Rapid Assessment Reference Condition Model

The Rapid Assessment is a component of the LANDFIRE project. Reference condition models for the Rapid Assessment were created through a series of expert workshops and a peer-review process in 2004-2005. For more information, please visit www.landfire.gov. Please direct questions to helpdesk@landfire.gov.

Potential Natural Vegetation Group (PNVG):

R9PCSN **Pocosin**

General Information

Contributors *(additional contributors may be listed under "Model Evolution and Comments")*

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Vegetation Type

Shrubland

Dominant Species*

LYLU3 CHCA2
CYRA
ILGL
ZEPU3

General Model Sources

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

LANDFIRE Mapping Zones

58
60

Rapid Assessment Model Zones

- [ ] California
- [ ] Great Basin
- [ ] Great Lakes
- [ ] Northeast
- [ ] Northern Plains
- [ ] N-Cent.Rockies
- [ ] Pacific Northwest
- [ ] South Central
- [x] Southeast
- [ ] S. Appalachians
- [ ] Southwest

Geographic Range

Pocosin exists along the coastal plain from southeastern Virginia, south through North Carolina and into South Carolina, with North Carolina encompassing the majority of this ecological land type. The most extensive examples are on large domed peatlands in the outer coastal plain, but medium to small patches occur in peat-filled Carolina bays and other depressions.

Biophysical Site Description

Pocosin occurs as shrubby vegetation on peat soils generally 1-3 meters deep. Pond pine (Pinus serotina) is present as sparse, stunted trees, forming an important structural component but not a true canopy. The shrub layer is very dense. Shrub height, and tree height and density vary with peat depth as well as fire history. The deepest peats are incapable of supporting shrubs over 1 meter tall (Low Pocosin), while shallower peats may have shrubs 2-3 meters tall (High Pocosin). Small (usually 2-5 meter) openings dominated by mosses, ferns, sedges, or forbs may be present, as may small clumps of taller shrubs. Most low pocosins occupy the centers of these domed peatlands, are higher than the surrounding lands, and have no surface or ground water draining into them, making them ombrotrophic. The peat is deep and saturated enough that plant roots never reach mineral soil. High pocosins occur in domed peatlands that are slightly higher than the surrounding lands and little surface or ground water drains into them, making them largely ombrotrophic. The peat is deep and saturated enough that plant roots can reach mineral soil only during droughts. Small, permanently flooded depressions may occur, but are less common than in low pocosin.

Extreme site conditions make pocosin vegetation relatively resilient to conversion to atypical states. Logging of trees, in rare cases where it is economically viable, creates a state resembling class D. Intensive artificial drainage, bedding, and pine plantation establishment, if successful, create conditions that differ somewhat from any of the reference condition states. Pine plantations without intensive site alteration are

*Dominant and Indicator Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.

generally unsuccessful. Successful fire exclusion for long periods leads to stagnation in a state resembling classes D or E, with lost productivity and increased dead fuels but little superficial change in structure.

Vegetation Description

The vegetation is predominantly dense shrubland and very shrubby open woodlands. A characteristic suite of primarily evergreen shrubs, greenbriars (Smilax spp.), and pond pine dominate. Herbs are scarce and limited to small openings, thought to be created by fires burning down through layers of the organic peat. Soil saturation, sheet flow, and peat depth create a distinct zonation, with the average vegetation heights higher, 2-3 meters on shallower peats (High Pocosin) and shrubs rarely over 1 meter tall on the deeper peats (Low Pocosin). The dense shrub layer common to high and low pocosin sites is dominated by fetterbush (Lyonia lucida), titi (Cyrilla racemiflora), gallberry (Ilex glabra), and zenobia (Zenobia pulverulenta), with less dense populations of large gallberry (Ilex coriacea) and greenbrier (Smilax laurifolia). Pond pine (Pinus serotina) is the characteristic tree along with widely scattered loblolly bay (Gordonia lasianthus), sweet-bay magnolia (Magnolia virginiana), and swamp bay (Persea palustris). Pools or openings, usually small and found in the sites with deeper peats, may be dominated by herbaceous species such as leather-leaf (Chamaedaphne [Cassandra] calyculata), sedge (Carex striata [walteriana]), Virginia chain fern (Woodwardia virginica), trumpets (Sarracenia flava), broomsedge (Andropogon glomeratus), Sphagnum spp., and rarely, cranberry (Vaccinium macrocarpon).

Disturbance Description

Fire is an important factor in these systems. Natural fire-return intervals are not well known, but are probably on the order of a decade or two in the wettest areas. Peripheral areas may be subject to fire as often as the surrounding vegetation burns, which may naturally have been an average of 3 years. Fires are typically intense due to the density and flammability of the vegetation, killing all above-ground vegetation. They are followed by vigorous root sprouting by shrubs and hardwoods, leading to recovery of standing biomass within a few years. Pond pine (Pinus serotina) recovers by epicormic sprouting or by regeneration from seeds released from serotinous cones. Recovery may be somewhat slower in high pocosin because of the higher normal biomass, but productivity is also higher. Some species, such as Zenobia and various herbs, recover particularly quickly and dominate several years after a fire, until they are out-competed by Cyrilla and Lyonia. Species diversity is generally highest right after a fire and declines gradually. Fires during droughts may ignite peat, forming holes that take longer to recover. Herb-dominated openings in pocosins may depend on peat fires, though this is not well documented. Some High Pocosin sites may once have been Arundinaria gigantea-dominated canebrakes, maintained by a more frequent fire regime. Natural fires occur in large patches, create a shifting patch structure in the system that interacts with the vegetational zonation created by peat depth.

Adjacency or Identification Concerns

Deep peat pocosins may be distinguished from pond pine woodland (R9POPI) by having a more stunted and less well-developed tree layer, though the shrub component may be similar. Pond pine woodlands have a thinner organic layer and a denser canopy of pond pines intermixed with scattered Bays (Gordonia lasianthus, Persea spp., Magnolia sp.), red maple (Acer rubrum), swamp black gum (Nyssa sylvatica), Atlantic white cedar (Chamaecyparis thyoides), and bald or pond cypress (Taxodium distichum, T. ascendens).

Scale Description

Sources of Scale Data ☑ Literature ☑ Local Data ☑ Expert Estimate

This system has three recognizable landscape patterns within it: domed peatlands, peat-filled Carolina Bays, and small swales. Some occurrences are in large to small peat-filled Carolina bays. Smaller patches occur in shallow swales associated with relict coastal dune systems or other irregular sandy surfaces. The deep peatlands can cover vast areas of unfragmented land. The Croatan National Forest in eastern North Carolina has three nearly intact tracts of pocosin, each close to 10,000 acres in size.

Issues/Problems

Model assumptions:
The herb-dominated openings are created by peat fires (widely believed but difficult to prove).

Taller shrub patches in low pocosins are a result of factors other than fire, and are implicitly included in other model states. They are not equivalent to class E. (The origin of them is not known, but they burn when the surrounding areas burn and are not the result of escaping fire).

There are three crucial strata that may be affected differently by fire and must be accounted for in the model – trees, shrub layer, and the peat itself. The 5 box model is a serious simplification of dynamics.

Areas following peat burns are not very flammable until much time has passed. Such fires do not re-burn the peat but only burn shrubs and herbs, so the effect is not a full reset of class A but only a setback of a few years.

Trees are more susceptible to fire mortality in the younger range of class E than older. This is not accounted for except in the average probability of tree mortality (probability of transition from E to B vs. to C) in mixed fires.

Explanation/justification of non-standard classes and model parameters:
The model needs to track the state of both the trees and the shrub layer. The true contiguous canopy that determines competition levels and fire behavior is the shrub layer, so the stand development terminology is applied to it. Therefore, all classes except A are considered to be "closed" because of the dense woody shrub layer.

Essentially, there are 3 early successional pathways that start at age 0 after fire: rare peat burns (A), uncommon burns that kill trees and top-kill shrubs (B), and common burns that top-kill shrubs but not trees C. Shrub layers recover rapidly by sprouting but peat takes a long time to recover.

There are 2 late successional pathways, with trees (E) or without (D). Trees may have survived the previous fire or may have regenerated after the previous fire, and these are not distinguished. The age of trees is not really tracked. The tree canopy is sparse enough to offer little competition, and tree size and cover varies more with peat depth than age. The loss of branches and epicormic sprouting after fire make crown size correlate poorly with age. But greater fire-resistance in older trees is not accounted for in this model, which averages the probability of tree mortality across the age range of the stage.

“Replacement fire” here is used to mean rare peat fire patches.

“Mixed fire” here is used to mean common high-intensity fires that top-kill shrubs and may or may not kill trees. Thus, “mixed fires” are generally replacement fires for the woody shrub layer and below.

Following a “mixed fire” that kills trees (class B), trees may or may not regenerate from seed, which must occur in the first few years after fire before the shrub layer closes. The typical successional pathway is for tree regeneration to occur (to E), so this is made the default. Competition and maintenance is a disturbance used to indicate regeneration failure, leading to the alternative pathway in which shrub competition prevents future tree regeneration until another fire (D).

The prevailing dynamic is a fire-driven cyclic succession from B or C to E. Repeated fires may make possible lower intensity fires that would maintain the vegetation in a state more like C than E.

Tree regeneration is assumed to be possible with time in peat burn patches, so all succession from A is assumed to follow the path to E. Trees are likely to come in fairly late, so not to be that old when they enter state E.

Model Evolution and Comments

Suggested Reviewers: Mike Schafale, Cecil Frost, Margit Bucher. The VDDT model was not modified from Mike Schafale's FRCC file.

Succession Classes

Succession classes are the equivalent of "Vegetation Fuel Classes" as defined in the Interagency FRCC Guidebook (www.frcc.gov).

Class A 5 %

Early1 Open

Description

Class A includes depressions caused by peat fires. These "holes" in the vegetation layer fill with water or herbs. Species that may occur in these holes are Chamaedaphne (Cassandra) calyculata, Carex striata (walteriana), Woodwardia virginica, Sarracenia flava, Andropogon glomeratus, Sphagnum spp., and vaccinium macrocarpon. A replacement fire that burns into the peat layer is needed to return this and older vegetation classes to this class.

Indicator Species* and Canopy Position

CHCA2	Upper
CAST41	Upper
WOVI	Upper
ANGL2	Upper

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Fuel Model 1

Structure Data (for upper layer lifeform)

	Min	Max
Cover	25 %	75 %
Height	Herb Short <0.5m	Herb Medium 0.5-0.9m
Tree Size Class	no data	

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Class B 23 %

Early2 Closed

Description

Class B is characterized as a post-fire condition without tree survival. It includes bare ground or low shrub sprouts with few or no trees, or only tree seedlings. A replacement fire that does not burn the peat layer will revert an area to this class.

Indicator Species* and Canopy Position

LYLU3	Upper
CYRA	Upper
ILGL	Upper
ZEPU3	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model 4

Structure Data (for upper layer lifeform)

	Min	Max
Cover	75 %	100 %
Height	Shrub Dwarf <0.5m	Shrub Tall >3.0 m
Tree Size Class	Sapling >4.5ft; <5"DBH	

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

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*Dominant and Indicator Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.

Class C 5 %

Early3 Closed

Description

Class C is a post-fire condition with tree survival. It includes bare ground, shrub sprouts, or a shrub/herb mosaic, with an open tree canopy. This is nearly a replacement fire in that the shrub layer is completely top-killed, but the sparsely scattered trees survive. This is the most common type of fire seen in pocosin. A more frequent fire regime would maintain the vegetation in this class and less frequent fire would result in more land in class E.

Indicator Species* and Canopy Position

LYLU3	Middle
CYRA	Middle
ILGL	Middle
ZEPU3	Middle

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 4

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	5 %
Height	Tree Regen <5m	Tree Medium 10-24m
Tree Size Class	Pole 5-9" DBH	

☑ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

The dominant lifeform is the woody shrub layer. The "canopy closure" of these woody shrubs varies from 75 to 100%. Pond pines and a few hardwoods are in the true upper layer, but do not produce a canopy closure. The shrub layer minimum height is .5 meters and the maximum height is between 1 and 3 meters.

Class D 2 %

Late2 Closed

Description

Class D contains mature shrubs, but no trees. A dense shrub layer is present at maximum height, with very few to no trees. This class is characterized by the shrub layer out-competing future tree regeneration until the next fire occurrence.

Indicator Species* and Canopy Position

LYLU3	Upper
CYRA	Upper
ILGL	Upper
ZEPU3	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model 6

Structure Data (for upper layer lifeform)

	Min	Max
Cover	75 %	100 %
Height	Shrub Medium 1.0-2.9m	Shrub Tall >3.0 m
Tree Size Class	no data	

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Class E 65 %

Late1 Closed

Description

Class E contains mature shrubs with trees. A dense shrub layer is present at maximum height, with an open canopy of stunted pond pines and some hardwoods (including trees with recent epicormic sprouts). This is the typical successional end result, until the next fire.

Indicator Species* and Canopy Position

LYLU3	Middle
CYRA	Middle
ILGL	Middle
ZEPU3	Middle

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	5 %
Height	Tree Short 5-9m	Tree Medium 10-24m
Tree Size Class	Medium 9-21"DBH	

☑ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

The dominant lifeform is the woody shrub layer. The "canopy closure" from these woody shrubs varies from 75 to 100%. Pond pines and a few hardwoods are in the true upper layer, but do not produce a canopy closure. The shrub layer minimum height is 1meter and the maximum height can exceed 3 meters.

Fuel Model 6

Disturbances

Non-Fire Disturbances Modeled

- ☐ Insects/Disease
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☑ Competition
- ☐ Other:
- ☐ Other:

Fire Regime Group: 1

I: 0-35 year frequency, low and mixed severity
II: 0-35 year frequency, replacement severity
III: 35-200 year frequency, low and mixed severity
IV: 35-200 year frequency, replacement severity
V: 200+ year frequency, replacement severity

Historical Fire Size (acres)

Avg: 20000
Min: 50
Max: 100000

Fire Intervals (FI):
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class. All values are estimates and not precise.

Sources of Fire Regime Data

- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

	Avg FI	*Min FI*	*Max FI*	*Probability*	*Percent of All Fires*
Replacement	1400			0.00071	1
Mixed	12	3	20	0.08333	99
Surface					
All Fires	12			0.08406	

References

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