LANDFIRE image-based update prototype

DETAILED ANNUAL UPDATES TO VEGETATION MAPS FOR THE U.S. USING MACHINE LEARNING

Daryn Dockter, Inga La Puma, Brian Tolk (KBR) and Josh Picotte (AFDS)
Contractors to the U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS)

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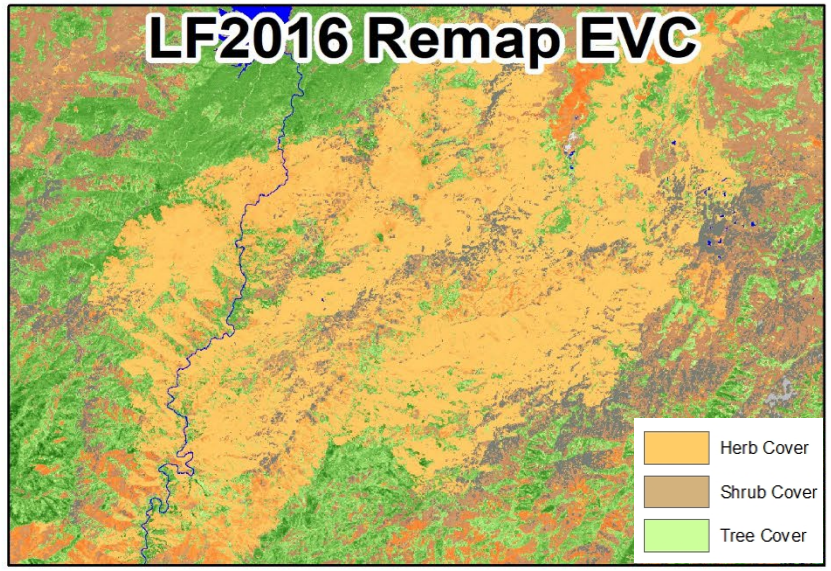
Image-Based Update

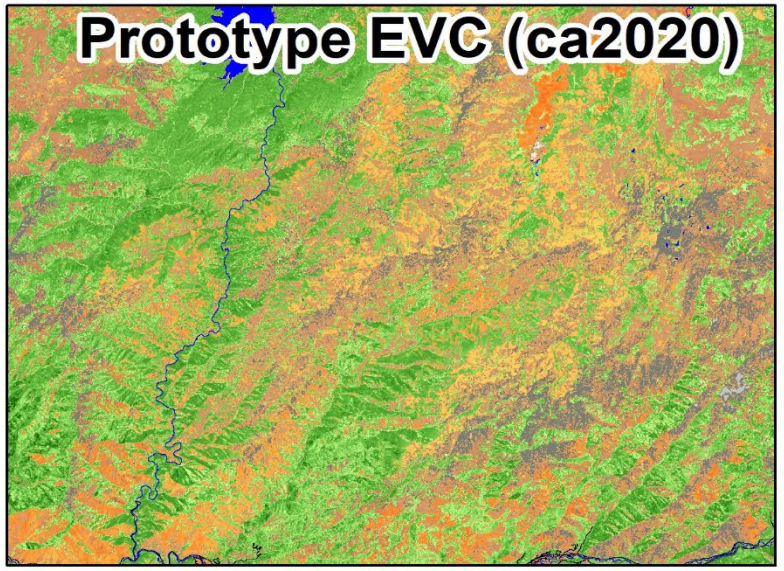
Name	LF 2001	LF 2001	LF 2008	LF 2010	LF 2012	LF 2014	LF 2016	LF 2020	LF 2022	LF 2023
Version	1.0	1.0.5	1.1	1.2	1.3	1.4	2.0	2.2	2.3	2.4
Type	base map	update					base map	update		Image-based update?
Status	Archived	Available	Archived				Available		In Progress	Prototyping

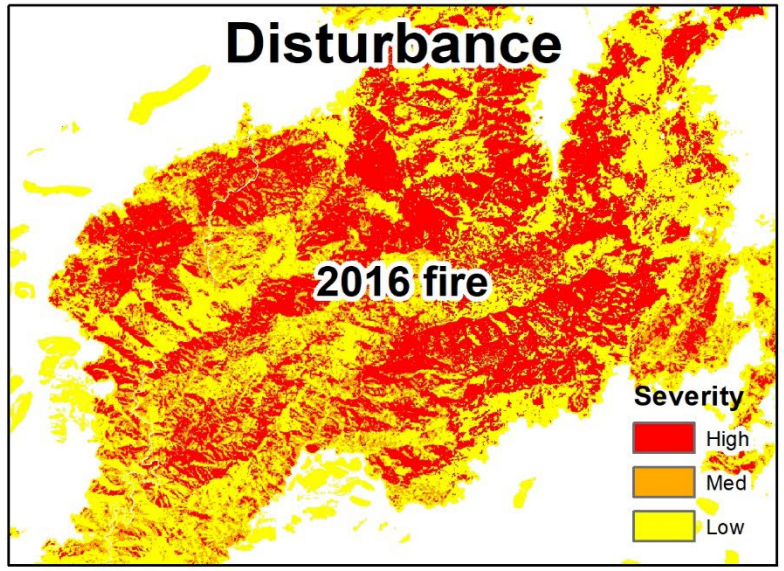
Prototype Goals

- More: model post-disturbance vegetation with recent imagery and machine learning
- Better: replace rulesets and improve modeling performance
- Faster: enable annual updates by reducing modeling time through automation

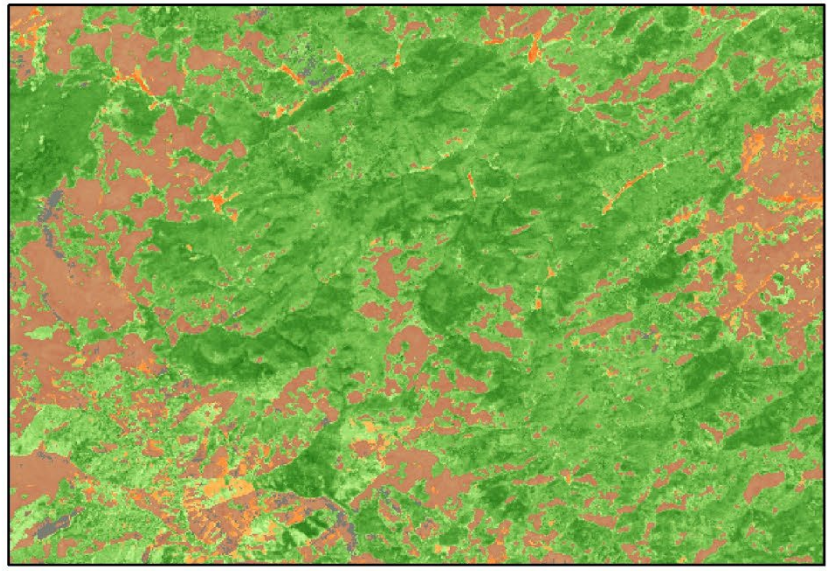
Updating Vegetation in Recovery Since Previous Mapping

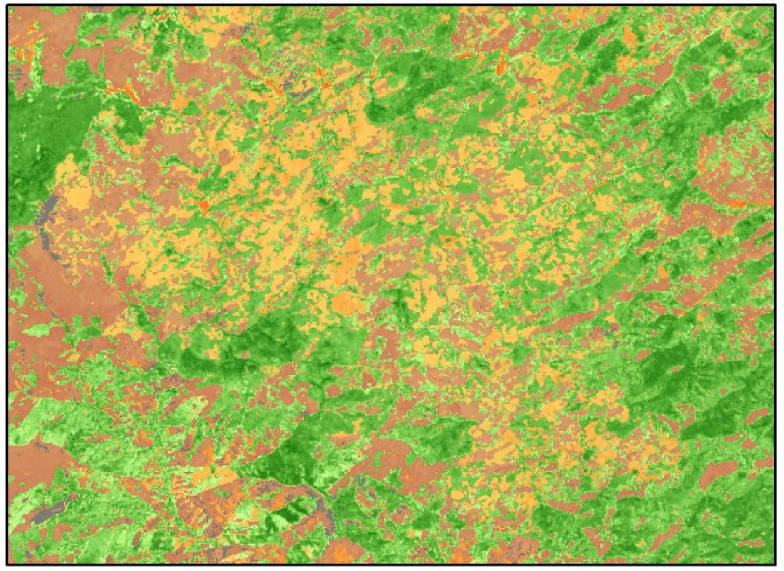


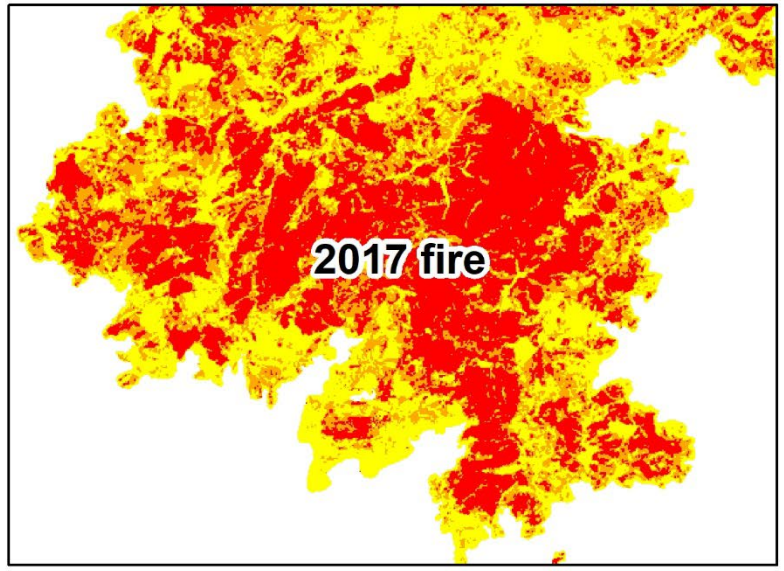




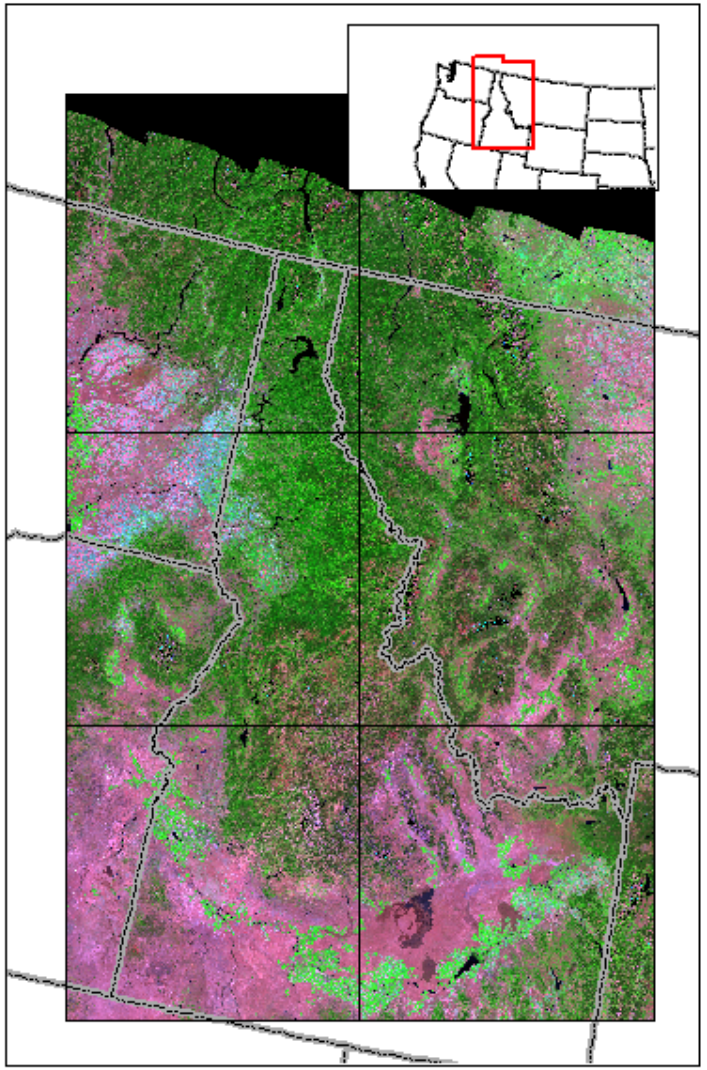
Updating Vegetation in Newly Disturbed Areas

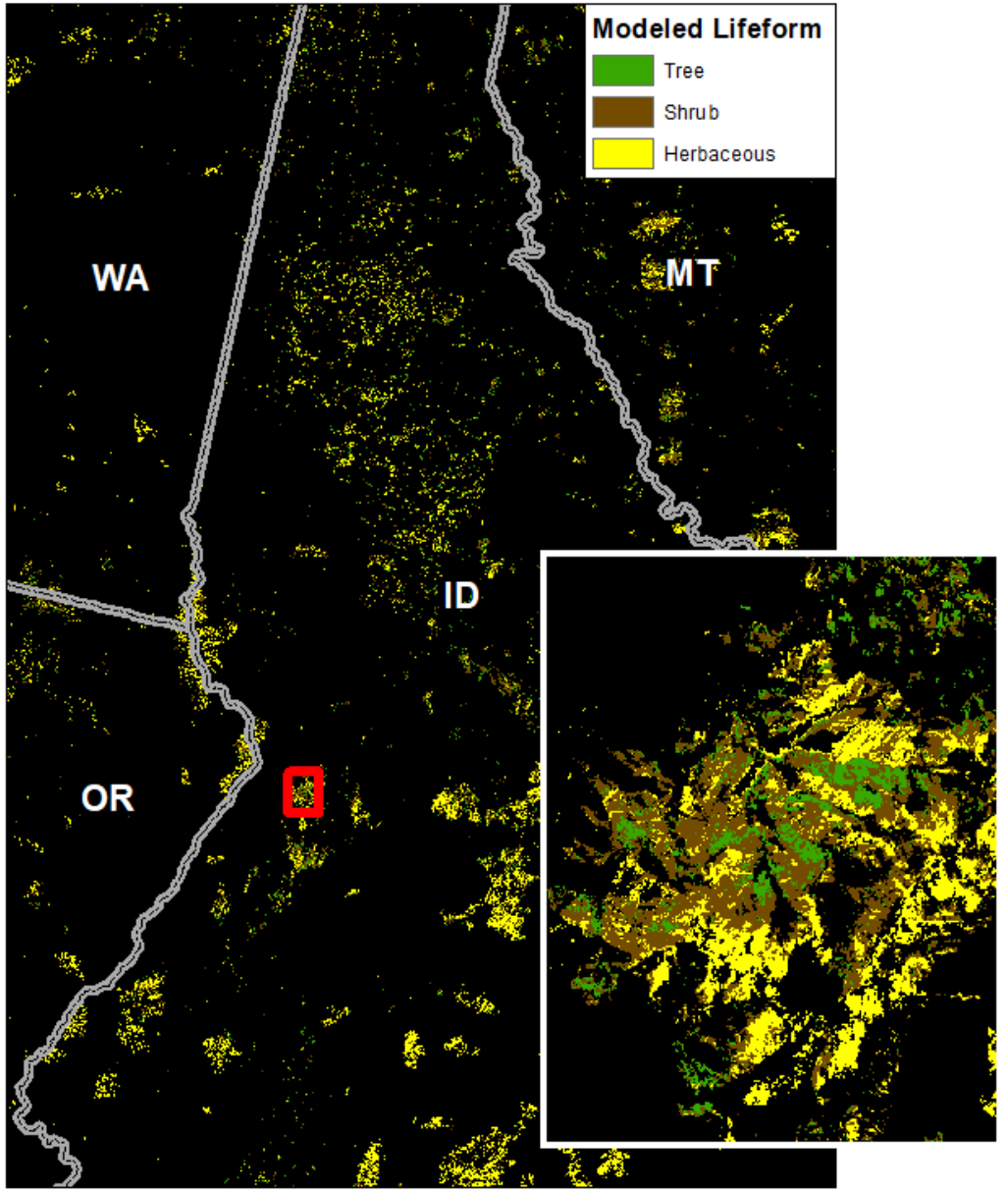






Prototype Area





Lifeform Modeling in Disturbed Areas

High Sun-Angle composite

Add Expert Opinion (Desktop) Plots in difficult areas

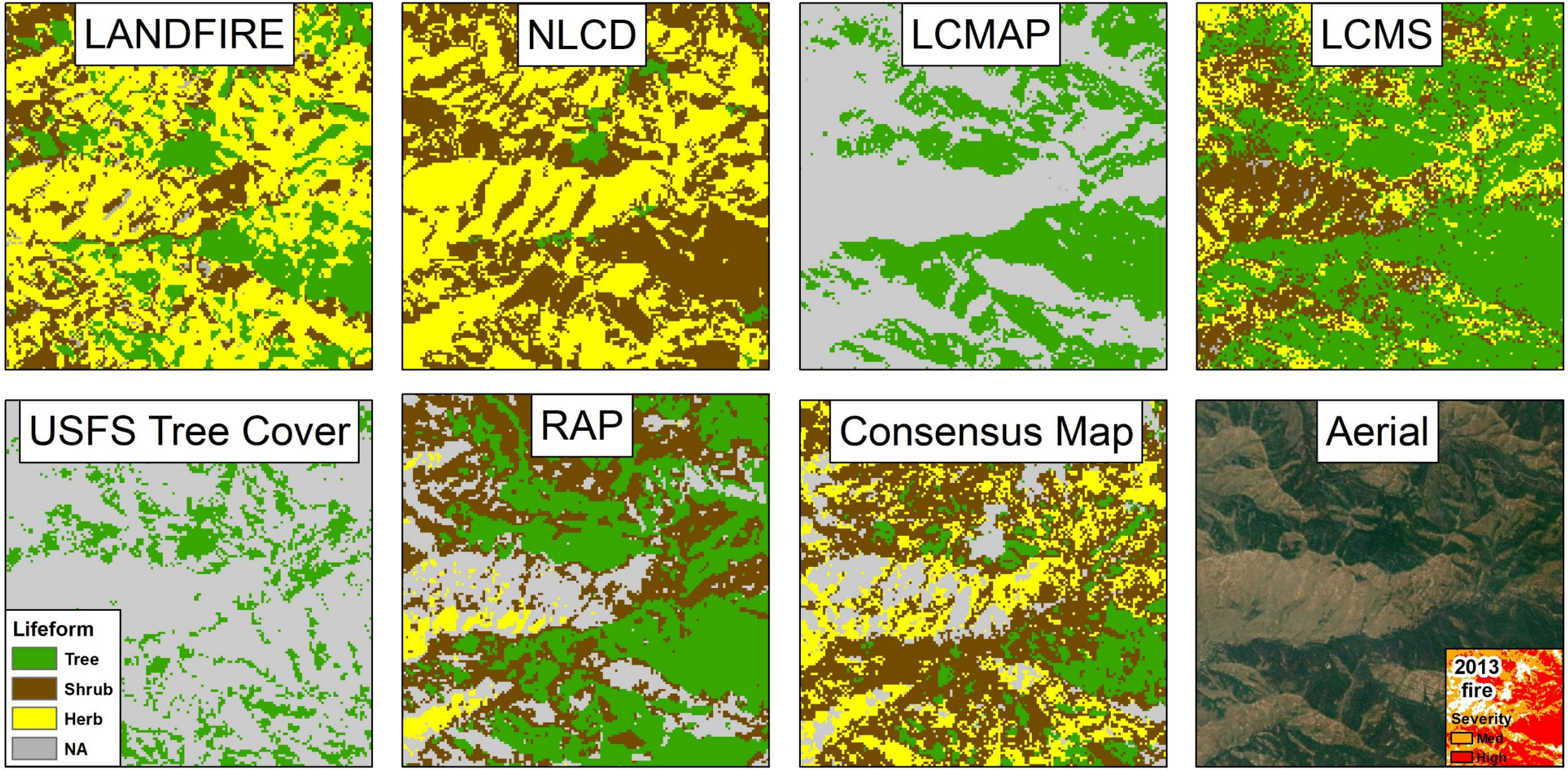
Add independent ‘predictor’ variables

- Disturbance Severity (Low, Med, High) and Year
- Solar Radiation
- Different windows for NDVI image composite
- Seasonal image composites

Balance training plots based on expected proportion of tree/shrub/herb

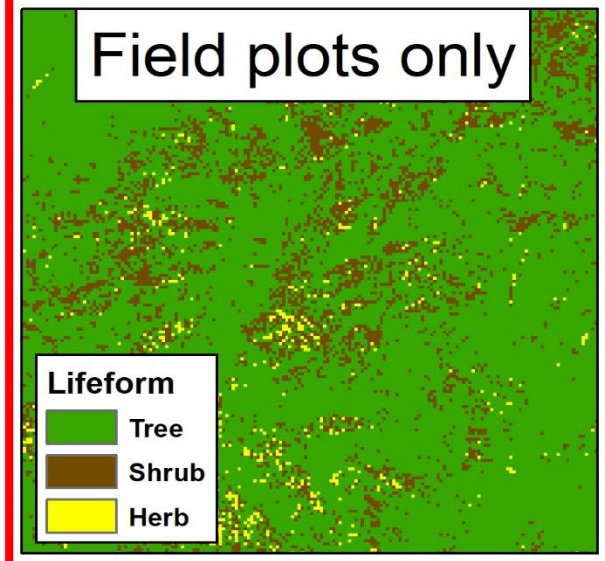
Filtered plots by consensus map

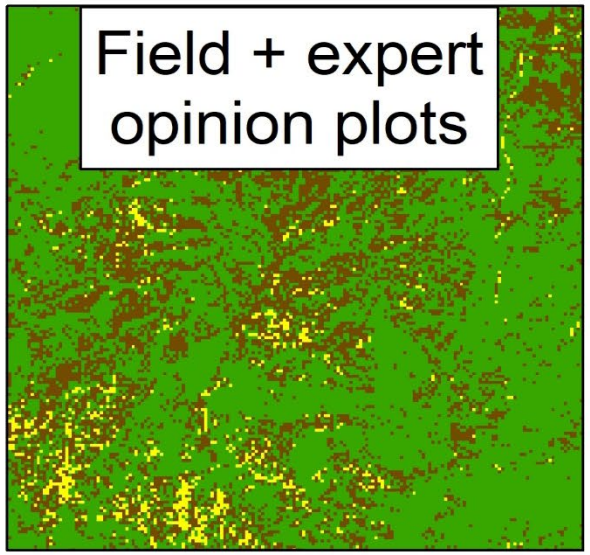
Add training samples from consensus map **in** disturbed areas

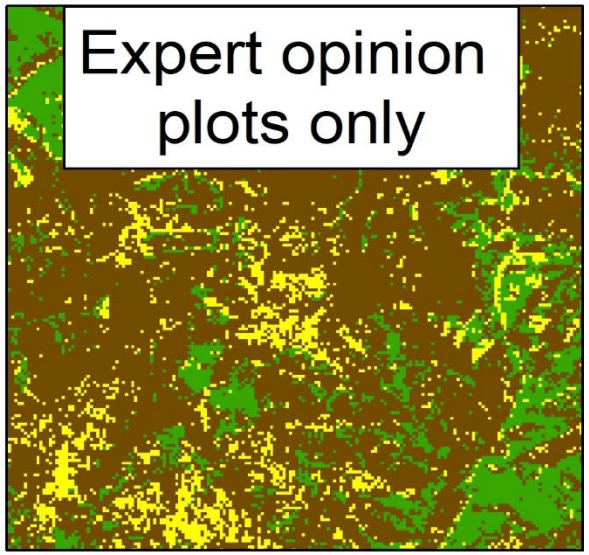


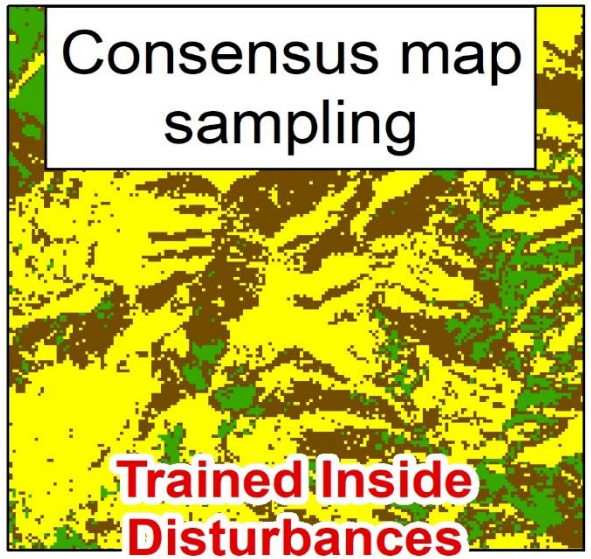
Example of Consensus Map

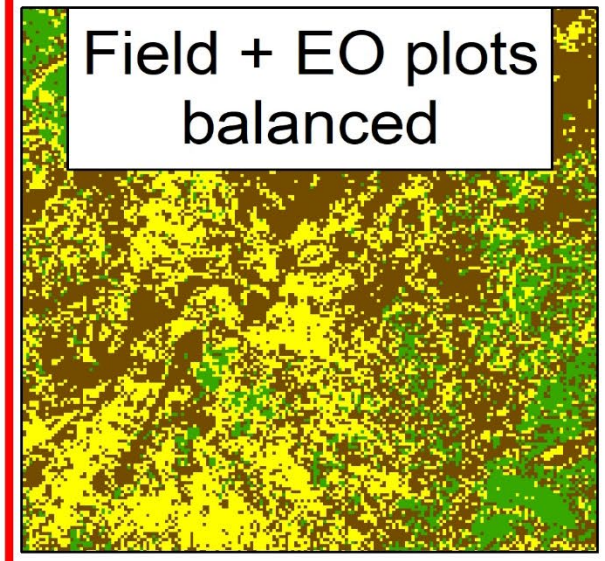
Lifeform Model Outputs

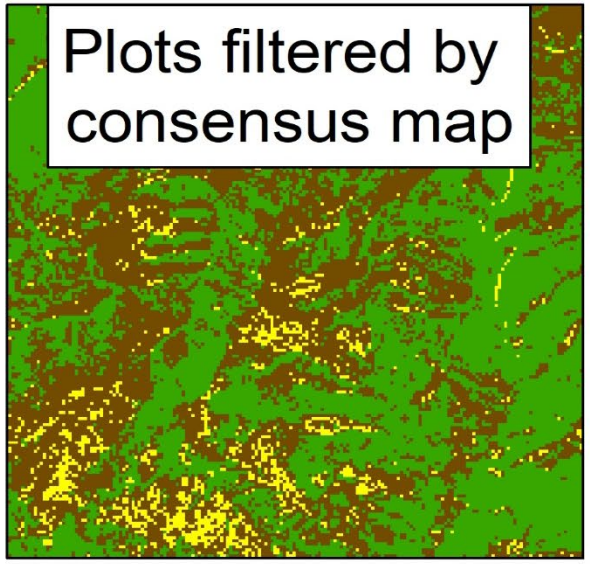


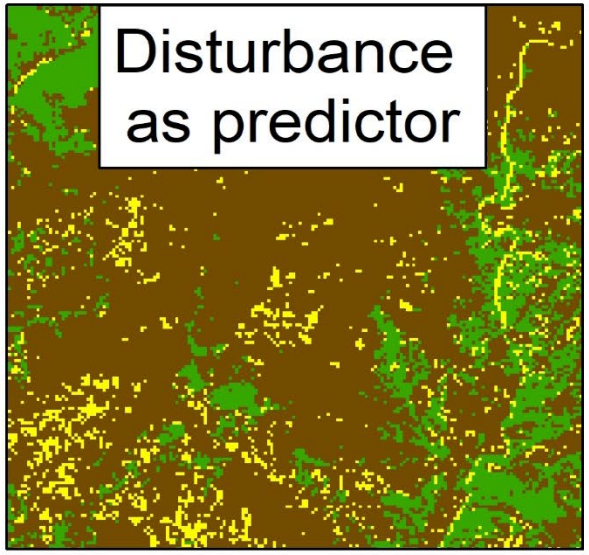


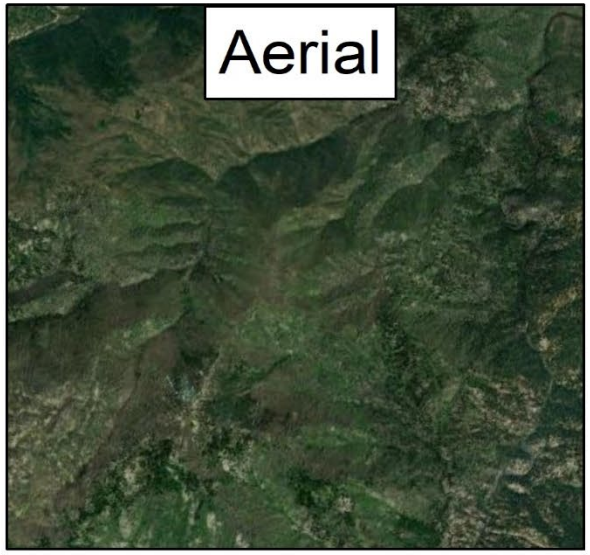












Trained Outside Disturbances

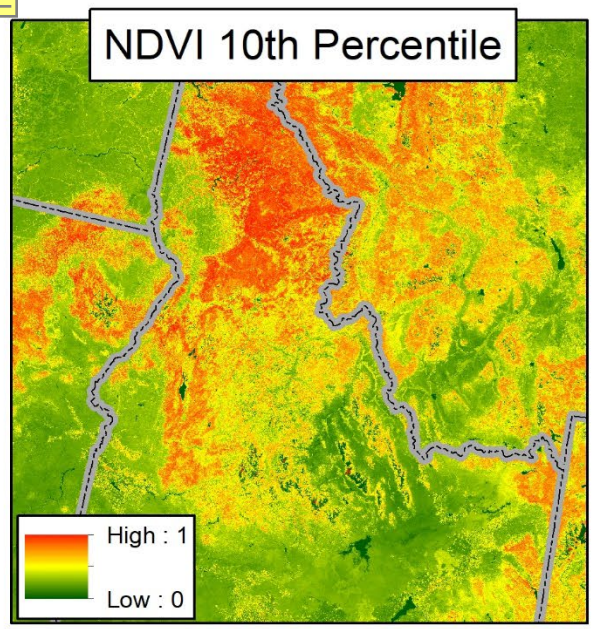
Lifeform Modeling in Disturbed Areas

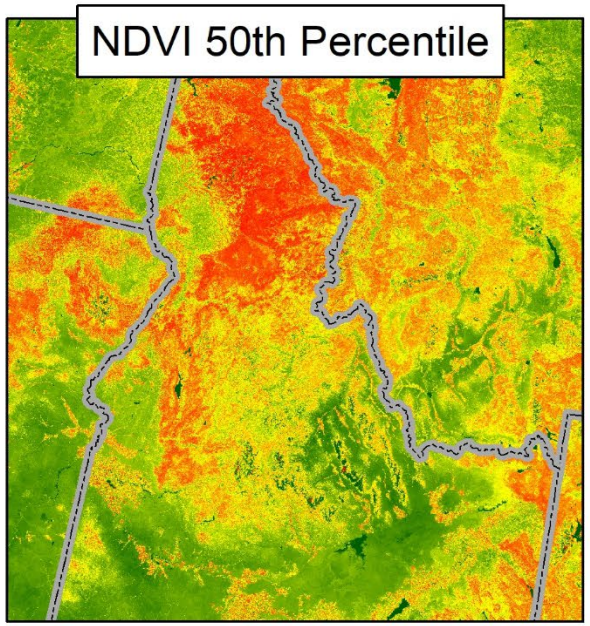
Assessed by consensus map samples in disturbed areas (~6,500)

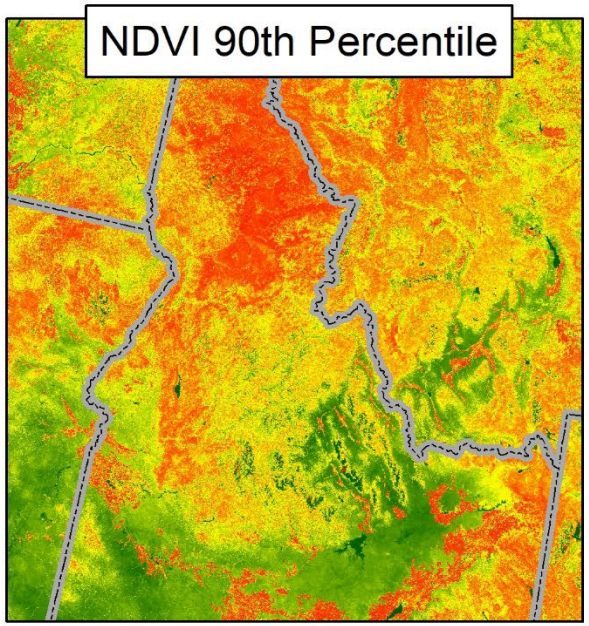
* MCC = Matthew's Correlation Coefficient

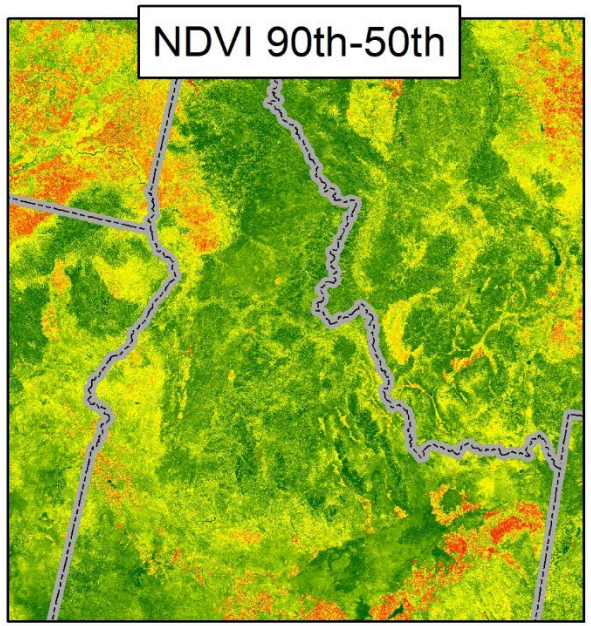
Training	Model Iteration	Row Agreement			Overall	MCC*		
		Tree	Shrub	Herb		Tree	Shrub	Herb
Trained **Outside** Disturbances	LFRDB plots only	6%	14%	92%	20%	16%	-16%	17%
	LFRDB plots with Remap expert opinion plots	9%	15%	87%	32%	22%	-16%	19%
	Remap expert opinion plots only	16%	16%	75%	38%	29%	-17%	4%
	LFRDB plots with revised expert opinion plots	7%	15%	91%	26%	20%	-18%	19%
	Expert opinion plots only	25%	24%	85%	43%	37%	1%	19%
	LFRDB plots and disturbance severity and year rasters as predictors	8%	22%	94%	29%	14%	-7%	19%
	LFRDB plots with revised expert opinion plots and disturbance severity and year rasters as predictors	35%	29%	91%	48%	34%	17%	26%
	LFRDB plots balanced for expected proportions	28%	26%	79%	59%	35%	4%	17%
	LFRDB plots balanced for expected proportions with revised expert opinion plots	28%	25%	79%	51%	32%	2%	13%
	LFRDB plots filtered by consensus map	9%	15%	93%	28%	25%	-21%	22%
	LFRDB plots filtered by consensus map with revised expert opinion plots	12%	16%	91%	32%	29%	-20%	22%
	LFRDB plots filtered by consensus map with solar radiation	9%	14%	92%	27%	24%	-21%	20%
	LFRDB plots filtered by consensus map with revised expert opinion plots and solar radiation	12%	17%	90%	30%	29%	-19%	19%
Trained **Inside** Disturbances	Consensus Map Sampling	76%	71%	87%	81%	68%	56%	70%
NA	Ruleset (LF2020)	30%	38%	70%	56%	29%	10%	23%

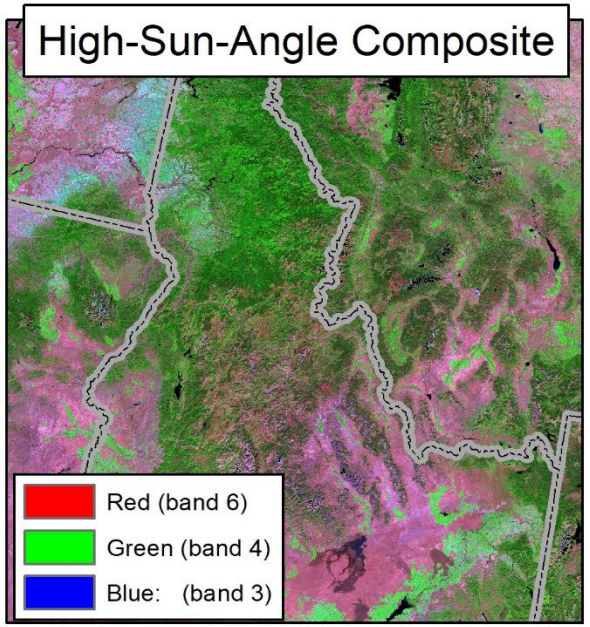
Note: all models generated with See5 using same image composites (high-sun-angle, tasseled cap, and NDVI)

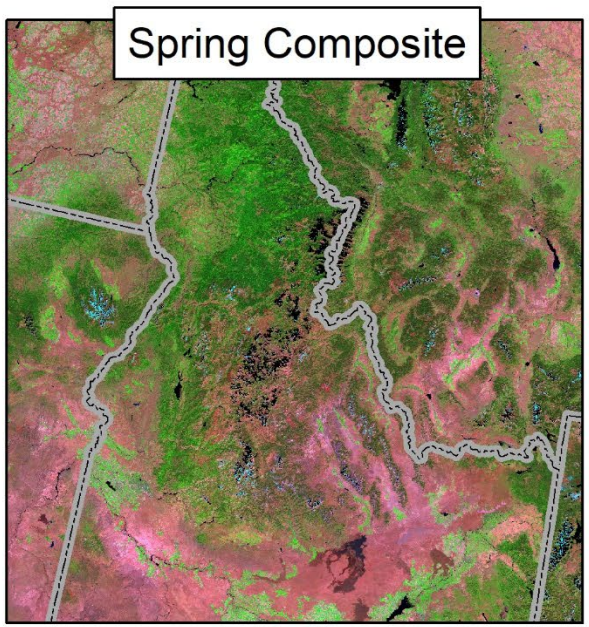

NDVI 10th Percentile
High : 1
Low : 0

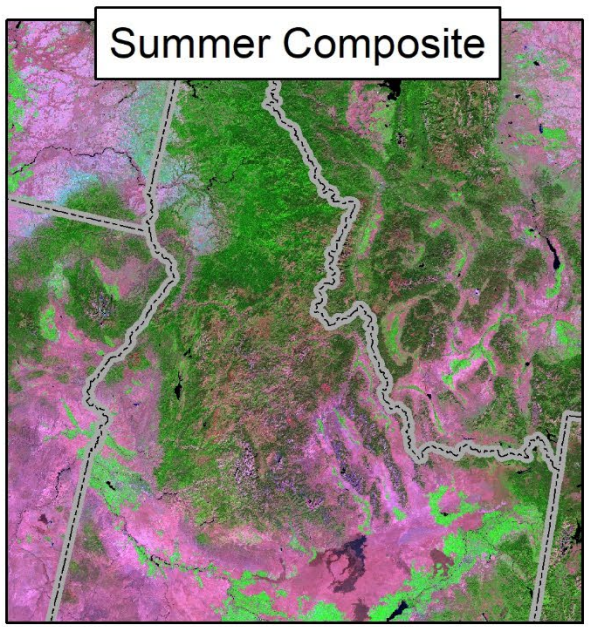

NDVI 50th Percentile


NDVI 90th Percentile


NDVI 90th-50th


High-Sun-Angle Composite
Red (band 6)
Green (band 4)
Blue: (band 3)


Spring Composite


Summer Composite

Fall Composite

Disturbed Areas – different composites

Name	Row Agreement			Overall	MCC*		
	Tree	Shrub	Herb		Tree	Shrub	Herb
High-Sun-Angle, Fall, Summer, NDVI short and long, Solar Radiation	70%	70%	89%	84%	54%	56%	64%
High-Sun-Angle, Fall, Summer, NDVI long, Solar Radiation	65%	70%	88%	84%	49%	55%	64%
High-Sun-Angle, Fall, Summer, NDVI long	68%	69%	88%	84%	53%	54%	63%
High-Sun-Angle, NDVI long	64%	66%	87%	83%	46%	51%	60%
High-Sun-Angle, NDVI short	64%	67%	87%	83%	48%	51%	60%
Fall, Summer, NDVI short and long, Solar Radiation	67%	70%	89%	84%	50%	56%	65%
Fall, Summer, NDVI short and long	66%	70%	88%	84%	52%	55%	64%
Fall, Summer, NDVI long	66%	68%	88%	76%	0%	29%	40%
Summer, NDVI short and long	71%	66%	87%	82%	48%	50%	59%
Summer, NDVI short and long, Solar Radiation	68%	69%	88%	84%	49%	54%	63%
Summer, NDVI long, Solar Radiation	70%	73%	88%	84%	55%	54%	62%
Summer, NDVI long	66%	66%	87%	82%	45%	49%	59%
Summer	64%	63%	86%	81%	42%	47%	57%
NDVI long, Solar Radiation	53%	64%	86%	81%	33%	46%	56%
NDVI long	66%	68%	88%	83%	48%	53%	62%

* MCC = Matthew's Correlation Coefficient

Note: all models generated with See5 trained with consensus map samples

Lifeform Modeling Outside Disturbances

Removed old field plots (pre-2000)

Manually labeled additional field plots

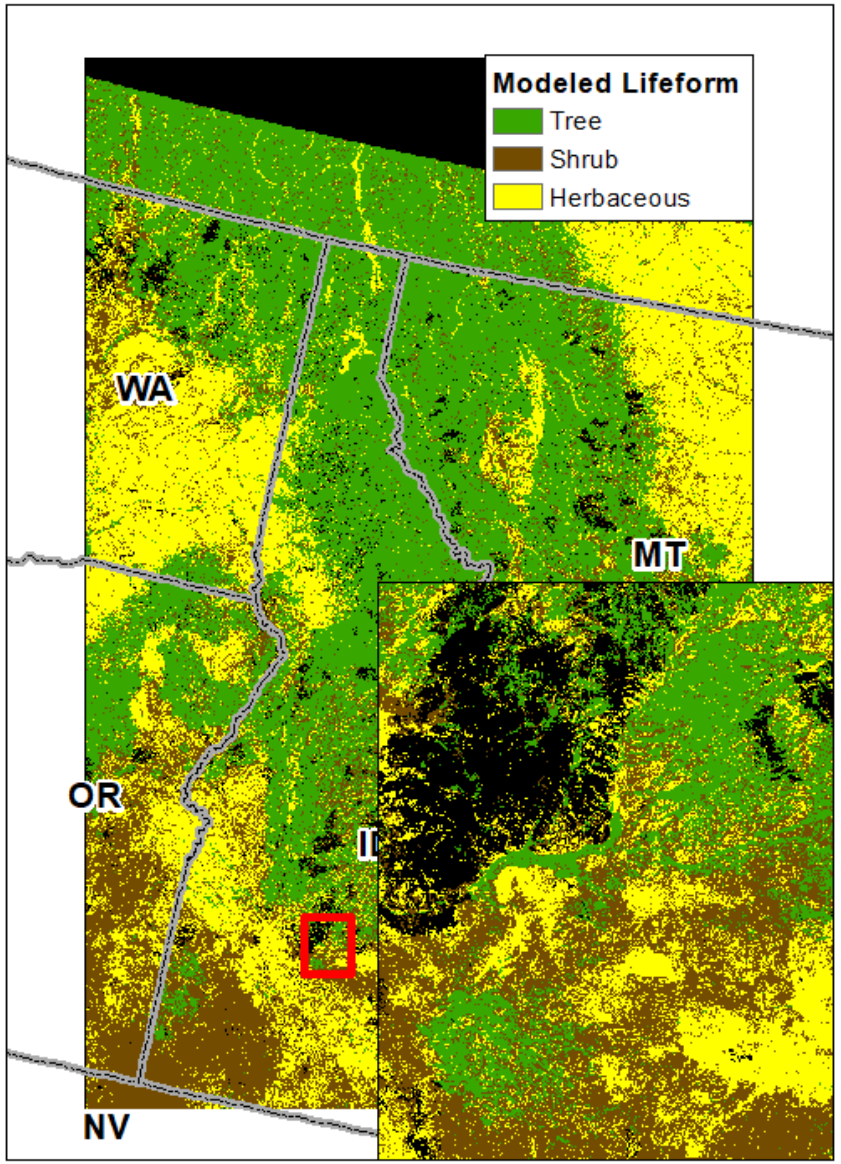
Added expert opinion plots based on aerials

Filtered field plots by consensus map

Added plots by consensus map sampling

Balanced plots by expected proportions in map

Assessed using 1,123 LCMAP reference plots



Lifeform Modeling in Non-Disturbed Areas

Model Iteration	Assessed with 10% holdout				Assessed with LCMAP reference plots				
	Overall	MCC*			Overall	Row Agreement		MCC*	
		Tree	Shrub	Herb		Tree	Shrub/Herb	Tree	Shrub/Herb
LFRDB plots	80%	80%	80%	80%	91%	84%	98%	82%	82%
Removed old plots (pre-2000)	80%	79%	65%	39%	90%	83%	98%	81%	81%
Added manually labeled plots	78%	71%	57%	46%	91%	86%	97%	83%	83%
LFRDB plots filtered by consensus map	93%	94%	84%	72%	92%	86%	97%	84%	84%
Consensus map samples	96%	99%	89%	87%	92%	88%	97%	85%	85%
LFRDB plots filtered by consensus map, removed old plots	92%	95%	85%	63%	92%	86%	97%	84%	84%
LFRDB plots filtered by consensus map, removed old plots, added manually labeled plots	91%	90%	83%	63%	92%	87%	97%	85%	85%
LFRDB plots filtered by consensus map, removed old plots, added manually labeled plots, added expert opinion plots	90%	90%	80%	79%	93%	89%	96%	85%	85%
LFRDB plots filtered by consensus map, removed old plots, added manually labeled plots, added expert opinion plots, balanced	90%	90%	81%	60%	93%	91%	96%	86%	86%
Combined above with consensus map samples	94%	97%	87%	84%	93%	88%	98%	86%	86%
Combined with expert opinion plots	94%	96%	85%	84%	93%	88%	97%	86%	86%
Combined and balanced	93%	97%	86%	82%	93%	90%	96%	86%	86%
LF2016 Remap					92%	90%	93%	83%	83%

Note: all models generated with See5 using same image composites (high-sun-angle, tasseled cap, fall, summer, NDVI, and solar radiation)

* MCC = Matthew's Correlation Coefficient

Thank you for listening

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