh Sedge Marsh
- 3A3E Fresh Grass Marsh
- 3A3H Halophytic Grass Wet Meadow
- 3A3I Halophytic Sedge Wet Meadow

Similar fuel types:

- (33) Open Low Willow/Sweetgale
- (47) Wet Meadow Tundra
- (49) Wet Sedge Meadow-Bog-Shrub

(47) Wet Sedge Meadow or Bog / Wet Sedge – Shrub Meadow or Bog



3A3j. Subarctic Lowland Sedge-Bog Meadow (Photo courtesy of Kanuti National Wildlife Refuge)



3A3j. Subarctic Lowland Sedge-Bog Meadow (Photo Courtesy of Kenai National Wildlife Refuge)



3A3j. Subarctic Lowland Sedge-Bog Meadow (Photo Courtesy Alaska Center for Conservation Science)

Fuel models/types

- FBFM40 – GR1
- FBFM13 – 9
- CFFBPS – O-1a/b

Primary carrier of fire:

- Herbs

Fire behavior comments:

- Dependent on water table, otherwise if submerged, will be fuel model NB6
- FBFM13 fuel model 2, if wanting to use a grass model

Vegetation characteristics:

Trees are absent or widely scattered and stunted. Low shrubs range from absent to 25% cover. These freshwater wetland communities are dominated by coarse and tall or slender and low sedges; low peat-forming sedges growing on bog peats; or mosses such as *Sphagnum* species. The sedges are not rooted in a moss mat. Mosses may be common when not dominant. Plant cover is usually complete. Lichens are common to scarce. The soil surface may have hummocks.

Viereck et al (1992) classes:

- 3A3F Subarctic Lowland Sedge Wet Meadow
- 3A3G Subarctic Lowland Sedge-Shrub Wet Meadow
- 3A3J Subarctic Lowland Sedge-Bog Meadow
- 3A3K Subarctic Lowland Sedge-Moss Bog Meadow

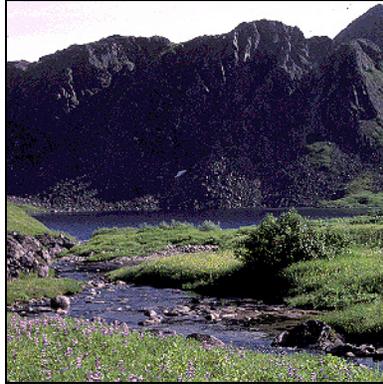
Similar fuel types:

- (33) Open Low Willow/Sweetgale
- (44) Mesic Sedge-Grass-Herb Meadow Tundra
- (47) Wet Meadow Tundra
- (48) Wet Sedge-Grass Meadow-Marsh
- (51) Wet Species – Non Burnable

(48) Dry Species – Non Burnable



3B1C. Alpine Herbs (Photo Courtesy of Wrangell – St. Elias National Park & Preserve)



3B1C. Alpine Herbs (Photo Courtesy of M. Fleming, SAIC)



3C1B. Dry Bryophyte (Moss) (Photo Courtesy of Gates of the Arctic National Park & Preserve)

Fuel models/types

- FBFM40 – NB7
- FBFM13 – 99
- CFFBPS – N/A

Primary carrier of fire:

- N/A

Fire behavior comments:

- NB7 custom fuel model is for non-burnable, dry, and sparse vegetation

Vegetation characteristics:

Woody plants range from absent to present. This type has a wide variety of herbs colonizing previously unvegetated landscapes or talus and block fields. These types may also be composed of bryophytes, usually mosses, and include moss mound communities of dead mosses and rock. Lastly, they may be dominated by foliose and fruticose lichens. Vascular plants and scattered grasses may be present to absent. Small patches of mosses may be present. Lichens range from scarce to common, especially crustose lichens. Cover is low and bare ground and rock may be common.

Viereck et al (1992) classes:

- 3B1A Seral Herbs
- 3B1C Alpine Herbs
- 3C1B Dry Bryophyte (moss)
- 3C2B Foliose and Fruticose Lichen

Similar fuel types:

- (37) Dwarf Shrub Tundra
- (44) Mesic Sedge-Grass-Herb Meadow Tundra
- (51) Wet Species – Non Burnable
- (54) Crustose Lichen

(49) Wet Species – Non Burnable



3B1B. Alpine Herb – Sedge (Photo Courtesy of M. Fleming, SAIC)



3B3A. Fresh Herb Wet Meadow (Photo Courtesy of Kenai National Wildlife Refuge)

Fuel models/types

- FBFM40 – NB6
- FBFM13 – 99
- CFFBPS – N/A

Primary carrier of fire:

- N/A

Fire behavior comments:

- NB6 custom fuel model is for non-burnable, wet vegetation

Vegetation characteristics:

Woody plants are absent. These types are varied. Some include a variety of herbs, mosses, and some lichens residing below late-lying snowbanks in mountainous areas. Others are dominated by emergent herbs in deep water. Floating-leaved or submerged aquatic plants may be present along with aquatic mosses. Wet meadows may be dominated by broad-leaved herbs (freshwater or halophytic) or nonwoody plants other than grasses or sedges (freshwater or halophytic), which are scattered to absent. Wet bryophyte communities differ from the others in that they are composed of bryophytes, including mosses and hepatics, with usually 100% cover. Cover for all other communities is likely sparse and much bare ground is present. Lichens and mosses may be present to absent.

Viereck et al (1992) classes:

- 3B1B Alpine Herb-Sedge (Snowbed)
- 3B3A Fresh Herb Marsh
- 3B3B Subarctic Lowland Herb Wet Meadow
- 3B3C Subarctic Lowland Herb Bog Meadow
- 3B3D Halophytic Herb Wet Meadow
- 3C1A Wet Bryophyte (moss)

Similar fuel types:

- (37) Dwarf Shrub Tundra
- (44) Mesic Sedge-Grass-Herb Meadow Tundra
- (47) Wet Meadow Tundra
- (48) Wet Sedge-Grass Meadow-Marsh
- (49) Wet Sedge Meadow-Bog-Shrub
- (50) Dry Species – Non Burnable

(50) Mesic Forb Herbaceous



3B2B. Fireweed (Photo Courtesy of Denali National Park & Preserve)



3B2D. Ferns (Photo Courtesy of M. Fleming, SAIC)



3B2A. Mixed Herbs (Photo Courtesy of Yukon Flats National Wildlife Refuge)

Fuel models/types

- FBFM40 – GR1
- FBFM13 – 1
- CFFBPS – O-1a/b

Primary carrier of fire:

- Herbs

Fire behavior comments:

- If dried out in the fall, fireweed (3B2B) will burn
- Large Umbel community (3B2C) will burn pre green-up

Vegetation characteristics:

Woody plants are rare to present. These types are dominated by herbs, fireweed, tall herbs in the Umbelliferae family, or a lush growth of ferns with almost complete cover. Sedges, grasses, ferns, and mosses (nonsphagnaceous and feathermosses) are common. Lichens may be present. Occurs at sites with spring snow melt or recently burned areas.

Viereck et al (1992) classes:

- 3B2A Mixed Herbs
- 3B2B Fireweed
- 3B2C Large Umbel
- 3B2D Ferns

Similar fuel types:

- (38) Elymus
- (42) Bluejoint Shrub Herb

(51) Foliose and Fruticose Lichen



3C2B. Foliose and Fruticose Lichen (Photo Courtesy of Gates of the Arctic National Park & Preserve)



3C2B. Foliose and Fruticose Lichen (Photo Courtesy of Tetlin National Wildlife Refuge)



3C2B. Foliose and Fruticose Lichen (Photo Courtesy of Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – GR1
- FBFM13 – 2
- CFFBPS – O-1a

Primary carrier of fire:

- lichen

Fire behavior comments:

- Highly dependent on low moisture for fire behavior
- More continuous lichen mat consider using GR2 or GR3

Vegetation characteristics:

Vascular plants are absent or nearly so. This type is dominated by foliose and fruticose lichens of the *Cladonia*, *Cladina*, and *Stereocaulon* genera. Crustose lichens may be present. Mosses are uncommon.

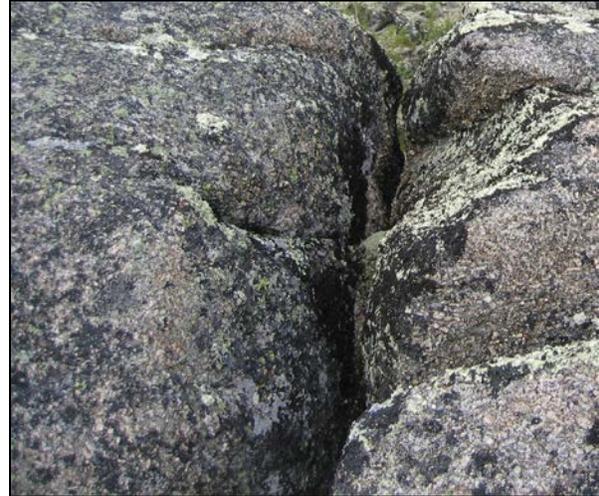
Viereck et al (1992) classes:

- 3C2B Foliose and Fruticose Lichen

Similar fuel types:

- (37) Dwarf Shrub Tundra
- (44) Mesic Sedge-Grass-Herb Meadow Tundra
- (54) Crustose Lichen

(52) Crustose Lichen



3C2A. Crustose Lichen (Photos Courtesy of Kanuti National Wildlife Refuge)

Fuel models/types

- FBFM40 – NB9
- FBFM13 – 99
- CFFBPS – N/A

Primary carrier of fire:

- N/A

Fire behavior comments:

- Rock present

Vegetation characteristics:

Vascular plants are absent or nearly so. This community is dominated by crustose lichens such as *Rhizocarpon*, and *Lecanora* genera. Rock inhabiting foliose lichens are common. Fruticose lichens, mosses, and vascular plants are absent to rare, with sparse plant cover.

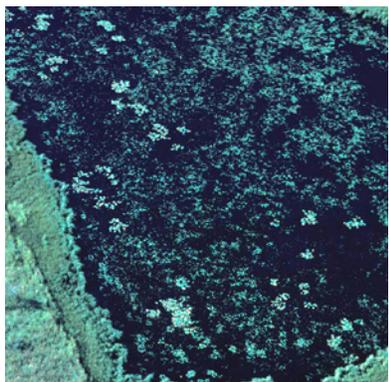
Viereck et al (1992) classes:

- 3C2A Crustose Lichen

Similar fuel types:

- (37) Dwarf Shrub Tundra
- (53) Foliose and Fruticose Lichen

(53) Aquatic Herbaceous



3D1F. Fresh Pondweed (Photo courtesy of Innoko National Wildlife Refuge)



3D1a. Pondlily (Photo Courtesy of M. Fleming, SAIC)



3D1. Freshwater Aquatic Vegetation, Innoko Flats. (Photo Courtesy of Ducks Unlimited)

Fuel models/types

- FBFM40 – NB8
- FBFM13 – 98
- CFFBPS – N/A

Primary carrier of fire:

- N/A

Fire behavior comments:

- Water present

Vegetation characteristics:

This type has a number of communities where either fresh or salt water are present at levels to inhibit fire behavior. The freshwater aquatic herbaceous communities include pondlilies, common marestalk, aquatic buttercup, burreed, water milfoil, pondweeds (growing submerged to extending above the surface), water star-wort, and aquatic cyptogams. Communities that reside in brackish water ponds near the sea coast include four-leaf marestalk and brackish pondweed. Aquatic marine herbaceous communities include eelgrass and marine algae. Emergent communities are scattered to absent. Vascular plants may be present.

Viereck et al (1992) classes:

- 3D1A Pondlily
- 3D1B Common Marestalk
- 3D1C Aquatic Buttercup
- 3D1D Burreed
- 3D1E Water Milfoil
- 3D1F Fresh Pondweed
- 3D1G Water Star-Wort
- 3D1H Aquatic Cryptogam
- 3D2A Four-Leaf Marestalk
- 3D2B Brackish Pondweed
- 3D3A Eelgrass
- 3D3B Marine Algae

Similar fuel types:

- (47) Wet Meadow Tundra
- (48) Wet Sedge-Grass Meadow-Marsh
- (49) Wet Sedge Meadow-Bog-Shrub
- (51) Wet Species – Non Burnable

(54) Standing Dead Beetle-Kill Spruce Forest



White Spruce Forest Killed by Bark Beetles *(Photo Courtesy of Alaska State Forestry)*



White Spruce Forest impacted by bark beetle infestation *(Photo Courtesy of Kenai Peninsula Borough)*



1A1J. Torching/Crown fire in closed white spruce forest *(Photo Courtesy of Wrangell - St. Elias National Park & Preserve)*



Torching Beetle-Kill Spruce in Background with Dead Canopy Structure in Foreground *(Photo Courtesy of Alaska State Forestry)*



Close up view of hairy species lichen growing on limbs of beetle kill spruce *(Photo Courtesy of the Kenai Peninsula Borough)*



Close up view of a Fruticose species lichen mixed a with Foliose Lichen on dead spruce *(Photo Courtesy of the Kenai Peninsula Borough)*

Suggested Fuel models/types

- FBFM40 – SB2/SB3
- FBFM13 – 12
- CFFBPS – M-3

Primary carrier of fire:

- Blue joint (*Calamagrostis*) grass, feathermoss, lichen

Fire behavior comments:

- Surface flames of one/two feet will initiate canopy fire involvement
- Active crown fire can occur in moderate wind and fire danger conditions
- Flame length of active crown fire involvement is typically 1 ½ times tree height
- Probability of spot fire ignition is very high in this fuel complex with spot fires of 1 mile distance common.

Vegetation characteristics:

Spruce forest with tree mortality ranging from 60% to 95% of stand structure as a result of bark beetle epidemic (*dendroctonus rufipennis*). Forest composition is predominately spruce conifer with less than 33% hardwood species; typically closed canopy. Beetle impacted spruce have a “red needle” stage as the last phase before tree mortality. Dead trees retain fine limbs for many years and often serve as host structure to an abundance of lichen species material. Depending on moisture/climatic conditions of beetle infestation area, standing dead spruce forests begin to experience stem decay and breakage within 5 to 10 years after bark beetle infestation. Most stands start to fully unravel by 20 years after beetle attack.

Viereck et al (1992) classes:

- 1A1J Closed White Spruce Forest

Similar fuel types:

- (3) Closed Black Spruce Forest
- (5) Open White Spruce Forest

Notes about burn patterns and post-fire vegetative succession:

- Early and mid-season fires in this fuel complex can generate high intensity canopy fires that are spectacular to observe which consume almost all above ground 1hr, 10hr and 100hr fuel loading.
- As contrast, depth of surface/duff layer fuel consumption is often “light” in early to mid-season fires. Later season fires with slow rates of spread and higher duff moisture code values (drought) can generate greater duff consumption patterns.
- Duff layer consumption is a pivotal factor for determining expected post-fire vegetation results.
- Canopy fire intensity in this type of fuel complex typically kills most remnant live spruce not affected by beetles along with many hardwood trees. The end result is far less tree seed production and seed dispersal density when compared to forest fires not influenced by bark beetle mortality.

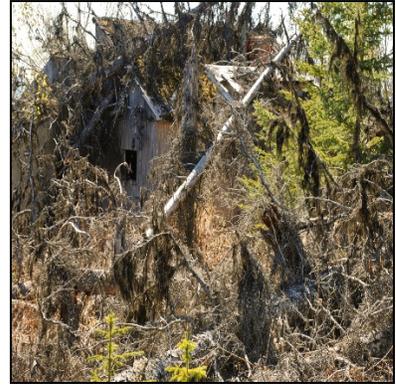
(55) Heavy Stem Breakage/Downed & Jack-Straw Spruce Aged Post Mortality Beetle-Kill Forest



Spruce Forest 13 years after bark beetle infestation
(Photo Courtesy of Alaska Division of Forestry)



Spruce Forest along salmon stream 16 years after extensive beetle attack (Photo Courtesy of Alaska Division of Forestry)



Spruce Forest with beetle kill at unmanaged cabin site
(Photo Courtesy of Kenai Peninsula Borough)



Spruce forest 11 years after bark beetle epidemic
(Photo Courtesy of Alaska Division of Forestry)



Close up view of Foliose lichen growing on downed beetle kill spruce (Photo Courtesy of the Kenai Peninsula Borough)



Aerial view of beetle impacted spruce forest 15 years after infestation (Photo Courtesy of Kenai Peninsula Borough)

Suggested Fuel models/types

- FBFM40 – SB3
- FBFM13 – 13
- CFFBPS - C-3

Primary carrier of fire:

- Grass fine fuels
- Lichen attached tree limb structure
- 10 hour dead tree material

Fire behavior comments:

- 10-hour and 100-hour fuel components are normally below expected fuel moisture content levels in early to middle fire season periods.
- Passive to active fire involvement of remnant canopy layers, both dead and green trees, are almost always included in the fire front spread.
- Down-wind fuel beds are highly receptive to spot fire development.
- Crew mobility and rates of travel through this fuel complex are greatly compromised. Well planned safety zones and locations for safe egress are paramount to crew safety in this fuel type.
- Use of aerial fire retardant is generally not effective because the retardant material does not fully penetrate through the fuel layer.

- Fires that occur after grass (*Calamagrostis*) has reached seasonal “green-up” will diminish rates of fire spread and intensity although prolific spot fire occurrence can still be expected.

Vegetation characteristics:

Spruce forests heavily impacted by bark beetle infestation usually begin to experience stem breakage about 8 to 15 years after mortality. More moist climatic areas with greater fungal growth activity cause more rapid stem breakage and timber stand unraveling. Significant windstorms also can accelerate stem breakage patterns.

Closed spruce forests accumulate a heavy fuel layer of downed and jackstraw trees as stem breakage becomes advanced. The forest floor layer of vegetation is commonly composed of blue joint (*Calamagrostis*) grass which adds a volume of 3 to 5 tons/acre of fine fuel component during early season fires.

Viereck et al (1992) classes:

- 1A1J Closed White Spruce Forest

Similar fuel types:

- (3) Closed Black Spruce Forest
- (5) Open White Spruce Forest

Notes about burn patterns and post-fire vegetative succession:

- Early and mid-season fires in this fuel complex can generate significant BTU combustion intensity at the surface level. Nevertheless, they commonly yield limited duff consumption because of frozen ground or high duff moisture content soon after snow melt.
- Herbaceous vegetation response after spring/early summer fires exhibits robust growth with warming soils associated with blackened surfaces and increased nutrient mineral availability in fire ash content.
- Fires in remnant forest sites composed with a mix of grass (*calamagrostis*) and fireweed tend to accelerate a flush of fireweed growth/dominance after a burn.
- Late summer/fall season fires in this fuel complex have greater probability of occurring with lower duff moisture content/drought conditions. These fires tend to have less initial fire intensity but longer burn residence time. This pattern causes less impact to live trees and typically generates more shrub and forest species sprouting response.

(56) Closed Spruce Forest with Moderate Downed Beetle Kill/ Mixed Spruce & Hardwood Forest with Moderate Beetle Kill



Spruce forest with about 50% beetle kill mortality and stem breakage (Photo Courtesy of the Kenai Peninsula Borough)



Open mixed birch and spruce forest with most spruce dead (Photo Courtesy of the Kenai National Wildlife Refuge)



Open spruce forest about 15 years after beetle infestation (Photo Courtesy of the Alaska Division of Forestry)



Open spruce stand about 12 years after beetle attack after grass seasonal "green-up" (Photo ??)



Downed spruce after grass seasonal "green-up" (Photo Courtesy of the Alaska Division of Forestry)



Example of fire energy release from a single downed spruce tree canopy structure (Photo Courtesy of the Alaska Division of Forestry)



Aerial view of downed beetle kill trees in a mixed spruce and birch timber stand (Photo Courtesy of the Kenai Peninsula Borough)

Suggested Fuel models/types

- FBFM40 – TU5
- FBFM13 – 10
- CFFBPS – M-3

Primary carrier of fire:

- Grass fine fuels
- Feathermoss, forest litter, duff
- Lichen attached to tree limb structure

Fire behavior comments:

- 10-hour and 100-hour fuels of downed and jackstraw dead spruce tree material are usually well below fuel moisture content levels expected in early to mid-season periods.
- Fires occurring at lower/mid-level hazard conditions will be fuels driven; expanding at 5 to 20 ch/hr in dead jackstraw fuel pockets with occasional passive torching in neighboring forest canopy.
- Slow moving fires with +/- 1 foot flames will generate 4' to 10' flames in a quick time frame after reaching downed beetle-kill spruce.
- Fires occurring at high level/extreme fire conditions will likely involve active crown fire because of ladder fuel loading

Vegetation characteristics:

This type of forest structure is associated with closed or open spruce forests, or mature stands with mixed spruce and deciduous tree composition, that have experienced moderate levels of bark beetle mortality in times past with subsequent dead tree breakage/unraveling. The forest canopy structure will be open with possible larger pockets of decadent jackstraw/downed spruce trees. Open canopy areas/expanses will usually have surface vegetation dominated by blue joint reed grass (*calamagrostis*). Portions of remnant healthy forest canopy will have concurrent surface vegetation normal to older dominant stands; principally, moss cover and numerous herbaceous berry species. Intermediate brush layers of rusty menziesia, devils club or sitka alder are found on some vegetative sites.

Viereck et al (1992) classes:

- 1C1A Closed Spruce-Paper Birch Forest
- 1C1C Closed Spruce-Paper Birch-Quacking Aspen Forest
- 1C2A Open Spruce-Paper Birch Forest

Similar fuel types:

- (3) Closed Black Spruce Forest
- (5) Open White Spruce Forest

(57) Post-Timber Harvest Areas with Bluejoint Grass and Logging Slash Fuel Beds



Mixed grass and fireweed fuels about 8 years after salvage timber harvest (Photo Courtesy of the Kenai Peninsula Borough)



Fall season grass fuels about 6 years after salvage logging (Photo Courtesy of the Kenai Peninsula Borough)

Suggested Fuel models/types

- FBFM40 – GR-7
- FBFM13 – 3
- CFFBPS – O-1a/b

Primary carrier of fire:

- grass
- 1hr & 10hr logging slash debris

Fire behavior comments:

- Logging slash 1hr and 10hr fuel loading of one to three tons/ac is typical volume range in post-timber harvest sites
- Logging slash component adds a longer burn residence time compared to grass fires
- When grass is dead/dormant, logging slash does not add significant change for Rate of Spread outputs but does increase flame length intensity compared to grass fuel models
- Logging slash fuels can generate significant fire intensity well into the grass “green-up” season when high fuel moistures normally diminish fire production
- Logging slash also affects resistance to fire control and mop-up time compared to grass fuel models

Vegetation characteristics:

Blue Joint grass (*Calamagrostis canadensis*) is a minor vegetative component in most mature upland timber stands. If sites are disturbed and canopy opens because of logging or insect infestation, *Calamagrostis* often becomes the principal surface vegetation on these sites. Once established, *Calamagrostis* can dominant site vegetation for 30 years or longer duration. Fires on grass dominated sites do not normally have adverse impact rhizome layers. To the contrary, ash mineralization actually serves to produce a flourish of new grass production.

Viereck et al (1992) classes:

- 3a2a Bluejoint meadow grass

Similar fuel types:

- Grass composition riparian zones

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