

Fire Regime Condition Class (FRCC) Interagency Handbook Reference Conditions

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PNVG Code: NOKS

Potential Natural Vegetation Group: Northern oak savannah (Kuchler # 81)

Geographic Area: Lower central Wisconsin. This savannah/woodland type historically occurred within the buffer zone between the Maple-Basswood-Oak forest and the tallgrass prairie.

Description: Oak savannas and oak openings were a distinctive feature of the landscape of southern Michigan, Wisconsin, and Minnesota, and they clearly were fire-maintained (Dorney and Dorney 1989). Farther north in the forest-prairie ecotone in Minnesota and the prairie provinces, open savanna-like aspen woodlands were maintained by frequent fire. Oaks and aspen could persist in the presence of fires occurring at intervals of one to 15 years due to fire adaptations and their capacity to sprout vegetatively from rootstocks—and in the case of larger oak trees to resist cambial injury (Vogl 1964). Savannas were more common on sloping topography where fire was less frequent than on the prairies—though these open woodlands could burn annually. Thus, oak and aspen savannas represented a transition type from grassland to closed forest.

Closed woodlands also occurred in the prairie-savanna matrix in protected areas not prone to persistent burning—on steep morainal hills and other dissected topography, on the east side of drainages and rivers, and in draws and river valleys (Anderson 1990). In the absence of fire, woody sprouts from persistent oak grubs and other woody rootstocks, as well as new seedlings, soon converted savannas to closed hardwood forest (Anderson 1990, Curtis 1959). Today oak savannas—and true prairies—are among the rarest communities in the Lake States.

The northern pre-European analog of the hardwood savanna was the pine barrens found on sandy, xeric outwash soils throughout the upper Great Lakes Region. Fire also frequently visited the barrens—maybe even annually—with fire cycles of 15 to 60 years. The barrens owed their unique savanna-like structure to the serotinous fecundity of jack pine and the resistance of older red and white pines to fatal fire injury. Jack pine was the most-common tree species and probably occurred in fire-maintained even-aged stands or thickets, particularly on north-facing slopes. Large red pines—and occasionally white pines—were widely scattered, uneven-aged, fire-scarred emergents. Sprouting early seral hardwoods like northern pin oak, aspens, and paper birch also were present (Vogl 1964, 1970; Whitney 1986). The barrens could be very flat or gently rolling, and wetlands were interspersed, so fire interacted with topography to produce a spatially variable landscape. Lightning most likely was a common source of ignitions, but barrens probably were burned regularly by indigenous people to maintain their open, easily traveled structure and encourage blueberry production and game species (Murphy 1931). Pine barrens still can be seen today in many places in the Lake States, especially where prescribed fire is used in their management, but the large red pine component is mostly missing.

Fire Regime Description: Fire Regime I. Mostly low intensity surface fires with an average fire frequency of 8 to 10 years. It is assumed that it takes 20 years without fire to establish a young oak savanna stand that can survive the frequent fire. Once established, mature oak savannah stands are not susceptible to replacement fires but are susceptible to catastrophic windthrow at an annual rate of 0.002 (500-year rotation).

Savannah stands that escape fire for 20 or more years (two missed fire cycles) develop a shrubby understory that make these stands somewhat susceptible to replacement fires. This susceptibility decreases as the stands get older. However, most fires in these multi-story classes

are of mixed severity, and simply move the stand back to an open savannah. Fire and windthrow disturbance probabilities by class are shown in the VDDT documentation section.

Vegetation Type and Structure

Class*	Percent of Landscape	Description
A: post replacement	20	Early-successional prairie with < 10% tree cover
B: mid seral open	30	Mid-succession open woodlands (21 - 100 yrs); > 10% oak canopy
C: mid seral closed	5	Mid-succession multi-canopied woodlands (21 –100 yrs)
D: late seral open	40	Late-successional open woodlands maintained by surface fires (>100 yrs); >10 % oak canopy.
E: late seral closed	5	Late-successional multi-canopied woodlands (> 100 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	33	.03	30	
Non-Replacement Fire	13	.075	70	
All Fire Frequency*	9	.105	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

Anderson, R.C. 1990. The historic role of fire in the North American grassland. In *Fire in North American Tallgrass Prairies*, edited by S.L. Collins and L.L. Wallace. University of Oklahoma Press, Norman, OK. p. 8-18.

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.

Curtis, J.T. 1959. *The Vegetation of Wisconsin*. University of Wisconsin Press, Madison, WI.

Dorney, C.H. and J.R. Dorney. 1989. An unusual oak savanna in northeastern Wisconsin: the effect of Indian-caused fire. *Amer. Midl. Nat.* 122:103-113.

Murphy, R.E. 1931. Geography of the northwest pine barrens of Wisconsin. *Trans. Wis. Acad. Sci. Arts Letters* 26:69-120.

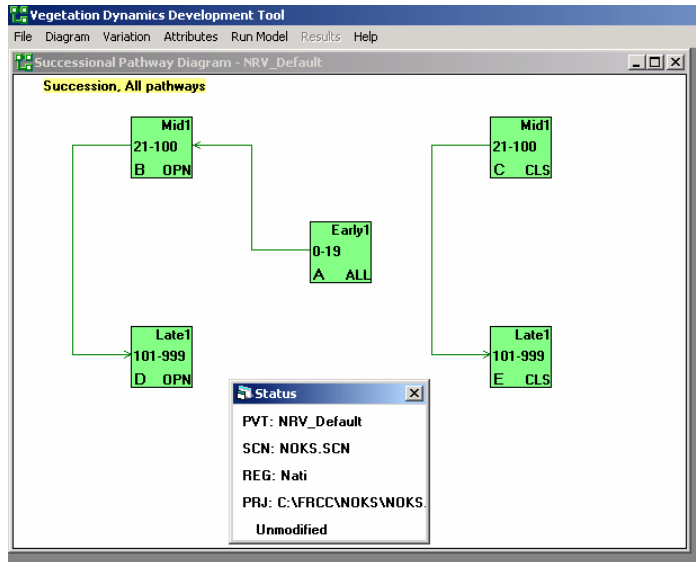
Personal communication (Dave Cleland). We have not found adequate descriptions of this type in the literature and believe that the acreage reported by Kuchler is grossly overestimated. More work with this model is needed.

Vogl, R.J. 1964. Vegetational history of Crex Meadows, a prairie savanna in northwestern Wisconsin. *Amer. Midl. Nat.* 72:157-175.

Vogl, R.J. 1970. Fire and the northern Wisconsin pine barrens. *Proc. Tall Timbers Fire Ecol. Conf.* 10:175-209.

Whitney, G.G. 1986. Relation of Michigan's presettlement pine forests to substrate and disturbance history. *Ecology* 67:1548-1559.

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



Disturbance probabilities by class: VDDT model NOKS

Class	To	Agent	Prob	TSD	Freq/ FRI	Rel Age
A	A	.1	.1	-20	10	-20
B	B	Surface fire	.1	0	10	0
B	B	Wind/weather/stress	.001	-80	1000	-80
B	C	AltSuccession	1	20	NA	0
C	A	Replacement fire	.025	0	40	0
C	B	Mixed fire	.075	0	13	0
C	C	Wind/weather/stress	.001	0	1000	-80
D	D	Surface fire	.1	0	25	0
D	B	Wind/weather/stress	.002	0	500	0
D	E	AltSuccession	1	20	NA	0
E	A	Replacement fire	.01	0	40	0
E	D	Mixed fire	.09	0	13	0
E	C	Wind/weather/stress	.002	0	500	0

Class A – tallgrass prairie with < 10% oak coverage: Class A succeeds to young oak savannah (class B) after 20 years without fire. Average burn frequency of 8 years maintains a significant acreage in this class.

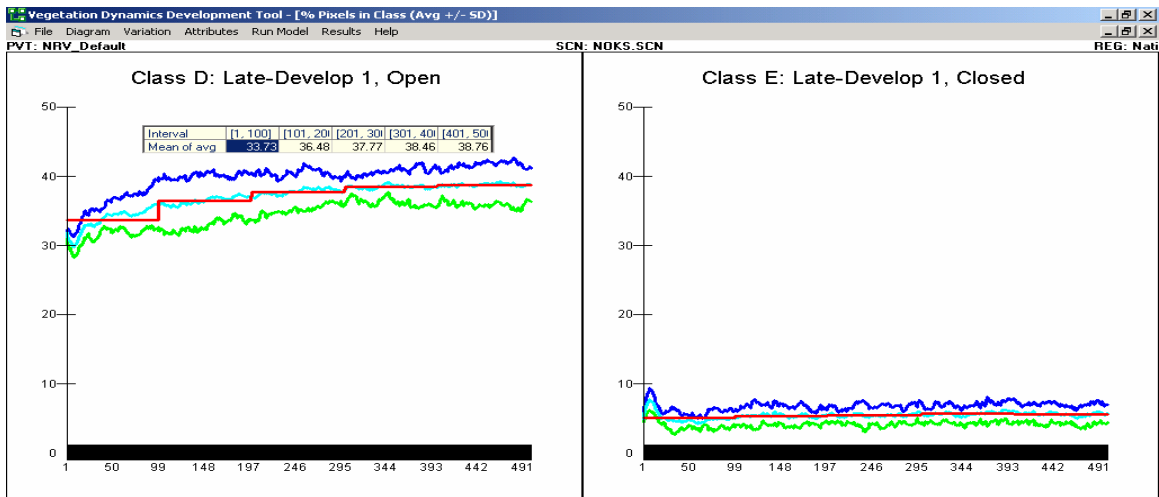
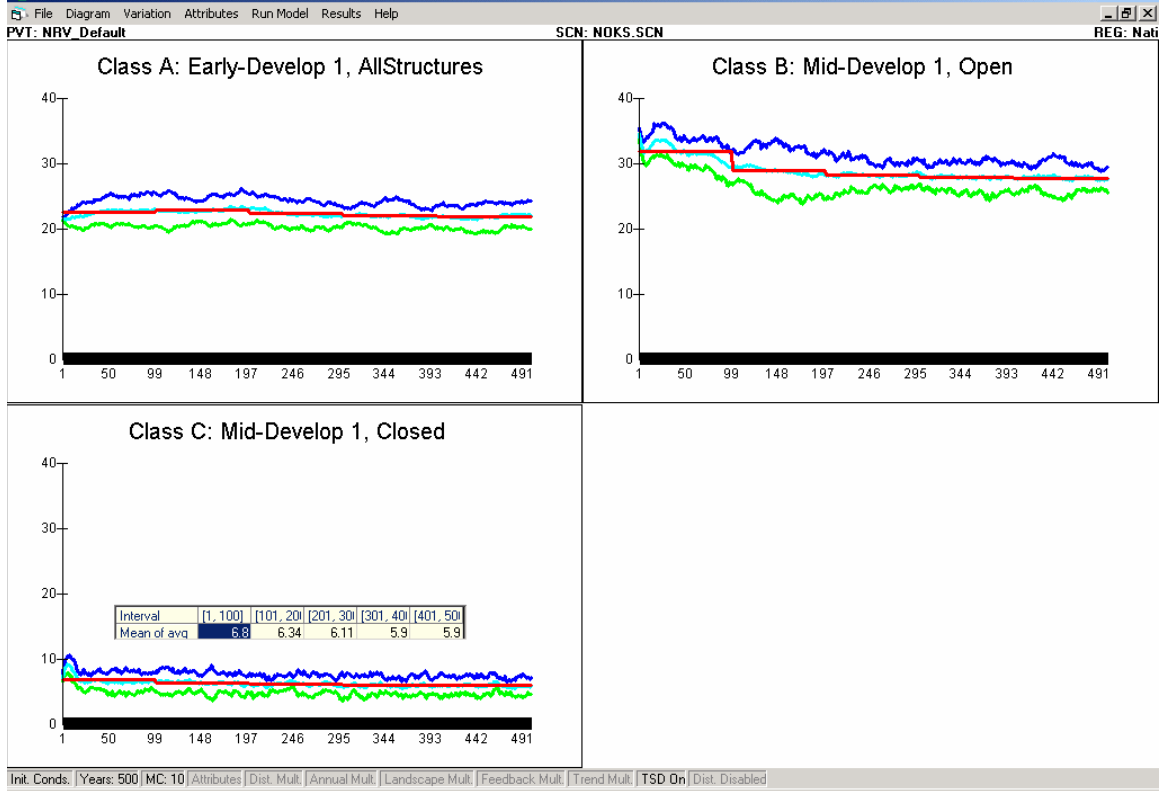
Class B – Young open oak savanna woodland (20 – 100 yrs): Maintained by frequent surface fires approximately every 10 years and succeeds to class D. If no fire occurs for 20 years this class moves to the multi canopy class (class C).

Class C – Young closed oak savanna woodland (20 – 100 yrs): Stands that develop a shrubby understory due to lack of fire for 20 or more years. These stands are more prone to replacement fire.

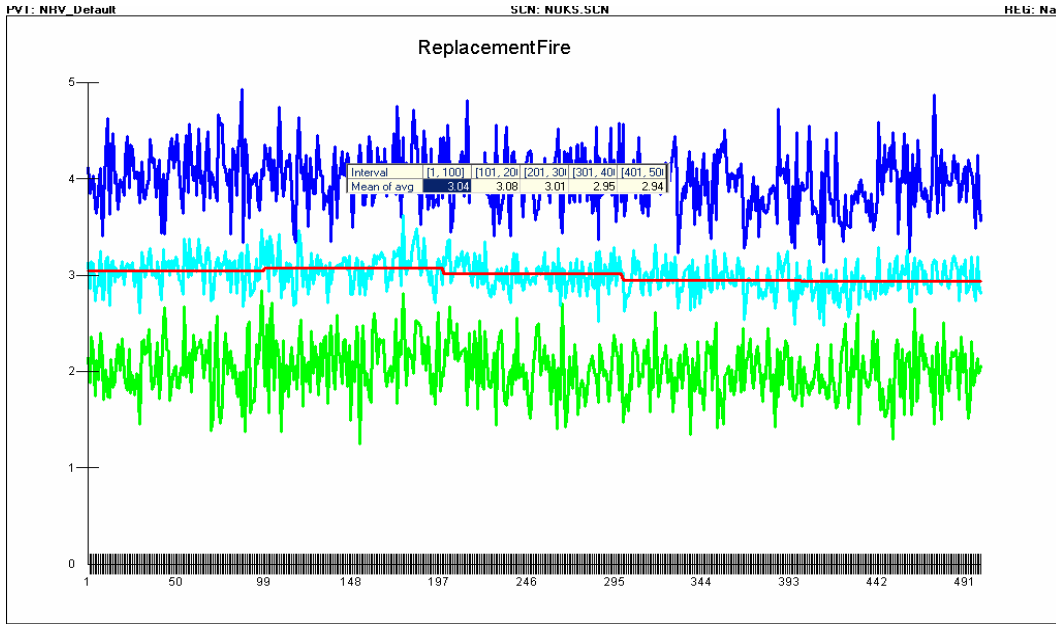
Class D – Old open savannah (> 100 yrs): Older pyrophilic stands maintained by frequent surface fires.

Class E – Old multi canopy (> 1100 yrs): Older stands with shrubby understory due to experiencing 2 or more missed fire cycles.

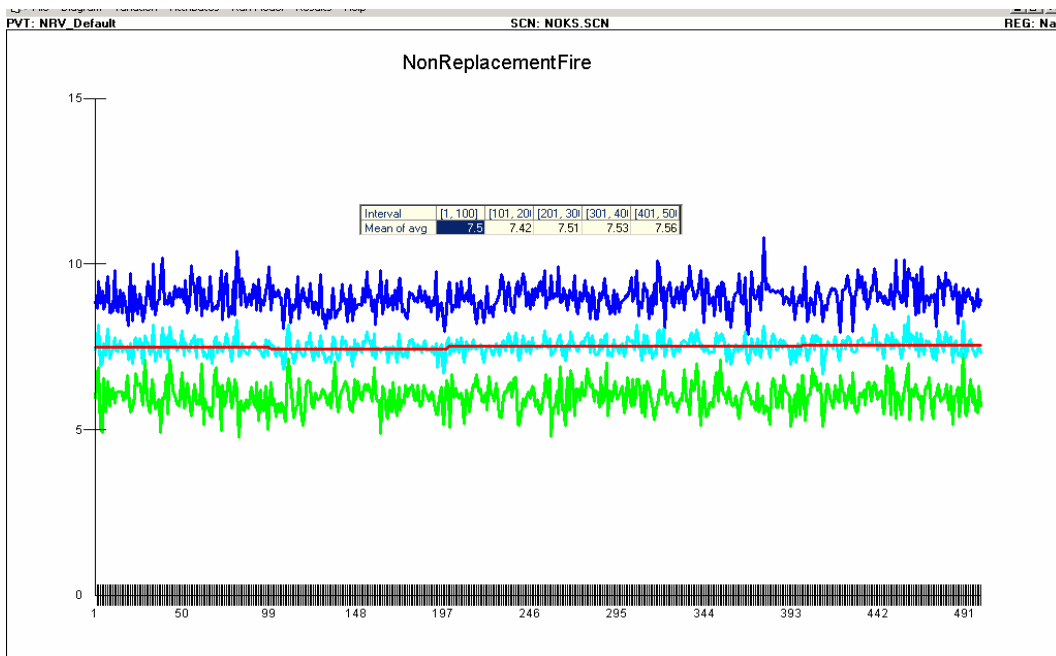
Results: Per cent of area by class for 500 years. Average values + or - 2 SD's



Percent of area with replacement fires (3.0 %/yr corresponds to a 33 year fire frequency).



Non -replacement fires per year (7.5 %/yr corresponds to a 13 year fire frequency)



Area affected by stand replacing windthrow per year (no graph). Windthrow occurs at a rate of 0.12 % per year (833 yr rotation) in mature and older stands and returns these stands to a young savannah (classes B or C).

