About LANDFIRE Rapid Assessment Vegetation Models

Vegetation dynamics models for the Rapid Assessment help to synthesize the best available knowledge of vegetation dynamics and quantify the natural range of variability in vegetation composition and structure. Models consist of two components: (1) a comprehensive description and (2) a quantitative, state-and-transition (box) model, created in the public domain software VDDT[1].

Models were developed in 2004-2005 during workshops across the United States where regional vegetation and fire ecology experts synthesized the best available data on vegetation dynamics and disturbances for vegetation communities in their region. A peer review process following workshops garnered additional expert input and offered an opportunity to refine models.

Rapid Assessment vegetation models were based on a simple, standardized five-box model that combines three generic succession stages with two canopy cover classes (Table 1). Each class is specifically defined for individual models. Variations on this standardized model were also developed.

Table 1. Classes in the standard five-box model. Models for the Rapid Assessment use this standard model with modifications as needed. Letters represent unique classes (combinations of cover and structure) and correspond to boxes in the state-transition models.

	Canopy Cover	
Succession Stage	*Closed*	*Open*
Early development	A	
Mid-development	B	C
Late-development	E	D

Quantitative models are based on inputs such as fire frequency and severity, the probability of other disturbances, and the rate of vegetation growth. Inputs are derived from literature review and expert input during and after modeling workshops. Models simulate several centuries of vegetation dynamics and produce outputs such as the percent of the landscape in each class and the frequency of disturbances. Outputs are checked against available data whenever possible, and are peer-reviewed during and after expert workshops.

Model descriptions and quantitative outputs were used in the Rapid Assessment to help define and map potential natural vegetation groups (PNVG), or the vegetation communities that are likely to exist under the natural range of variability in biophysical environments and ecological processes, including fire and other disturbances. Models are used as reference conditions to calculate Fire Regime Condition Class (FRCC)[2], a standardized, interagency index to measure the departure of current conditions from reference condition.

A key to the fields that appear in Model Descriptions appears below. For a complete description of the methodology used to develop Rapid Assessment vegetation models, please consult the *LANDFIRE Rapid Assessment Modeling Manual*[3].

LANDFIRE Rapid Assessment vegetation models are used as first draft models for the national LANDFIRE project, and will be refined, added to, and improved upon through 2009 for the national implementation of LANDFIRE.

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[1] Beukema, S. J., Kurz, W.A., Pinkham, C.B., Milosheva, K. and Frid, L. 2003. *Vegetation Dynamics Development Tool User's Guide, Version 4.4c.* Prepared by ESSA Technologies, Ldt., Vancouver, BC. 239 pp. Available at: www.essa.com.

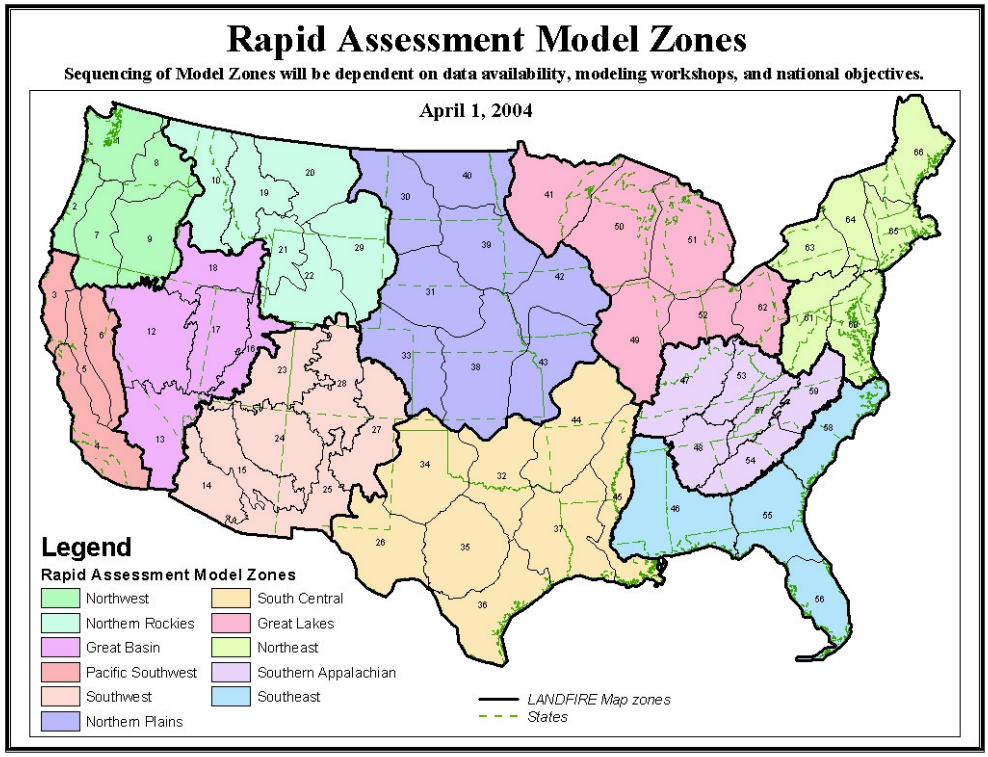
[2] Hann, Wendel J. et al. 2004. *Interagency Fire Regime Condition Class Guidebook.* Available at: www.frcc.gov.

[3] The Nature Conservancy, USDA Forest Service, and Department of the Interior. LANDFIRE Rapid Assessment Modeling Manual, Version 2.1. January 2005. Boulder, CO. 72 pp. Available at: www.landfire.gov.

Key to Fields in Model Descriptions

Potential Natural Vegetation Group	
Field Name	**Explanation**
Potential Natural Vegetation Group	The PNVG code is listed first. Codes follow this general format: ***R # SPSP ql*** Where: • *R* = R for Rapid Assessment • *#* = a numeric code for the model zone: *#* Pacific Northwest *0* Northern & Central Rockies *1* California *2* Great Basin *3* Southwest *4* Northern Plains *5* South Central *6* Great Lakes *7* Northeast *8* Southern Appalachians *9* Southeast • *SPSP* = the first two letters of each word in the dominant species. If there are more than one dominant species, common names will be used. • *ql* = an optional lowercase alphabetical qualifier for biophysical or geographic constraints. Common qualifiers include: *an* ancient; *co* cool; *cw* cool-wet; *dy* dry; *ff* with frequent fire; *gr* grass; *if* with infrequent fire; *in* interior; *lw* lower; *mn* montane; *ms* mesic; *no* north; *pl* parkland; *pu* pumice; *ri* riparian; *se* steppe; *so* south; *sp* serpentine; *st* with shrubs and trees; *up* upper; *wa* warm; *wd* warm dry; *we* wet; *wg* with grass; *ws* with shrub; *wt* with trees The name of the PNVG is listed second. This is typically a descriptive title that includes the dominant species, region and qualifier.

General Information	
Field Name	**Explanation**
Contributors	Those who contributed to the model are listed here, along with email addresses. This may include modelers (i.e., people who directly created the model) and reviewers (i.e., people who reviewed the model and provided feedback after its development). Additional contributors may be listed in the "Model Evolution and Comments" field.

General Information	
Field Name	**Explanation**
Vegetation Type	The vegetation type (UNESCO world physiognomic classification) for the *majority* of the PNVG. Classes are defined as follows: • Forest: >5 m tall; 60-100% cover • Woodland: >5 m tall; 25-60% cover • Shrubland: 0.5-5 m tall; >25% cover (<25% cover of trees) • Grassland (herbaceous): >25% cover (<25% cover of trees and shrubs)
Dominant Species	The NRCS Plants Code of up to eight dominant species for the PNVG. These reflect the *majority* of the landscape in the PNVG and are in order of dominance. To look up a NRCS Plants Code, please visit http://plants.usda.gov.
General Model Source	The sources of information consulted in the development of the model. • Literature: the model generally came from published sources. • Local data: the model generally came from local research or information. • Expert estimate: the model was generally estimated experts.
LANDFIRE mapping zones	Up to ten LANDFIRE mapping zones (numbered below) that this model applies to. 
Rapid Assessment Model Zones	The Rapid Assessment model zones for which this model applies. See the map above for the delineation of model zones.
Geographic Range	Describes the geographic distribution of this PNVG.
Biophysical Site Description	Describes the biophysical characteristics for this PNVG. This may include things like geographic distribution, elevation, aspect, soils, and slope.

General Information	
Field Name	**Explanation**
Vegetation Description	Describes the vegetation of this PNVG, including species, structure, and botanical characteristics.
Disturbance Description	Describes the dominant disturbances that impact this PNVG, including the agents, frequency, severity, and seasonality.
Adjacency or Identification Concerns	Information that may help identify the PNVG in the field, including: • synonymous local classifications (e.g., habitat type, plant association), • adjacent PNVGs, • PNVGs that this one may be confused with, • typical identifiers not described elsewhere, and • uncharacteristic types (i.e., patterns or processes that would not have existed under the historic range of variability, like exotics) that may frequently occur in this PNVG today.
Scale Description	Describes the typical scale of the most common disturbance extent, the general minimum analysis area (e.g., the minimum size that would encompass the mosaic of this PNVG), and/or the average patch size.
Scale Source	Documents the sources of information about scale. • Literature: the values entered came from published sources. • Local data: the values entered came from local observations or records. • Expert estimate: the values entered were estimated by experts.
Issues/ Problems	Describes any difficulties, issues, or concerns contributors have about the model, the availability of data on this PNVG, or other considerations.
Model Evolution and Comments	Tracks the changes, edits, and improvements to the model through the development and peer review processes. Describes any disagreements among experts about how to model the system.

Succession Classes	
Field Name	**Explanation**
Class label	Name of the class (A-E) and definition, representing a unique combination of succession stage (Early, Mid-, and Late Development) and canopy cover (All, Open, or Closed).
Class %	The percent of the landscape in this class from the VDDT model, rounded to the nearest 5%.
Description	Describes the structure, composition, and other attributes for each class.
Dominant Species	The NRCS Plants Code of up to four dominant species for the vegetation class, in order of dominance.
Dominant Species Canopy Position (optional)	The relative position of each dominant species in the canopy: • *Upper*: upper-most portion of the canopy; dominant or emergent. • *Mid-Upper*: ranging from middle to upper portions of the canopy; co-dominant. • *Middle*: middle section of the canopy; co-dominant or intermediate. • *Lower-Mid*: ranging from the lower to the middle portions of the canopy; intermediate or suppressed. • *Lower*: below the main canopy; may be suppressed or understory. • *All*: can vary between any canopy position, or occupies all levels of the canopy.

Succession Classes	
Field Name	**Explanation**
Upper Layer Lifeform (optional)	The lifeform of the vegetation at the top of the canopy, either tree, shrub, or herbaceous.

Succession Classes	
Field Name	**Explanation**

Fuel Model (optional)

The 13 Fire Behavior Fuel Models[4] for the class, if known. Fuel models are:

#	*Vegetation Type*	*Fuels*
1	Perennial grasslands, annual grasslands, savannahs, grass-tundra, grass-shrub with < 1/3 shrub or timber	Cured fine, porous herbaceous; .5-.9 tons surface fuel load per acre; .5-2 foot depth
2	Shrub, pine, oak, pinyon-juniper with < 2/3 shrub or timber cover	Fine herbaceous surface cured or dead, litter, dead stem or limb wood; 1-4 tons surface fuel load per acre; .5-2 foot depth
3	Tall grassland, prairie, and Meadow	Tall herbaceous surface with > 1/3 dead or cured; 2-4 tons fuel load per acre; 2-3 foot depth
4	Coastal/Sierra chaparral, pocosin shrub (fetterbrush, gallberry, bays), southern rough shrub, closed jack pine, pine barrens	Flammable foliage and small dead woody material with or w/o litter layer; 10-15 tons fuel load per acre; 4-8 foot depth
5	Moist or cool shrub types (laurel, vine maple, alder, manzanita, chamise), forest/shrub, regeneration shrubfields after fire or harvest	Green foliage with or w/o litter; 3-5 tons per acre; 1-3 foot depth
6	Pinyon-juniper w/ shrubs, southern hardwood/ shrub w/ pine, frost killed gambel oak, pocosin shrub, chamise, chaparral, spruce-taiga, shrub-tundra, hardwood slash	Flammable foliage, but shorter and more open than FM 4 w/ less dead small wood and litter; 4-8 tons per acre; 2-4 foot depth
7	Palmetto-gallberry w/ or w/o pine overstory, black spruce/shrub, southern rough, slash pine/gallberry	Flammable foliage even when green; 4-6 tons per acre; 2-3 foot depth
8	Closed canopy short needle conifer types, closed canopy broadleaf or hardwood types	Usually low to moderately flammable foliage with litter or scattered vegetation understory; 4-6 tons per acre surface fuels; .1-.5 foot depth
9	Long needle (ponderosa, Jeffrey, red, southern) conifer types, oak-hickory and similar hardwood types	Flammable foliage with needle or leaf litter and some dead down woody material; 3-4 tons per acre; .1-.5 feet
10	Any Forest type with > 3" down dead woody fuels)	Dead down > 3" woody fuels and litter; 10-14 tons per acre of total surface fuel < 3"; .5-2 foot depth
11	Light logging slash, partial cut slash	10-14 tons per acre total fuel load < 3"; .5-2 foot depth
12	Moderate and continuous logging slash in clearcuts or heavy partial cuts and thinned areas	30-40 tons per acre total fuel load < 3"; 2-3 foot depth
13	Heavy and continuous logging slash in clearcuts or heavy partial cuts and thinned areas	50-60 tons per acre total fuel load > 3"; 2-4 foot depth

[4] Anderson, Hal. 1982. Aids to determining fuel models for estimating fire behavior. USDA Forest Service. Intermountain Forest and Range Experiment Station, Ogden, UT. General Technical Report INT-122. 28 pp.

Succession Classes

Field Name	Explanation
Minimum and Maximum Canopy Cover	The minimum and maximum canopy cover expected for the upper layer lifeform of each class.
Minimum and Maximum Height (optional)	The minimum and maximum height for the upper layer lifeform. The height selected should be a class related to the Upper Layer Lifeform selected above. Height classes are:

Trees		*Shrubs*		*Herbaceous*	
Regen-eration	<5 m (~<16 ft)	Dwarf	<0.5m (~<1.6 ft)	Short	<0.5m (~<1.6 ft)
Short	5-9 m (~16-30 ft)	Short	05.-0.9m (~1.6-3 ft)	Medium	0.5-0.9m (~1.6-3 ft)
Medium	10-24 m \ (~30-78 ft)	Medium	1-2.9m (~3-9.5 ft)	Tall	>1m (~3-9.5 ft)
Tall	24-49 m (~78-160 ft)	Tall	>3m (~>9.5 ft)		
Giant	>50 m (~>160 ft)				

Tree Size Class (optional)	The maximum tree diameter class. Size classes are:

Seedling	<4.5 ft tall (~<1.4 m)
Sapling	>4.5 ft tall; <5" DBH (~>1.4m tall; ~<13 cm DBH)
Pole	5-9" DBH (~13-23 cm DBH)
Medium	9-21" DBH (~23-53 cm DBH)
Large	21-33" DBH (~53-84 cm DBH)
Very Large	>33" DBH (~>84 cm DBH)

Upper layer is different from dominant lifeform	If the upper layer lifeform is different from the dominant lifeform (e.g., in a savanna type system), the canopy cover range and height for the dominant lifeform are described here.

Disturbances

Field Name	Explanation
Disturbances Modeled	All of the disturbance types used in the model are checked.
Historical Fire Size (optional)	The estimated average, minimum, and maximum fire size (in acres) under the natural range of variability.
Sources of Fire Regime Data	Indicates the sources of information about fire regimes: • Literature: the values entered came from published sources. • Local data: the values entered came from local observations or records. • Expert estimate: the values entered were estimated by experts.

Disturbances	
Field Name	**Explanation**
Fire Regime Group	The single *dominant* Fire Regime Group (FRG). • FRG I = 0-35 year frequency; low and mixed severity • FRG II = 0-35 year frequency; replacement severity • FRG III = 35-200 year frequency; low and mixed severity • FRG IV = 35-200 year frequency; replacement severity • FRG V = 200+ year frequency; replacement severity
Average Fire Interval	For each severity class (Replacement, Mixed Severity, Surface), the average (or other central tendency) fire interval in years, as in the VDDT model. Fire interval is defined as the number of years between fires.
Minimum Fire Interval	For each severity class (Replacement, Mixed Severity, Surface), the minimum fire interval (smallest number) in years. This is not the statistical minimum and is entered by modelers based on observation and/or literature for informational purposes only. It is not derived from the VDDT model.
Maximum Fire Interval	For each severity class (Replacement, Mixed Severity, Surface), the maximum fire interval (largest number) in years. This is not the statistical maximum and is entered by modelers based on observation and/or literature for informational purposes only. It is not derived from the VDDT model.
Probability	Probability is equal to 1/Average Frequency. It should closely mirror the probability of fire in the VDDT model.
Percent of all fires	Percent of fires that burned for a given severity class. Percent of all fires is equal to the probability of a severity / All Fire Probability.
All Fire Frequency	All Fire Frequency is equal to 1/ All Fire Probability. It should reflect the AllFire frequency in the model.
All Fire Probability	All Fire Probability is equal to the sum of probabilities for the three severity classes.

References	
Field Name	**Explanation**
References	Lists all of the references used while creating this model, whether or not they are cited directly in the text.