LANDFIRE

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State Fire Assessments and LANDFIRE: A Case Study

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Tallgrass Prairie and Oak Savanna Fire Science
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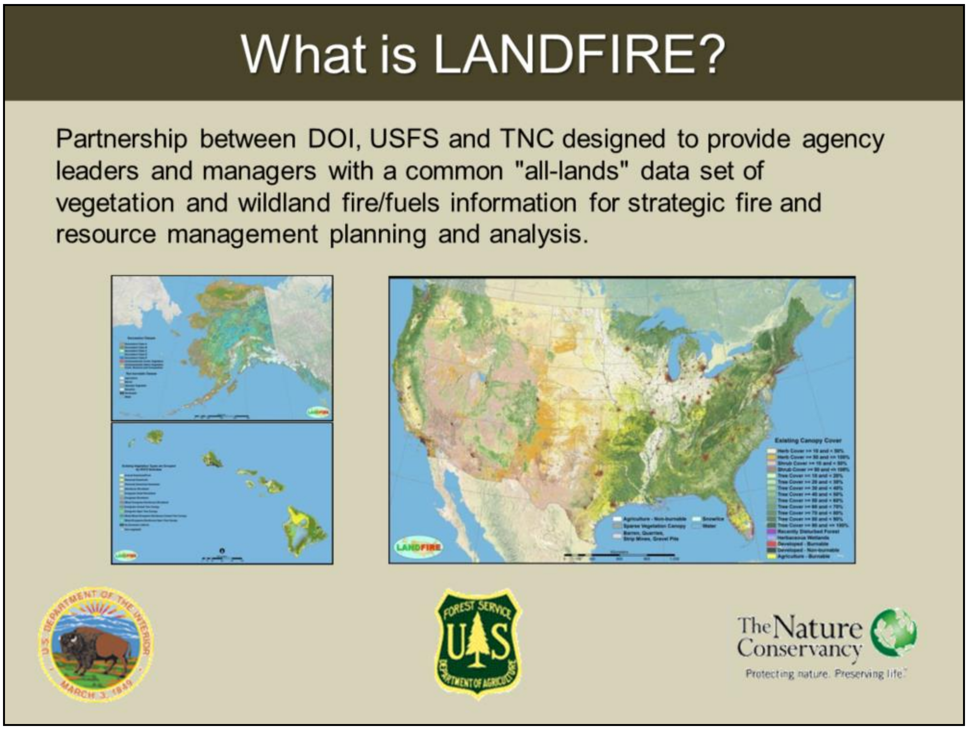
LANDFIRE's mission is to provide agency leaders and managers with a common "all-lands" data set of vegetation and wildland fire/fuels information for strategic fire and resource management planning and analysis.

Tallgrass Prairie and Oak Savanna Fire Science Consortium

A JFSP KNOWLEDGE EXCHANGE CONSORTIUM



In order to tell you about our process, I first need to take a moment to explain the LANDFIRE project to you.

LANDFIRE project was begun circa 2002, and funded by DOI, USDA and TNC

LANDFIRE developed with a fire focus, but we now also explore how LF products can help field offices achieve fire and non-fire goals

The program is funded by USDA, USDOI and TNC, who together are mapping several ecologically relevant metrics and identifying areas closest to and farthest from "reference" ecological conditions.

While LANDFIRE was developed for national/regional/very large landscape analyses, the products have relevance for smaller geographies as well.

Basic data is often the most limiting factor in many assessments because time/resources are not available to develop truly landscape-scale data sets. When data are available from partners, they are often inconsistent in quality and content.

LANDFIRE has created a set of comprehensive, cross-boundary, consistent vegetation and fire data and has implemented a long term Operations and Maintenance Plan to keep this data fresh.

Key take-aways:

1. partnership-this official statement captures part of the community that makes up LANDFIRE as academics, private consultants, students, and NGOs are all contributing.
2. Here you see maps and a funny model thing. This is also part of the story. LANDFIRE is about people, ideas and making the most of the current products available to us.

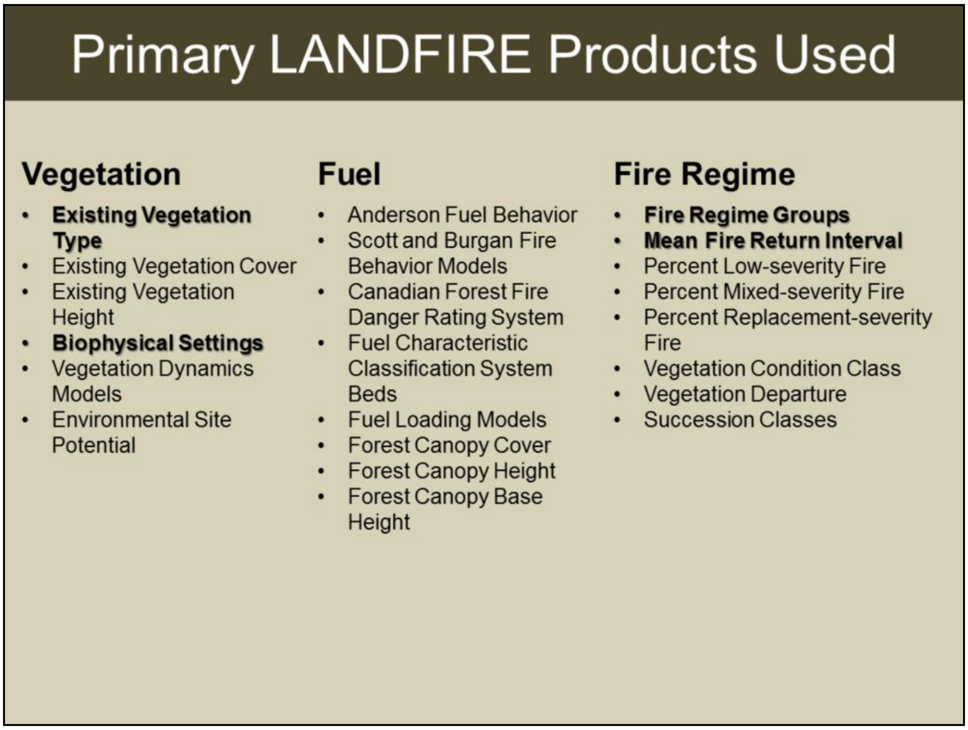
3. Note the word "vegetation." While named LANDFIRE, the program is not only about solving fire-related issues, but also about broader vegetation and values that are connected to it.

What is LANDFIRE?

LANDFIRE is *huge repository*, a *dynamic program*, a *community of partners* that delivers …

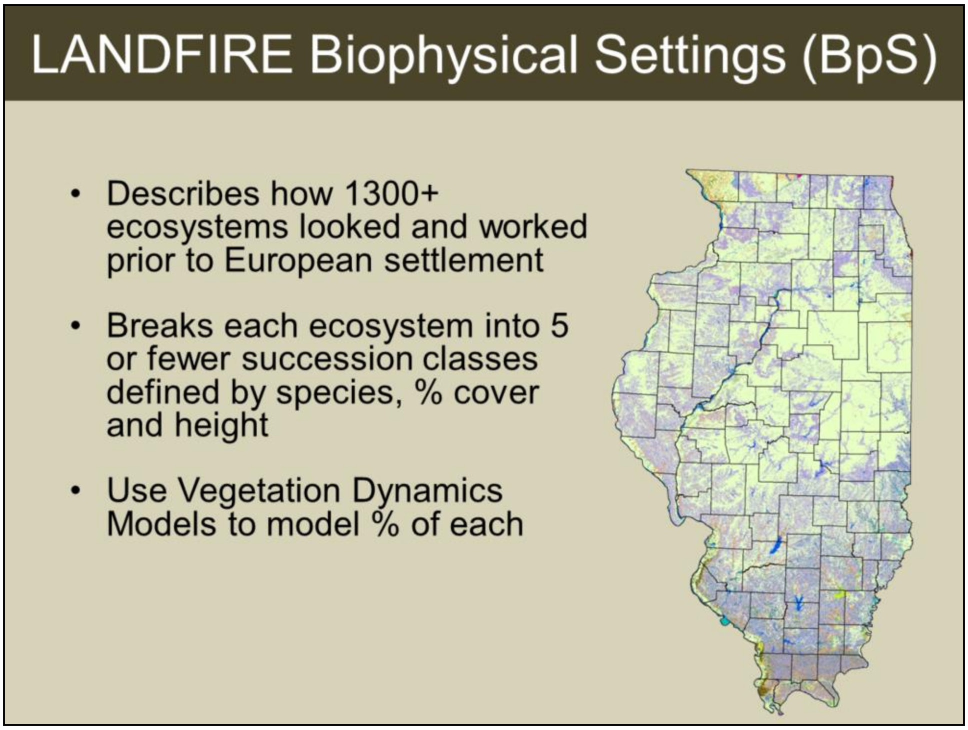
- reference condition *models* and *descriptions*
- vegetation, fire and fuels *spatial data*
- hundreds of *research* and other *reports*
- *tutorials* and *user guides*
- *documentation, adaptations, updates*

LANDFIRE



LANDFIRE has a large suite of products developed for a wide range of disciplines: vegetation, fuels, fire regime, and disturbance

The layers we are predominantly concerned with for these assessments are: Biophysical Settings, Existing Vegetation Type, Mean Fire Return Interval, and Fire Regime Groups, although you may find some of the fire and fuels datasets helpful to you in your assessments or your work with fire.



A note about Biophysical Settings as Reference Conditions:

We are not looking at climate change, and we are not necessarily saying that reference conditions are the same as "Desired Future Conditions." However, we think this view is helpful. In some ecosystems, departure from reference conditions means higher vulnerability to climate change, and we can look to the reference vs. current conditions to asses what we might need to do to adapt.

Vegetation Modeling is used in LANDFIRE to

• Understand historic disturbance patterns

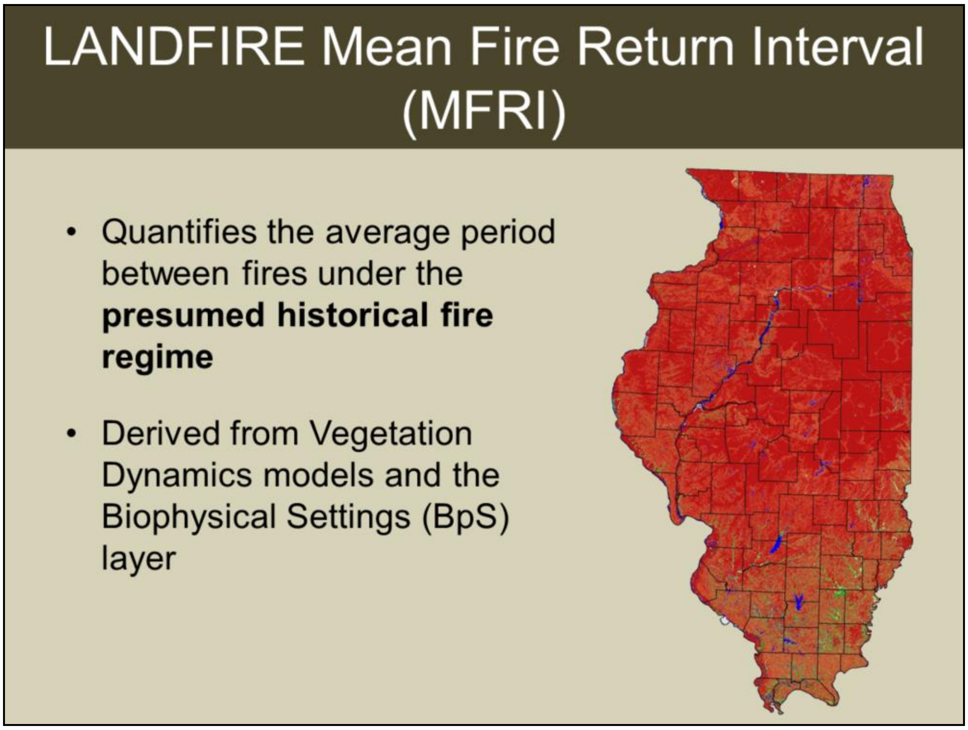
• Estimate proportions of succession classes

•Get overall return interval of surface, mixed and replacement fires

•Map spatial layers

•Engage experts

In this map, the large, pale yellow patches are the central tallgrass prairie BpS type, and the light purple is the North-Central Interior Dry-Mesic Oak Forest BpS type. These were the two most common systems on the Illinois landscape, historically, with a mosaic of other landcover types mixed in in the southern third of the state and the northwest corner of the state, as well as along the riparian areas that run through the state.

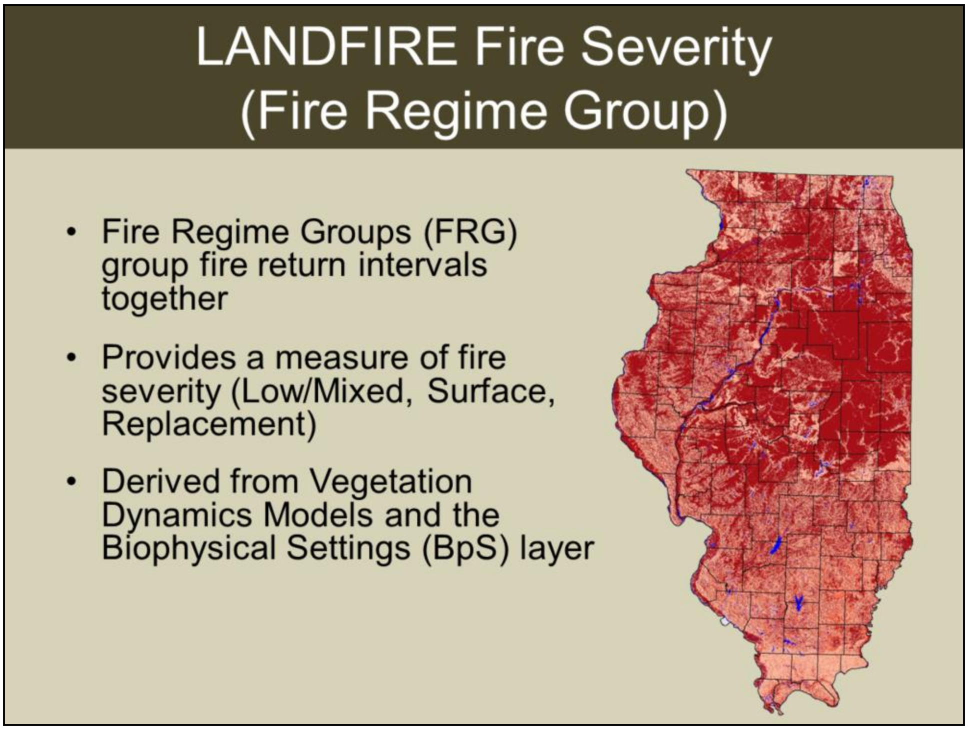


The Mean Fire Return Interval (MFRI) layer is intended to describe one component of historical fire regime characteristics in the context of the broader historical time period represented by the LANDFIRE Biophysical Settings (BpS) layer and BpS Model documentation.

MFRI is derived from the vegetation dynamics model. This layer is created by linking the BpS Group attribute in the BpS layer with the Refresh Model Tracker (RMT) data and assigning the MFRI attribute. This geospatial product should display a reasonable approximation of MFRI, as documented in the RMT.

MFRI is used in landscape assessments.

In this map, darker red colors have a more frequent fire return interval while yellow and greens have a less frequent fire return interval. As you can see, most of the state historically had very frequent fire needs.



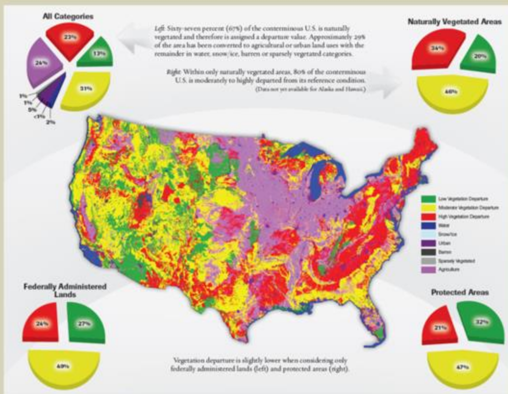
The Fire Regime Groups (FRG) were intended to characterize the presumed historical fire regimes within landscapes based on interactions between vegetation dynamics, fire spread, fire effects, and spatial context. FRG definitions have been altered from previous applications to best approximate the definitions outlined in the Interagency Fire Regime Condition Class Guidebook. These definitions were refined to create discrete, mutually exclusive criteria appropriate for use with LANDFIRE's fire frequency and severity data products.

FRG is created by linking the Biophysical Settings (BpS) Group attribute in the BpS layer with the Refresh Model Tracker (RMT) data and assigning the FRG attribute. This geospatial product should display a reasonable approximation of FRG, as documented in the RMT.

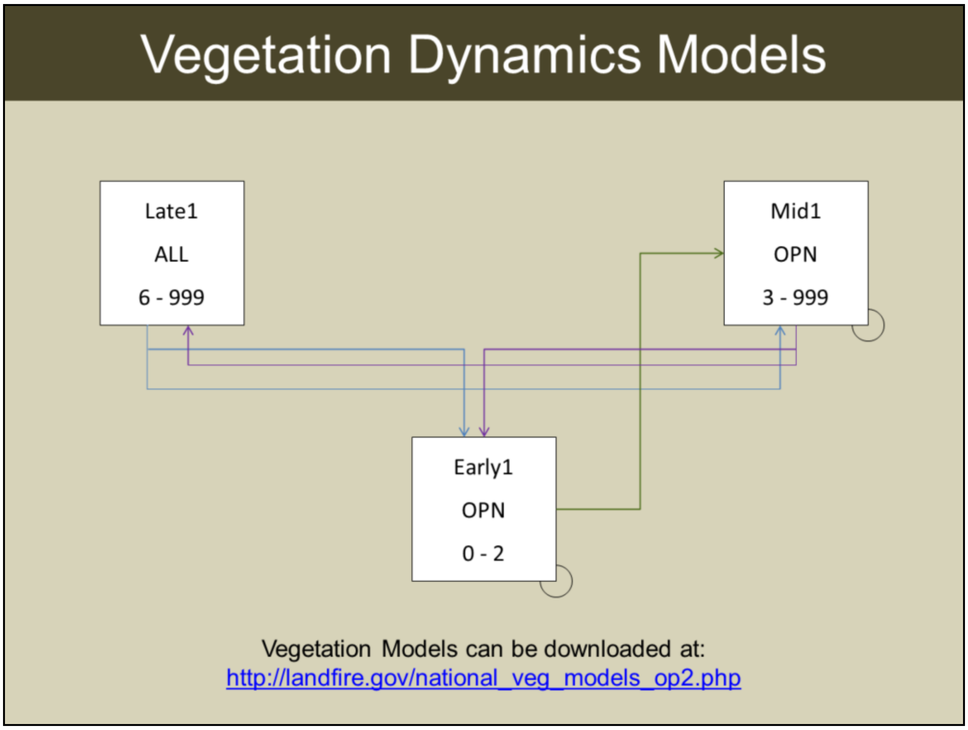
FRG can be used in landscape assessments.

In this map, darker red indicates high-intensity (replacement severity) fire, medium reds indicate a surface severity fire, and the pink color indicates low and mixed severity fire. As you can see, the large patches of tallgrass prairie were historically in a high-intensity replacement severity state.

Models Summarized



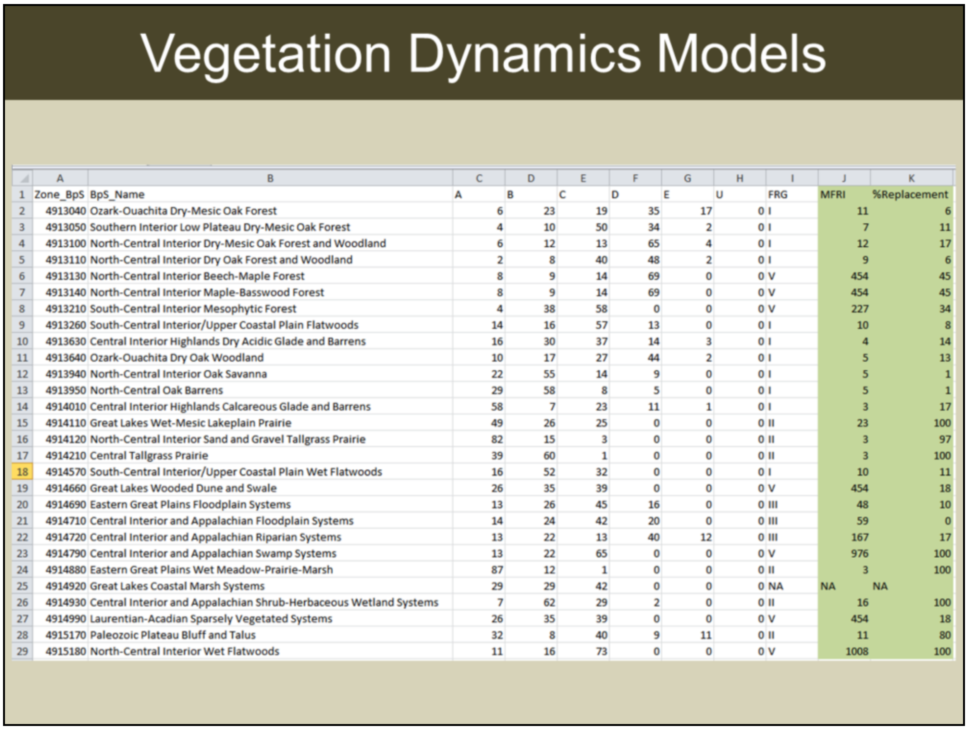
- Represent how the ecosystems of the US worked prior to major European settlement
- Two parts: the model and the description
- Not a prescription for how things should be today or tomorrow
- Models can be hacked or modified
- Not rocket science to modify



Using the Vegetation Dynamics Development Tool, which has been since replaced by software called ST-sim, we entered in the parameters of the succession classes, up to 5, then the natural disturbance regimes and their impacts. These natural disturbances include 3 types of fire, wind, flooding, insects and can also have user defined disturbances such as beaver herbivory.

- These are state-and-transition models that quantify rates and pathways for succession and probability of disturbance under pre-settlement reference conditions.
- Accompanied by a description document that describes the site characteristics, species, geographic ranges, etc. for each Biophysical Setting, or BpS.
- Models used to estimate reference conditions for each BpS , specifically how much of each succession class that would be on the landscape.

SyncroSim and ST-Sim have been designed and developed by ApexRMS. Its ongoing development has been generously supported by several agencies, including The Nature Conservancy, U.S. Forest Service, U.S. Geological Survey and the LANDFIRE project; as a result it is available as a free download.

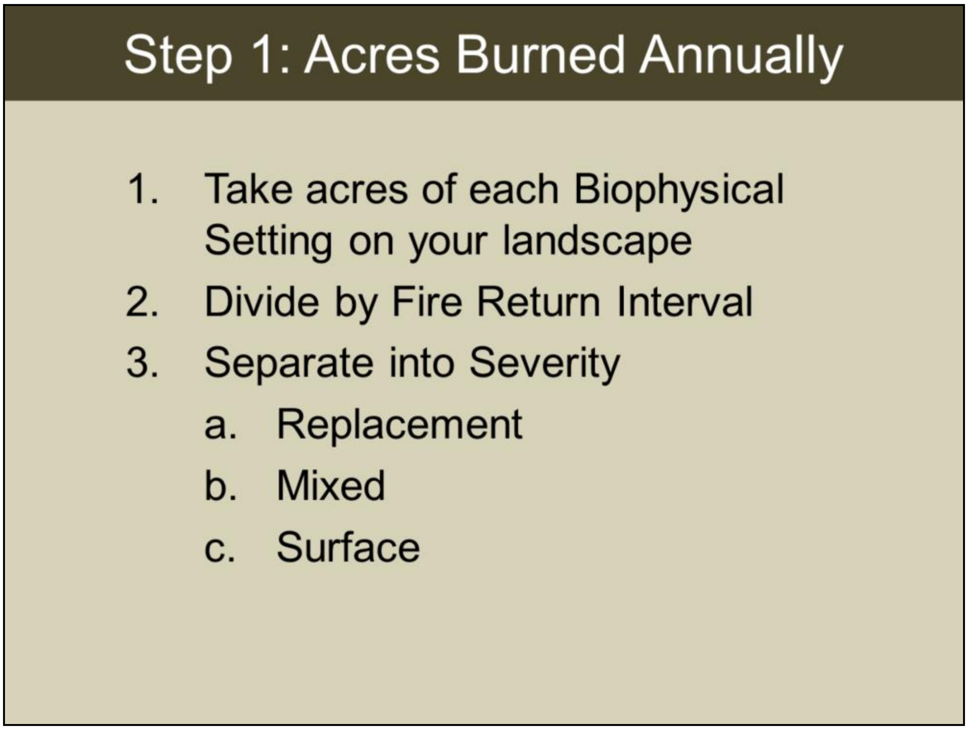


Vegetation Dynamics Models

	A	B	C	D	E	F	G	H	I	J	K
1	Zone_BpS	BpS_Name	A	B	C	D	E	U	FRG	MFRI	%Replacement
2	4913040	Ozark-Ouachita Dry-Mesic Oak Forest	6	23	19	35	17	0	I	11	6
3	4913050	Southern Interior Low Plateau Dry-Mesic Oak Forest	4	10	50	34	2	0	I	7	11
4	4913100	North-Central Interior Dry-Mesic Oak Forest and Woodland	6	12	13	65	4	0	I	12	17
5	4913110	North-Central Interior Dry Oak Forest and Woodland	2	8	40	48	2	0	I	9	6
6	4913130	North-Central Interior Beech-Maple Forest	8	9	14	69	0	0	V	454	45
7	4913140	North-Central Interior Maple-Basswood Forest	8	9	14	69	0	0	V	454	45
8	4913210	South-Central Interior Mesophytic Forest	4	38	58	0	0	0	V	227	34
9	4913260	South-Central Interior/Upper Coastal Plain Flatwoods	14	16	57	13	0	0	I	10	8
10	4913630	Central Interior Highlands Dry Acidic Glade and Barrens	16	30	37	14	3	0	I	4	14
11	4913640	Ozark-Ouachita Dry Oak Woodland	10	17	27	44	2	0	I	5	13
12	4913940	North-Central Interior Oak Savanna	22	55	14	9	0	0	I	5	1
13	4913950	North-Central Oak Barrens	29	58	8	5	0	0	I	5	1
14	4914010	Central Interior Highlands Calcareous Glade and Barrens	58	7	23	11	1	0	I	3	17
15	4914110	Great Lakes Wet-Mesic Lakeplain Prairie	49	26	25	0	0	0	II	23	100
16	4914120	North-Central Interior Sand and Gravel Tallgrass Prairie	82	15	3	0	0	0	II	3	97
17	4914210	Central Tallgrass Prairie	39	60	1	0	0	0	II	3	100
18	4914570	South-Central Interior/Upper Coastal Plain Wet Flatwoods	16	52	32	0	0	0	I	10	11
19	4914660	Great Lakes Wooded Dune and Swale	26	35	39	0	0	0	V	454	18
20	4914690	Eastern Great Plains Floodplain Systems	13	26	45	16	0	0	III	48	10
21	4914710	Central Interior and Appalachian Floodplain Systems	14	24	42	20	0	0	III	59	0
22	4914720	Central Interior and Appalachian Riparian Systems	13	22	13	40	12	0	III	167	17
23	4914790	Central Interior and Appalachian Swamp Systems	13	22	65	0	0	0	V	976	100
24	4914880	Eastern Great Plains Wet Meadow-Prairie-Marsh	87	12	1	0	0	0	II	3	100
25	4914920	Great Lakes Coastal Marsh Systems	29	29	42	0	0	0	NA	NA	NA
26	4914930	Central Interior and Appalachian Shrub-Herbaceous Wetland Systems	7	62	29	2	0	0	II	16	100
27	4914990	Laurentian-Acadian Sparsely Vegetated Systems	26	35	39	0	0	0	V	454	18
28	4915170	Paleozoic Plateau Bluff and Talus	32	8	40	9	11	0	II	11	80
29	4915180	North-Central Interior Wet Flatwoods	11	16	73	0	0	0	V	1008	100

The models come as a Microsoft database file and also as a Comma Separated Variable (CSV) file. The CSV contains much of what you will need to complete the next phases of the fire assessment. With the CSV file, you can use the BpS Code (far left column) to find the Mean Fire Return Interval and Percent Replacement Severity for that BpS. This will directly plug in to the process to help us understand historic and current fire on the landscape.

You can (and are encouraged to) re-define fire return intervals to better match what is on your landscape. The TNC LANDFIRE team encourages you to submit your modifications to us for possible inclusion in future iterations of LANDFIRE data.



Now I'll dive into the process that we undertook in Illinois to get a measure of how much fire should be on the ground. Note that our assessment is still in progress, so we do not have final data nor have we made all refinements to the process. We do welcome your input on this process, especially as we reach the latter stages.

We began by getting a measure of how much fire was on the ground historically, using Biophysical Settings as reference conditions and historic mean fire return intervals.

LANDFIRE Biophysical Settings (BpS)

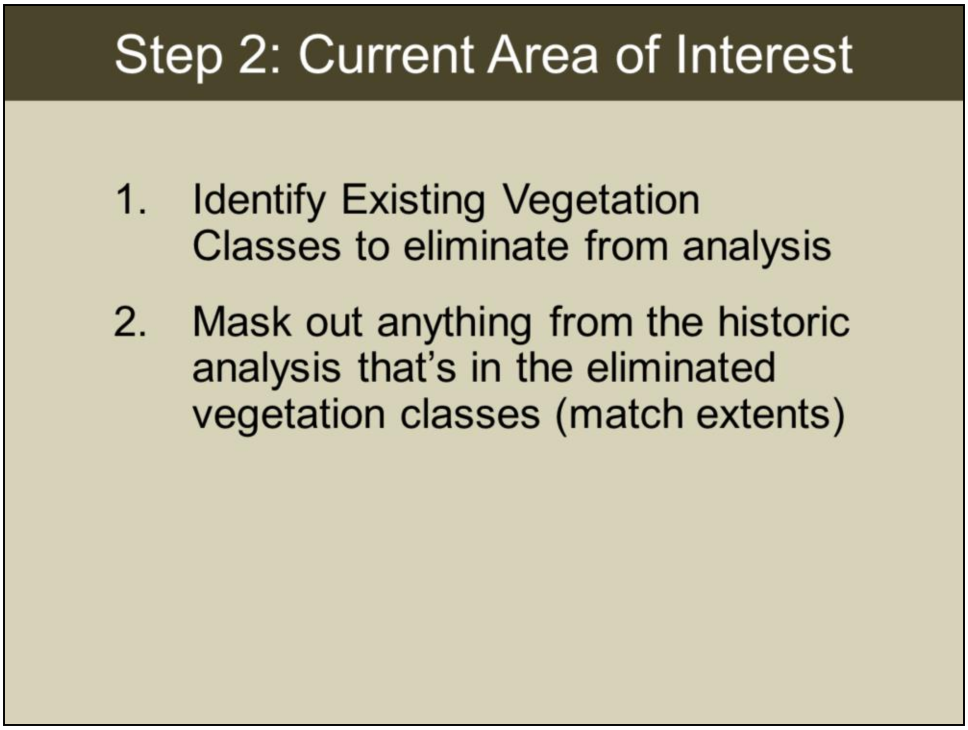
BpS Name	Acres
Central Tallgrass Prairie	20,100,235
North-Central Interior Dry-Mesic Oak Forest and Woodland	10,560,344
North-Central Interior Maple Basswood Forest	1,204,945
South-Central Interior Mesophytic Forest	1,053,474
North-Central Interior Oak Savanna	262,108

First, we used the LANDFIRE Biophysical Settings (BpS) layer to get an idea of what the historic vegetation breakdown was across the state prior to European settlement. As we expected, the state was dominated by tallgrass prairie and oak forests and woodlands. Shown in the table are the five most widely spread Biophysical Settings types. We will use these as our representative vegetation types as I move through our assessment.

LANDFIRE Historic Mean Fire Return Intervals (MFRI)

BpS Name	Acres	MFRI	Acres Burned/yr
Central Tallgrass Prairie	20,100,235	3 years	6,700,078
North-Central Interior Dry-Mesic Oak Forest and Woodland	10,560,344	20 years	528,017
North-Central Interior Maple Basswood Forest	1,204,945	455 years	2,648
South-Central Interior Mesophytic Forest	1,053,474	148 years	7,118
North-Central Interior Oak Savanna	262,108	5 years	52,422

Using LANDFIRE Biophysical Settings and LANDFIRE Mean Fire Return Intervals, we can create a crosswalk table using GIS or any database system. This will give us an estimate of the historic fire return intervals in each pre-settlement vegetation type in the state. From this, we can use a basic calculation to derive how many acres of each vegetation type were burned on average each year under our reference conditions. This is what we can refer to as our historical baseline.



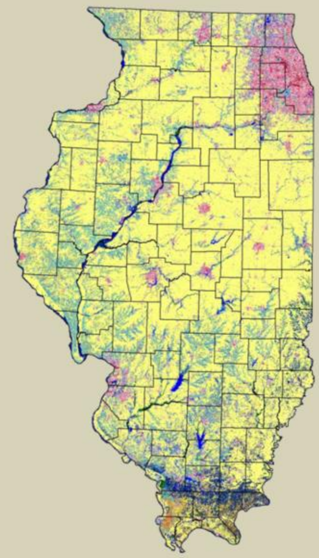
The next step of the process is to try to get a picture of the fire needs across the state under current vegetation conditions. In states like Illinois, we understand that it is not realistic to assume we're going to return to reference conditions, so we need to take some measures to adjust the acres of fire needed each year to a more realistic picture.

In order to do this we used LANDFIRE Existing Vegetation Type (EVT) data to eliminate urban, ag, and other vegetation classes that were not of concern to your current fire estimates.

To create a common comparison framework between today and yesterday, we used the BpS MFRI just on the acres that are currently of interest. By cutting out the 'non natural' current EVT from the BpS map we can create a pre-European settlement map but only for areas that are currently naturally vegetated.

LANDFIRE Existing Vegetation Type (EVT)

EVT Name	Acres
Central Tallgrass Prairie	51,239
North-Central Interior Dry-Mesic Oak Forest and Woodland	2,319,062
North-Central Interior Maple Basswood Forest	464,664
South-Central Interior Mesophytic Forest	712,968
North-Central Interior Oak Savanna	3,700



The Existing Vegetation Type (EVT) layer represents the species composition currently present at a given site. Vegetation map units are primarily derived from NatureServe's Ecological Systems classification, which is a nationally consistent set of mid-scale ecological units. Additional units are derived from NLCD, National Vegetation Classification Standard (NVCS) Alliances, and LANDFIRE specific types.

EVTs are mapped using decision tree models, field data, Landsat imagery, elevation, and biophysical gradient data. Decision tree models are developed separately for each of the three lifeforms -tree, shrub, and herbaceous and are then used to generate lifeform specific EVT layers.

The table shows our five most widespread vegetation types as calculated in reference conditions. As you can see, they are all far less dominant on the landscape now, so we'll need to drastically adjust our numbers for how many acres we expect to burn in each of these types each year.

In this map, the pink patches indicate urban areas, and the predominant yellow color you can see throughout most of the state represents row crop agriculture. The fingers of light green you can see along river and stream banks represents the North-Central Interior Dry-Mesic Oak Forest and Woodland vegetation system, which is one of the only vegetation systems that still remains at least somewhat intact from the historic conditions in the state.

Adjusted Existing Vegetation Type

EVT Name	Acres
Aquaculture	69
Barren	15,407
Bush Fruit and Berries	38
Close Grown Crop	931,601
Developed High, Med, Low Intensity	1,428,586
Roads	1,627,884
Open Water	670,622
Orchard/Vineyard	4553
Quarries, Strip Mines, Gravel Pits	20,249
Row Crop	2,0696,757
Wheat	217,680

To get a more accurate picture of what may realistically be considered for a fire analysis on our current landscape, we used ArcGIS Spatial Analyst tools to remove most agriculture and developed systems from analysis, though we did choose to leave in some of the developed types with ruderal vegetation. This was a decision made by the steering committee in order to help us leverage the assessment across key partnerships. We acknowledge that these vegetation classes will not be high priorities for scarce fire resources. This process is best done by consulting a small team of experts familiar with the landscape and the fire culture of your area.

Much of what remains in most of the state (shown in this map) is the North-Central Interior Dry-Mesic Oak Forest and Woodland (again represented by the lighter green color). The remaining vegetation types are predominantly featured in the southern third of the state where there has been far less conversion to agriculture due to the shift in landscape from prairie types to forest and wetland types as we transition into the southern vegetation and systems characteristic in the Ozarks.

Adjusted Biophysical Settings

BpS Name	Acres
Central Tallgrass Prairie	2,858,702
North-Central Interior Dry-Mesic Oak Forest and Woodland	3,751,868
North-Central Interior Maple Basswood Forest	648,924
South-Central Interior Mesophytic Forest	483,556
North-Central Interior Oak Savanna	117,740

Once you have selected the area of current vegetation you will be using for analysis, the next step is to match the extent of historic fire analysis to the current vegetation. I used ArcGIS Spatial Analyst Tools to create a mask of the selected EVT data and extracted the BpS layer by that mask. This will give you a more realistic comparison of what the historic fire acreages were on your landscape so that you can more easily match current to historic and set realistic goals about fire needs in your area.

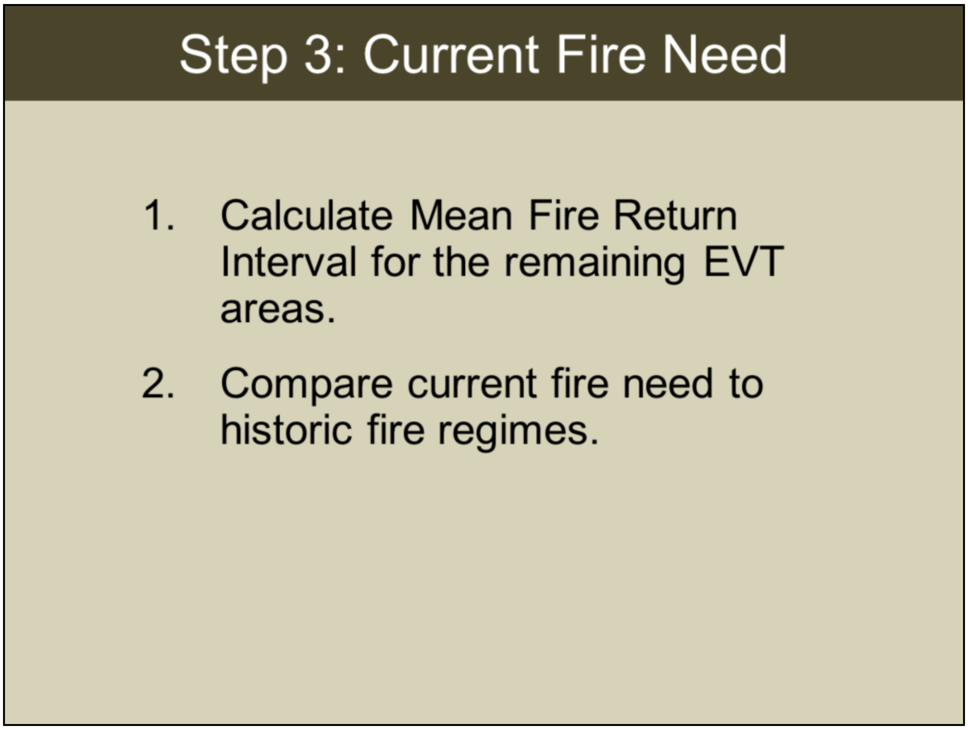
This is still not truly current, as the acreages of each of these systems do not match between EVT and BpS, but it is more reflective of current than assuming today's landscape is the same extent as it was before we showed up.

In the map, you can see that the North-Central Interior Dry Mesic Oak forest and Woodland BpS (represented by light purple) is now the predominant BpS on the landscape with some patches of Central Tallgrass Prairie (in a light yellow color) still remaining. However, much of the Central Tallgrass Prairie is now eliminated from analysis due to conversion to agriculture.

Adjusted Historic Mean Fire Return Intervals (MFRI)

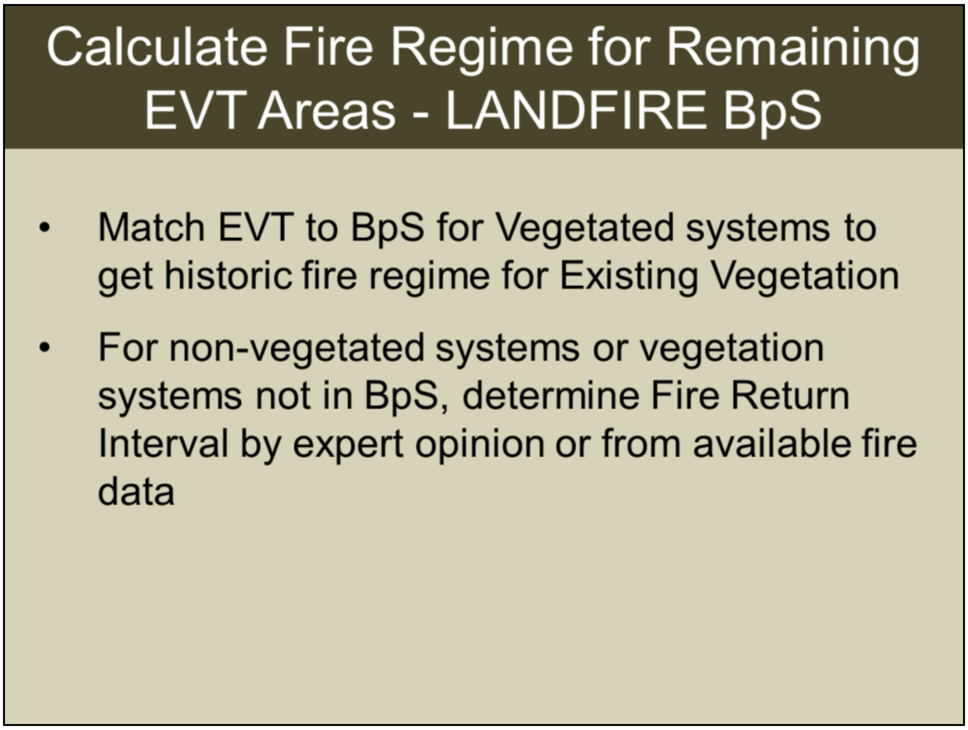
BpS Name	Acres	MFRI	Acres Burned/yr
Central Tallgrass Prairie	2,858,702	3 years	952,901
North-Central Interior Dry-Mesic Oak Forest and Woodland	3,751,868	20 years	187,593
North-Central Interior Maple Basswood Forest	648,924	455 years	1,426
South-Central Interior Mesophytic Forest	483,556	148 years	3,267
North-Central Interior Oak Savanna	117,740	5 years	23,548

Using the same process I used in the full-state historical assessment, I crosswalked the historic mean fire interval data with the Biophysical Settings data (with acreages adjusted to our new area of interest) to get a more useful picture of how much fire was on the ground historically. Again, this is not to say that under current vegetation we can expect this level of fire frequency, but it does help us make a more accurate comparison of historic conditions to current conditions.



Next, we come to an assessment of current fire needs. We have reasonably good numbers now for how much fire should be on the ground assuming our current vegetation matched reference conditions in cases where somewhat natural vegetation still remains, but this is not an accurate picture of what fire we need right now.

The first issue we identified, thanks to help from our fire experts, is that using historic mean fire return intervals on current systems is not appropriate. Fire needs now are, in many cases, very different than they were when we had less threat of invasive species and needed to conduct less intensive management. If we want to get a better picture of how much fire we need now, we need to adjust the fire return intervals.



The first step I took, to give us a baseline of what our fire needs were if we did apply historic fire return intervals, was to match the Biophysical Settings classes to the Existing Vegetation classes and apply the historic mean fire return intervals. Any naturally vegetated EVT will have an MFRI from a LANDFIRE model, so to apply the historic fire return intervals, you can use the same process you would do if this was a BpS instead of an EVT. The challenge is that some vegetated EVTs (such as ruderal types) will not have a model so no MFRI. You will have to decide what to do with those---perhaps eliminate them as well or match them to reasonably relevant BpS types (i.e. use grassland MFRI for the ruderal grassland types).

There is a pattern to match the EVT and BpS codes, though it is not exact. Sometimes there will be an issue with identifying the most appropriate MFRI even in vegetation systems, but these are relatively minor types and can usually be determined by digging in to the BpS descriptions or using expert opinion to see what is appropriate for a fire regime.

Calculate Fire Regime for Remaining EVT Areas—LANDFIRE BpS

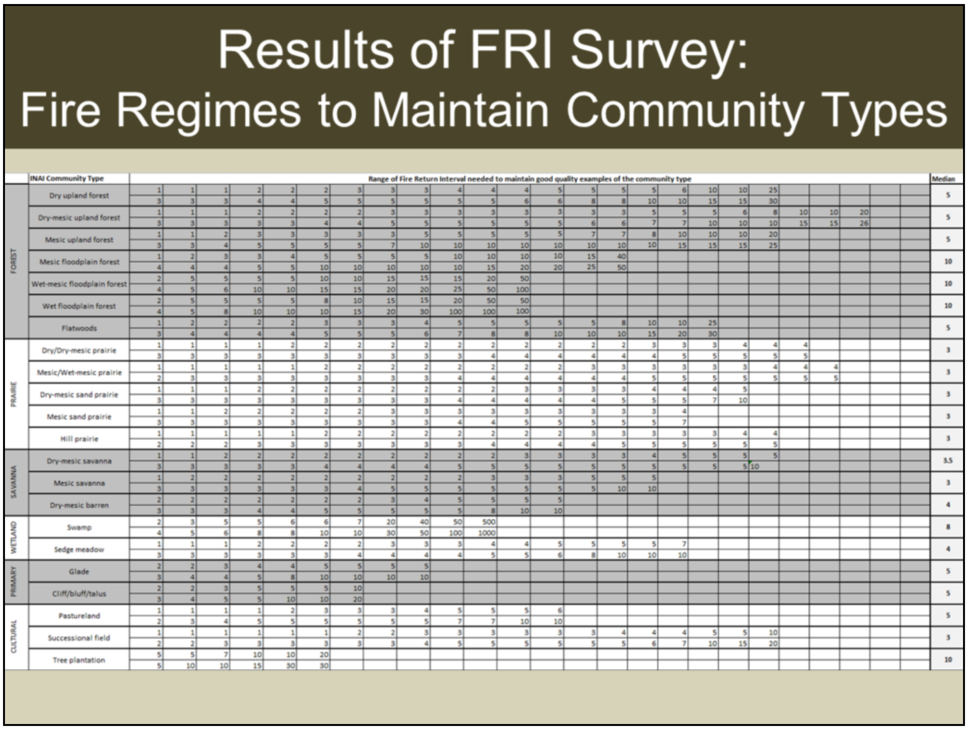
EVT Code	BpS Code	EVT Name	EVT Count	EVT Acres	Mean Fire Return Interval	Percent Replacement	Fire Severity	Acres Burned/year
3395	13950	North-Central Oak Barrens	316,381	68,338	5	3	Low	13,667.66
3313	13130	North-Central Interior Beech-Maple Forest	246,065	53,150	454	48	Mixed	117.07
3421	14210	Central Tallgrass Prairie	237,218	51,239	3	100	Replacement	17,079.70
3493	14930	Central Interior and Appalachian Shrub-Herbaceous Wetland Systems	137,644	29,731	16	100	Replacement	1,858.19
3518	15180	North-Central Interior Wet Flatwoods	126,542	27,333	974	100	Replacement	28.06
3517	15170	Paleozoic Plateau Bluff and Talus	90,209	19,485	11	79	Replacement	1,771.38
3479	14790	Central Interior and Appalachian Swamp Systems	32,748	7,074	994	100	Replacement	7.12
3412	14120	North-Central Interior Sand and Gravel Tallgrass Prairie	29,836	6,445	3	98	Replacement	2,148.19
3364	13640	Ozark-Ouachita Dry Oak Woodland	21,695	4,686	5	13	Low	937.22
3394	13940	North-Central Interior Oak Savanna	17,130	3,700	5	3	Low	740.02
3472	14720	Central Interior and Appalachian Riparian Systems	10,146	2,192	167	17	Low	13.12
3362	13622	Laurentian-Acadian Northern Pine Forest	6,275	1,355	38	2	Low	35.67
3457	14570	South-Central Interior/Upper Coastal Plain Wet Flatwoods	2,811	607	9	8	Low	67.46
3466	14660	Great Lakes Wooded Dune and Swale	1,883	407	454	18	Low	0.90
3475	14750	Laurentian-Acadian Floodplain Systems	1,784	385	57	0	Low	6.76
3473	14730	Gulf and Atlantic Coastal Plain Floodplain Systems	1,665	360	53	47	Mixed	6.79
3513	15130	Lower Mississippi River Flatwoods	1,597	345	50	13	Low	6.90
3494	14940	Laurentian-Acadian Shrub-Herbaceous Wetland Systems	1,478	319	180	100	Replacement	1.77
3344	13440	Boreal Jack Pine-Black Spruce Forest	460	99	80	100	Replacement	1.24
3480	14800	Gulf and Atlantic Coastal Plain Swamp Systems	370	80	408	41	Mixed	0.20
3243	14071	Laurentian Pine-Oak Barrens	80	17	4	4	Low	4.32
3488	14880	Eastern Great Plains Wet Meadow-Prairie-Marsh	35	8	408	41	Mixed	0.02
3245	13651	Boreal White Spruce-Fir-Hardwood Forest	33	7	213	85	Replacement	0.03
3420	14200	Northern Tallgrass Prairie	9	2	6	100	Replacement	0.32
3367	13670	Ozark-Ouachita Shortleaf Pine Forest and Woodland	7	2	5	1	Low	0.30
3241	13660	Laurentian-Acadian Pine-Hemlock-Hardwood Forest	2	0	178	37	Mixed	0.00
3308	13080	Crosstimbers Oak Forest and Woodland	1	0	5	3	Low	0.04
3418	14180	Pennyroyal Karst Plain Prairie and Barrens	1	0	1	94	Replacement	0.22
3244		Boreal Hardwood Forest	1,353	292				
3365		Boreal White Spruce-Fir Forest	1,666	360				
3463		Central Appalachian Dry Oak Forest	535,572	115,684				
3369		Central Appalachian Dry Pine Forest	102,087	22,051				
3409		Great Lakes Alvar Shrubland	17	4				
3242		Laurentian Oak Barrens	7,367	1,591				
3269		Laurentian Pine Barrens	516	111				
3407		Laurentian Pine Barrens	2,290	495				
3240		Laurentian-Acadian Hardwood Forest	72	16				
3238		Laurentian-Acadian Northern Oak Forest	6,455	1,394				
3239		Laurentian-Acadian Northern Pine-Oak Forest	559	121				
3366		Laurentian-Acadian Pine-Hemlock Forest	108	23				

This table shows my crosswalk with BpS Codes, EVT codes, and Historic Mean Fire Return Intervals. As you can see, only about 25 of the vegetation classes matched exactly, meaning that we needed to calculate our own fire return intervals for the remainder of the Existing Vegetation types. In addition, we knew that many of these historic fire return intervals would need to be adjusted to reflect current management practices.

Calculate Current Fire Regime for Remaining EVT Areas—Expert Review

- We surveyed fire managers and experts across the state to ask them to provide us with a range of fire return intervals in current systems following two different scenarios:
  - Range of fire return intervals needed to maintain good quality examples of the community type.
  - Range of fire return intervals needed to restore or remediate degraded examples of the community type.

I will note before I show you the preliminary survey results that we had to do a bit of a data crosswalk. Because land managers in Illinois are more comfortable working with the state-developed Illinois Natural Areas Inventory (INAI) vegetation types, some of our experts weren't comfortable responding with fire return intervals for the unfamiliar LANDFIRE Existing Vegetation Types. In order to help our survey responders give us more meaningful data, we used the vegetation descriptions from the LANDFIRE Biophysical Settings models and the vegetation descriptions provided in the INAI-produced documentation on the Classification of Natural Communities in Illinois and matched EVT to INAI as best we could. We acknowledge that these vegetation matches are not perfect, but we feel that they will be representative enough for our current assessment. If issues arise, we may refine the crosswalk at a later date.



	INAI Community Type	Range of Fire Return Interval needed to maintain good quality examples of the community type																									Median
FOREST	Dry upland forest	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	5	6	10	10	25						5
		3	3	3	4	4	5	5	5	5	5	5	6	6	8	8	10	10	15	15	30						
	Dry-mesic upland forest	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3	5	5	5	6	8	10	10	20			5
		3	3	3	3	3	4	4	5	5	5	5	5	5	6	6	7	7	10	10	10	15	15	26			
	Mesic upland forest	1	1	2	3	3	3	3	3	5	5	5	5	5	7	7	8	10	10	10	20						5
		3	3	4	5	5	5	5	7	10	10	10	10	10	10	10	10	15	15	15	25						
	Mesic floodplain forest	1	2	3	3	4	5	5	5	5	10	10	10	10	15	40											10
		4	4	4	5	5	10	10	10	10	10	15	20	20	25	50											
	Wet-mesic floodplain forest	2	5	5	5	5	10	10	15	15	15	20	50														10
		4	5	6	10	10	15	15	20	20	25	50	100														
	Wet floodplain forest	2	5	5	5	5	8	10	15	15	20	50	50														10
		4	5	8	10	10	10	15	20	30	100	100	100														
	Flatwoods	1	2	2	2	2	3	3	3	4	5	5	5	5	5	8	10	10	25								5
		3	4	4	4	4	5	5	5	6	7	8	8	10	10	10	15	20	30								
PRAIRIE	Dry/Dry-mesic prairie	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	4	4	4					3
		3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	5	5	5	5	5					
	Mesic/Wet-mesic prairie	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4				3
		2	3	3	3	3	3	3	3	3	4	4	4	4	4	4	5	5	5	5	5	5	5				
	Dry-mesic sand prairie	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	4	4	4	5							3
		3	3	3	3	3	3	3	3	3	4	4	4	4	4	5	5	5	7	10							
	Mesic sand prairie	1	1	2	2	2	2	2	3	3	3	3	3	3	3	3	3	4									3
		3	3	3	3	3	3	3	3	3	4	4	5	5	5	5	5	7									
	Hill prairie	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	4	4						3
		2	2	2	3	3	3	3	3	3	3	4	4	4	4	5	5	5	5	5	5						
SAVANNA	Dry-mesic savanna	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	4	5	5	5	5						3.5
		3	3	3	3	3	4	4	4	4	5	5	5	5	5	5	5	5	5	5	10						
	Mesic savanna	1	2	2	2	2	2	2	2	2	2	3	3	3	5	5	5										3
		3	3	3	3	3	3	4	5	5	5	5	5	5	5	10	10										
	Dry-mesic barren	2	2	2	2	2	2	2	3	4	5	5	5	5													4
		3	3	3	4	4	5	5	5	5	5	8	10	10													
WETLAND	Swamp	2	3	5	5	6	6	7	20	40	50	500															8
		4	5	6	8	8	10	10	30	50	100	1000															
	Sedge meadow	1	1	1	2	2	2	2	3	3	3	4	4	5	5	5	5	7									4
		3	3	3	3	3	3	4	4	4	4	5	5	6	8	10	10	10									
PRIMARY	Glade	2	2	3	4	4	5	5	5	5																	5
		3	4	4	5	8	10	10	10	10																	
	Cliff/bluff/talus	2	2	3	5	5	5	10																			5
		3	4	5	5	10	10	20																			
CULTURAL	Pastureland	1	1	1	1	2	3	3	3	4	5	5	5	6													5
		2	3	4	5	5	5	5	5	5	7	7	10	10													
	Successional field	1	1	1	1	1	1	2	2	3	3	3	3	3	3	4	4	4	5	5	10						3
		2	2	3	3	3	3	3	3	4	5	5	5	5	5	5	6	7	10	15	20						
	Tree plantation	5	5	7	10	10	20																				10
		5	10	10	15	30	30																				

This table and the next summarize the preliminary results of our survey. The survey completed with moderate success on February 6, 2015. I split the ranges given into high and low for each community type and then calculated the median of all the numbers in these ranges as the final Adjusted Fire Return Interval for that community type. We asked people to respond for the area of the state they are most familiar with, so we acknowledge that at a later date we will likely need to break down these fire return intervals by region to get a more accurate picture of fire needs in the state. For example, the fire return interval needed to maintain good quality examples of upland forest in the southern portion of the state may be very different than in the eastern or central parts of the state. Our current numbers do not reflect this.

Results of FRI Survey:
Fire Regimes to Restore Community Types

	INAI Community Type	Range of Fire Return Interval needed to restore or remediate degraded examples of the community type																								Median
FOREST	Dry upland forest	1	1	1	1	1	1	1	1	2	2	2	2	3	3	3	3	3	5	5						2.5
		2	2	2	2	2	2	2	3	3	3	3	3	3	5	5	5	5	10	10						
	Dry-mesic upland forest	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3	3	3	3	5	5			2
		1	2	2	2	2	2	2	2	3	3	3	3	3	3	4	5	5	5	5	5	8	10			
	Mesic upland forest	1	1	1	1	1	1	1	1	1	2	2	2	2	3	3	4	5	5	5						2.5
		1	2	2	2	2	2	3	3	3	3	5	5	5	5	6	7	8	10	10						
	Mesic floodplain forest	1	1	1	1	2	2	2	3	3	5	5	5	8	10	10										5
		1	2	2	3	3	5	5	5	7	10	10	10	10	15	15										
	Wet-mesic floodplain forest	1	1	1	2	3	5	5	5	10	15	20	20													5
		2	2	3	3	5	5	6	10	15	20	50	50													
	Wet floodplain forest	1	1	1	1	2	3	5	10	15	15	20	50													5
		1	2	2	3	3	5	10	10	20	20	50	100													
	Flatwoods	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	5	5							3
		1	2	2	2	2	3	3	3	3	3	3	3	5	5	5	5	10	10							
PRAIRIE	Dry/Dry-mesic prairie	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	3	3				2
		1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	5	5				
	Mesic/Wet-mesic prairie	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3				2
		1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	4	5	5				
	Dry-mesic sand prairie	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3							2
		1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	5	5							
	Mesic sand prairie	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3									2
		1	2	2	2	2	2	2	2	3	3	3	3	3	3	5	5									
	Hill prairie	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3							2
		1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	4	5	5							
SAVANNA	Dry-mesic savanna	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3							2
		1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	5	5							
	Mesic savanna	1	1	1	1	1	1	1	1	1	1	1	2	2	3	3										2
		1	1	2	2	2	2	3	3	3	3	3	3	3	5	5										
	Dry-mesic barren	1	1	1	1	1	2	2	2	2	2	3	3	3	3											2
		2	2	2	2	3	3	3	3	3	4	5	5	5	5											
WETLAND	Swamp	1	2	2	3	3	3	5	5	15	500															5
		3	3	4	5	5	5	7	10	20	1000															
	Sedge meadow	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	3									2
		1	1	2	2	2	2	2	3	3	3	3	3	4	5	5	5									
PRIMARY	Glade	1	1	1	1	1	2	3	3	4																3
		2	2	3	3	3	3	4	5	5																
	Cliff/bluff/talus	1	1	1	1	3	3	5	5																	3
		2	2	3	5	5	5	5	10																	
CULTURAL	Pastureland	1	1	1	1	1	1	2	2	2	3	4	5													3
		2	2	3	3	3	4	5	5	5	5	5	10													
	Successional field	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	5						2
		1	1	1	2	2	2	2	3	3	3	3	3	5	5	5	5	5	5	10						
	Tree plantation	5	5	5	5	10																				5
		5	5	10	10	15																				

Crosswalk Vegetation Types to LANDFIRE Existing Vegetation Types

Existing Vegetation Type	Illinois Natural Areas Inventory
Central Appalachian Dry Oak Forest	Dry upland forest
Central Appalachian Dry Pine Forest	Dry upland forest
North-Central Interior Dry Oak Forest and Woodland	Dry/dry-mesic upland forest
North-Central Interior Dry-Mesic Oak Forest and Woodland	Dry-mesic upland forest
Ozark-Ouachita Dry-Mesic Oak Forest	Dry-mesic upland forest
Southern Interior Low Plateau Dry-Mesic Oak Forest	Dry-mesic upland forest
North-Central Interior Beech-Maple Forest	Mesic upland forest
North-Central Interior Maple-Basswood Forest	Mesic upland forest
South-Central Interior Mesophytic Forest	Mesic upland forest
Urban Deciduous Forest	Upland forest
Central Interior and Appalachian Riparian Systems	Floodplain forest
Central Interior and Appalachian Floodplain Systems	Floodplain forest
Eastern Great Plains Floodplain Systems	Floodplain forest
North-Central Interior Wet Flatwoods	Flatwoods
Ozark-Ouachita Dry Oak Woodland	Dry woodland
Central Tallgrass Prairie	Dry, Dry-mesic, mesic and wet prairie
North-Central Interior Sand and Gravel Tallgrass Prairie	sand prairie
North-Central Oak Barrens	Savanna

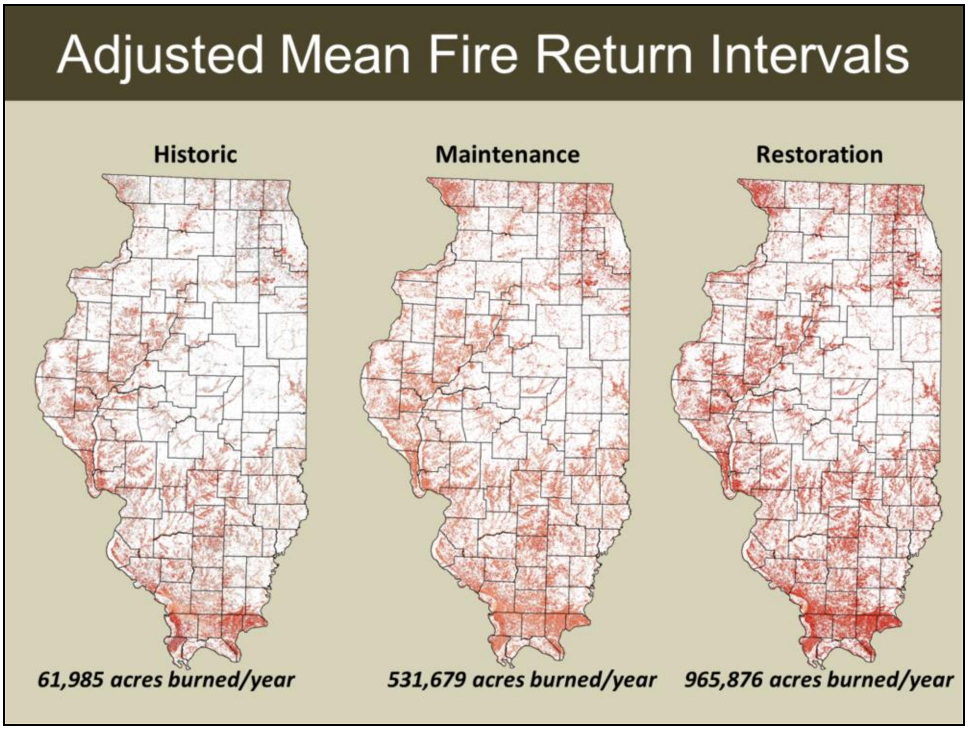
Existing Vegetation Type	Illinois Natural Areas Inventory
North-Central Interior Oak Savanna	Dry/Dry-mesic/mesic savanna
Central Interior and Appalachian Swamp Systems	Swamp
Central Interior and Appalachian Shrub-Herbaceous Wetland Systems	sedge meadow
Central Interior Highlands Calcareous Glade and Barrens	Glades, Barrens
Paleozoic Plateau Bluff and Talus	Cliff, Bluff and talus
Modified/Managed Northern Tallgrass Grassland	Cultural - cropland, pasture, successional
Developed Ruderal Grassland	Cultural - cropland, pasture, successional
Undeveloped Ruderal Grassland	Cultural - cropland, pasture, successional
Urban Herbaceous	Cultural - developed, successional
Undeveloped Ruderal Deciduous Forest	Cultural - successional, grading towards upland forest
Developed Ruderal Shrubland	Cultural - successional
Recently Logged-Herb and Grass Cover	Cultural - successional
Developed Ruderal Deciduous Forest	Developed - successional
Urban Shrubland	Developed - successional
Ruderal Forest-Northern and Central Hardwood and Conifer	Cultural - tree plantation
Introduced Upland Vegetation-Treed	Cultural - tree plantation
Urban Evergreen Forest	Cultural - tree plantation
Urban Mixed Deciduous-Evergreen Forest	Cultural - tree plantation

In order to better compare fire return intervals in the historic systems and the two current scenarios, we needed to use our vegetation crosswalk to match survey responses back to Existing Vegetation Types. In order to do this, as we did not have a one-to-one match, I took a straight average of the adjusted mean fire return intervals from the survey across each vegetation type that corresponds to an Existing Vegetation Type. I acknowledge that this may be problematic and that we will look for ways to refine this data in the future, but I wanted to get an idea of the new fire regimes and acreages burned in each vegetation type. We will revisit this process in the near future.

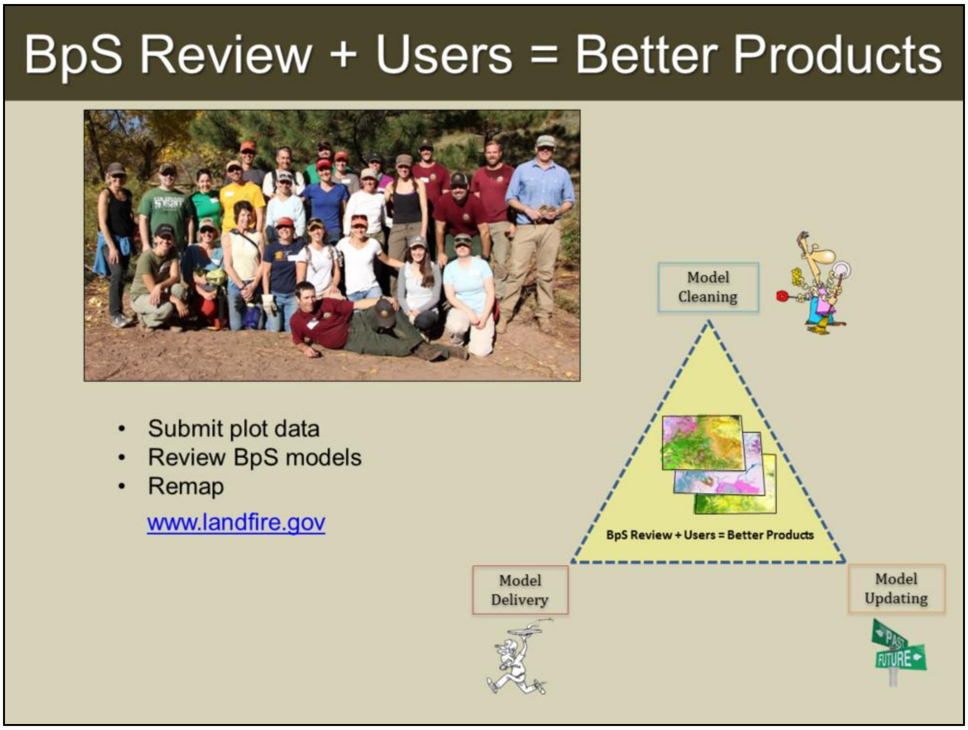
Current Mean Fire Return Intervals (MFRI) Based on Survey Results

EVT Name	Acres	MFRI--Maintenance	Acres Burned/yr--Maintenance	MFRI--Restoration	Acres Burned/yr--Restoration
Central Tallgrass Prairie	51,239	3 years	17,150	2 years	26,681
North-Central Interior Dry-Mesic Oak Forest and Woodland	2,319,062	5 years	463,812	2 years	1,159,531
North-Central Interior Maple Basswood Forest	464,664	5 years	92,933	5 years	92,933
South-Central Interior Mesophytic Forest	712,968	5 years	152,594	5 years	152,594
North-Central Interior Oak Savanna	3,700	3 years	1,233	2 years	1,875

This table shows our updated fire return intervals and updated fire needs in the five most widespread vegetation classes under reference conditions. First we look at the scenario of using fire to maintain good quality examples of a vegetation class and then we look at the scenario of using fire to restore degraded examples of the vegetation class. As is to be expected, our experts identified more frequent fire return intervals to restore landscapes to reference conditions than to maintain them in their current state.



These three maps show our preliminary application of fire returns under historic fire return intervals and the two scenarios we created for our survey. The darker red colors imply more frequent fire. This shows us that current management practices call for more fire on the ground than historic fire regimes account for and give us a more realistic number for how many acres of each vegetation type we should be burning each year. Beneath the maps you will see the numbers for how many total acres of the state should burn each year under each of these scenarios. We will continue to refine our analysis and hopefully present even better numbers and an even more accurate assessment of the current fire needs in Illinois.



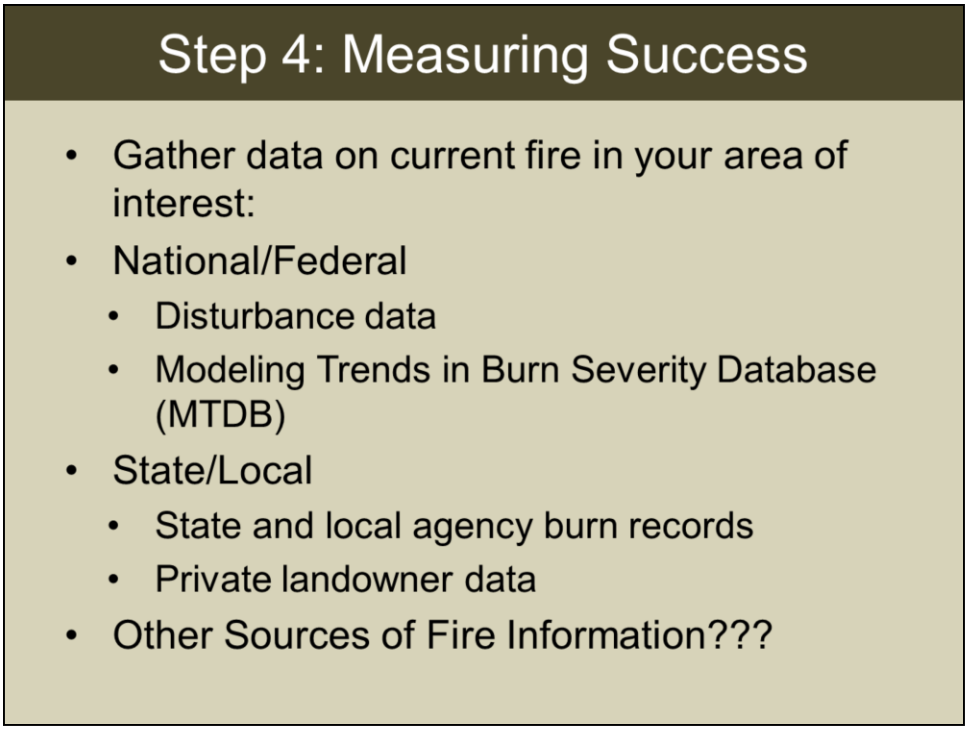
A brief digression into an opportunity for you to help us make these data better and offer input on changes to fire regimes, succession classes, and other vegetative characteristics.

LANDFIRE is a dynamic program, with a community that makes it live, adapt and grow – and it works best when users share experience and knowledge. Because maps and models cross political, social and geographical boundaries, it is important that users offer input, especially in LANDFIRE's latest undertaking: reviewing and updating all of the more than 2,000 Biophysical Settings (BpS) models!

The BpS review involves three steps: model cleaning, model updating, and model delivery. If you know how vegetation systems function, or have ideas how we can better deliver the information, we want your expertise and input. Start at the LANDFIRE Program website where you'll find information on how to join the effort.

- The importance of the user community to improving LF products can not be overstated. You've already seen how users contribute to our mapping of disturbance and treatment events.
- Another example of how important users are to our mapping effort is demonstrated by this map which shows the plot data that the LF National maps were based on; it includes 817,393 geo-referenced plot locations many of which came from the user community.
- Plots are the foundation of our maps and with a few exceptions at the start of the project, LF does not collect plot data. We gather plots from existing data sources.
- In addition to providing plots, users can provide feedback. To the extent possible, we incorporate user feedback to **improve** our maps, not just update them, over time. Improvements to mapping forest height and cover that were incorporated into the 2001 update were a result of user feedback.
- [[The map shows what we compiled for LF National. The vegetation/fuel plot data that is stored in the LFRDB is not instrumental for the LF Updates. Since LF National we have acquired more vegetation/fuel plot data but most of it has been archived to use in future remaps, or on an "as needed" basis. (~99,000 plots with confidential coordinates are not shown here, e.g. FIA)

The BpS review involves three steps: model cleaning, model updating, and model delivery. If you know how vegetation systems function, or have ideas how we can better deliver the information, we want your expertise and input. Start at the BpS review website where you’ll find information on how to join the effort

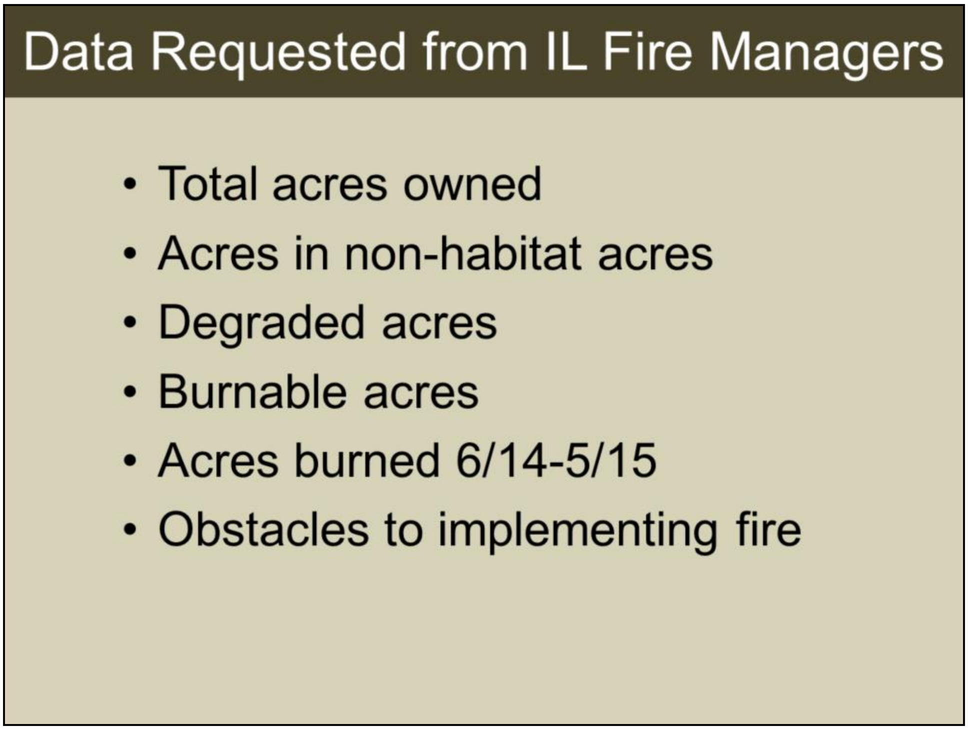


The big question amongst all who undertake the fire needs assessment is "how do we measure successes"? While no one has yet determined a good, reliable, accurate way to measure current fire on the ground across a state or larger set of geographies, there are a few resources available to help determine some of these numbers.

If you can use LANDFIRE disturbance and/or other data to get at an annual area burned per EVT, then you can get an annual fire return interval.

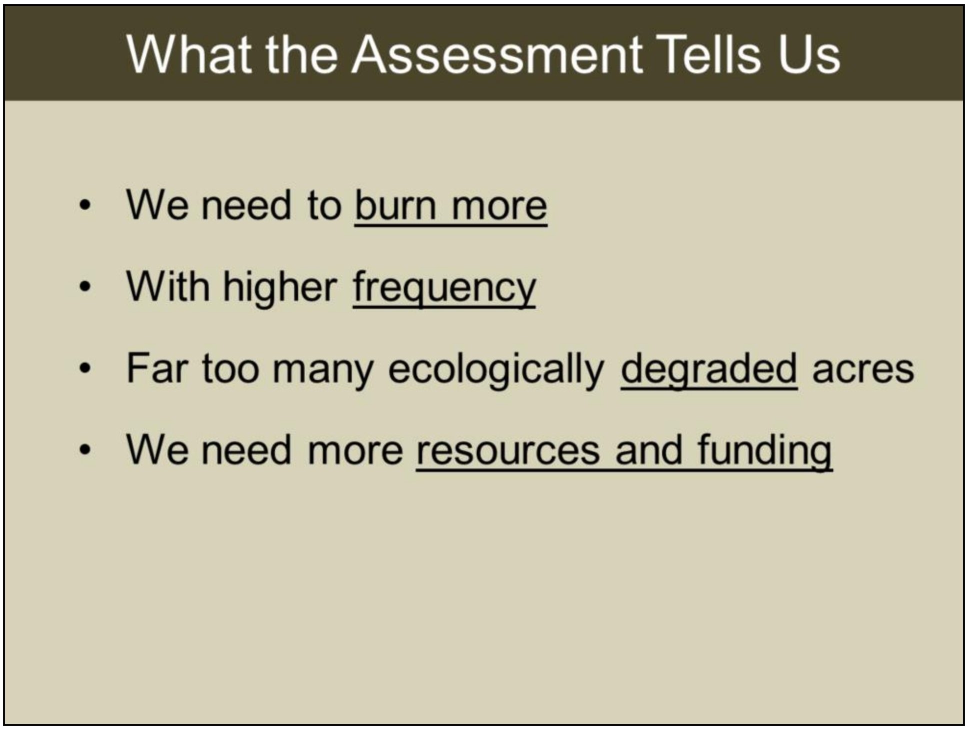
Use the LANDFIRE Modeling Trends in Burn Severity Database (available from the landfire.gov website) to collect some national trends in burn severity and fire.

Use available state/national burn records or other local sources where they are available to you



Here's a list of the data we requested from fire managers in Illinois in order to try to get a sense of how much fire was actually being implemented on the ground. Bill Kleiman and Mike Saxton of The Nature Conservancy's Nachusa Grasslands preserve and the Illinois Prescribed Fire Council created a survey that they sent to state and federal agencies and private groups around the state to get a sense of these numbers. Respondents included federal, state, and local agencies, not-for-profit land trusts, a university, and a private individual. The response was outstanding with 25 agencies representing more than a million acres of ownership responding to the survey. This allowed us to create a pretty good picture of what is actually happening in prescribed fire around the state and compare these numbers back to our results.

For reference, there are at least 1.3 million acres of conservation and park land in Illinois, owned by more than 200 agencies, organizations, and individuals (Aaron Lange, The Nature Conservancy, 20 January 2016). The total does not include the more than 150,000 acres in permanent Wetland Reserve Program or Conservation Reserve Enhancement Program easements, but not otherwise in conservation ownership.



Unsurprising to those of you involved in prescribed fire, I'm sure, the assessment tells us that:

- Dramatically more acres need to be burned each year
- Natural areas need to be managed with prescribed fire at a much higher frequency
- Far too many ecologically degraded acres across the state are in need of fire
- Considerably more resources need to be allocated to prescribed fire programs

So, how are we planning to solve those problems? Well, your guess is as good as mine, I'm sure, but we're hoping that analyses like this will help us at least make the case for moving toward solutions.

What was Burned?

Total acres owned	Acres lawns, water, crops	Degraded Acres	Burnable Acres	Degraded + Burnable	Acres burned 6/14-5/15	% burnable acres burned	% total habitat burned	% total owned burned
1,049,573	256,379	210,533	582,661	793,194	50,789	9%	6%	5%

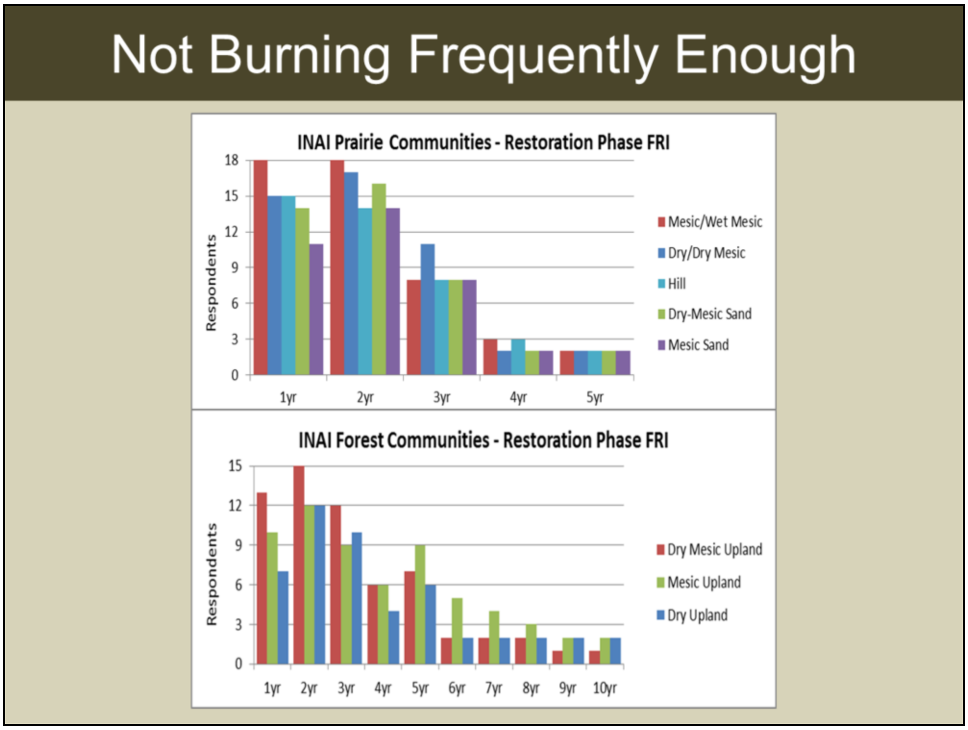
- Burned only 9% of quality, burnable acres
- Burned only 6% of total habitat acres

- Is that good? Bad?
- **How bad is it?**

So, let's dig a little deeper into the state of fire in Illinois and look at what was burned in the 2014-2015 fire season.

I want to call out a bit for you that only 9% of quality, burnable acres were burned during that season and only 6% of total habitat acres (which the fire needs assessment defines as "the combined total of burnable and degraded acres.") Burnable acres should be interpreted as higher quality areas, capable of carrying fire and to which managers would apply prescribed fire if they had adequate capacity to do so.

The questions we then ask here are: "is this good? Is it bad? (hint: it's bad) If it's bad, how bad is it?"



To do these calculations, we made some assumptions about the needed fire return intervals based on our results from the FRI survey. In short, we're assuming that overall, for the restoration phase, Prairie and grasslands have a 1 -2 year fire return interval and savannas, woodlands, and forests should have a 1 -3 year fire return interval. For the maintenance phase, we assume prairie has a 2 – 4 year fire return interval, savanna and woodland a 2 -5 year fire return interval, and forest a 3 -10 year fire return interval.

Not Burning Frequently Enough

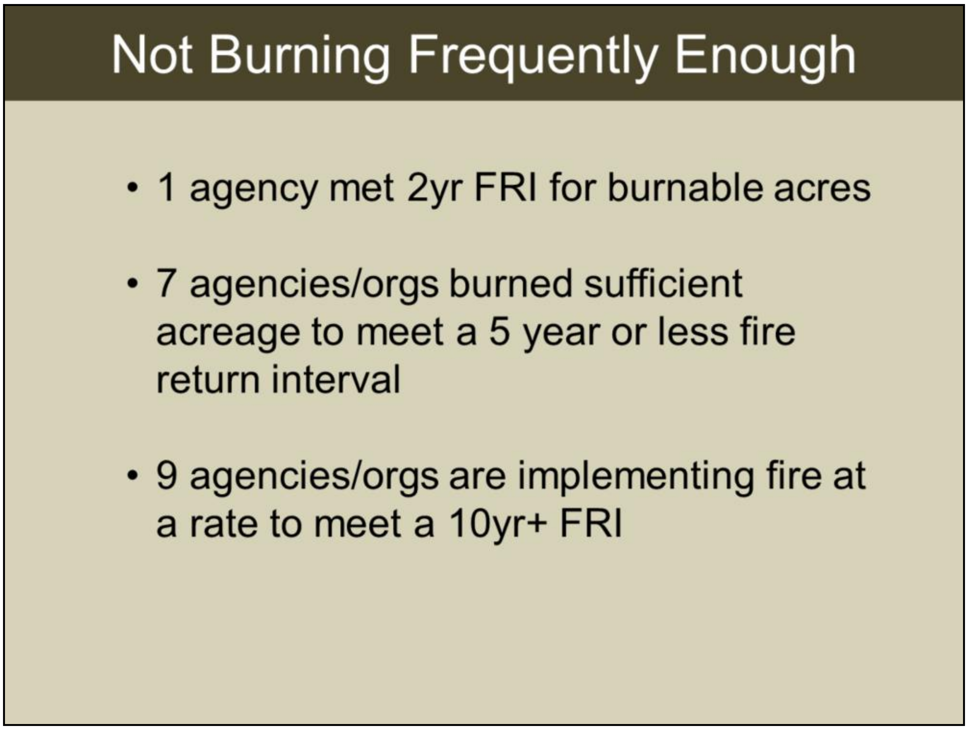
Burnable Acres	Acres Burned 6.14-5.15	2yr FRI Acreage	Acres Short	% target burned	3yr FRI Acrage	Acres Short	% target burned	4yr FRI Acreage	Acres Short	% target burned
582,661	50,789	291,331	240,542	17%	194,220	143,431	26%	145,665	94,876	35%

Restoration Phase
- Prairie **1-2yr**
- Savanna/Woodland/Forest **1-3yr**

Maintenance Phase
- Prairie **2-4yr**
- Savanna/Woodland **2-5yr**
- Forest **3-10yr**

- This assumes different acres burned annually, which may not always be the case

Here's a look at what the survey returned for the 2015-2016 fire year. As you an see, we fall well short of our target acreages burned whether we assume a 2 year fire return interval, a 3-year, or a 4-year. It is important to note that this also assumes that agencies are burning different acres in each of the years, which may not always be the case.



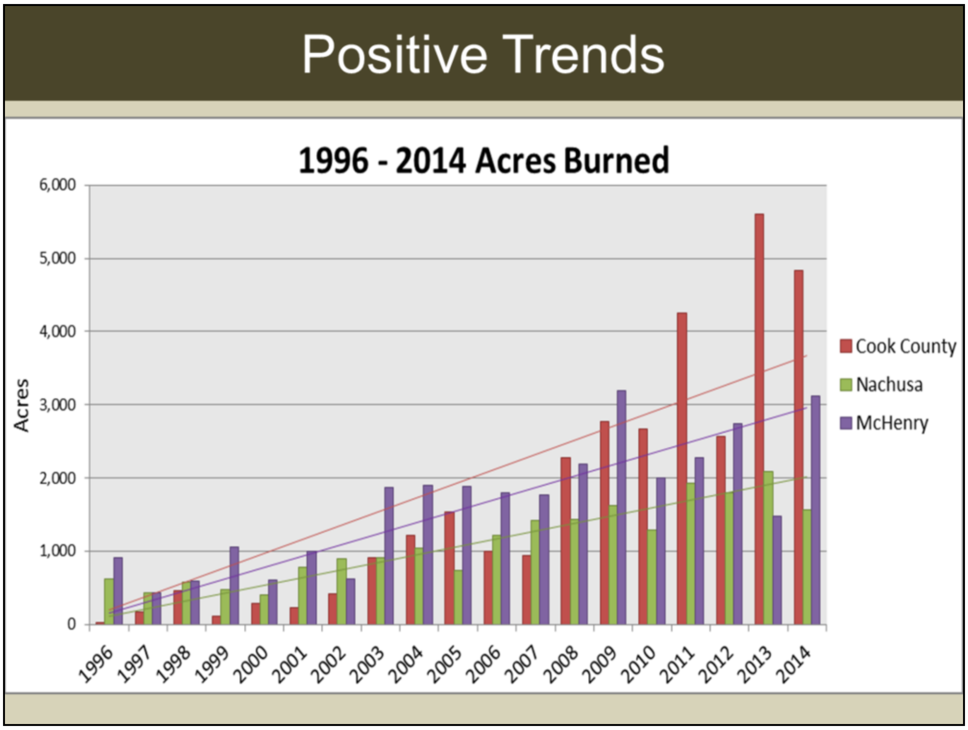
Looking at some individual agency numbers we can see that only one agency met the 2 year fire return interval for burnable acres. Seven agencies burned enough acreage to meet a 5 year or less fire return interval, and nine agencies are putting enough fire on the ground to meet a 10 year fire return interval.

Too Many Degraded Acres

Total acres owned	Acres lawns, water, crops, parking	% acres lawns, water, crops	Degraded Acres	% acres degraded	Burnable Acres	% burnable acres	Degraded + Burnable	% habitat acres
1,049,573	256,379	24%	210,533	20%	582,661	56%	793,194	76%

- Dire need of management & restoration
- Fate for infrequently burned quality acres?

As you can see from this table, Illinois has more than 200,000 managed acres that are in dire need of intensive management and restoration. These acres require even more fire than the high quality acres discussed previously. If we can't put more fire on the ground across all ownership and if quality acres are burned too infrequently, the state is at risk of these areas digressing into low quality acres, thus exacerbating the problem of too many acres that may be too degraded to even carry fire.

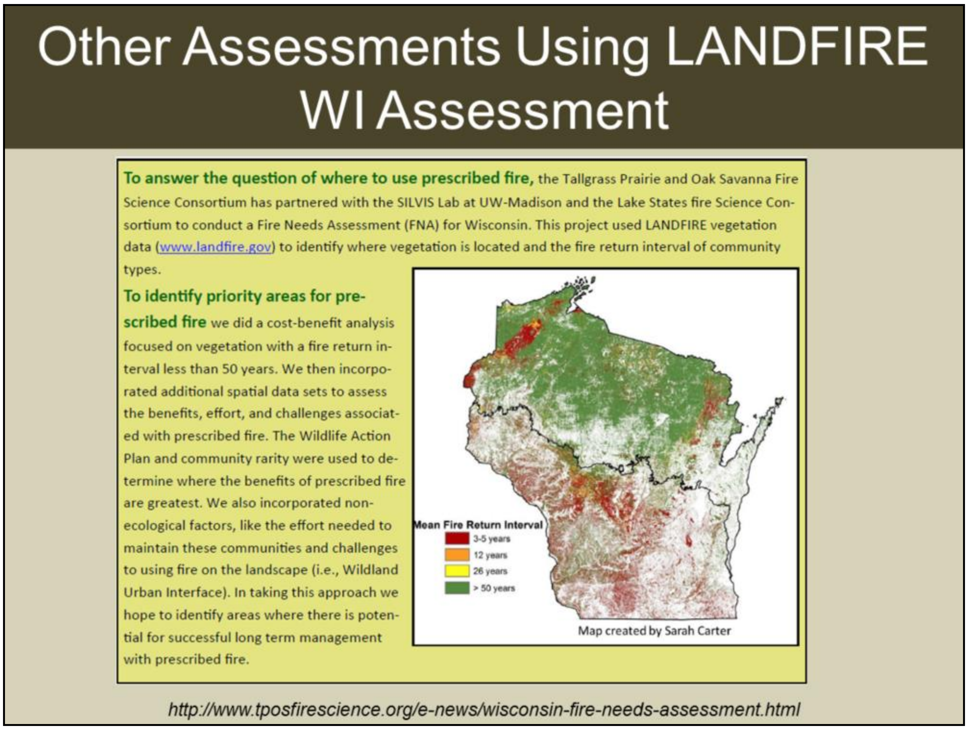


I wanted to end on a happy note and show you that at least for some of the land managers in the state, the acres they have been able to burn have increased markedly in the last 20 years.

For example, Cook County (part of the Chicago metro area) only burned 27 acres in 1996 and in 2013 burned a record 5,600 acres. It is possible to increase the amount of fire on the ground as long as states and agencies are able to promote a fire culture and overcome some of the major barriers to putting fire on the ground.

A few more places you can find LANDFIRE data helping set the stage for fire assessments in other states:

The Nature Conservancy's Michigan Chapter planners worked with partners at the Michigan Natural Features Inventory in a research and analysis project designed to support the prioritization of restoration efforts in selected conservation areas. Using LANDFIRE ecological condition datasets and MNFI data, the team developed a fire needs assessment and designed a process for analysis and strategic planning that can be duplicated across ecosystems and conservation areas.



A few more places you can find LANDFIRE data helping set the stage for fire assessments in other states:

The Tallgrass Prairie and Oak Savanna and Lake States Fire Science Consortia, in collaboration with researchers in the SILVIS lab at the University of Wisconsin at Madison, have completed an initial Fire Needs Assessment (FNA) for the state of Wisconsin. The goal of this project was to identify priority areas for management with prescribed fire, with a focus on fire dependent ecosystems with fire return intervals of less than 50 years. Using vegetation data from LANDFIRE, the State Wildlife Action Plan, Wildland Urban Interface data, and input from numerous stakeholder groups, a cost benefit analysis was conducted. This cost benefit analysis used the spatial data to identify where the ecological benefits of using prescribed fire are likely to be greatest when accounting for the effort and challenges of conducting prescribed burns.

Here is the contact info for some of the people who worked on the Illinois Fire Needs Assessment. You can find a more comprehensive presentation as well as the full Fire Needs Assessment at the link to the Illinois Prescribed Fire Council at the bottom of this slide. Please contact us with questions. We're always happy to help other organizations promote prescribed fire and create a fire culture wherever they are.

LANDFIRE Resources

- LANDFIRE Program Home http://www.landfire.gov
- Conservation Gateway: http://nature.ly.landfire
- Twitter: @nature_LANDFIRE
- YouTube: LANDFIREvideo
- Bulletins/Post cards via e-mail
  - Opt in: http://eepurl.com/baJ_BH
- Email: LANDFIRE@tnc.org

BpS review website: http://www.landfirereview.org/

Questions? Comments?

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