# *Demystifying LANDFIRE's Biophysical Settings in the Great Plains*

*Presented by*


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The Nature Conservancy LANDFIRE Team


Great Plains Fire Science Exchange

April 25, 2016

*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.*

# TNC-LANDFIRE Team

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-partner on LANDFIRE
-education, outreach, bps models

# Today's Agenda



BpS Models 101

Using the BpS Models

Improving the BpS Models

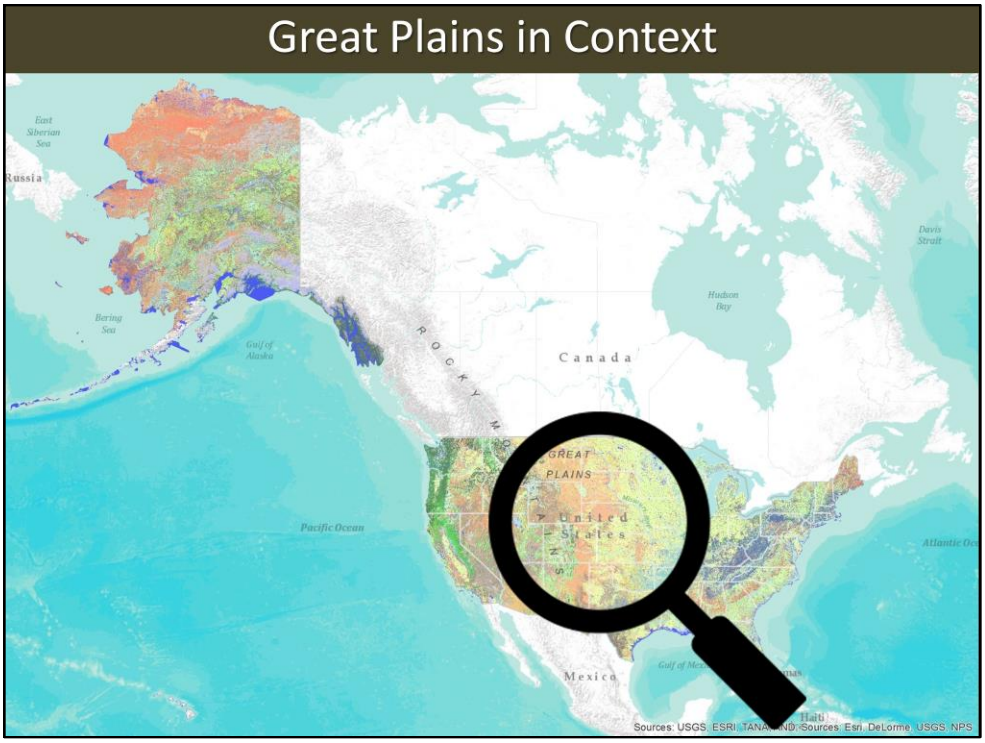
# Take-Home Message

BpS models are important because they:

- Help us to understand complex ecological processes and relationships
- Provide a framework for exploring management actions

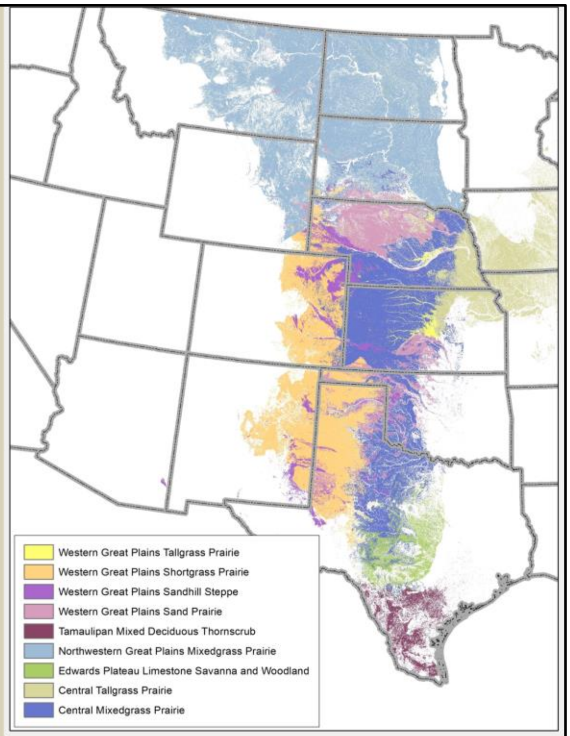

-focus on disturbance and succession dynamics
-help us understand complex ecological processes and relationships

-management, scenario testing, analyzing affects of alternative approaches to mgmt
-looking at restoration opportunities




- LANDFIRE not the only data
  - NW is data rich
- Other STSM efforts: ILAP, FS NW research station, FS Eastside restoration strategy, Interior Columbia Basin
- LANDFIRE’s role:
  - Coarser resolution – geography and detail in the model
    - Easier to map, links well to FRCC
  - Provide reference conditions (e.g. ILAP models do not)
  - All lands, forest and rangelands
  - Link to spatial data
- recognize that LF is not the only player in the data biz; we hope to educate about appropriate use so users can make informed decisions and choose the best data for their specific needs

# Major Biophysical Settings




Models have 2 parts: description and quantitative state-and-transition model
Together they describe basic ecology of the bps prior to Euro-American settlement
**SHOW DESCRIPTION**
*Picture: Griffith Prairie north of Aurora, Nebraska. Mixed-grass prairie on a storm spring evening. Owned by Prairie Plains Resource Institute. Photo credit: © Chris Helzer/TNC*

# Mixed Grass Prairie

**11320**

**Central Mixedgrass Prairie**

Model Date: 10/12/06 Report Date: 8/21/14

| Modelers | | Reviewers | |
|---|---|---|---|
| Dan Nosal | dan.nosal@co.usda.gov | Este Muldavin | muldavin@sevilleta@unm.edu |
| Rich Sterry | richard_sterry@fws.gov | Karin Decker | karin.decker@ColoState.edu |
| Terri Schulz | tschulz@tnc.org | Keith Schulz | keith_schulz@natureserve.org |

**Vegetation Type**
Upland Grassland/Herbaceous

**Map Zones**
33

**Model Splits or Lumps**
This BpS is lumped with: 1148; 1150

**Geographic Range**
This type historically occurs in western KS, western NE, eastern CO and northeastern NM. This becomes more common proceeding east. This BpS comprises the majority of acres in MZ33. It occurs in every ECOMAP subsection of MZ33 and CO portion of MZ27. See map of Central Shortgrass Ecoregional Plan (The Nature Conservancy 1998) for mixedgrass and shortgrass prairie potential. In NM, this type would be most prevalent along the eastern boundary of the mapzone.

**Biophysical Site Description**
This type occurs on sandy loam, loamey or clayey upland sites of the southern Great Plains.

In NM and CO, elevations range from 1500-2000m. In KS, elevations can be 1000m.

Precipitation ranges from 14-22in, and occurs predominantly during the summer. Precipitation can go down to 10in.

Midgrasses and not shortgrasses would be on steeper slopes and rockier sites - but these are isolated occurrences. Away from the eastern edge of the mapzone, this is the most common situation for this type in NM, i.e.: on rocky breaks and mesa slopes.

**Vegetation Description**
Historically, vegetation was co-dominated with tallgrass, midgrass, short grass, and shrubs. (Species in order of dominance in boxes.) Dominant species include mix of tall and short grass - side oats grama, needlegrasses, little bluestem, yellow indiangrass, big bluestem, switchgrass, blue grama and western wheatgrass (most dominant in CO and KS), with intermingled forbs - American vetch.

# Mixed Grass Prairie

comata and Bouteloua gracilis and Bouteloua hirsuta can also be found within this system. Shrub species include 5-7% Western sandcherry, Prunus pumila L. var. besseyi (not in NM). Yucca glauca is present. Also present - switchgrass, little bluestem, yellow indian grass and more rarely - western wheatgrass. Farther east, might get leadplant. Sand bluestem occurs on sandy range sites in eastern portion whereas big bluestem occupies sandy foothills sites (However, a reviewer felt that ANGE big bluestem should rather be part of 1147 WGP Foothills and Piedmont Grassland; therefore, ANGE was removed from the dominant species list).

Shrubs included four-wing saltbush, winterfat, with lesser amounts of rabbitbrush, broom snakeweed, fringed sage, sunsedge and also plains prickly pear.

**BpS Dominant and Indicator Species**

| Symbol | Scientific Name | Common Name |
|---|---|---|
| PASM | Pascopyrum smithii | Western wheatgrass |
| SCSC | Schizachyrium scoparium | Little bluestem |
| HECO26 | Hesperostipa comata | Needle and thread |
| BOGR2 | Bouteloua gracilis | Blue grama |
| BOCU | Bouteloua curtipendula | Sideoats grama |
| SONU2 | Sorghastrum nutans | Indiangrass |
| PAVI2 | Panicum virgatum | Switchgrass |

**Disturbance Description**

Historically, fire return intervals were probably approximately 20-25yrs (Dan Nosal, Rich Sterry, Terri Schulz, pers comm) - slightly shorter return interval (more frequent fire) and probably less variable than shortgrass prairie due to higher fuel loads, at least in eastern Colorado/western Kansas area. However, shortgrass prairie interval was changed to approx 20-25yrs post-review; therefore, since it is thought that mixedgrass interval should be shorter than shortgrass, but because original mixedgrass model had a 20-25yr interval, RL changed the MFRI for mixedgrass to approximately 15-20yrs. Also - RA model for R4PRMGs Mixedgrass Prairie south, was modeled with an interval of nine years. And MZ34 1132 Mixedgrass Prairie was modeled with an interval of 11yrs. All modelers/reviewers informed of changes.

We are uncertain about MFRI in general for the prairie ecosystems. We have few consistent records on fires and their extent and frequency, particularly in good condition sites. However, fires on the landscape level occur frequently and generally burn in a mosaic pattern. They do not return to the same acreage that frequently, however.

Going east out of MZs 27 and 33, MFRI gets shorter. Return interval for fire could be extended by ungulate grazing. Fire return intervals are now occurring more infrequently - over 50yrs (based on years of personal observation, Sprock et al).

Prairie dogs would have occurred extensively. There were some very large towns, but there were also areas without any towns. When present, they would likely extend the MFRI.

# Mixed Grass Prairie

Large herds of bison went through this system - as well as elk, deer, pronghorn. The dynamics of the herbivore populations is key to the MFRI, because it creates a mosaic pattern of heavier and lighter grazed areas.

However, currently, there is overgrazing/overstocking and continuous grazing, creating more shortgrass and increasing fire intervals (less fire).

This is a drought tolerant system. However, extended drought (over 3-4yrs) will reduce cover.

Drought and grazing were probably most important disturbances historically.

**VDDT Fire Frequency Results**

| Severity | Avg FI | Min FI | Max FI | Percent of All Fires |
|---|---|---|---|---|
| Replacement | 15 | | | 100 |
| Moderate (Mixed) | | | | |
| Low (Surface) | | | | |
| **All Fires** | **15** | | | **100** |

**Scale Description**

This is a matrix community in areas to the east. In CO and western KS - the Central Shortgrass Prairie Ecoregion - it is considered a large patch system. Mixedgrass prairie can occur in small to large patches. Disturbances are also variable in size - small to large, huge patches. Driving variable is climate (drought, low rainfall, etc), grazing, and to a lesser extent fire.

**Non-Fire Disturbances**

Wind/Weather/Stress
Native Grazing
Other 1: prairie dogs
Other 2: continual grazing

**Adjacency or Identification Concerns**

This system could be confused with shortgrass prairie. Production is less in shortgrass versus mixedgrass prairie. Grasses taller in mixedgrass prairie. These two systems are intermixed, with the shorter grasses further west with less precipitation (other than the foothills areas).

Mixedgrass and shortgrass can be distinguished by a higher occurrence of blue grama, which would indicate shortgrass. If there is more mixedgrasses (i.e.: 50% or more midgrasses), the system should be considered mixedgrass prairie.

Much of the historic mixedgrass in Colorado has been converted to row crops/cropland/agriculture, transportation corridors and some shortgrass prairie as a result of continuous grazing. Agricultural conversion is the primary threat to this system today, in NM as well. These were sites for extensive dryland cropping. Abandoned fields are now in a different process of old field succession with some of the same species.

# Mixed Grass Prairie

**Issues or Problems**
The successional class model used for this system was adopted from a draft version of a shortgrass system.

**Native Uncharacteristic Conditions**
When mixedgrass appears like shortgrass with shortgrass species, it is uncharacteristic.

**Comments**
This model for MZs 27 and 33 was adapted from the draft model for BpS 1149 shortgrass prairie for MZs 27 and 33 created by Terri Schulz, Harvey Sprock, Rich Sterry, Dan Nosal and Keith Schulz, who were also the modelers for 1132. Other modelers for MZs 27 and 33 for 1132 were Keith Schulz, Randy Reichert. Other reviewer for MZs 27 and 33 was Harvey Sprock.

***Succession Classes***

**Class A** 7 **Early Development 1 - Open**

*Structural Information*
Upper Layer Lifeform: Herb
Upper Layer Canopy Cover: 0 - 30%
Upper Layer Canopy Height: Herb 0m - Herb 0.5m
Tree Size Class: None

*Indicator Species*

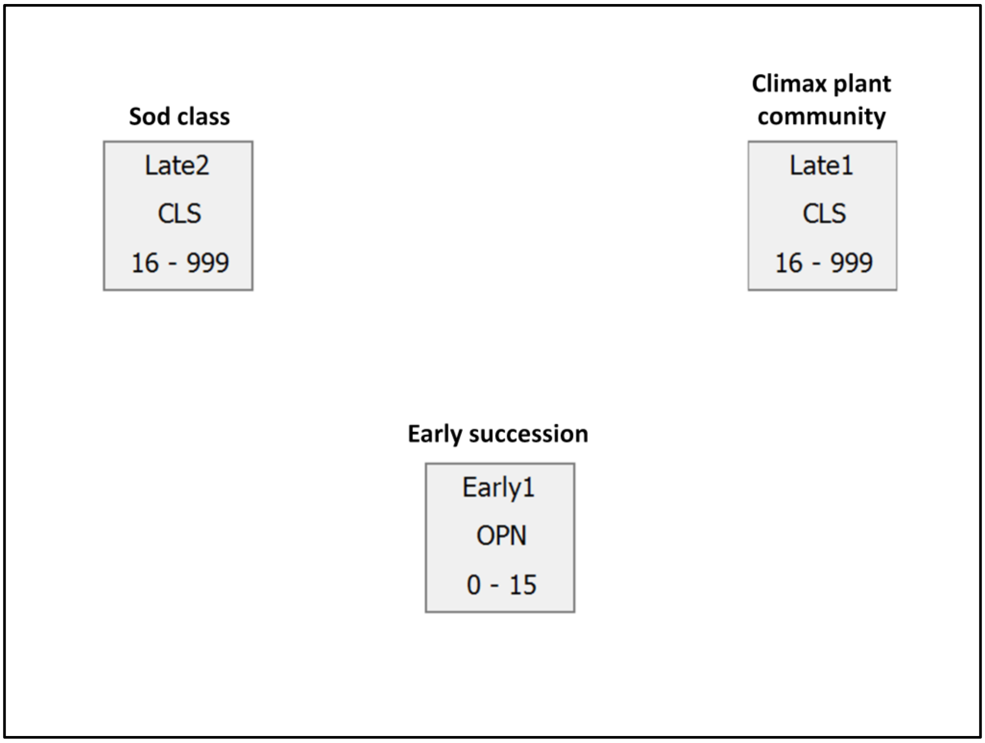
| Symbol | Scientific Name | Common Name | Canopy Position |
|---|---|---|---|
| ARIST | Aristida | Threeawn | Upper |
| VUOC | Vulpia octoflora | Sixweeks fescue | Lower |
| AMBRO | Ambrosia | Ragweed | Upper |
| SPCR | Sporobolus cryptandrus | Sand dropseed | Upper |

*Description*
Class A is early succession stage. Species include - sand and tall dropseed, sixweeks fescue, Red three-awn, ragweed and annual forbs. (Currently, you would see non-native annuals in this class such as cheatgrass and kochia; might also see non-native of bindweed on prairie dog towns today, but not historically.) There was also a lot of bare ground in this stage. This would also be a typical prairie dog town and buffalo wallows. (Today, might be go-back-cropland.)

Native grazing occurs - bison, on approximately five percent of this class each year, but does not cause a transition.

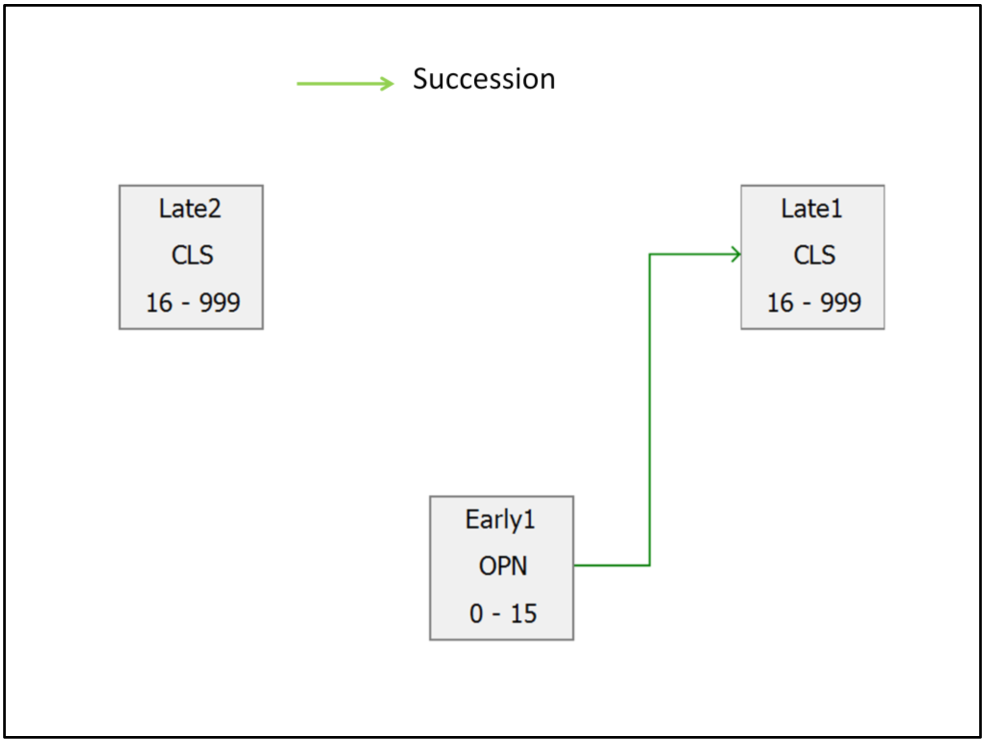
Fire might occur, but not often - every 100yrs+. Would be small occurrence due to low fuels. It doesn't set back succession to zero, in terms of modeling. Fire would be more frequent in mixedgrass vs shortgrass due to higher fuel loads.

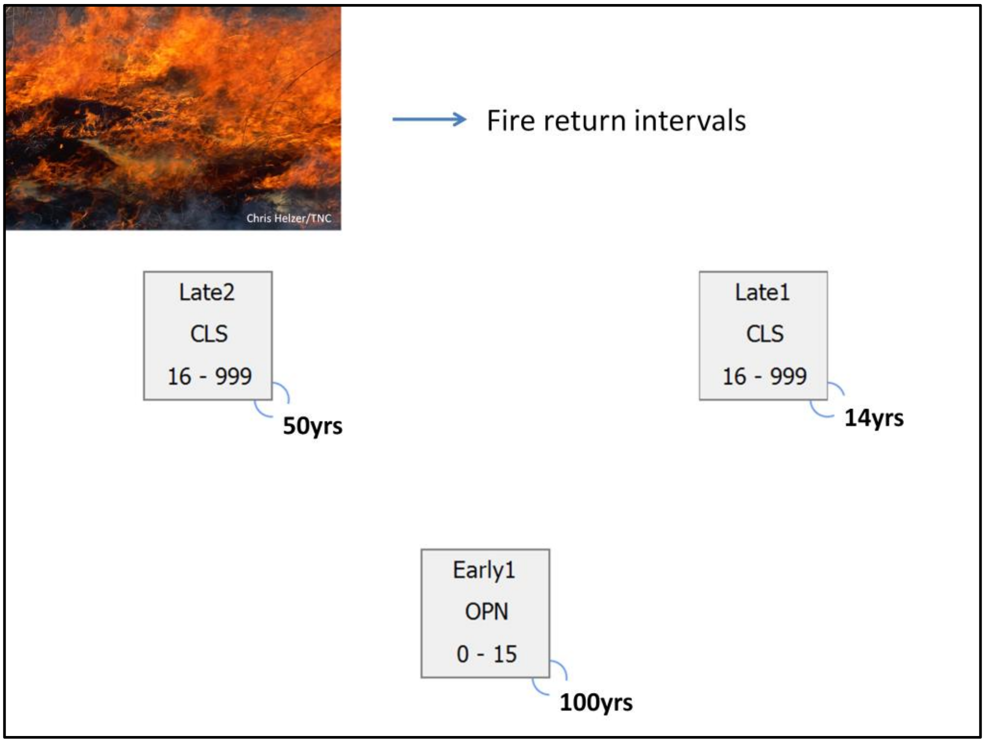
This class might move to the next stage more quickly due to higher precip levels. Modelers originally kept this age range the same as the original interval as in the draft model for shortgrass




Model in ST-Sim (3311320)

5 states
ages


Succession
Late2
CLS
16 - 999
Late1
CLS
16 - 999
Early1
OPN
0 - 15



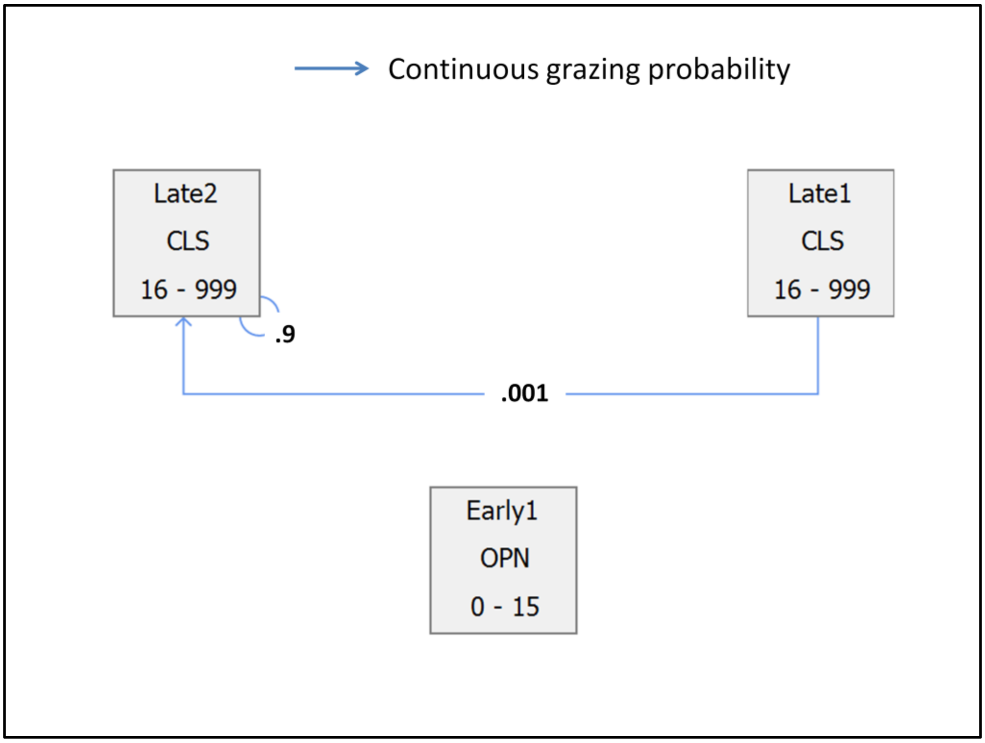

Replacement fire


→ Native grazing probability

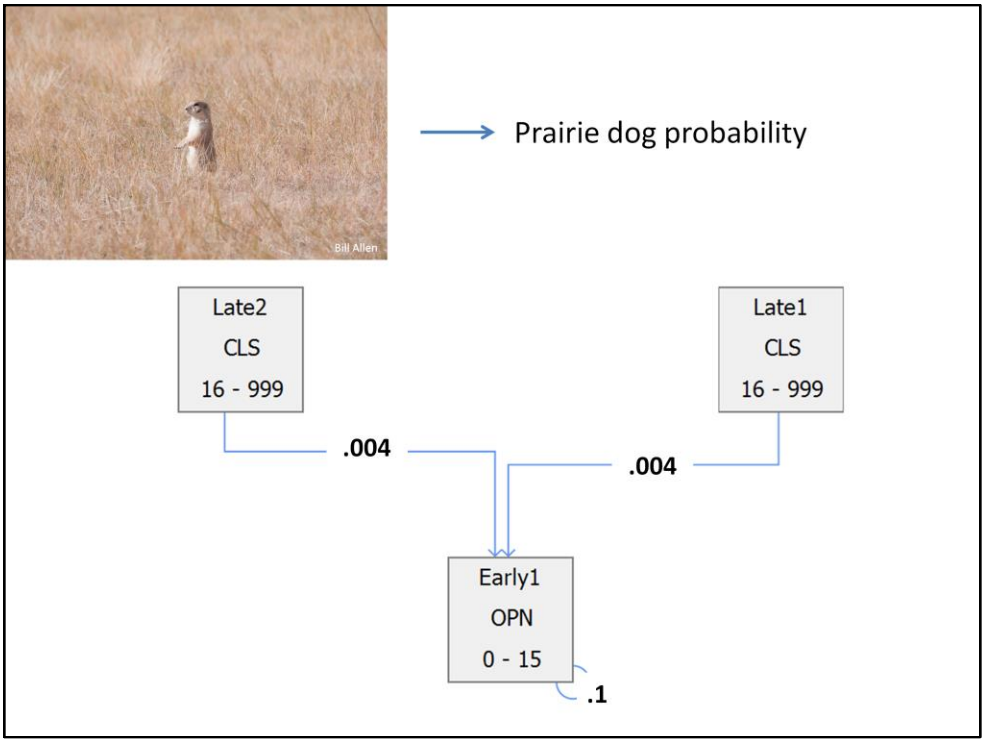
Late2
CLS
16 - 999

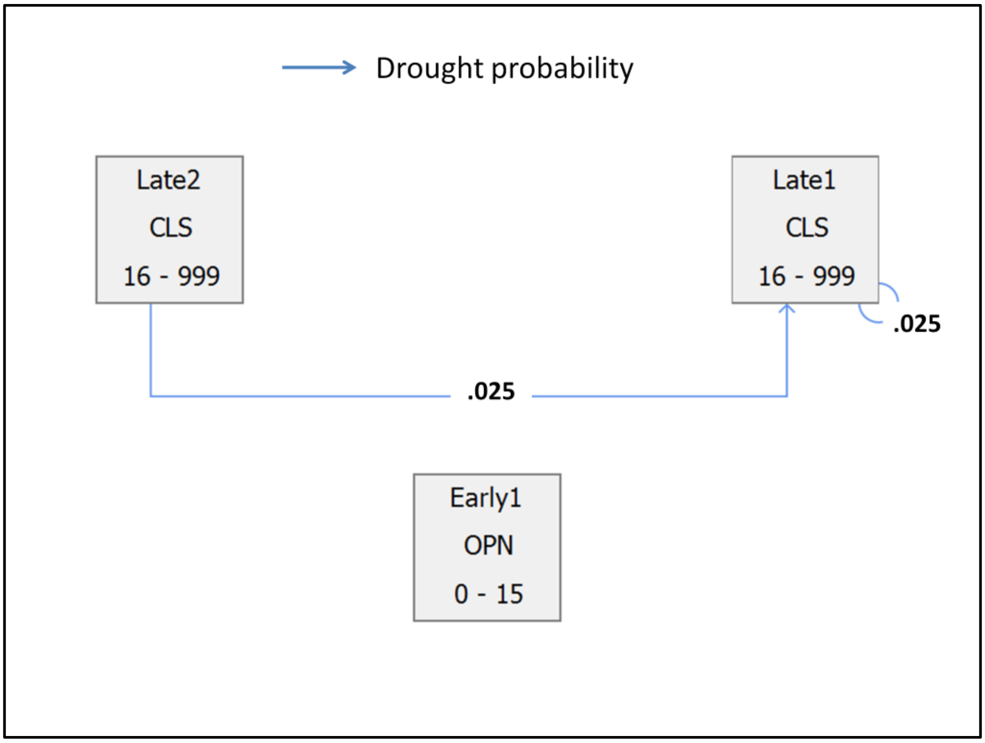
Late1
CLS
16 - 999
.7

Early1
OPN
0 - 15
.05



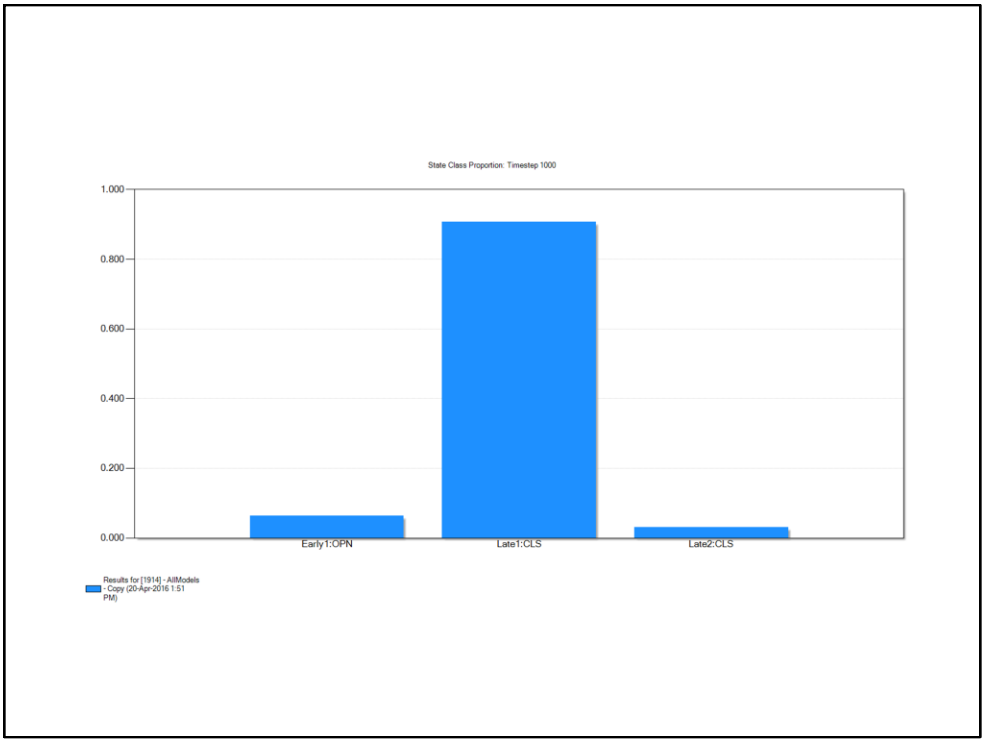

Continuous grazing


Bill Allen
Prairie dog probability
Late2
CLS
16 - 999
Late1
CLS
16 - 999
.004
.004
Early1
OPN
0 - 15
.1



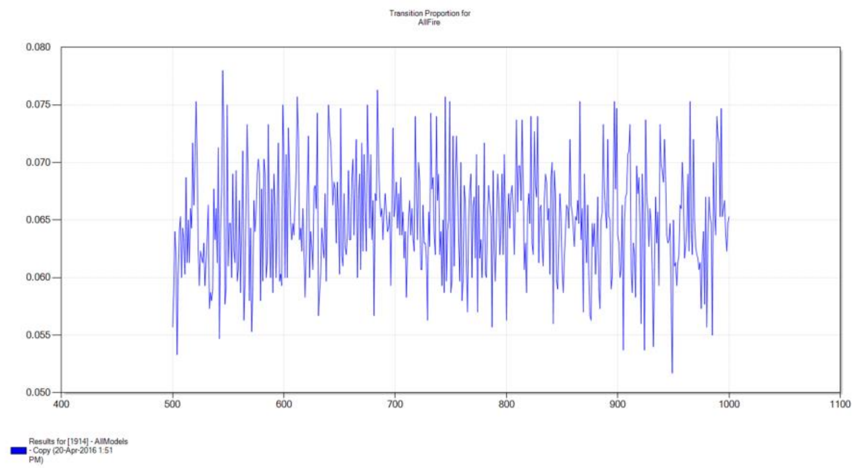
Drought probability
Late2
CLS
16 - 999
Late1
CLS
16 - 999
.025
.025
Early1
OPN
0 - 15


drought




Ref con can be compared to current con

## Overall FRI = 15yrs




See variability in fire frequency over time – model is stochastic

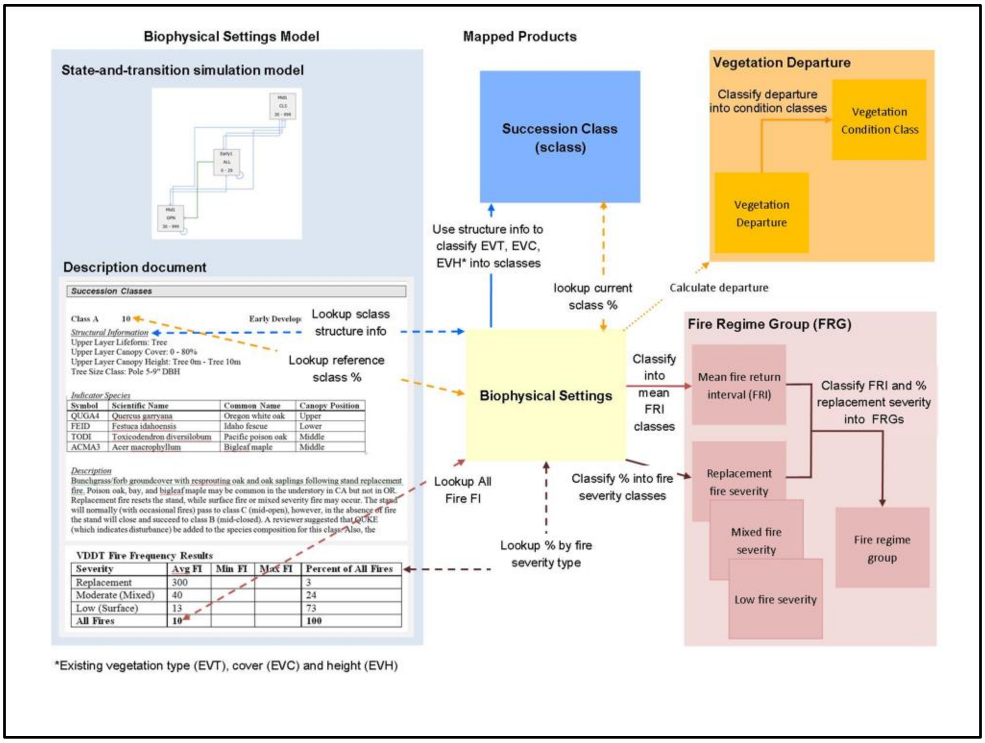
# Creating the BpS Models

-collaborative process facilitated by TNC-LF
-represent collective ecological knowledge of hundreds of people around the country
->700 contributors to the models, >40 expert workshops plus individual meetings

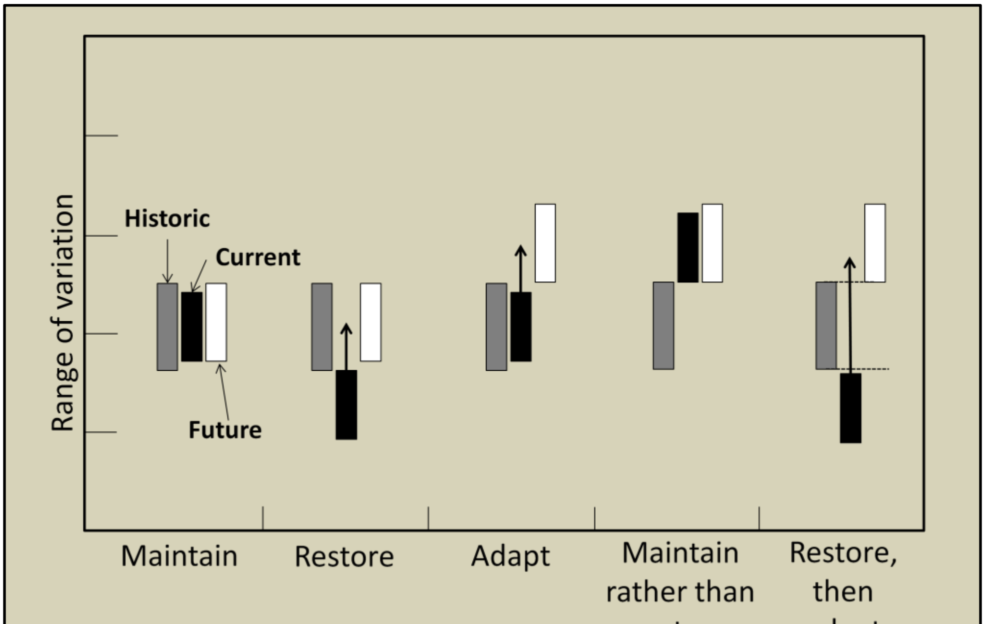
| Strengths | Limitations |
|---|---|
| Cover ~500 BpS | Don’t include management or climate change |
| Connected to spatial data | Modeling constraints |
| Relatively easy to use, supported by LANDFIRE | Non-spatial |
| Good documentation | Difficult to validate, limited information |
| Suitable for large landscapes | Refine for local use |

Support – tutorials, guides on line
Documentation – state assumptions in the description, numbers in model are explained in the description

Constraints – 5 boxes
Non-spatial – st-sim has spatial functionality
Difficult to validate – little hx data

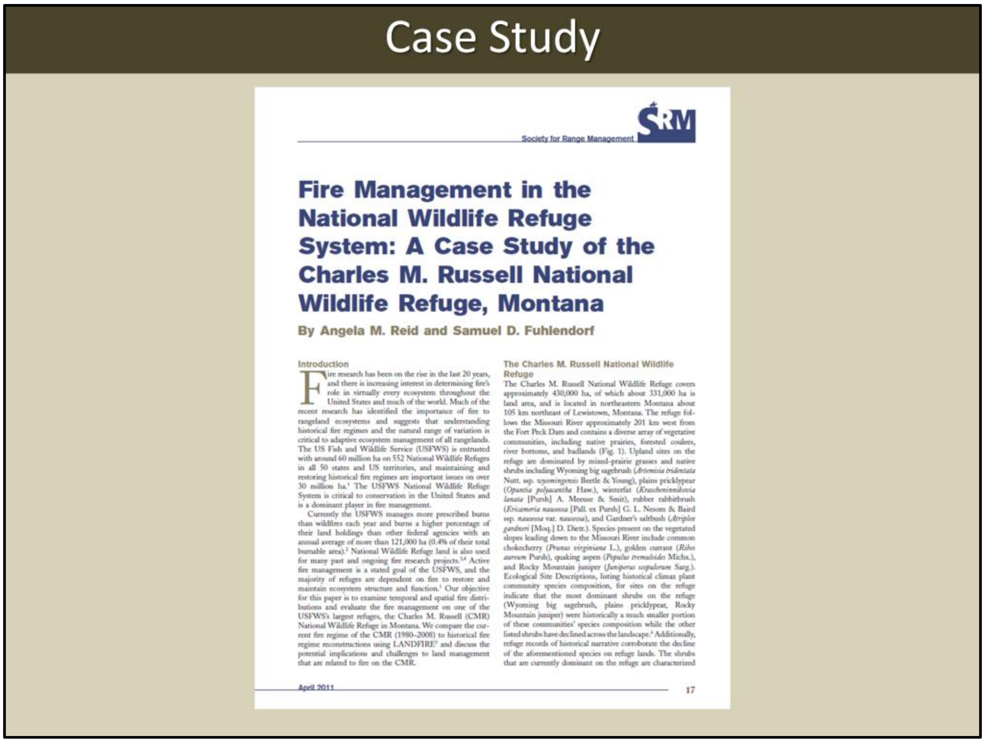



-LANDFIRE use of model info
-quality of spatial products depends on quality of BpS models




Graph modified from Safford et al. *Historical Ecology, Climate Change, and Resources Management: Can the Past Still Inform the Future?* Chapter 4 in Weins et al. 2012.

*Conceptual model use*
-Historic condition is not necessarily desired condition
-hx information provides important context when evaluated w/ current and expected future conditions




Society for Range Management

SRM

## Fire Management in the National Wildlife Refuge System: A Case Study of the Charles M. Russell National Wildlife Refuge, Montana

By Angela M. Reid and Samuel D. Fuhlendorf

### Introduction

Fire research has been on the rise in the last 20 years, and there is increasing interest in determining fire's role in virtually every ecosystem throughout the United States and much of the world. Much of the recent research has identified the importance of fire to rangeland ecosystems and suggests that understanding historical fire regimes and the natural range of variation is critical to adaptive ecosystem management of all rangelands. The US Fish and Wildlife Service (USFWS) is entrusted with around 60 million ha on 552 National Wildlife Refuges in all 50 states and US territories, and maintaining and restoring historical fire regimes are important issues on over 30 million ha.[1] The USFWS National Wildlife Refuge System is critical to conservation in the United States and is a dominant player in fire management.

Currently the USFWS manages more prescribed burns than wildfires each year and burns a higher percentage of their land holdings than other federal agencies with an annual average of more than 121,000 ha (0.4% of their total burnable area).[2] National Wildlife Refuge land is also used for many past and ongoing fire research projects.[3,4] Active fire management is a stated goal of the USFWS, and the majority of refuges are dependent on fire to restore and maintain ecosystem structure and function.[1] Our objective for this paper is to examine temporal and spatial fire distributions and evaluate the fire management on one of the USFWS's largest refuges, the Charles M. Russell (CMR) National Wildlife Refuge in Montana. We compare the current fire regime of the CMR (1980–2008) to historical fire regime reconstructions using LANDFIRE[5] and discuss the potential implications and challenges to land management that are related to fire on the CMR.

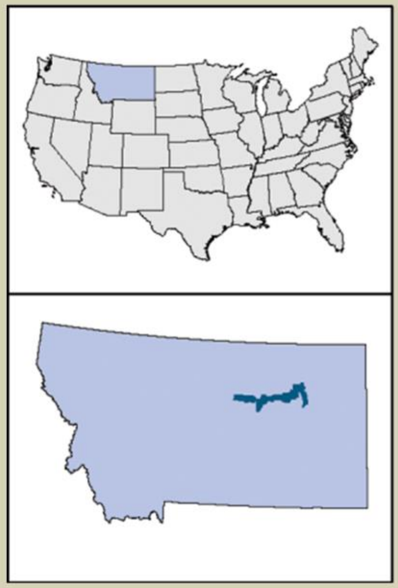
### The Charles M. Russell National Wildlife Refuge

The Charles M. Russell National Wildlife Refuge covers approximately 430,000 ha, of which about 331,000 ha is land area, and is located in northeastern Montana about 105 km northeast of Lewistown, Montana. The refuge follows the Missouri River approximately 201 km west from the Fort Peck Dam and contains a diverse array of vegetative communities, including native prairies, forested coulees, river bottoms, and badlands (Fig. 1). Upland sites on the refuge are dominated by mixed-prairie grasses and native shrubs including Wyoming big sagebrush (*Artemisia tridentata* Nutt. ssp. *wyomingensis* Beetle & Young), plains pricklypear (*Opuntia polyacantha* Haw.), winterfat (*Krascheninnikovia lanata* [Pursh] A. Meeuse & Smit), rubber rabbitbrush (*Ericameria nauseosa* [Pall. ex Pursh] G. L. Nesom & Baird ssp. *nauseosa* var. *nauseosa*), and Gardner's saltbush (*Atriplex gardneri* [Moq.] D. Dietr.). Species present on the vegetated slopes leading down to the Missouri River include common chokecherry (*Prunus virginiana* L.), golden currant (*Ribes aureum* Pursh), quaking aspen (*Populus tremuloides* Michx.), and Rocky Mountain juniper (*Juniperus scopulorum* Sarg.). Ecological Site Descriptions, listing historical climax plant community species composition, for sites on the refuge indicate that the most dominant shrubs on the refuge (Wyoming big sagebrush, plains pricklypear, Rocky Mountain juniper) were historically a much smaller portion of these communities' species composition while the other listed shrubs have declined across the landscape.[6] Additionally, refuge records of historical narrative corroborate the decline of the aforementioned species on refuge lands. The shrubs that are currently dominant on the refuge are characterized

April 2011 17

- Reid and Fuhlendorf 2011
- examined the fire regime of the Charles M. Russell National Wildlife Refuge (CMR) over the previous 28 years and compared it to historical fire regime reconstructions using LANDFIRE National Fire Regime Condition Class, Fire Regime Group, and Mean Fire Return Interval layers. By comparing the refuge records to what was available through LANDFIRE, they determined that a large majority of the refuge was moderately or highly departed from the historic fire regime. The average mean fire return interval for the refuge based on LANDFIRE reconstructions was 48 years compared to 134 years as calculated based on refuge records from 1980-2008.

# Case Study

Pictures and maps from Reid & Fuhlendorf 2011

# Case Study

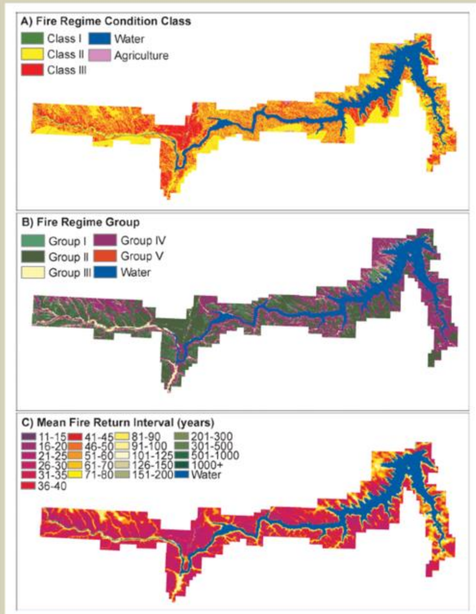



Figure from Reid & Fuhlendorf 2011

# Case Study

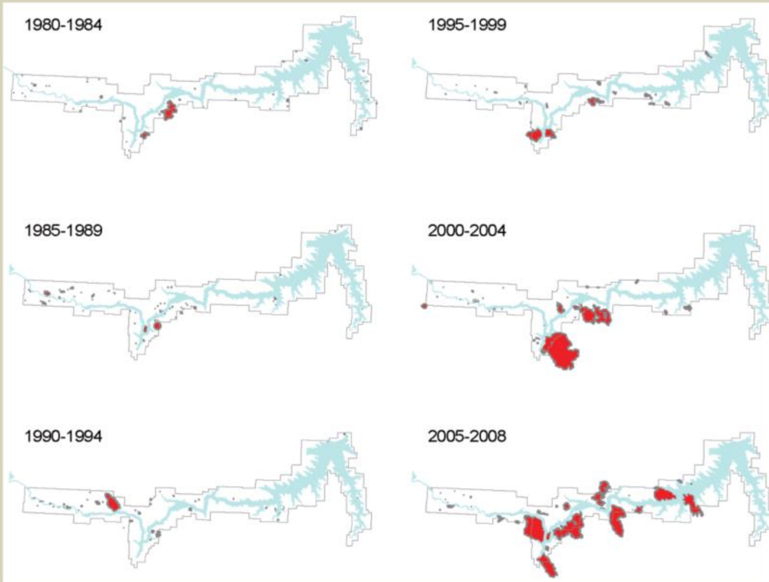
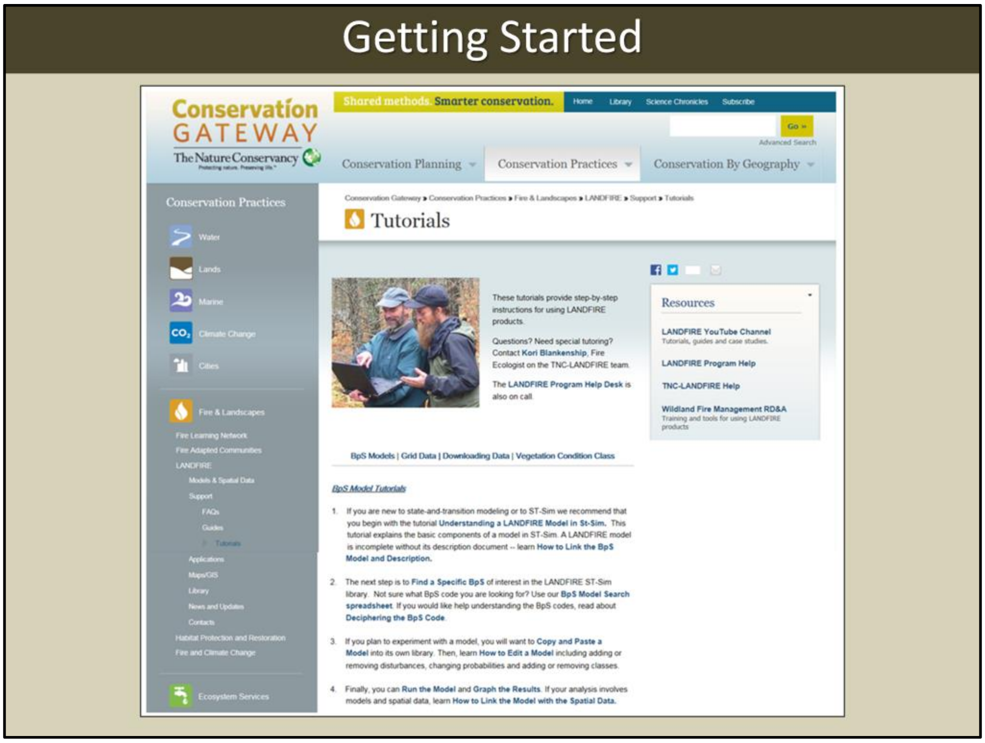
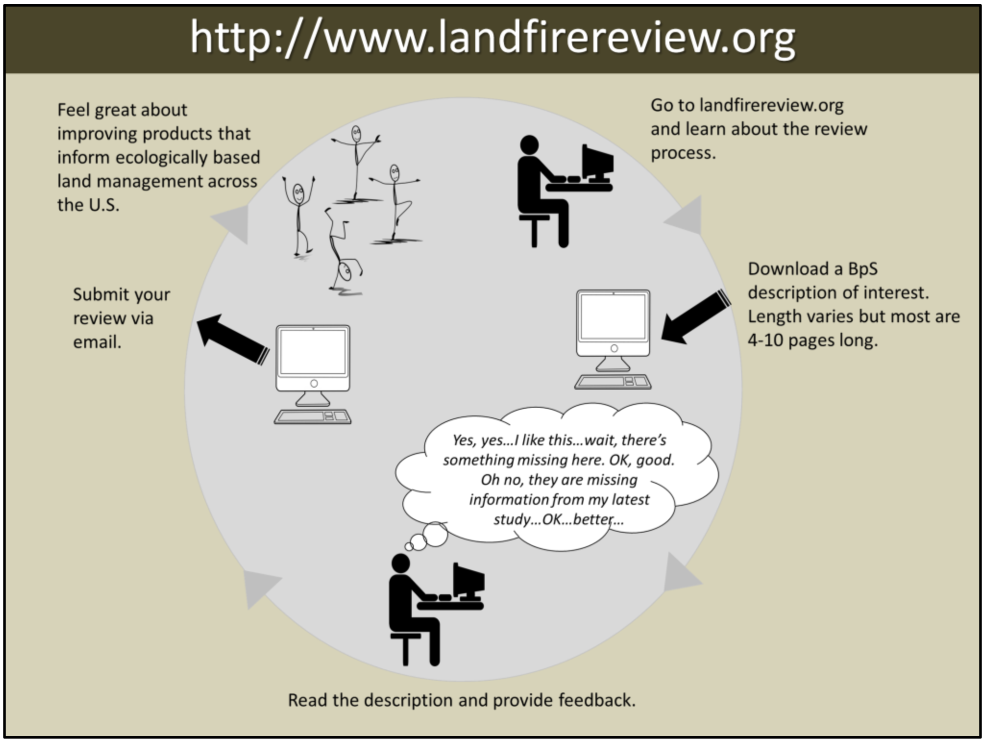



Figure from Reid & Fuhlendorf 2011




- TNC-LANDFIRE team can help too




- No review since the models were delivered
- Review offers chance to improve models
    - incorporate new science, correct errors and inconsistencies

## 3 Good Reasons to Review

1. Multiply your impact
2. Improve the data used to manage land
3. "Fun"

1. translate your knowledge into vital products that are used in all sorts of applied and research settings
2. Models have been used in dozens of land management applications and we want to make sure that we have the best data available to support these efforts
3. Think about ecology and disturbance and succession

1. Please help if you can and if you are not sure how to get started contact me

# Take-Home Message

BpS models are important because they:

- Help us to understand complex ecological processes and relationships
- Provide a framework for exploring management actions


-focus on disturbance and succession dynamics
-help us understand complex ecological processes and relationships

-management, scenario testing, analyzing affects of alternative approaches to mgmt
-looking at restoration opportunities

# Online Connections

- 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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