Developing a Spatial Model of Yellow-billed Cuckoo Breeding Habitat

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Project Objectives

- Characterize Yellow-billed Cuckoo breeding habitat
- Develop spatially explicit models of cuckoo breeding habitat
- Identify all potential cuckoo habitat on the Lower Colorado River
- Extrapolate the model to other parts of the state
- Use the predictive model for habitat restoration and enhancement effectiveness monitoring

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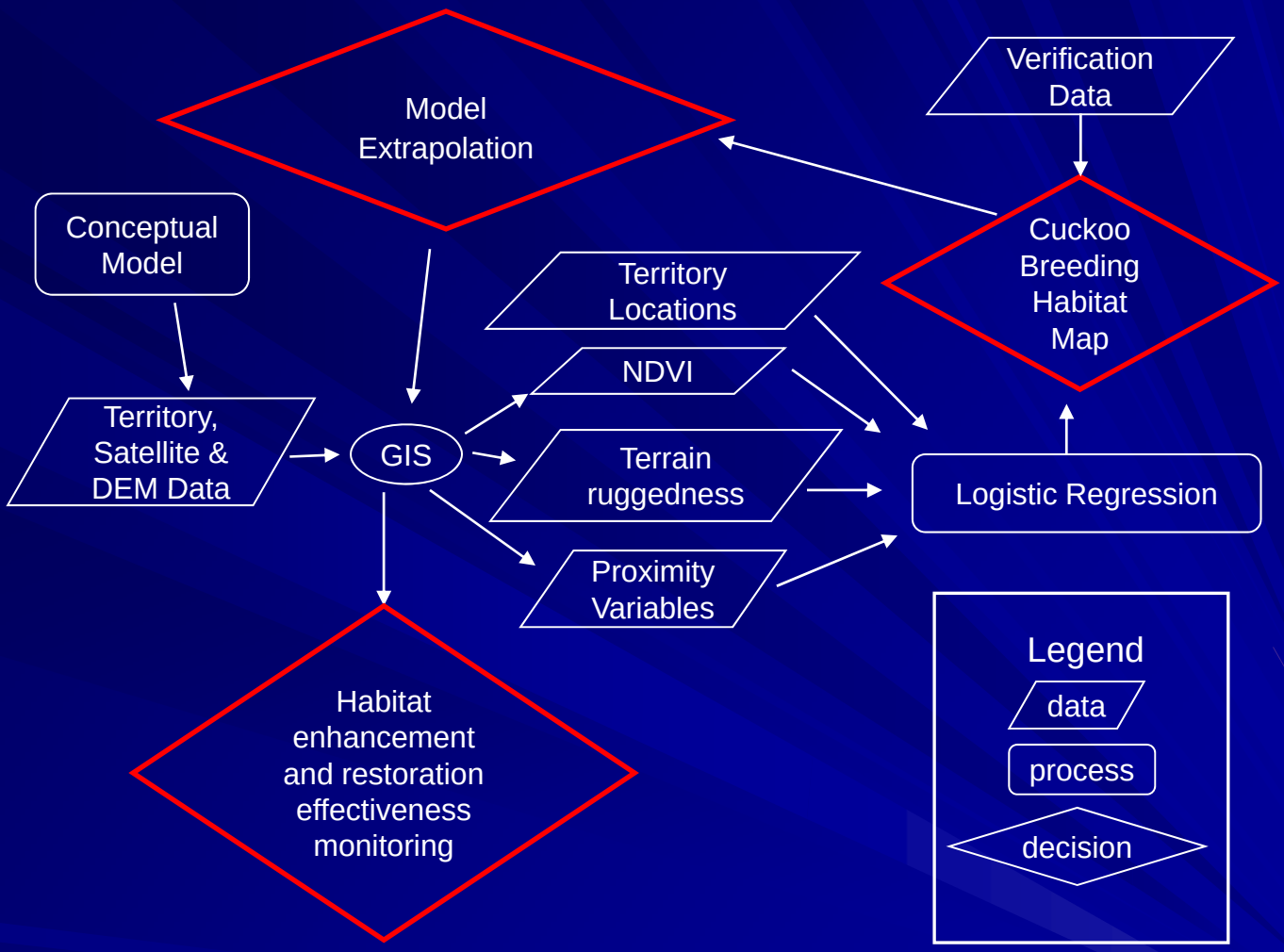
Modeling Approach



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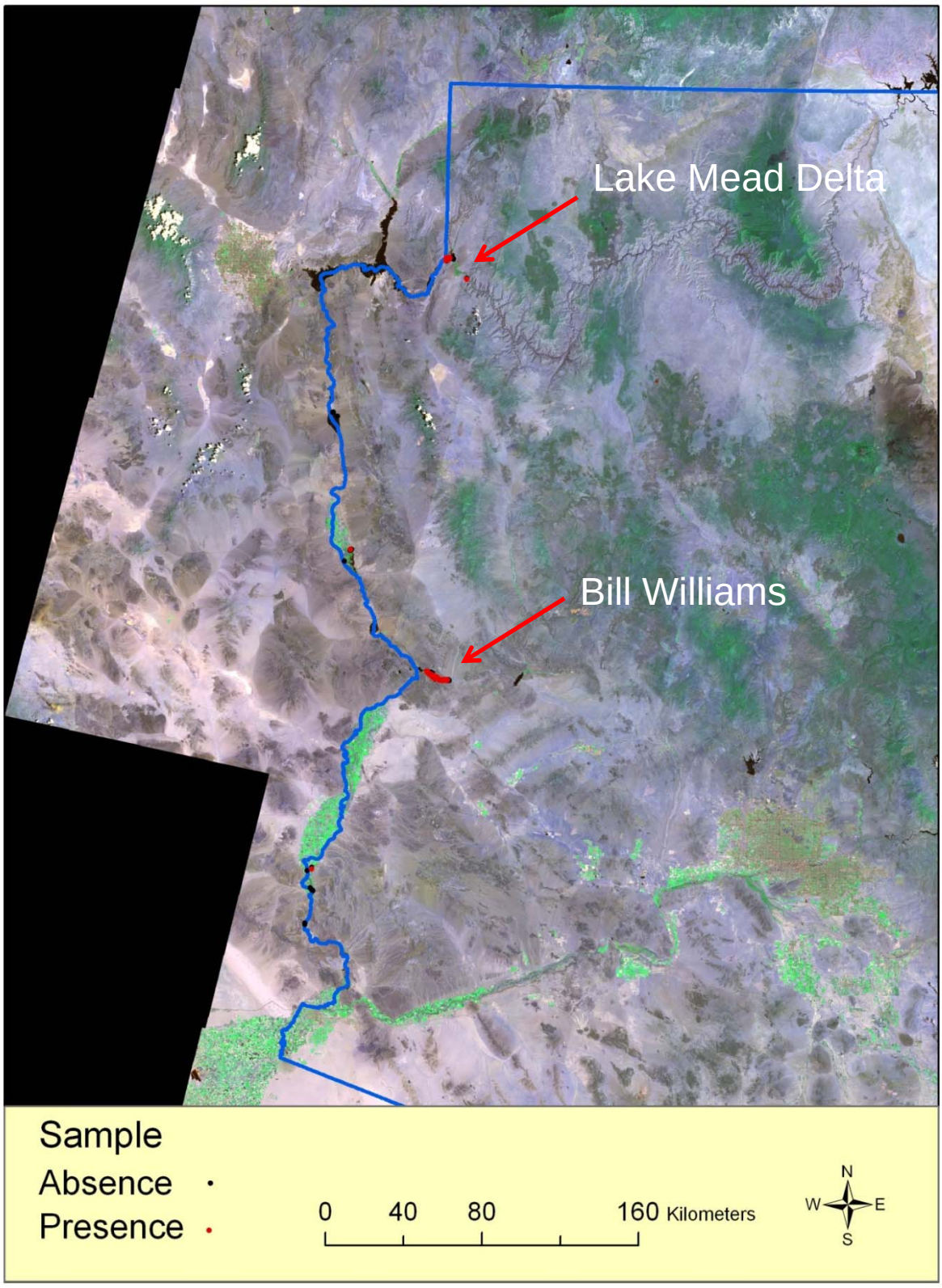
Sample Locations - 2006



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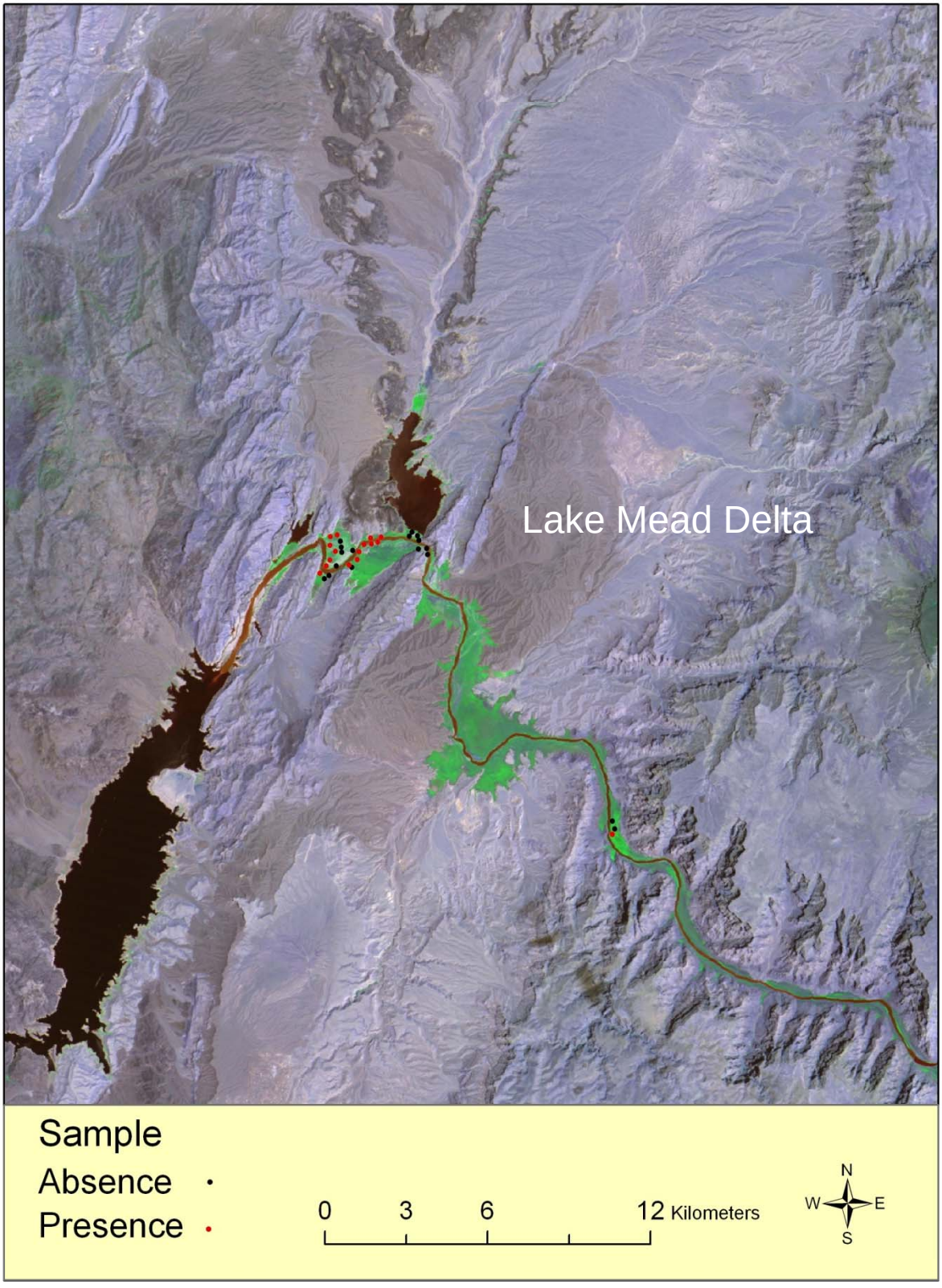
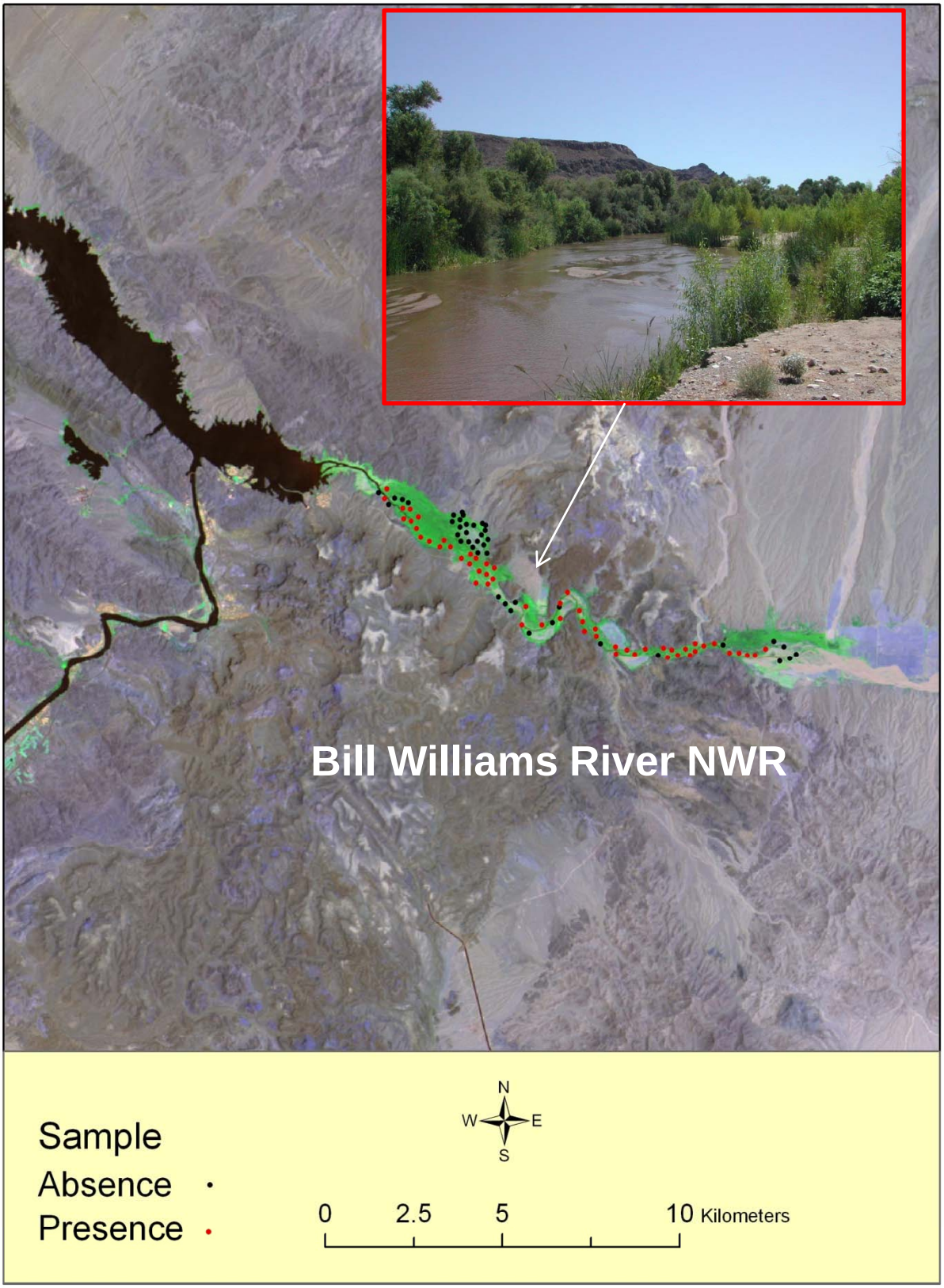

Lake Mead Delta
Sample
Absence
Presence
0
3
6
12 Kilometers
N
W
E
S

USGS


Bill Williams River NWR
Sample
Absence
Presence
N
W
E
S
0
2.5
5
10 Kilometers

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Exploratory Variables

- Terrain roughness (30-m DEMs)
- Distance to water
- Distance to agriculture or cities
- Vegetation density (Thematic Mapper)
  - NDVI
  - Tasseled Cap
- Vegetation heterogeneity
- Patch size and configuration
  - Multiple scales
- Hydro-geomorphic classification
  - Different approaches

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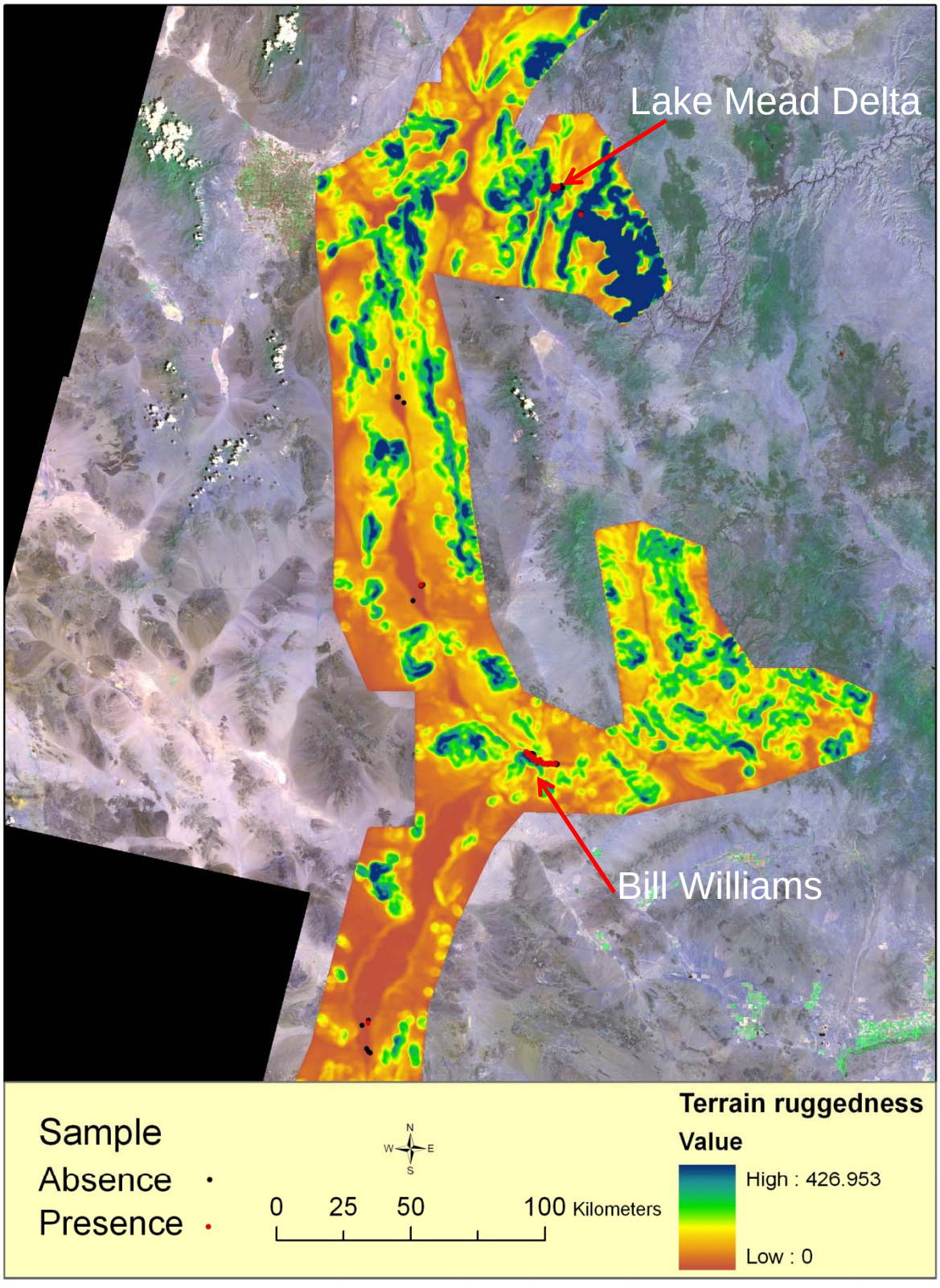
Terrain Ruggedness



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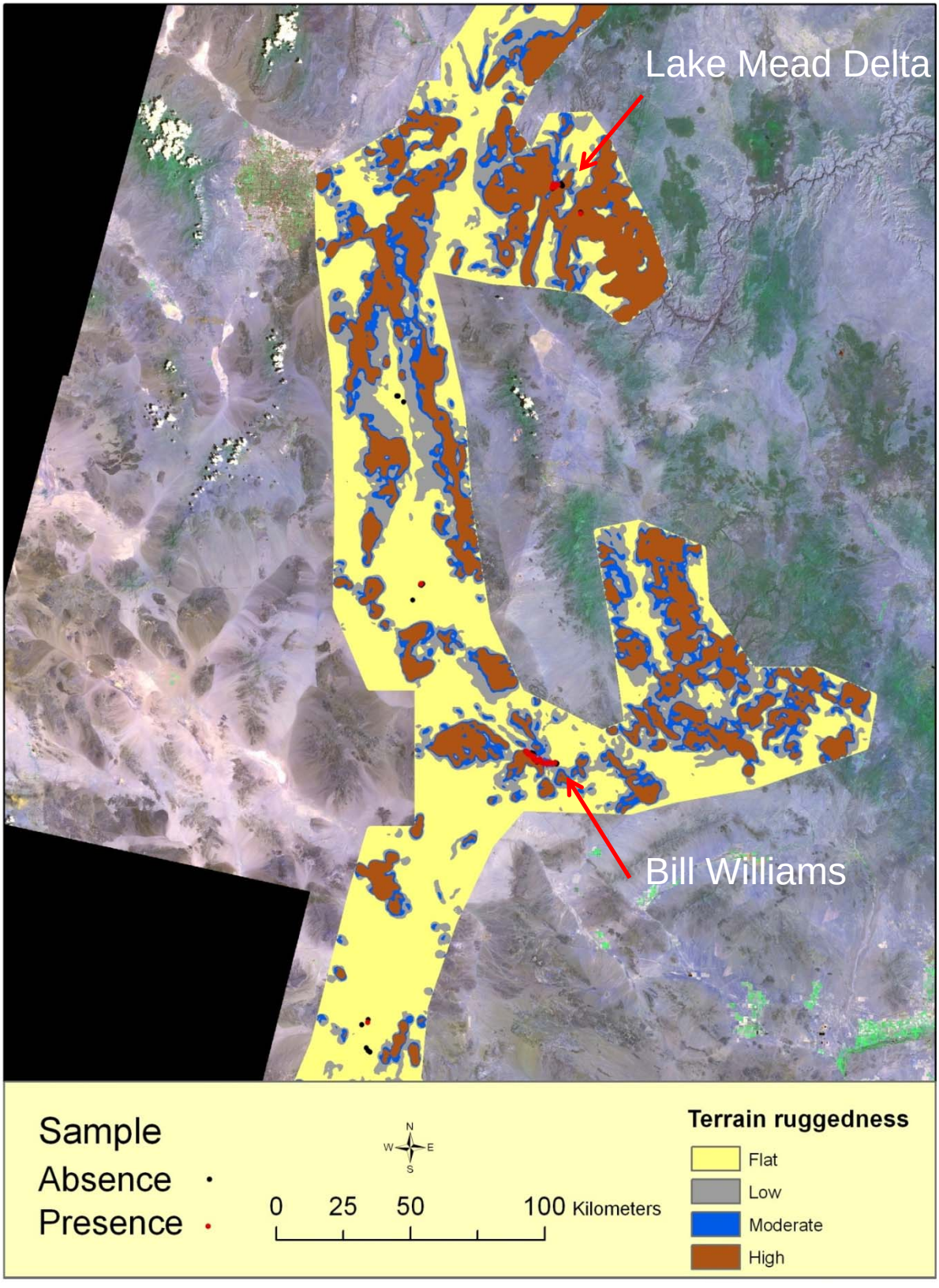
Terrain Ruggedness (classified)



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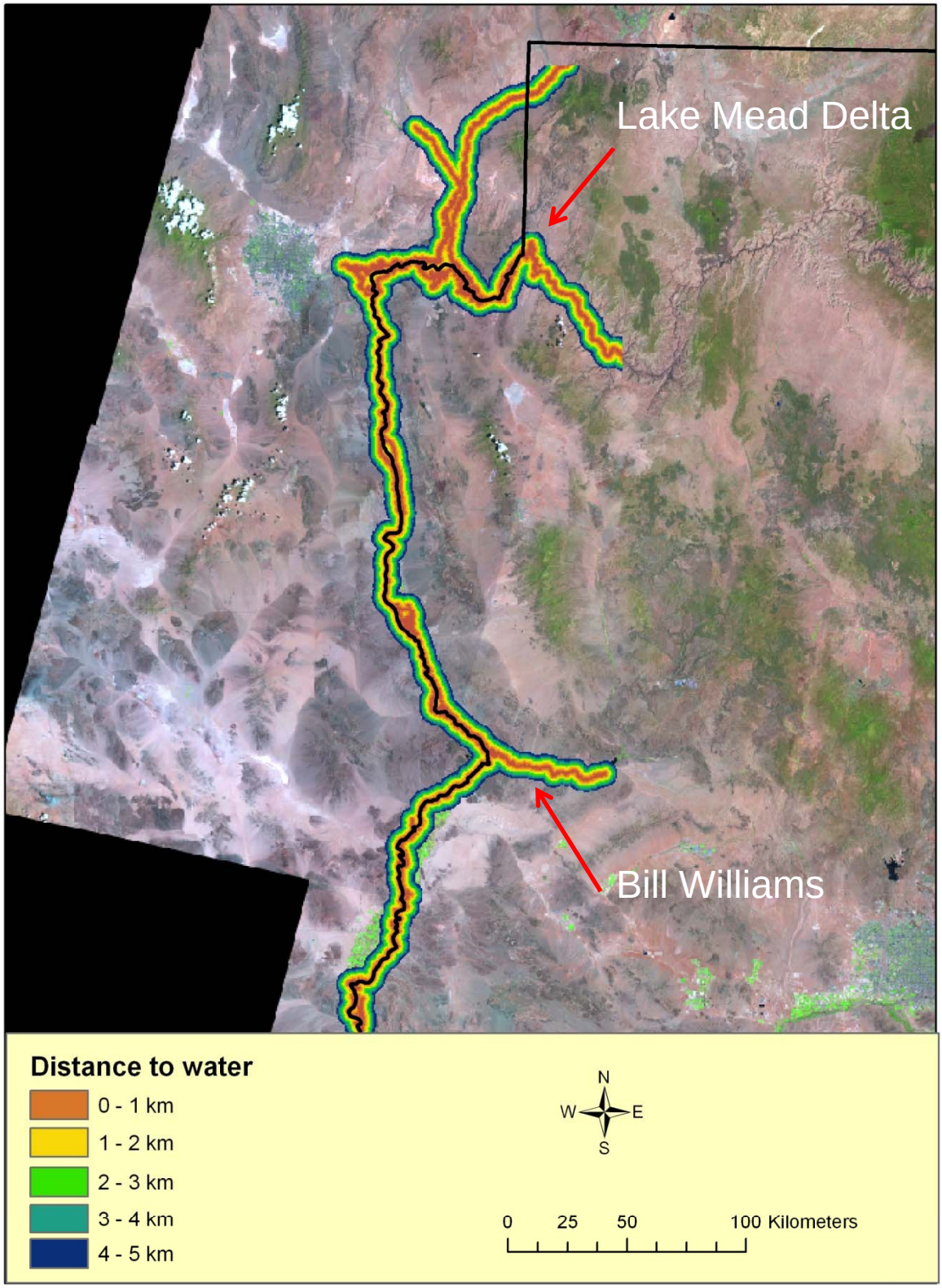
Distance to Water



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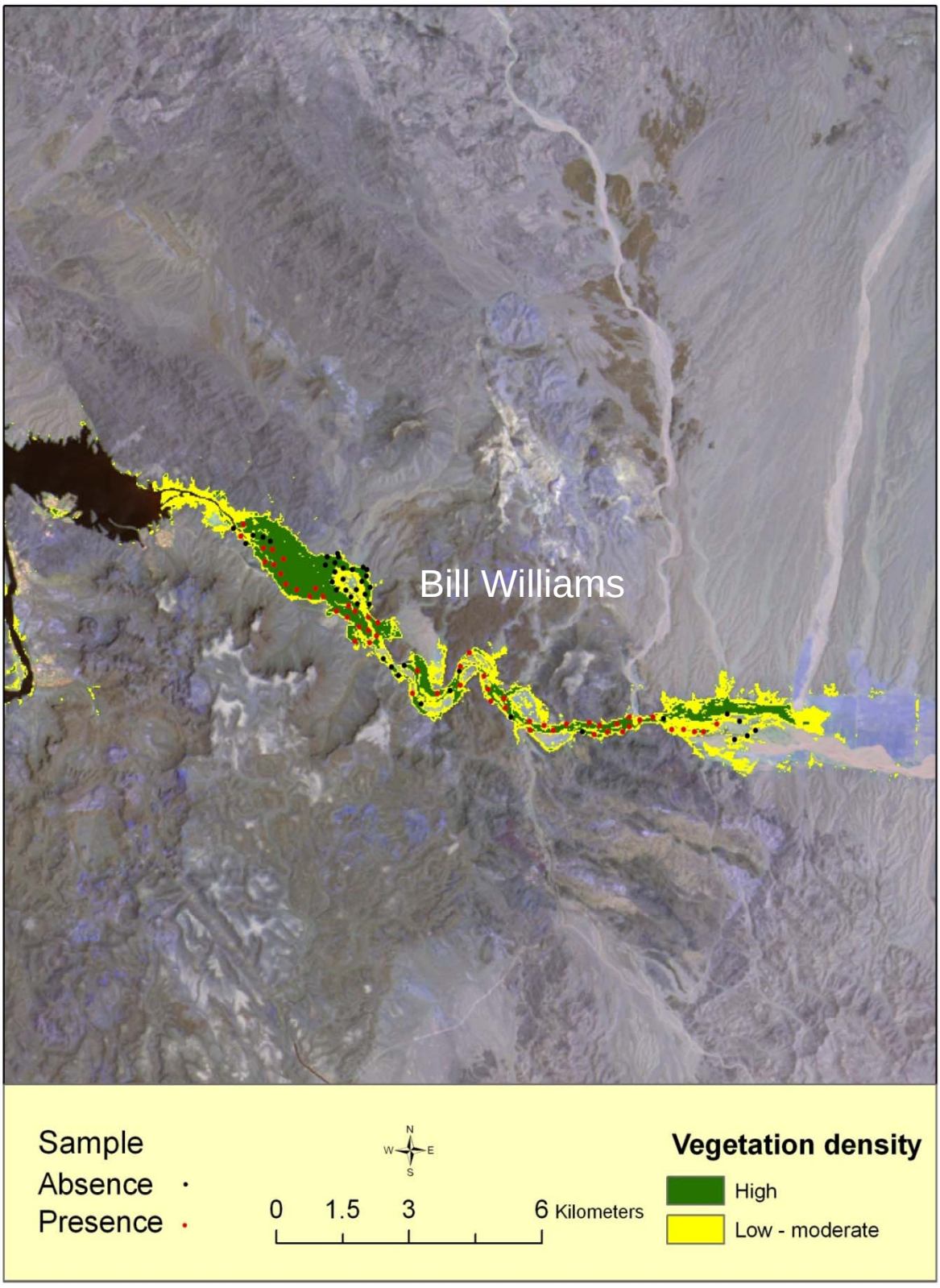
Vegetation Density (NDVI)



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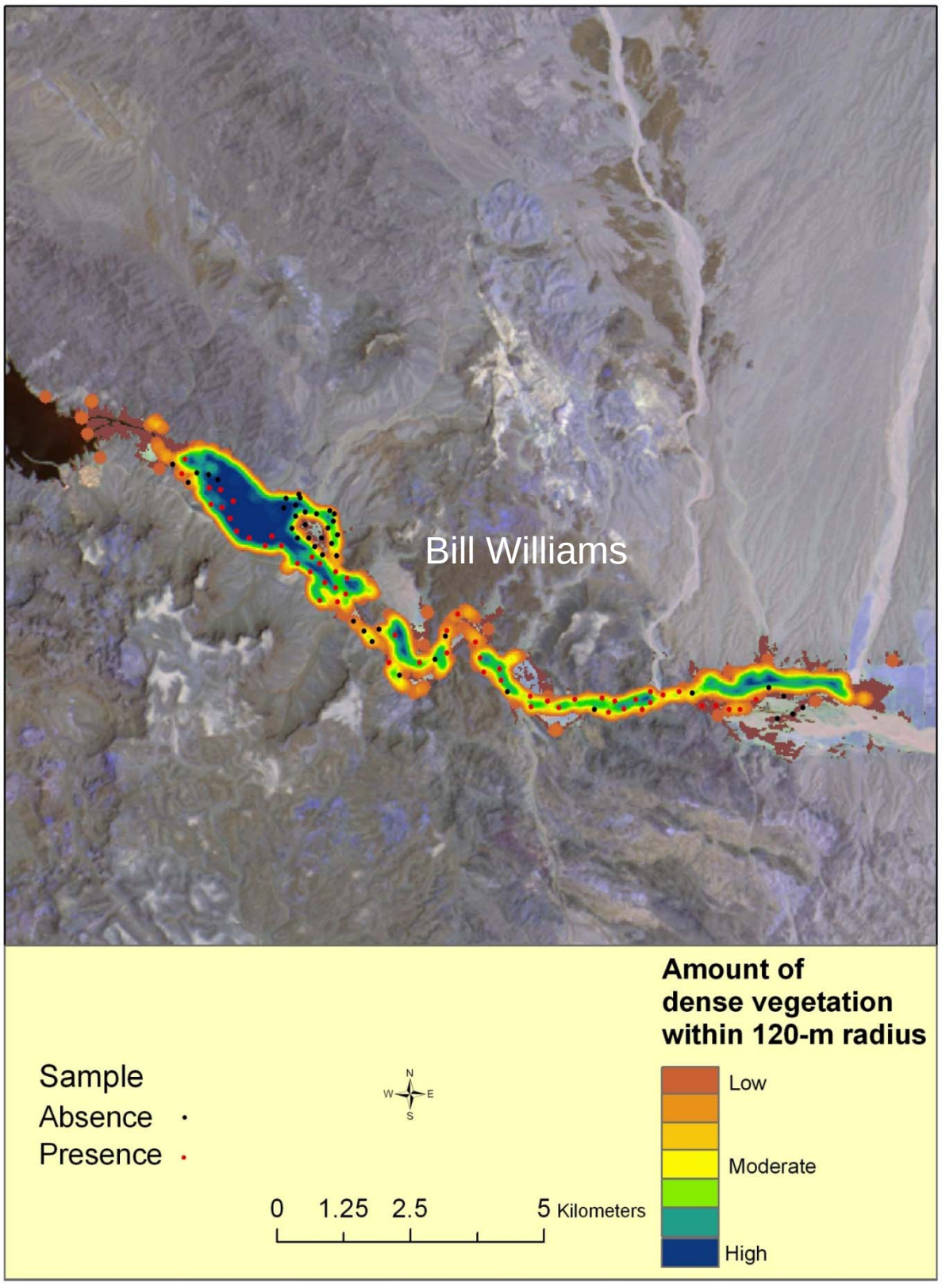
Patch (120-m radius)



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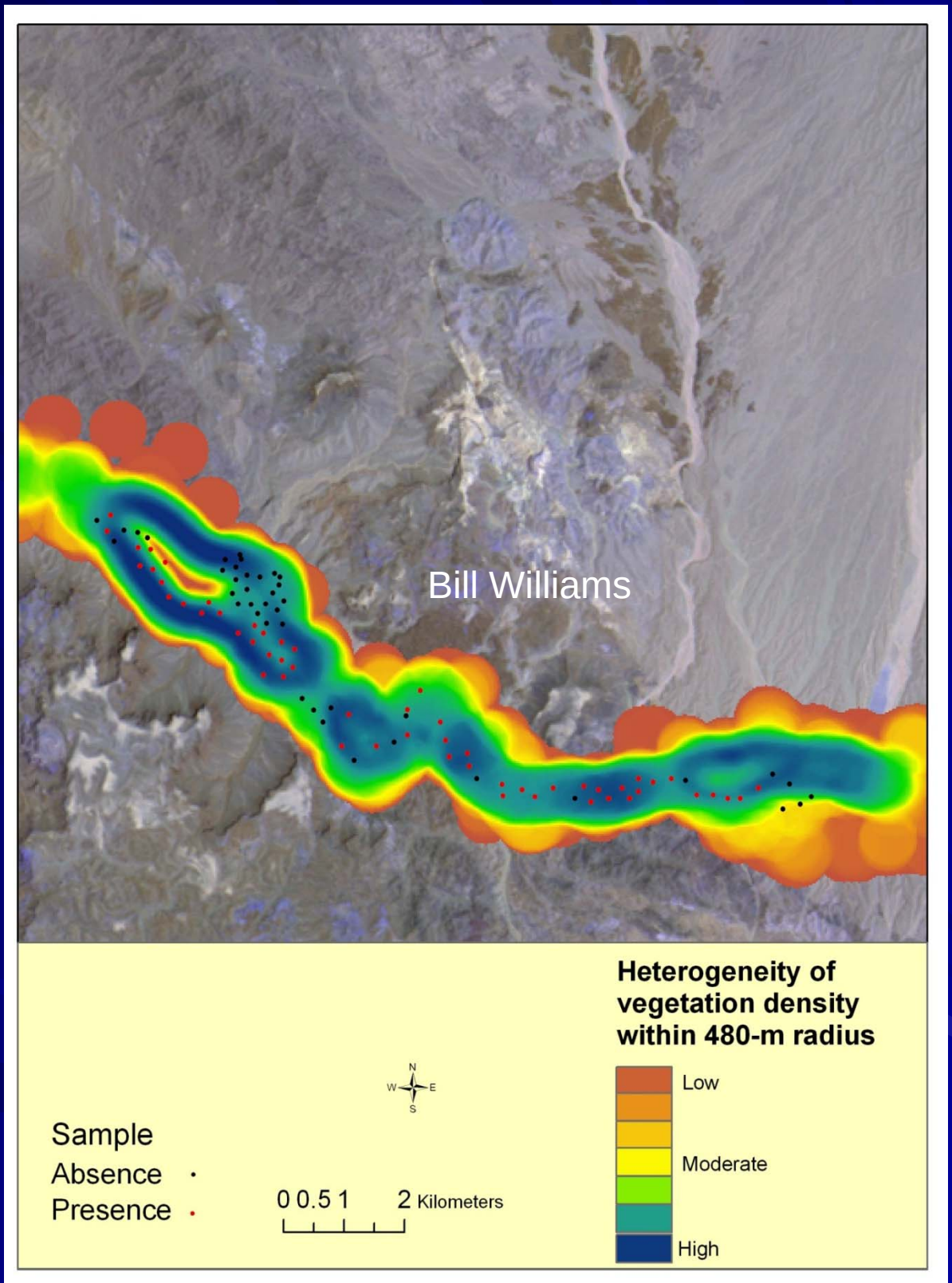
Vegetation Heterogeneity (480-m radius)



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Significant Variables

- Terrain ruggedness

  4 classes: flat, low, moderate, high

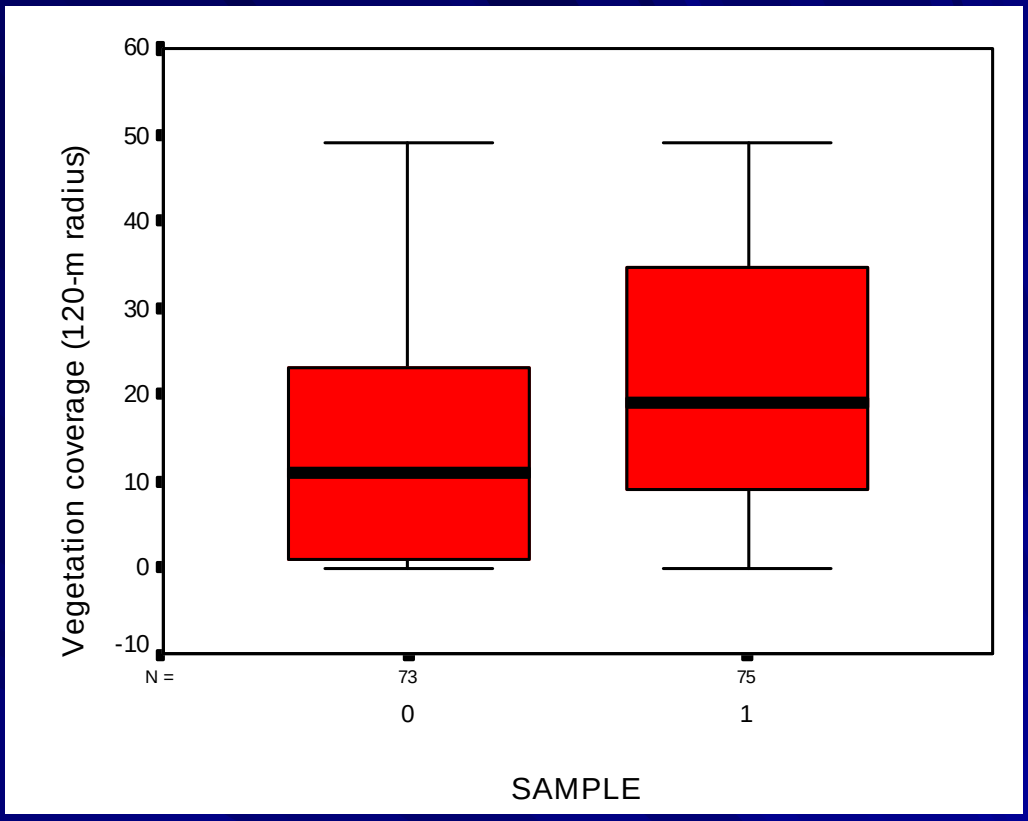
- Patch density

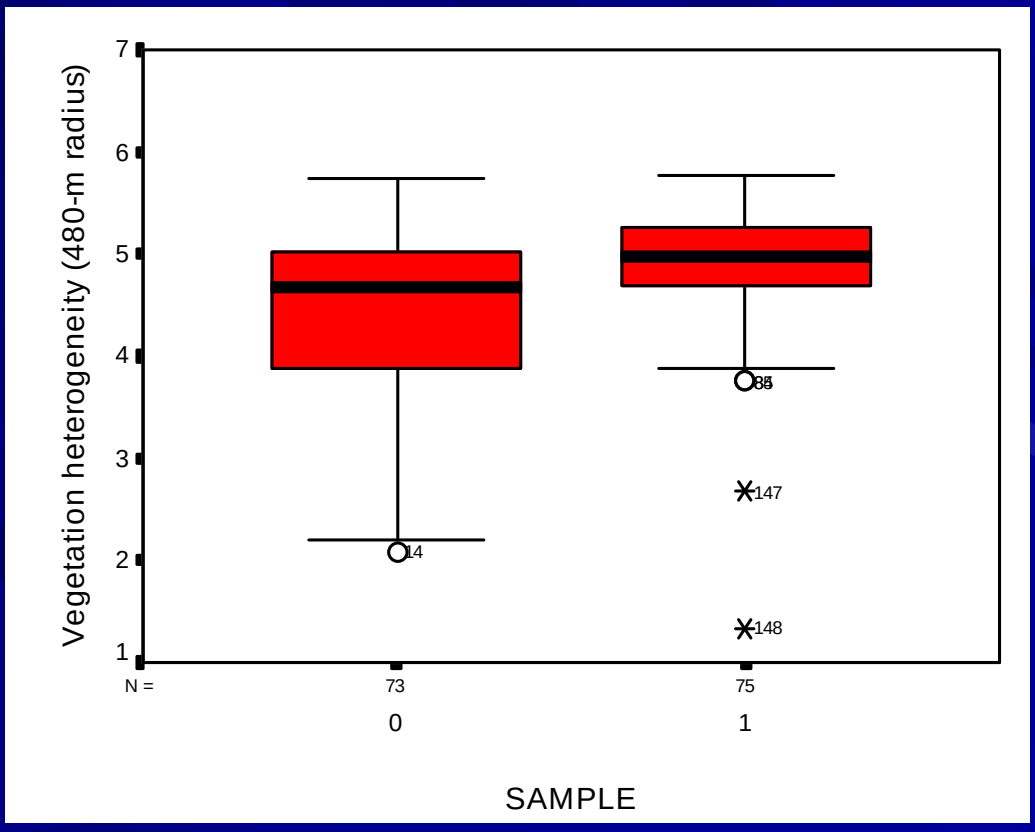
  Amount of dense vegetation (NDVI > 0.41) within 120-m radius (4.5 ha)

- Patch heterogenity

  Variation in vegetation density (SD of NDVI) inside a 480-m radius (72 ha)

Significant Covariates





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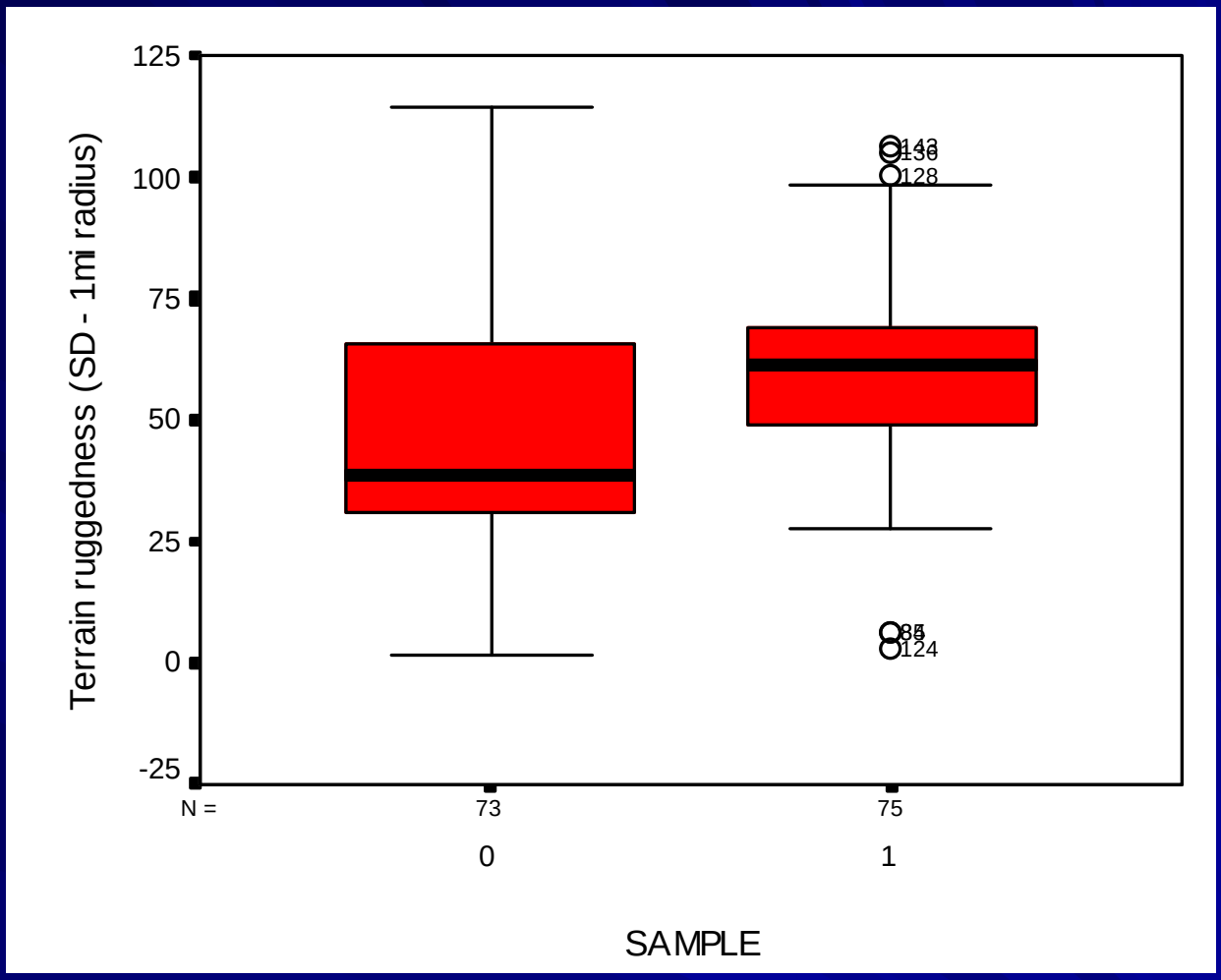
Significant Covariates



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Model Outputs

- Probability grids
- Spatially explicit maps
- Multiple classification approaches

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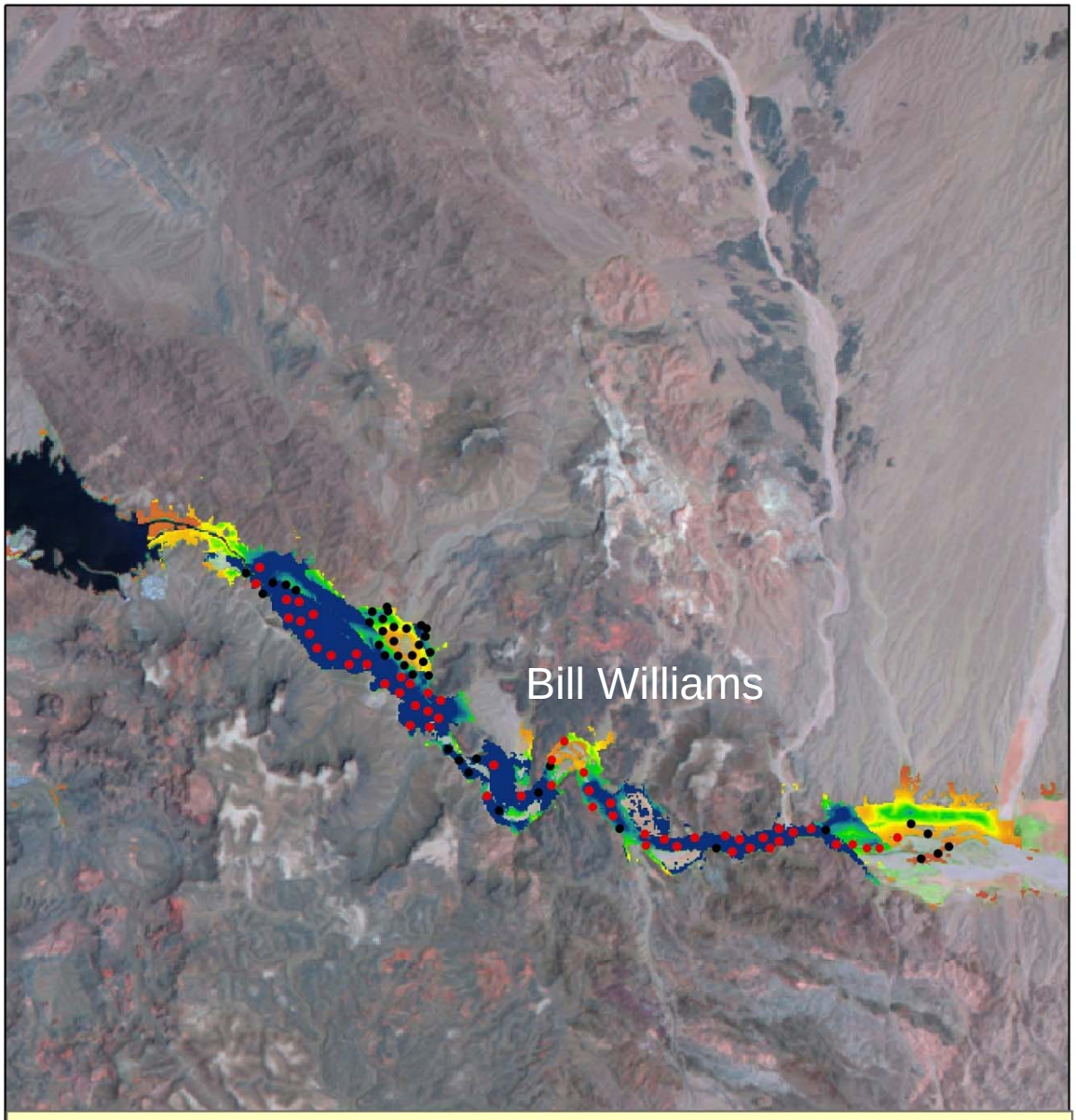
Probability Surface - 2006



SAMPLE

- Absence
- Presence

Model probability

High : 0.999999

Low : 0.0122897

N
W E
S

0 1.25 2.5 5 Kilometers

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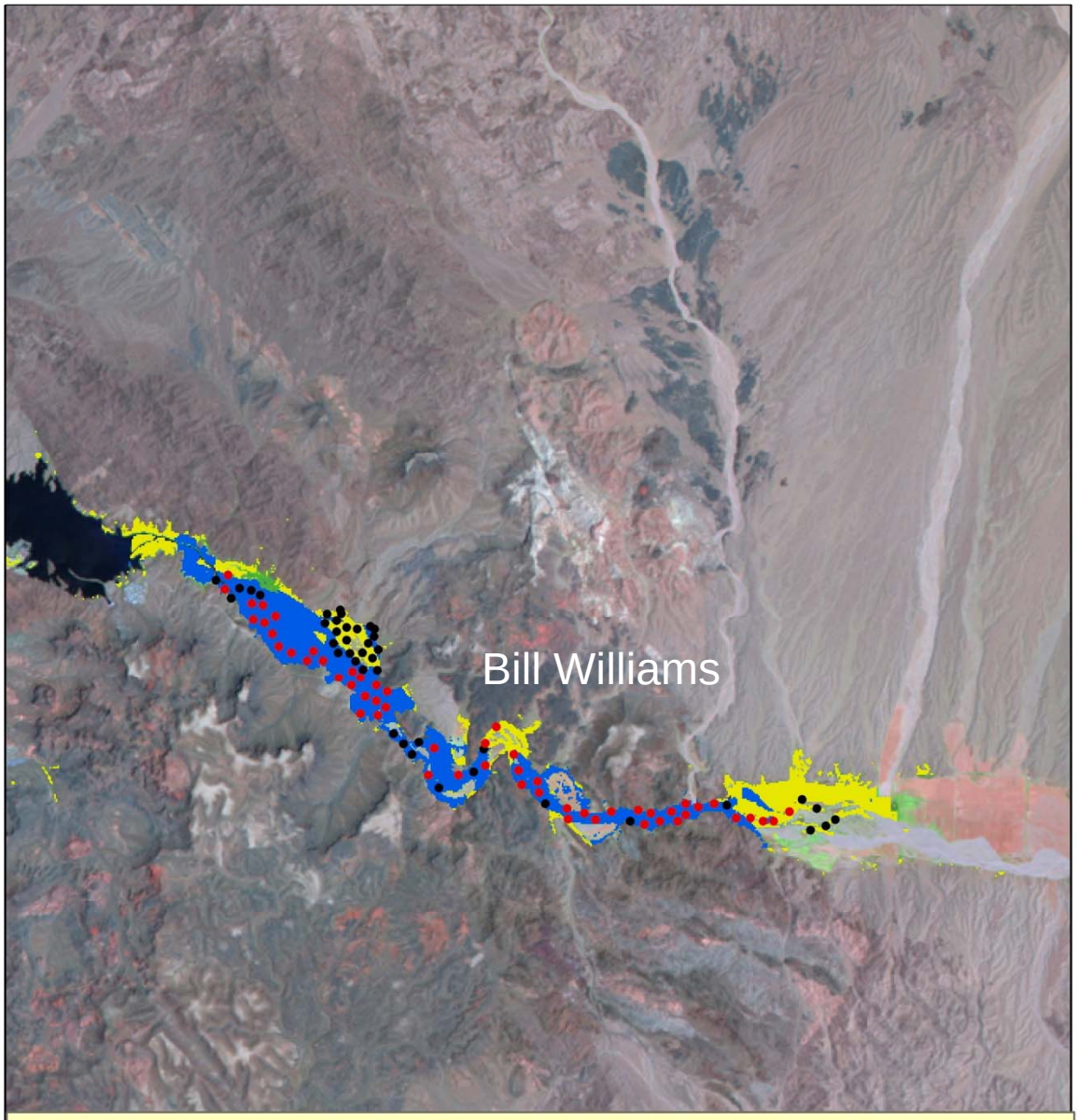
Binary Habitat Map - 2006



75% overall accuracy

SAMPLE

- Absence
- Presence
- Predicted unsuitable
- Predicted suitable

N
W E
S

0 1.5 3 6 Kilometers

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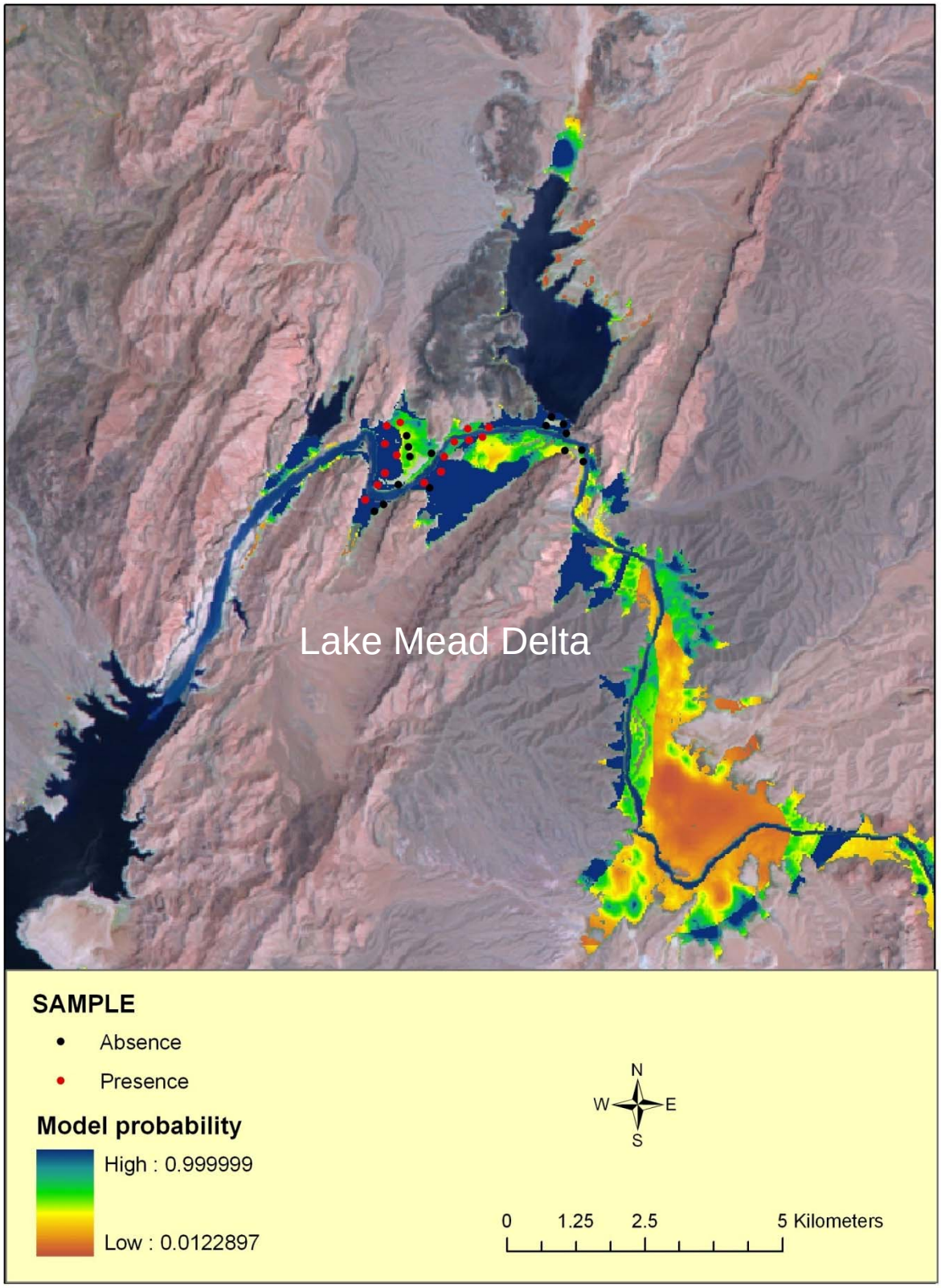
Probability Surface - 2006



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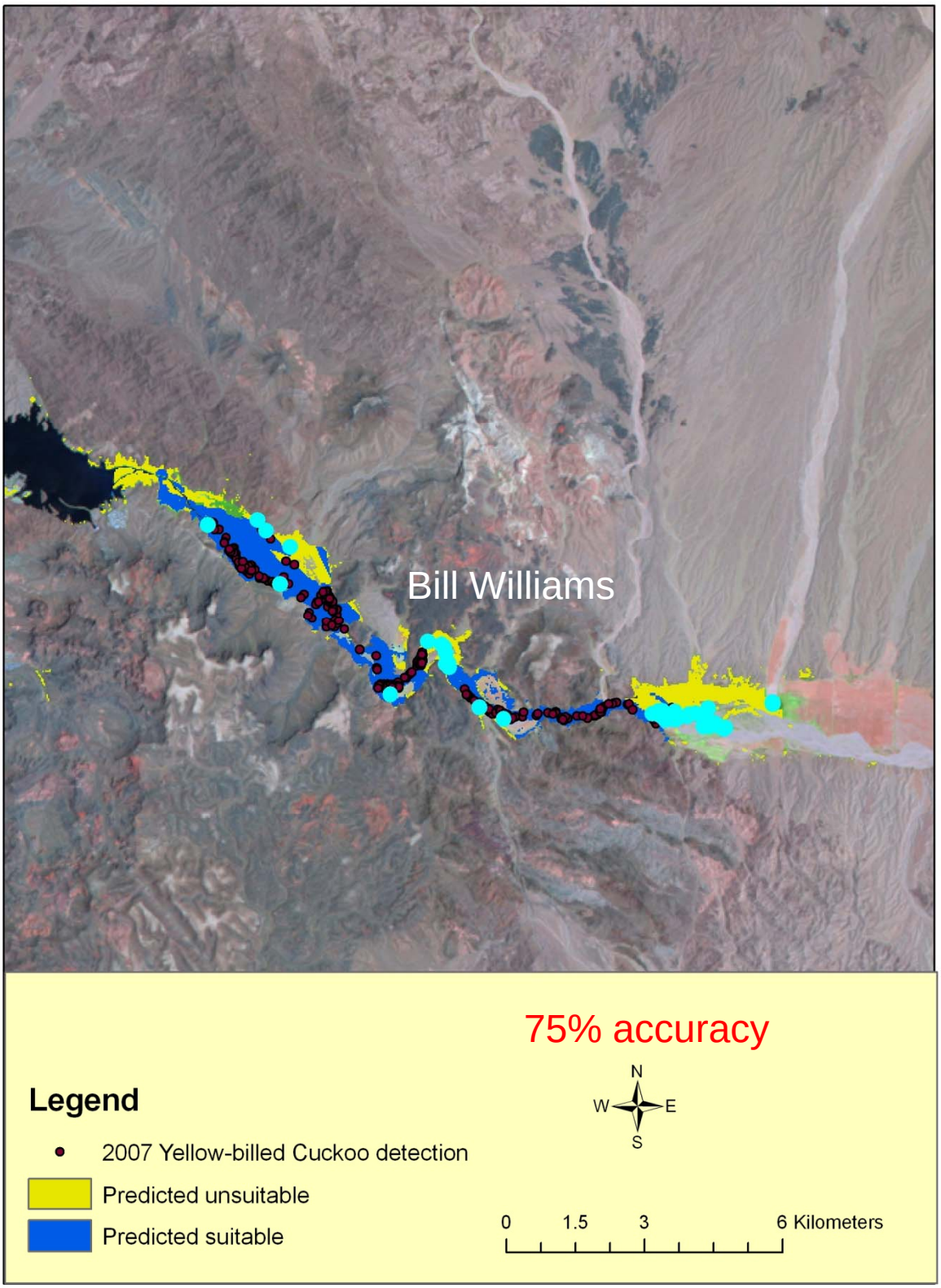
Binary Habitat Map - 2007



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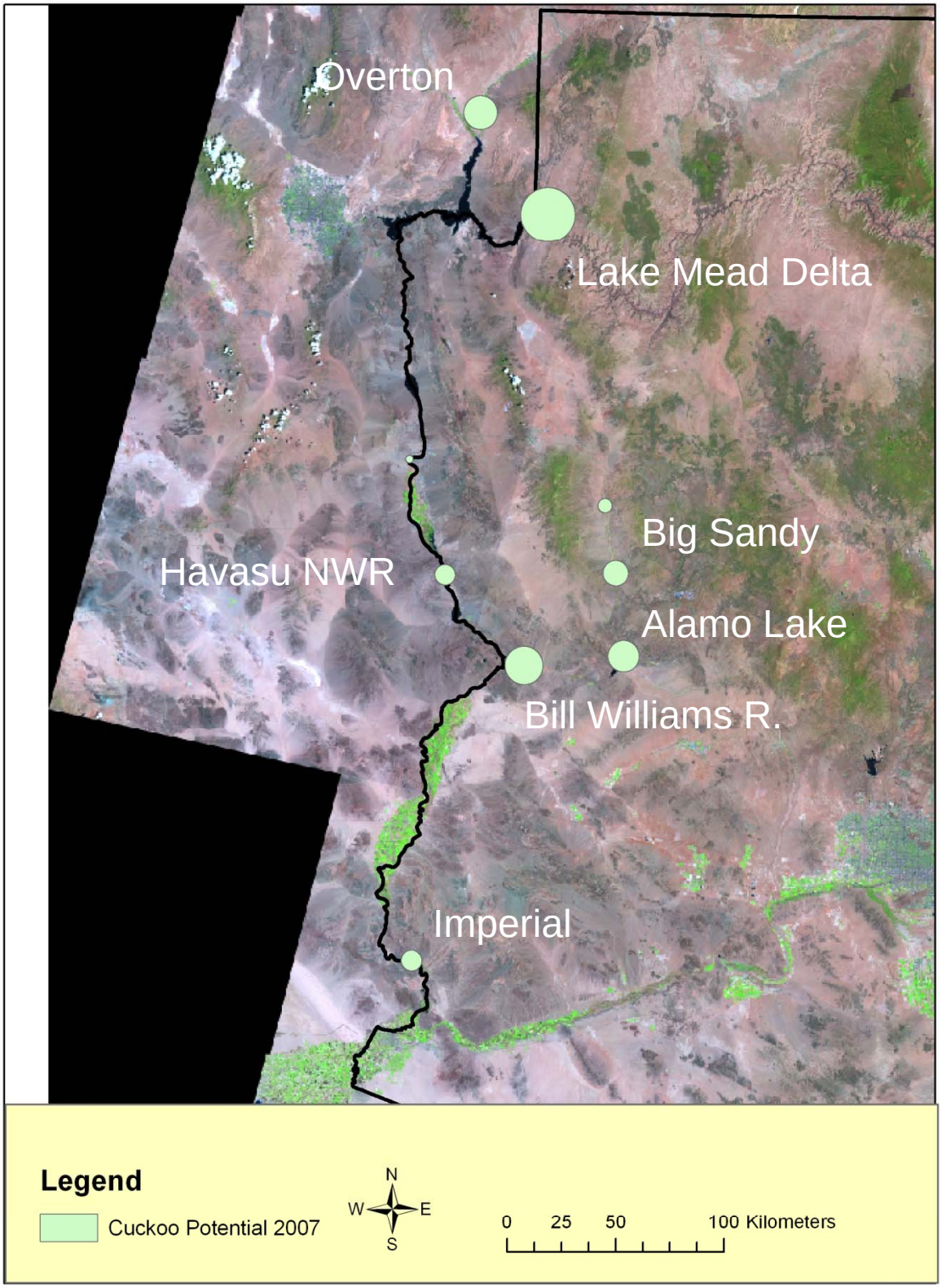
Potential Cuckoo Habitat 2007



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Preliminary Conclusions

Terrain ruggedness most important

-moderate terrain ruggedness the best (>20 times as likely to have YBCU as flat terrain)

Patch size and composition important

- 120 m radius (core density)
- 480 m radius (vegetation heterogeneity)
- Each 10% of core area covered in dense vegetation = 15% increase in YBCU
- Each 1SD increase in vegetation heterogeneity = 68% increase in YBCU

Classification accuracy ~75%

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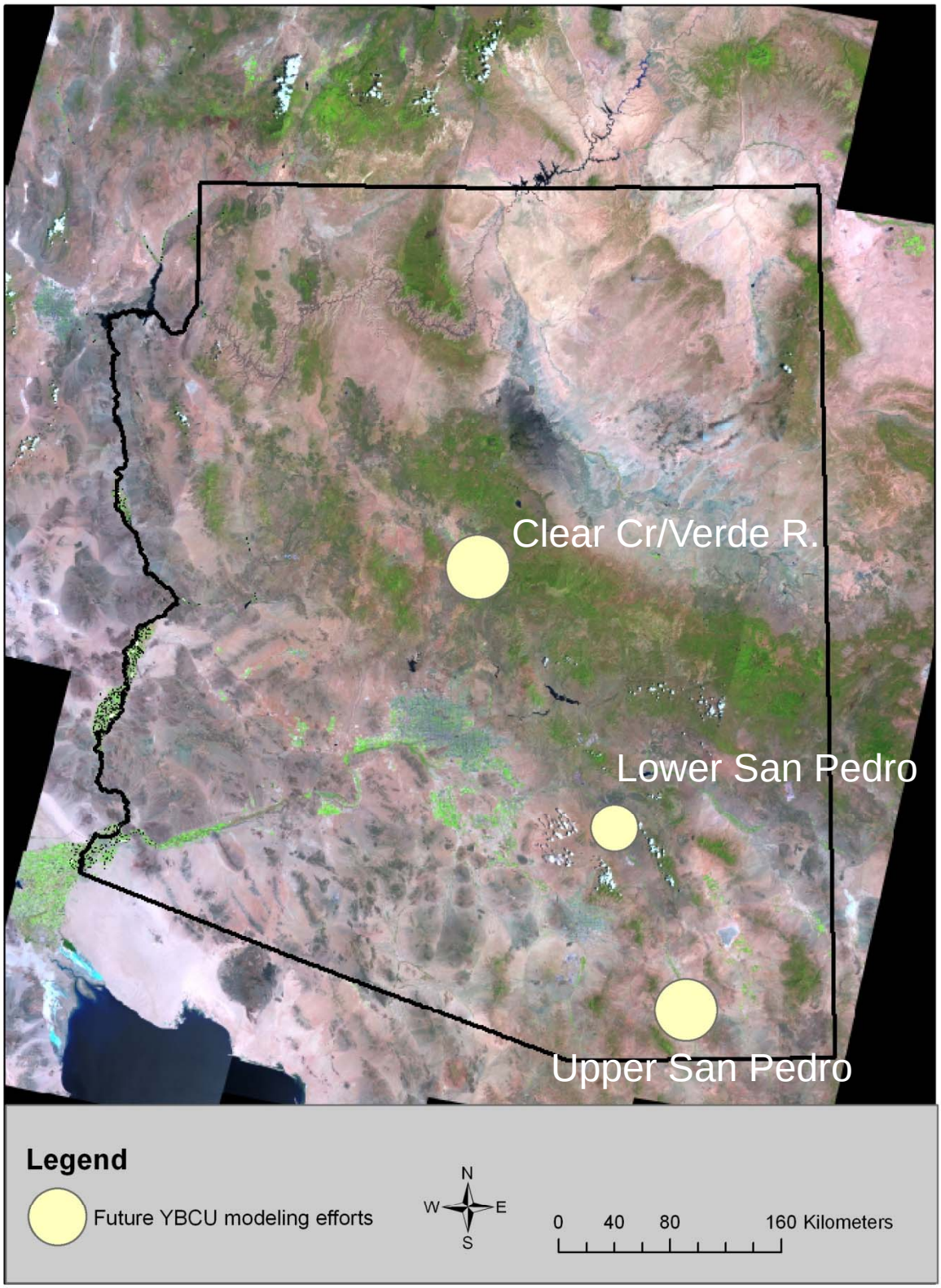
Future Modeling



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