



Local Customization of LANDFIRE Fuels Data on the Huron and Hiawatha National Forests

Don Helmbrecht, Wildland Fire Analyst
USFS TEAMS Enterprise Unit



**Tallgrass Prairie/Oak Savanna & Lake States Fire Science Consortia
October 29, 2014**





LANDFIRE/JFSP 2014 Webinar Series



- LANDFIRE and TPOS/Lake States offered the series to talk about and illustrate LANDFIRE products and processes that can support large land management and planning.
- Others: Northwest Fire Science Consortium and the Northern/Southern Rockies Fire Science Networks
- Southern Fire Exchange series ends November 17: Curt Stripling, Geospatial Coordinator, Texas A&M Forest Service, and David Buckley, Principal Consultant, Technosylva, present *Leveraging LANDFIRE for the Southern Wildfire Risk Assessment*.

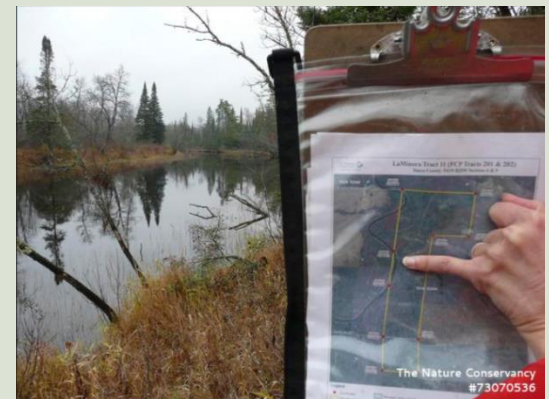
Today: Customizing Data - Don Helmbrecht, Wildland Fire Analyst, USDA Forest Service, TEAMS Enterprise Unit. *Local Customization of Fuels Data on the Huron-Manistee and Hiawatha National Forests.*

Previous TPOS & Lake States Consortia webinars are recorded and available:

- LANDFIRE 101 – Randy Swaty’s introduction to LANDFIRE products and processes.
- Assessing Needs - Tracy Hmielowski presented *Where Should We Burn? A Fire Needs Assessment for Wisconsin.*

Presentation Overview

- Review of LANDFIRE application scale
- Common considerations
- Five-step conceptual framework
- Huron & Hiawatha examples
- Available resources & support

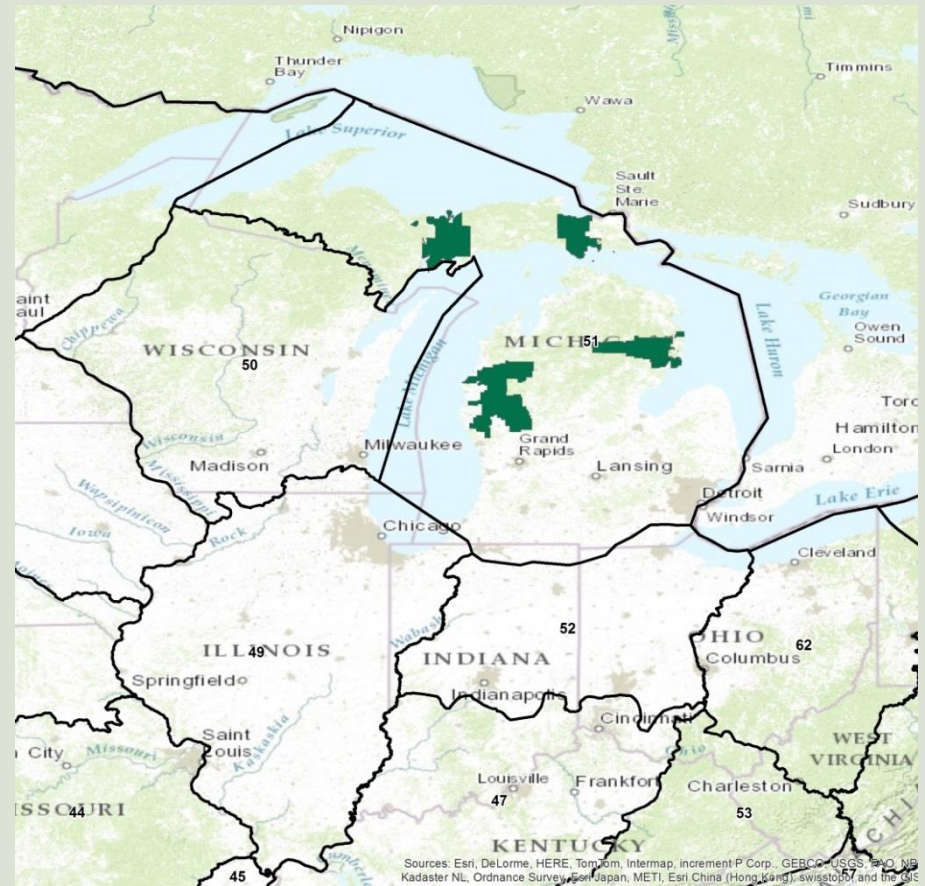


LANDFIRE Application Scale

- Scale:
 - Cartographic scale: a mathematical relationship between a given feature on a map and that feature on the ground; a ratio (e.g., 1:24,000).
 - Spatial resolution: the pixel size (raster data) or MMU (polygon data).
 - Application scale: specific geography for which the data can be appropriately applied without significant adjustment.
- LANDFIRE data is designed to be used “out-of-the-box” at the national, regional, or very-large landscape level.
- However, this varies by the specific application, geography/ecological and spatial complexity, and product.

LANDFIRE Application Scale

- Fire behavior fuel models are mapped using a rule-based approach.
- Rules are developed at the map zone level (range between 12 and 60 million acres).
- The “best fit” for the zone may not be the best fit for your local area.



Common Considerations



Are the data current?



Is the classification system appropriate for your objectives?

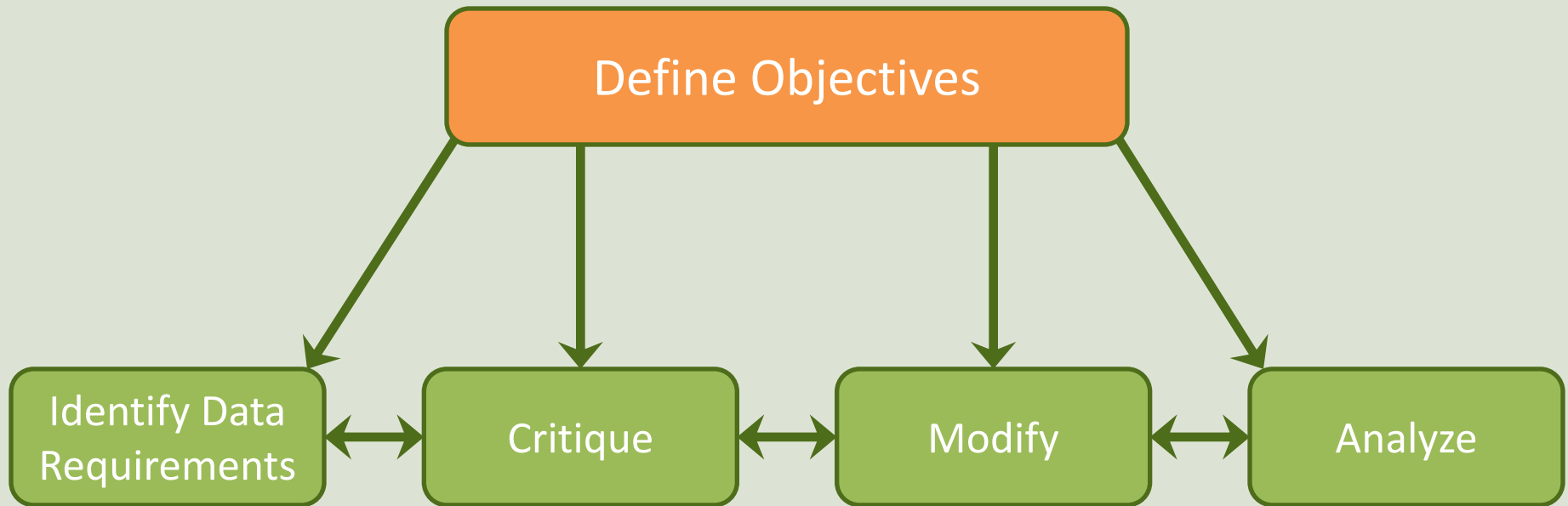


Does the data contain accuracy errors?

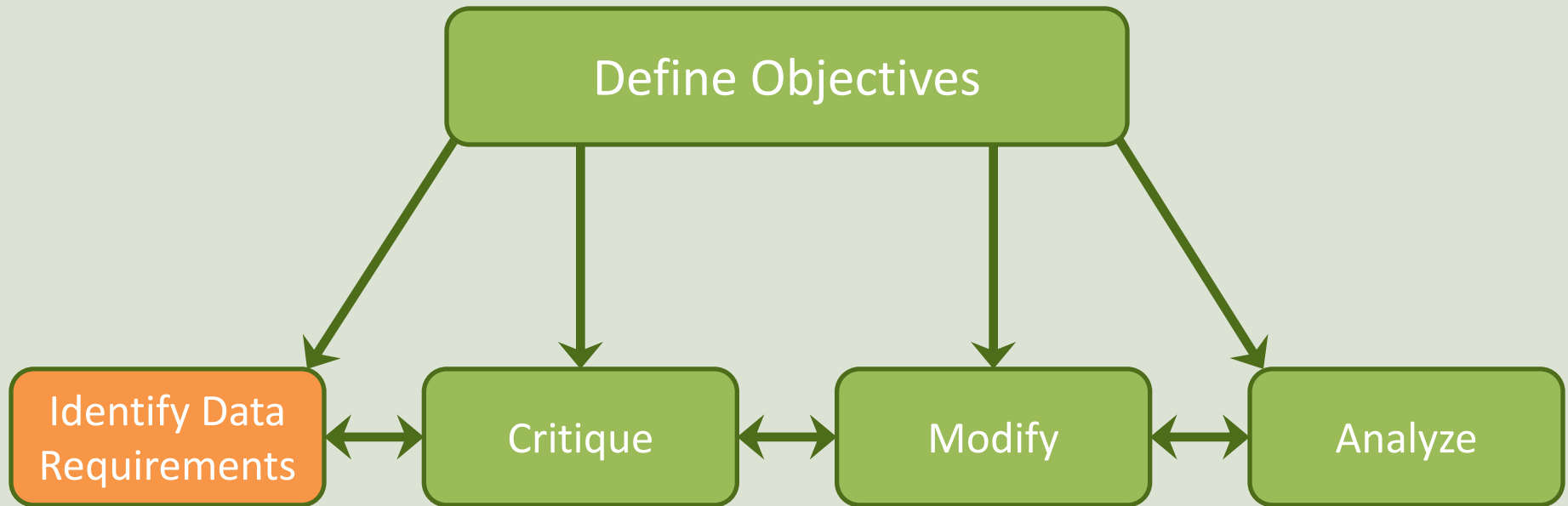


Can the data be improved with local information?

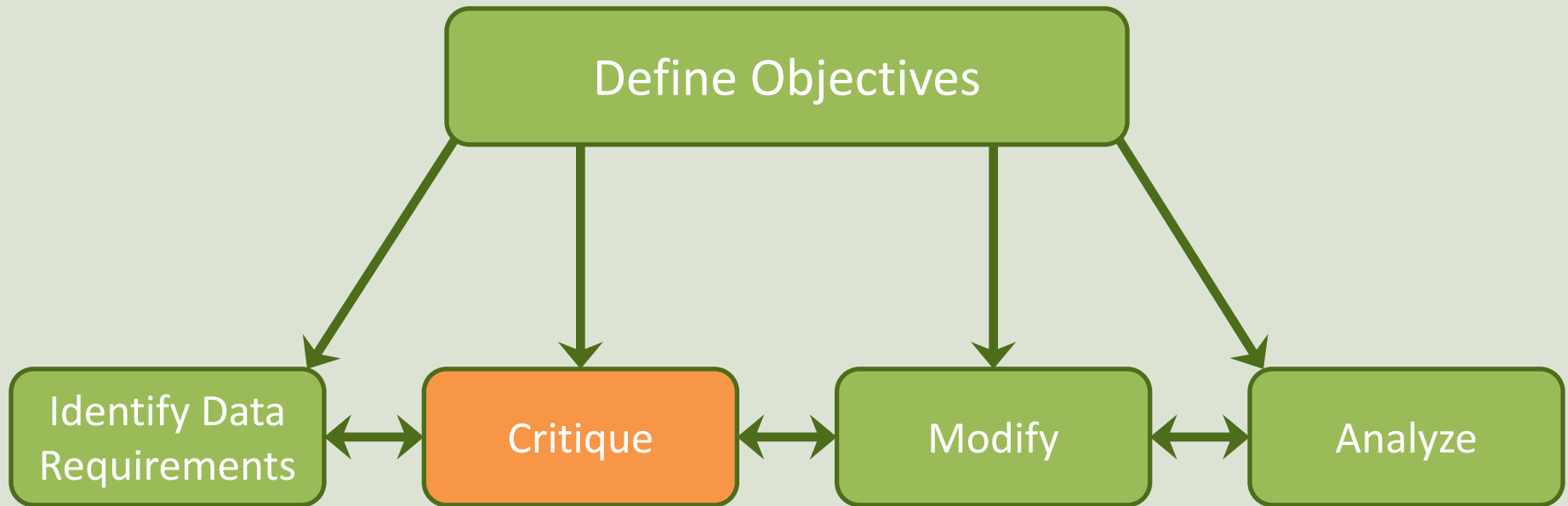
Data Critique and Modification Process



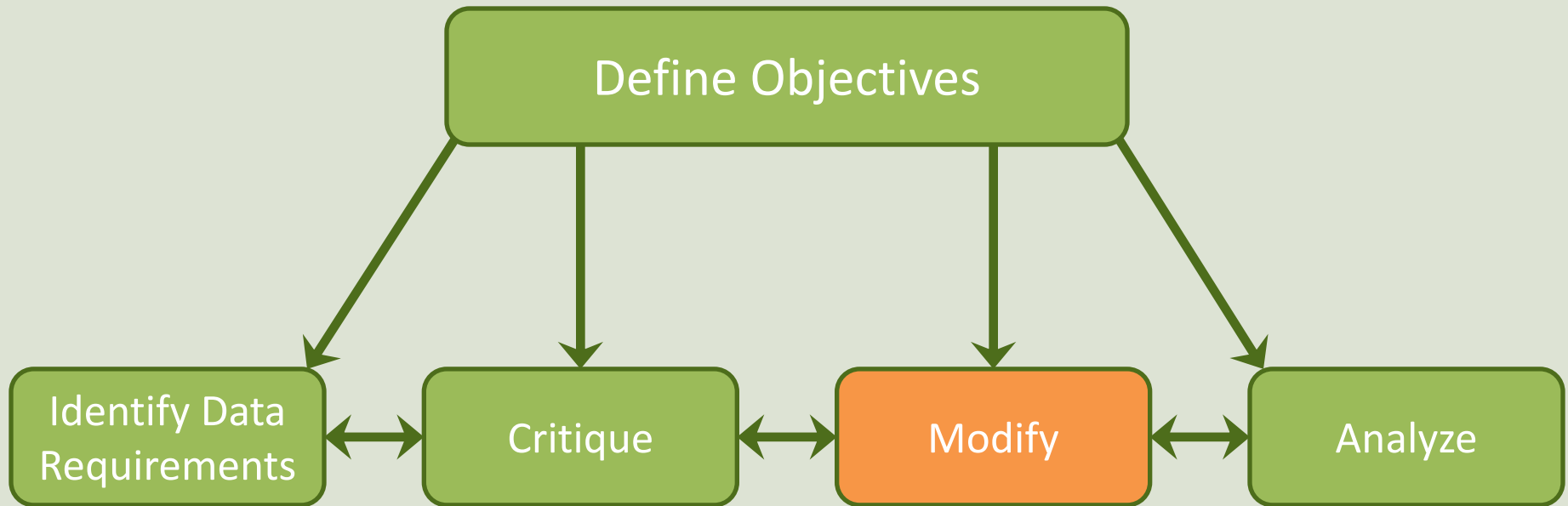
Data Critique and Modification Process



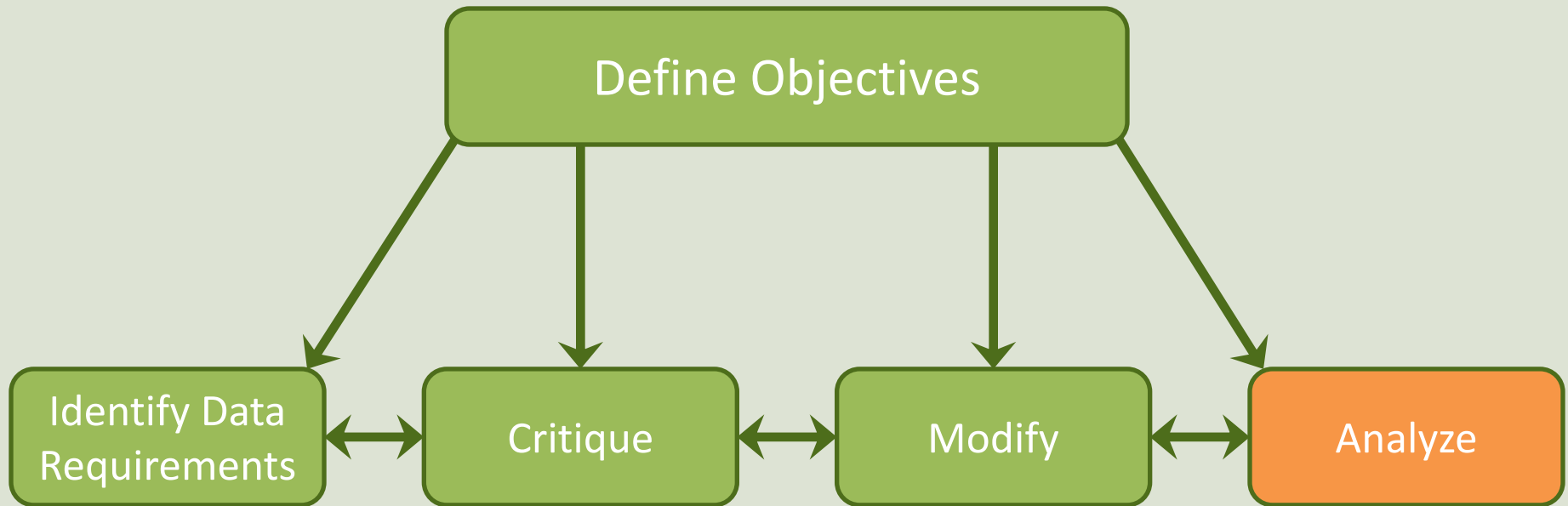
Data Critique and Modification Process



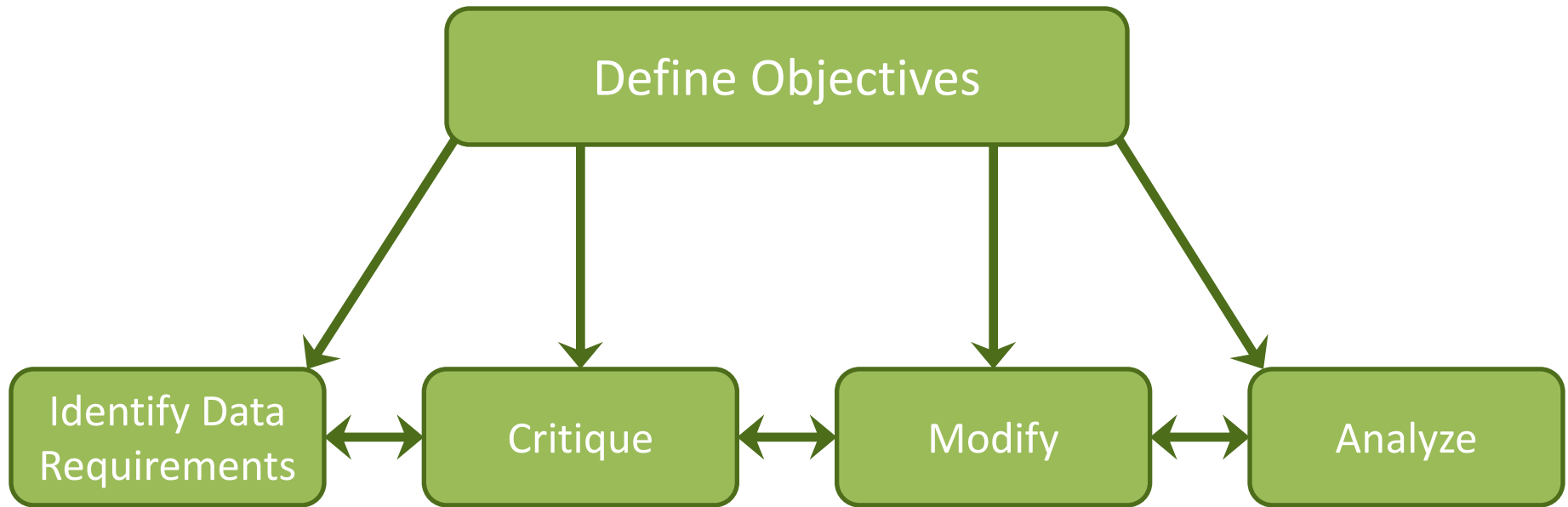
Data Critique and Modification Process



Data Critique and Modification Process



Data Critique and Modification Process



Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

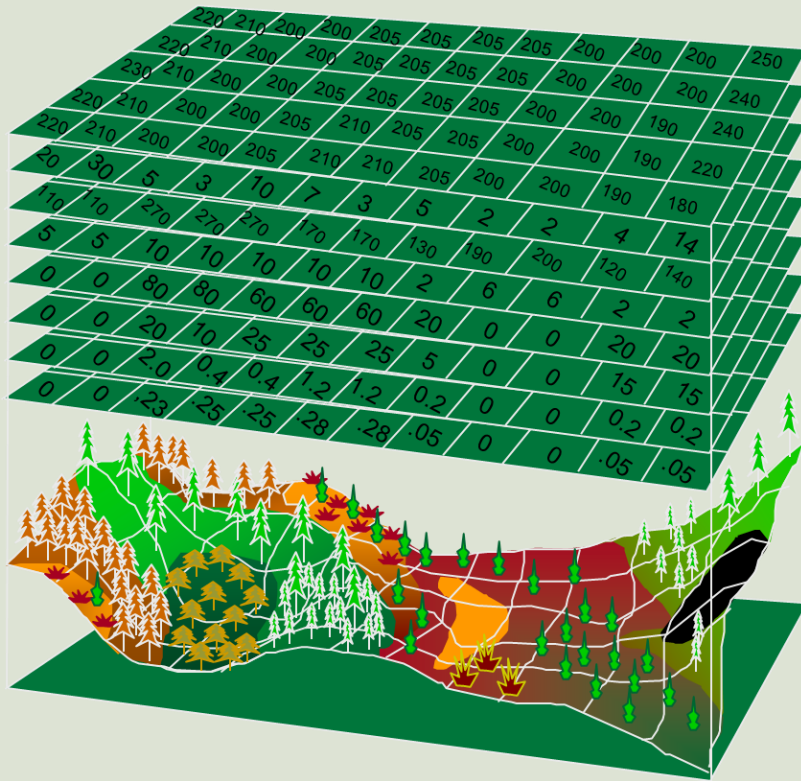
“Conduct wildfire behavior analysis to support forest planning and wildfire incident management, more specifically, model spatial wildfire hazard.”



Hughes Lake Fire
Photo courtesy:
Persephone Whelan

Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application



Eight geospatial data layers comprise the fire behavior modeling landscape:

- Elevation
- Aspect
- Slope
- Forest canopy cover
- Forest canopy height
- Fire behavior fuel model
- Canopy base height
- Canopy bulk density

Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

Each layer influences environmental and fire behavior characteristics:

Elevation

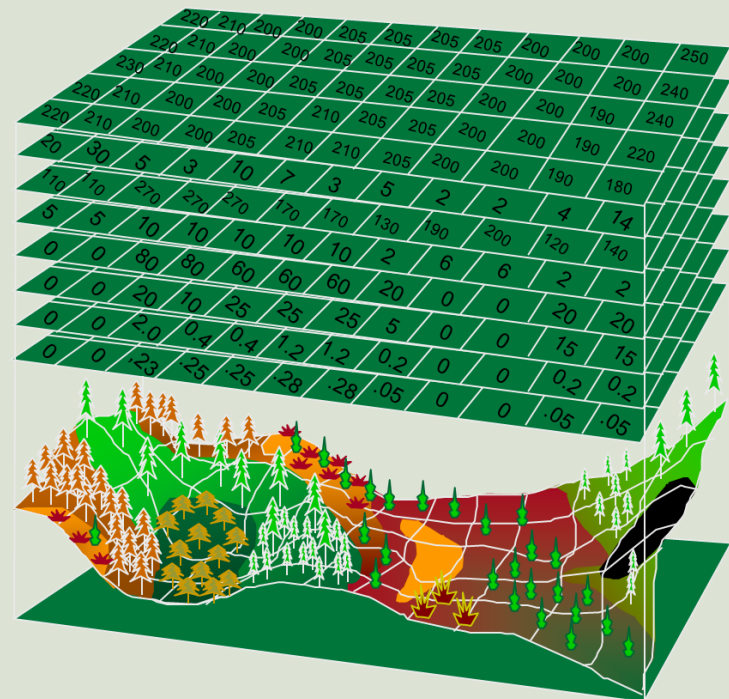
- Fuel moisture content

Aspect

- Fuel moisture content
- Direction of fire spread

Slope

- Fuel moisture content
- Rate of spread



Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

Forest canopy cover

- Mid-flame wind speed
- Dead fuel moisture content

Forest canopy height

- Mid-flame wind speed
- Spotting potential

Fire behavior fuel model

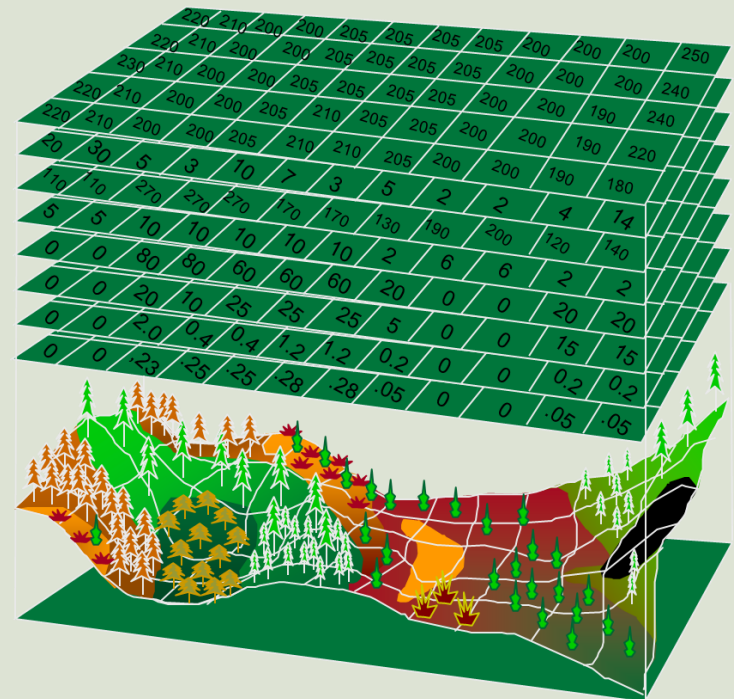
- Surface fire spread rate and intensity

Canopy base height

- Crown fire initiation

Canopy bulk density

- Crown fire type, intensity, and rate of spread



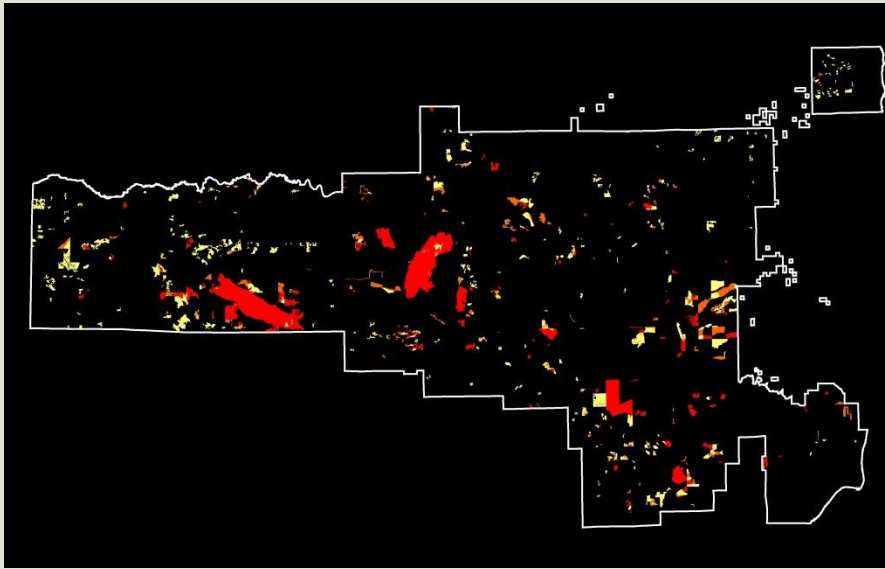
Example Application

Questions we asked:

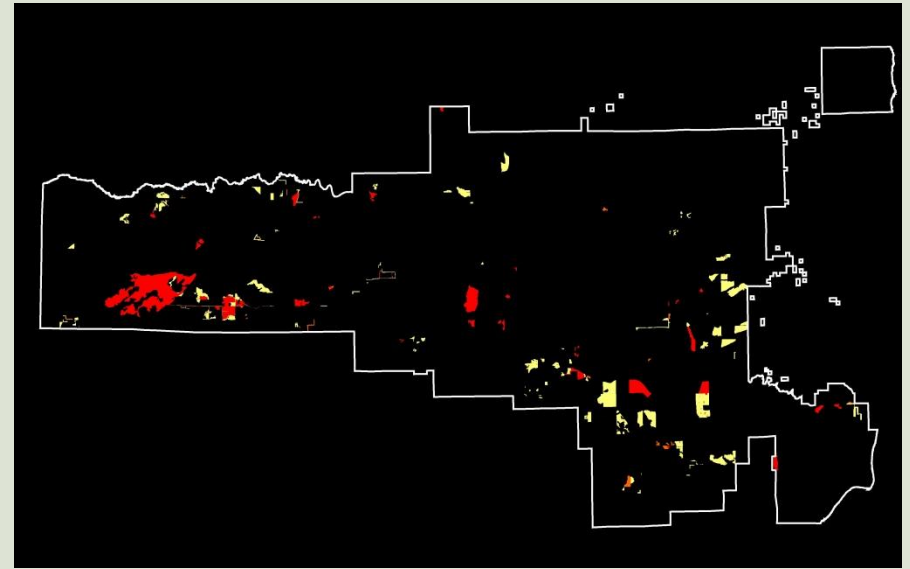
- Are the data up to date?
 - Project year: 2013
 - Data year: 2008
 - 7,478-acre Meridian Road Fire occurred in 2010 on the Huron NF
 - Huron and Hiawatha NFs' silviculture, wildlife, and fire management programs collectively treat thousands of acres per year.
- Is modeled fire behavior representative of actual/observed fire behavior?
 - Fuels data have not been updated to reflect post-disturbance conditions.
 - Will use fire behavior calculators to critique fuel assignments.

Example Application

Data Currency – Huron National Forest:



LANDFIRE 2008 disturbance grid (1999-2008)



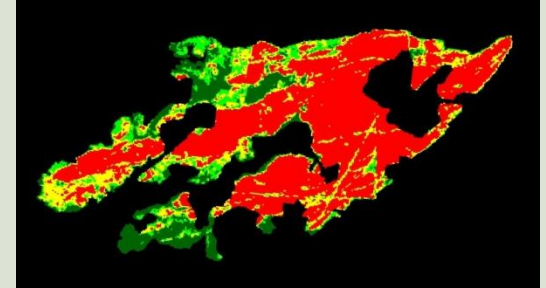
New disturbances (2009-2012)

Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

The critique revealed new data requirements:

- ✓ Burn severity of Meridian Road Fire
- ✓ Type, severity, and year of treatment activities



Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

Before critiquing fuels we therefore needed to update our disturbance and canopy cover grids:

1. Update Time-Since-Disturbance for the 1999-2008 disturbances.
2. Reclassify Meridian Road fire-severity codes to LANDFIRE disturbance codes.
3. Assign LANDFIRE disturbance codes to FACTS activities data.
4. Create an updated 1999-2012 disturbance geospatial layer.
5. Reduce pre-disturbance canopy cover to reflect post-disturbance effects.
6. Create an updated 2012 canopy cover geospatial layer.

Example Application

LANDFIRE fuel disturbance coding:

Disturbance Attribute	Description	LANDFIRE FDist Code
NA	No Disturbance	0
Type (1 st digit)	Fire	1XX
	Mechanical Add	2XX
	Mechanical Remove	3XX
	Windthrow	4XX
	Insects-Disease	5XX
	Exotics	6XX
Severity (2 nd digit)	Low Severity	X1X
	Moderate Severity	X2X
	High Severity	X3X
Time Since Disturbance (3 rd digit)	1 Year	XX1
	2-5 Years	XX2
	6+ Years	XX3

Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

1) Update Time-Since-Disturbance for the 1999 – 2008 disturbances:

Disturbance Year	Pre-2004	2004 – 2007	2008
Refresh08 TSD	> 5 years	2 – 5 years	1 year
Updated TSD	> 5 years	> 5 years	2 – 5 years

2) Reclassify Meridian Road fire-severity codes to LANDFIRE disturbance codes:

RAVG Attribute	RAVG Code	LANDFIRE Attribute	LANDFIRE Code
Outside Perimeter	0	No Disturbance	0
Unchanged/Unburned	1	No Disturbance	0
Low-Severity	2	Fire/Low-Severity/2-5 Years TSD	112
Moderate-Severity	3	Fire/Moderate-Severity/2-5 Years TSD	122
High-Severity	4	Fire/High-Severity/2-5 Years TSD	132

Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

3) Assign LANDFIRE disturbance codes to FACTS activities data:

Disturbance Attribute	Description	LANDFIRE FDist Code
NA	No Disturbance	0
Type (1 st digit)	Fire	1XX
	Mechanical Add	2XX
	Mechanical Remove	3XX
	Windthrow	4XX
	Insects-Disease	5XX
	Exotics	6XX
Severity (2 nd digit)	Low Severity	X1X
	Moderate Severity	X2X
	High Severity	X3X
Time Since Disturbance (3 rd digit)	1 Year	XX1
	2-5 Years	XX2
	6+ Years	XX3



Additional considerations for FACTS data:

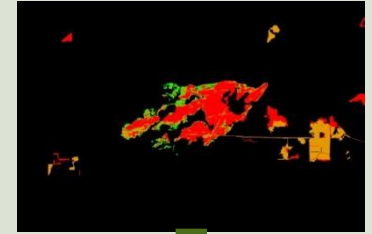
- Cumulative effect of multiple activities from 2009-2012?
- Harvest method: short-wooding or whole tree?
- Site preparation method: remove activity fuel or roller chop and chain?
- Temporal variability in methods?
- Has the site been planted?

Example Application

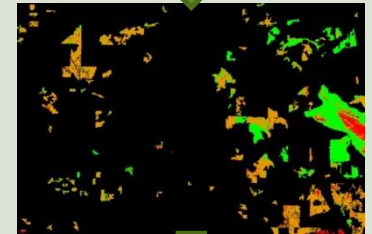
4) Create an updated 1999-2012 disturbance geospatial layer.

- Spatially merge new disturbances with updated (for TSD) 1999-2008 disturbance grid.

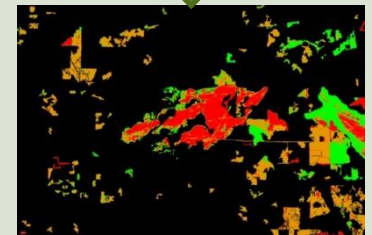
2009-2012 disturbances



1999-2008 disturbances



Updated disturbance layer



Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

- 5) Reduce canopy cover to reflect disturbance effects:
- If available, use a measured or remote sensing canopy cover reduction product (e.g., RAVG).
 - Otherwise, assign reduction factor to disturbance severity.

Severity Class	Severity Description	Reduction Factor
Low	< 25% canopy reduction	12.5%
Moderate	25 – 75% canopy reduction	50%
High	> 75% canopy reduction	87.5%

Example:

Canopy Cover Range	Mid-point	Low	Moderate	High
50 – 59%	55%	48.1%	27.5%	6.9%

Example Application

6) Create an updated 2012 canopy cover geospatial layer

- Reduce canopy cover using a “disturbance mask.”

Pre-disturbance cover



Cover reduction



Post-disturbance cover



Define Objectives Identify Data Requirements Critique **Modify** Analyze

Example Application

Fire Behavior Fuel Model Critique

What is a FBFM?

Set of fuelbed characteristics:

- Fuelbed depth
- SAV ratio by category (live or dead) and size class
- Fuel load by category and size class
- Extinction moisture content
- Particle heat content

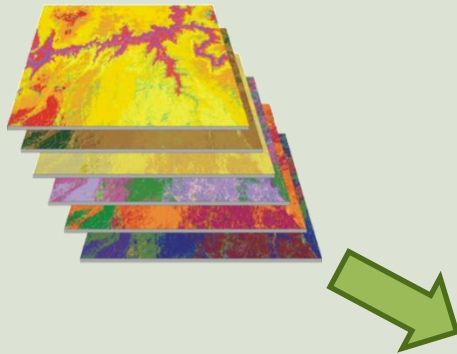
Fuel Types:

- Grass
- Grass/Shrub
- Shrub
- Timber-litter
- Timber-understory
- Slash/Blowdown

Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

- LANDFIRE FBFMs are mapped using a rule-based approach
- Fuel mapping rules identify combinations of biophysical setting, existing vegetation type and ranges of existing cover and height that would indicate a particular fuel model



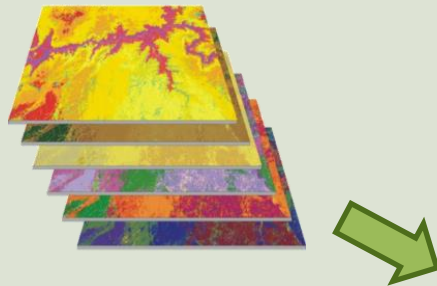
Range of Cover	Range of Height	BPS	Wild	FM40	CG	CBD40	CBH40	On/Off	Acres	% EVT	
10%- 100%	Tree 0(m)- 50(m)	Tree	any	any	TL2 / 182	1	9999	9999	On	363061.73	80.94%
10%- 49%	Shrub 0(m)- max	Shrub	any	any	652 / 122	0	9999	9999	On	57378.3	12.79%
10%- 100%	Tree 0(m)- 50(m)	Tree	any	702	TU1 / 161	1	9999	9999	On	28125.83	6.27%

Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

Requires new data:

- ✓ Existing vegetation type
- ✓ Existing vegetation cover
- ✓ Existing vegetation height
- ✓ Biophysical setting
- ✓ Disturbance type, severity, and time since it occurred.

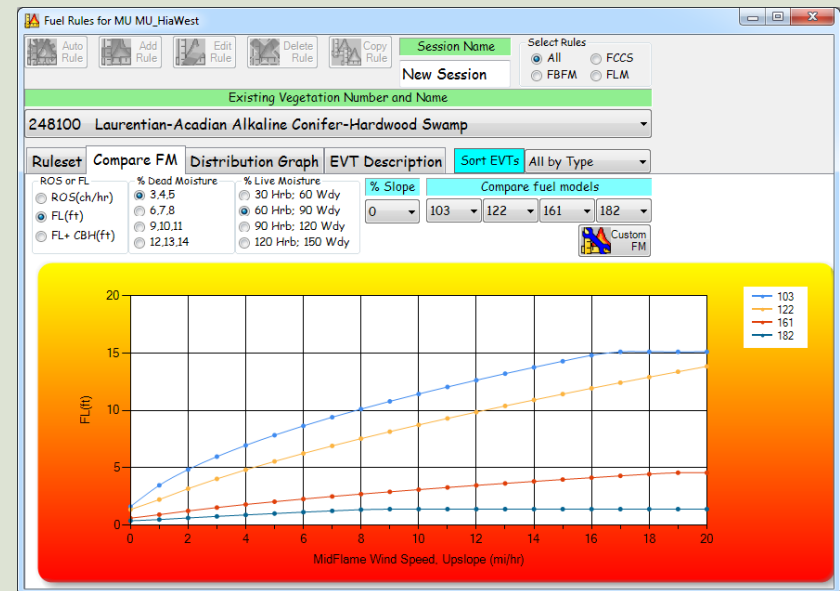
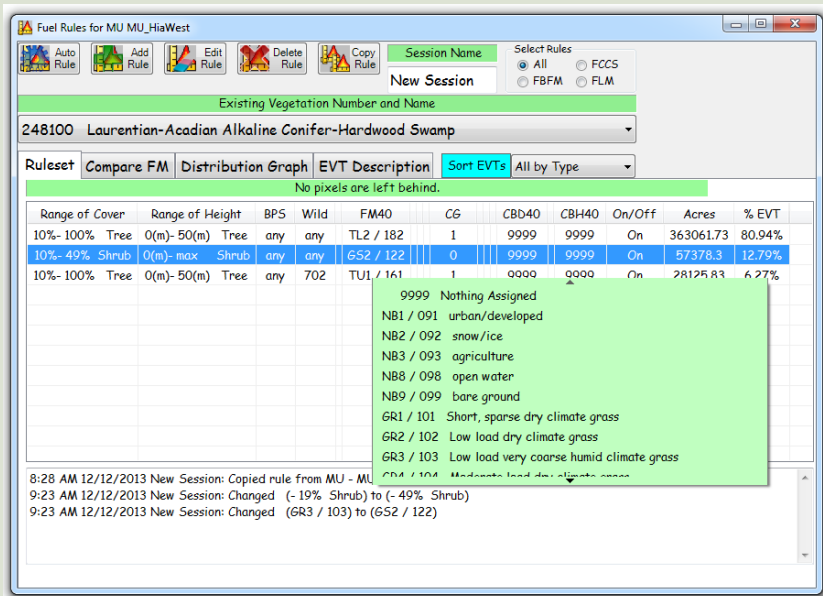


Range of Cover	Range of Height	BPS	Wild	FM40	CG	CBB40	CBH40	On/Off	Acres	% EVT		
10%- 100%	Tree	0(m)- 50(m)	Tree	any	any	TL2 / 182	1	9999	9999	On	363061.73	80.94%
10%- 49%	Shrub	0(m)- max	Shrub	any	any	652 / 122	0	9999	9999	On	57378.3	12.79%
10%- 100%	Tree	0(m)- 50(m)	Tree	any	702	TU1 / 161	1	9999	9999	On	28125.83	6.27%

Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

- LANDFIRE Total Fuel Change Tool facilitates the critique, modification, and analysis of fuels data in one tool.



Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

Where is adjustment needed?

Existing Vegetation Number and Name
248100 Laurentian-Acadian Alkaline Conifer-Hardwood Swamp

Ruleset Compare FM Distribution Graph EVT Description Sort EVTs All by Type

No pixels are left behind.

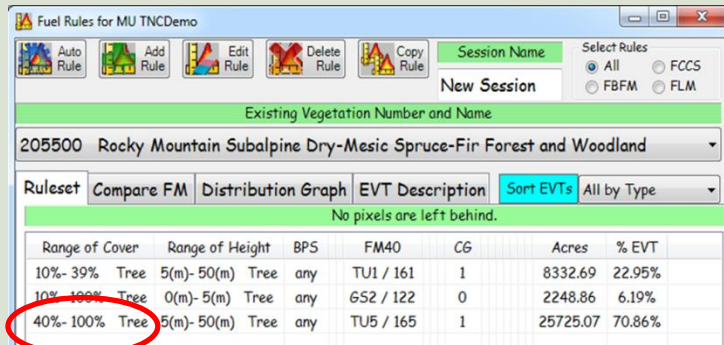
Range of Cover	Range of Height	BPS	Wild	FM40	CG	CBD40	CBH40	On/Off	Acres	% EVT	
10%- 100%	Tree 0(m)- 50(m)	Tree	any	any	TL2 / 182	1	9999	9999	On	363061.73	80.94%
10%- 49%	Shrub 0(m)- max	Shrub	any	any	652 / 122	0	9999	9999	On	57378.3	12.79%
10%- 100%	Tree 0(m)- 50(m)	Tree	any	702	TU1 / 161	1	9999	9999	On	28125.83	6.27%

Modify combinations
and thresholds

Modify
assignment

Example Application

- Rules can be added, deleted, or modified and results easily remapped with the LFTFC tool.
- By changing a threshold the spatial distribution is modified.



Fuel Rules for MU TNC Demo

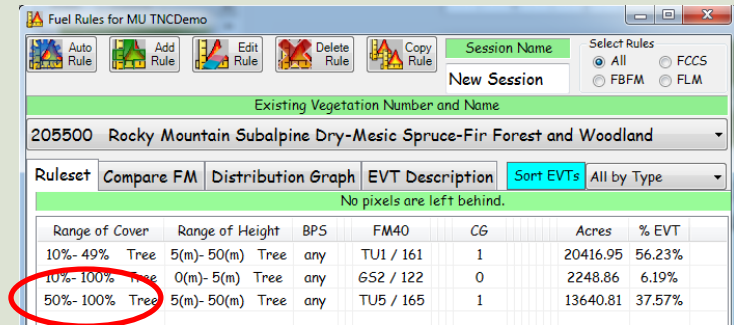
Session Name: [New Session] Select Rules: All FCCS FBFM FLM

Existing Vegetation Number and Name: 205500 Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland

Ruleset: Compare FM Distribution Graph EVT Description Sort EVTs All by Type

No pixels are left behind.

Range of Cover	Range of Height	BPS	FM40	CG	Acres	% EVT
10%- 39%	Tree 5(m)- 50(m)	Tree any	TU1 / 161	1	8332.69	22.95%
10%- 100%	Tree 0(m)- 5(m)	Tree any	GS2 / 122	0	2248.86	6.19%
40%- 100%	Tree 5(m)- 50(m)	Tree any	TU5 / 165	1	25725.07	70.86%



Fuel Rules for MU TNC Demo

Session Name: [New Session] Select Rules: All FCCS FBFM FLM

Existing Vegetation Number and Name: 205500 Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland

Ruleset: Compare FM Distribution Graph EVT Description Sort EVTs All by Type

No pixels are left behind.

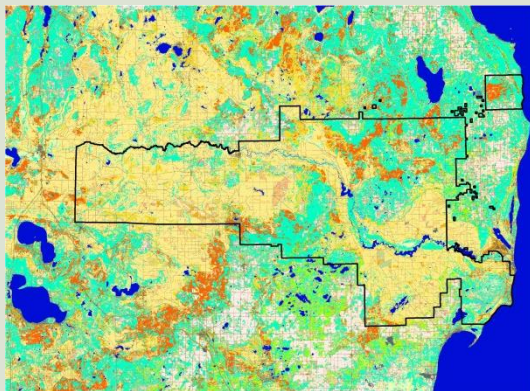
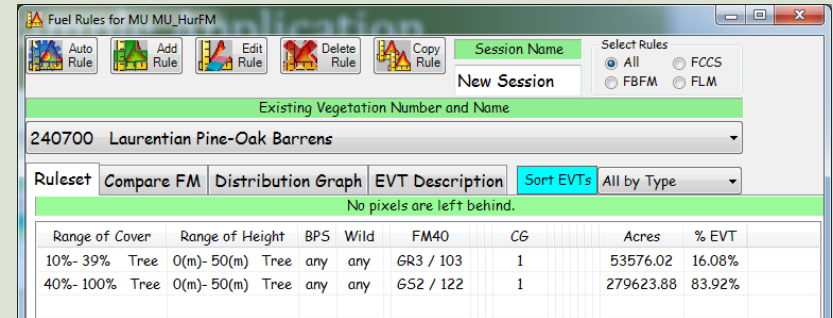
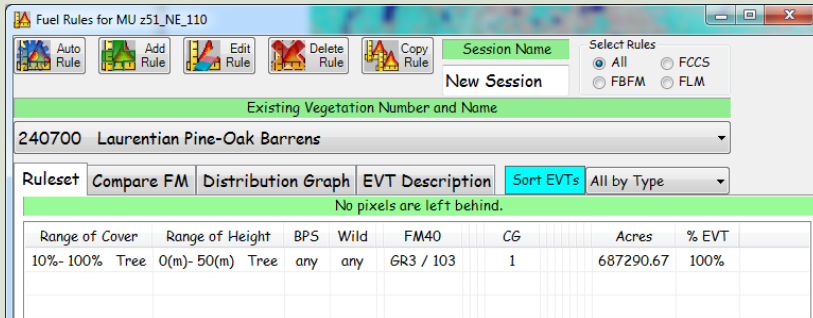
Range of Cover	Range of Height	BPS	FM40	CG	Acres	% EVT
10%- 49%	Tree 5(m)- 50(m)	Tree any	TU1 / 161	1	20416.95	56.23%
10%- 100%	Tree 0(m)- 5(m)	Tree any	GS2 / 122	0	2248.86	6.19%
50%- 100%	Tree 5(m)- 50(m)	Tree any	TU5 / 165	1	13640.81	37.57%



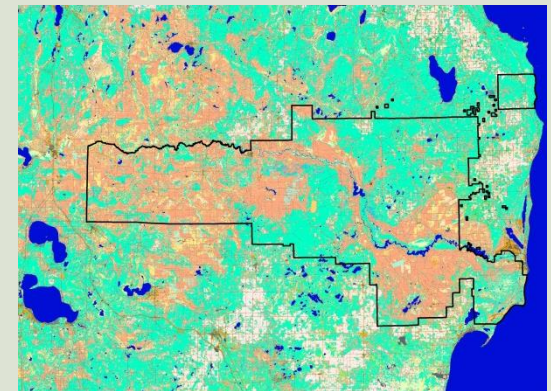
Spatial distribution
is modified



Example Application

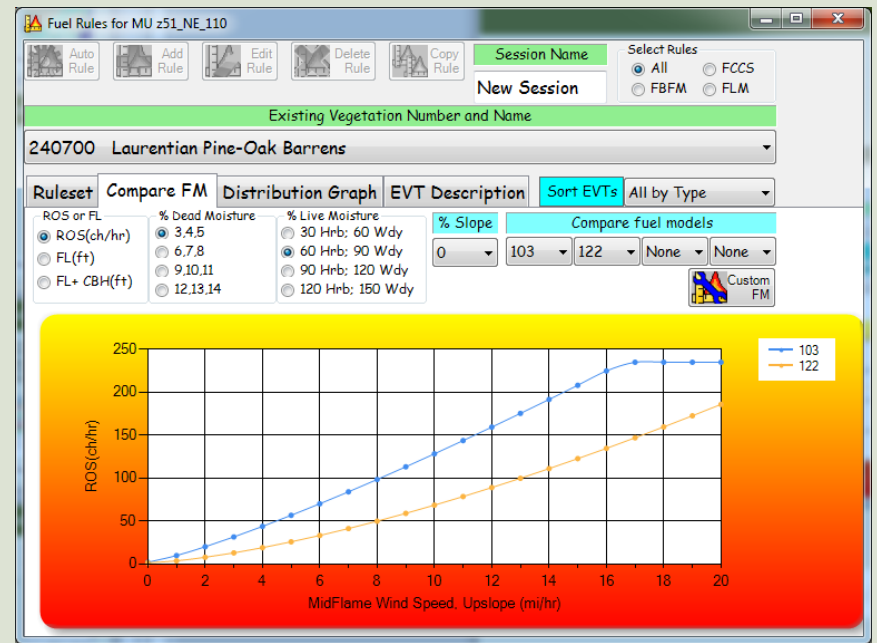
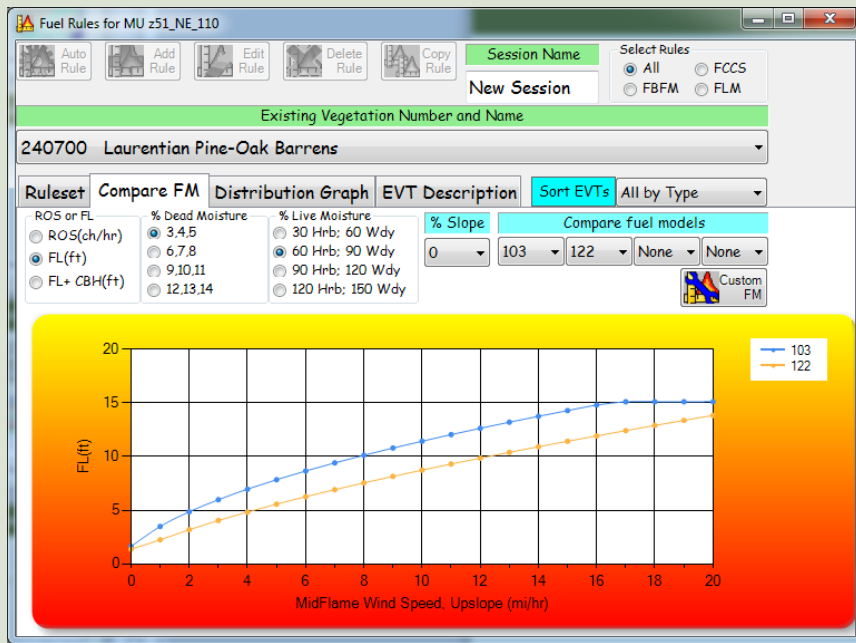


Fuel model assignment is modified



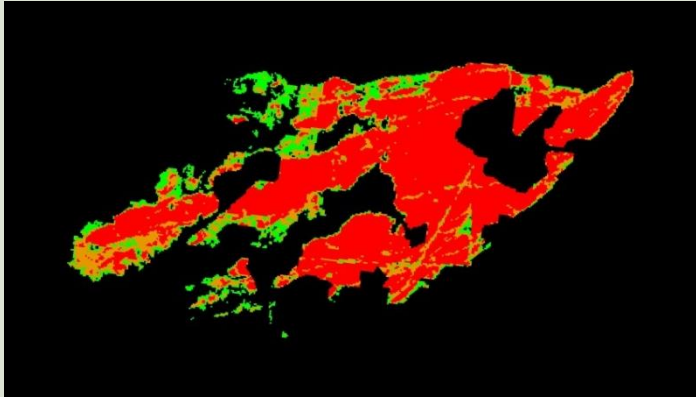
Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

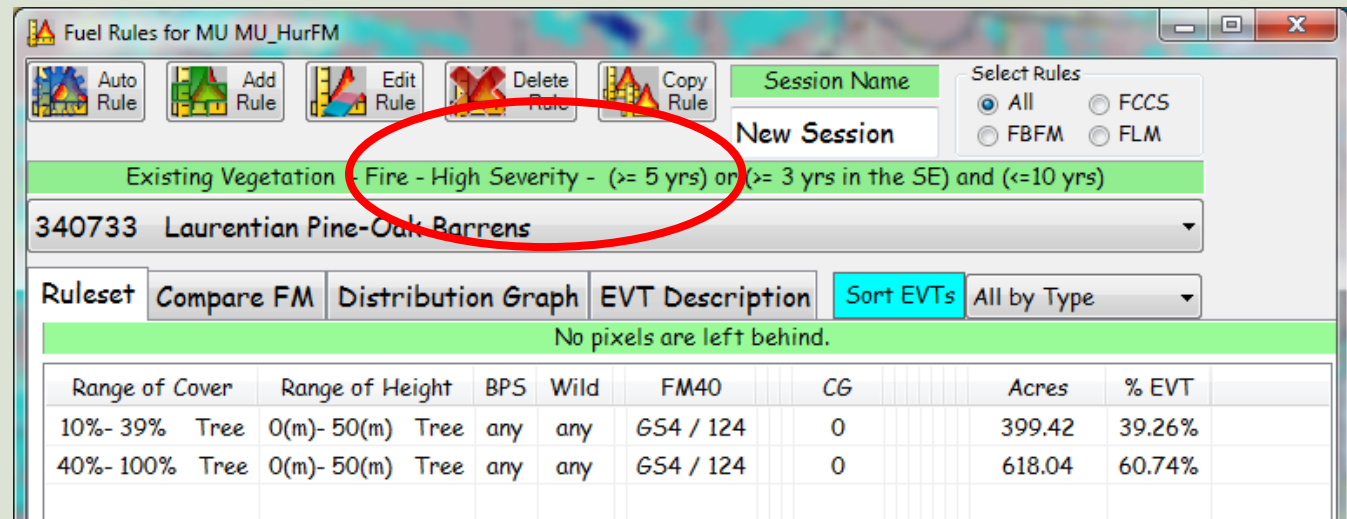


Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application



Separate rules are available for disturbed areas based on disturbance type, severity, and time since occurrence.



Fuel Rules for MU MU_HurFM

Auto Rule Add Rule Edit Rule Delete Rule Copy Rule

Session Name: New Session

Select Rules: All FCCS FBFM FLM

Existing Vegetation - Fire - High Severity - (>= 5 yrs) or (>= 3 yrs in the SE) and (<=10 yrs)

340733 Laurentian Pine-Oak Barrens

Ruleset: Compare FM Distribution Graph EVT Description Sort EVTs All by Type

No pixels are left behind.

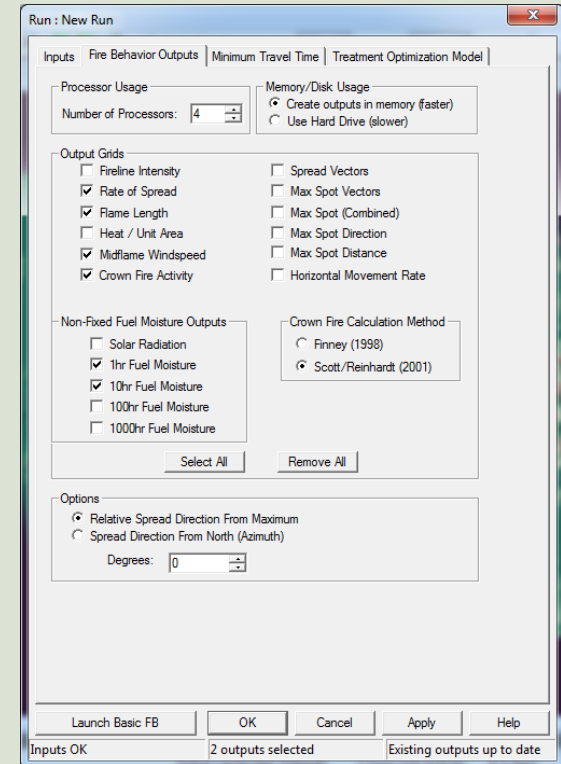
Range of Cover	Range of Height	BPS	Wild	FM40	CG	Acres	% EVT	
10%- 39% Tree	0(m)- 50(m)	Tree	any	any	654 / 124	0	399.42	39.26%
40%- 100% Tree	0(m)- 50(m)	Tree	any	any	654 / 124	0	618.04	60.74%

Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

Analysis:

- Review results to see if they pass the “straight face test.”
- Sometimes results can highlight hidden errors.



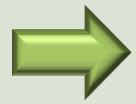
Define Objectives Identify Data Requirements Critique Modify Analyze

Example Application

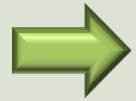
Summary of Modification Steps:

- Updated the disturbance grid for time-since-disturbance and post-2008 disturbances.
- Updated canopy cover to reflect new disturbances.
- Critiqued FBFM mapping rules and made modifications where needed based on local expertise.
- Conducted preliminary fire behavior modeling to evaluate data modifications.

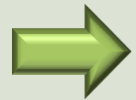
What does it take?



Expertise

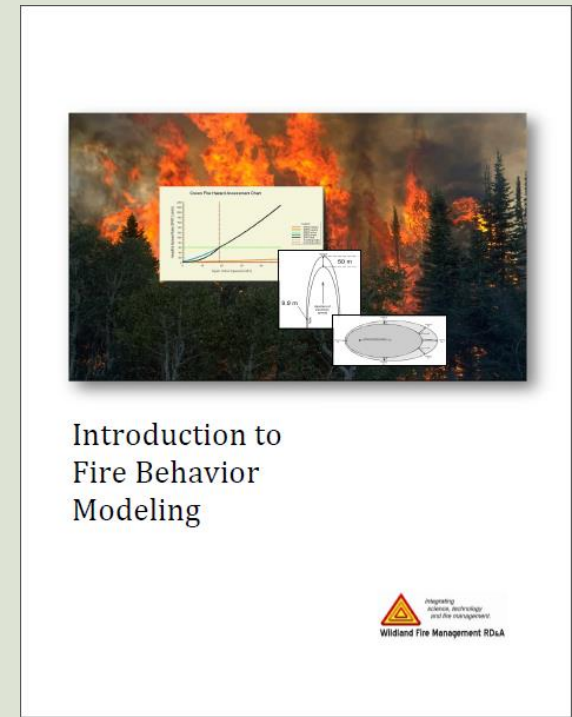


Time



Expense

Resources and Support



www.conservationgateway.org

Modifying LANDFIRE data guide

www.frames.gov/wfmrda-ffe

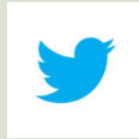
Questions? Comments?



LANDFIRE National
www.landfire.gov



Conservation Gateway:
<http://nature.ly/landfire>



@nature_LANDFIRE



Key Word: **LANDFIREvideo**

Email: **LANDFIRE@tnc.org**

Newsletter? Just ask. Write to us.

Questions? Comments?



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