Development And Applications of the LANDFIRE Forest Structure Layers

Chris Toney
Rocky Mountain Research Station,
USDA Forest Service

Birgit Peterson
ASRC Research and Technology Solutions, USGS EROS

Don Long
Russ Parsons
Greg Cohn
Rocky Mountain Research Station,
USDA Forest Service

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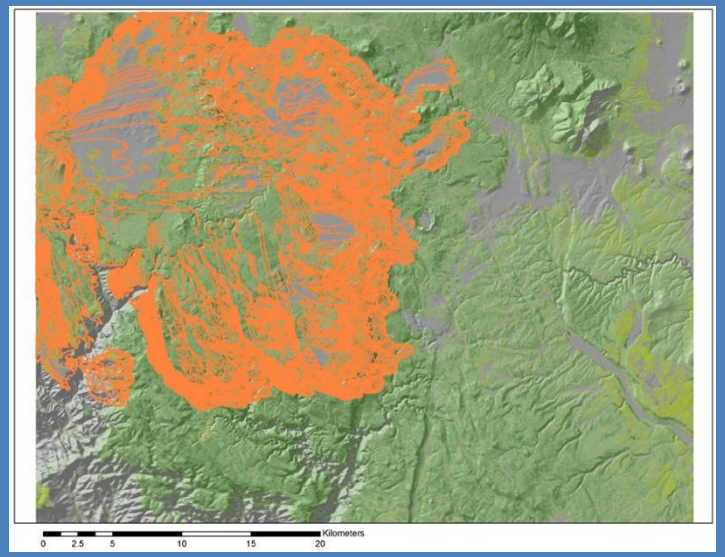
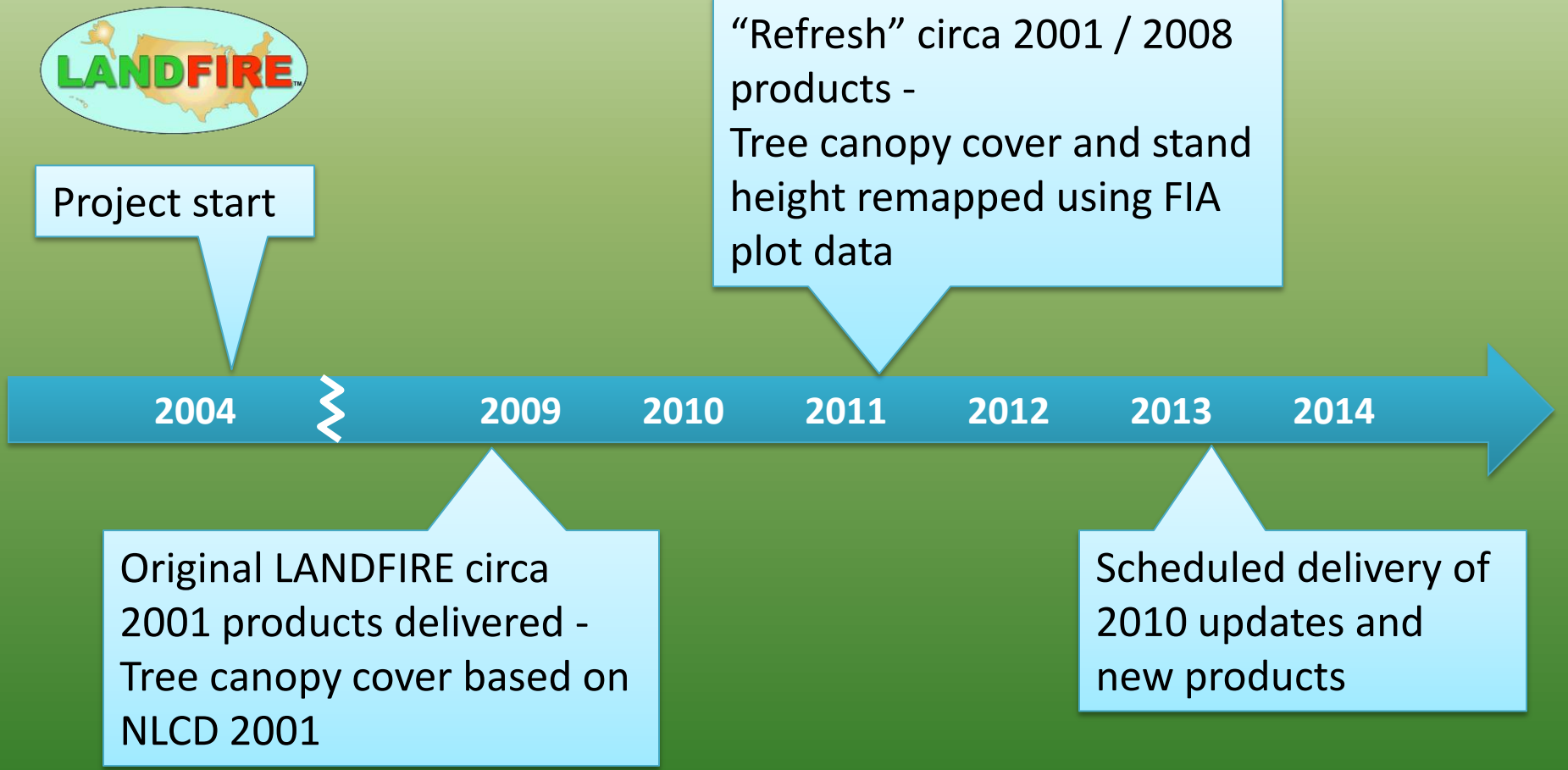
Applications of LANDFIRE tree canopy cover and stand height layers

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



LANDFIRE Timeline

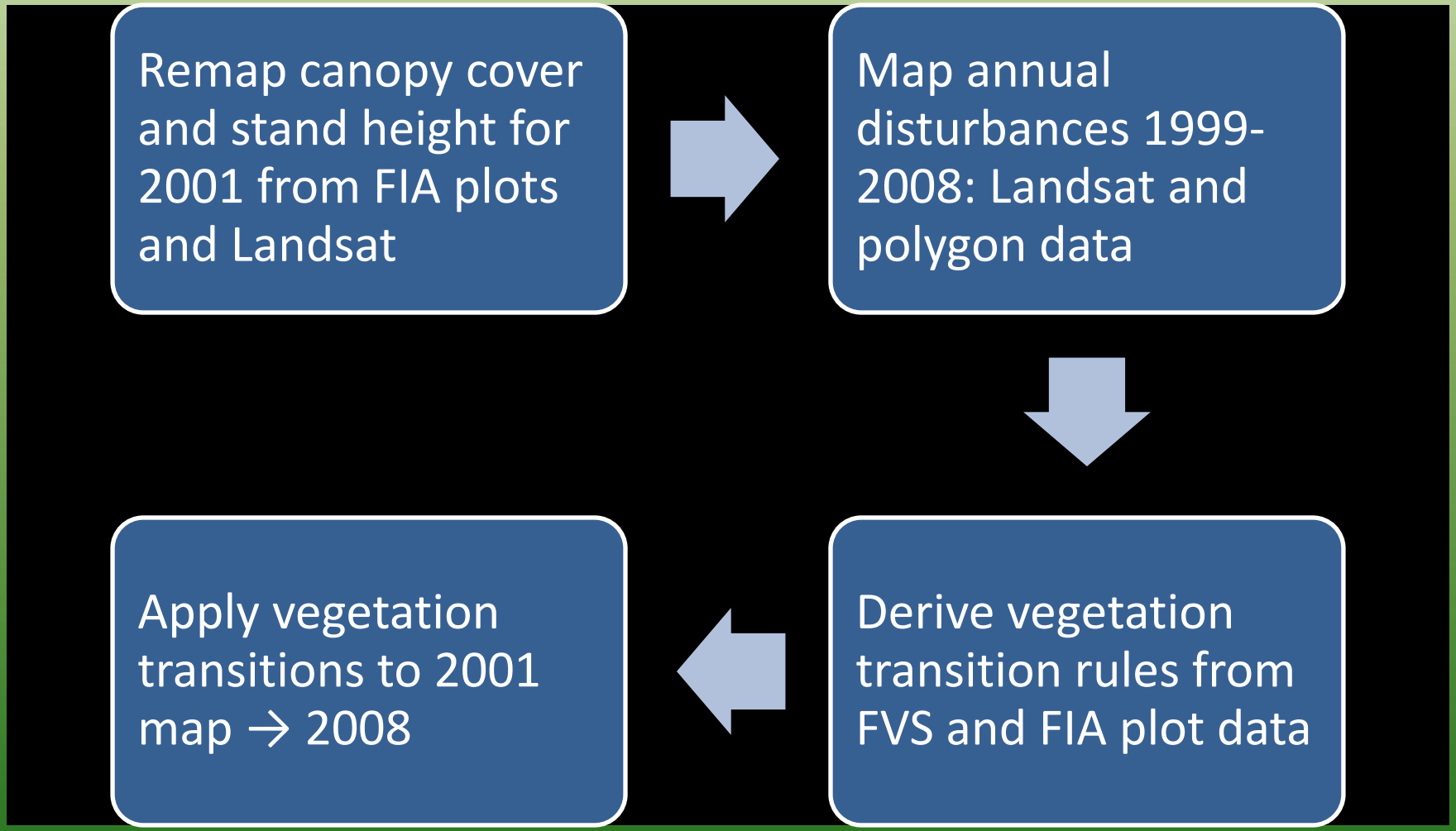


End user feedback and assessments by fuels specialists of the original 2001 tree cover/height layers

- 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

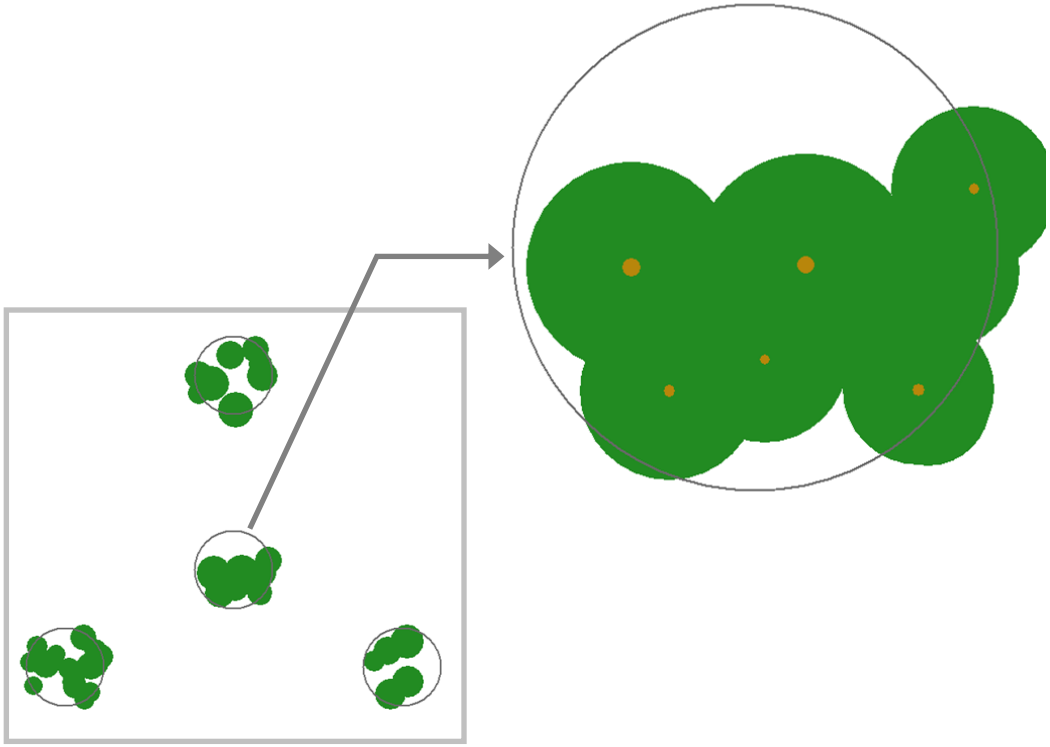
Remap tree canopy cover and stand height as part of Refresh 2008

LANDFIRE “Refresh” 2008 overview



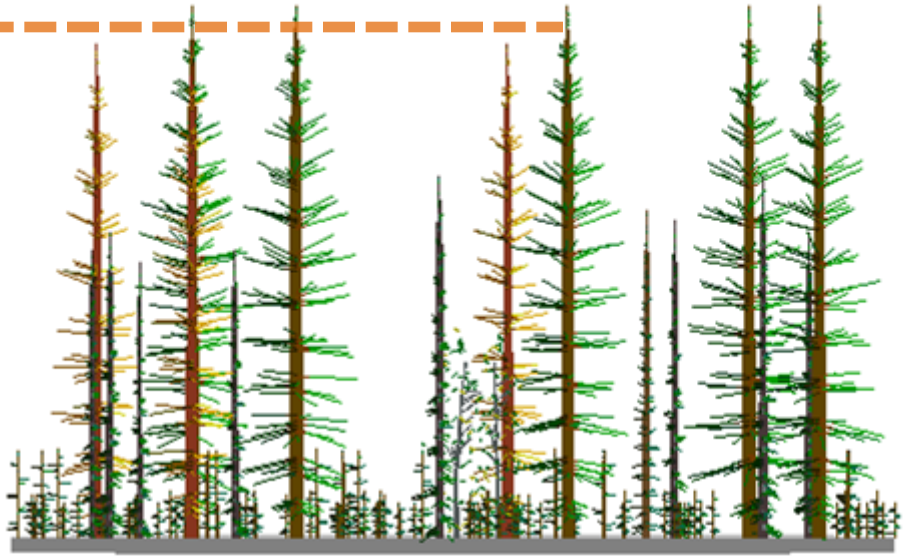
Tree canopy cover of FIA plots was estimated by stem-mapping and modeling crown dimensions

- 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

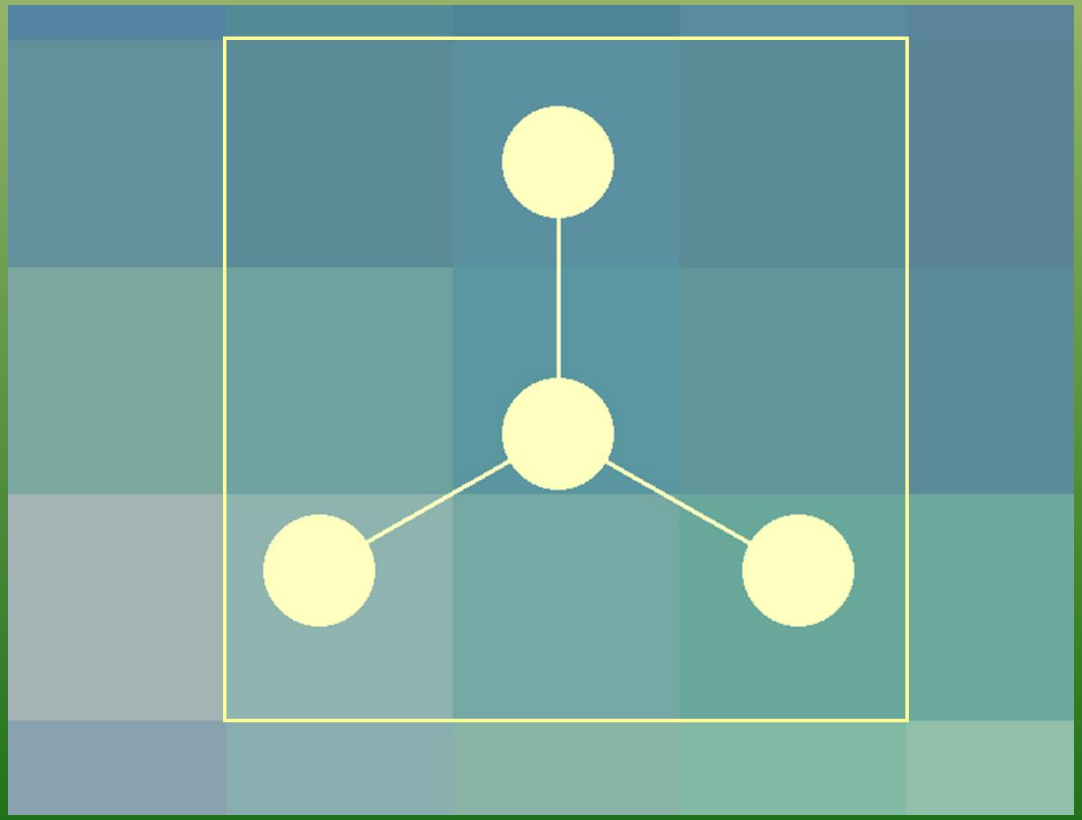
- Predictor variables:
  - LANDSAT leaf-on, leaf-off, and spring dates
  - Elevation, slope, aspect
  - Image texture derived from tassel-cap images
  - SRTM-based height metric (Kellndorfer et al. 2004 RSE)
- Regression tree models by map zone
- Seam lines, clouds, and other artifacts addressed

Updating 2001 to 2008

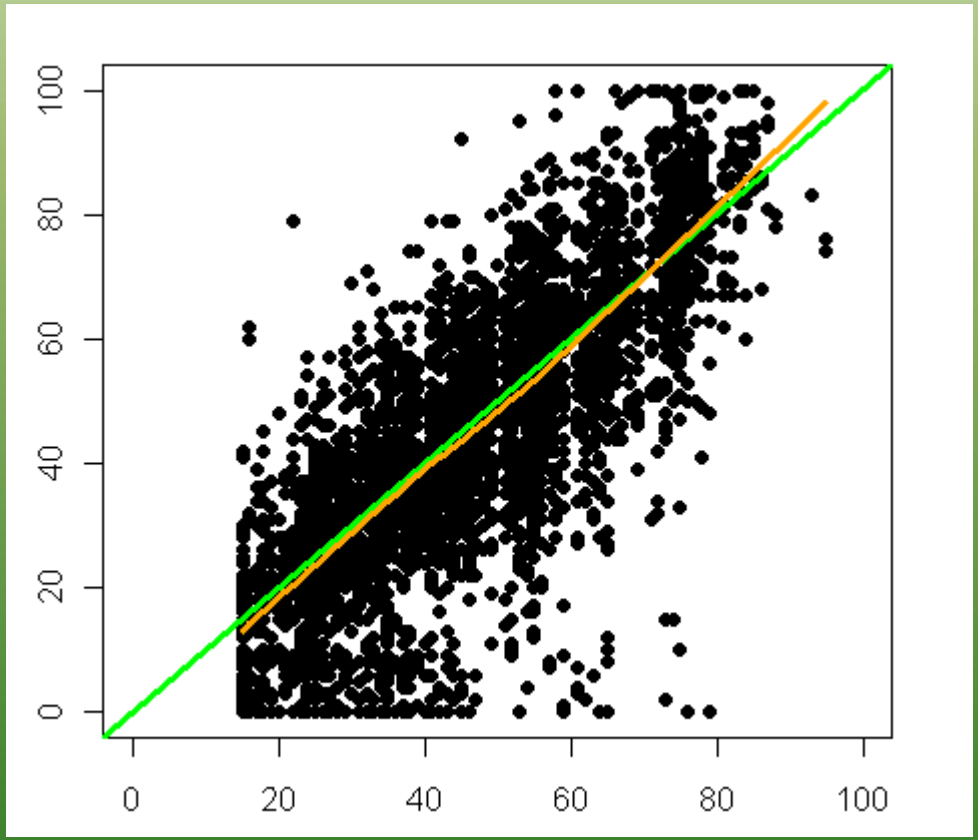
- Annual disturbance maps 1999-2008: MTBS, LANDSAT time series (VCT), and contributed polygon data
  - Disturbance types and severity
- Canopy cover and stand height updated based on modeled vegetation transitions
  - FIA data used in FVS to model 10 years of growth for each combination of vegetation type, disturbance type, severity
  - 2001 map →
    time since disturbance + transition rule
    → 2008 map
- FVS also used to model transition in undisturbed areas

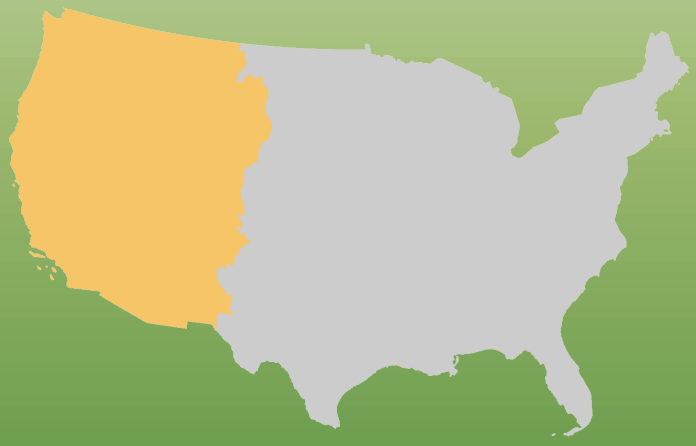
Plots measured in 2008-2009 were used to assess 2008 canopy cover and height

- 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





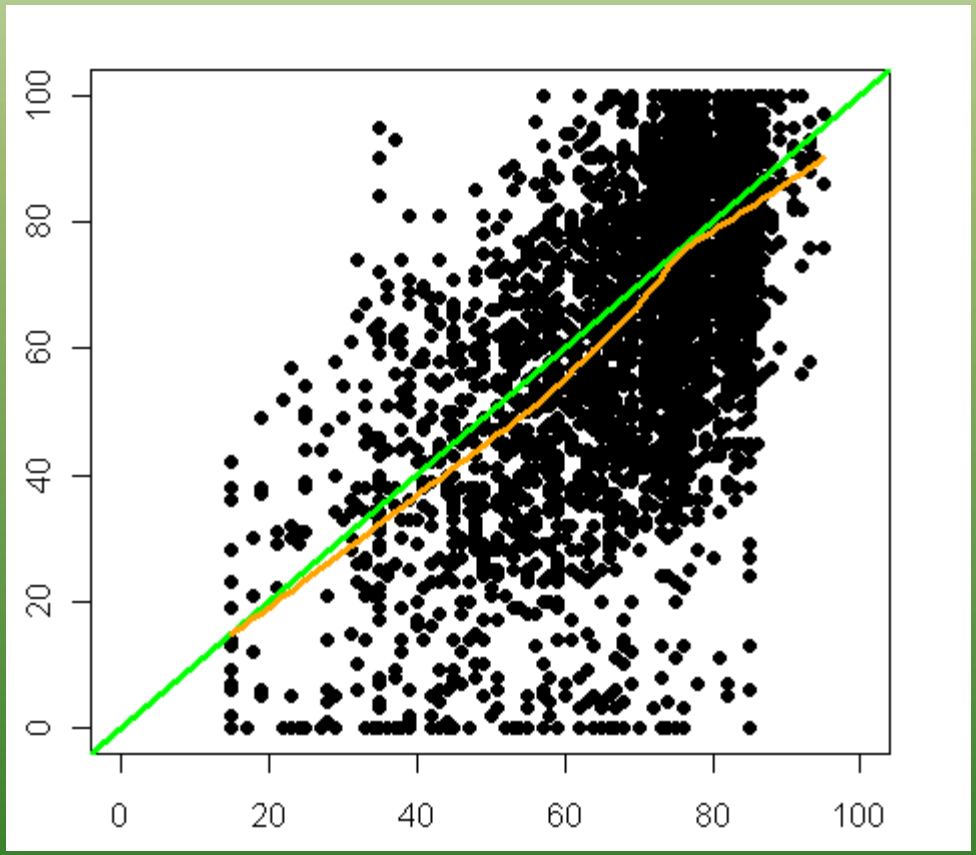
mean difference: -2

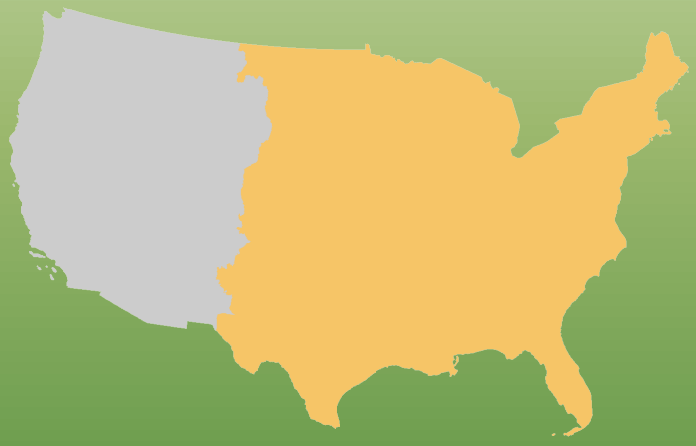
mean absolute diff: ± 11

$R^2 = 0.58$

n = 3,589 plots

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						
		0-5m	**5-10m**	**10-25m**	**25-50m**	**>50m**	Row total	Producer accuracy
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%