Development And Applications of the LANDFIRE Forest Structure Layers

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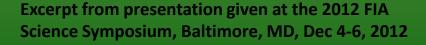
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LANDFIRE 2008 Refresh Updates: Existing Vegetation Cover

Existing Canopy Cover
- Herb Cover >= 10 and < 50%
- Herb Cover >= 50 and <= 100%
- Shrub Cover >= 10 and < 50%
- Shrub Cover >= 50 and <= 100%
- Tree Cover >= 10 and < 20%
- Tree Cover >= 20 and < 30%
- Tree Cover >= 30 and < 40%
- Tree Cover >= 40 and < 50%
- Tree Cover >= 50 and < 60%
- Tree Cover >= 60 and < 70%
- Tree Cover >= 70 and < 80%
- Tree Cover >= 80 and < 90%
- Tree Cover >= 90 and <= 100%
- Recently Disturbed Forest
- Herbaceous Wetlands
- Developed - Burnable
- Developed - Non-burnable
- Agriculture - Burnable

- Agriculture - Non-burnable
- Sparse Vegetation Canopy
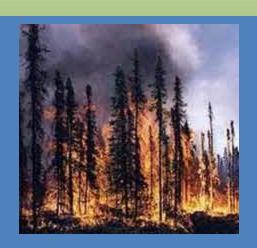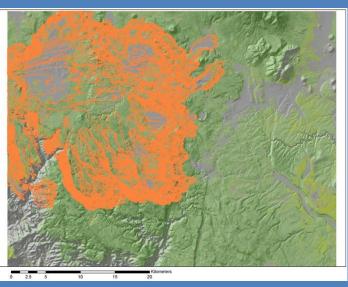- Barren, Quarries, Strip Mines, Gravel Pits
- Snow/Ice
- Water

Applications of LANDFIRE tree canopy cover and stand height layers

- **Fire behavior analyses**
  - **FARSITE**
  - **Wildland Fire Decision Support System (WFDDS)**
  - **Fire Program Analysis (FPA) system**
- **Successional stage**
- **Habitat mapping**
- **Climate, biomass**

LANDFIRE Timeline

Project start

"Refresh" circa 2001 / 2008 products -
Tree canopy cover and stand height remapped using FIA plot data

| 2004 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |

Original LANDFIRE circa 2001 products delivered - Tree canopy cover based on NLCD 2001

Scheduled delivery of 2010 updates and new products

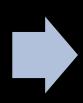# End user feedback and assessments by fuels specialists of the original 2001 tree cover/height layers

- **Tree canopy cover values tended to be too high**
  - **Many western forest types have max 70-80% canopy cover**
  - **Accuracy low?**
- **Stand height values tended to be too low**
- **Significant impact on fire behavior modeling systems**

Remap tree canopy cover and stand height as part of Refresh 2008

LANDFIRE "Refresh" 2008 overview

Remap canopy cover and stand height for 2001 from FIA plots and Landsat

→

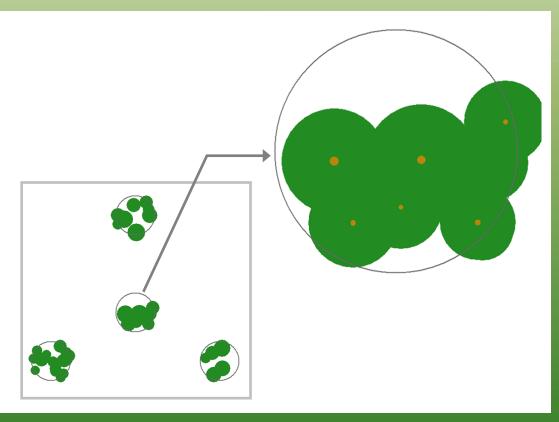Map annual disturbances 1999-2008: Landsat and polygon data

↓

Apply vegetation transitions to 2001 map → 2008

←

Derive vegetation transition rules from FVS and FIA plot data
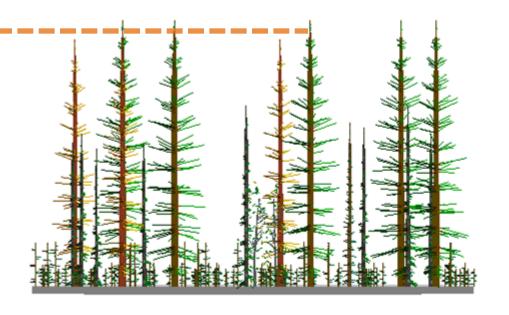
Tree canopy cover of FIA plots was estimated by stem-mapping and modeling crown dimensions

- **Vertically projected canopy cover of FIA tally trees ≥ 1.0 in. diameter**

- **Sapling component modeled from microplot data and spatial pattern of overstory trees**

- **Calibrated to line intercept field measurements**

- **Toney et al. 2009**

Stand height was calculated as basal-area weighted height of the dominant and co-dominant trees in the plot

- **Canopy top height**

- **Sapling-stage plots used average height of the saplings only**

FIA single-condition forested plots used for training data and validation

- **Plots measured 1999-2007 used for mapping 2001 cover/height**
- **Plots omitted if disturbed following location-specific image dates**
  → 54,000 plots in CONUS after screening

- **Predictor variables:**
  - **LANDSAT leaf-on, leaf-off, and spring dates**
  - **Elevation, slope, aspect**
  - **Image texture derived from tassel-cap images**
  - **SRTM-based height metric (Kellndorfer et al. 2004 RSE)**
- **Regression tree models by map zone**
- **Seam lines, clouds, and other artifacts addressed**

Updating 2001 to 2008

- **Annual disturbance maps 1999-2008: MTBS, LANDSAT time series (VCT), and contributed polygon data**
  - **Disturbance types and severity**

- **Canopy cover and stand height updated based on modeled vegetation transitions**
  - **FIA data used in FVS to model 10 years of growth for each combination of vegetation type, disturbance type, severity**
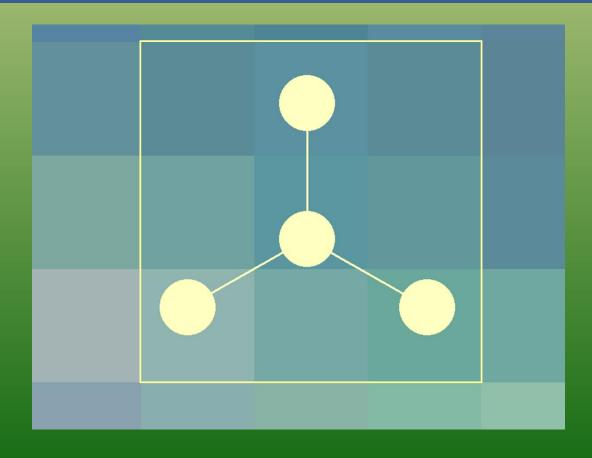 - **2001 map →**
      time since disturbance + transition rule
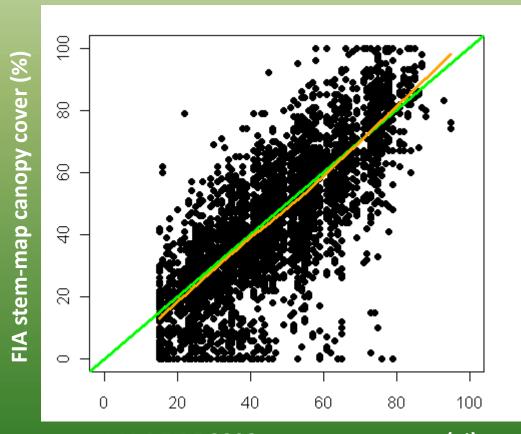   **→ 2008 map**

- **FVS also used to model transition in undisturbed areas**

Plots measured in 2008-2009 were used to assess 2008 canopy cover and height

- **Excluded plot locations that were used in mapping**
- **Assessed 3 x 3 (90 meter) map regions:**

LANDFIRE 2008 tree canopy cover compared with FIA plots measured during 2008-2009: western US
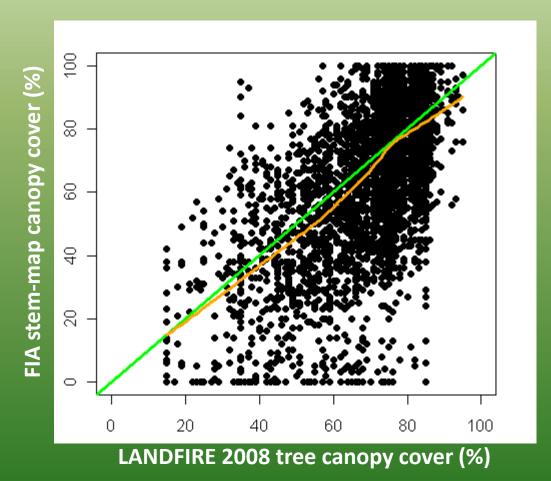

FIA stem-map canopy cover (%)

LANDFIRE 2008 tree canopy cover (%)

mean difference: -2
mean absolute diff: ± 11
R^2 = 0.58
n = 3,589 plots

— 1:1   — loess

LANDFIRE 2008 tree canopy cover compared with FIA plots measured during 2008-2009: eastern US

mean difference: -3.8
mean absolute diff: ± 13
R^2 = 0.40
n = 4,587 plots

LANDFIRE 2008 tree height compared with FIA plots measured during 2008-2009: CONUS

		Field tree height					Row total	Producer accuracy
		0-5m	**5-10m**	**10-25m**	**25-50m**	**>50m**		
Mapped tree height	**0-5m**	**141**	43	63	7	0	254	56%
	5-10m	243	**346**	95	4	0	688	50%
	10-25m	157	307	**4450**	665	1	5580	80%
	25-50m	17	10	372	**958**	44	1401	68%
	>50m	0	1	0	3	**6**	10	60%
	Column total	558	707	4980	1637	51	7933	
	User accuracy	25%	49%	89%	59%	12%		

Overall accuracy: 74%
Within one class: 95%