Fire Regime Condition Class (FRCC) Interagency Handbook
Reference Conditions

Modeler: Greg Nowacki, Thomas-Van Gundy, Cleland, Merzenich **Date:** 20 December, 2004 **PNVG Code:** MBOA

Potential Natural Vegetation Group: Maple-Basswood Oak-Aspen Forest Mosaic

Geographic Area: This mosaic forest type historically occurred within the buffer zone between the "Big Woods" of southeastern Minnesota and the prairie lying to the west (Grimm 1984). This forest type spans from northern Minnesota and Wisconsin southward into Iowa and Illinois, and from the forest-prairie margin eastward to Lake Michigan. This forest type abuts northern hardwoods to the north and prairies to the west. The western range of beech forms the eastern boundary, whereas its southern margin roughly parallels the maximum extent of past glaciation.

Description: Following deglaciation, most of the present Maple-Basswood Oak-Aspen Forest Mosaic became prairie between 9000 and 6000 years before present (Webb et al. 1993). Oak woodland began invading the prairie about 5000 years ago, becoming fully established 2400 years ago (Grimm 1981). Oak woodland persisted until 300 years ago, when elm, basswood, and sugar maple rapidly expanded and became a co-dominant with oak in this fire-induced mosaic. The changes from prairie to oak woodland, and from oak woodland to 'bigwoods' must have resulted from reductions in fire frequency, which were probably caused by increased precipitation and possibly decreased temperatures (ibid). Historically, elm dominated the overstory within the maple-beech component, however this species has been largely eliminated from this system due to Dutch Elm Disease. The elm-basswood-maple forests occurred on rich, mesic sites that were inherently more protected from fire, whereas oak and aspen dominated within analogous edaphic settings that were exposed to fire and repeatedly burned.

Fire Regime Description: Fire Regimes III (mixed severity) and V (long-interval replacement). Mosaic landscapes composed of both fire-sensitive mesophilic and fire-tolerant pyrophilic hardwood species. Stands dominated by elm, basswood, and maple historically were restricted to fire-protected portions of the landscape, such as east sides (leeward sides) of lakes and rivers, north-facing slopes, mesic ravines, river bottoms, etc. Occasionally during drought conditions, surface fires did burn into these stands, setting back succession. Where fire was more frequent on the landscape, oak-hickory and oak-aspen forests would dominate. However, over time without fire, mesophytic species would regenerate and gain dominance where conditions allowed.

Vegetation Type and Structure

Class*	Percent of Landscape	Description
A: post replacement	5	Early-successional aspen, white birch, oak, openlands (< 60 yrs).
B: mid seral open	15	Mid-succession open forests (61-150 yrs)
C: mid seral closed	10	Mid-succession closed forests (61-150 yrs)
D: late seral open	50	Late-successional open forests maintained by surface fires (>150 yrs)
E: late seral closed	20	Late-successional closed fire resistant forests (> 150 yrs)
Total	100	

*Formal codes for classes A-E are: AESP, BMSC, CMSO, DLSO, and ELSC, respectively.

Fire Frequency and Severity

Fire Severity	Fire Frequency (yrs)	Probability	Percent, All Fires	Description
Replacement Fire	750	.0013	5	
Non-Replacement Fire	33	.03	95	
All Fire Frequency*	32	.031	100	

*All Fire Probability = sum of replacement fire and non-replacement fire probabilities. All Fire Fire Frequency = inverse of all fire probability (previous calculation).

References

Brown, James K.; Smith, Jane Kapler, eds. 2000. Wildland fire in ecosystems: effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 257 p.

Grimm, Eric C. 1981. Chronology and dynamics of vegetation change in the prairie-woodland region of southern Minnesota, U.S.A. New Phytologist. 93:311-350.

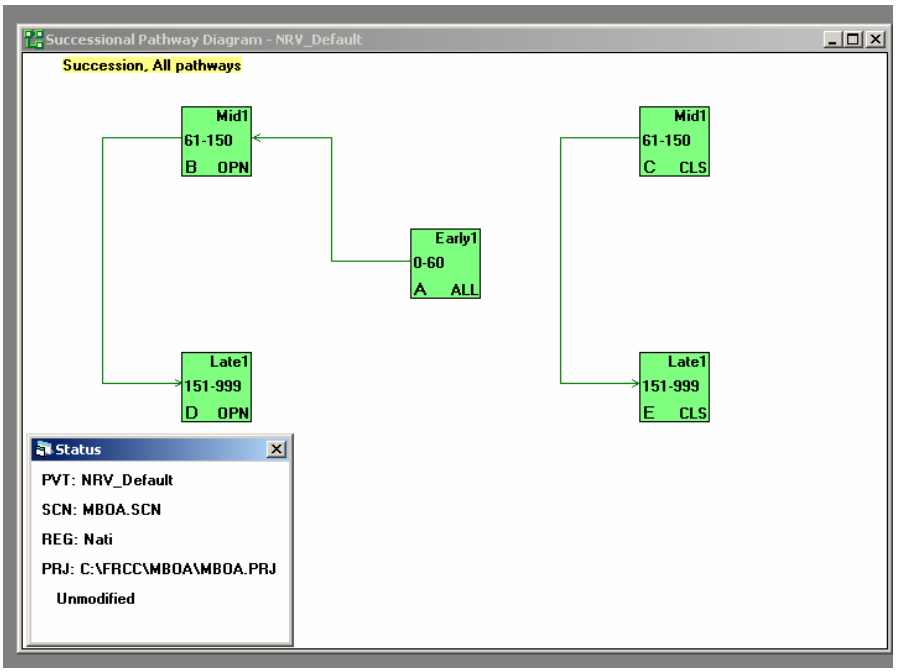
Grimm, E.C. 1984. Fire and other factors controlling the Big Woods vegetation of Minnesota in the mid-Nineteenth century. Ecological Monographs 54:291-311.

Schmidt, Kirsten M, Menakis, James P., Hardy, Colin C., Hann, Wendel J., Bunnell, David L. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 41 p. + CD.

U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, December). Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/.

Webb, T., III; Bartlein, P.J.; Harrison, S.P.; Anderson, K.H. 1993. Vegetation, lake levels, and climate in eastern North America for the past 18,000 years. Pp. 415-467. In: Wright, H.E, Jr..; Kutzbach, J.E.; Webb, T., III; Ruddiman, W.F.; Street-Perrot, F.A.; Bartlein, P.J., eds. Global Climates since the Last Glacial Maximum. Minneapolis, MN: University of Minnesota Press.

VDDT File Documentation: Model is located in C:\FRCC\MBOA. Text files must be located in C:\FRCC for project file to work. Diagram shows succession only.



Model structure

Disturbance probabilities by class: VDDT model MBOA

Class	To	Agent	Prob	TSD	Freq/ FRI	Rel Age
A	A	Surface fire	.03	0	33	0
A	A	Replacement fire	.01	0	100	-60
B	B	Surface fire	.04	0	25	0
B	B	Wind/weather/stress	.001	0	1000	-90
B	A	AltSuccession	1	60	NA	0
C	A	Replacement fire	.0025	0	400	0
C	B	Mixed fire	.0075	0	133	0
C	C	Wind/weather/stress	.001	0	1000	-90
D	D	Surface fire	.04	0	25	0
D	B	Wind/weather/stress	.002	0	500	0
D	E	AltSuccession	1	60	NA	0
E	A	Replacement fire	.0025	0	400	0
E	D	Mixed fire	.0075	0	133	0
E	C	Wind/weather/stress	.002	0	500	0

Class A – early seral aspen, birch, oak < 60 yrs: A succeeds to mid age stands (Class B). Burn frequency of 25 years due to presence of oak and openings (25 % replacement; 75 % surface)

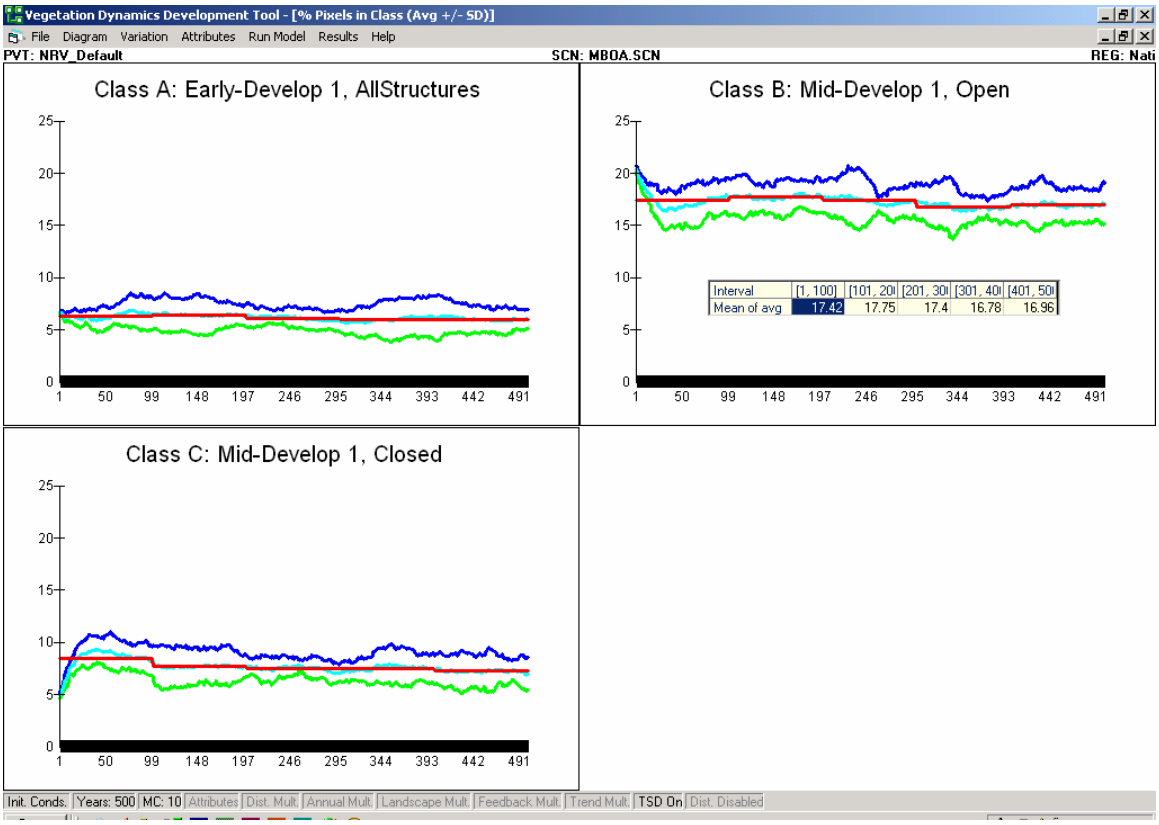
Class B - Mid-succession maturing forests (61-150 yrs): Maintained by frequent surface fires approximately every 25 years and succeeds to class D. If no fire occurs for 60 years this class moves to the closed canopy class (class C).

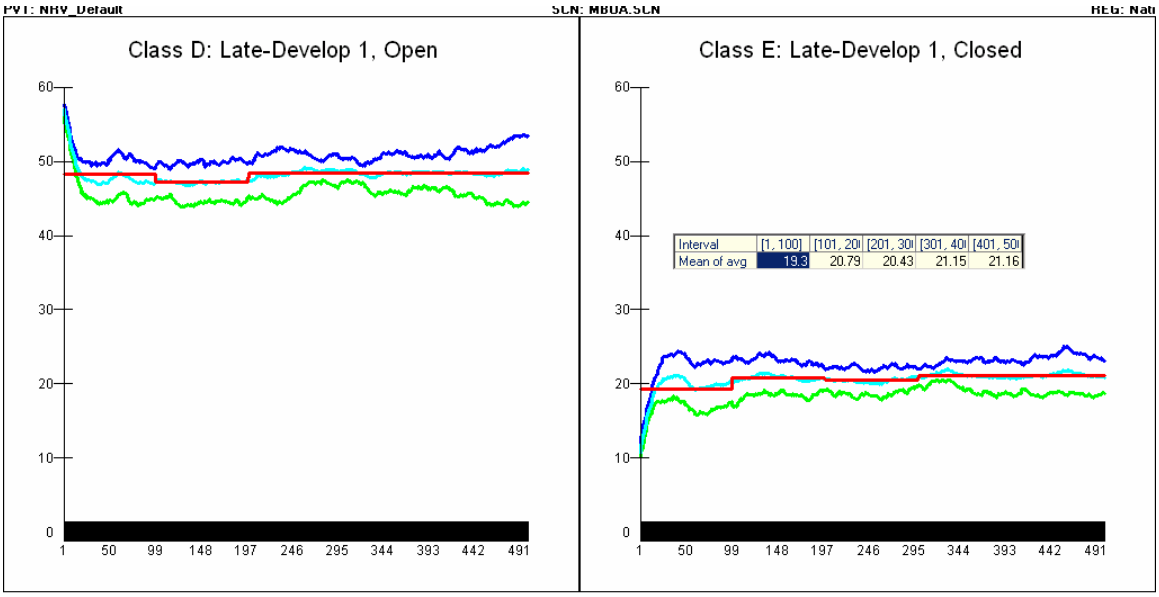
Class C – Mid-successional closed forests (61-150yrs): This class tends to occur in protected areas and is assumed to be only one-fourth as likely to burn as open stands. If fires do occur 25% are replacement and 75% are mixed.

Class D – Late–successional open forests(> 150 yrs): Older pyrophilic stands maintained by frequent surface fires. This class moves to a closed mesophilic stand if no fires occur for a 60 year period. Catastrophic windthrow occurs on an approximate 500 year interval.

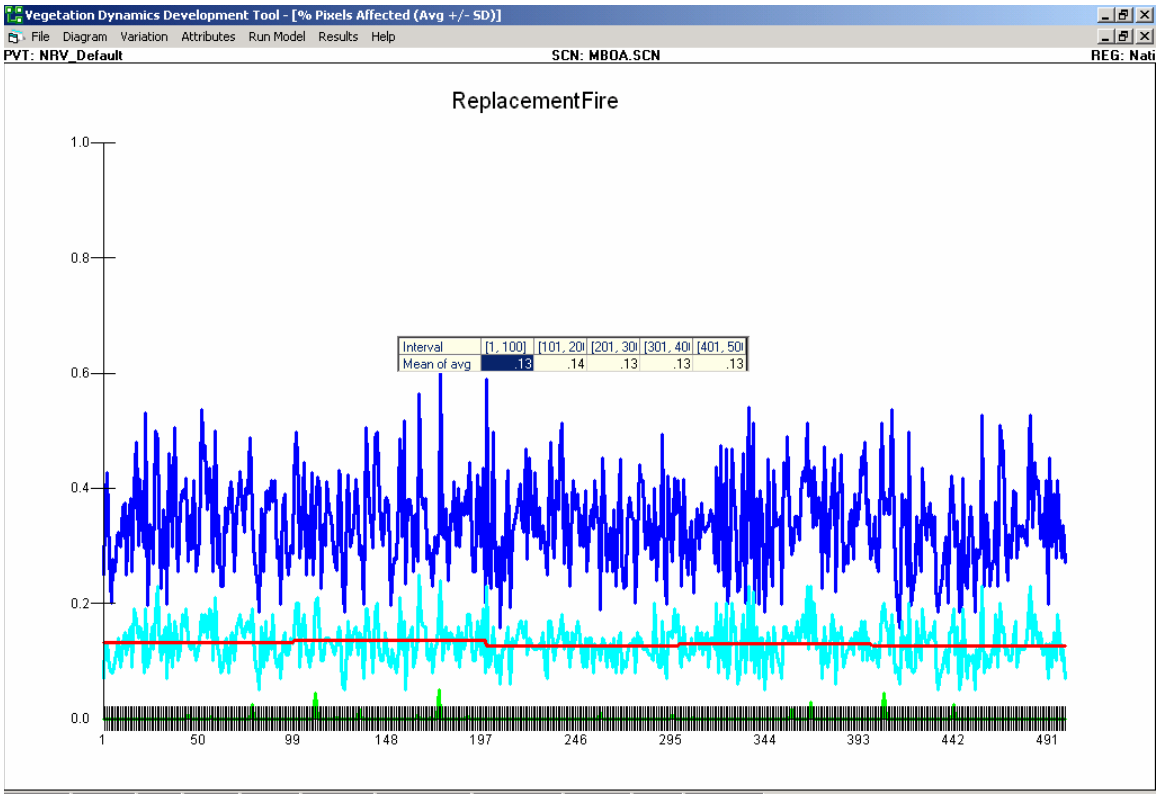
Class E – Late–successional closed forests(> 150 yrs): Older mesophilic stands more resistant to fire. If fires do occur 25% are replacement. Also prone to windthrow

Results: Per cent of area by class for 500 years. Average values + or - 2 SD's

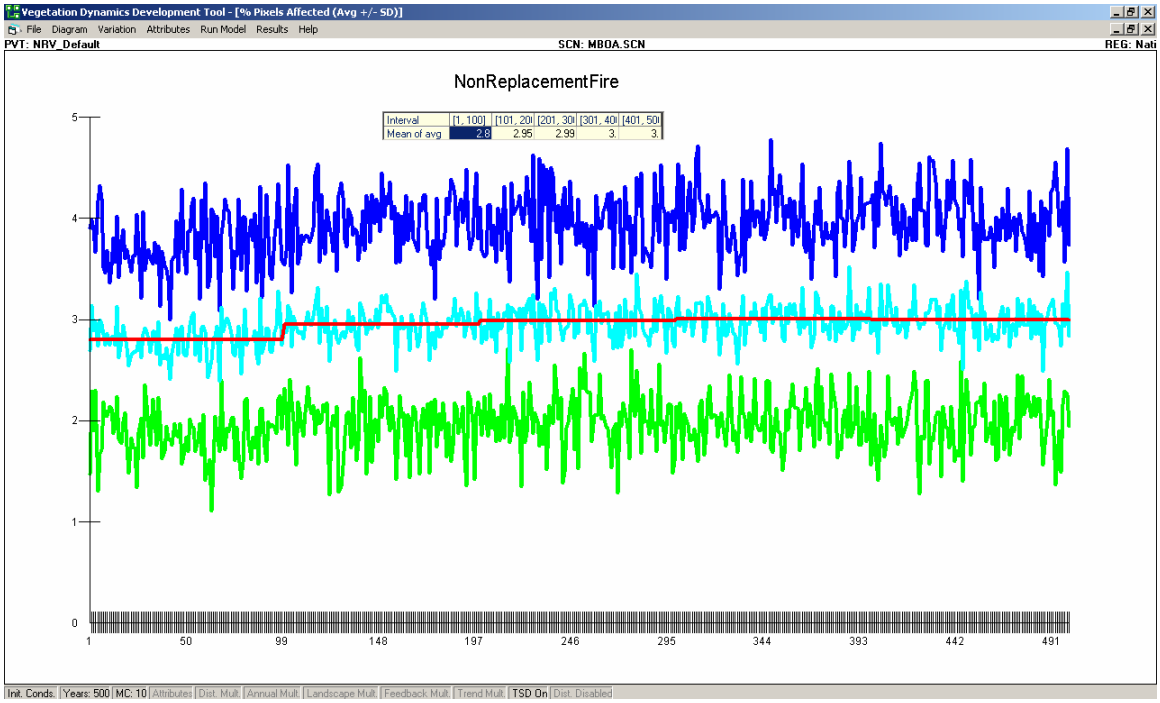




Percent of area with replacement fires (0.13 %/yr corresponds to a 750 fire frequency).



Non -replacement fires per year (3.0 %/yr corresponds to a 33 year fire frequency.



Area affected by stand replacing windthrow per year (no graph) Windthrow occurs at a rate of 0.16 % per year (625 yr rotation) in mature and older stands.