Terrestrial Condition Assessment

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TCA Goals and Intent

The Terrestrial Condition Assessment (TCA) is a management tool that provides a mid-scale assessment of resource conditions and stressors that may warrant restoration consideration and investment.

The primary goals of the TCA are to assist land managers in identifying terrestrial restoration needs at a national scale, and provide the tools necessary for Regional and local applications including science delivery, data access and guidance on analytical procedures.

TCA Development Process

Cross-deputy Brainstorming to identify:

- What restoration investments are ongoing,
  and what conditions warrant restoration consideration?
- What is needed to assess those conditions?
- What landscape analysis units to use?
- What attributes to include?
- What national data sets are available?
- **How to minimize field impacts?**

Design Steps

- Developed Landscape Analysis Units – LTA's

- Identified ten attributes and obtained data
  - National data sets (9 indicators, 35 variables)
  - Regional inputs (1 indicator)

- Conducted exploratory data analyses

- Utilized EMDS (Ecosystem Management Decision Support) logic model to compute an overall rating and ratings for individual attributes
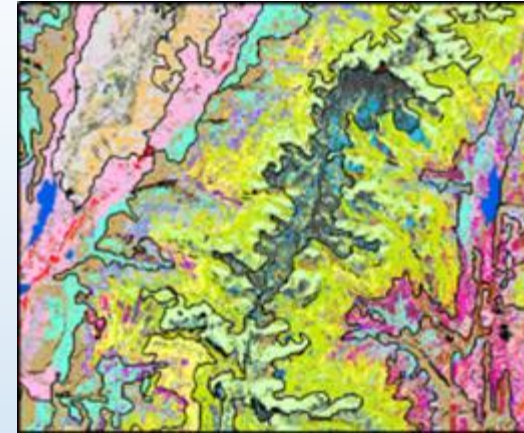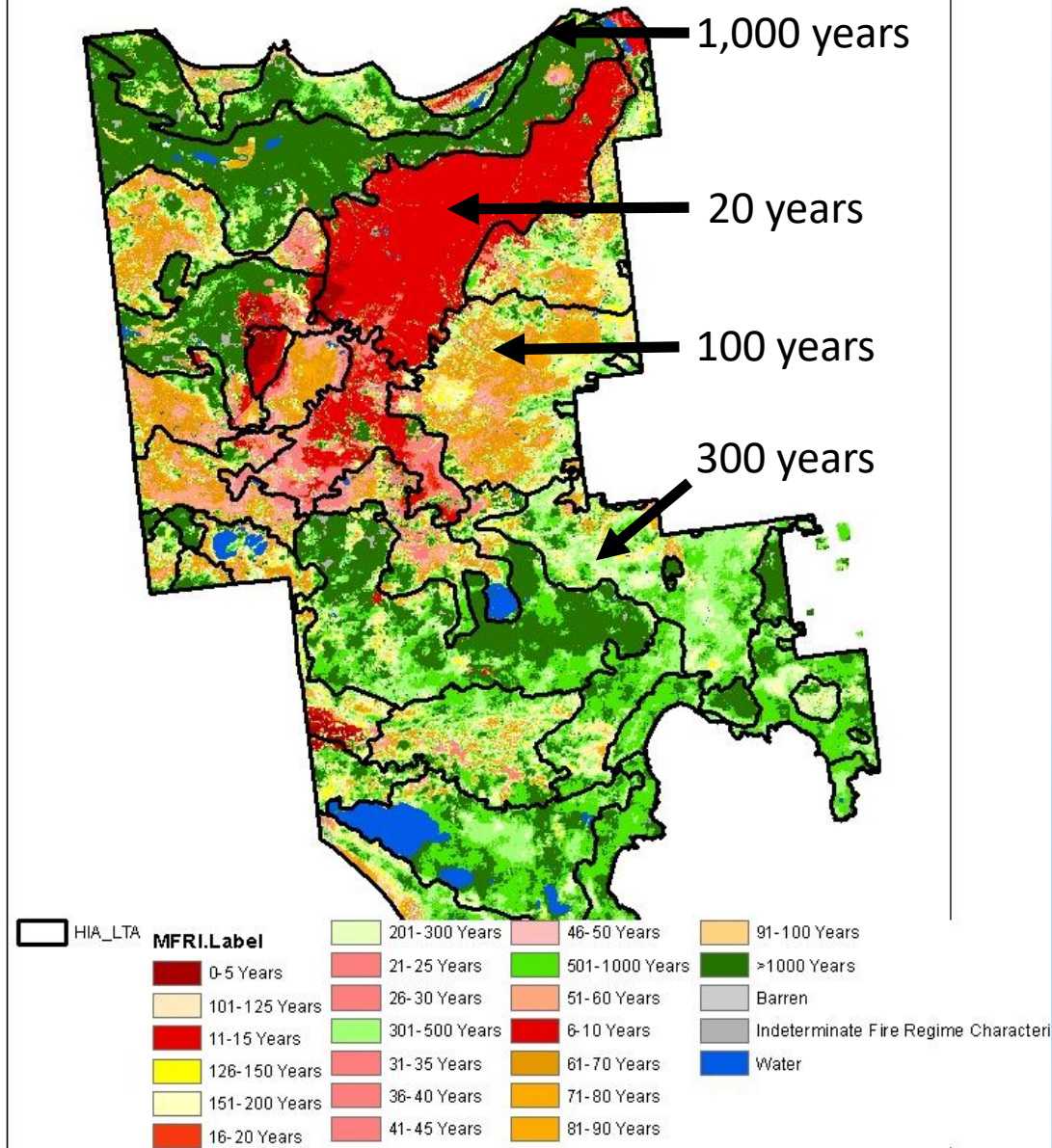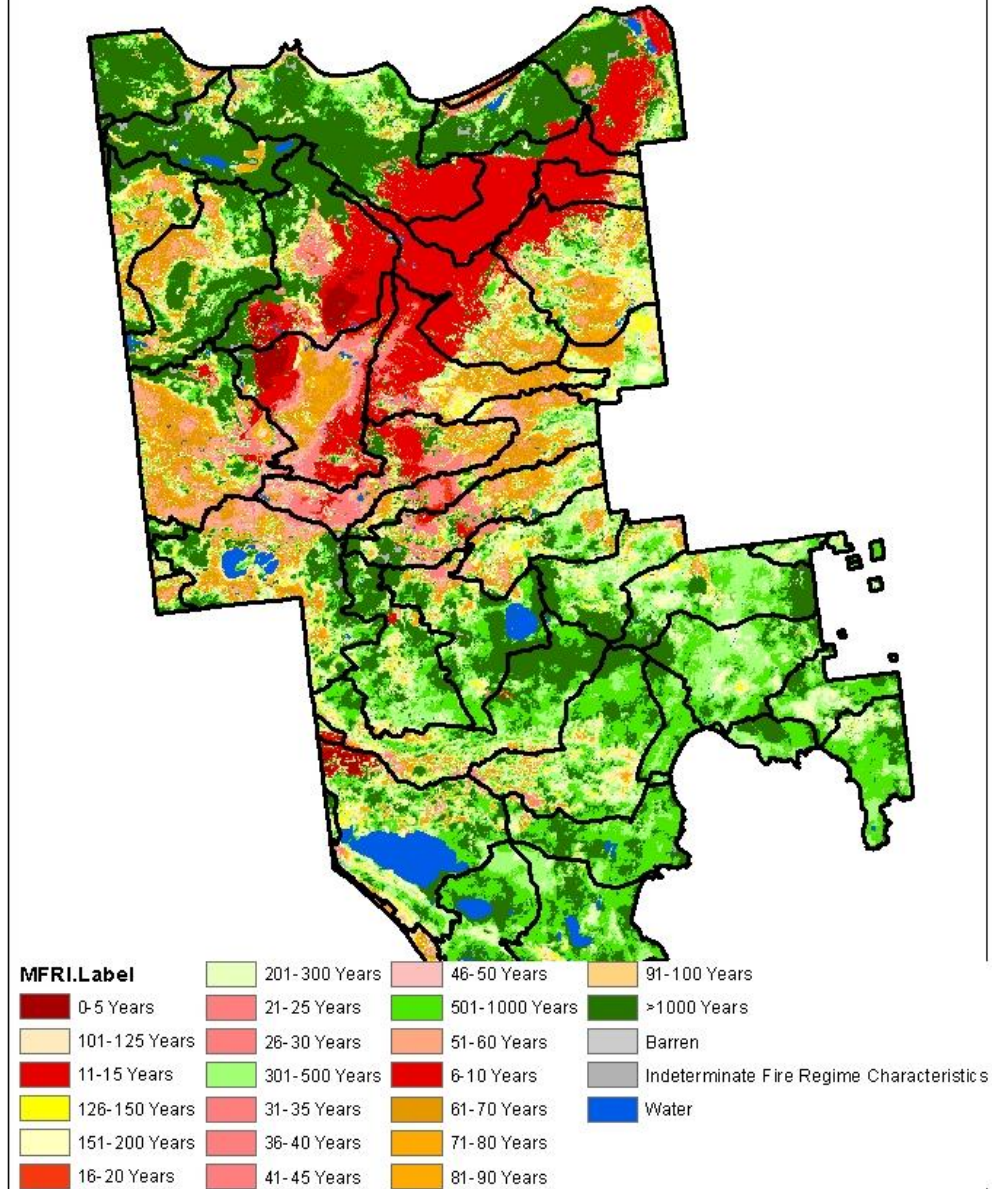
Analysis Units

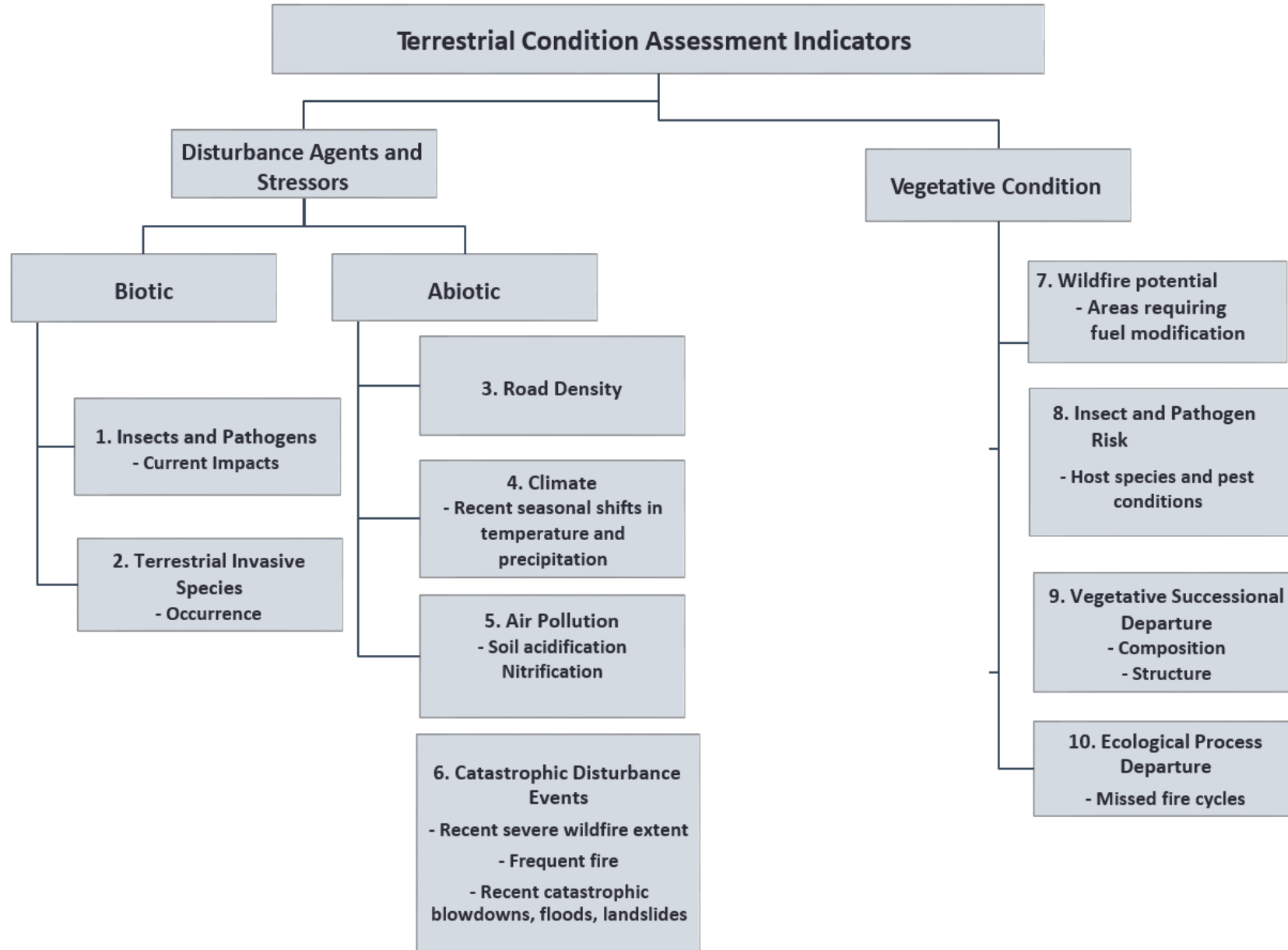10,213 LTA's were mapped across NFS lands and used to evaluate conditions at a landscape scale

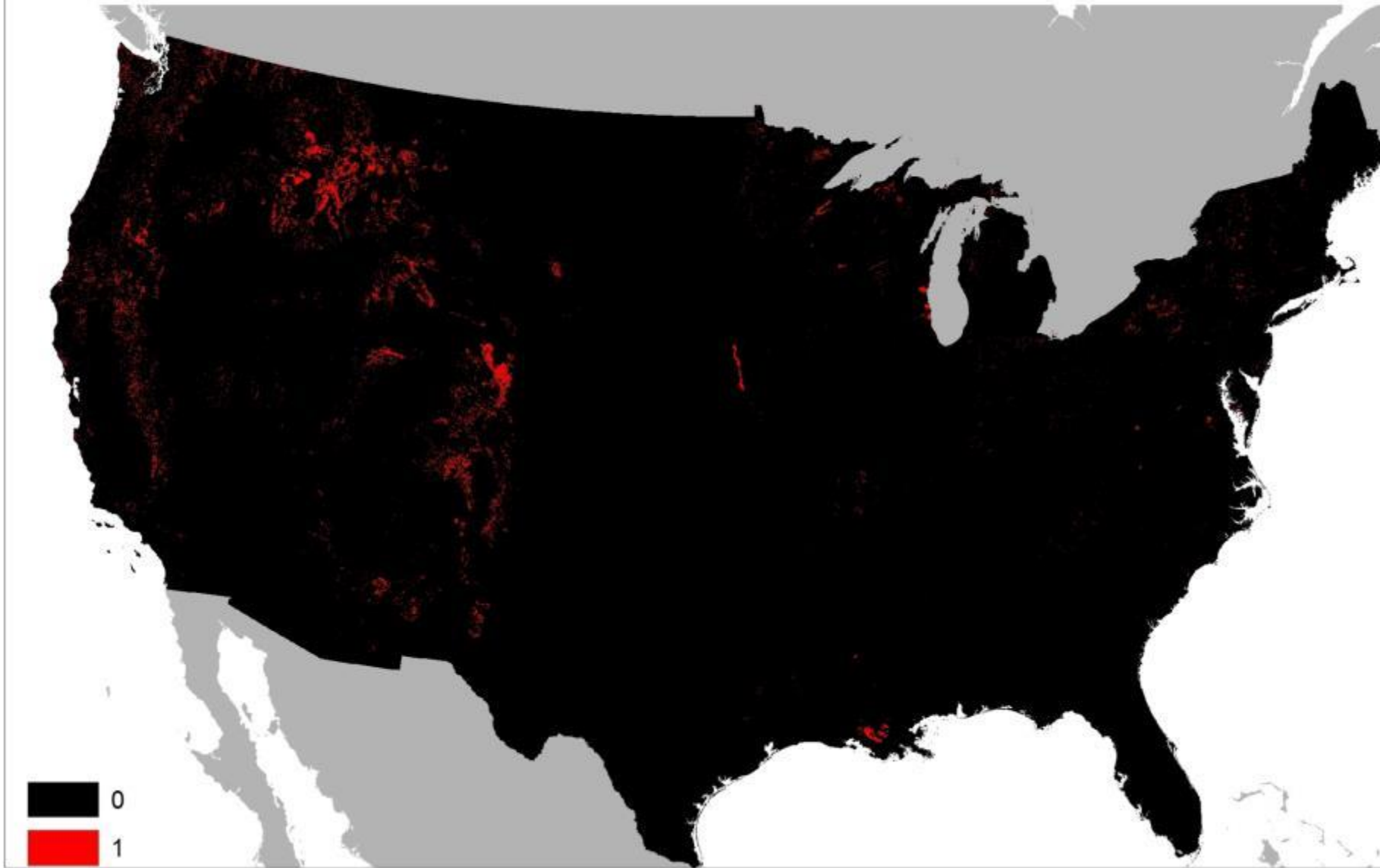Reference conditions for mean fire return intervals

Reference conditions for mean fire return intervals

Terrestrial Condition Assessment Indicators

Disturbance Agents and Stressors

Vegetative Condition

Biotic

Abiotic

1. Insects and Pathogens
- Current Impacts

2. Terrestrial Invasive Species
- Occurrence

3. Road Density

4. Climate
- Recent seasonal shifts in temperature and precipitation

5. Air Pollution
- Soil acidification Nitrification

6. Catastrophic Disturbance Events
- Recent severe wildfire extent
- Frequent fire
- Recent catastrophic blowdowns, floods, landslides

7. Wildfire potential
- Areas requiring fuel modification

8. Insect and Pathogen Risk
- Host species and pest conditions

9. Vegetative Successional Departure
- Composition
- Structure

10. Ecological Process Departure
- Missed fire cycles

Observed mortality or defoliation in 3 of the past 5 years – 16.6 million acres of NFS lands

0

1

Mortality	Frequency	Cumulative %
0	3455	33.83%
1	1764	51.10%
2	747	58.42%
3	513	63.44%
4	372	67.08%
5	343	70.44%
6	237	72.76%
7	206	74.78%
8	170	76.44%
9	174	78.15%
10	160	79.71%
11	118	80.87%
12	130	82.14%
13	116	83.28%
14	96	84.22%
15	92	85.12%
16	83	85.93%
17	67	86.59%
18	61	87.18%
19	62	87.79%
20	68	88.46%
21	59	89.03%
22	60	89.62%
23	59	90.20%
24	42	90.61%
25	51	91.11%

| Mortality	Frequency	Cumulative %
26	49	91.59%
27	35	91.93%
28	38	92.30%
29	32	92.62%
30	33	92.94%
31	35	93.28%
32	27	93.55%
33	20	93.74%
34	34	94.08%
35	29	94.36%
36	21	94.57%
37	22	94.78%
38	31	95.08%
39	16	95.24%
40	22	95.46%
41	23	95.68%
42	13	95.81%
43	17	95.98%
44	10	96.07%
45	8	96.15%
46	16	96.31%
47	16	96.47%
48	20	96.66%
49	10	96.76%
50	11	96.87%

<5%

>25%
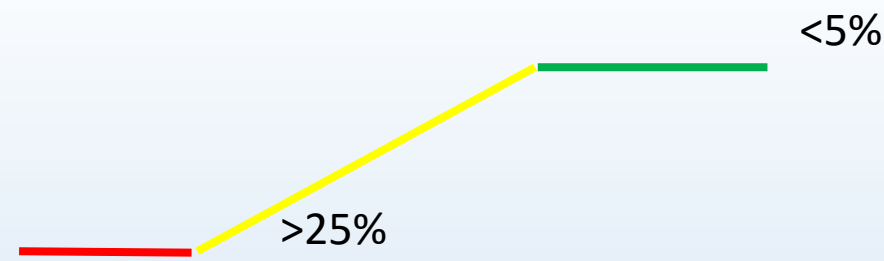
Ensuring model sensitivity – examining data distributions while setting parameters.

The natural background rate for mortality is 1%, hence 5% in 5 years is "very good". Five times that rate (25%) is "very poor". Values between those parameters are ramped continuously such that 7% is close to very good, 20% is close to very bad, etc.

Indicator 3:
Road Density

- Data source: FSTOPO Rd Data

- This indicator was included for assessing effects of road density on wildlife habitat

- Four types of roads evaluated:
  - Highway
 - Paved
  - Light duty
  - Unimproved
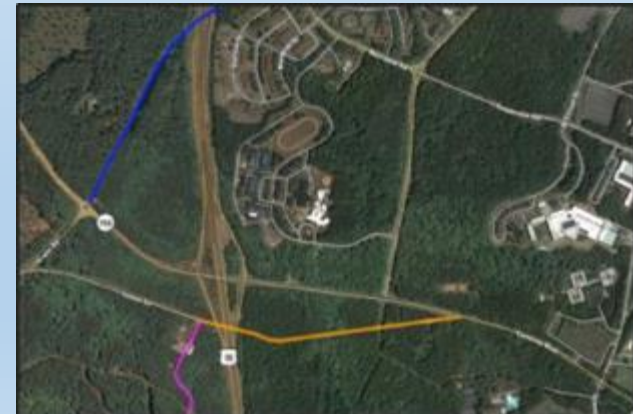
Indicator 4: *Climate*

- Data source: PRISM data at Subsection and LTA scales from RSAC

- Compares data from a recent 5-year period (2011-2015) with the prior 114-year period (1895-2009)

- Identifies locations where recent changes in precipitation or temperature may be imposing stress on species, ecosystems, or key processes
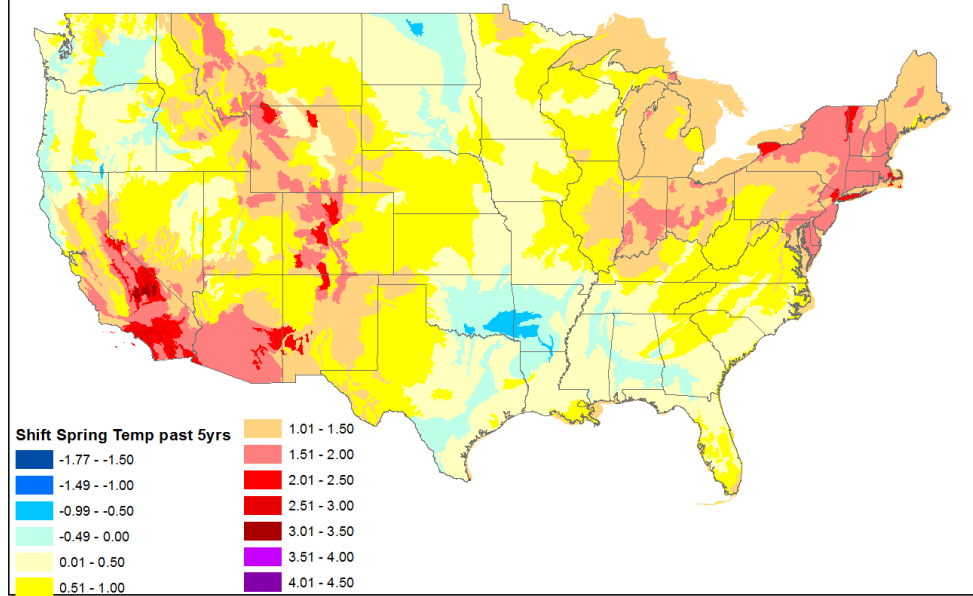
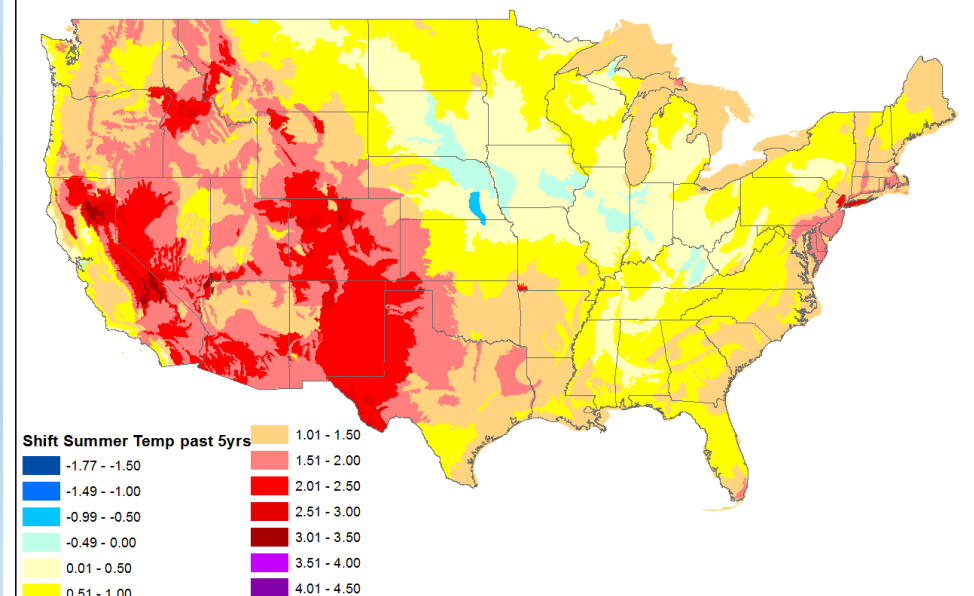Change in fall temperature 1895-2010 versus 2011-2015
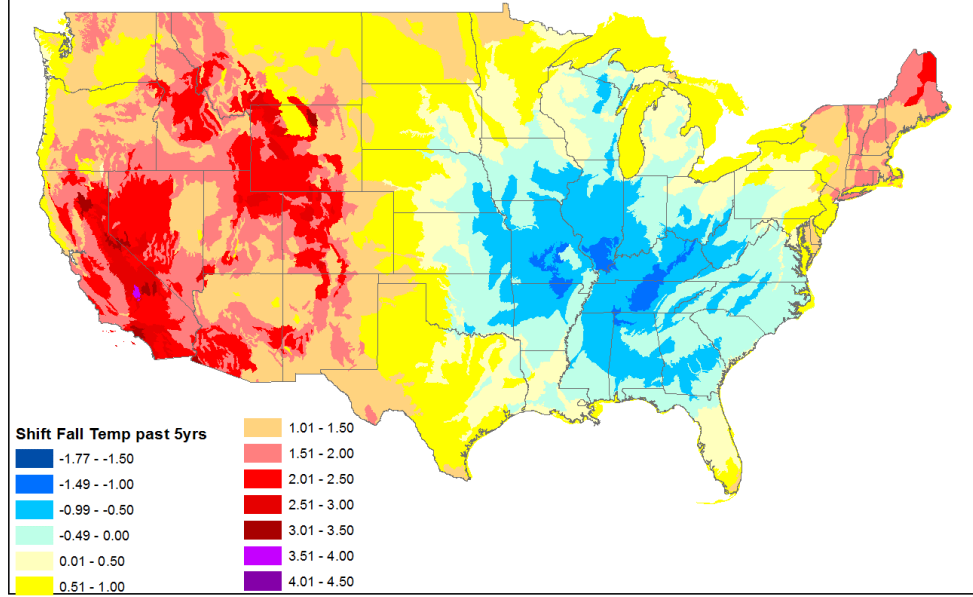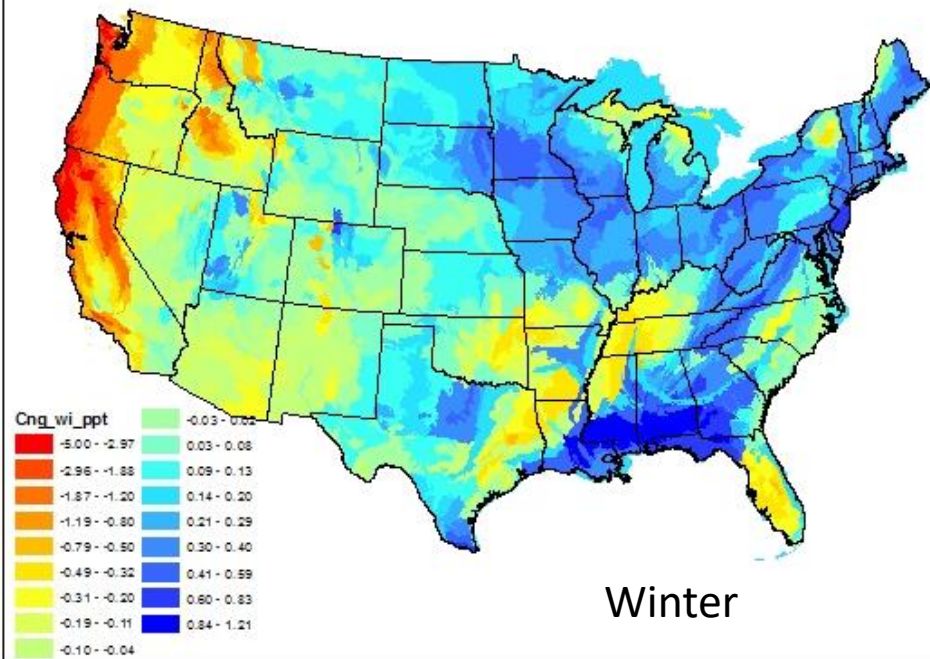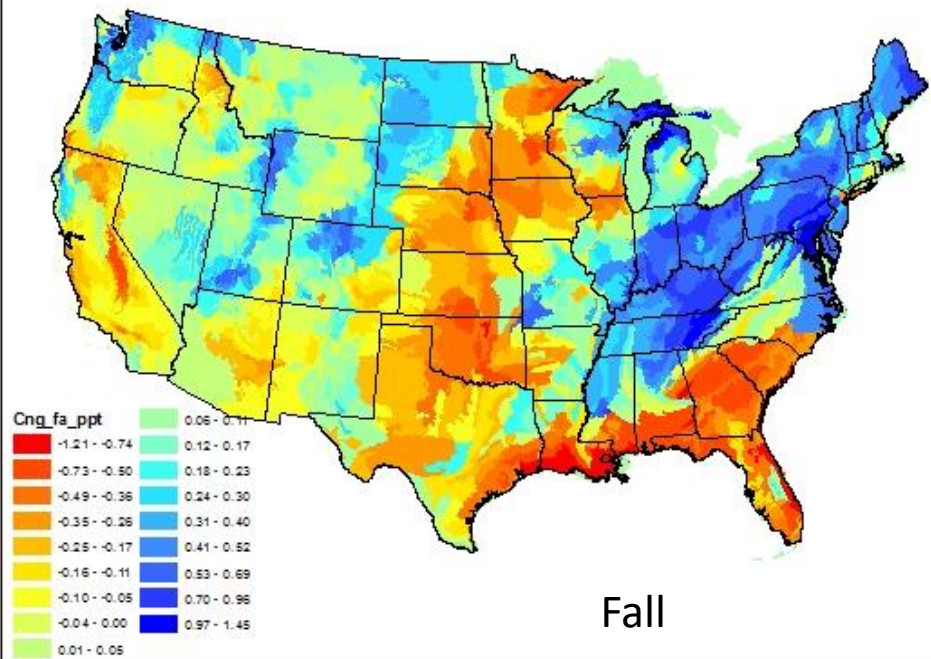
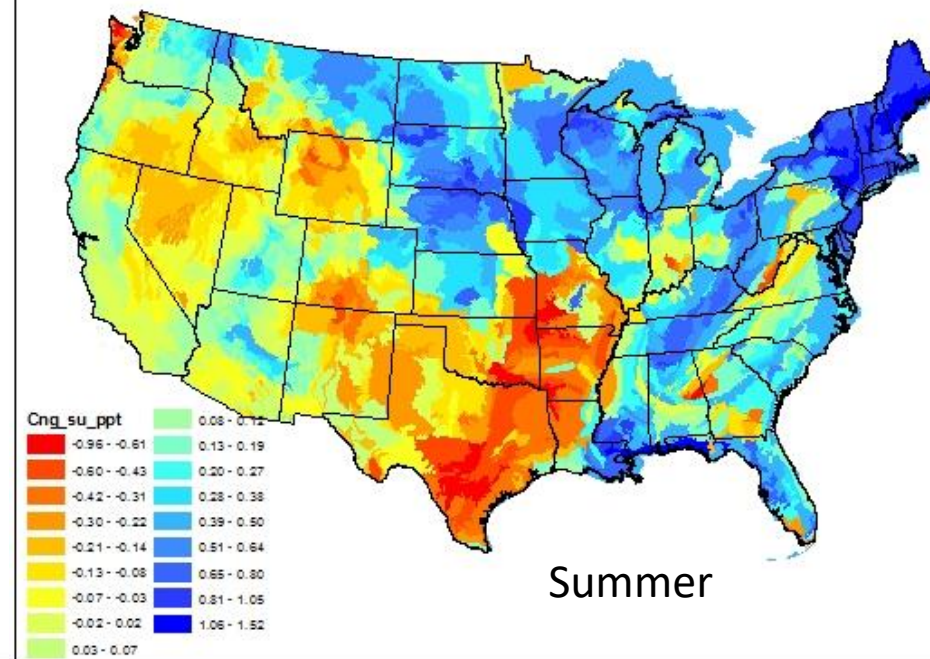Change in winter temperature 1895-2010 versus 2011-2015
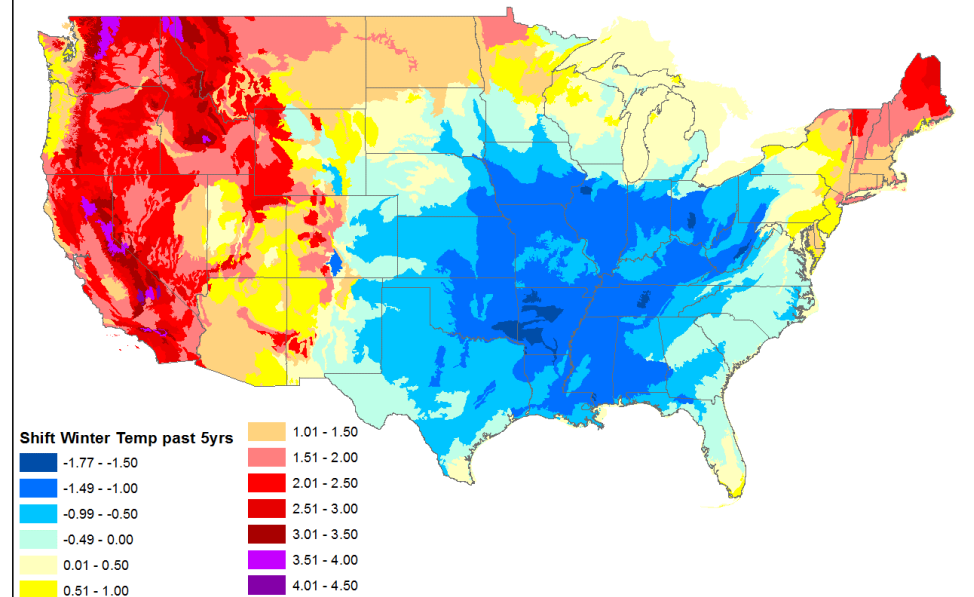
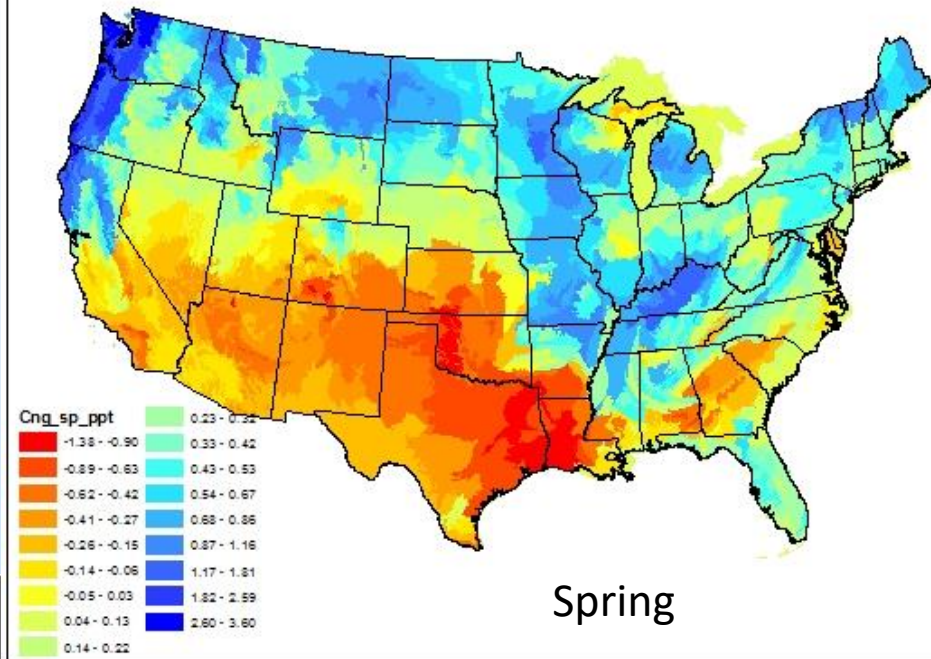Change in spring temperature 1895-2010 versus 2011-2015

Change in summer temperature 1895-2010 versus 2011-2015

Shift Fall Temp past 5yrs

▮ -1.77 - -1.50	▮ 1.01 - 1.50
▮ -1.49 - -1.00	▮ 1.51 - 2.00
▮ -0.99 - -0.50	▮ 2.01 - 2.50
▮ -0.49 - 0.00	▮ 2.51 - 3.00
▮ 0.01 - 0.50	▮ 3.01 - 3.50
▮ 0.51 - 1.00	▮ 3.51 - 4.00
	▮ 4.01 - 4.50

Shift Winter Temp past 5yrs

▮ -1.77 - -1.50	▮ 1.01 - 1.50
▮ -1.49 - -1.00	▮ 1.51 - 2.00
▮ -0.99 - -0.50	▮ 2.01 - 2.50
▮ -0.49 - 0.00	▮ 2.51 - 3.00
▮ 0.01 - 0.50	▮ 3.01 - 3.50
▮ 0.51 - 1.00	▮ 3.51 - 4.00
	▮ 4.01 - 4.50

Shift Spring Temp past 5yrs

▮ -1.77 - -1.50	▮ 1.01 - 1.50
▮ -1.49 - -1.00	▮ 1.51 - 2.00
▮ -0.99 - -0.50	▮ 2.01 - 2.50
▮ -0.49 - 0.00	▮ 2.51 - 3.00
▮ 0.01 - 0.50	▮ 3.01 - 3.50
▮ 0.51 - 1.00	▮ 3.51 - 4.00
	▮ 4.01 - 4.50

Shift Summer Temp past 5yrs

▮ -1.77 - -1.50	▮ 1.01 - 1.50
▮ -1.49 - -1.00	▮ 1.51 - 2.00
▮ -0.99 - -0.50	▮ 2.01 - 2.50
▮ -0.49 - 0.00	▮ 2.51 - 3.00
▮ 0.01 - 0.50	▮ 3.01 - 3.50
▮ 0.51 - 1.00	▮ 3.51 - 4.00
	▮ 4.01 - 4.50

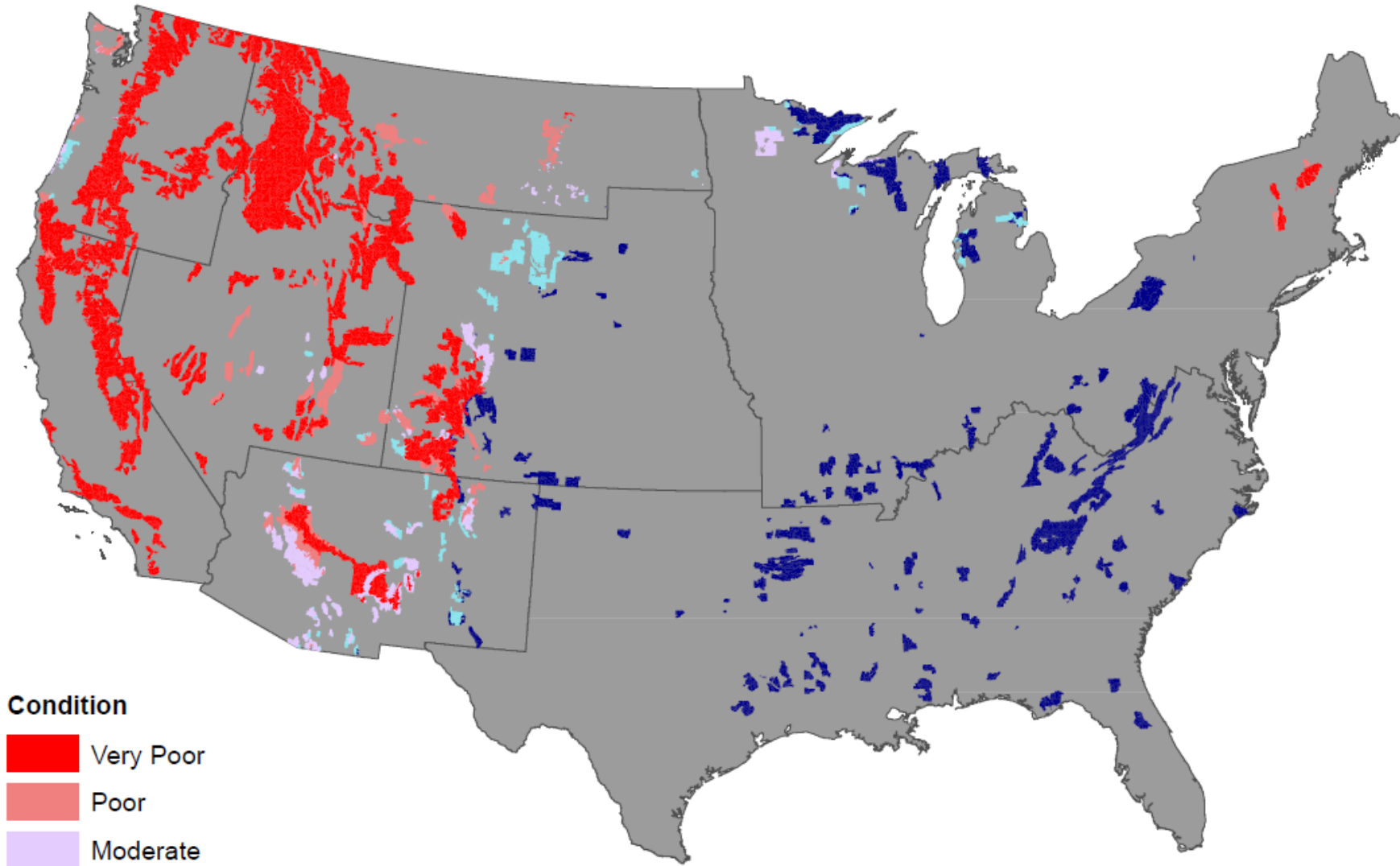Change in seasonal precipitation: 1895-2010 vs 2011-2015

TCA_Ind_4_precip_exposure_winter
Terrestrial Condition Assessment (TCA) Results v 1.0

Condition

- Very Poor
- Poor
- Moderate
- Good
- Very Good

October, 2016
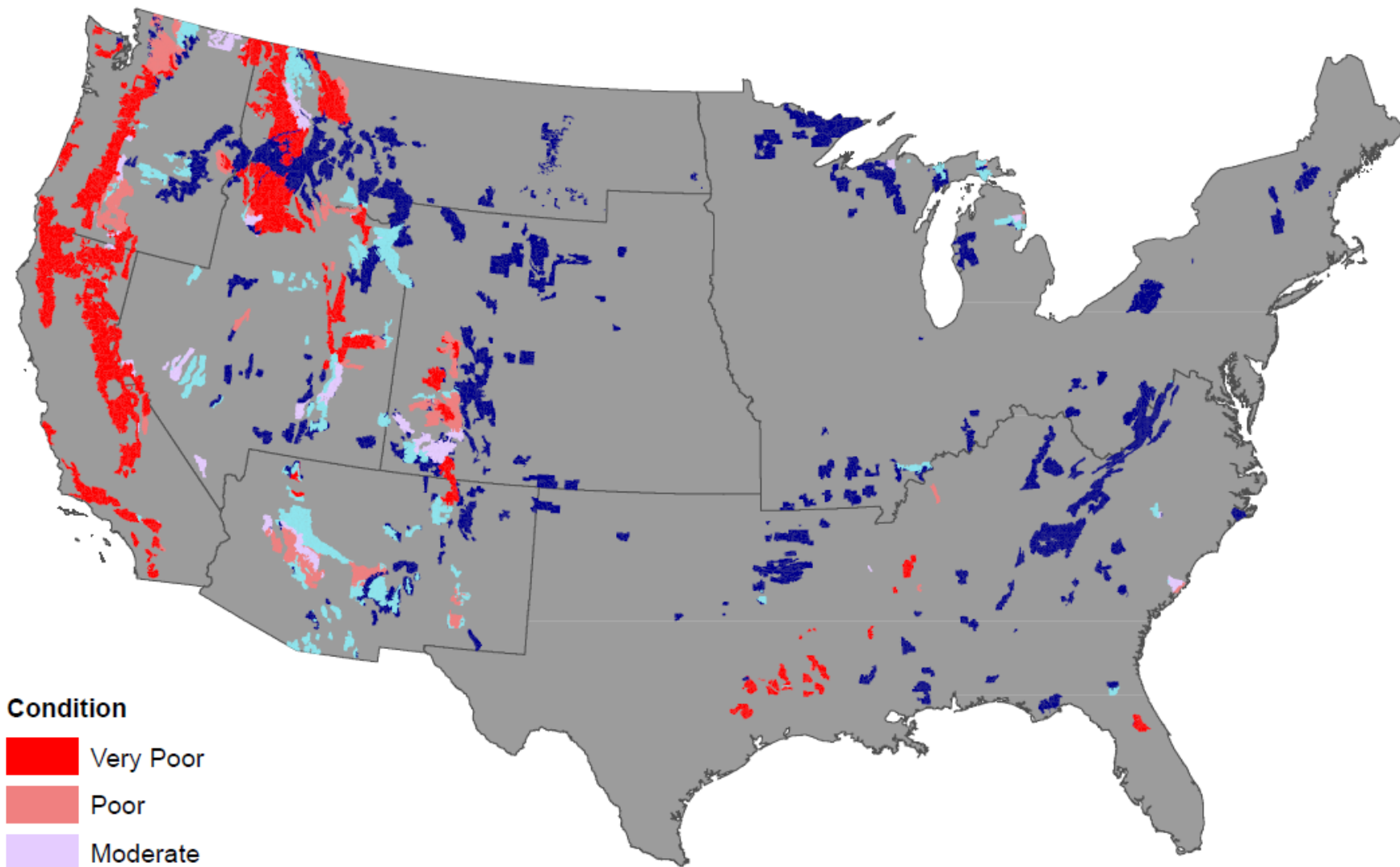
TCA_Ind_4_temp_exposure_winter
Terrestrial Condition Assessment (TCA) Results v 1.0

Condition

- Very Poor
- Poor
- Moderate
- Good
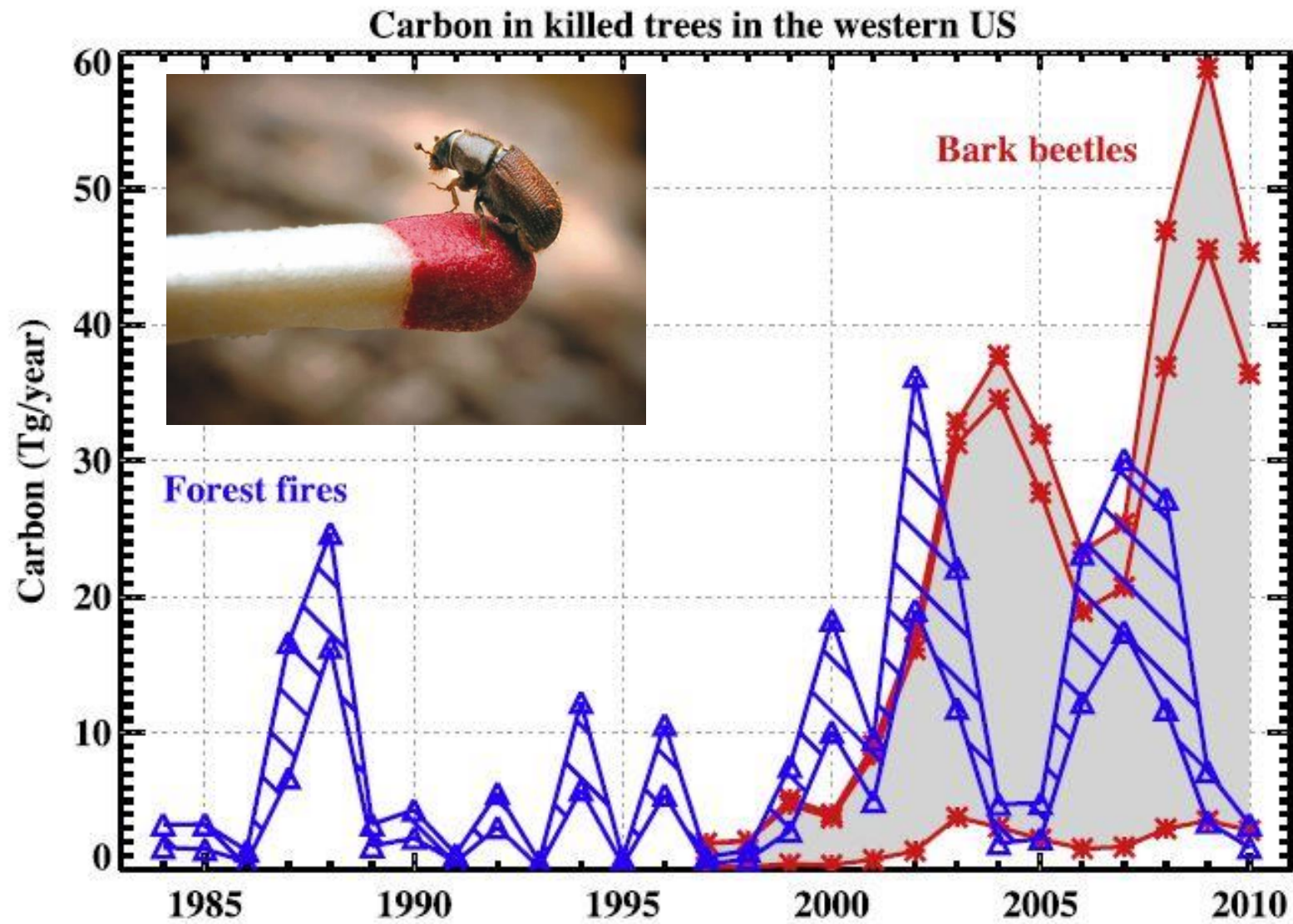- Very Good

October, 2016

J A Hicke *et al*

Figure 1. Carbon in trees killed by major bark beetle species (1997–2010; red lines representing upper, middle, and lower estimates; gray shading indicates range between lower and upper estimates) and forest fires (1984–2010; blue lines; hatching indicates range between moderate- and moderate + high-severity burned areas).

Indicator 5:
Air Pollution

- Data source: FS Air Program
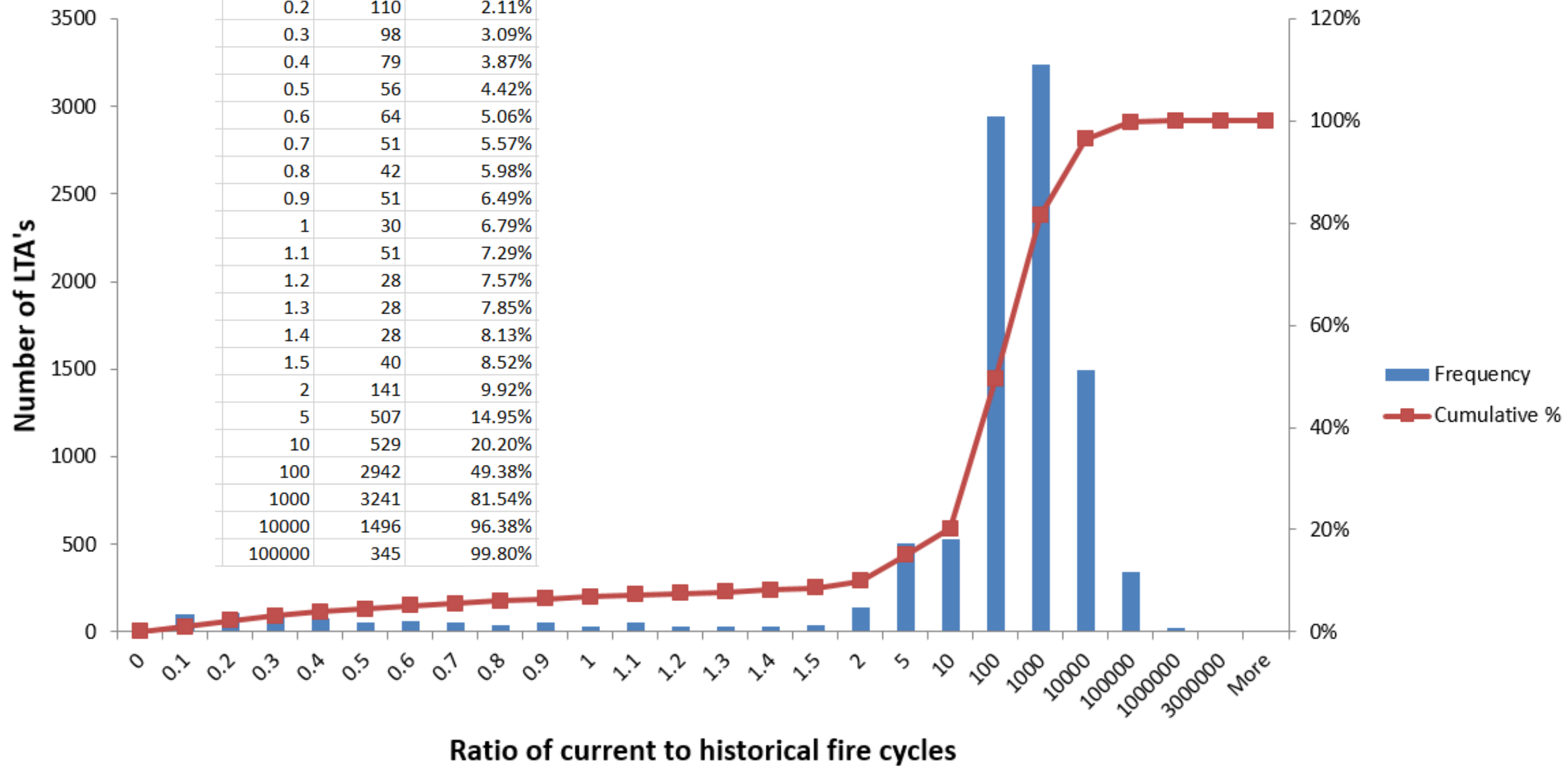- Critical load ratings for terrestrial acidification
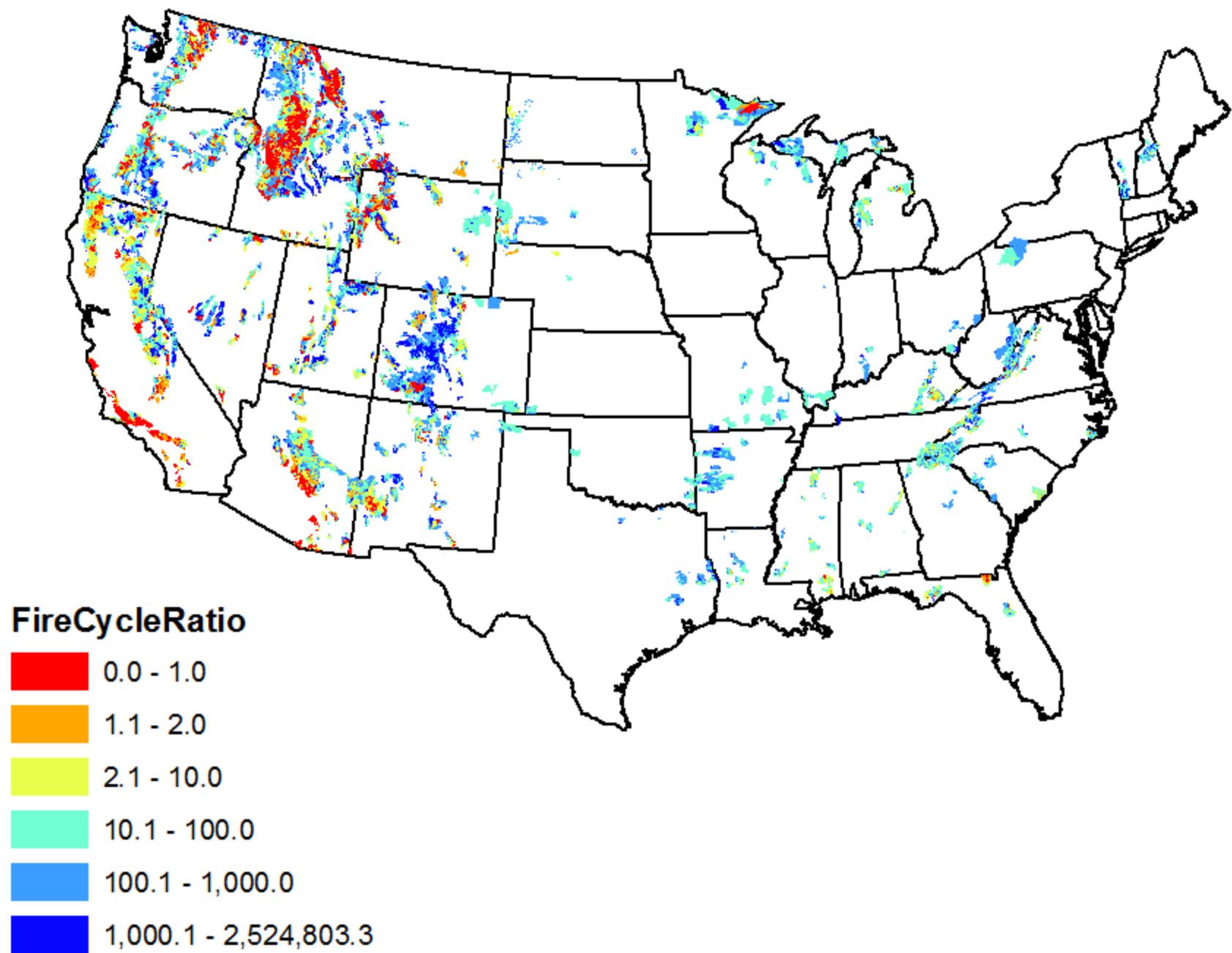- Nitrogen

Indicator 6:
Uncharacteristic Disturbance Events

- Data sources: Monitoring Trends in Burn Severity, and LANDFIRE's (i) historical fire severity and (ii) mean historical fire return interval

- Identifies areas that have burned more severely or frequently than historical fire regimes

Ratio	Frequency	Cumulative %
0	0	0.00%
0.1	103	1.02%
0.2	110	2.11%
0.3	98	3.09%
0.4	79	3.87%
0.5	56	4.42%
0.6	64	5.06%
0.7	51	5.57%
0.8	42	5.98%
0.9	51	6.49%
1	30	6.79%
1.1	51	7.29%
1.2	28	7.57%
1.3	28	7.85%
1.4	28	8.13%
1.5	40	8.52%
2	141	9.92%
5	507	14.95%
10	529	20.20%
100	2942	49.38%
1000	3241	81.54%
10000	1496	96.38%
100000	345	99.80%

Ratio of current to historical fire cycles

FireCycleRatio

- 🟥 0.0 - 1.0
- 🟧 1.1 - 2.0
- 🟨 2.1 - 10.0
- 🟩 10.1 - 100.0
- 🟦 100.1 - 1,000.0
- 🟦 1,000.1 - 2,524,803.3

Indicator 7:
Wildfire Hazard Potential *(Uncharacteristic Fuel Conditions)*

- Data source: USFS Wildfire Hazard Potential 2014

- Identifies areas where fuel buildup is of most concern

Indicator 8:
Forestland conditions promoting uncharacteristic mortality

- Data source: National Insect and Disease Risk Map from FHM, 2013

- http://www.fs.fed.us/foresthealth/technology/

- Represents imminent risk of unnaturally high rates of tree mortality (>25% BA within the next 15 yrs)

- Based on condition of host tree species and distribution of current pests

TCA_Ind_8_insect_and_pathogen_risk
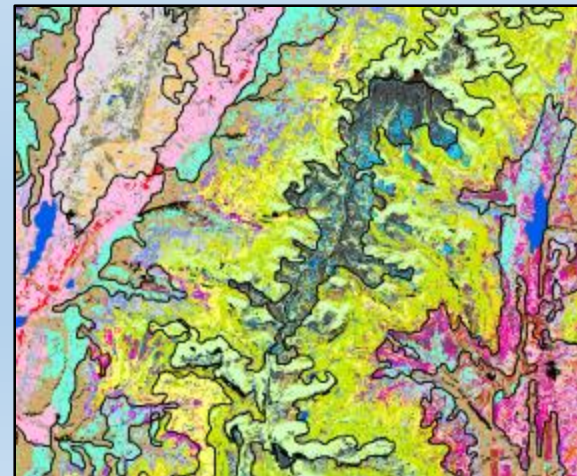Terrestrial Condition Assessment (TCA) Results v 1.0
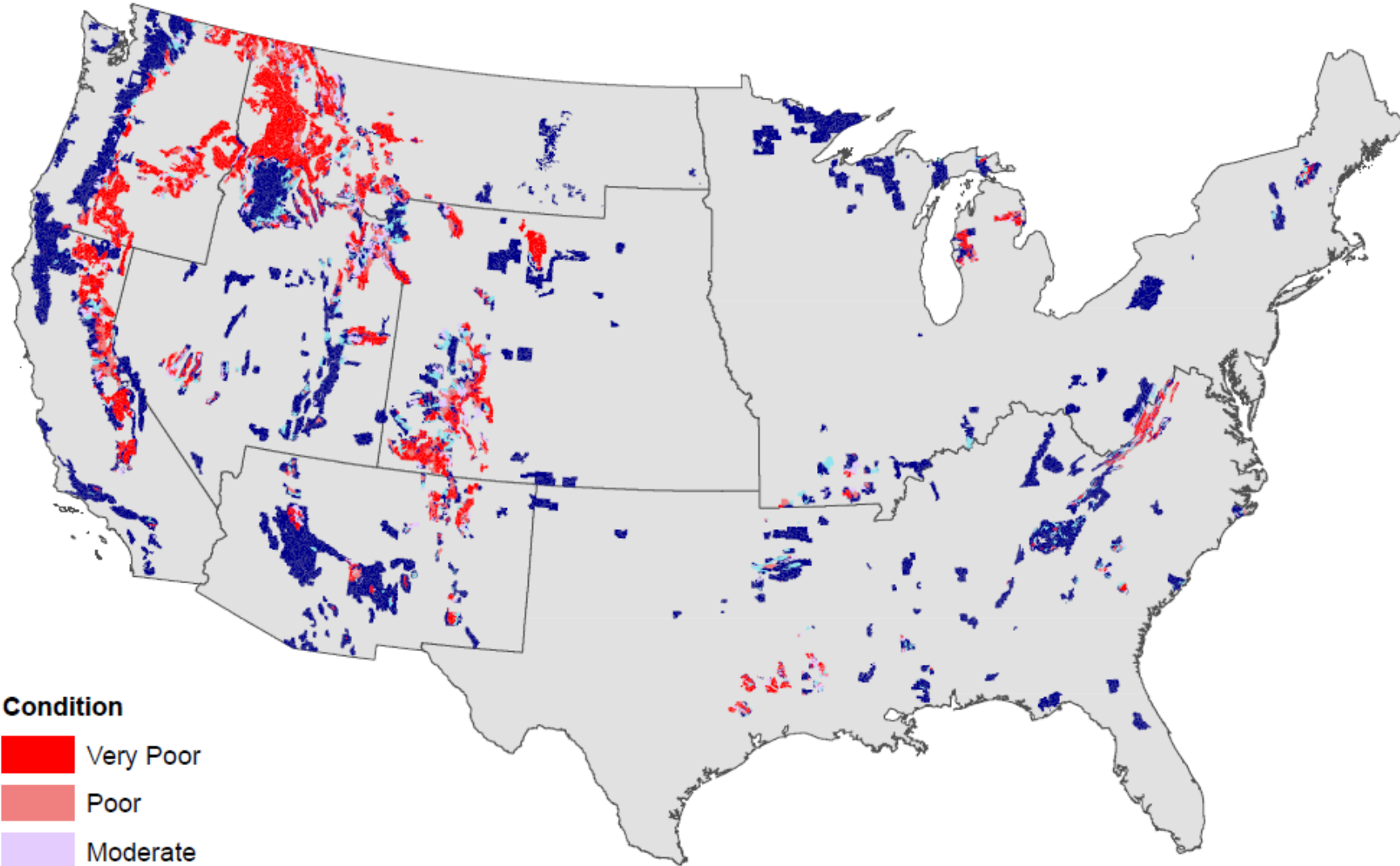
Condition

- Very Poor
- Poor
- Moderate
- Good
- Very Good

37 million acres of NFS lands are at imminent risk of uncharacteristic rates of insect and disease caused mortality

April, 2017

Indicator 9:
Vegetative Successional Departure (VDep)

- Data source: LANDFIRE

- Current seral stages compared with the historic range using a similarity index

- Data on vegetation composition and structure/succession class
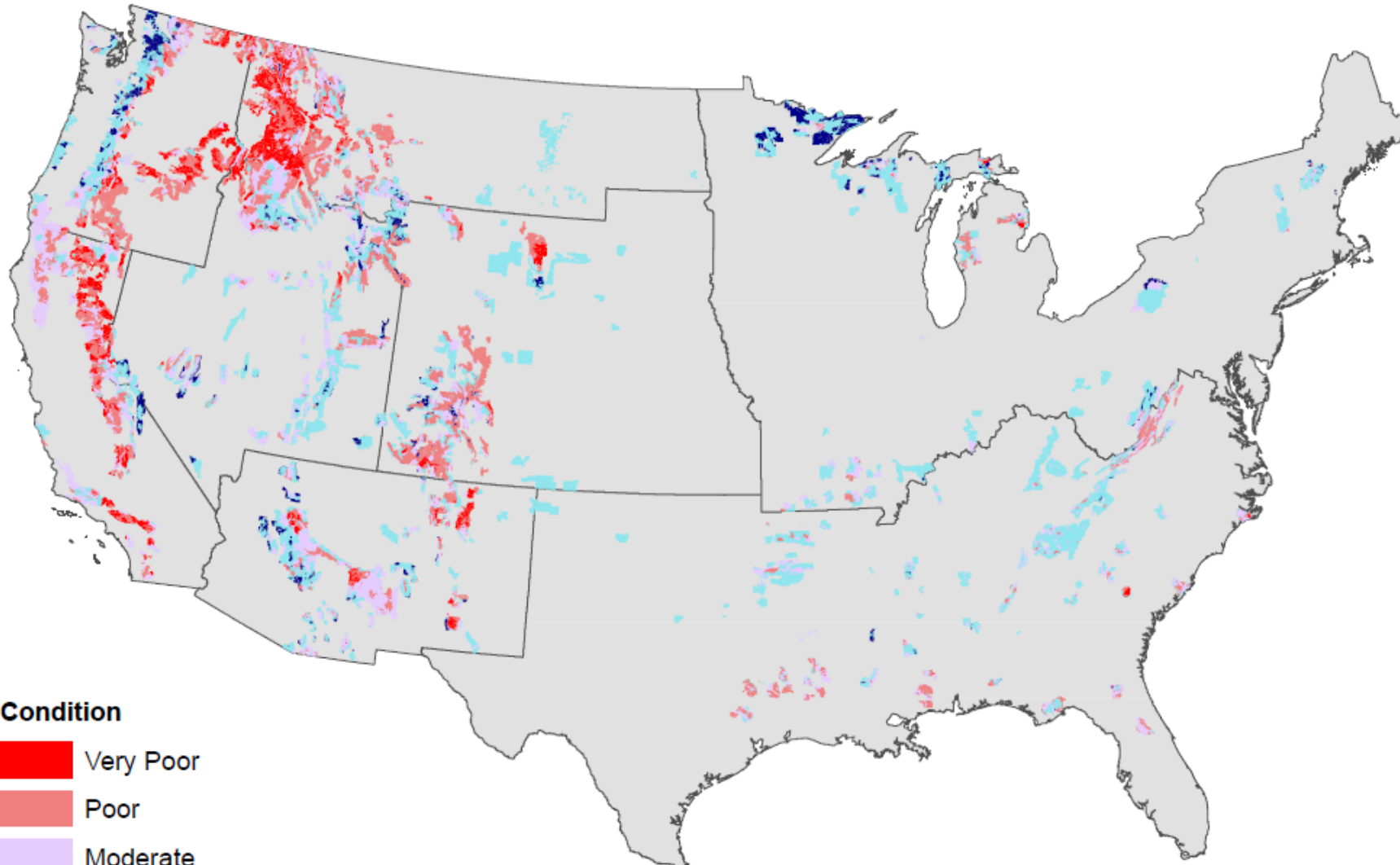
Indicator 10:
Ecological Process Departure

- Data sources: LANDFIRE historic mean fire return interval (MFRI)

- Information on missed fire cycles

TCA_Terrestrial_Condition
Terrestrial Condition Assessment (TCA) Results v 1.0

Condition
- Very Poor
- Poor
- Moderate
- Good
- Very Good

Interpreting ratings – do we maintain good areas, improve moderately degraded areas for moderate costs, or improve poor areas for high costs? Decisions based on local needs, priorities, capacity, etc.

April, 2017

The five most important stressors causing poor conditions nationally include:

- insect and disease risk
- incidence of mortality
- wildfire hazard potential
- elevated winter temperatures
- uncharacteristically severe fires

All indicators were influential, however, but their importance varied by Region.

Terrestrial Condition	Frequency	Acres	Percent national
Very good	1,618	39,196,114	18.41
Good	3,962	78,817,893	37.02
Moderate	1,736	39,394,691	18.50
Poor	1,226	24,180,659	11.36
Very poor	1,491	31,306,992	14.71

Terrestrial Condition Assessment (TCA) web map user guide v2.0

June 2017

A user guide has been produced with instructions on how to access the web viewer, use it to interpret results, and access data.

Forest Service

Questions?