Using Remote Sensing Data in Assessing Past Productivity and Future Resource Availability in the NWF Region of Pakistan

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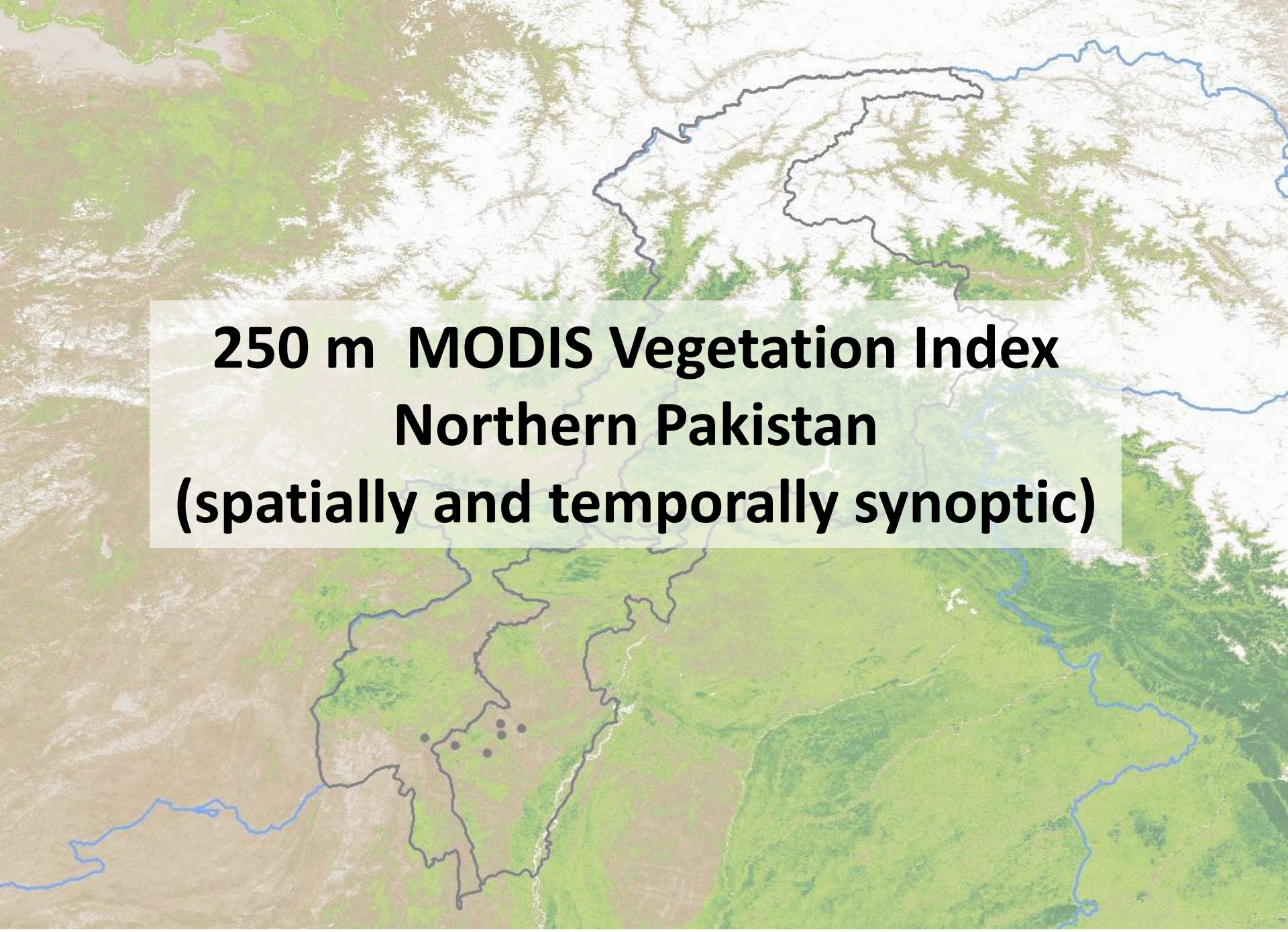
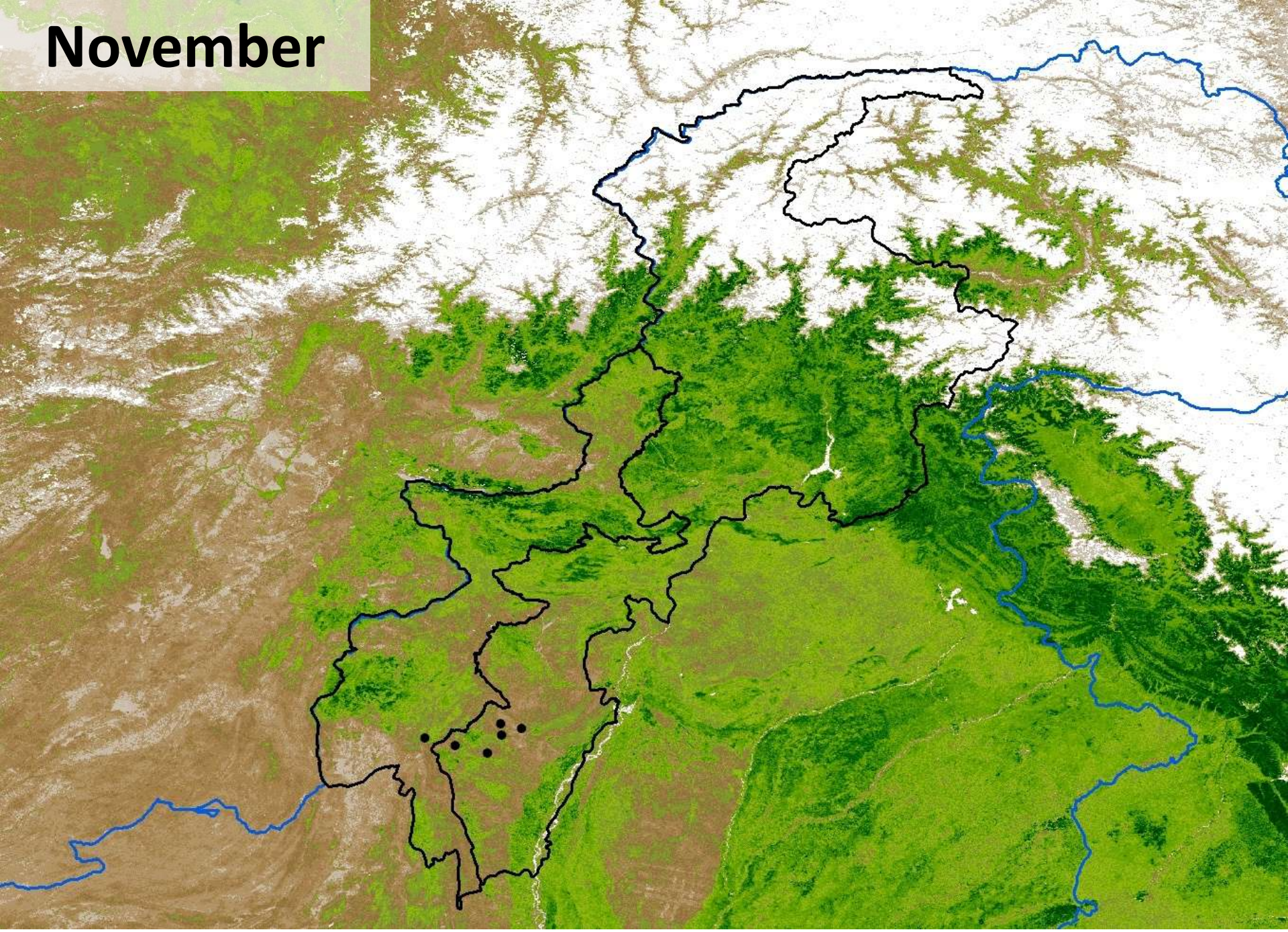
Value of Remote Sensing for Watershed Assessment and Monitoring

1. Spatially and temporally synoptic
2. Sample stratification
3. Prioritization of sites based on specific criteria
4. Extrapolation of field measures
5. Monitoring rehabilitation efforts
6. Can be combined with other geospatial data as a response or predictor


250 m MODIS Vegetation Index
Northern Pakistan
(spatially and temporally synoptic)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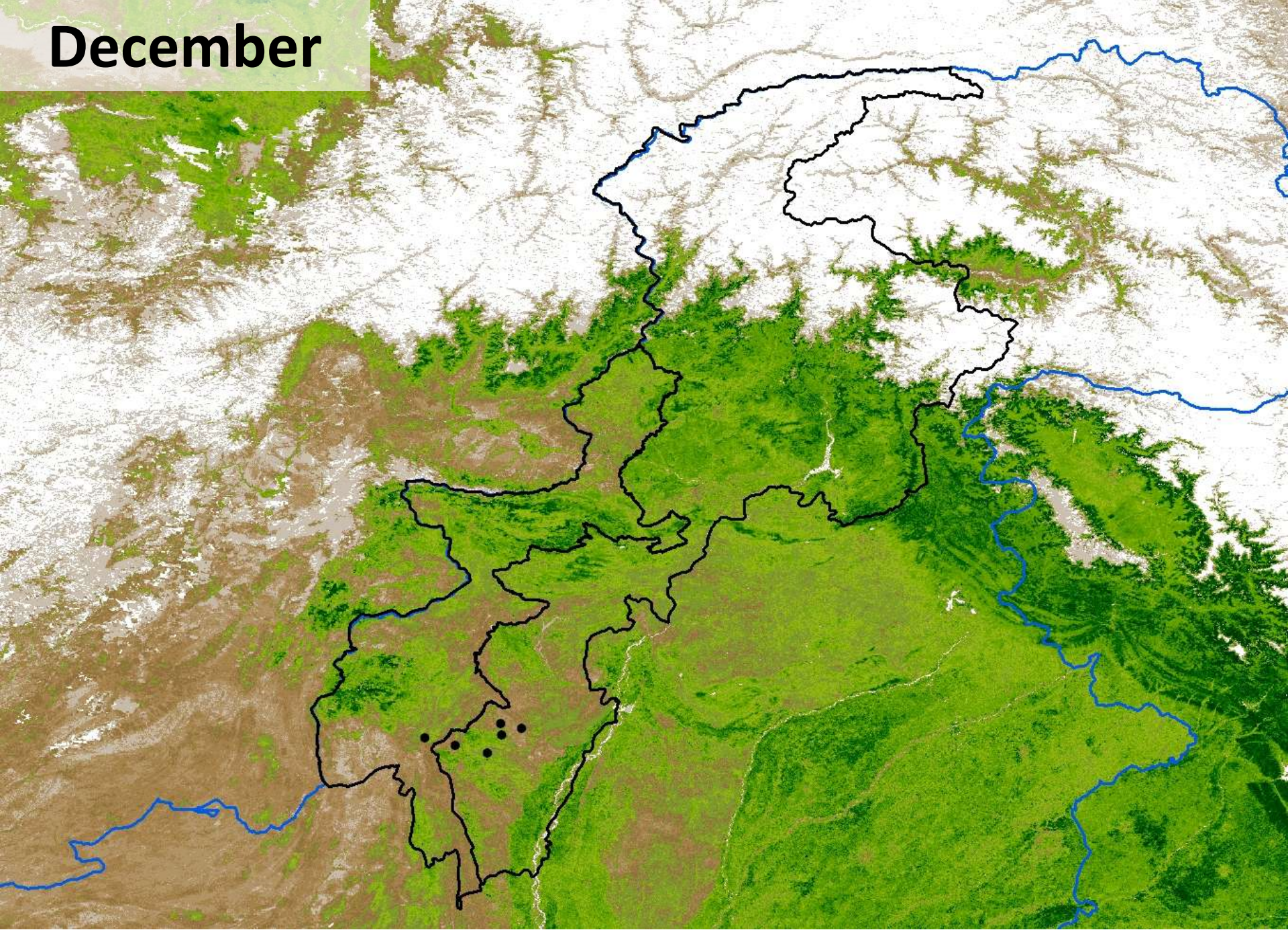
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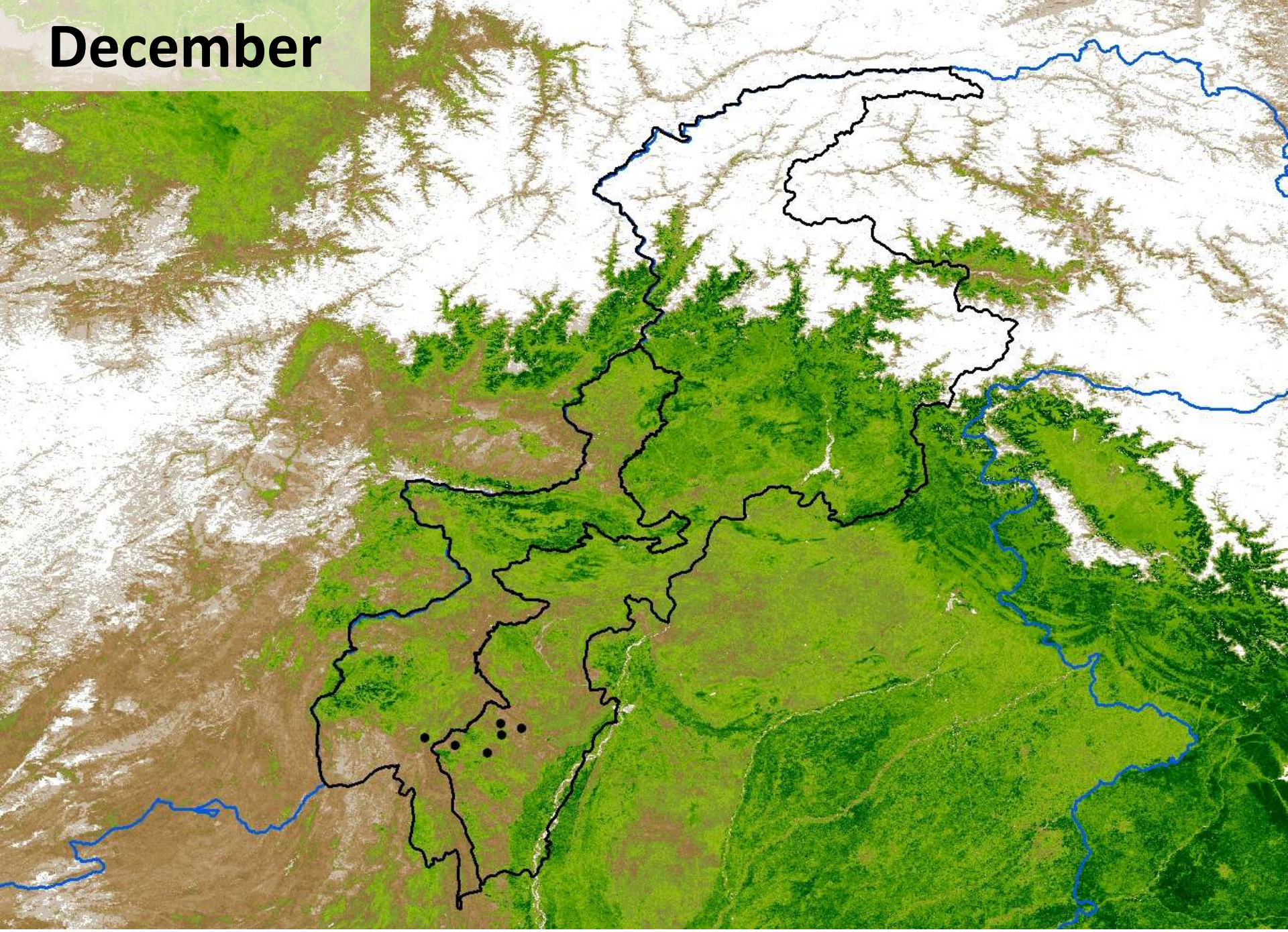
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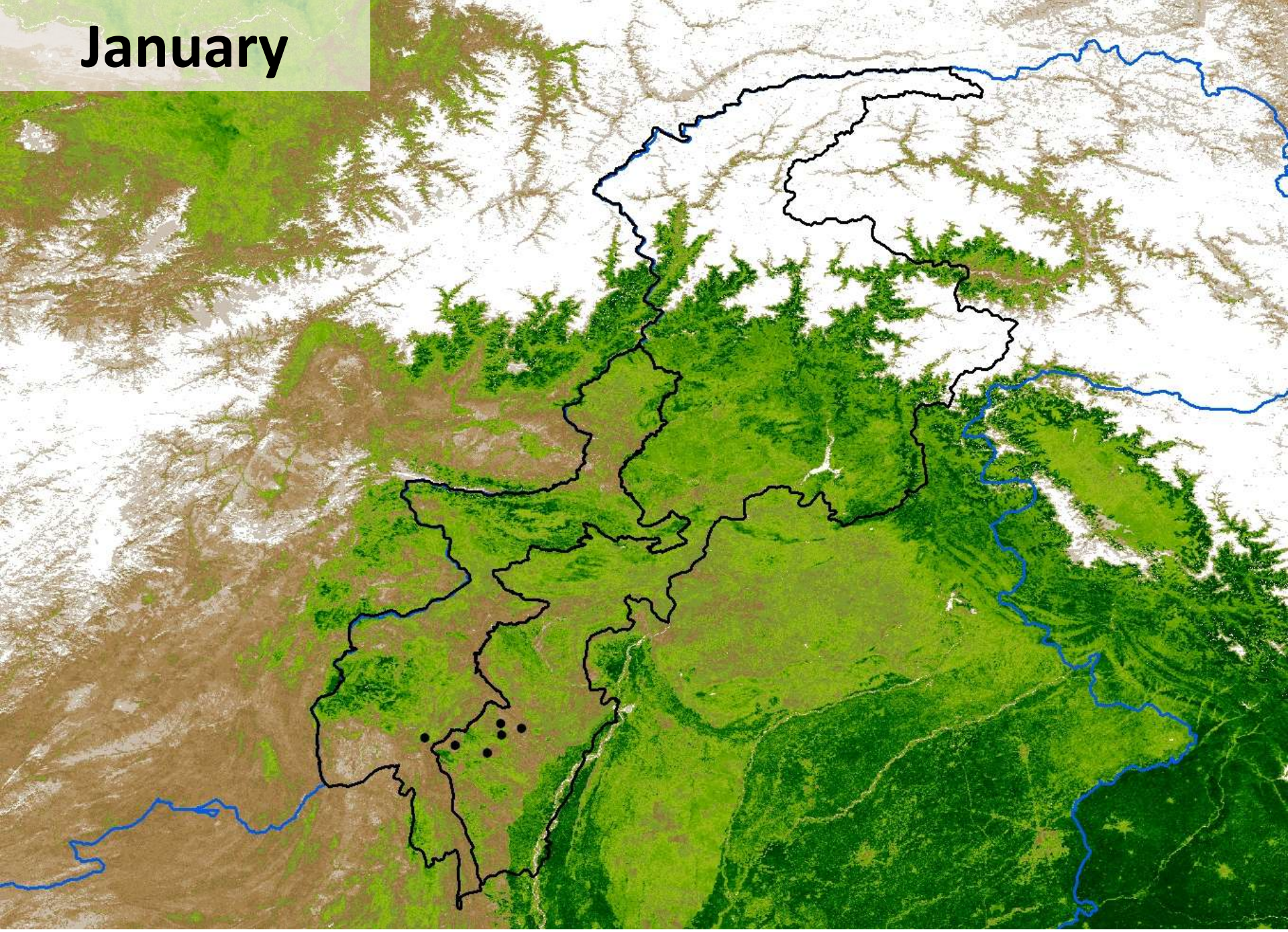
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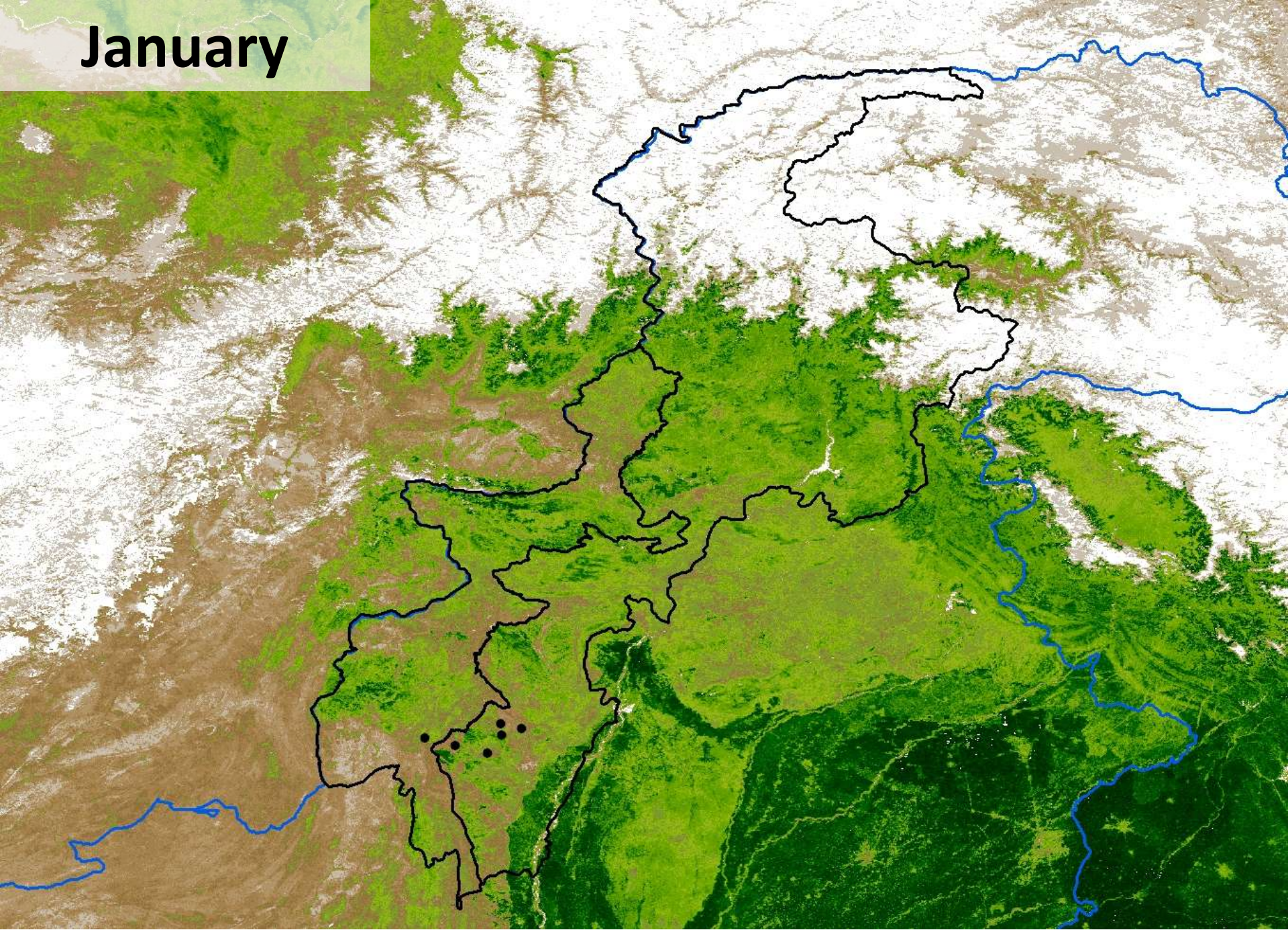
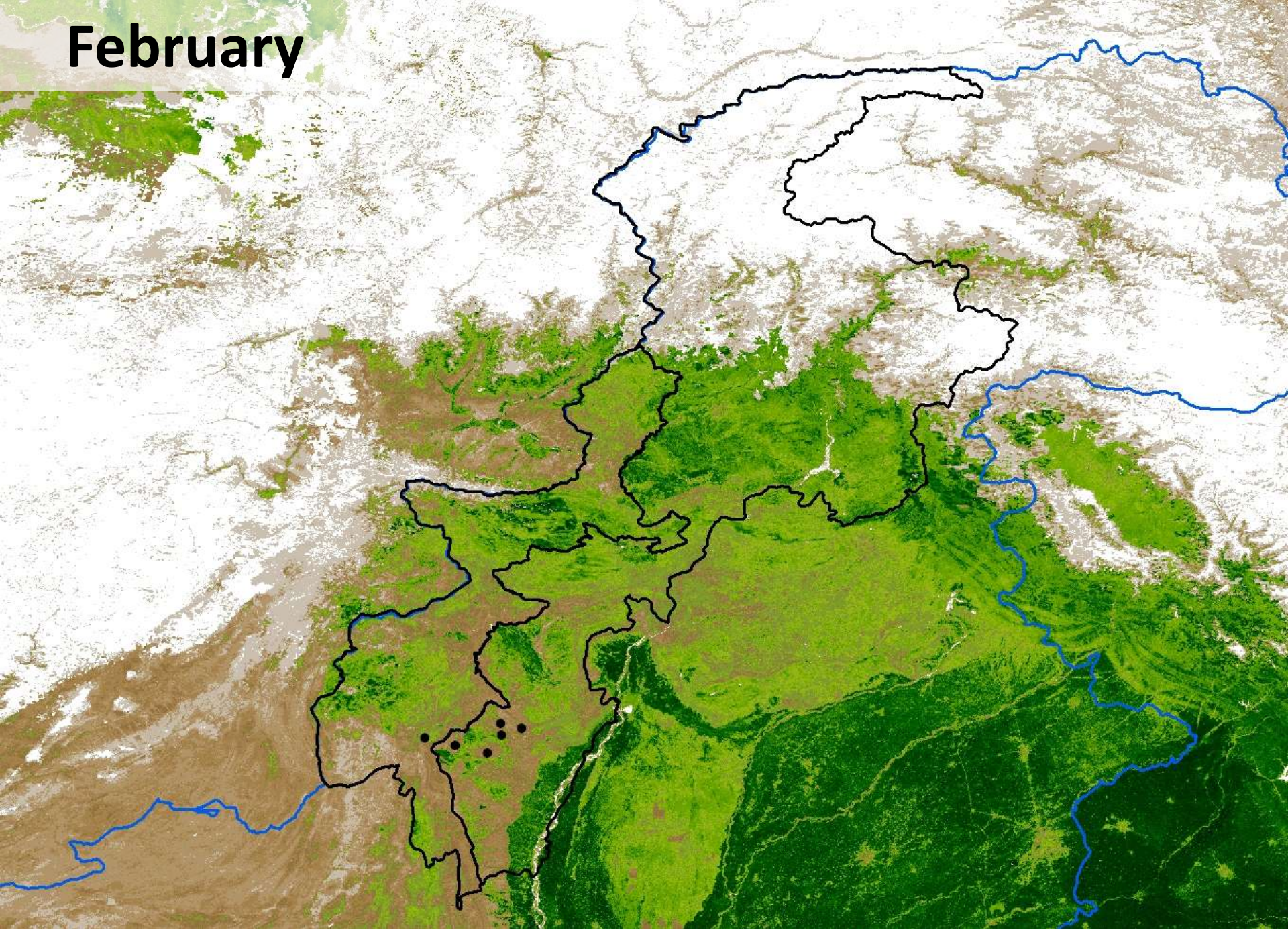
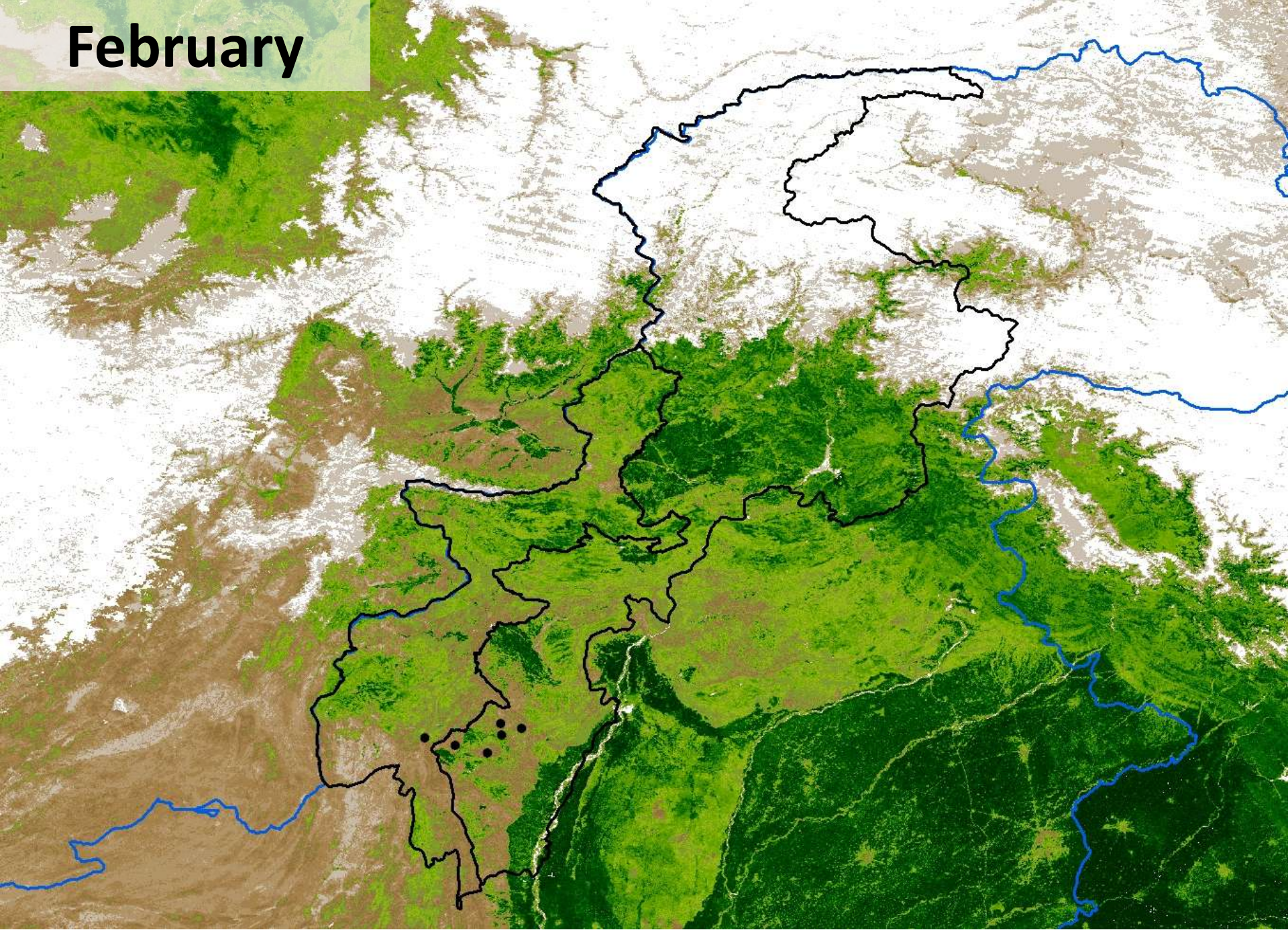

January

February

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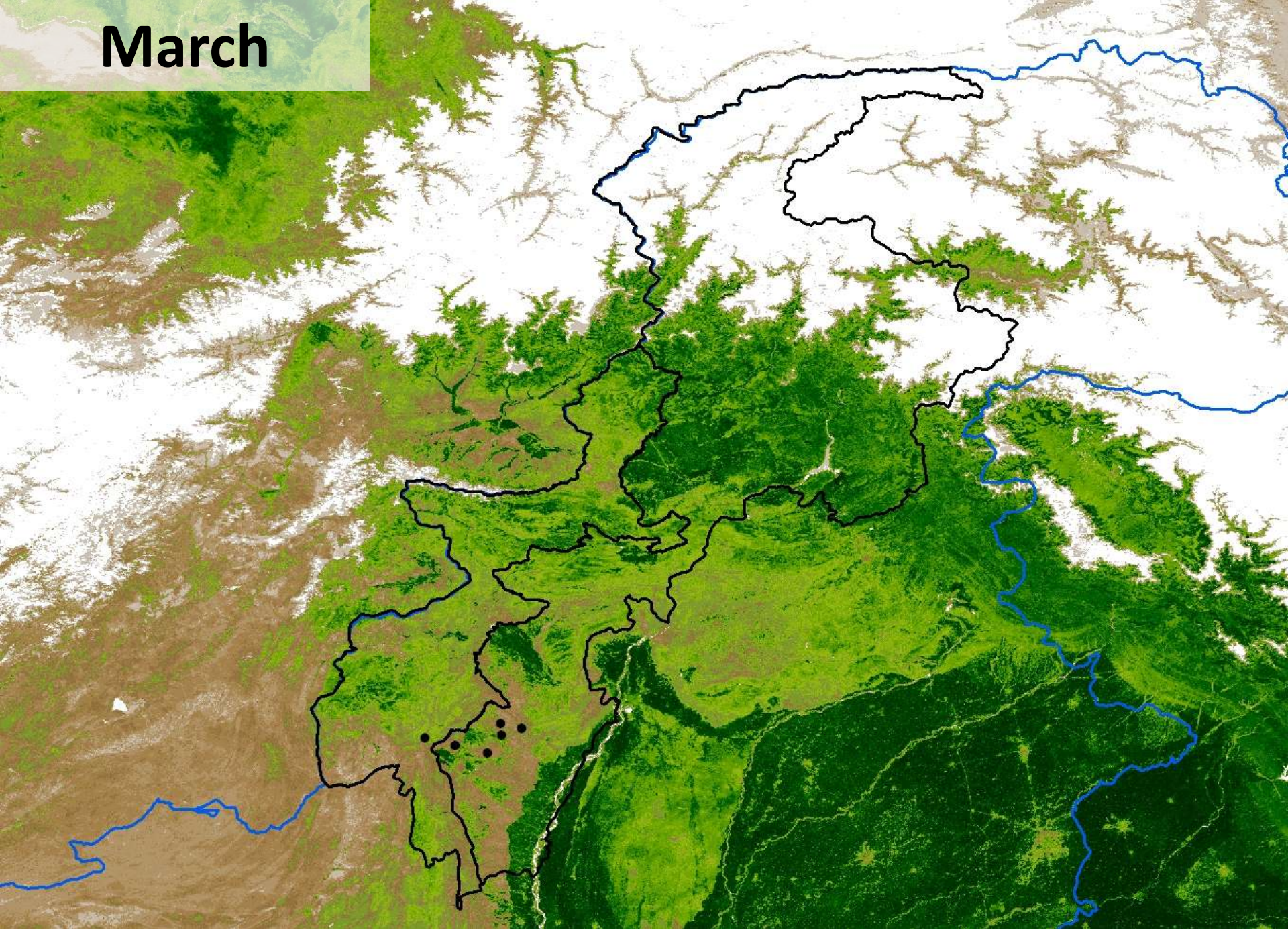
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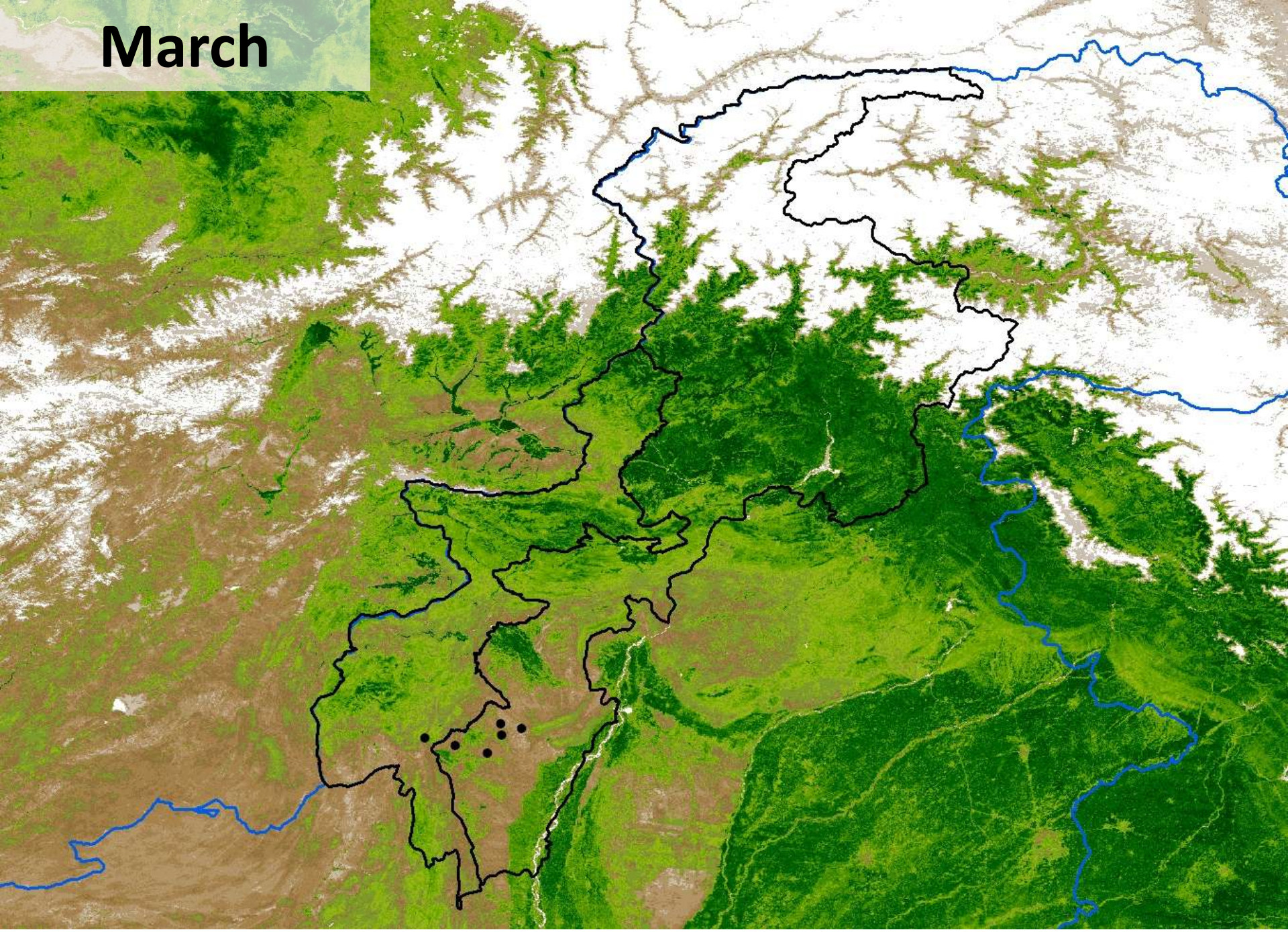
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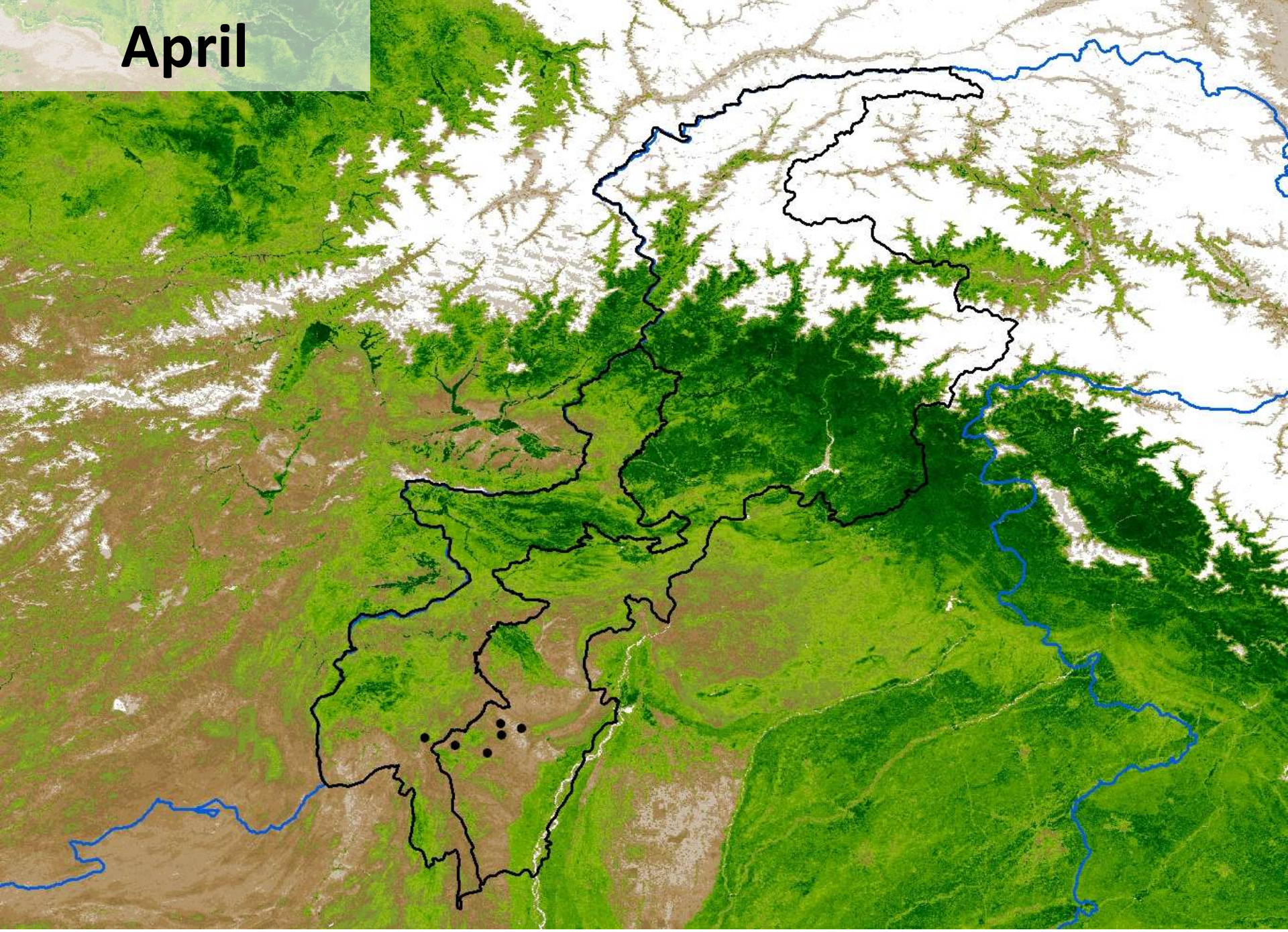
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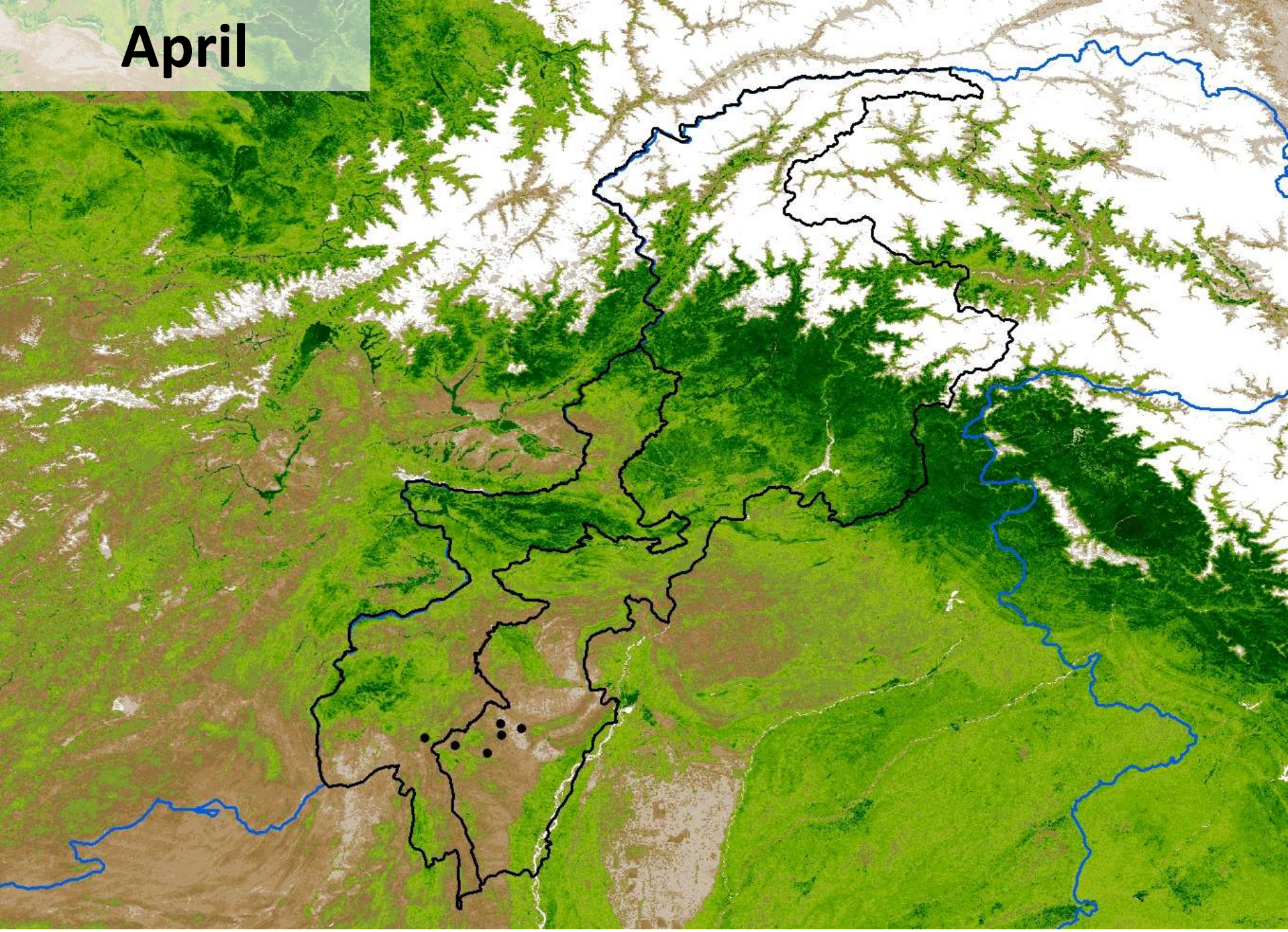
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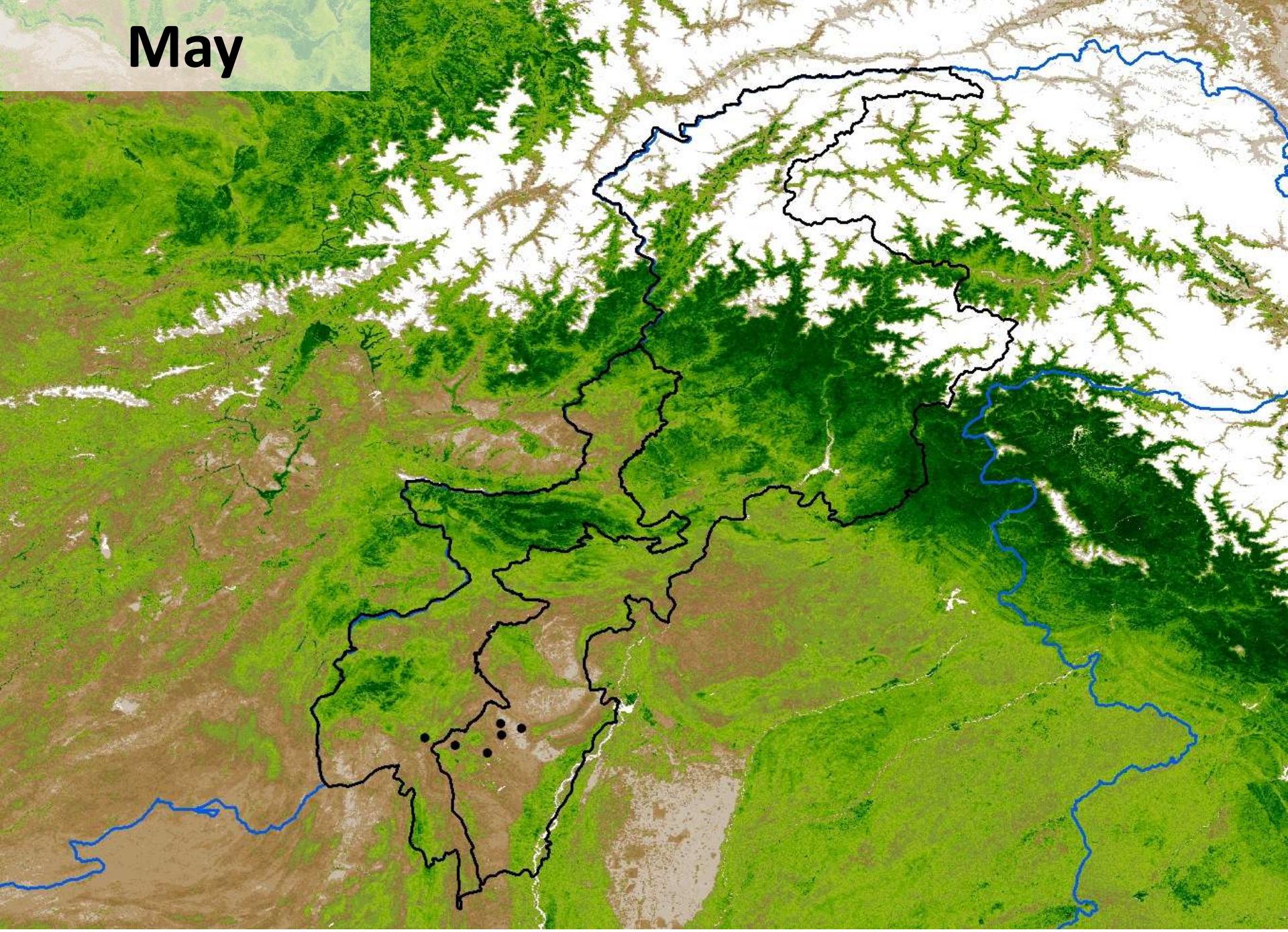
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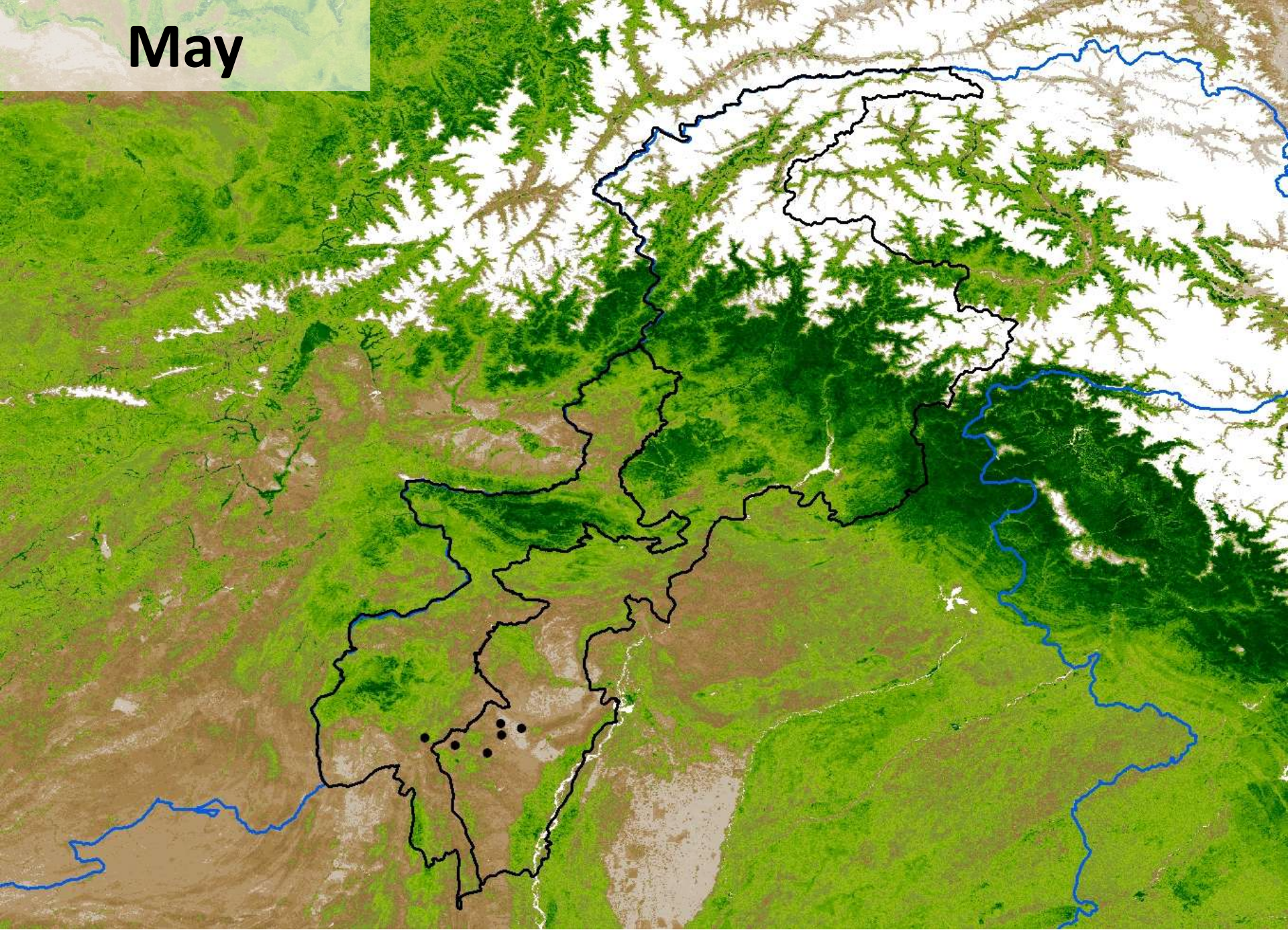
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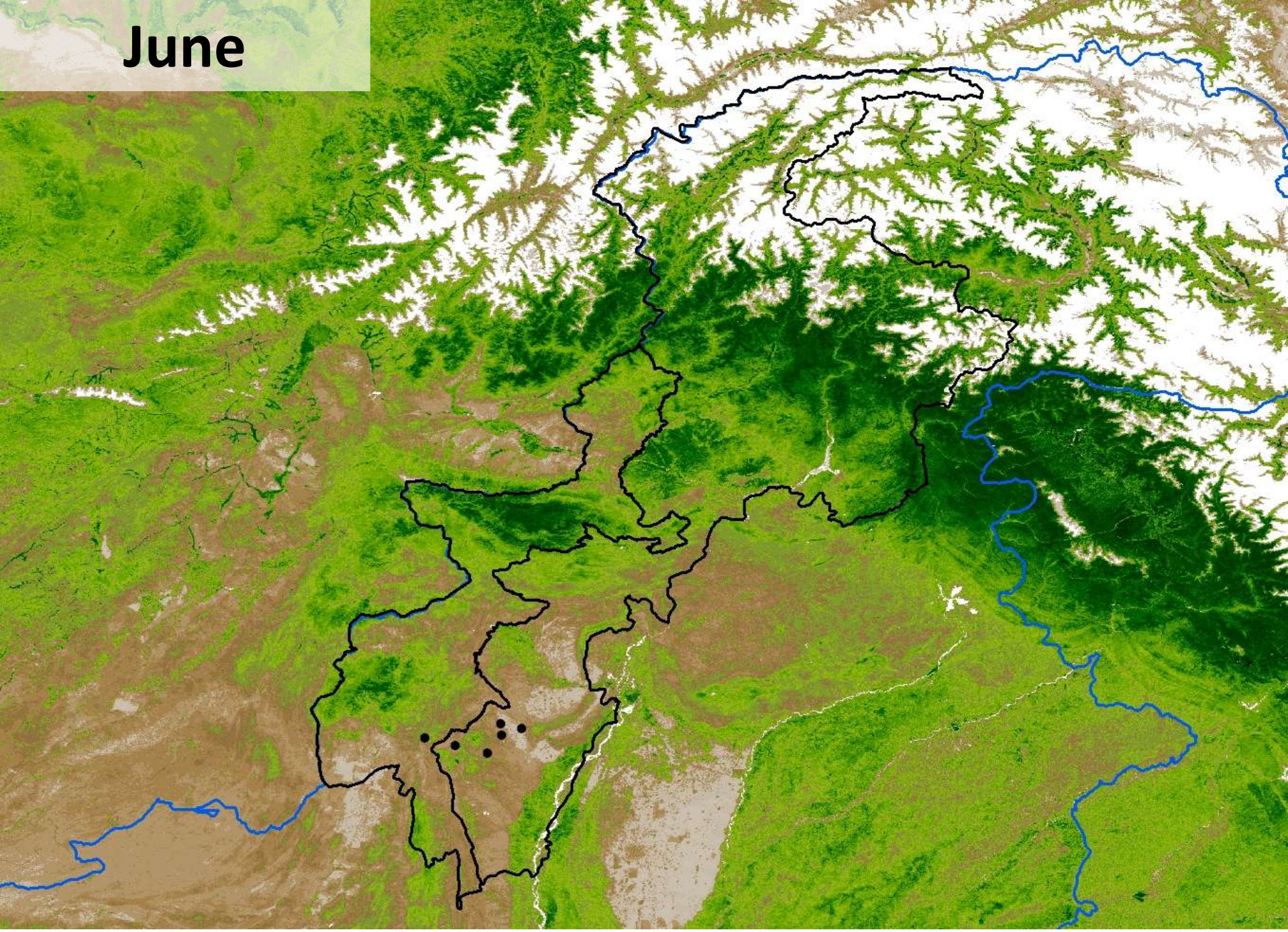
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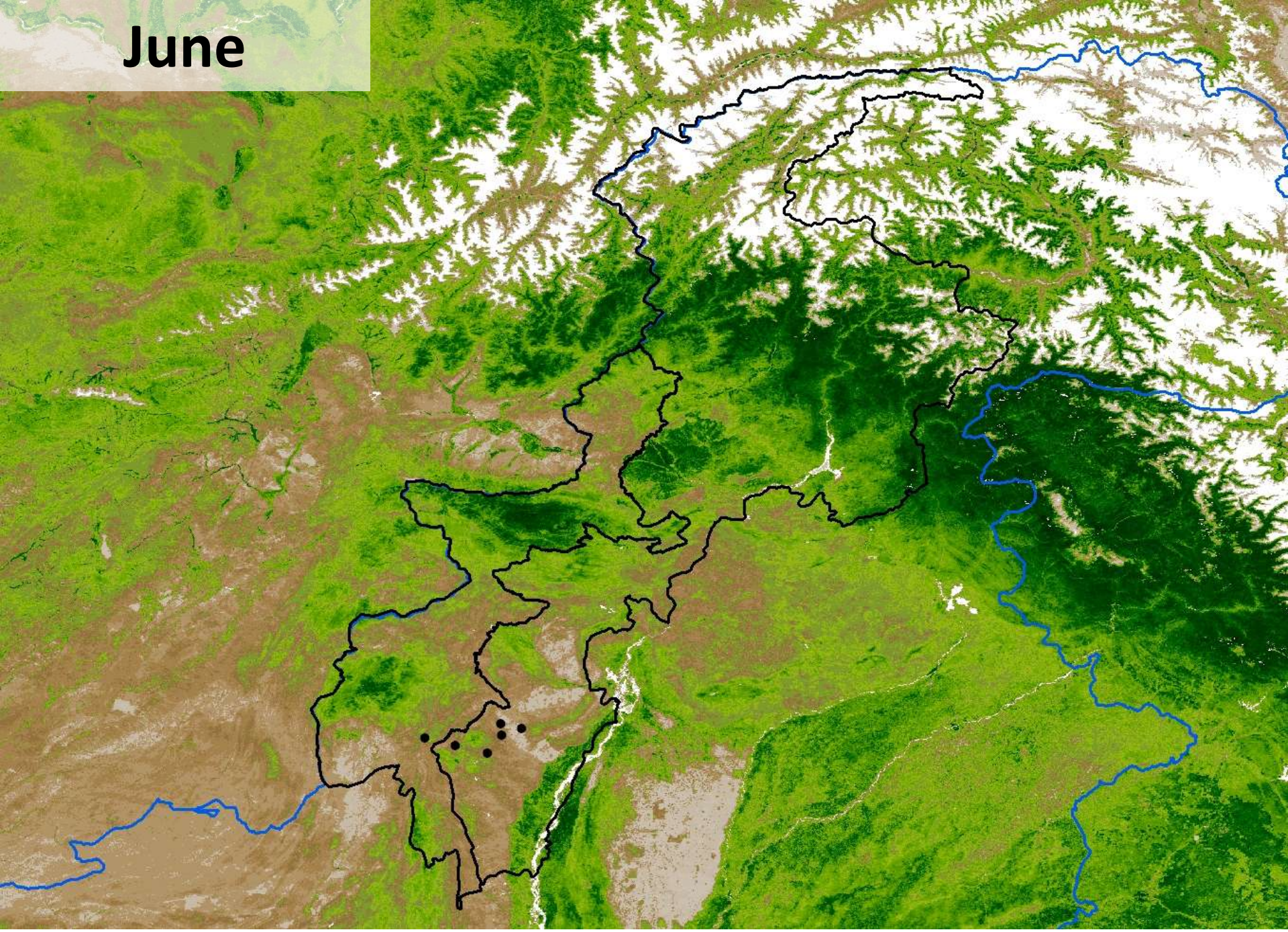
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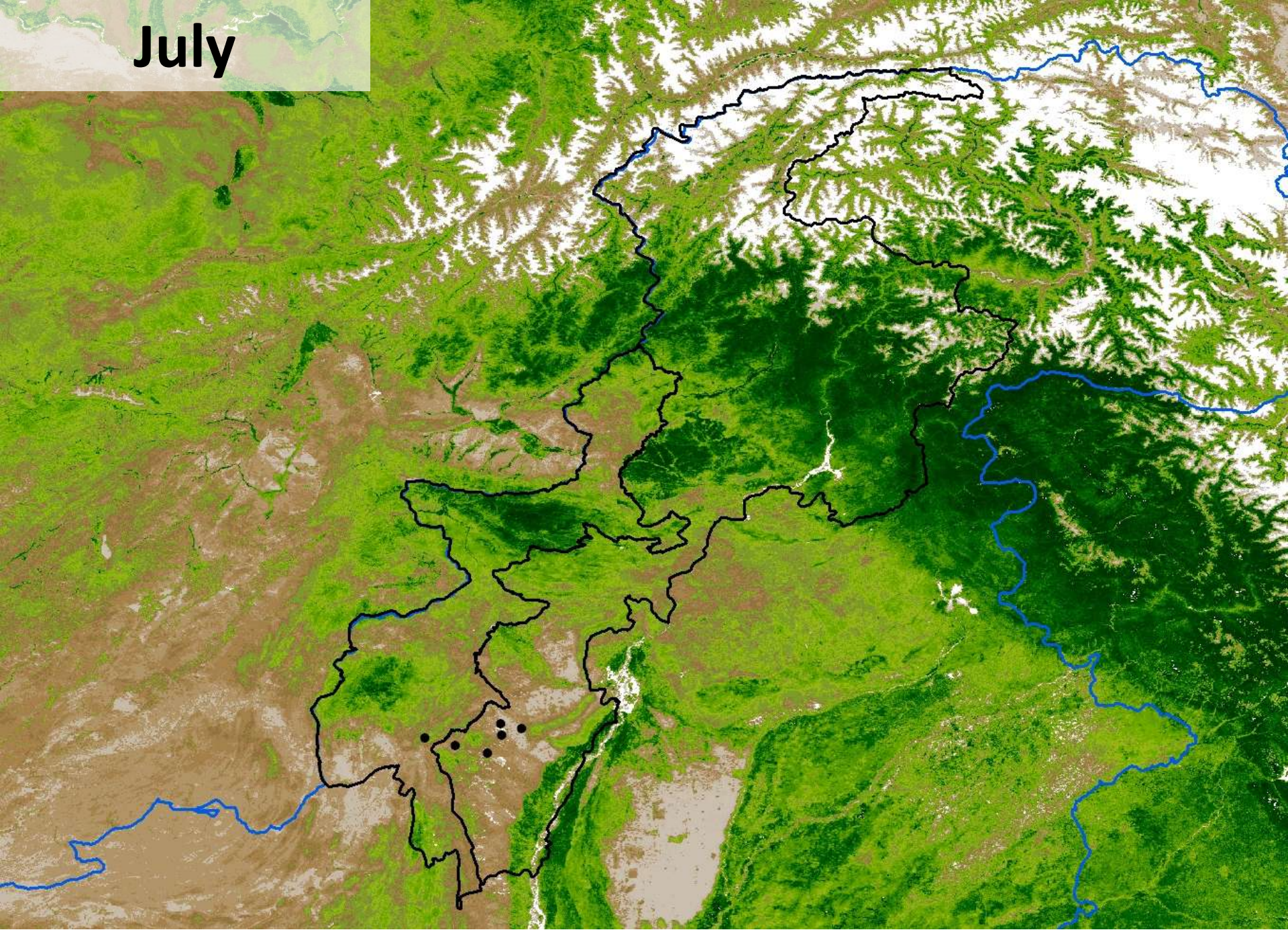
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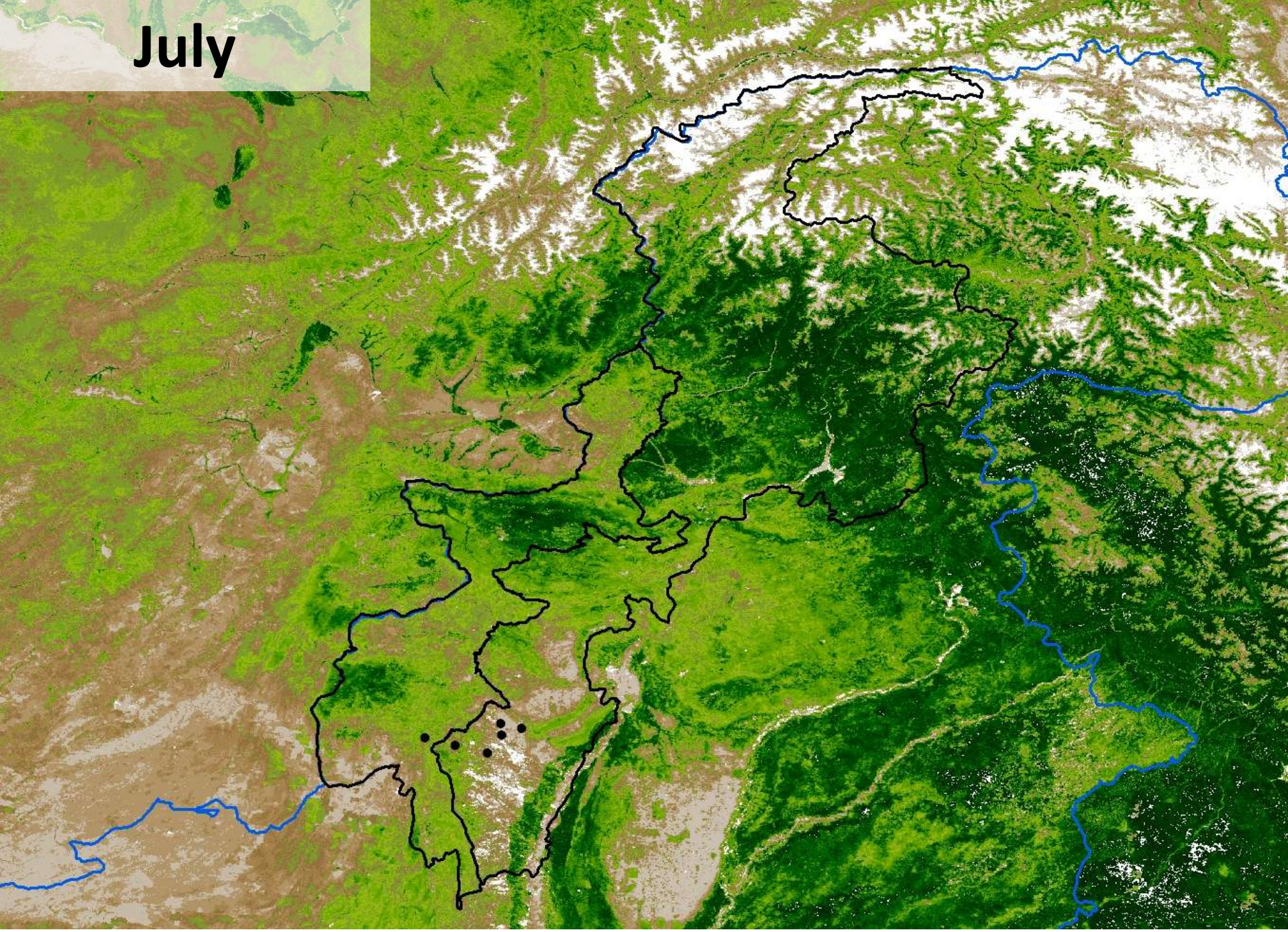
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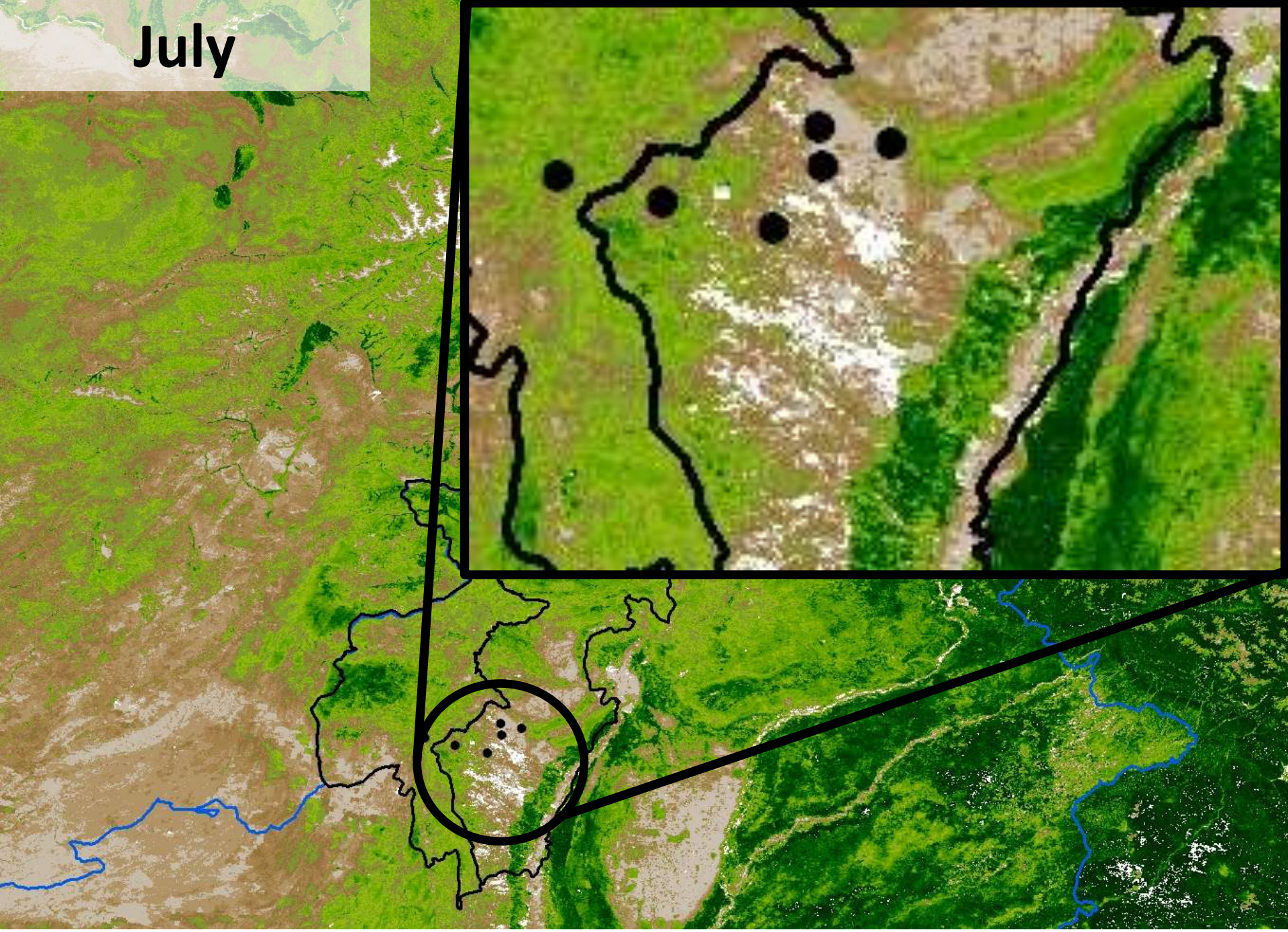
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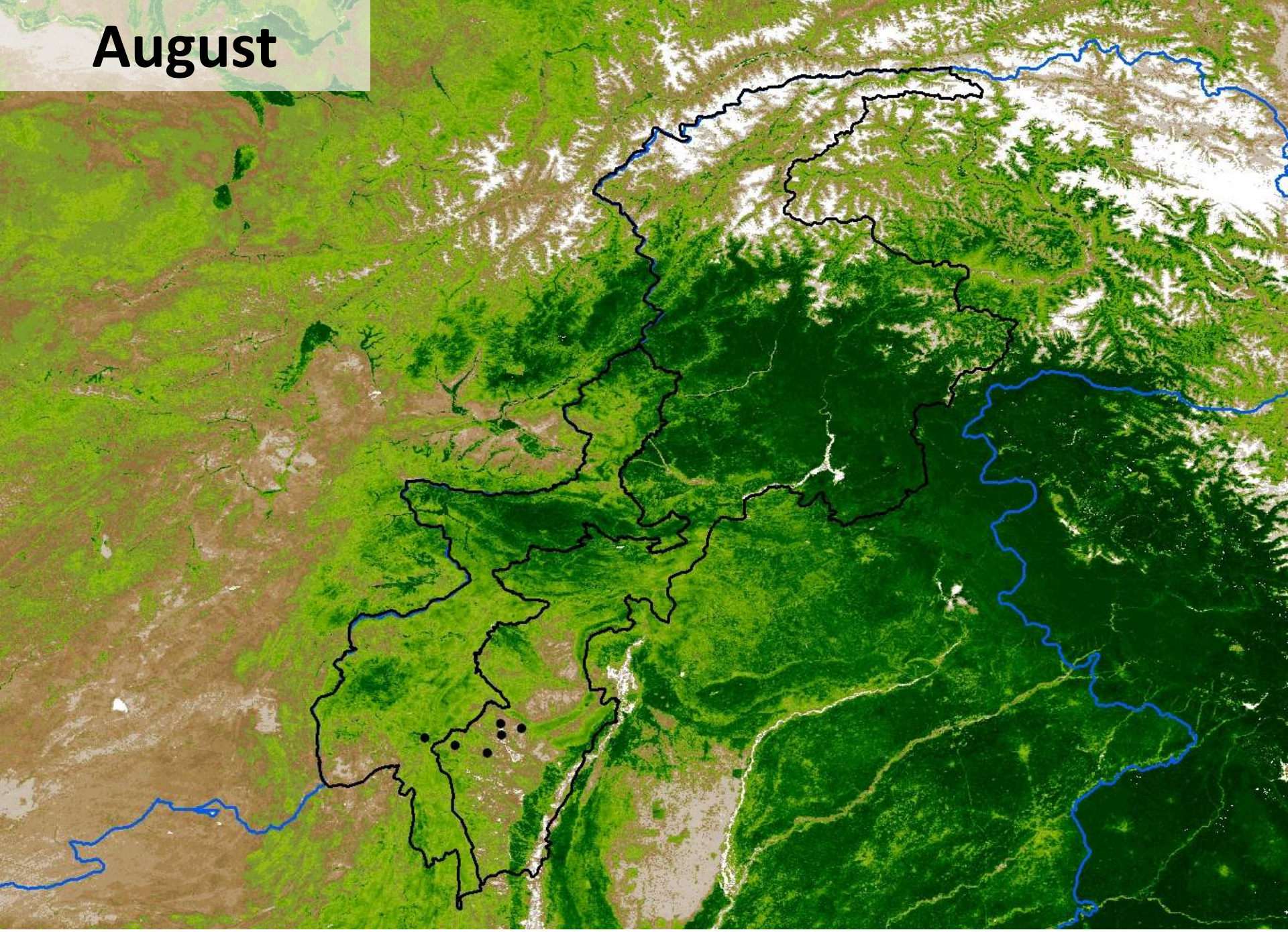
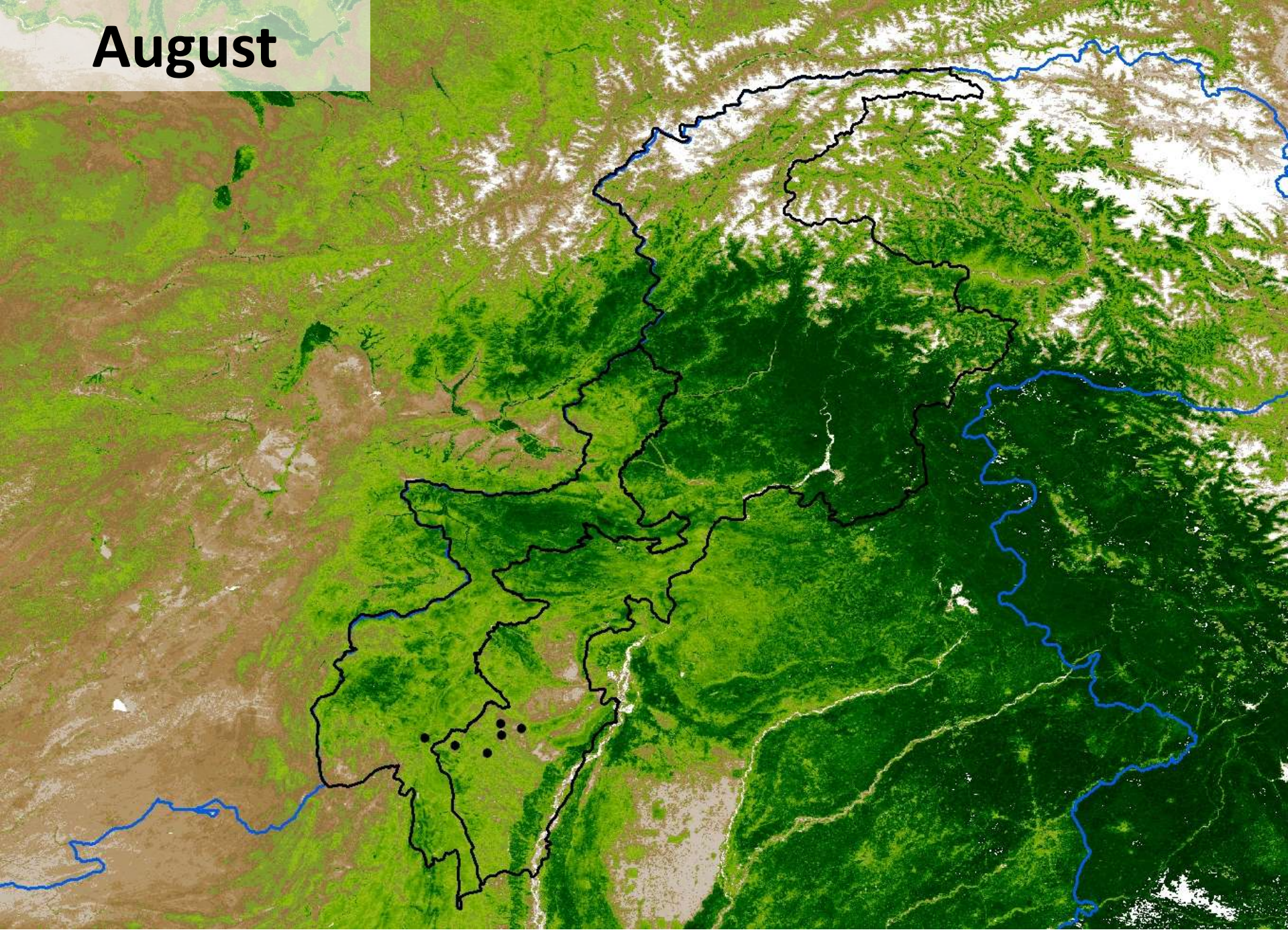

August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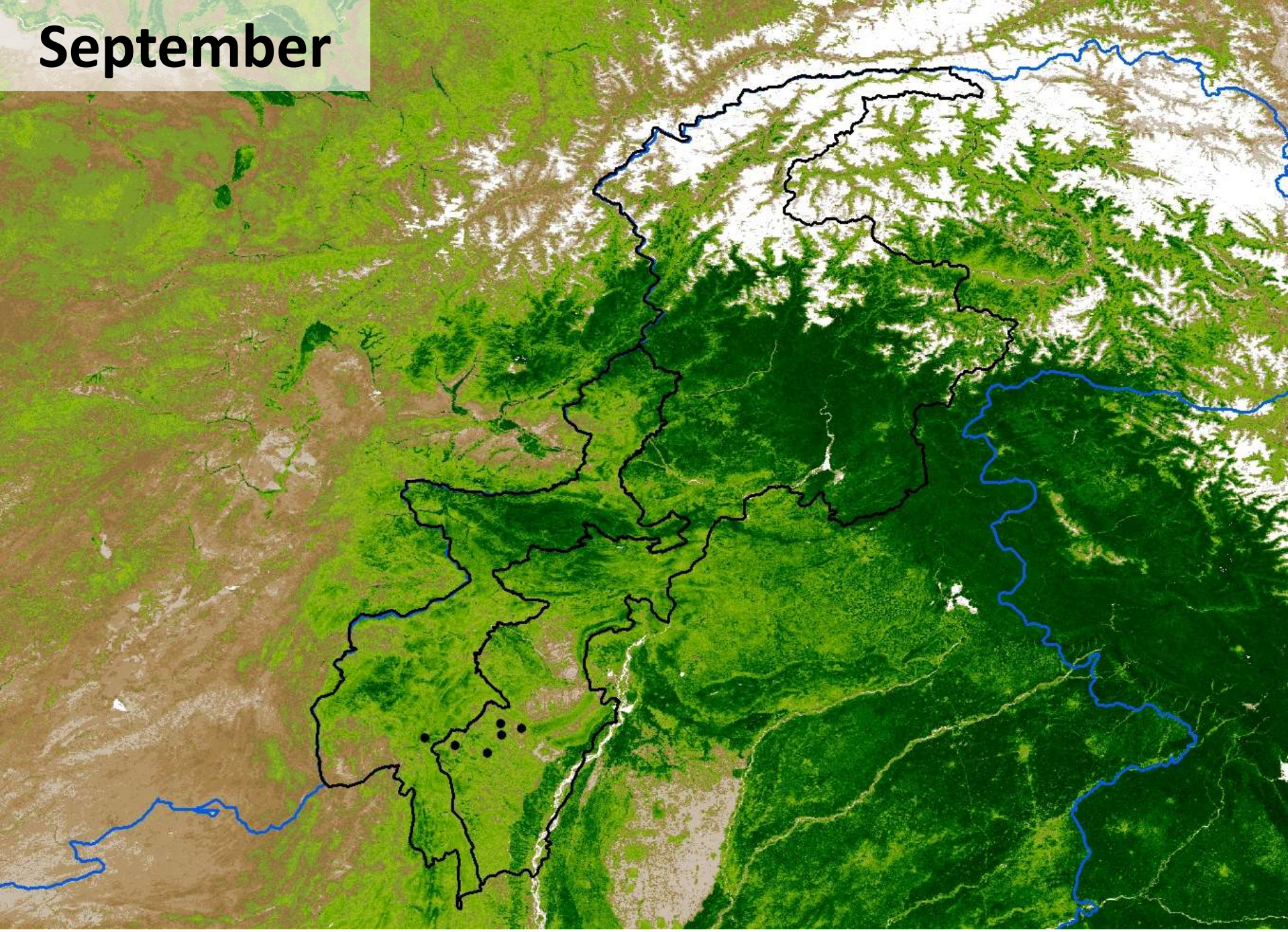
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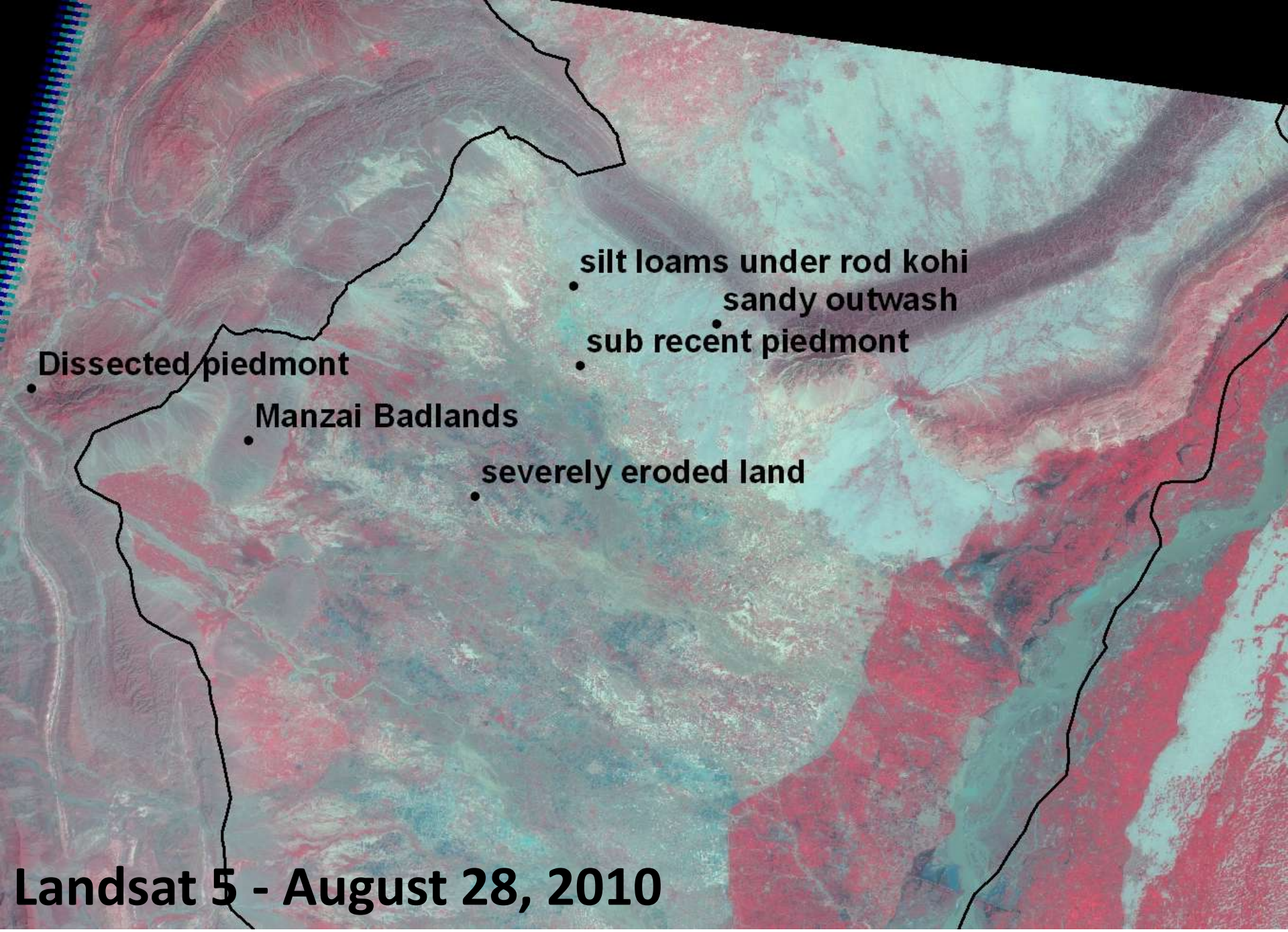
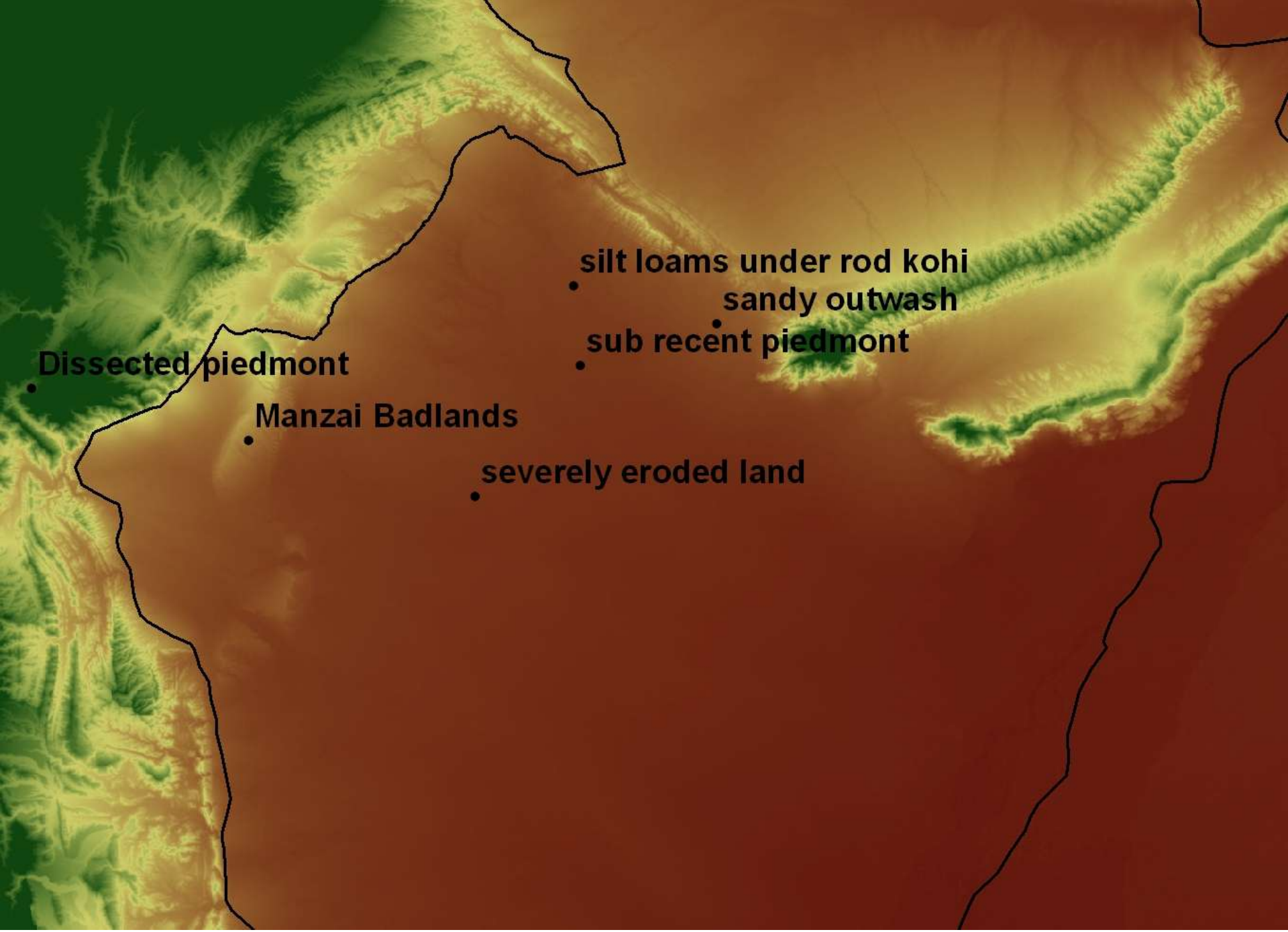
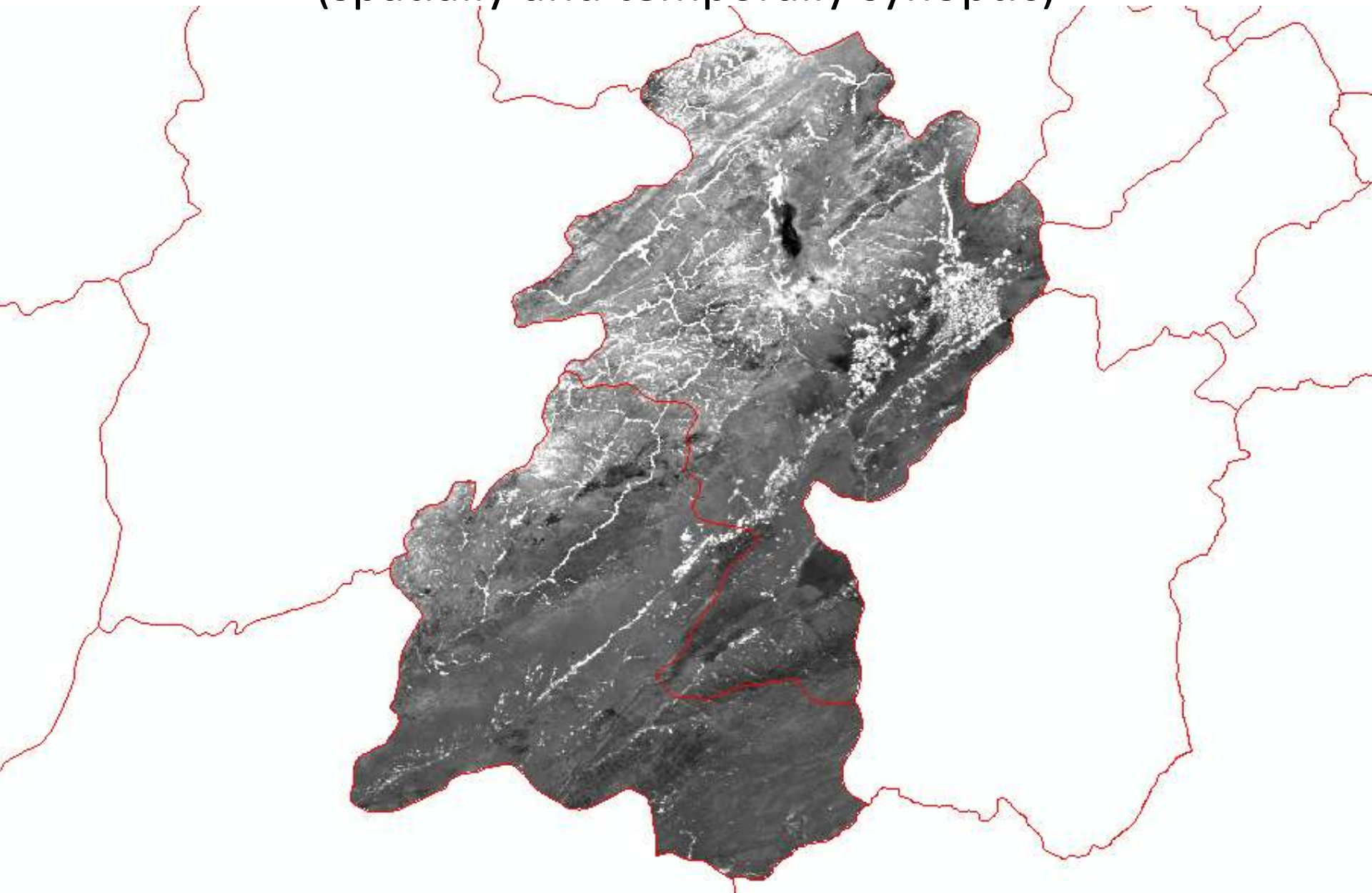


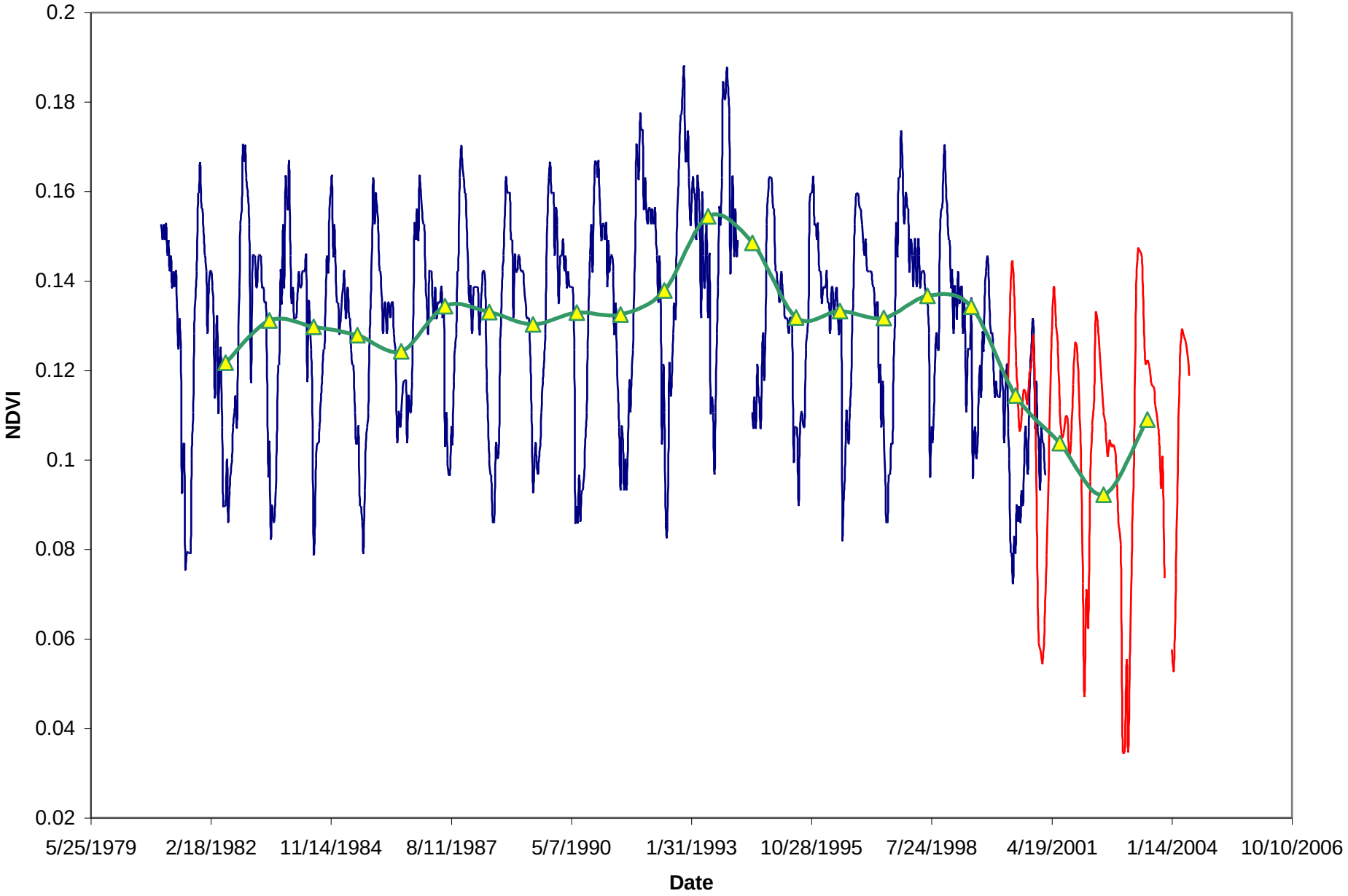
Landsat 5 - August 28, 2010

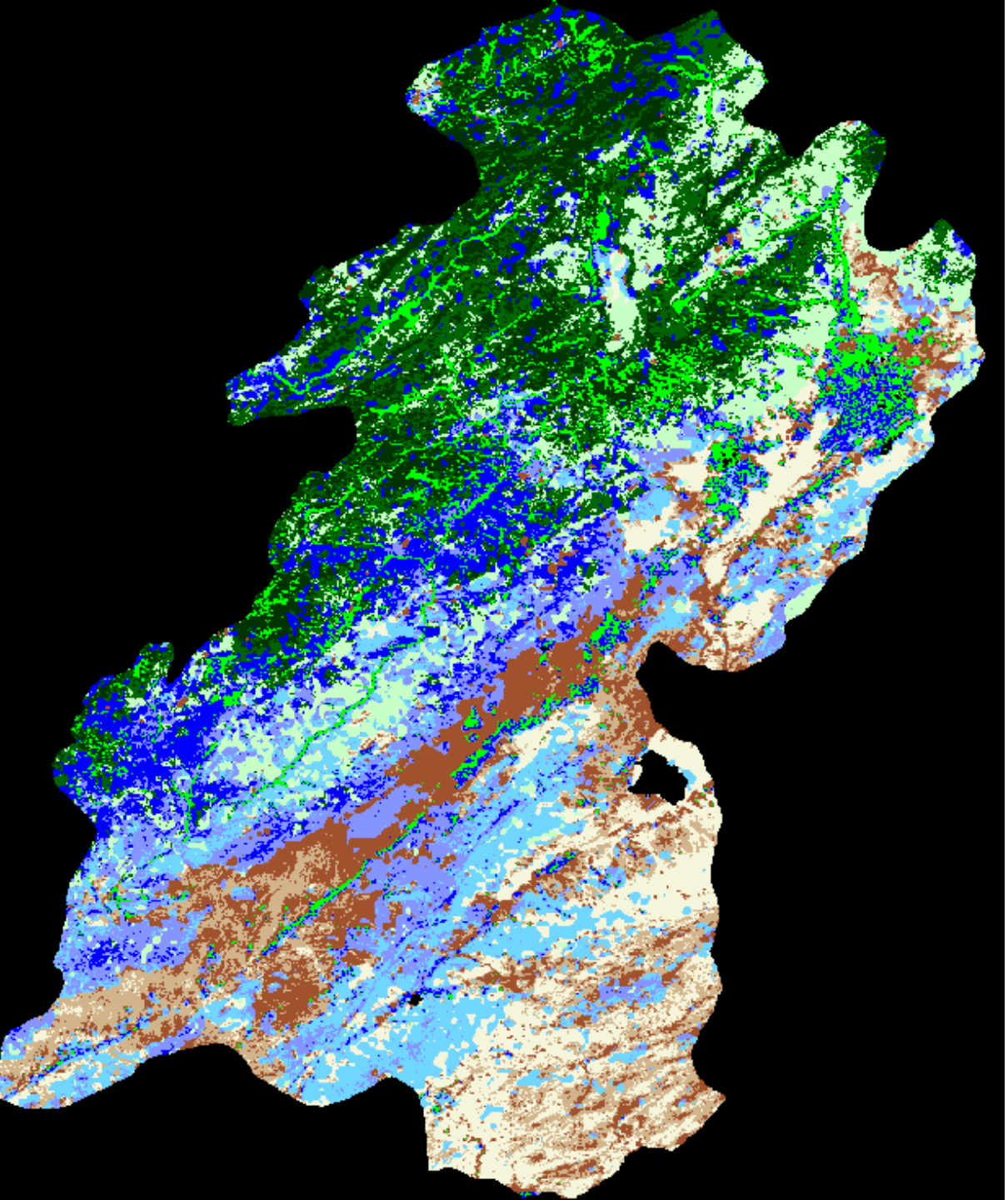

silt loams under rod kohi
sandy outwash
sub recent piedmont
Dissected piedmont
Manzai Badlands
severely eroded land

Rangelands in Ghazni and Zabul, Afghanistan

(spatially and temporally synoptic)



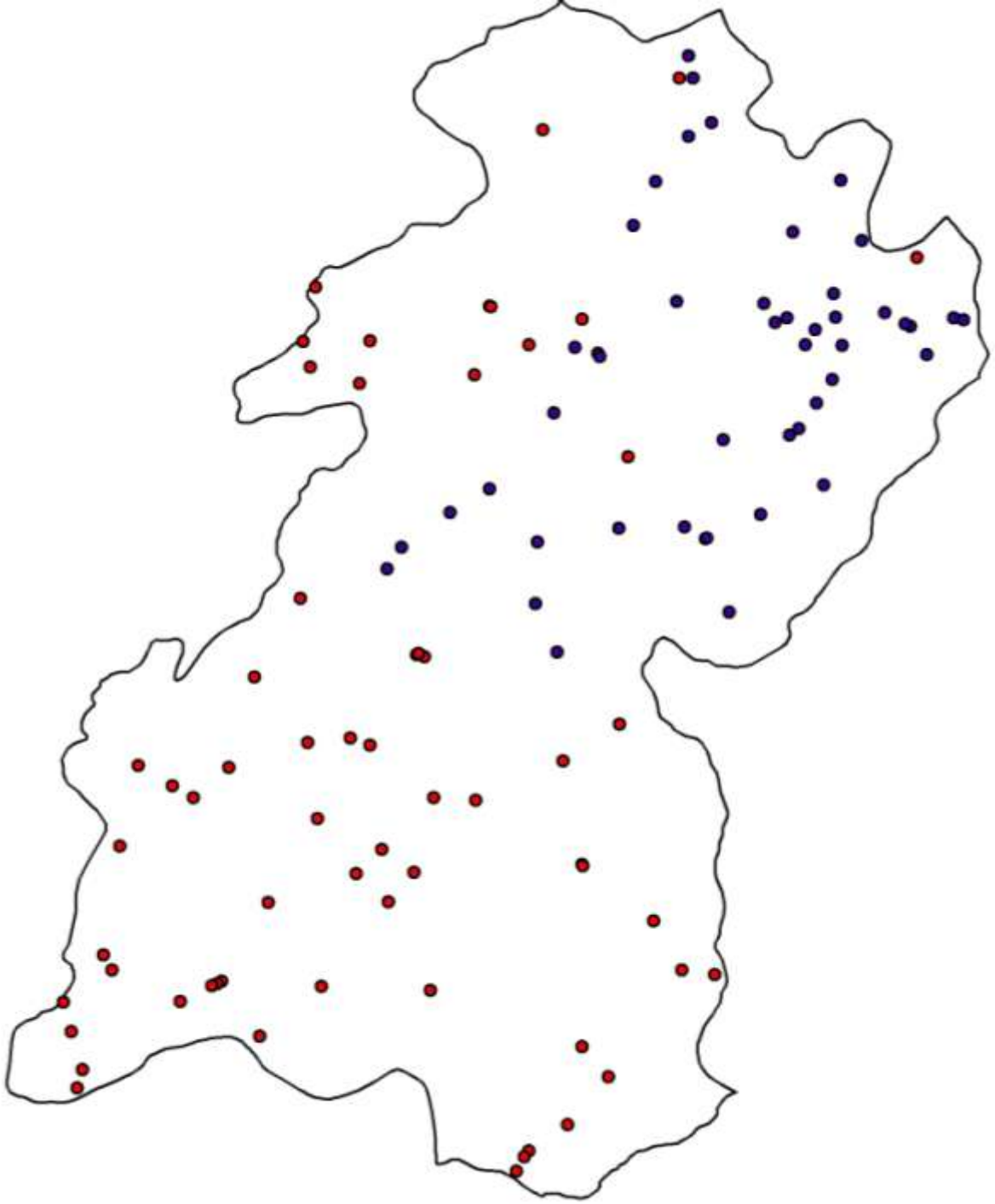

0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
NDVI
5/25/1979
2/18/1982
11/14/1984
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
Date



Sample Stratification

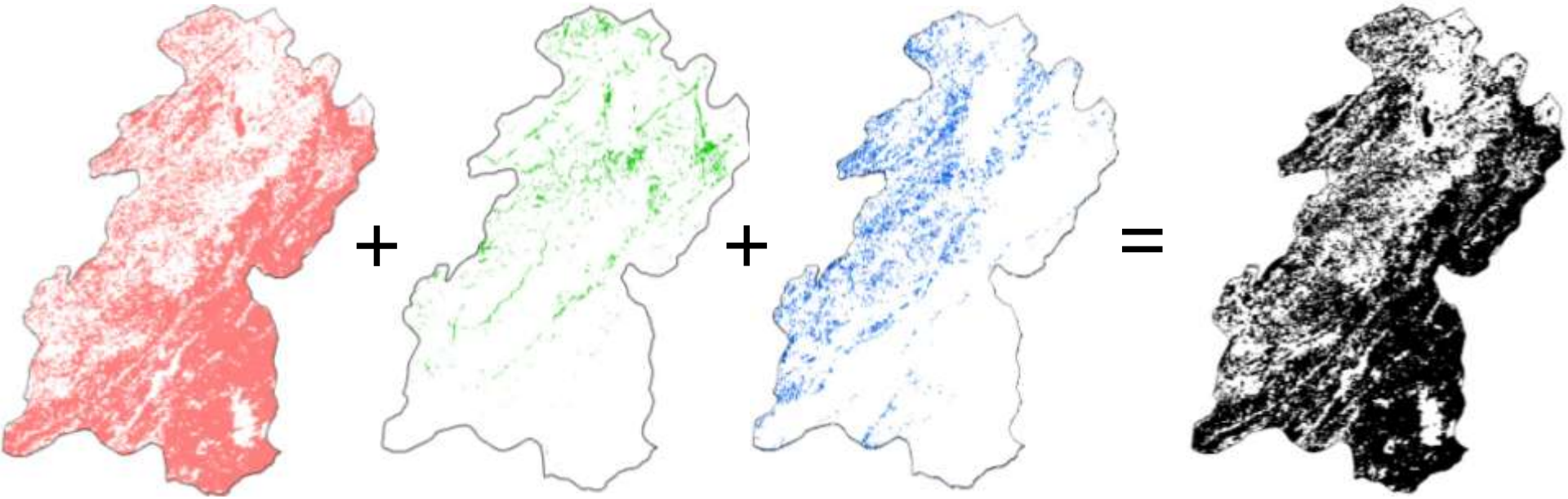
10 classes were produced for the stratification of samples across the region.

1 for irrigated areas
3 for each of the three major land cover types, barren, grassland, and shrubland.



12 sample locations were randomly selected for each of the 9 upland stratum. Samples were collected from 6 of the 12 for each stratum.

Selection of sites based on specific criteria



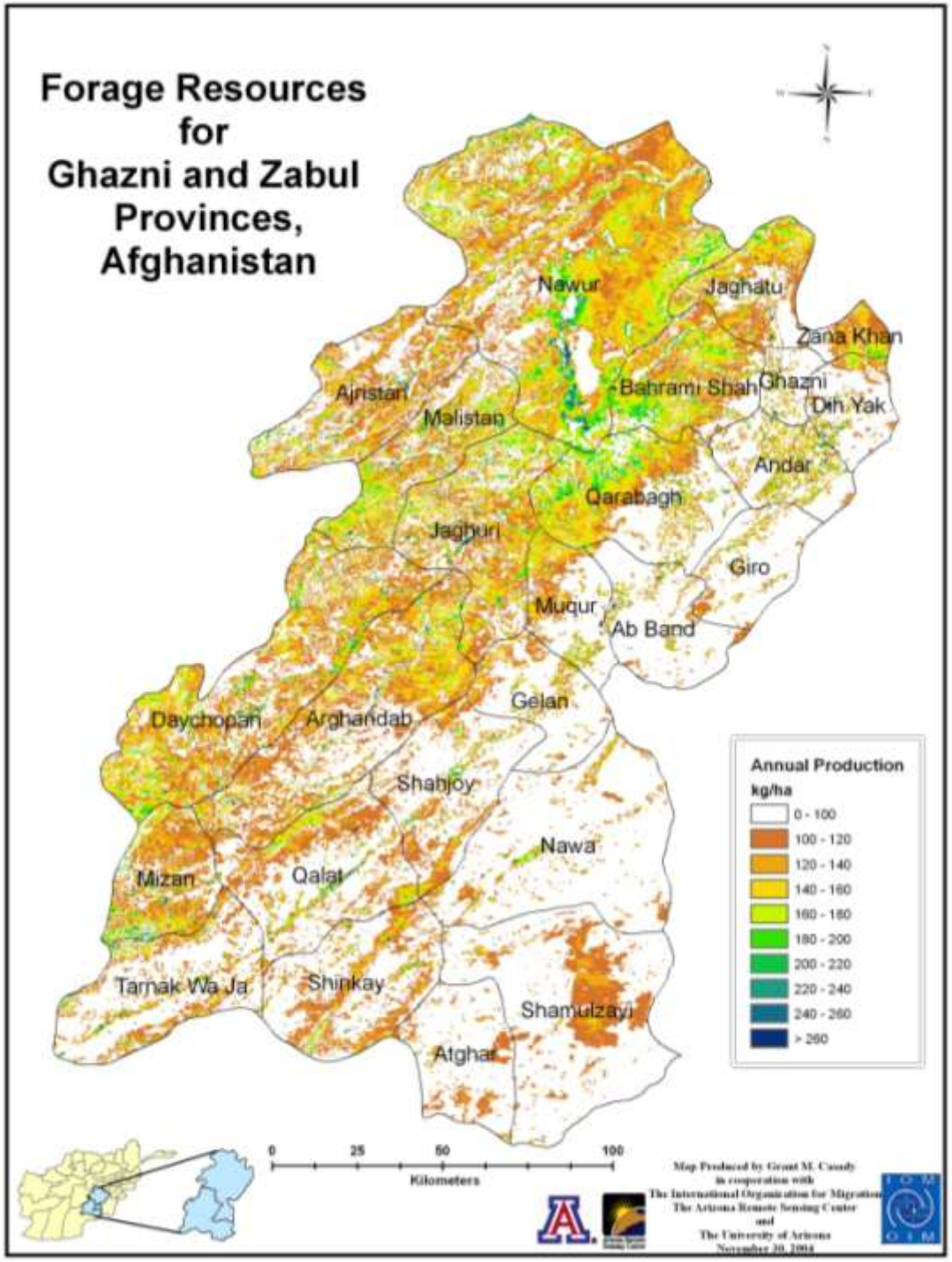
Low productivity

Cropland

High slopes

Extrapolation of field measures

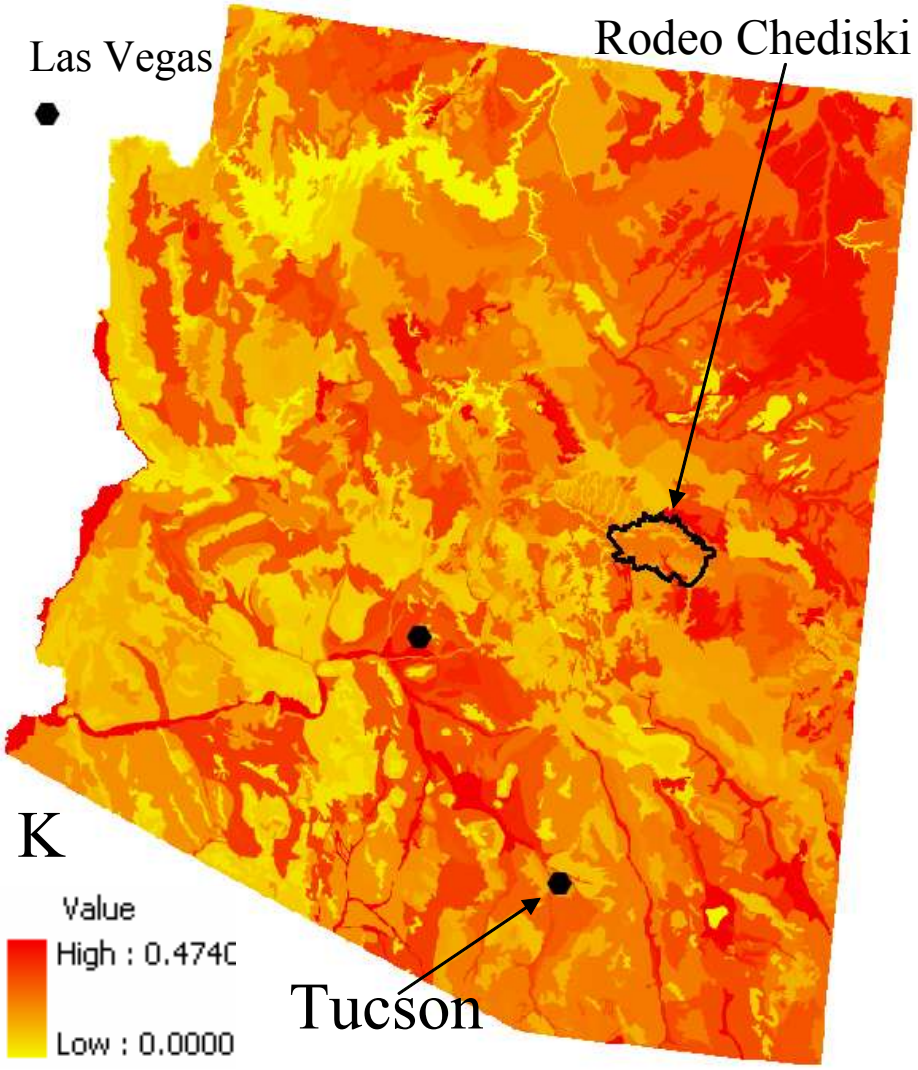
Using the mask and the equations relating production to NDVI, a final map was created for Ghazni and Zabul provinces.

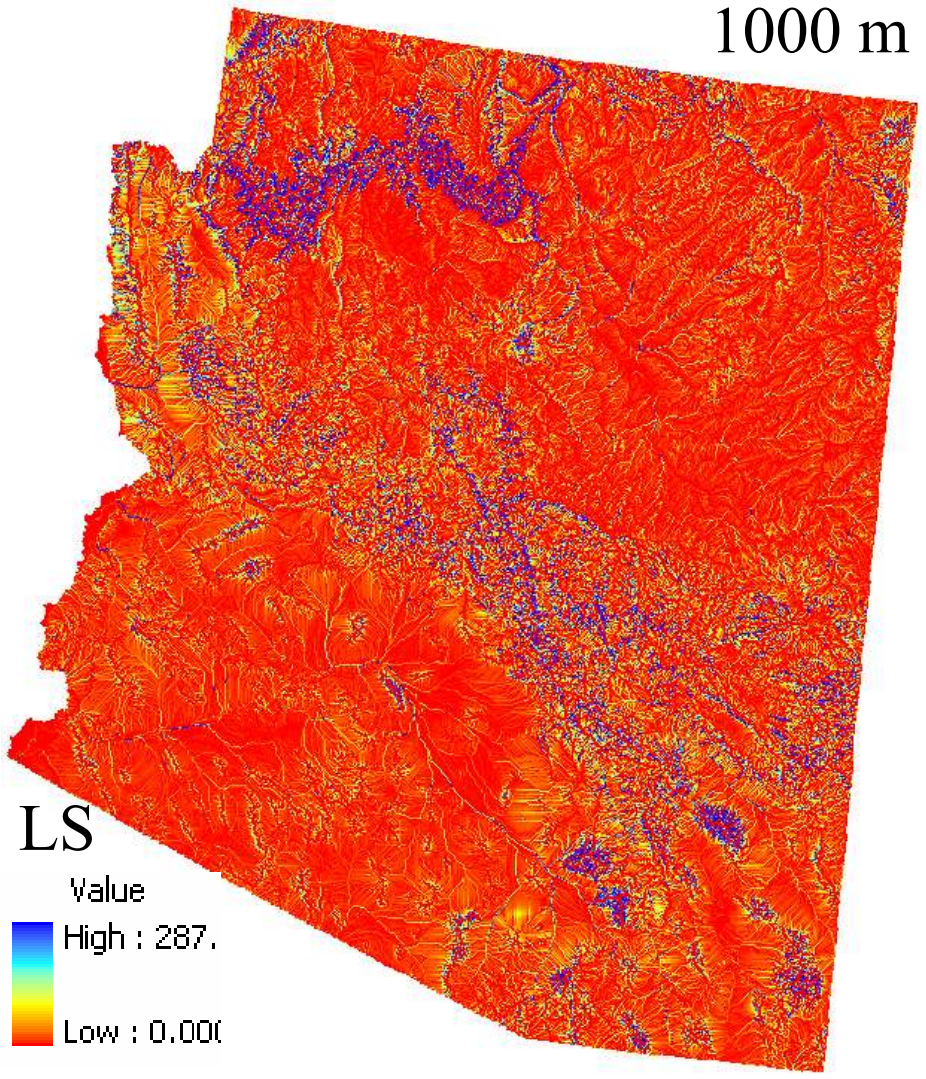


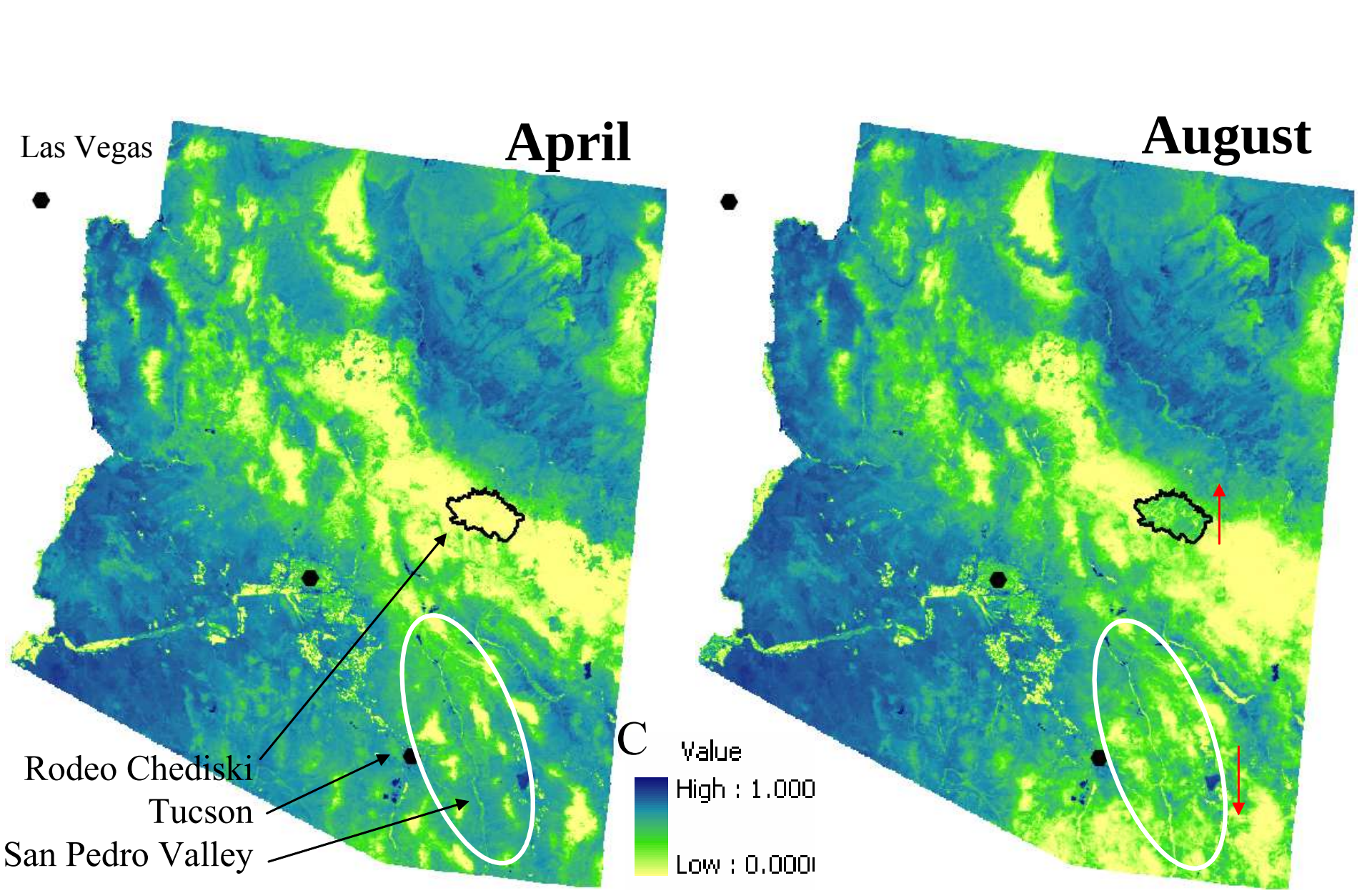
Arizona Monthly Soil Loss RUSLE – revised again (as one predictor of soil loss)

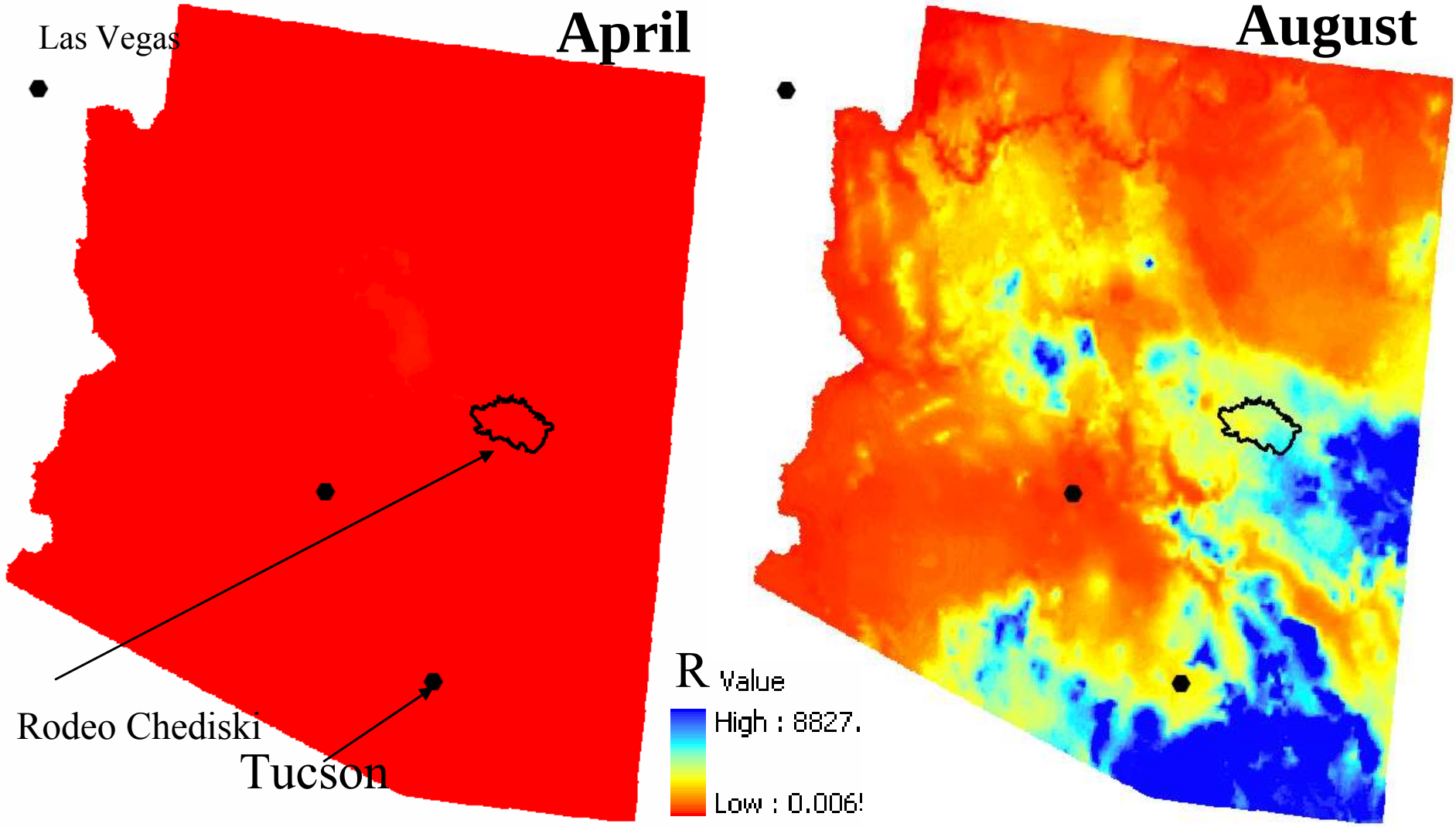
$$A_i = K\ L\ S\ C_i\ R_i\ P$$

- A_i = average **monthly** soil loss
- K = soil erodibility factor
- L S= slope length and steepness
- C_i = monthly cover-management factor
- R_i = monthly rainfall erosivity factor, and
- P = soil erosion prevention practice factor.


Las Vegas
Rodeo Chediski
Tucson
K
Value
High : 0.474(
Low : 0.0000

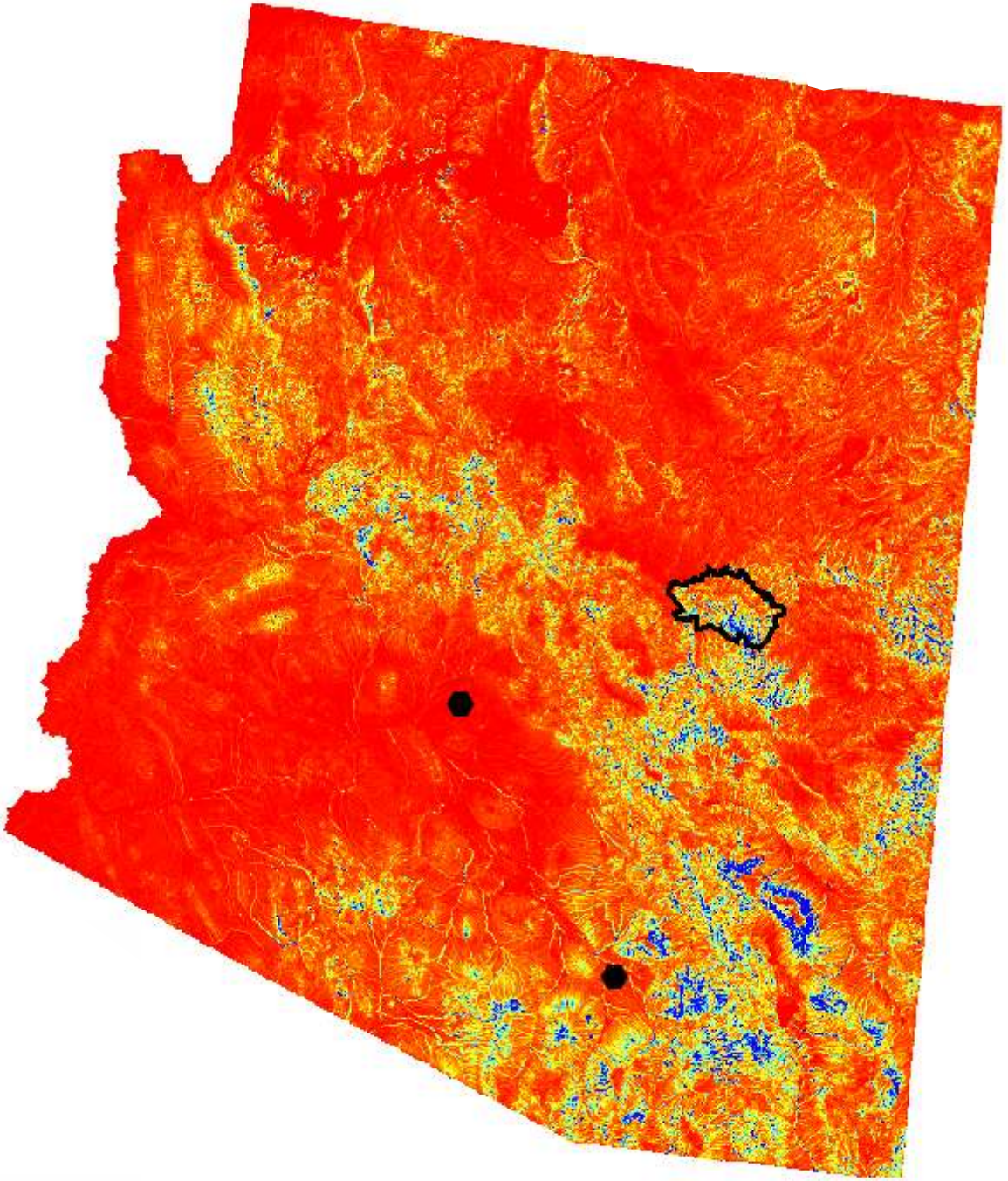

1000 m
LS
Value
High : 287.
Low : 0.00(


Las Vegas
April
August
Rodeo Chediski
Tucson
San Pedro Valley
C
Value
High : 1.000
Low : 0.0001


Las Vegas
April
August
Rodeo Chediski
Tucson
R Value
High : 8827.
Low : 0.006!

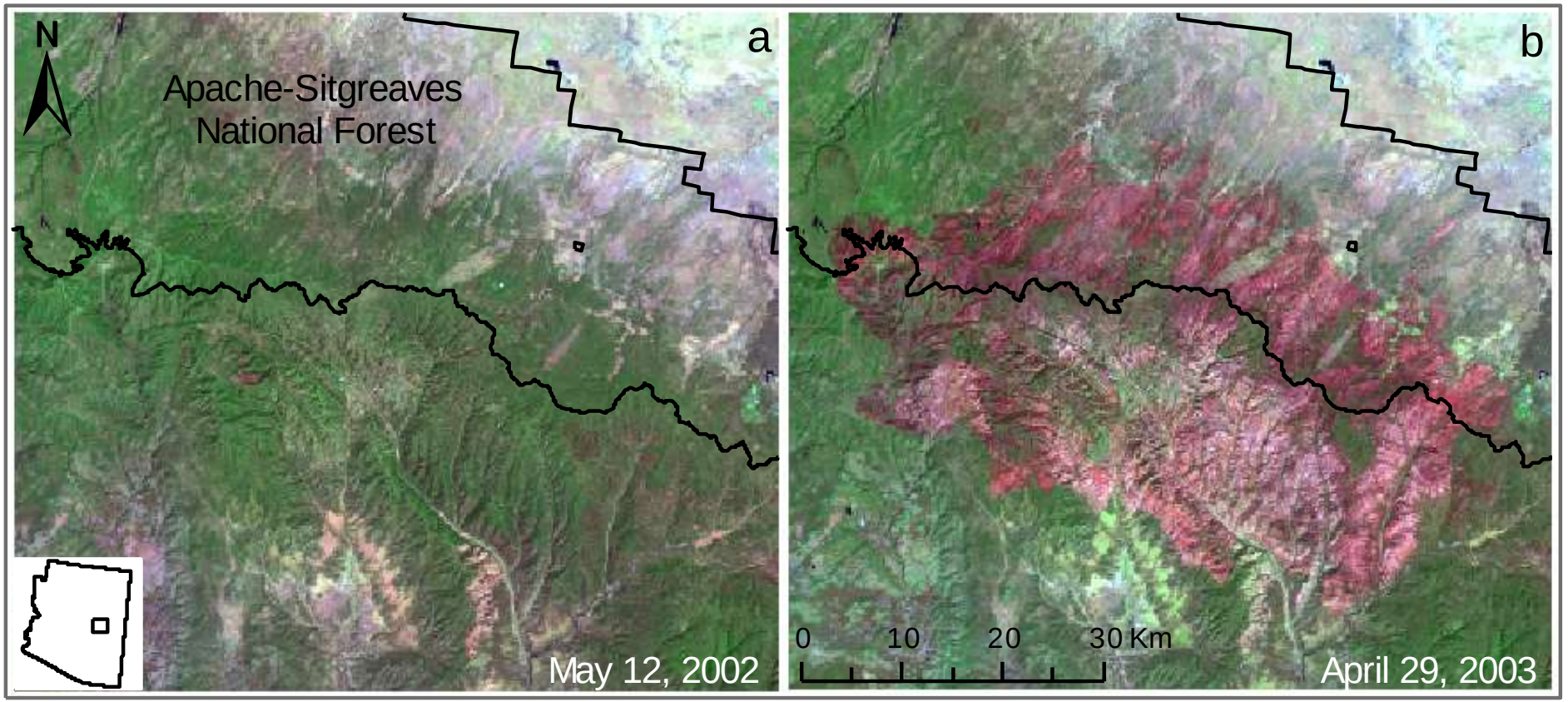
$$A_i = K\ L\ S\ C_i\ R_i$$

Estimated soil loss vulnerability for August

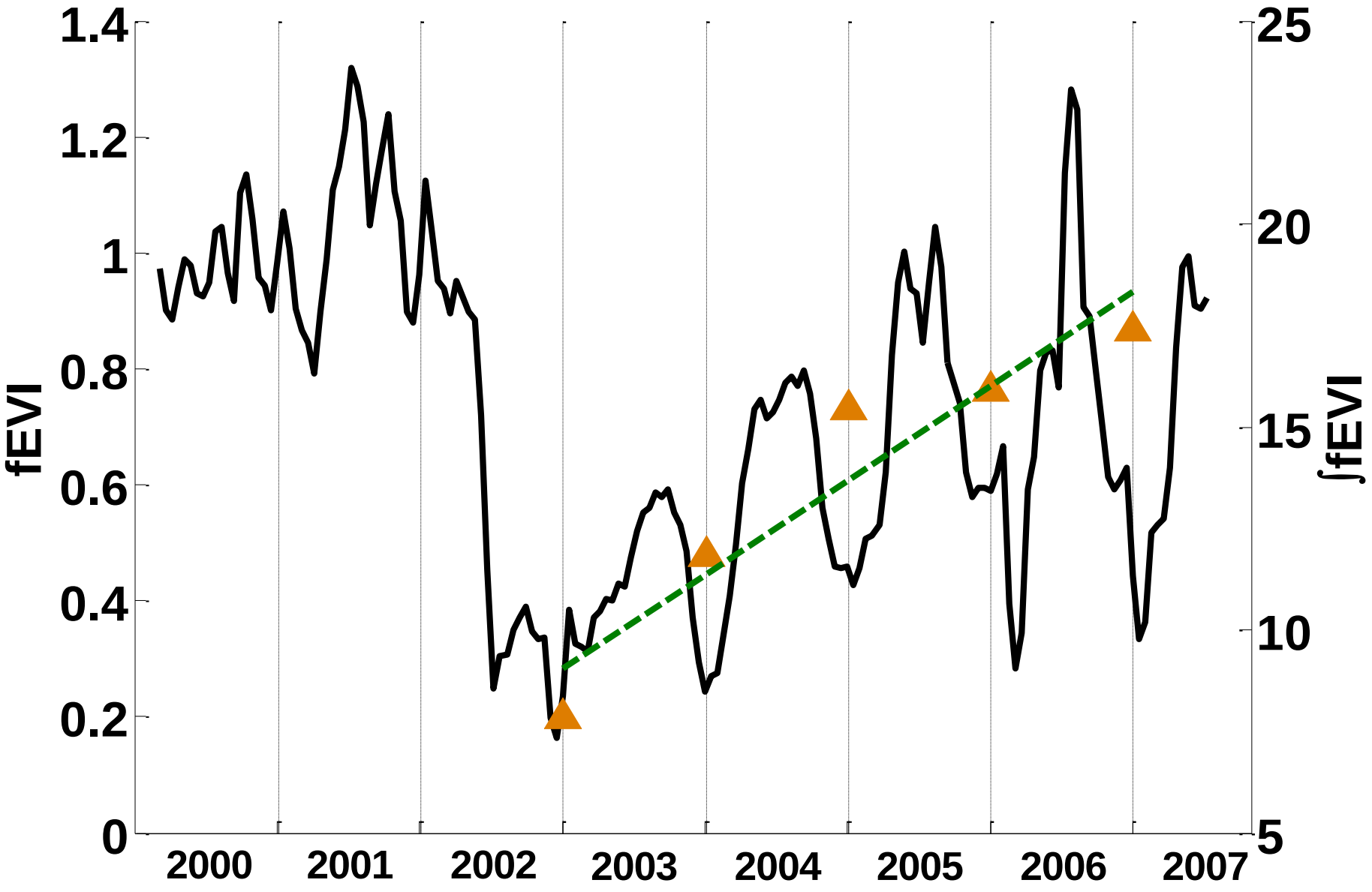


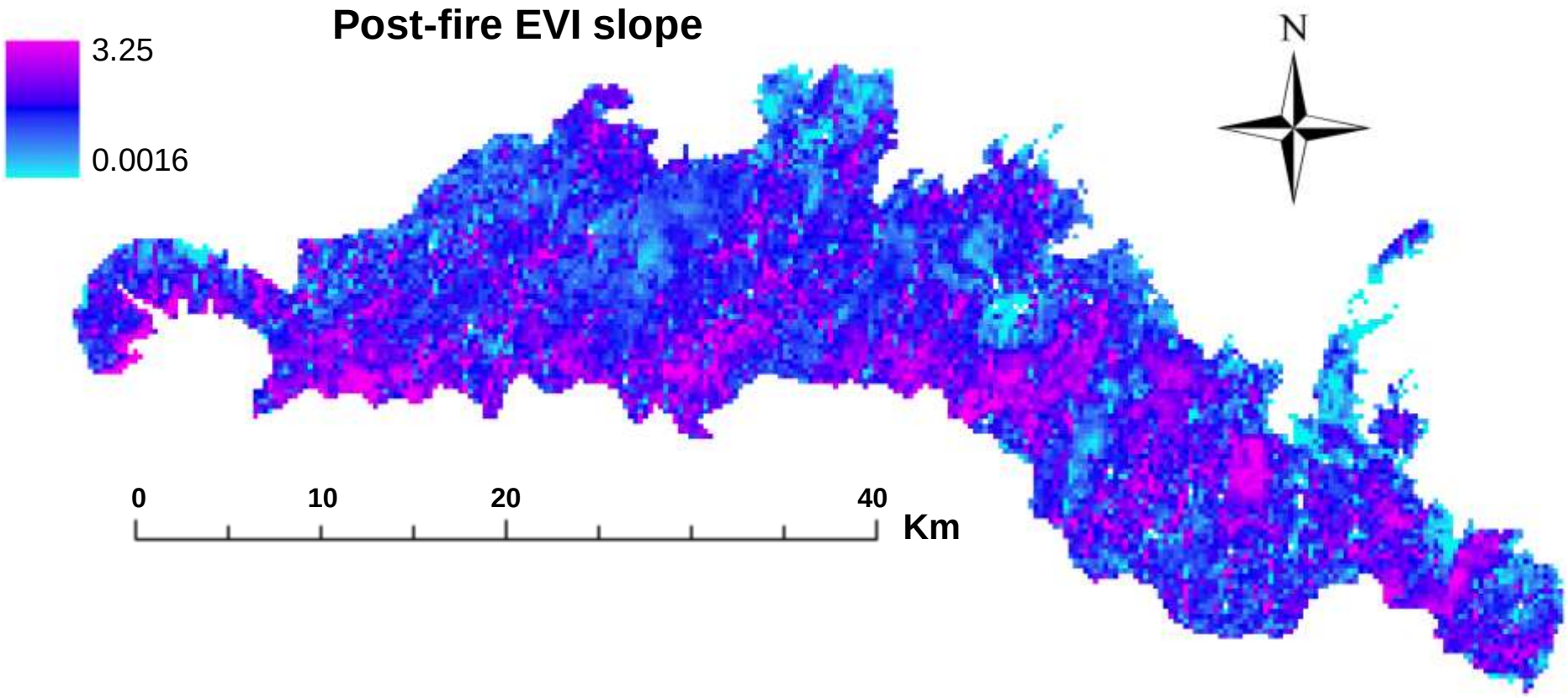
Rodeo-Chediski Fire
(Monitoring rehabilitation efforts)

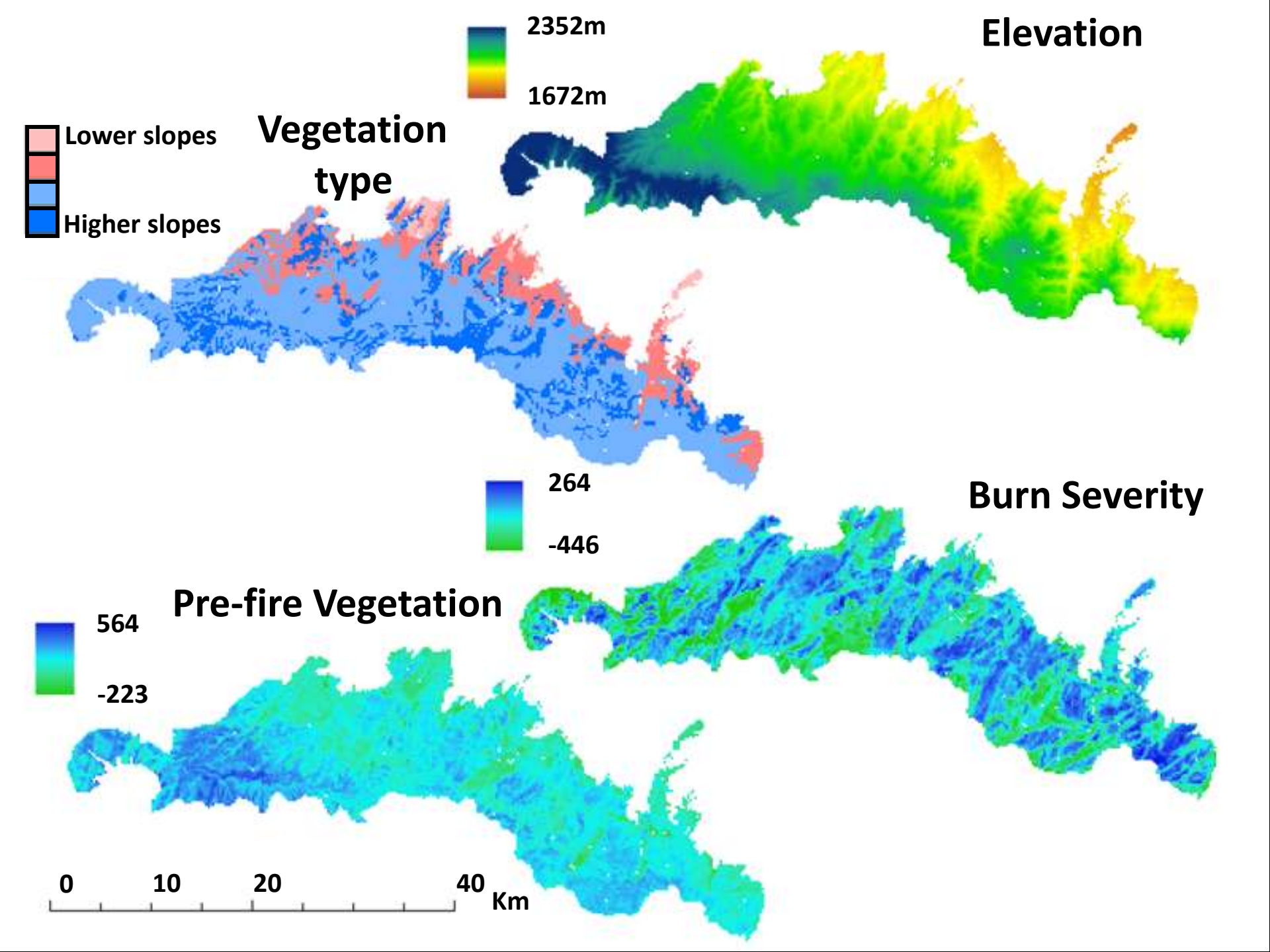
- June 18 – July 7, 2002
- 1800 km^2
- Ponderosa pine, gambel oak, pinyon/juniper

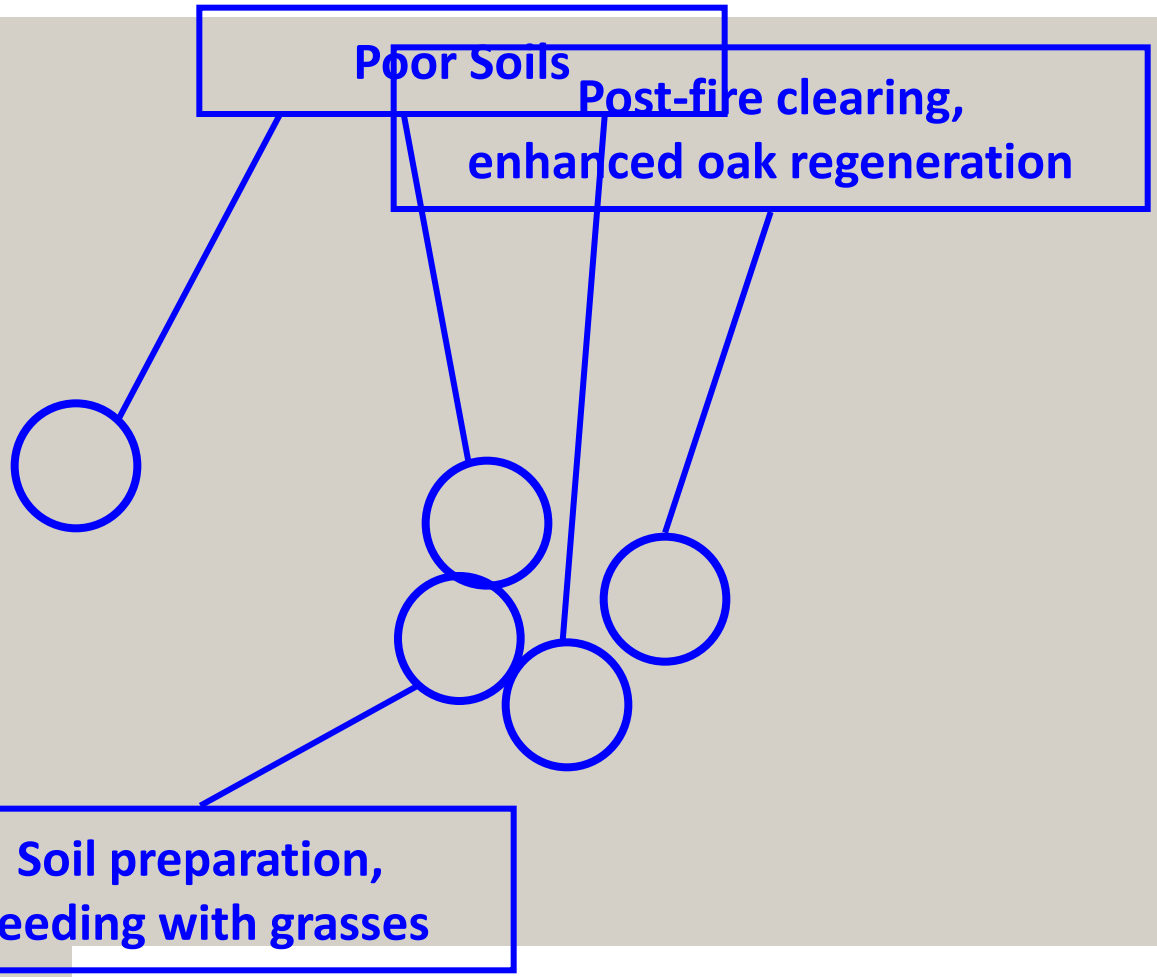


Time-series for a Single MODIS Pixel



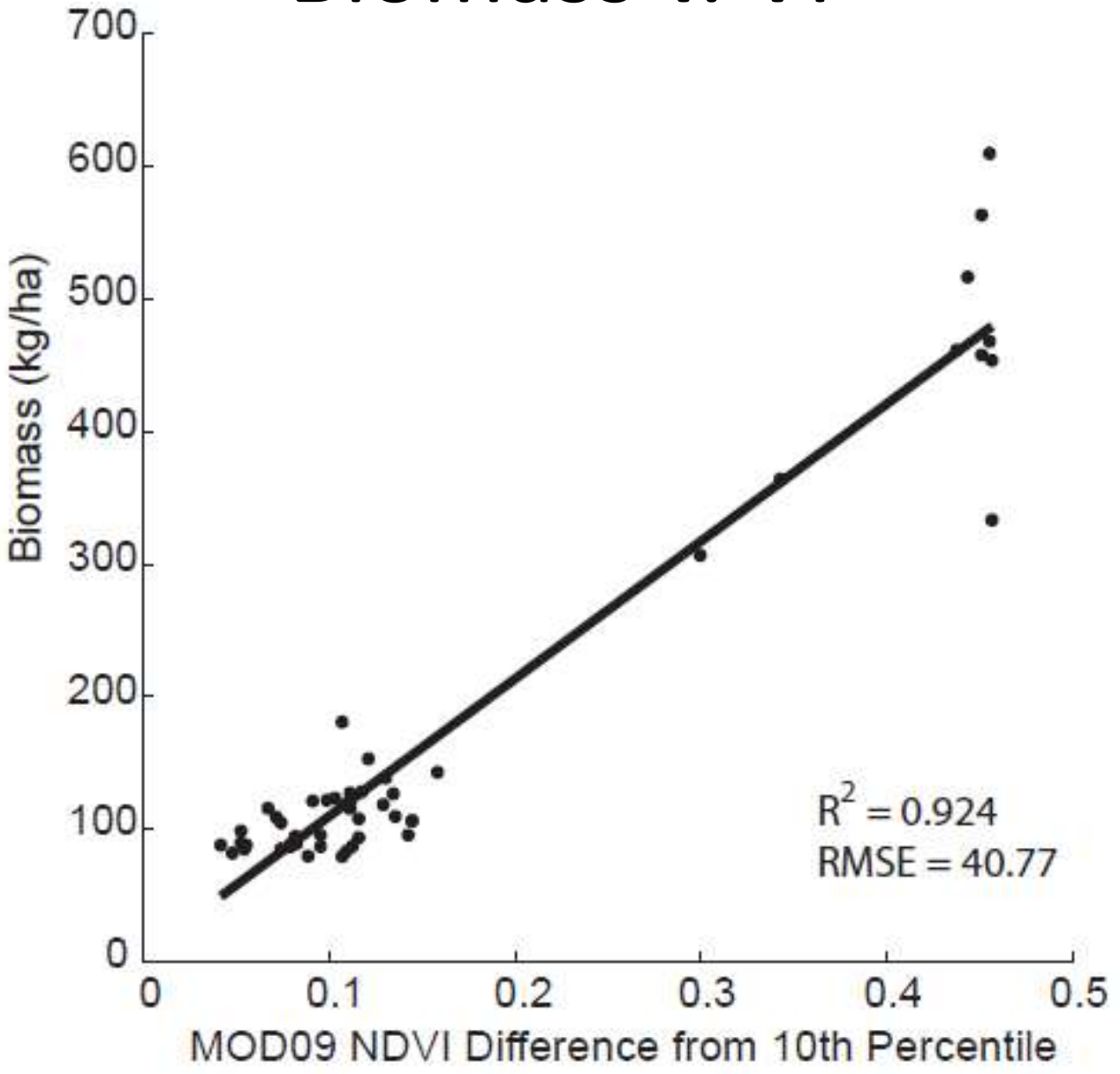

Post-fire EVI slope
3.25
0.0016
N
0
10
20
40
Km

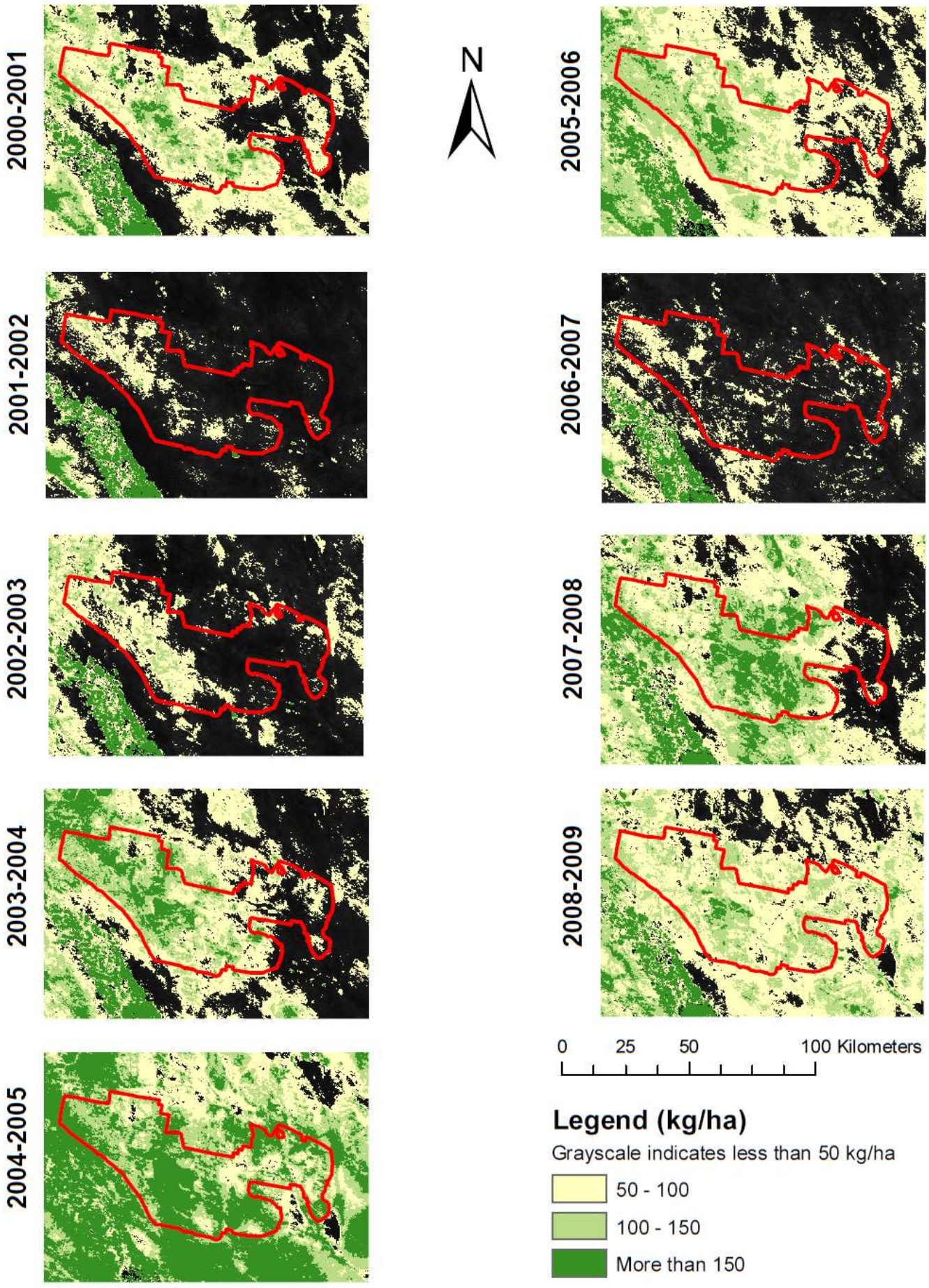

2352m
1672m
Elevation
Lower slopes
Higher slopes
Vegetation type
264
-446
Burn Severity
Pre-fire Vegetation
564
-223
0
10
20
40
Km


Poor Soils
Post-fire clearing,
enhanced oak regeneration
Soil preparation,
Seeding with grasses

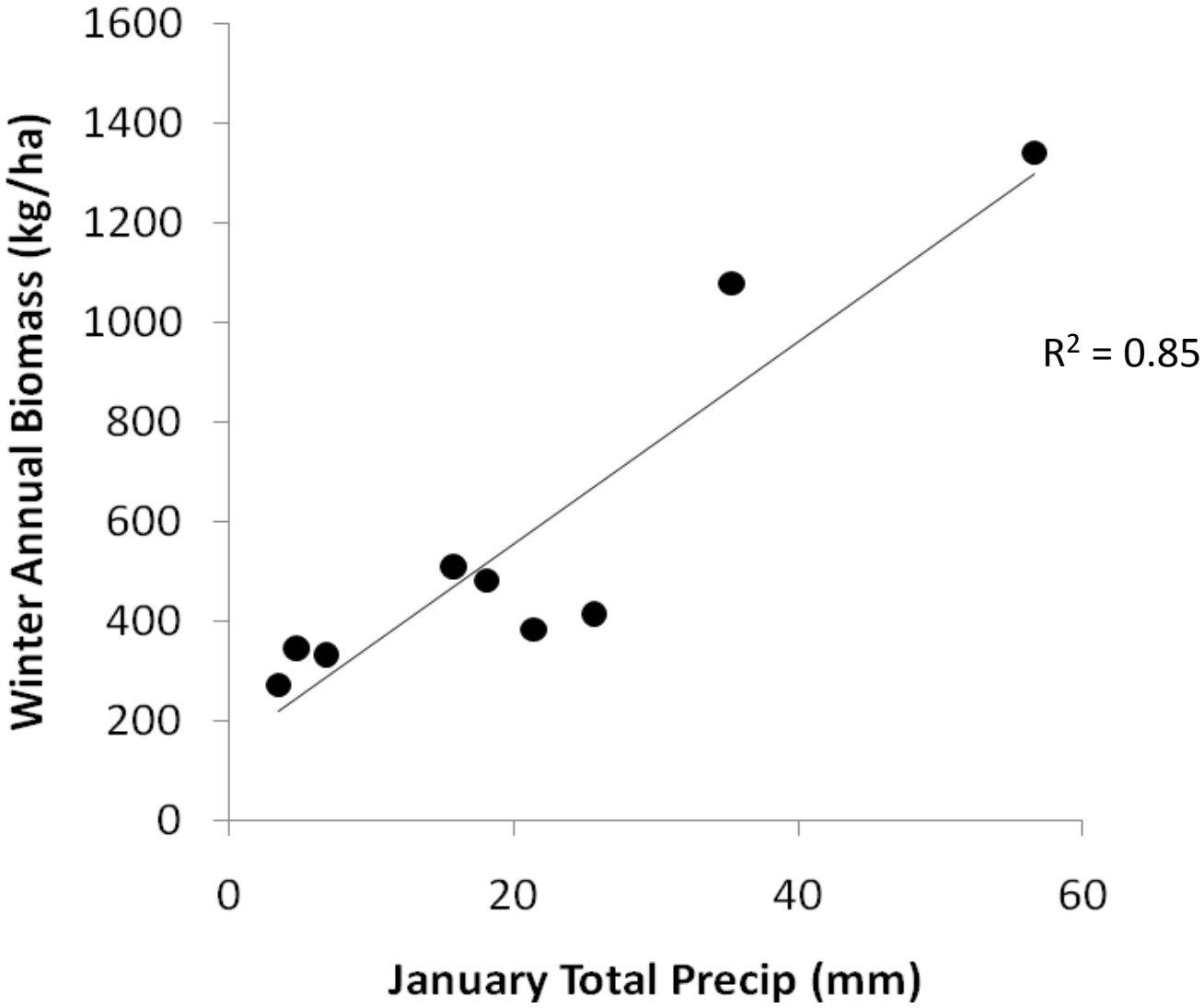
Winter Vegetation in Joshua Tree National Park (productivity as a function of climate)

Biomass v. VI


Biomass (kg/ha)
700
600
500
400
300
200
100
0
0
0.1
0.2
0.3
0.4
0.5
MOD09 NDVI Difference from 10th Percentile
$R^2 = 0.924$
RMSE = 40.77


2000-2001
2001-2002
2002-2003
2003-2004
2004-2005
2005-2006
2006-2007
2007-2008
2008-2009
N
0
25
50
100 Kilometers
Legend (kg/ha)
Grayscale indicates less than 50 kg/ha
50 - 100
100 - 150
More than 150

Production v. Precip



Applications in the KPK

- Prioritization/stratification for demonstration sites
- Monitoring and assessment of rehabilitation efforts
- Modeling watershed function over time
- Predicting impacts of large-scale implementation of demonstration projects
- Others?

Thank you!

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