Improving National Shrub and Grass Fuel Maps Using Remotely Sensed Data and Biogeochemical Modeling to Support Fire Risk Assessments--Stage 1 Feasibility Study in the Owyhee Upland

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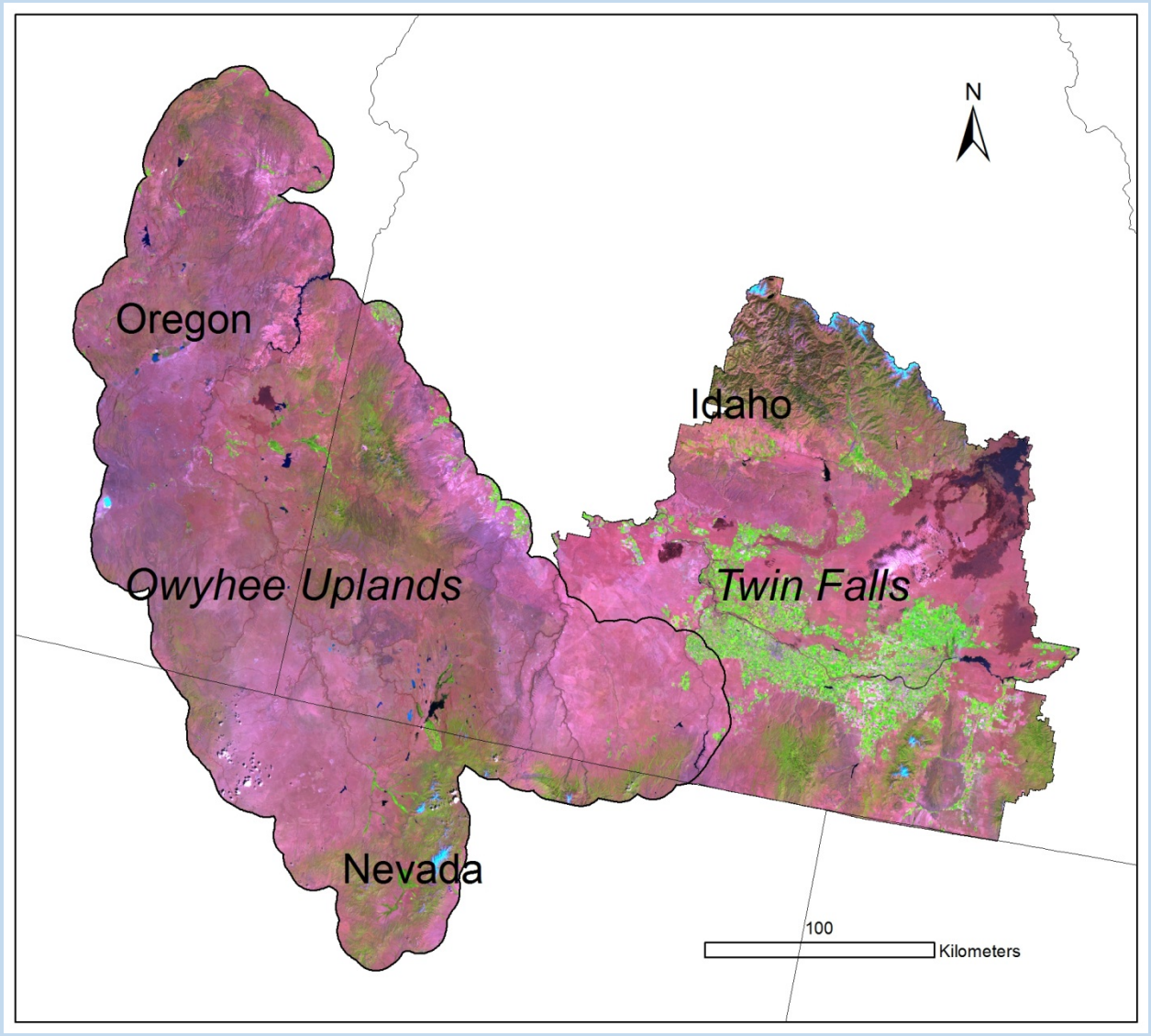
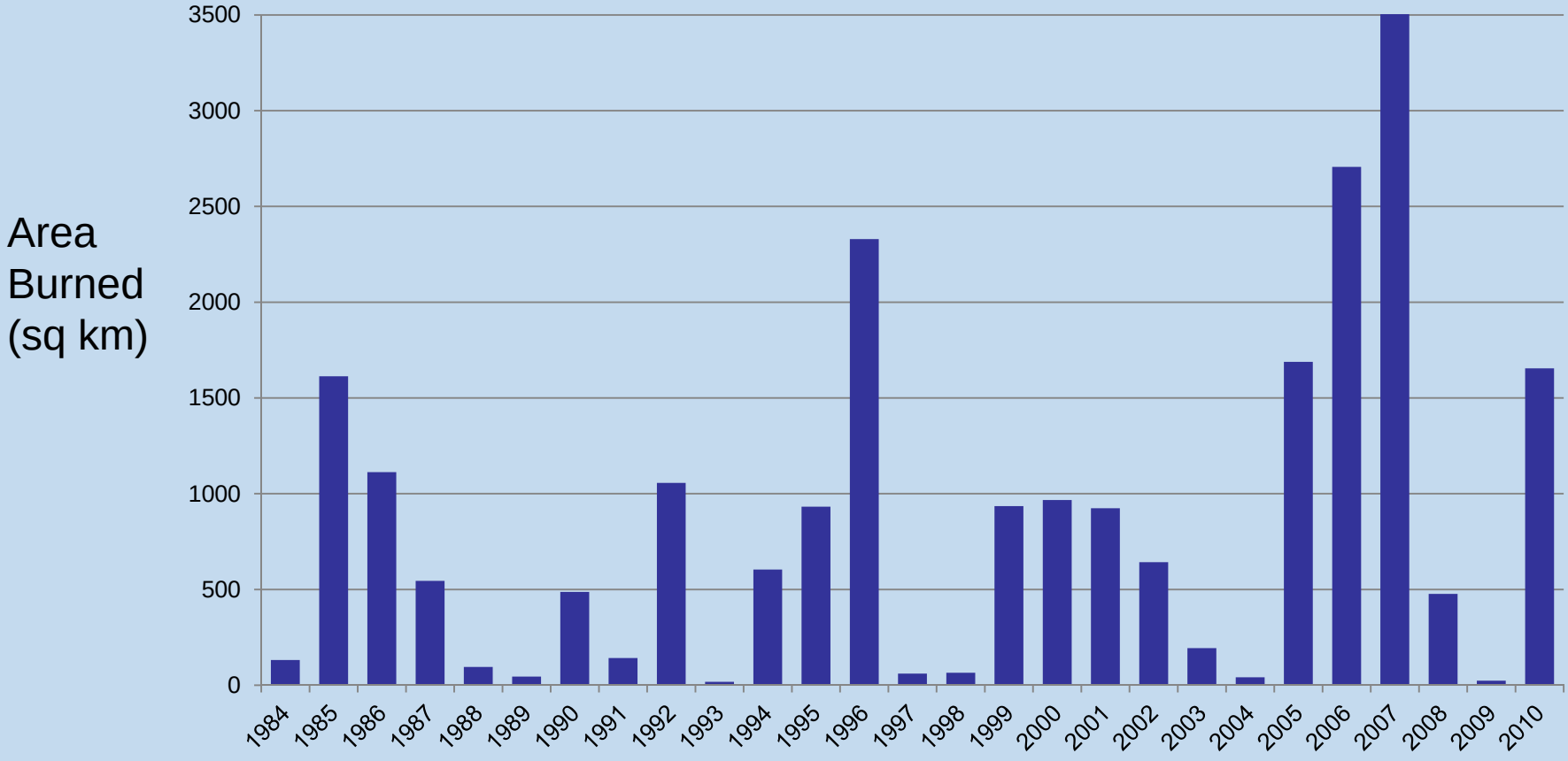
Some Goals of the Our Project

- Improve upon shrub and grassland mapping for fire applications
  - Feasibility effort concentrating on Owyhee Basin in southwest Idaho and parts of adjacent Nevada
- Develop weekly or monthly fuel data sets in shrub and grasslands with Landsat/MODIS data
  - Make use of temporal frequency of MODIS, and ultimately meld this information with higher resolution Landsat data
- Determine if improvements in shrub and grass data layers will improve fire behavior model results
  - e.g. FARSITE model simulations


N
Oregon
Idaho
Owyhee Uplands
Twin Falls
Nevada
100
Kilometers

Study Area

Amount of Area Burned in Study Area (based on MTBS data)



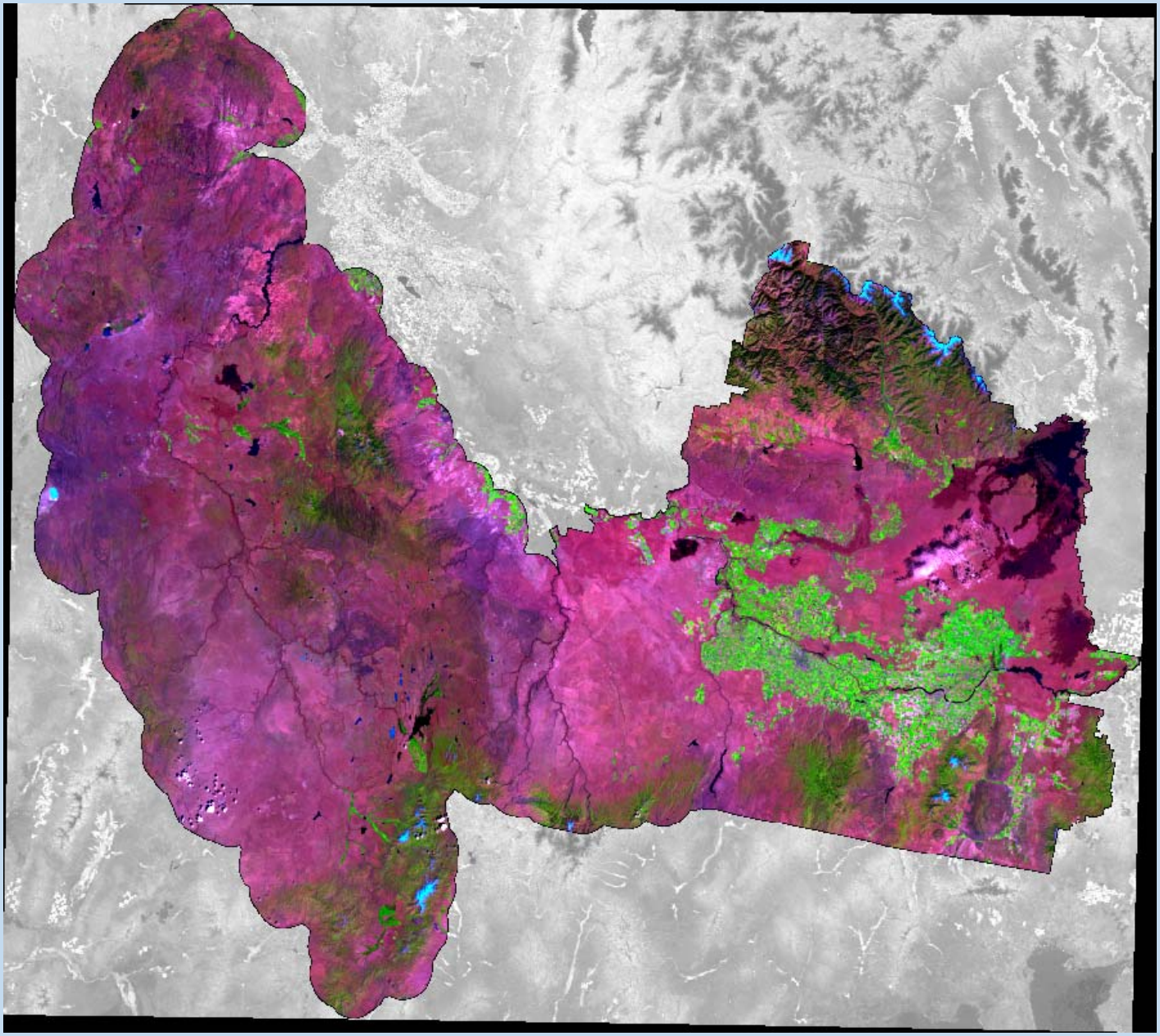
Data sets

- Much of initial stages of project has involved “data mining”
- Major data sets used thus far:
  - Enhanced MODIS weekly composites (2000-2011)
  - Daymet (precip, max temp, min temp)
  - LANDFIRE (fuels, vegetation type)
  - Monitoring Trends in Burn Severity (MTBS)
  - Landsat (including Web Enabled Landsat Data)
  - Field information from BLM

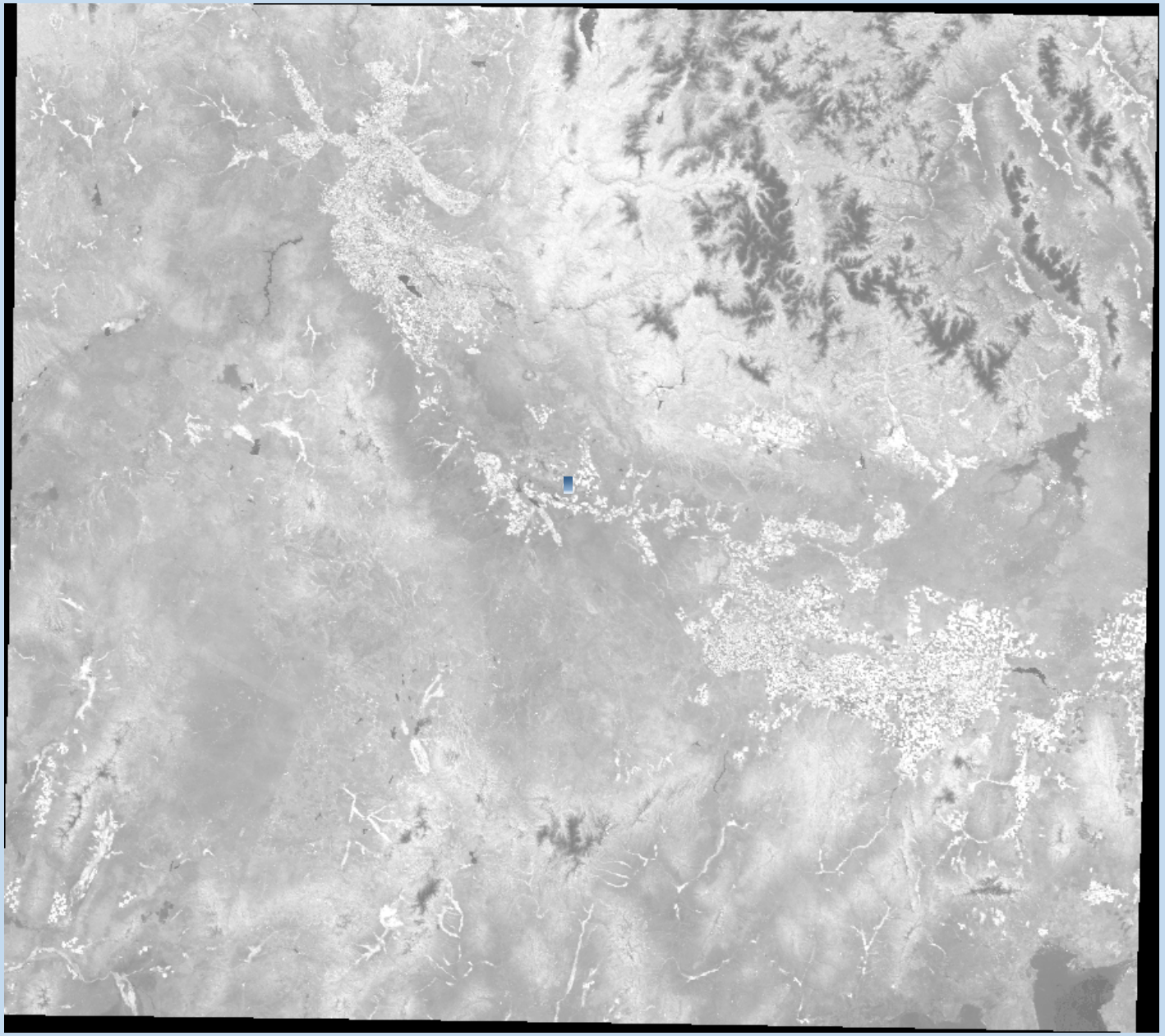
Some Approaches Used

- Trend analyses and data mining
  - How has NDVI changed over time period in Owyhee Basin?
  - How has climate changed over time period in Owyhee Basin?
  - How do shrub and grasslands vary spectrally intra- and inter-annually in Owyhee Basin?
  - How do shrubland NDVI conditions relate to fire in Owyhee Basin?
  - Much of the above was done using EMODIS data
- Translation of NDVI to data meaningful to fire community
  - Grams biomass per square meter
  - Inferred from shrub and grassland biomass data in the literature
- Data merging (ESTARFM)
  - Can we combine the high temporal frequency MODIS data with the high spatial resolution of Landsat?
- Fire spread simulations with improved fuel data layers
  - Farsite
  - Compare simulated results with actual data from fires that have recently burned

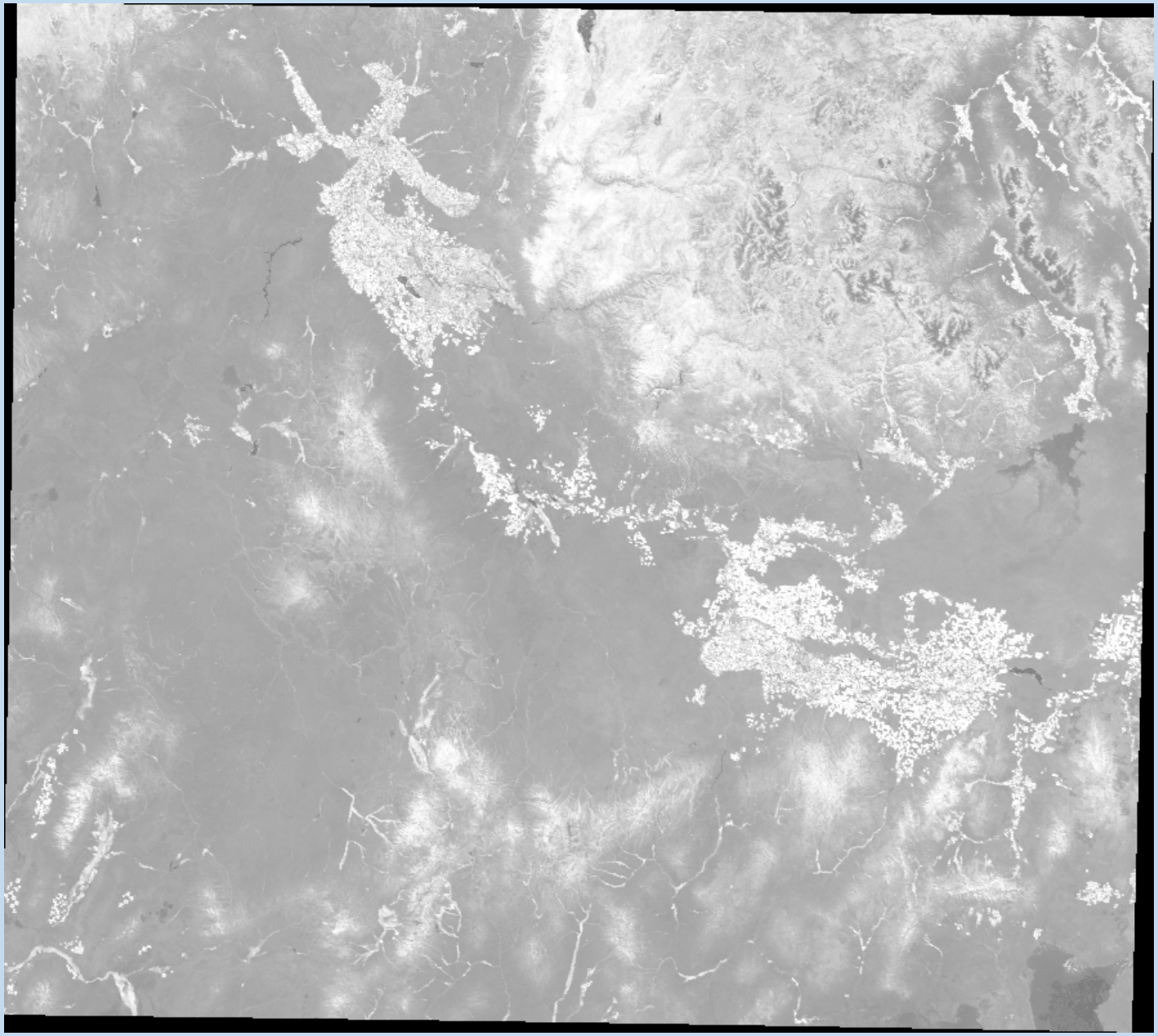
EMODIS NDVI Monthly Composite; June 2011 (With Landsat Overlay)



EMODIS NDVI Monthly Composite; June 2011



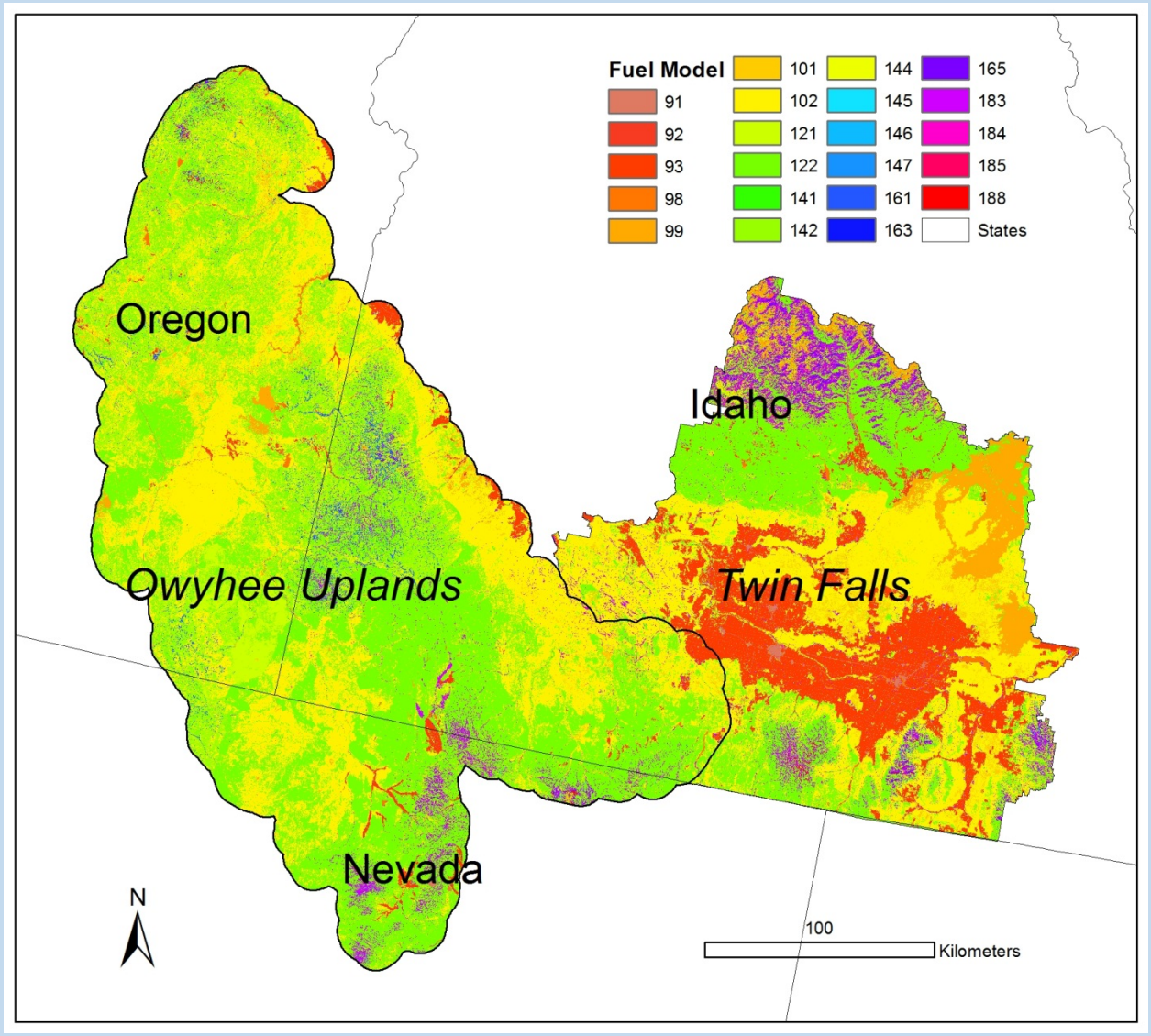
EMODIS NDVI Monthly Composite; August 2011



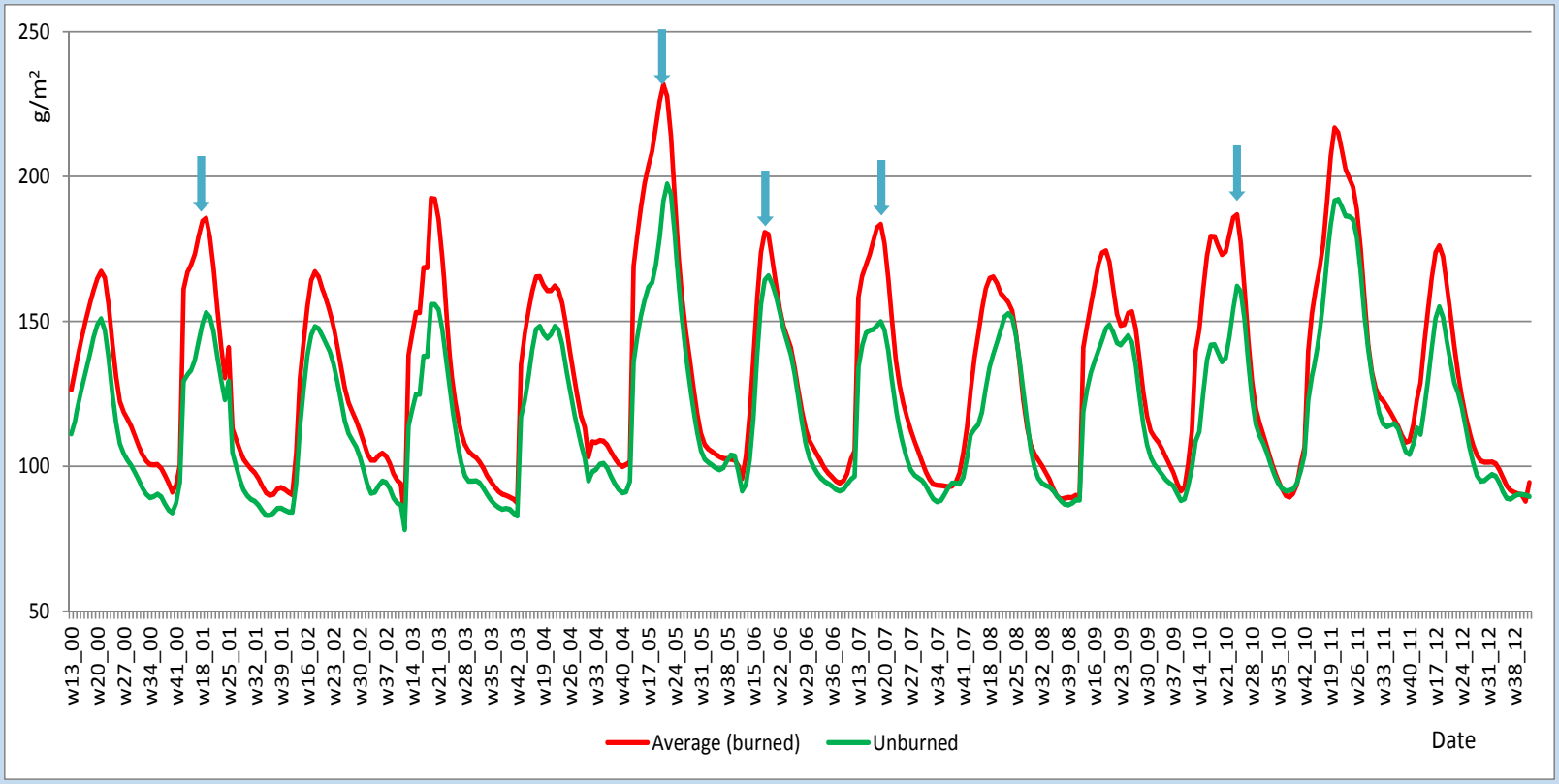
LANDFIRE Scott Burgan (40) Fuel Models

Yellow is a single Grass-Shrub Fuel Class

Green is a single Shrub Fuel Class



Seasonal Live Biomass Profile for Shrublands. Red indicates live biomass for sagebrush sites that have burned at least once between 1984 and 2010. green indicates sites that have never burned. Blue arrows indicate high fire years.



Grassland plots show the same patterns, except that NDVI values tend to be slightly higher

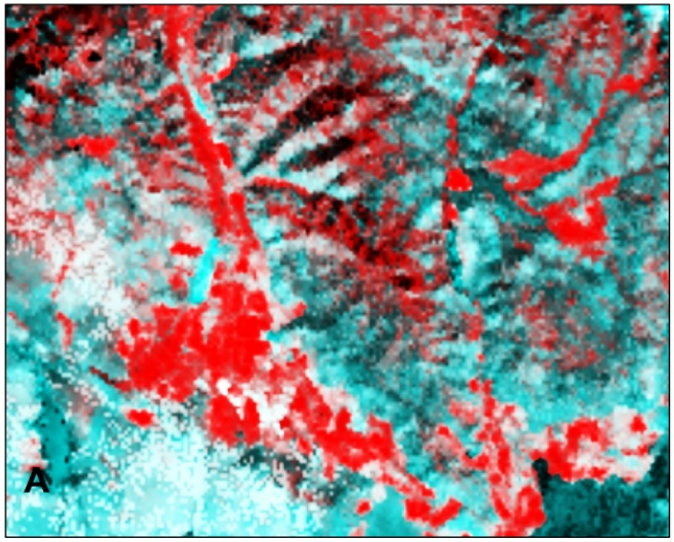
ESTARFM

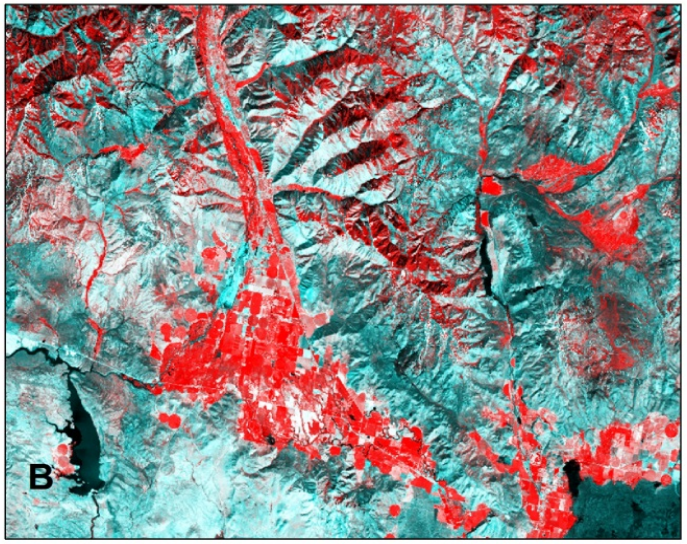
- Approach that enables merging of different resolution imagery (e.g. MODIS and TM)
- Enables one to “fill in the gaps” when only coarse resolution imagery is available for date of interest when you need high resolution imagery
- In the following example, started with:

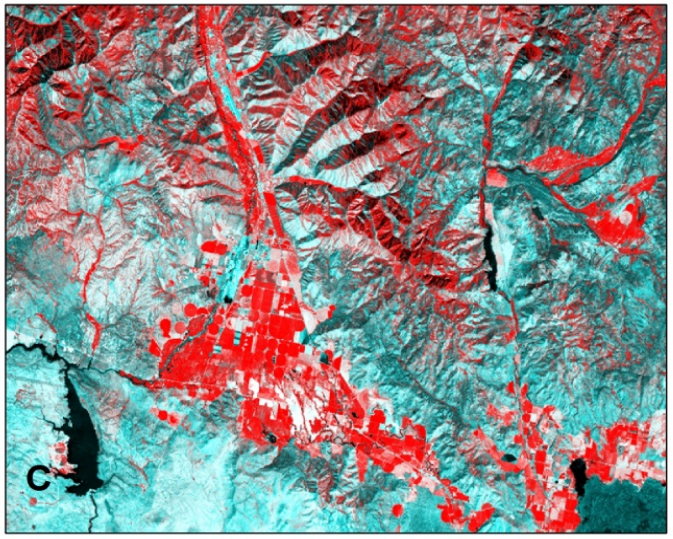
  MODIS data from Time A, Time B and Time C.
  Landsat data from Time A and Time C.

  Use above data to generate Landsat-like imagery from Time B.

ESTARFM Results







A: EMODIS Julian Date 171, 2006

B: ESTARFM Projected Landsat Like Image, Julian Date 171, 2006

C: Actual Landsat Image, Julian Date 171, 2006

Key from this is that we use EMODIS data to bridge the Landsat temporal data gap, providing LANDFIRE-scale resolution

Table 1. Fuel load values used for simulating fire behavior and fire spread.

		Fuel loads (tons per acre)				
Fuel type	Fuel Load	Live herbaceous	Live woody	1-hour dead	ERC	FL
Grass	High (2005)	1.46	0.00	1.75	36	11
Grass	Moderate (2007)	1.16	0.00	2.01	35	11
Grass	Low (2008)	0.93	0.00	0.00	8	5
Grass	Default (GR2)	1.00	0.00	0.10	10	6
Shrub	High (2005)	0.78	4.44	1.39	47	6
Shrub	Moderate (2007)	0.58	4.30	1.57	47	6
Shrub	Low (2008)	0.51	0.68	0.00	17	3
Shrub	Default (GS2)	0.60	1.00	0.50	37	5

Some key observations

- There is much seasonal variability in NDVI in shrub and grasslands
- There is much inter-annual variability in NDVI
- Areas with high NDVI in spring and low NDVI in summer have higher propensity for fire
- There appears to be limited variability in LANDFIRE Fuel Model data sets in these areas
- Use of the “new” fuel data sets result in different ERC and FL values in simulated fire behavior/spread models as compared with LF