



Wetlands and Fire: Reframing the Questions

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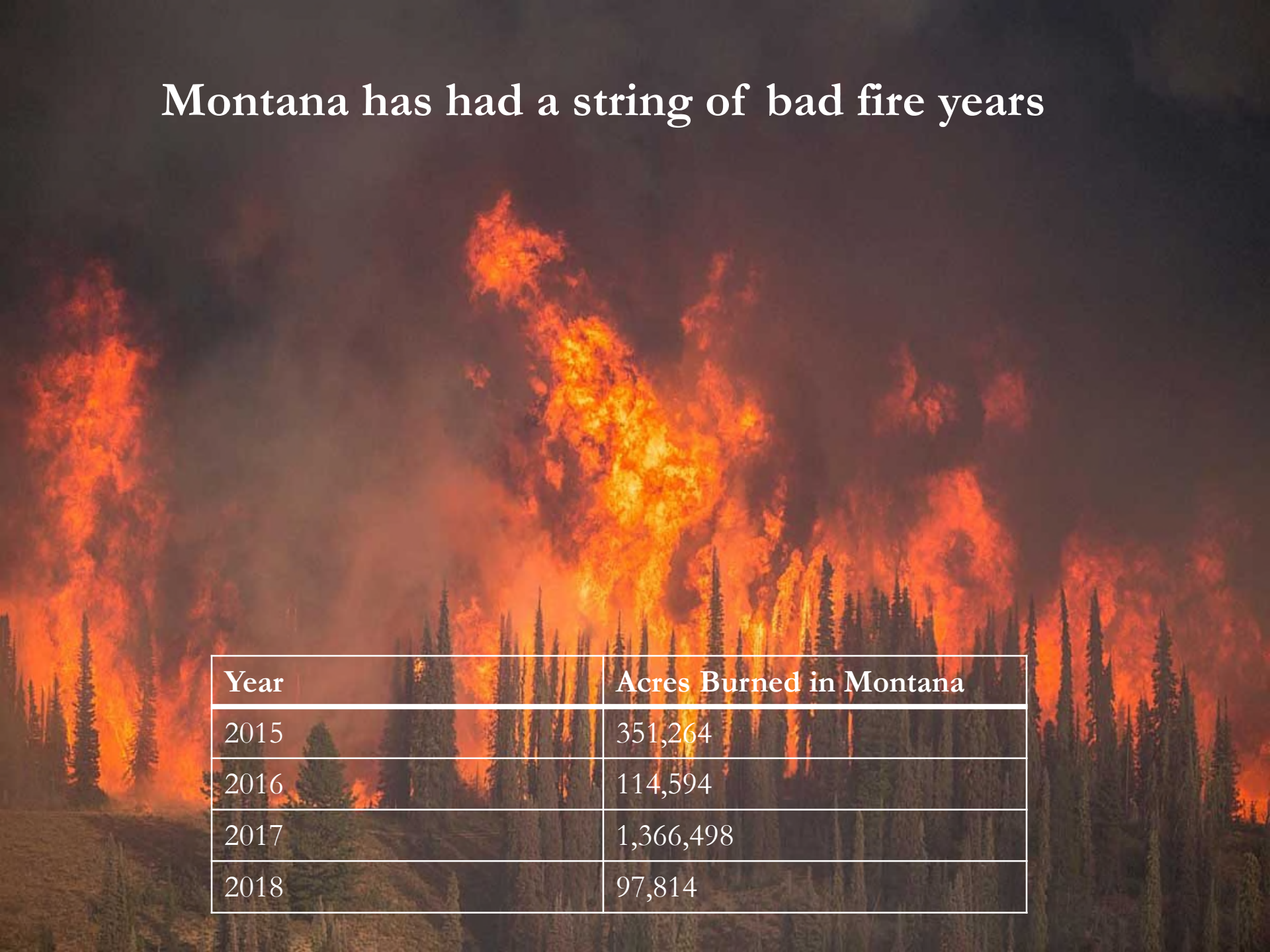
National Water Quality Monitoring Conference
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Goals of this presentation

- Briefly introduce our initial questions about wetlands and fire;
- Describe why we felt we needed to reframe the questions
- Discuss what we learned
- Summarize future directions



Montana has had a string of bad fire years



Year	Acres Burned in Montana
2015	351,264
2016	114,594
2017	1,366,498
2018	97,814

So we set out to study impacts of fires on wetlands

Changes to wetland structure and function due to:

- Combustion/loss of plant material
- Hydroperiod alteration
- Increased solar radiation
- More available soil moisture where adjacent trees killed
- Loss of soil organic carbon
- Loss of soil nitrogen
- Increase in sedimentation
- Pioneer species moving in



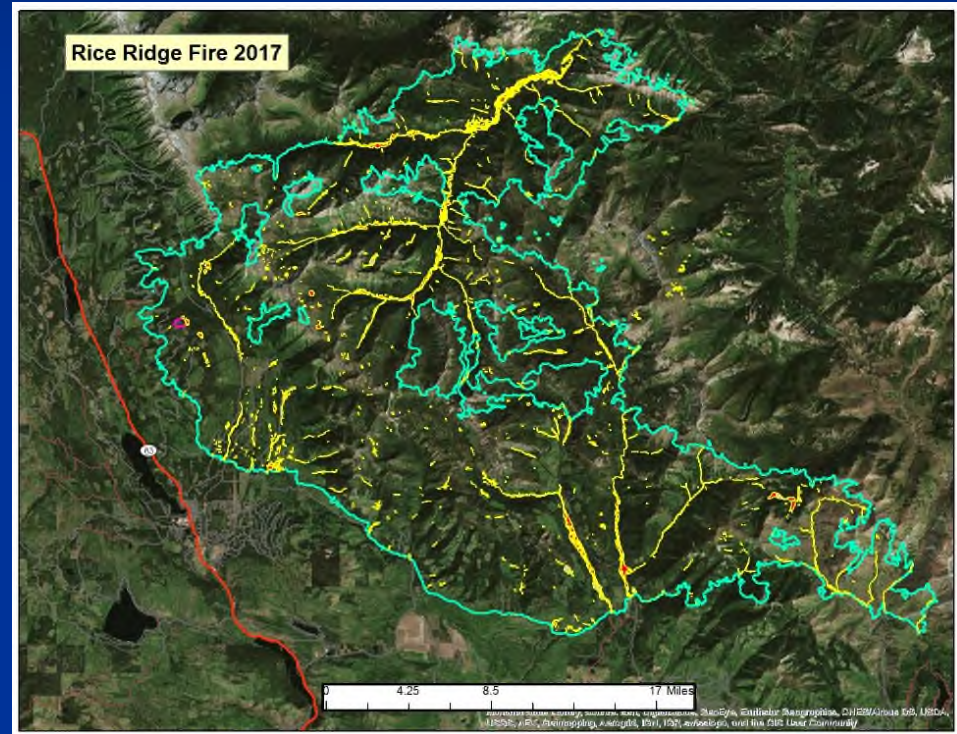
Selection of study sites relied on GIS

Datasets:

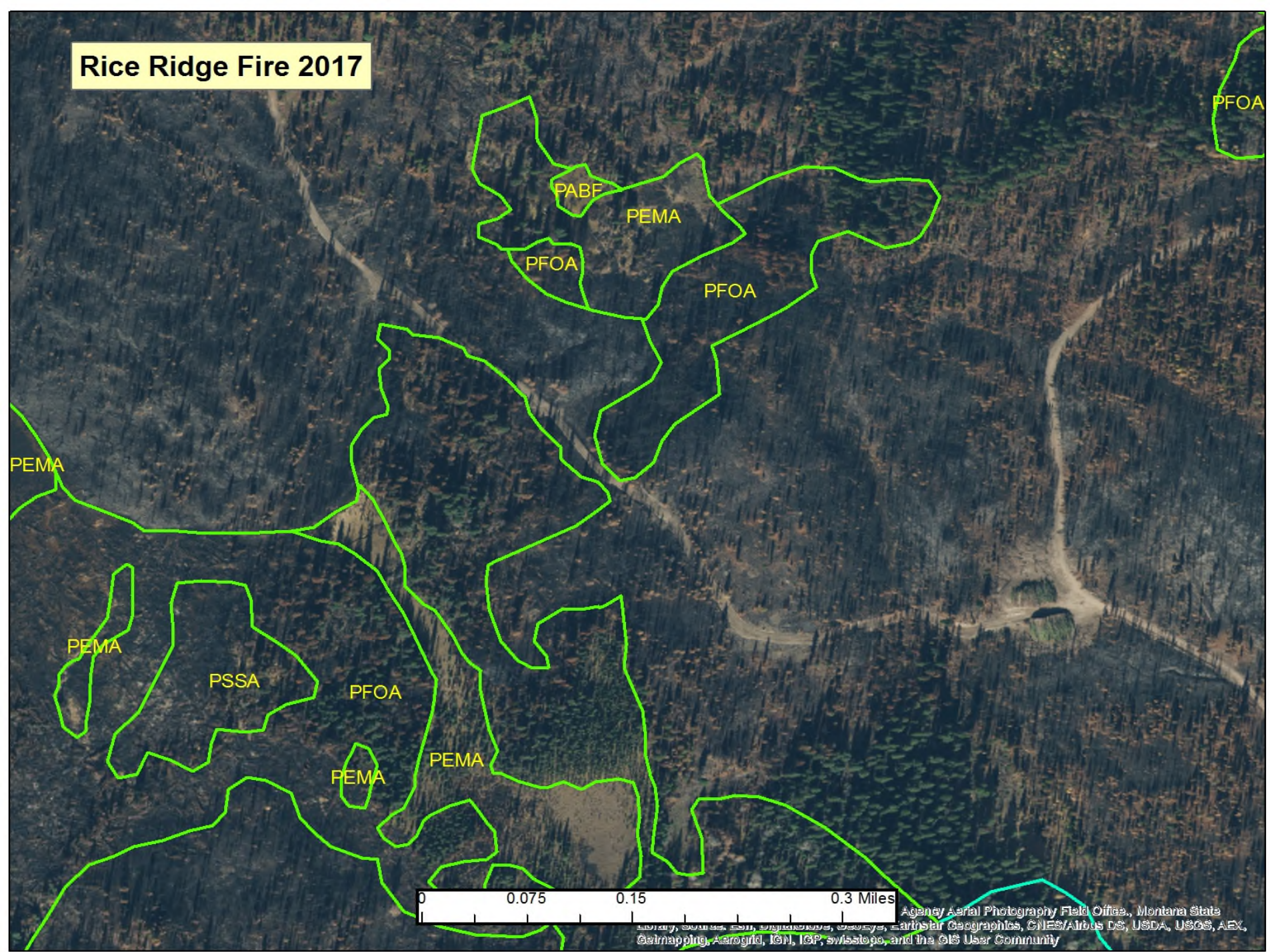
- Wetland polygons from National Wetlands Inventory (produced by MTNHP)
- Fire perimeters from Geomac (www.geomac.gov)
- 4-band NAIP Imagery from 2013, 2015, 2016 and 2017;
- ESRI World Imagery
- Landsat 8

Methods:

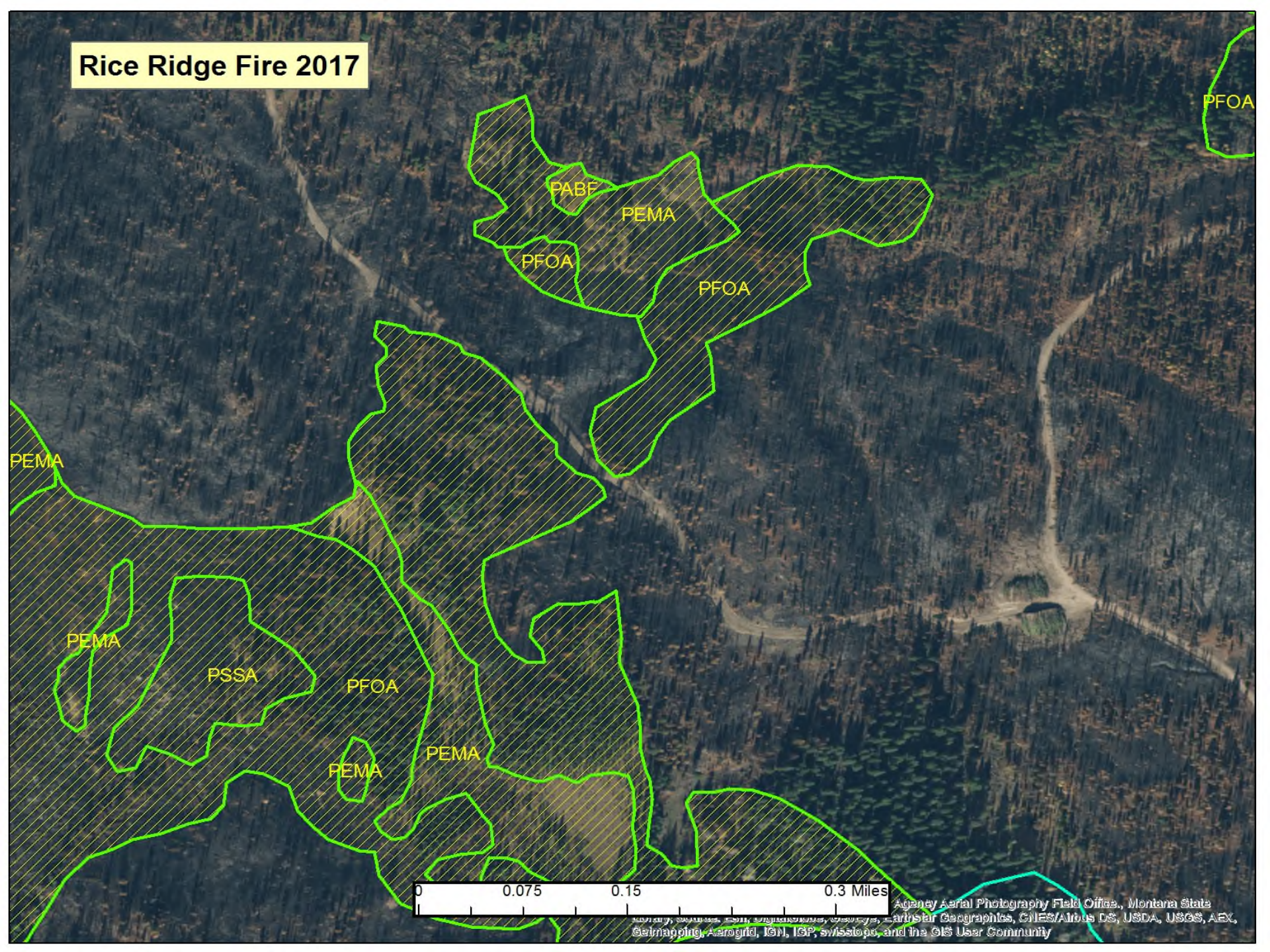
- Select wetlands within fire perimeters;
- Visually inspect for evidence of burn
- Use Landsat reflectance bands 7-5-2 and tasseled-cap transformed 3rd band (wetness) when no imagery available



Rice Ridge Fire 2017



Rice Ridge Fire 2017



PFOA

PABF

PEMA

PFOA

PFOA

PEMA

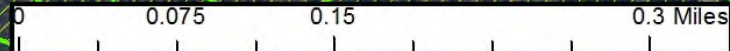
PEMA

PSSA

PFOA

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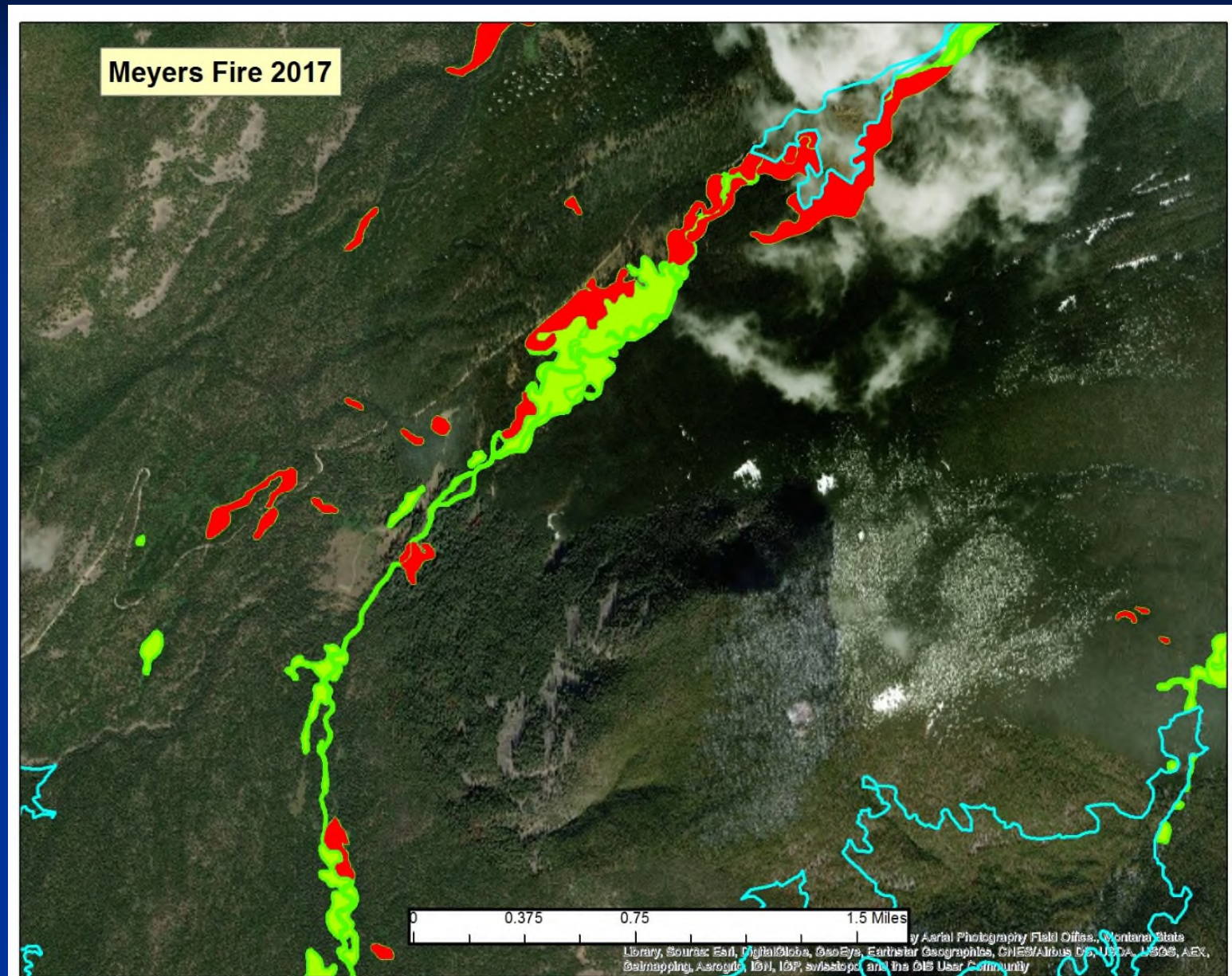
PEMA



Agency Aerial Photography Field Office, Montana State
Earthstar Geographics, GILES/Airbus DS, USDA, USGS, AEX,
GeoMapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



But: Not all wetlands burned



And of course, we wanted to know 1) why not and 2)
if wetlands were affecting the fires



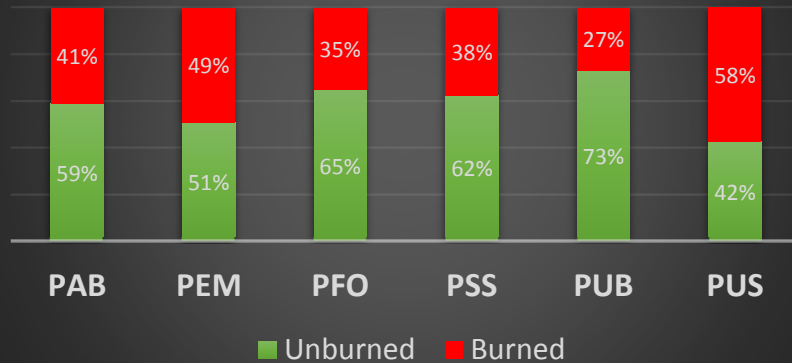
Preliminary step: generate hypotheses about burn vulnerability that could be tested in a GIS

- Wetland type
 - Emergent, aquatic, forested?
- Wetland water regime
 - Wetter vs drier
- Wetland size
 - Larger vs smaller
- Wetland landscape position
 - Valley vs hillside
- Wetland mosaics
 - Solitary vs complex wetlands

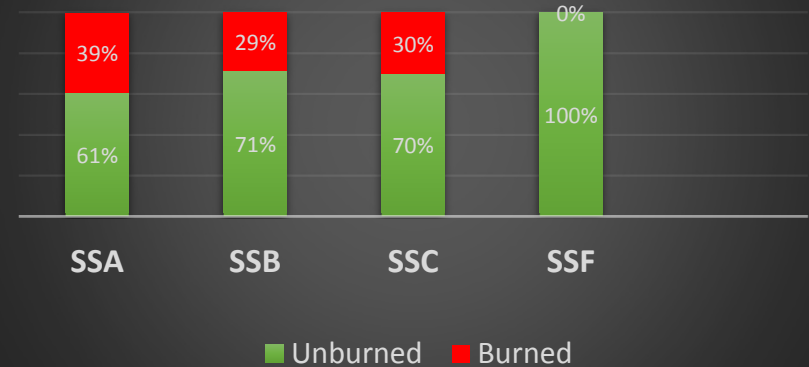


Wetland type, water regime affected burn status

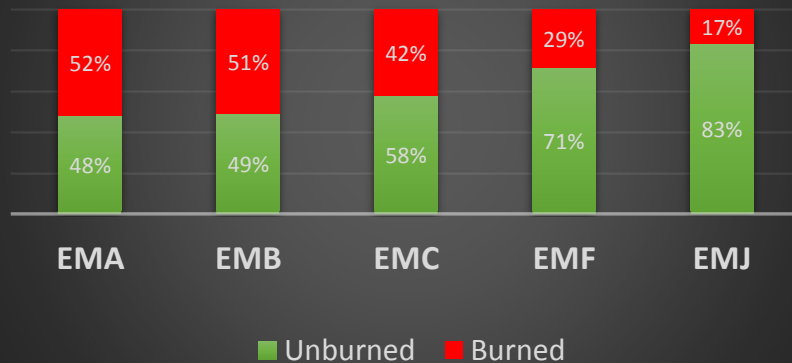
Burned/unburned by type



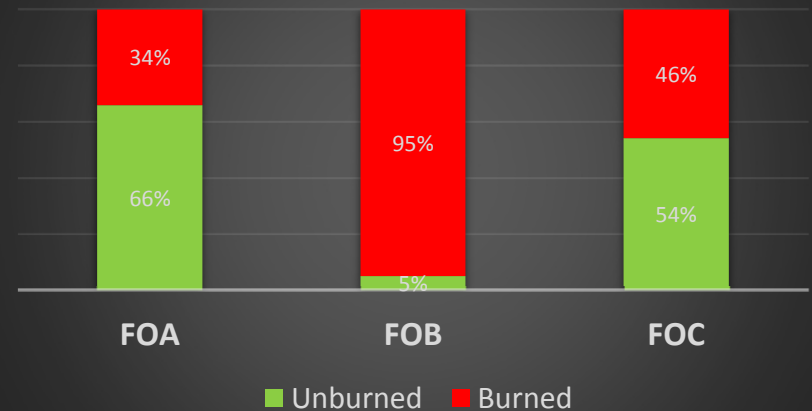
PSS wetlands by water regime



PEM wetlands by water regime



PFO wetlands by water regime



Wetland size and fire size both affected burn status

- Except for forested wetlands, unburned wetlands were larger than burned wetlands



	PEM	PAB	FO	SS
Unburned	2.17	0.94	3.27	3.27
Burned	1.24	0.80	4.85	1.41

Mean size in acres, by class

	PEM	PAB	FO	SS
Large Fires Unburned	44%	55%	61%	57%
Small Fires Unburned	63%	61%	72%	68%

Percent unburned in large vs small fires, by class



- In all cases, the percent of unburned wetlands, by class, was higher in fires <25,000 acres

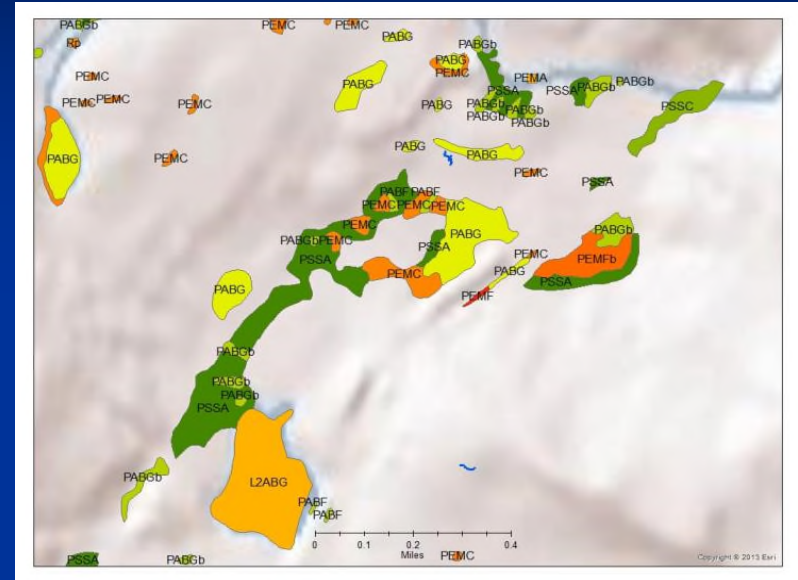
Landscape position had no predictive value

- We hypothesized that wetlands in a valley bottom were less likely to burn than wetlands on slope locations.
 - There was no statistically significant relationship
- We also hypothesized that proximity to a stream would be a predictor of burn outcome
 - There was no statistically significant relationship



Wetland mosaics may act as buffers

- In a GIS, wetland mosaics are clusters of wetland polygons, typically representing multiple classes and water regimes
- By class, wetlands that are part of mosaics were more likely to remain unburned than those that occur as single features
- It is likely that the overall size of the mosaic, as well as the diversity of water regimes, attenuates fire impacts.



	UNBURNED % SOLITARY	UNBURNED % MOSAICS
PEM	47%	59%
PAB	56%	66%
PFO	66%	64%
PSS	60%	65%

General conclusions: why not all wetlands burn

More susceptible to burning

- Drier wetlands
- Forested wetlands
- Smaller wetlands
- Wetlands as solitary landscape units

Less susceptible to burning

- Wetter wetlands
- Shrub wetlands
- Larger wetlands
- Wetlands in larger mosaics



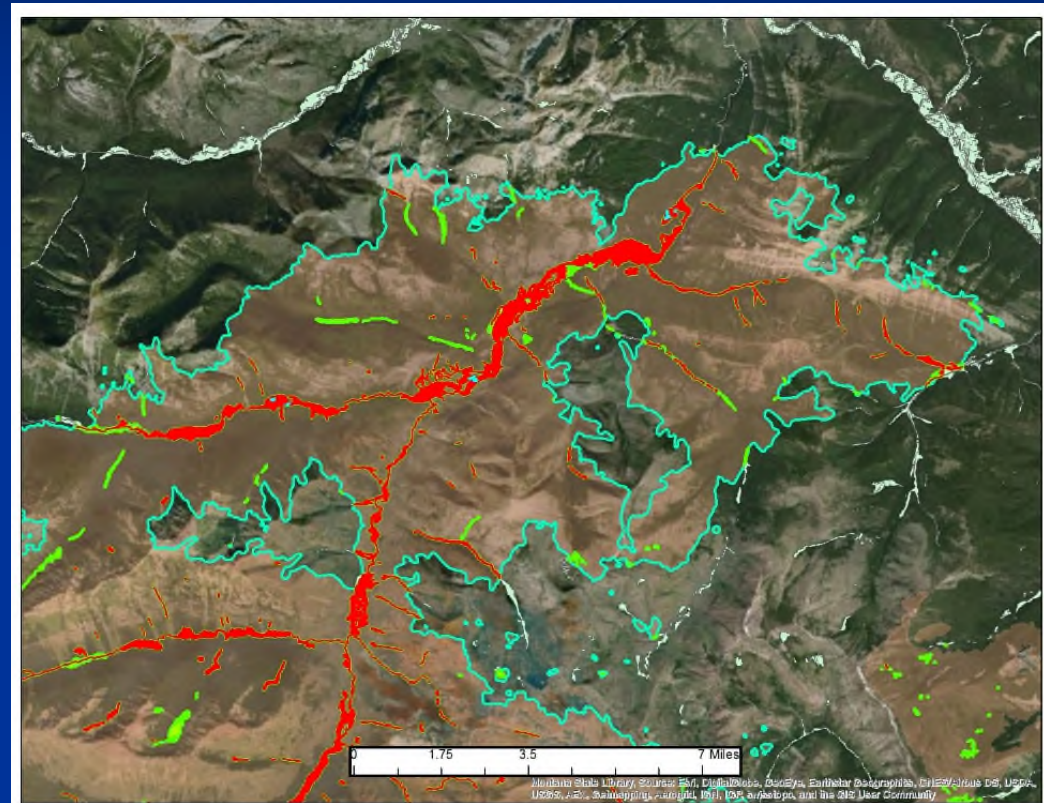
Do wetlands affect fires?

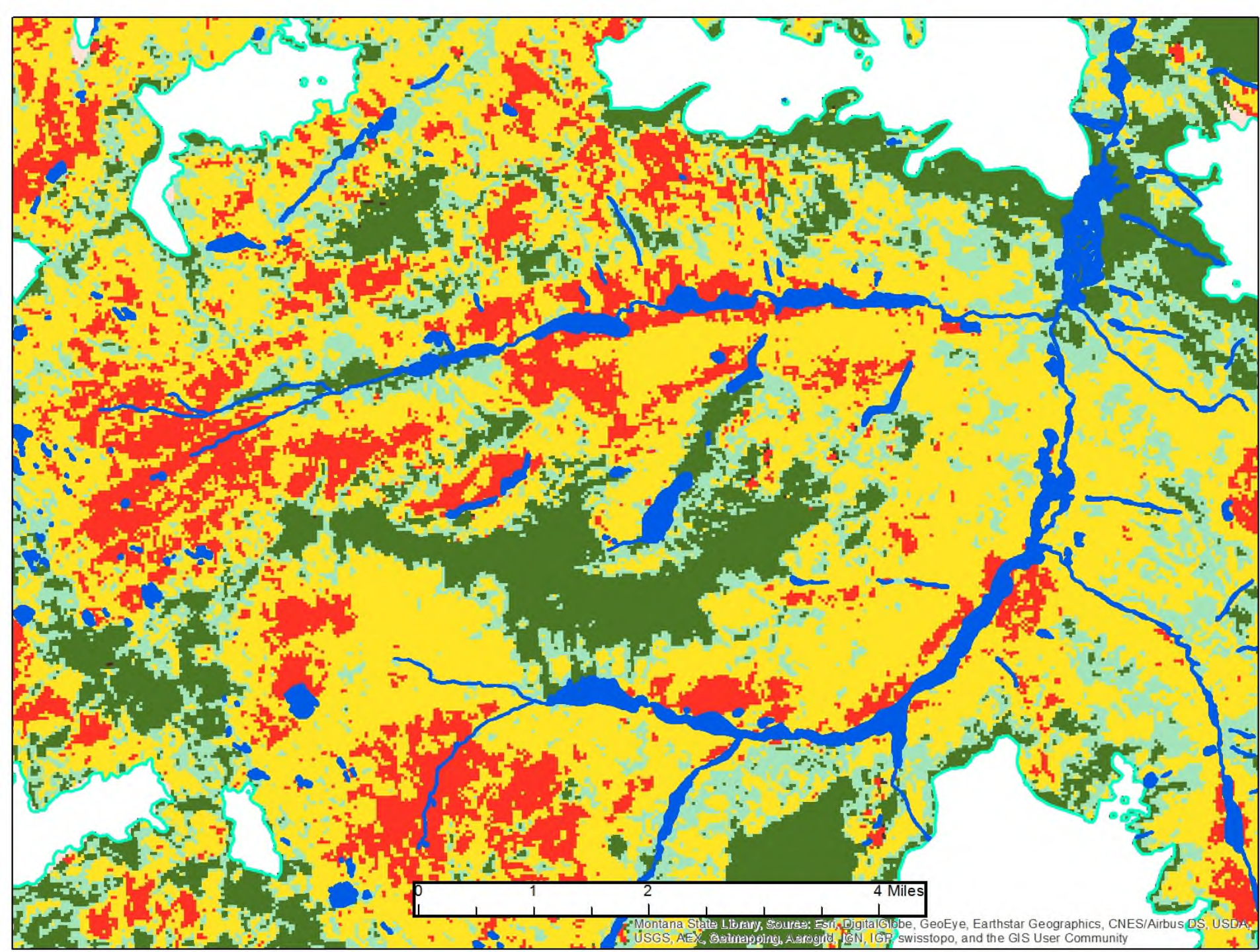
- In the field, we saw multiple instances of wetlands appearing to act as fire breaks
- For the most part, these were narrow-to-medium valley bottoms with a mixture of shrub, forest and emergent wetlands, and clay or gravelly soils, usually with a stream channel.
- Herbaceous wetlands, including peaty and mucky wetlands, did not appear to have the same fire-attenuating qualities



Turning observations into analysis

- Do wetlands act as fire breaks?
- Do wetlands dampen fire severity?
- Do wetlands redirect fire path?





Finding the right scale

- All of the GIS data has issues with precision and accuracy
- Spatial analysis tools are limited and often data hungry
- There is tremendous underlying variability in wetlands, landscapes and fires
- We may still be asking the wrong questions



Questions?

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