

LANDFIRE Webinar

New LANDFIRE Remap Products for the
Southwestern United States



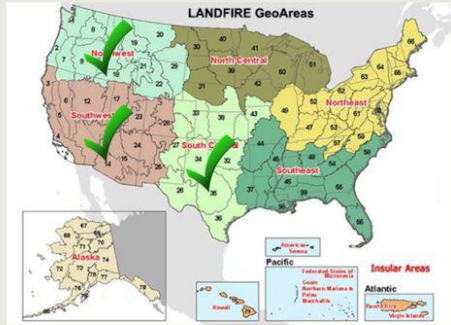
Presented to Southern Rockies, Southwest, Great Basin Fire Science Networks
by Kori Blankenship and Jim Smith – The Nature Conservancy's LANDFIRE Team
October 9, 2019



On behalf of the TNC LANDFIRE Team and the entire LANDFIRE Program, Kori and I thank you for the opportunity to present this webinar describing the status and plans for the LANDFIRE Program.

AGENDA

- Background: The Past
- LF Remap: The Present
- LF Update: The Future
- Impacts
- BpS Review
- Support/Resources



Review agenda

Who is LANDFIRE?



USDA FS, DOI, USGS Production Team, Program Leaders, and GAP



The Nature Conservancy's LANDFIRE Team

An innovative program designed to create and periodically update comprehensive **vegetation**, **fire**, and **fuel** characteristics data using a consistent process for the entire U.S.



LANDFIRE is a partnership between the U.S. Forest Service and the U.S. Department of Interior, and TNC. On the left is a significant part of the LF Production team at EROS, and the right is the TNC team.

Past: The LANDFIRE Foundation

LANDFIRE Charter establishes 4-C's:

- **Comprehensive**
- **Compatible**
- **Consistent**
- **Current**

.... which are our design criteria/design constraints for

20+ current and historic vegetation/fuels/condition 30m, spatial data layers and 800+ quantitative state-and-transition BpS models and descriptions.

Delivered versions circa 2000/1 (LF National/Improved), updates in 2008, 2010, 2012 and 2014, and now **Remap 2016**.



LANDFIRE program products

- are created for every acre in CONUS, AK, HI and the Island Territories - comprehensive
- match thematically and geometrically - compatible
- are produced using similar data sets and processes across time and space - consistent (there are changes due to feedback and product improvement desires)
- are produced and delivered as rapidly as possible - current

These criteria have tangible impacts on what the products are, when we can deliver them, and how well they represent ground conditions.

The LANDFIRE product suite consists of nearly 2 dozen 30-meter spatial data sets (veg, fuels, etc.) and 800+ quantitative state-and-transition models in 5 (1 original + 4 temporal updates) completed delivered versions, and 1 partial delivery (Remap)

Past: The LANDFIRE Foundation

[L.F. Version Descriptions](#)

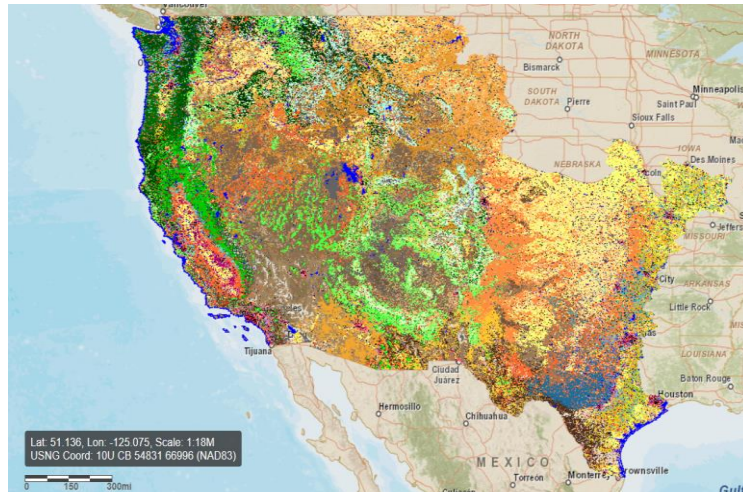
Under each column, links are provided to download full extent mosaics or databases. Please note that mosaics are not available until the full extent is complete. Data availability is shown on LP's [Data Distribution Site \(DDS\)](#), which offers data downloads at selected extents.

Product Name	Address	Theme	DOB	LP 2004 LP 2.0.0	LP 2008 LP 2.0.0	LP 2010 LP 2.0.0	LP 2012 LP 2.0.0	LP 2014 LP 2.0.0	LP 2016 LP 2.0.0
LP Fuelbase Database	USFS	Reference	—	US 1 00 1 00	n/a	n/a	n/a	n/a	n/a
Risk: Events Database, 1999-2006	Events	Reference	n	—	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
Forest Vegetation Simulator Fuelbase Database	FVSDB	Reference	—	—	—	—	US 1 00 1 00	—	—
Disturbance	Disturbance	Disturbance	n	—	US 1 00	US 1 00	US 1 00 1 00	US 1 00 1 00	n
Vegetation Disturbance	Disturbance	Disturbance	n	—	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	—
Reference Disturbance	Disturbance	Disturbance	n	—	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
Vegetation Transition Map/Scale	VTMap	Disturbance	n	—	—	US 1 00	US 1 00 1 00	US 1 00 1 00	—
Forest Vegetation Transition Database	FVTD	Disturbance	—	—	—	—	US 1 00 1 00	n/a	—
Non-forest Vegetation Transition Database	NVTD	Disturbance	—	—	—	—	US 1 00 1 00	n/a	—
Fuel Disturbance	FVDB	Disturbance	n	—	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
Forest Vegetation Simulator Disturbance Database	FVSDB	Disturbance	—	—	—	—	US 1 00 1 00	n/a	—
Biophysical Settings	BPS	Vegetation	n	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
Environmental Site Potential	ESP	Vegetation	n	US 1 00 1 00	n/a	US 1 00 1 00	n/a	n/a	—
Existing Vegetation Cover	EVC	Vegetation	n	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
Existing Vegetation Height	EVI	Vegetation	n	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
Existing Vegetation Type	EVT	Vegetation	n	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
National Vegetation Classification	NVC	Vegetation	—	—	—	—	—	—	—
Biophysical Settings Module and Descriptions	BBS	Vegetation	—	BBS Module	n/a	n/a	n/a	n/a	—
US Anderson Fire Behavior Fuel Models	FBPM13	Fuel	n	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
40 South and Bergen Fire Behavior Fuel Models	FBPM40	Fuel	n	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
Canadian Forest Fire Danger Rating System	CFDARS	Fuel	n	—	—	—	US 1 00 1 00	US 1 00 1 00	n
Forest Canopy Bulk Density	CBD	Fuel	n	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
Forest Canopy Bulk Height	CBD	Fuel	n	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
Forest Canopy Height	CH	Fuel	n	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
Fuel Characteristic Classification System Fuelbase	FCCS	Fuel	n	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
Fuel Loading Models	FLM	Fuel	n	US 1 00	US 1 00	—	—	—	—
Fuel Vegetation Cover	FVC	Fuel	—	—	—	—	—	—	—
Fuel Vegetation Height	FVH	Fuel	—	—	—	—	—	—	—
Fuel Vegetation Type	FVT	Fuel	—	—	—	—	—	—	—
Fuel Schedules Database	—	Fuel	—	—	—	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
Fire Regime Groups	FRG	Fire Regime	n	US 1 00 1 00	n/a	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	n
Forest Fire Regime Group	FRG	Fire Regime	n	US 1 00 1 00	n/a	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	—
Forest Low-severity Fire	FLS	Fire Regime	n	US 1 00 1 00	n/a	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	—
Forest High-severity Fire	FHS	Fire Regime	n	US 1 00 1 00	n/a	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	—
Forest Regime-severity Fire	FHS	Fire Regime	n	US 1 00 1 00	n/a	US 1 00 1 00	US 1 00 1 00	US 1 00 1 00	—
Vegetation Classes	VCLASS	Fire Regime	n	US 1 00 1 00	US 1 00 1 00	—	US 1 00 1 00	US 1 00 1 00	n
Vegetation Condition Class**	VCC	Fire Regime	n	US 1 00 1 00	US 1 00 1 00	—	US 1 00 1 00	US 1 00 1 00	n
Vegetation Exposure Index**	VEI	Fire Regime	n	US 1 00 1 00	US 1 00 1 00	—	US 1 00 1 00	US 1 00 1 00	n
Aspect ***	ASP	Topographic	n	n/a	n/a	US 1 00 1 00 1 00	n/a	n/a	US 1 00 1 00 1 00
Elevation ***	DEM	Topographic	n	n/a	n/a	US 1 00 1 00 1 00	n/a	n/a	US 1 00 1 00 1 00
Slope ***	SLOP	Topographic	n	n/a	n/a	US 1 00 1 00 1 00	n/a	n/a	US 1 00 1 00 1 00



I don't expect you to read this, but to appreciate the depth and breadth of program products

Present: Remap 2016



Remap is NOT an update...it is a re-creation of the majority of the product suite from scratch...new plots, new imagery, new processes, etc.

NW, SW, and South Central U.S. GeoArea Vegetation and Fuels (EVT, EVC, EVH, FBFM, Canopy Fuels, BpS) have been delivered.

Fire Regime data will be created and delivered when veg and fuels are complete for CONUS.

LF Remap – What Remains the Same?

LANDFIRE Program has the **same design criteria/constraints**: comprehensive, compatible, consistent and current.

The **basic product suite is the same**, but there are changes to mapping processes and thematic content intended to improve product usability.

Should still be considered a large landscape, regional, national data set as delivered out-of-the-box.



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LF Remap – What's New?

- Mapping footprints based on **Omernik Level III** ecoregions instead of NLCD Map Zones.
- New **compositing/tiling/masking methods** that provide an improved and more consistent image base.
- New, **improved plot “Auto-Keys”** for assigning vegetation type to field plots.
- Landsat 8 imagery and Landsat Analysis Ready Data Sets (**image stacks**).
- Included **external review** of the Existing Vegetation Type legend and draft products.
- Independently mapped **NVC Group**.



LF Remap – What's New?

- Many more **field-plots** and more diverse field-plots to support mapping.
- Incorporation of **lidar** data sets to improve the thematic resolution of structure products.
- Incorporation of **NLCD** Continuous Shrub Cover mapping project processes/products.
- Review of **Biophysical Settings** models and descriptions.
- **New products**: Historic disturbance, Year-Capable Fuels Products.
- New, **backwardly compatible** Fire Regime Group schema.



New Fire Regime Group Schema

Original Fire Regime Group	New Group Designation	All Fire Fire Return Interval	% Replacement Fire
I	I-A	0 - 5 years	Less than 66.7%
	I-B	6 - 15 years	
	I-C	16 - 35 years	
II	II-A	0 - 5 years	66.7% or greater
	II-B	6 - 15 years	
	II-C	16 - 35 years	
III	III-A	36 - 100 years	Less than 80%
	III-B	101 - 200 years	Less than 66.7%
IV	IV-A	36 - 100 years	80% or greater
	IV-B	101 - 200 years	66.7% or greater
V	V-A	201 to 500 years	Any severity
	V-B	501+ years	



Based on user comments from previous versions the FRG schema was often problematic....insufficient FRI resolution

Wendel Hann LF did an analysis of FRG, and then developed a new, backwardly compatible FRG definitions that we hope is more useful.

LF Remap Quality

- EVT assessments for Ecological Systems, NVC Group, NVC Macrogroup, and SAF/SRM cover type.
- Thousands of independent plots.
- Traditional Contingency Table.
- Example of how to collapse categories in the

Plot Assignment

LANDFIRE	7008 North Pacific Oak Woodland	7014 Central and Southern California Mixed Evergreen Woodland
7008 North Pacific Oak Woodland	10	
7014 Rocky Mountain Aspen Forest and Woodland	0	10
7015 Rocky Mountain Bigleaf Maple Racine Woodland	0	
7016 Central and Southern California Mixed Evergreen Woodland	0	
7017 California Coastal Redwood Forest	0	
7018 Colorado Plateau Piñon-Juniper Woodland	0	
7019 Columbia Plateau		

Collapsing categories in a contingency table
In this example, for our combined Column A with C, and D with E, B is unchanged

Category	A, C	B	D, E	Col Total
A	10	0	0	10
B	0	10	0	10
C	0	0	10	10
D	0	0	0	0
E	0	0	10	10
Row Total	10	10	20	40

Sum of values for combined rows and columns

Category	A, C	B	D, E	Col Total
A, C	10	0	0	10
B	0	10	0	10
D, E	0	0	20	20
Row Total	10	10	20	40



Vegetation Height (EVH)---and exploring FBFM

LF Remap Quality

- Category Agreement Table

EVT Map Value	EVT_Name	Row Total (msh)	% of Row Pixels	Row Agreement	Primary Within Row Mismatch	Secondary Within Row Mismatch	Tertiary Within Row Mismatch	Data Source
7023	Madrean Encinal	45	0.35%	60.0%	7025 Madrean Pinon-Juniper Woodland; 13 Incorrect Pixels	7104 Mogollon Chaparral; 3 Incorrect Pixels	7024 Southern Rocky Mountain Ponderosa Pine Woodland; 1 Incorrect Pixels	LANDFIRE LFRDB
7114	California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna	122	0.94%	59.84%	8902 Californian Ruderal Forest; 22 Incorrect Pixels	7205 Northern and Central California Dry-Mesic Chaparral; 9 Incorrect Pixels	7020 Mediterranean California Lower Montane Conifer Forest and Woodland; 7 Incorrect Pixels	LANDFIRE LFRDB
7087	Sonoran Mojave Crenatebush-White Bursage Desert Scrub	286	2.21%	59.09%	9054 North American Warm Desert Wash Shrubland; 38 Incorrect Pixels	7082 Mojave Mid-Elevation Mixed Desert Scrub; 27 Incorrect Pixels	7289 Sonoran Paloverde-Mixed Cacti Desert Scrub; 24 Incorrect Pixels	LANDFIRE LFRDB
7110	Southern California Dry-Mesic Chaparral	260	2.03%	58.46%	7097 California Mesic Chaparral; 41 Incorrect Pixels	7092 Southern California Coastal Scrub; 34 Incorrect Pixels	9137 California Ruderal Scrub; 16 Incorrect Pixels	LANDFIRE LFRDB
7050	Rocky Mountain Lodgepole Pine Forest	346	2.67%	58.09%	7146 Southern Rocky Mountain Montane Subalpine Grassland; 39 Incorrect Pixels	7145 Rocky Mountain Subalpine-Montane Mesic Meadow; 38 Incorrect Pixels	7955 Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland; 20 Incorrect Pixels	LANDFIRE LFRDB

- Planning on an assessment of Vegetation Cover (EVC) and Vegetation Height (EVH), and perhaps FBFM.



Vegetation Height (EVH)---and exploring
FBFM

LANDFIRE Future

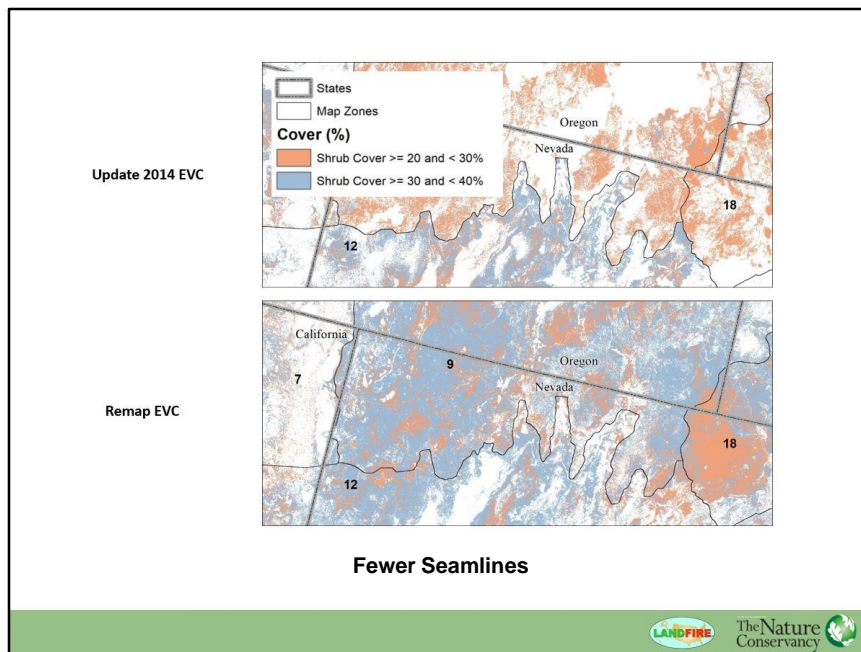
- Remap 2016 will wrap up in CONUS during the summer of 2020, and then Alaska, Hawai'i, and the island territories over the following months.
- Because "remapping" is more expensive than "updating," we may not be able to conduct another remap in the future.
- The goal is to find a way to provide more frequent updates (annually, delivered within a few months) along with more complete updates, perhaps bi-annually.



- We expect to complete Remap in CONUS, followed by AK, HI and Insular areas
- Then we will begin an update cycle, final plan impacted by budget
- Updating alternatives being explored
 - Annual, next year rapid updates based on submitted disturbances/landscape changes
 - Bi-annual updates based on submitted disturbances + remotely sensed landscape change
- Communications and support---listening as much as talking
- Now I will turn over the presentation duties to Kori Blankenship, Fire Ecologist on our team and a NW native

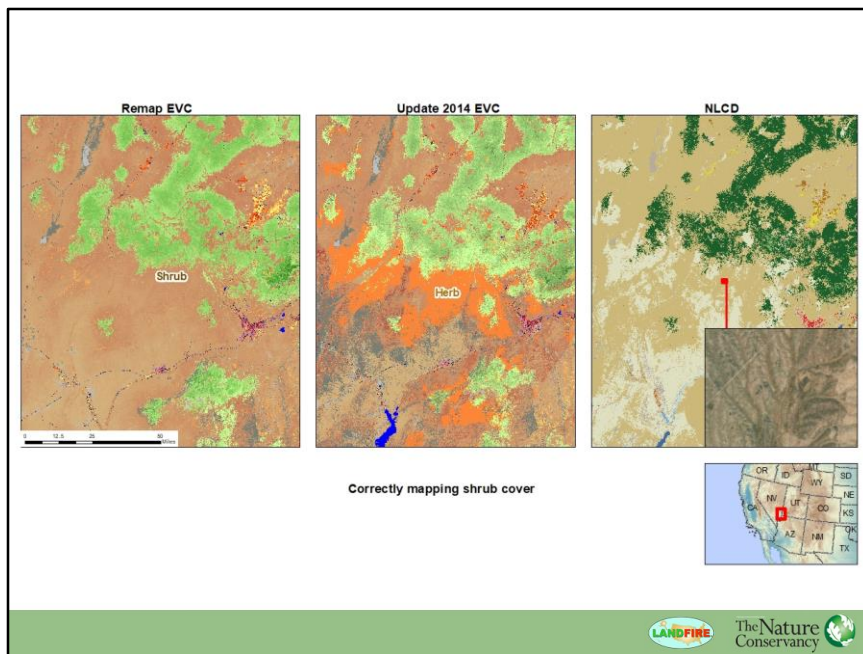
Remap Improvements





Fewer Seamlines

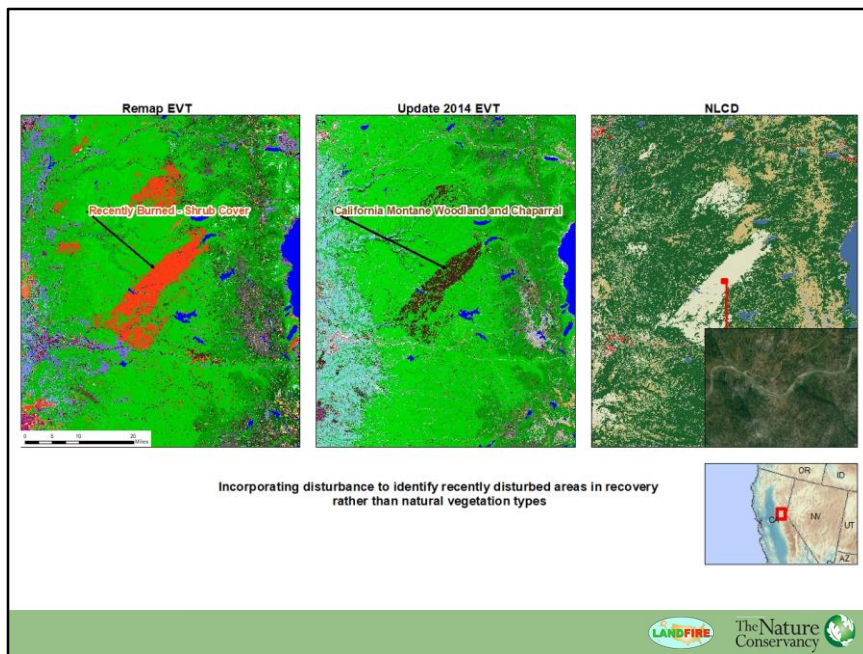
- As mentioned previously by Jim the way we process the imagery now (e.g. using tiling, larger processing unit) leads to fewer seamlines.
- Here you can see a seamline created at the mapzone border where shrub cover abruptly changes in the 2014 cover product.
- In Remap, the seamline is not evident due to improvements in how LANDIFRE mapping teams process the imagery.



Improved Shrub Cover

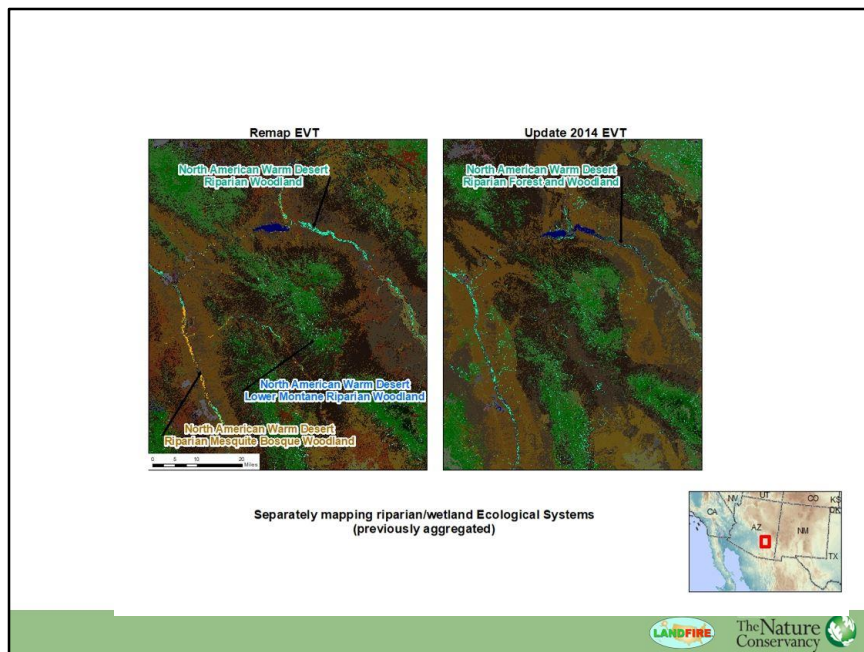
- NLCD produces a continuous shrub cover product based on very high resolution imagery that LF has incorporated into its process for Remap.
- Here you can see an area mapped in 2014 as herb is mapped as shrub in Remap
- In arid areas, like the one shown here, we are doing a better job of identifying low shrub cover using new methods.

Note: "NLCD 2016 Shrub Component products characterize the percentage of each 30-meter pixel in the Western United States covered by shrub, herbaceous, bare ground, litter, sagebrush, big sagebrush and annual herbaceous, along with estimating shrub height and sagebrush height."



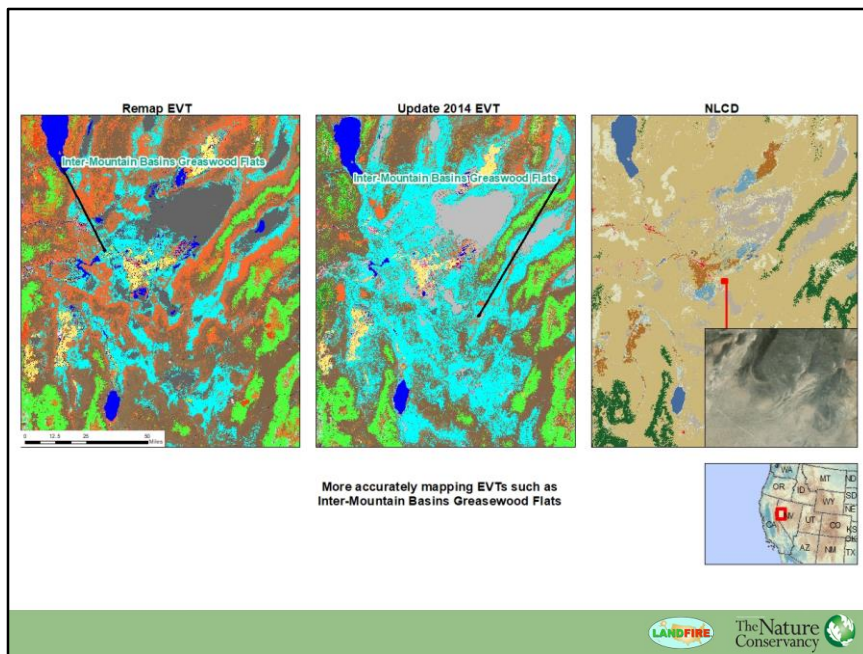
Improved EVT Mapping in Disturbed Areas

- In previous LF versions natural EVTs were mapped regardless of disturbance history.
- We've changed that in Remap to more accurately reflect the vegetation on the ground post-disturbance.
- In this example, starting on the right you can see an area mapped as shrub by NLCD. In 2014, shown in the middle, we mapped the area as CA Montane Woodland and Chaparral.
- Based on LF disturbance data we know that this area was recently burned and so in the Remap product, shown on the left, we have assigned it to the EVT class Recently Burned – Shrub Cover, more accurately reflecting the vegetation currently on the ground.



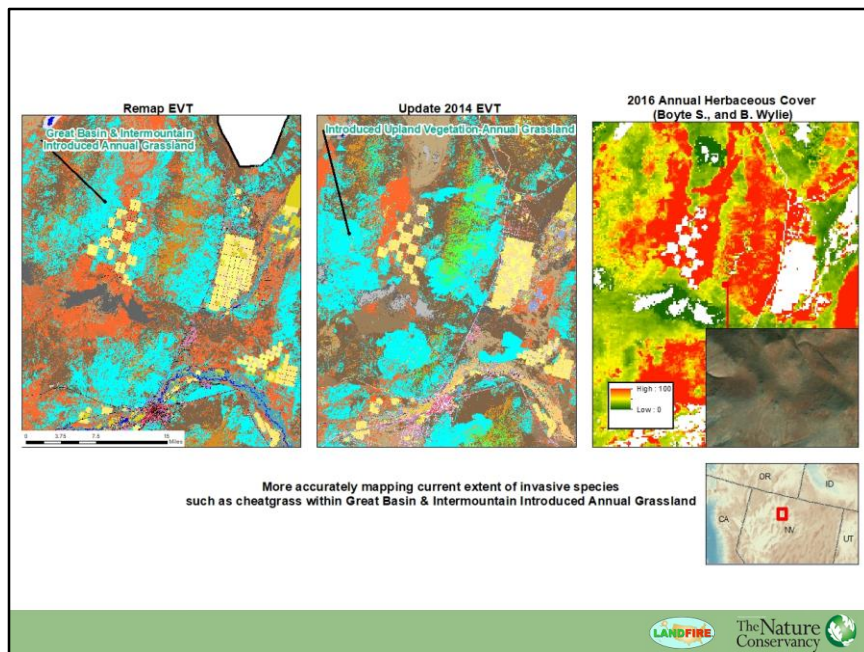
Finer Level Distinctions in Aggregate Types

- In previous LANDFIRE versions riparian and wetland types were aggregated into coarse types.
- Here you can see how we have split out some previously aggregated types: for example what we mapped in 2014 as N.A. Warm Desert Riparian Forest and Woodland is now mapped as Riparian Woodland, Lower Montane Riparian Woodland and Riparian Mesquite Bosque Woodland types.
- A similar change was made to aggregate Barren types. In the Remap legend you'll find areas previously mapped as Barren mapped into finer classes such as Bedrock and Scree or Playa.



Improved EVT

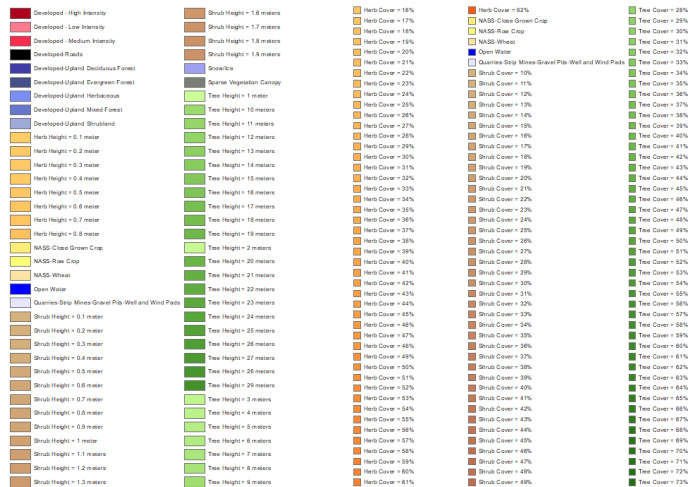
- In previous LF versions Greasewood Flat was mapped in higher slope positions where other shrub types are more appropriate. In Remap, mappers restricted it to lower slopes.



Improved Mapping of Invasives

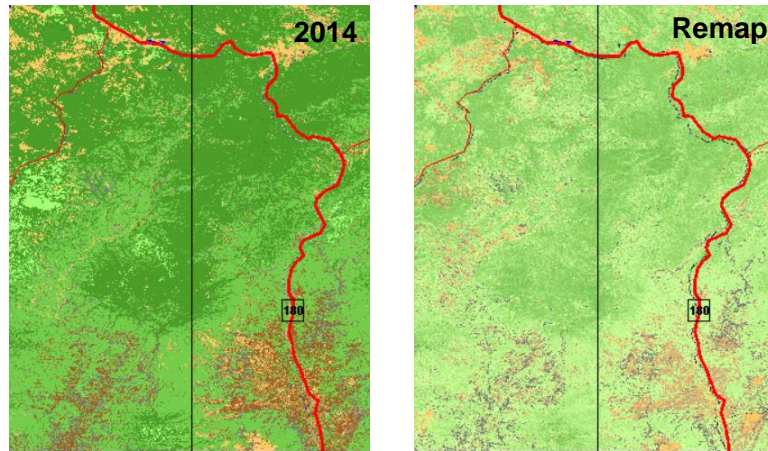
- Mappers made an effort to improve the mapping of invasive species such as cheatgrass.
- Here you see a comparison of Remap (left) and 2014 EVT (middle) to the Near Real Time Annual Herbaceous Cover product (on the right; Boyte and Wylie). You can see the Remap product aligns more closely with the Near Real Time product.

Continuous Height & Cover



- LANDFIRE EVH (left) and EVC (right) are now delivered in continuous classes. Previously the data were binned into broader classes; e.g. 10% classes for EVC.
- Graphic shows partial legends, too many classes to display.

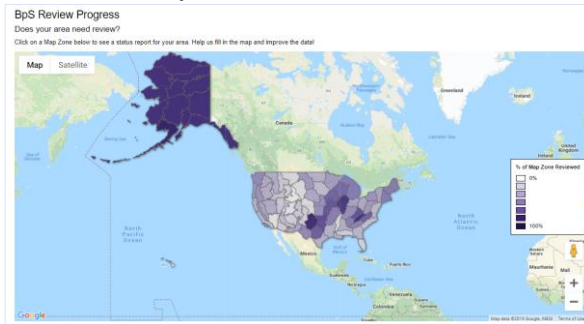
Continuous Height Comparison



- 2014 EVH data on the left is dominated by two shades of green representing forest.
- Remap EVH data on the right show many shades of green representing more fine scaled variation in height.
- Similar patterns are shown in the brown tones that represent shrubs.

BpS Review

- BpS updated with new science
- Succession class mapping rules completed
- New model description document
- User-friendly data access website

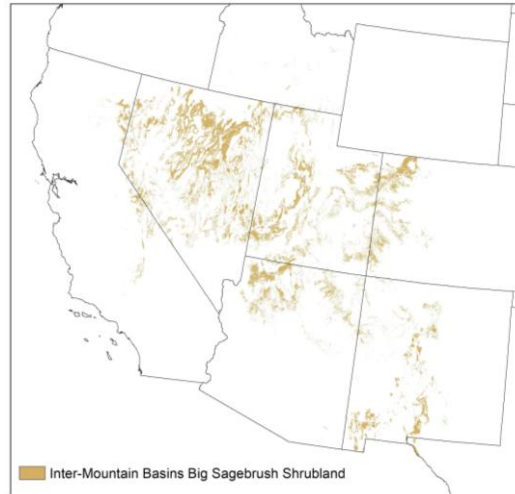


BpS Review

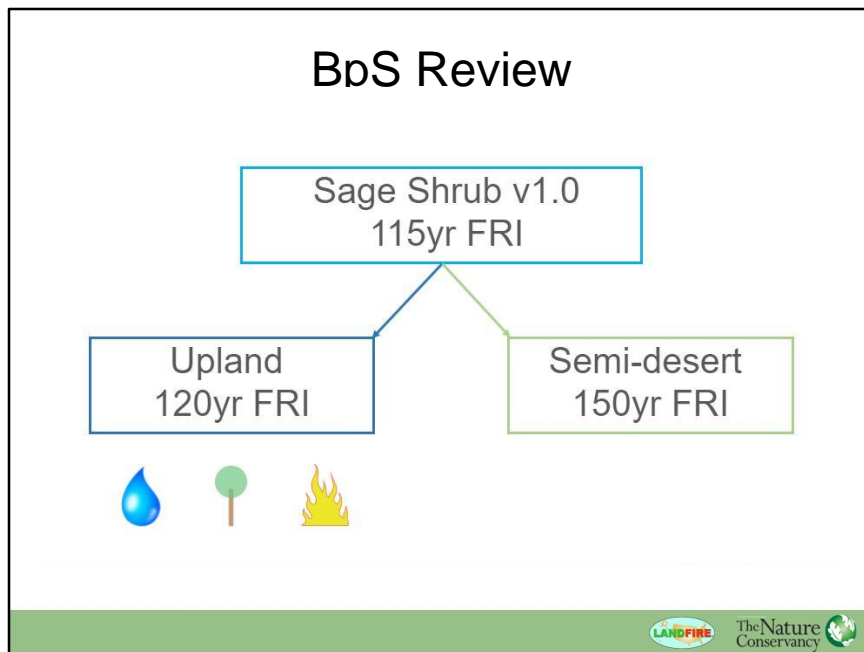


- We made a special effort to get review of major western rangeland types.
- 4 BpS were part of a what we call a “macro review” effort where we looked at the logical consistency between models for widespread systems.
- For example, LANDFIRE mapped the Inter-Mountain Basins Big Sagebrush Shrubland BpS (show here in brown) on nearly 52 million acres. We created 12 unique BpS models to represent the system throughout its range.
- We felt it was important to review all the models for this type as a set.
- The review focused on several key questions:
 - Does the set of models encompass the full range of variability we see across the range of the type?
 - Do the models accurately reflect ecological differences?
 - Is the relationship between models logically consistent? For example, does the fire regime change as expected as models change north to south and east to west?

BpS Review

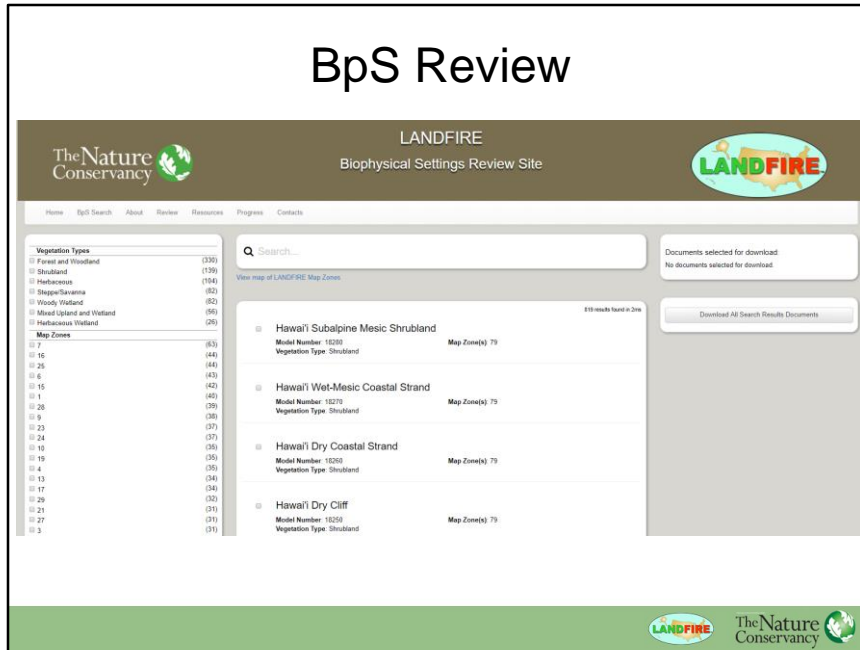


- Many improvements were made to the BpS models.
- I'll illustrate the types of changes users can expect using one example – Inter-Mountain Basins Big Sagebrush Shrubland in the great basin



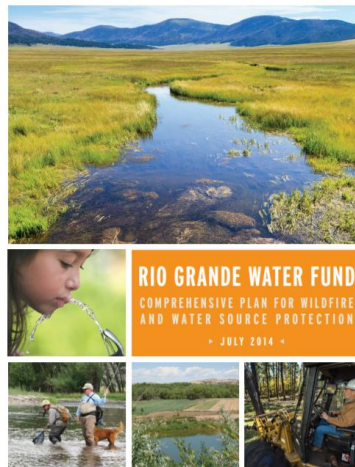
- The big sage brush shrubland BpS for the Great Basin was reviewed by a group of Nature Conservancy scientists. They indicated that the original model encompasses a lot of variability and would be more useful for managers if it were divided into two types.
- Based on this feedback we split the model into two variants:
 - 1) Upland Soils type - receives enough moisture (>10 inches annual) to support pinyon and juniper trees.
 - 2) Semi-Desert soils - found in areas with 8-10 inches of annual precipitation, generally too dry to support trees
 - The two types have different indicator species, different fire frequencies, different management strategies.
- The models were refined to reflect these differences.

BpS Review



- LANDFIRE has developed a new, searchable, user interface for downloading model information.
- The reviewed and updated BpS model dataset for CONUS and HI are complete, but not publicly available yet.
- AK models are still being finalized.

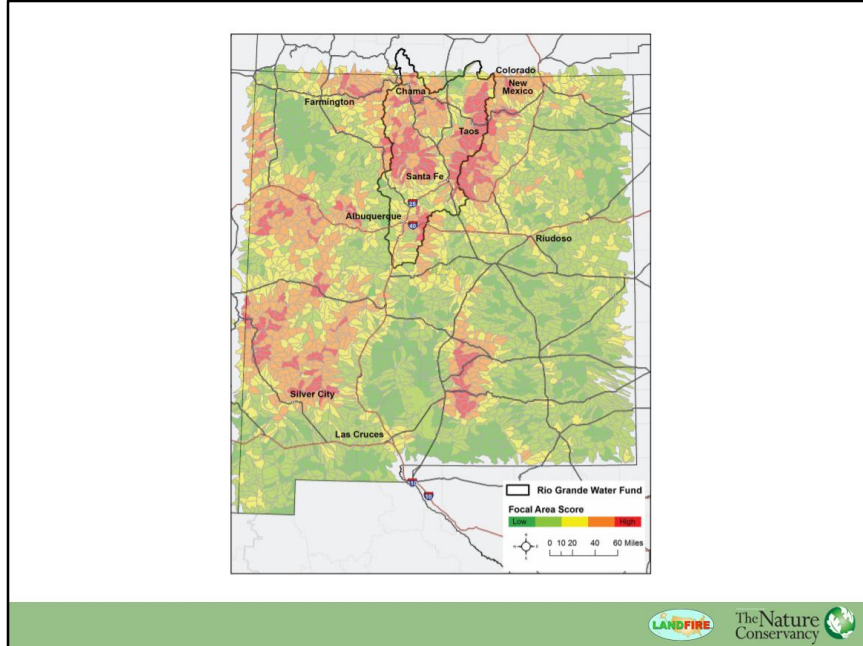
Application



- The Rio Grande Water Fund is an effort in New Mexico to protect municipal water supplies through improved management of the watershed.
- The Nature Conservancy and partners developed the “Rio Grande Comprehensive Plan for Wildfire and Water Source Protection.”
- The Plan uses the best available data to describe the current wildfire threat to water sources and forested watersheds and prioritizes where treatments will help reduce wildfire

impacts such as post-fire erosion.

- LANDFIRE spatial data were key this effort providing ready to go data for the entire state.



- A focal areas analysis was used to identify areas where water supply were at risk.
- Data about forest conditions, water supplies and users, potential for wood use, and social and economic importance to the state were the bases for identifying focal areas
- LANDFIRE fuels data were used in the wildfire risk portion of the analysis to model fire behavior.
- Here you see areas in need of restoration treatment to protect water supplies shown in red and areas with a lower need for treatment in

green.

- The focal areas map can be used to ensure that the water funds are allocated to the areas where the risk to water supplies is greatest and where restoration actions have the highest probability of success.

Take-home Messages

LANDFIRE products


- are comprehensive, compatible, consistent and current. (4 C's)
- are designed for use at regional and national scales.
- can be modified for local use.

LF Remap incorporated new processes and data sets to improve usability of the products, and represents conditions in 2016.

Users can help improve LANDFIRE products by providing plots and data + feedback.




Feedback



E-mail: helpdesk@landfire.gov

Website:
<https://landfire.gov/contactus.php>



LANDFIRE welcomes feedback. Contact the helpdesk and/or provide feedback via the LANDFIRE website.

Our Contact Information



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