****DRAFT****

Fire Regime Condition Class (FRCC) Interagency Handbook
Reference Conditions

Modeler: Cecil Frost Date: 09/01/2004 PNVG Code: **MARF** (Maritime Forest)

Potential Natural Vegetation Group: Maritime Forest (MARF)

Geographic Area: Southeastern Virginia to Florida, and west along the Gulf Coast to eastern Texas.

Description: A coastal type, occurring extensively around the Atlantic and Gulf coastal tidewater regions, and along brackish and saline waterways up to 50 miles inland from the coast. Habitats include barrier islands, the coastal mainland just inland from barrier islands, estuarine islands and peninsulas bordered by salt marsh, mesic sand flats, and dry coastal dunes exposed to salt spray. Also found along the lower reaches of coastal rivers and streams, to the upper extent of salt influence.

Live oak (*Quercus virginiana*) is the characteristic species. Other common canopy dominants include laurel oak (*Quercus laurifolia*) and loblolly pine (*Pinus taeda*). Species of more sheltered stands may include *Quercus pagodifolia*, pignut hickory (*Carya glabra)*, sand hickory (*Carya pallida*) and other oaks and hickories. Coastal fringe stands from central South Carolina south may have palmetto (*Sabal palmetto*) in the understory. Typical shrubs include yaupon (*Ilex vomitoria*), wax myrtle (*Myrica cerifera)* and *Erythrina herbacea*. Herb layer diversity is low except where fire-maintained stands grade into longleaf pine communities. The most typical herb layer species, especially where frequently burned, is slender wood-oats (*Chasmanthium laxum*). Rare species include bluff oak (*Quercus austrina*) in South Carolina stands. With exception of Virginia and North Carolina, tallow tree (Sapium sabiferum), has become an invasive species in coastal areas.

Stand structure: Most natural stands were influenced by fire. Those with frequent fire (2-5 years) were bilayered, having a nearly closed tree canopy over a moderately well-developed grassy layer dominated by *Chasmanthium laxum*. With lower fire frequency (5-7) years a shrub layer, often dominated by yaupon, was found. Occasionally tornadoes, particularly those spawned by hurricanes, created narrow streaks of damaged trees over a small percent of the landscape.

Fire Regime: Bimodal, with March-April lightning season fires and October-November fires ignited by Native Americans. Fire regime group I, with frequent, light surface fires in thin grass, pine needle and evergreen oak litter. Original Mean Fire Return Interval (MFI) ranged from 2-26 years, depending on topographic situation and ignition source. Lightning was the dominant source in the largest fire compartments of the coastal plain mainland, producing a 2-3 year fire interval (Frost 2000). On coastal islands and peninsulas, isolated from the frequent fire regime of the mainland, Native American burning became the dominant factor (Frost 2004). These fires, for hunting purposes, were mostly in the fall. An island of about 2 km^2 in size with no Indian burning would have been expected to experience lightning ignition only about every 26 years. On most

of these isolated stands a combination of lightning and Native American burning produced a fire frequency around 5-7 years (Frost 2004).

Fire Suppression and logging. Fire suppression and logging has led to conversion of two-layered stands with open understories to dense, multistoried woody vegetation. In some places these form nearly impenetrable thickets. Such stands may have abundant cat-brier (*Smilax bona-nox, Smilax glauca, Smilax rotundifolia*), and the interface between maritime forest and marsh can be bounded by a wall of poison ivy. Essentially all live oak stands have been logged at least twice for ship timbers beginning in the early 1700's (Wood 1981).

Model Assumptions and special definitions: A special definition was used for closed versus open classes in the succession model: "Open" here refers to stands with *open understories* maintained by fire (as opposed to stands with canopy openings). With exception of areas undergoing primary succession, most stands had 85-95% canopy cover. Replacement in the long-lived, hurricane and fire-resistant trees of maritime forest is essentially a tree-by tree replacement model. Most stands were highly stable communities, maintained with frequent fire. As is the case with most southeastern vegetation, these were not seral stands. Hurricanes have little effect on live oak, the strength and iron hardness of the wood of which caused them to be sought out for over two hundred years for ships timbers, especially for keels and right-angled keel knee braces which were cut and shaped on site from the natural forks of massive side branches with the main trunk (Wood 1981).

Relation to other vegetation types. On the wet side, grades into salt marsh or dense vines, wetland shrubs and saplings on the margins of cypress (*Taxodium distichum*) and black gum (*Nyssa biflora*) swamps and interdunal pools. On the dry side, grades into pure live oak canopy on sand dunes with salt spray. Dunes, especially in primary succession, may have red cedar, shrubs and patches of dune grassland vegetation in gaps. These gaps may have sea oats (*Uniola paniculata*) and salt meadow cordgrass (*Spartina patens*) as well as a variety of xerophytic coastal forb specialists such as *Physalis viscosa*, and jumping cactus (*Opuntia drummondii*). On the fire-exposed mainland, grades into longleaf pine communities.

Primary Succession plays an important part in the geologically unstable dune and sand flat communities of the barrier islands Early primary succession stands of live oak may have essentially no other species below the dense, evergreen canopy. Primary succession, affecting perhaps only 5-10% of the coastal landscape, is caused by formation of new sand deposits on the accreting southern ends of barrier islands, and by he availability of new habitat in recently stabilized portions of moving dune fields, as they come to rest against older vegetated dunes (Latrobe 1799). While natural primary succession characterized only a small percent of stands in presettlement conditions, many new stands are developing today on what were open sands or maritime grasslands before the construction of man-made barrier dunes, beginning when the work of the Civilian Conservation Corps in the 1930's stopped ocean overwash and reduced salt spray (Wentworth et al. 1992).

Model Notes: In the barrier island type of maritime forest habitat, fire-maintained stands can be cut off from fire flow by formation of a new inlet which may break the connection to a source of fire. In this situation an old-growth stand in class D would develop a

dense understory with cessation of fire, moving it to class E. This is such a rare event and affects such a small part of the landscape that it is not shown in the model.

Vegetation Type and Structure

Class*	Percent of Landscape	Description
A: post replacement	9	Live oak, laurel oak and loblolly pine reproduction to 15' tall. Stands of almost entirely woody species. Openings tend to be single tree gaps or narrow streaks in tornado paths. Up to 90% small tree canopy cover.
B: mid-seral closed	6	Near 100% closed canopy, of the same species in class A. Little herbaceous understory. Stem density of vines may be high if fire has not occurred since disturbance.
C: mid-seral open	22	Mid-development, nearly closed canopy with understory cleared out by fire. A shrub component, most typically yaupon and wax myrtle is typical. The maritime forest grass *Chasmanthium laxum* may occur as patches in areas where canopy is thin enough to admit light to the forest floor.
D: late-seral open	56	This was overwhelmingly the most typical stage in natural maritime forest stands before logging, fire suppression and other modern human disturbance. A few small canopy openings representing single tree gaps, admit sunlight to maintain a nearly continuous grass layer. Fires keep understory free of vines and control shrub density. Yaupon, about 1-2 meters tall, occurs as single plants and patches.
E: late-seral closed	7	Closed stands with dense understories developed only in areas too isolated on barrier islands or too small to be of interest to Native Americans for burning (<5 ha). As such these dense, closed stands, composed almost entirely of multistoried woody vegetation and tall, climbing vines occupied only a small percent of the original landscape.
Total	100	

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

Fire Frequency and Severity

Fire Severity	Fire Frequency (yrs)	Probability	Percent, All Fires	Description
Replacement Fire	300	.003	1.5	March-April lightning season fires (mainland fringes) and fall fires (Native Americans)
Non-Replacement Fire	5	.2	98.5	Primarily surface fire in all classes.
All Fire Frequency*	4.93	.203	100	

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

Model Document 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.

Dolan, R., P.J. Godfrey and W.E. Odum. 1973. Man's impact on the Barrier Islands of North Carolina. American Scientist 61:152-162.

Frost, Cecil C. 2004. Presettlement vegetation and fire frequency of Bailey Island, South Carolina. Report to the Nature Conservancy.

Frost, Cecil C. 2000. Studies in landscape fire ecology and presettlement vegetation of the southeastern United States. Doctoral dissertation, University of North Carolina, Chapel Hill. 620 p.

Latrobe, B. H. 1799. Memoir on the Sand-hills of Cape Henry in Virginia. Trans. Am. Philosophical Soc. 4:439-444.

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/.

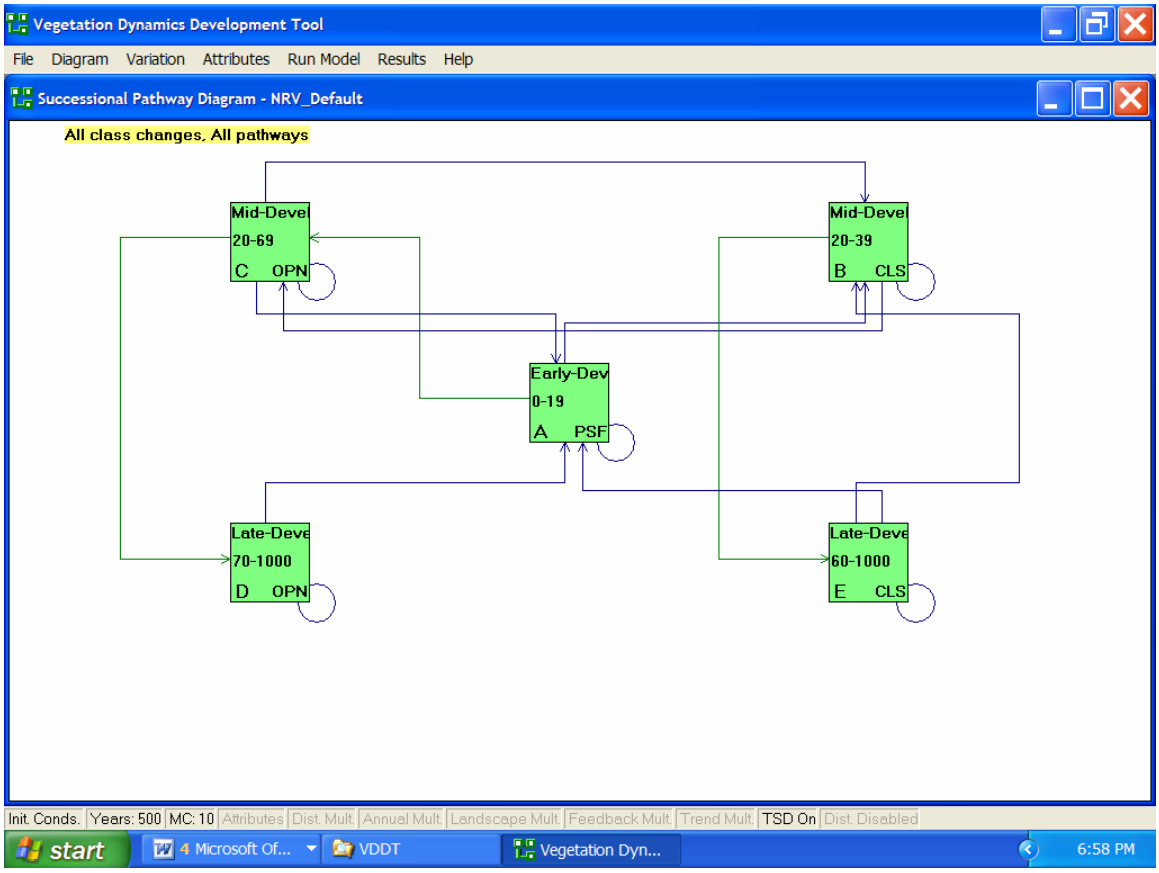
Wentworth, T.R., M.P. Schafale, A.S. Weakley, R.K. Peet, P.S. White and C.C. Frost. 1992. A preliminary classification of North Carolina barrier island forests. In: C.A. Cole and K. Turner, eds: Proceedings of a conference on barrier island ecology of the mid-Atlantic coast. December 7-8, 1989. Kill Devil Hills, North Carolina. National Park Service Tech Rept. NPS/SERCAHA/NRTR-93/04. Atlanta, GA.

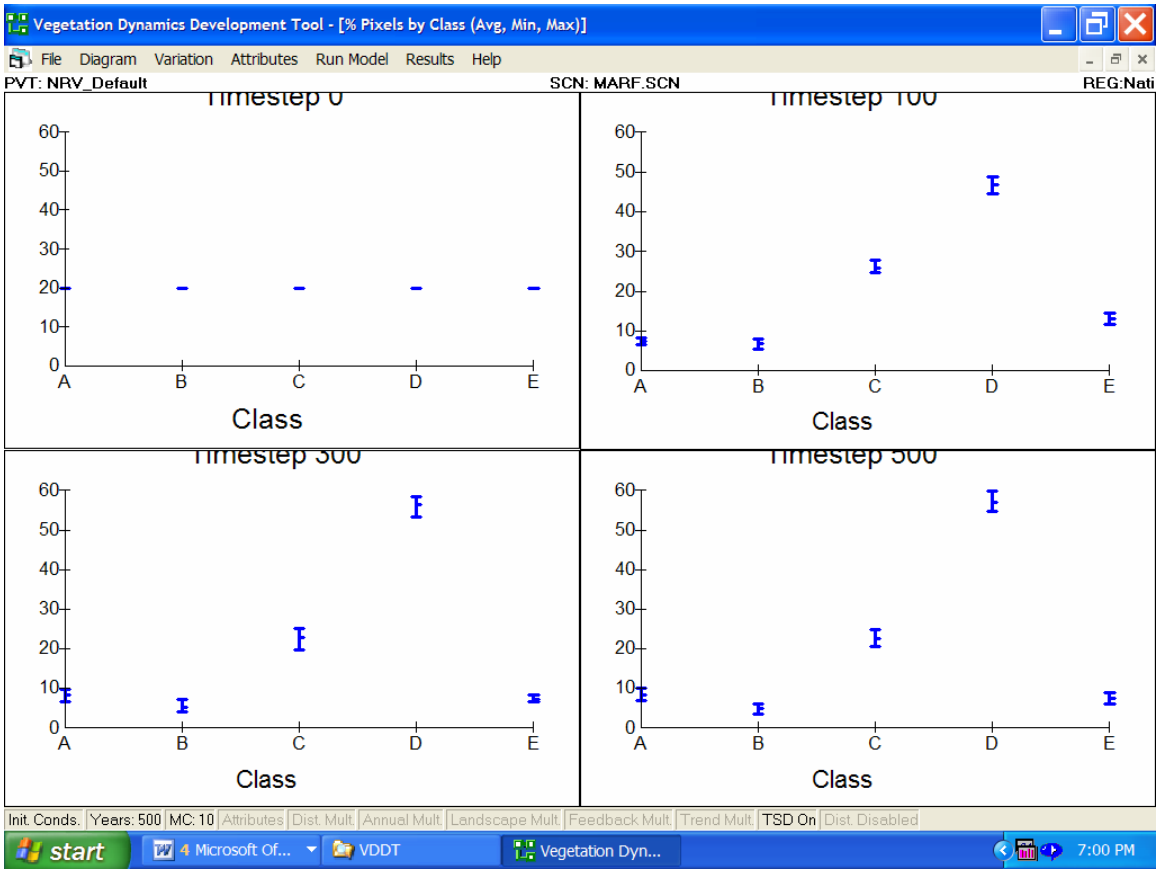
Wood, V.S. 1981. Live oaking, southern timber for tall ships. Boston: Northeastern Univ. Press. 206 p.

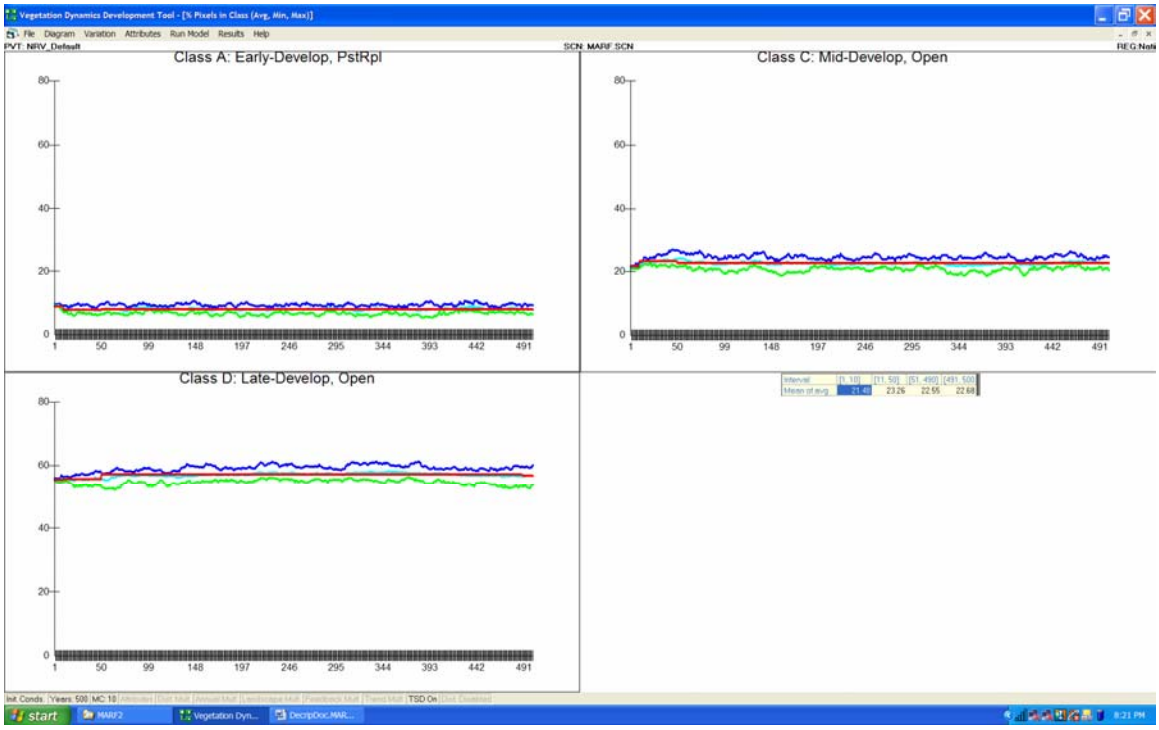
VDDT File Documentation

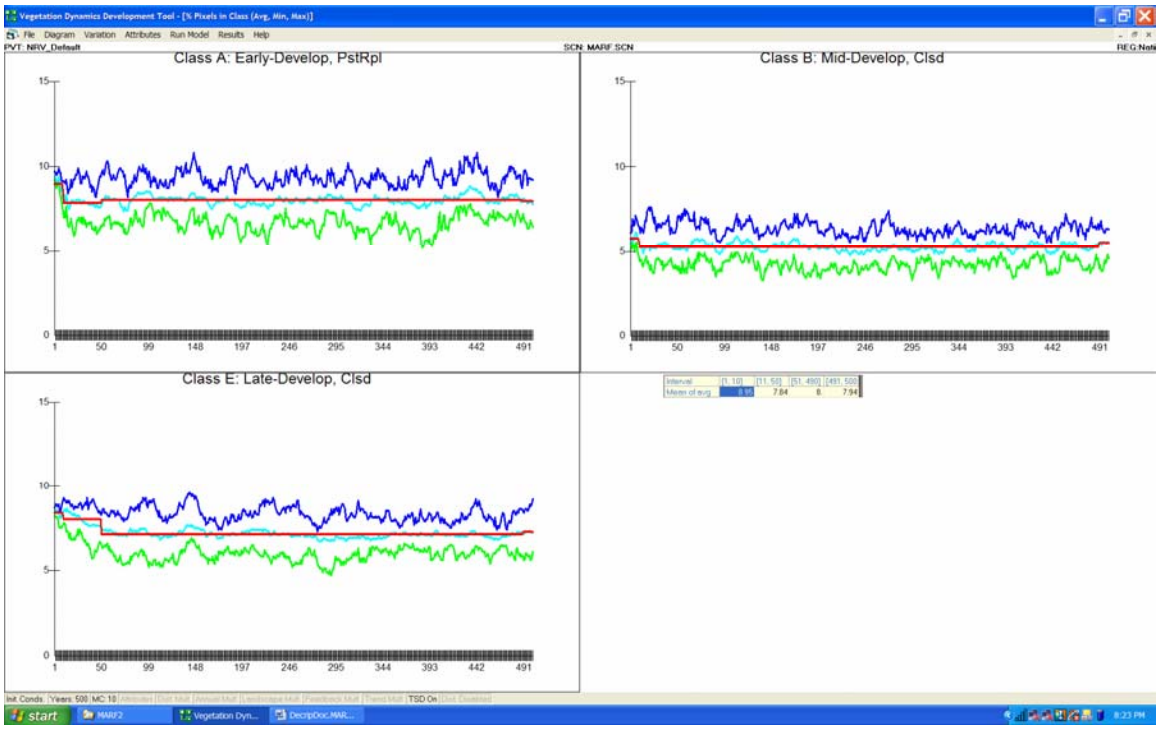
This includes screen captures (print-screens) from VDDT graphs that were used to develop reference conditions for presettlement vegetation in maritime forest. Below is a copy of the model and a set of graphs showing the percent of maritime forest in the landscape at each of four time stages beginning with starting conditions and after 100,

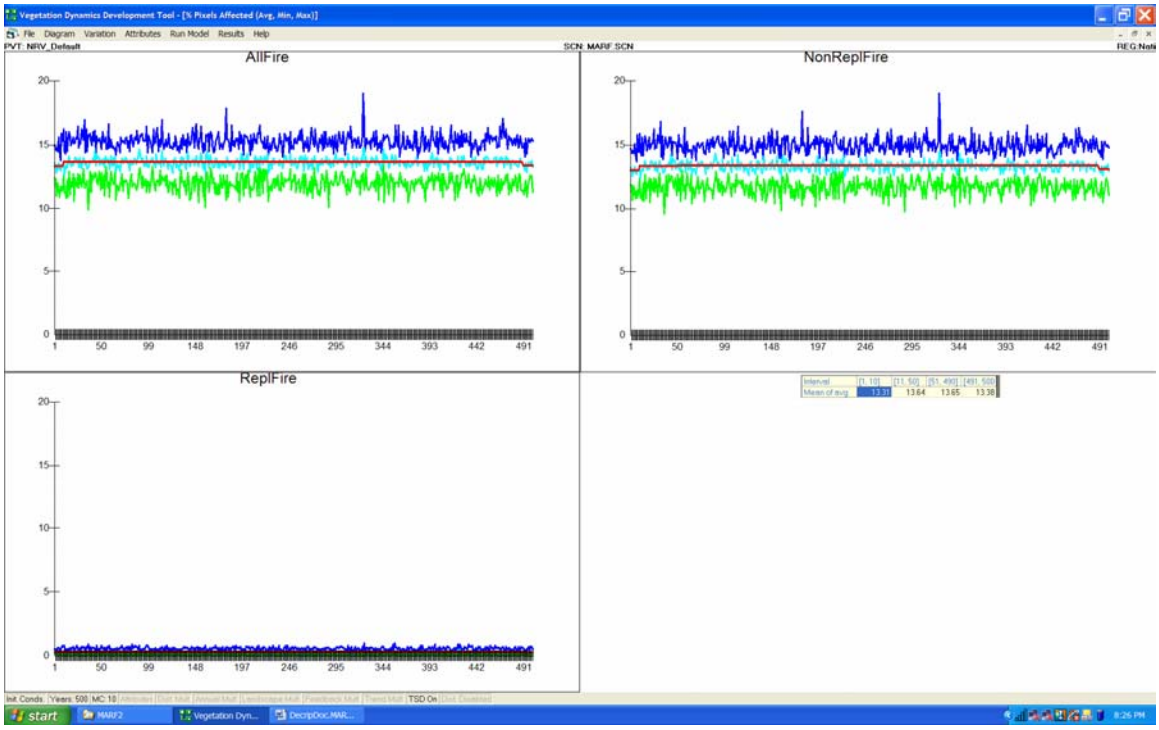
300 and 500 years. The final graph showing time step 500 is an approximation of the percent of landscape in each of 5 successional states in the presettlement landscape. This takes into account disturbances by hurricanes, tornadoes and fire.

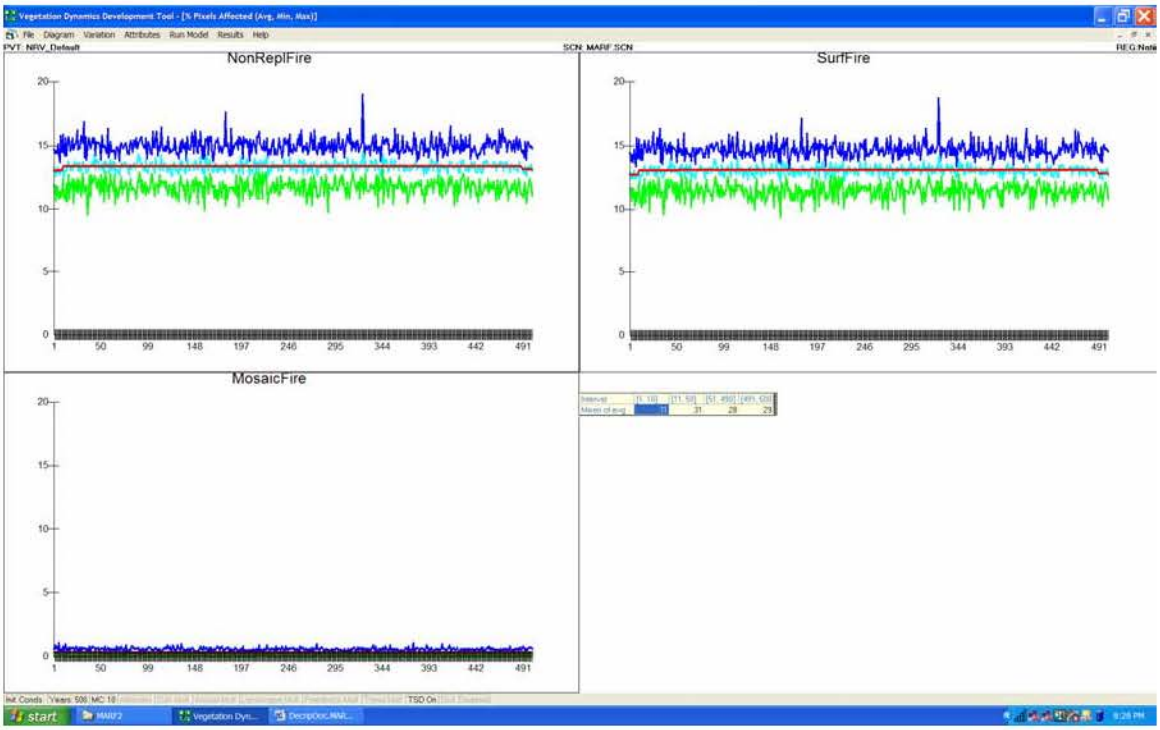



Vegetation Dynamics Development Tool - [% Pixels by Class (Avg, Min, Max)]
File Diagram Variation Attributes Run Model Results Help
PVT: NRV_Default
SCN: MARF.SCN
REG:Nati
Timestep 0
Timestep 100
Timestep 300
Timestep 500
60
50
40
30
20
10
0
A B C D E
Class
Init. Conds. Years: 500 MC: 10 Attributes Dist. Mult. Annual Mult. Landscape Mult. Feedback Mult. Trend Mult. TSD On Dist. Disabled
start
4 Microsoft Of...
VDDT
Vegetation Dyn...
7:00 PM


Class A: Early-Develop, PstRpl
Class C: Mid-Develop, Open
Class D: Late-Develop, Open
80
60
40
20
0
1 50 99 148 197 246 295 344 393 442 491


Vegetation Dynamics Development Tool - [% Pixels in Class (Avg, Min, Max)]
File Diagram Variation Attributes Run Model Results Help
PVT: NRV_Default
SCN: MARF.SCN
REG:Nat
Class A: Early-Develop, PstRpl
Class B: Mid-Develop, Clsd
Class E: Late-Develop, Clsd
Init Conds Years: 500 MC: 10
start
MARF2
Vegetation Dyn...
DescriptDoc.MAR...
8:23 PM


Vegetation Dynamics Development Tool - [% Pixels Affected (Avg, Min, Max)]
File Diagram Variation Attributes Run Model Results Help
PVT: NRV_Default
SCN: MARF.SCN
REG:Nat
AllFire
NonReplFire
ReplFire
Init Conds Years: 500 MC: 10
start
MARF2
Vegetation Dyn...
DescriptDoc.MAR...
8:26 PM


Vegetation Dynamics Development Tool - [% Pixels Affected (Avg, Min, Max)]
File Diagram Variation Attributes Run Model Results Help
PVT: NRV_Default
SCN: MARF.SCN
REG:Nats
NonReplFire
SurfFire
MosaicFire
20
15
10
5
0
1
50
99
148
197
246
295
344
393
442
491
start
MARF2
Vegetation Dyn...
DecipDoc.RAR...
9:28 PM

An “open path” stand of maritime forest dominated by live oak and loblolly pine under a 5 year fire return interval (Currituck Banks, North Carolina). Condition Class 1.

A “closed path” stand of maritime forest with fire suppression (Bald Head Island, North Carolina). Both stands have a closed forest canopy. “Open” as used for this model refers to the open understory maintained by fire. Condition Class 3