Susceptibility Factors Controlling the Occurrence of Slow-Moving Large Landslides in the Whanganui Basin Sediments, North Island

Thomson Awards Oct 28th, 2020

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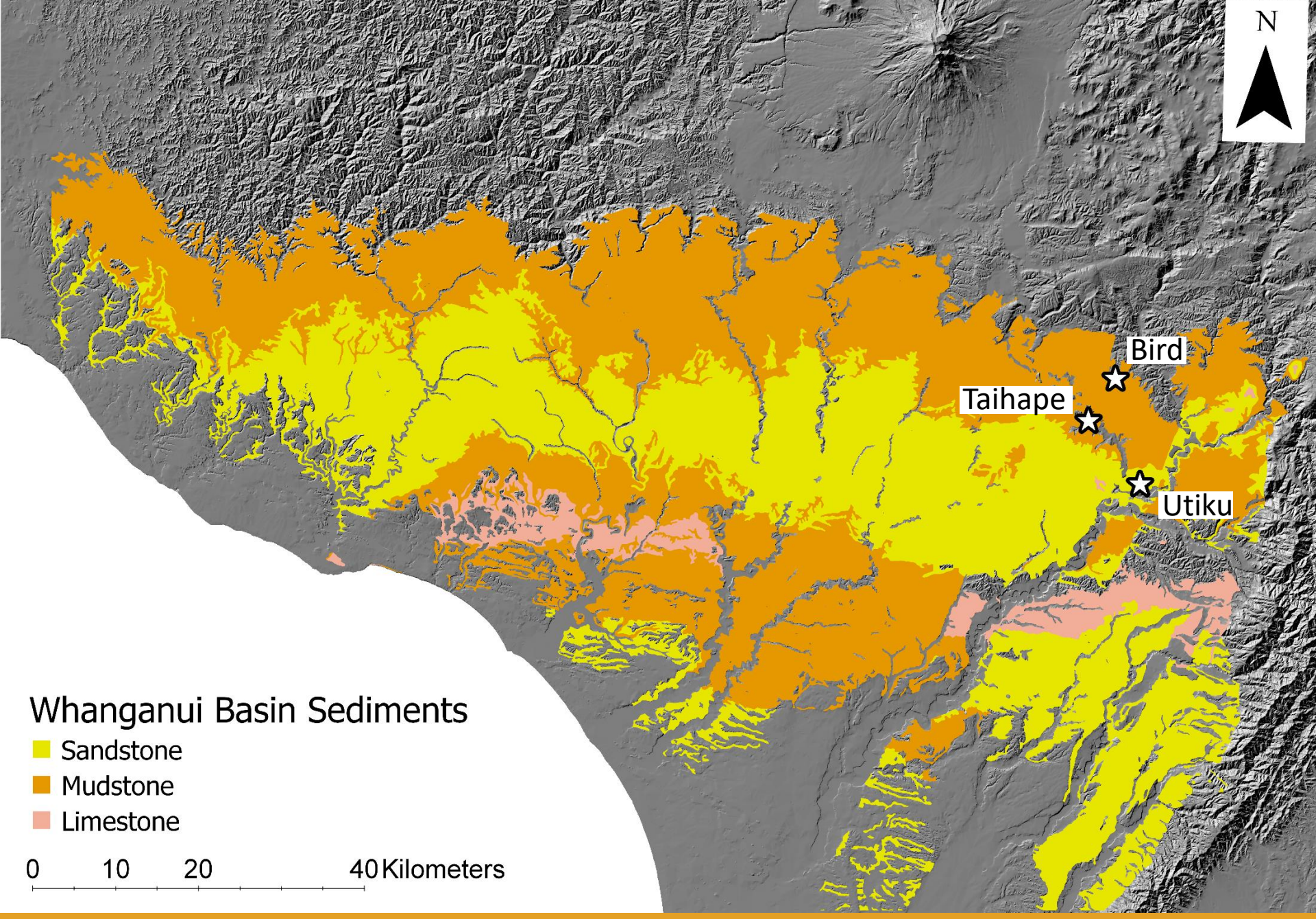

N
Bird
Taihape
Utiku
Whanganui Basin Sediments
Sandstone
Mudstone
Limestone
0
10
20
40 Kilometers

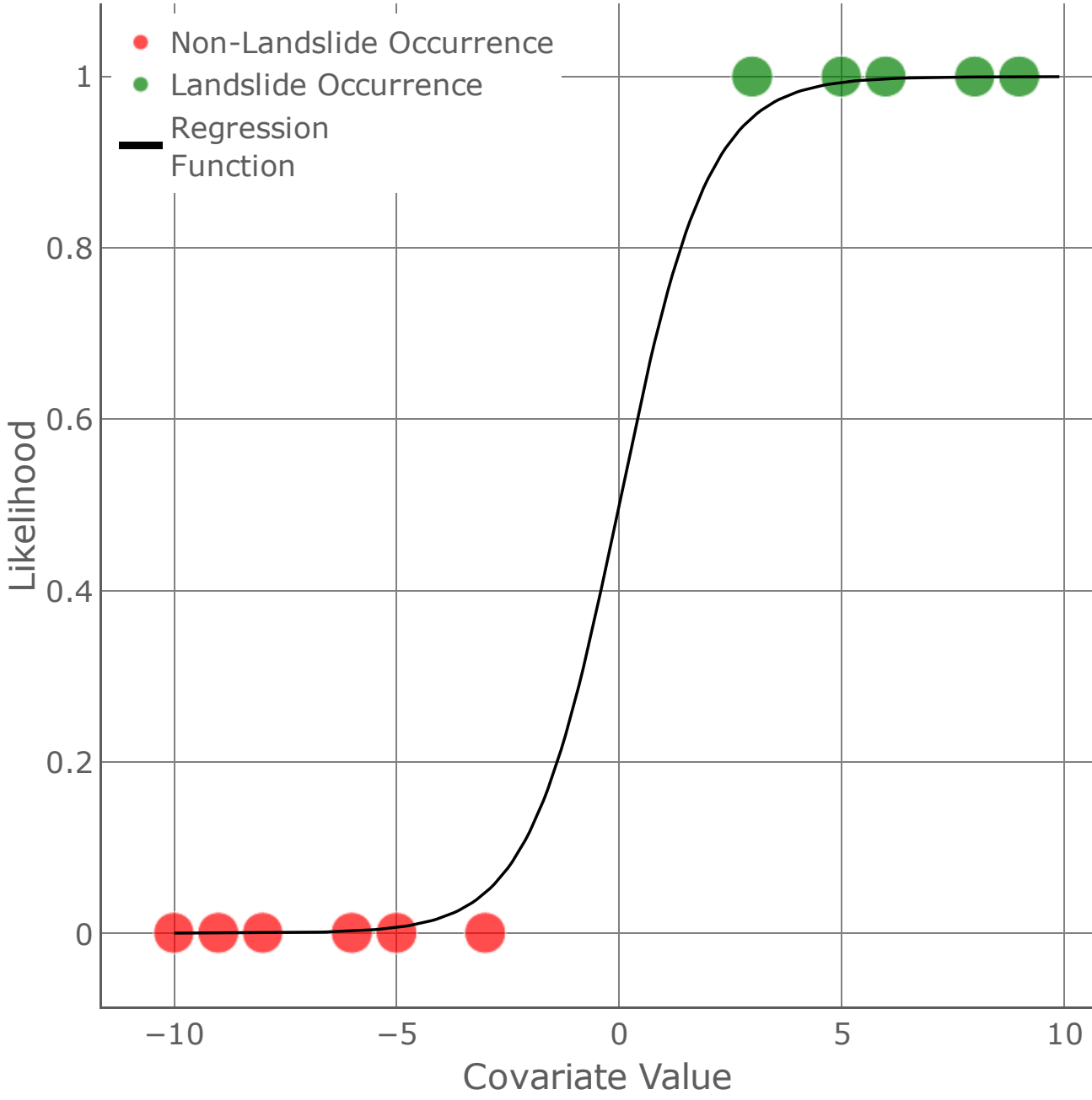

Landslide headscarp
Landslide boundary
Taihape Rural Hospital
Kaka Road
Landslide boundary
Former St Joseph's Primary School
O'Taihape Valley Stream
O'Taihape Valley Road

Rangitikei Landslide – July 2015 to May 2017

Logistic Regression Susceptibility Model

Components:

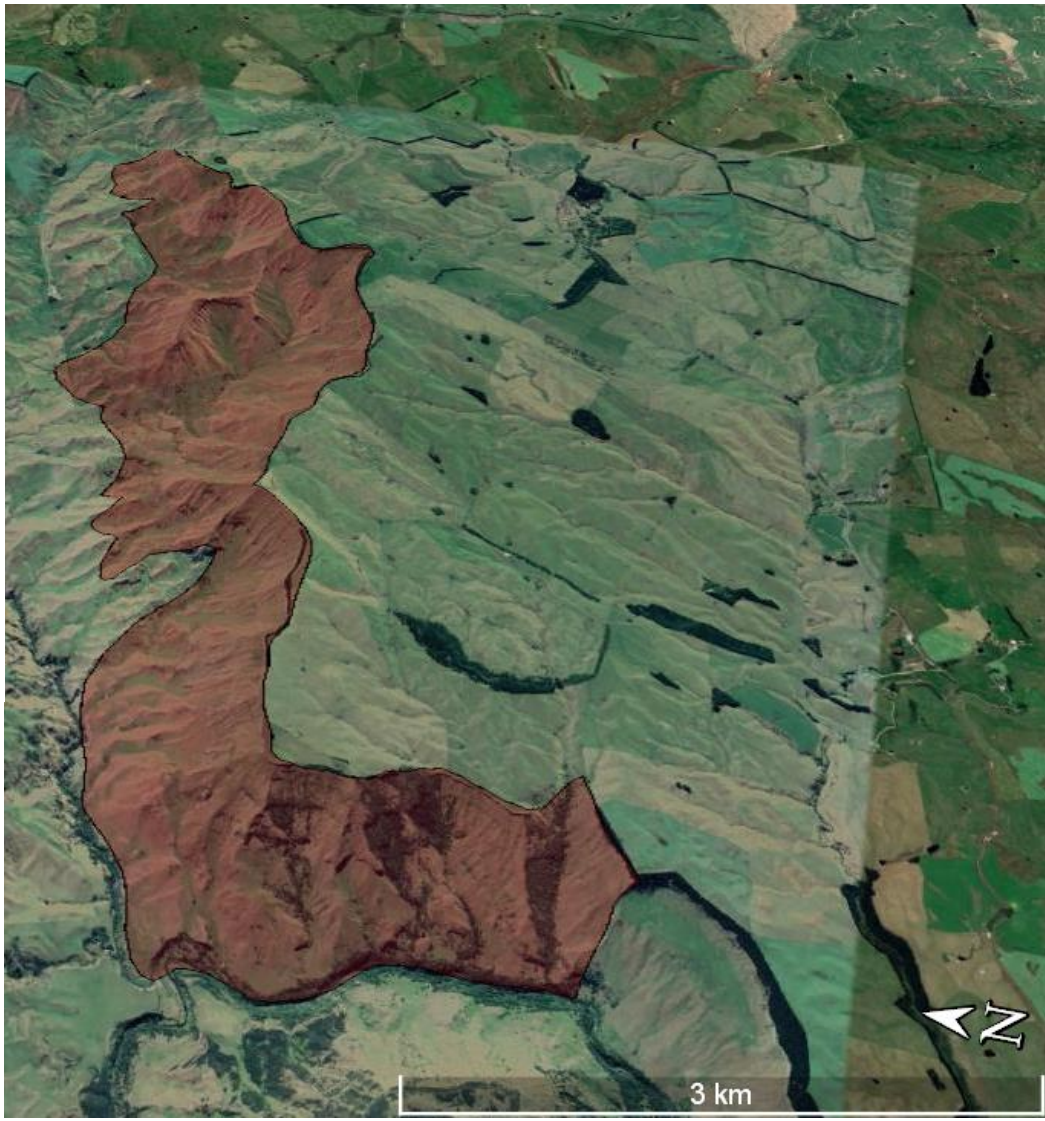
1. Landslide Observations
2. Non-Landslide Observations
3. Covariates

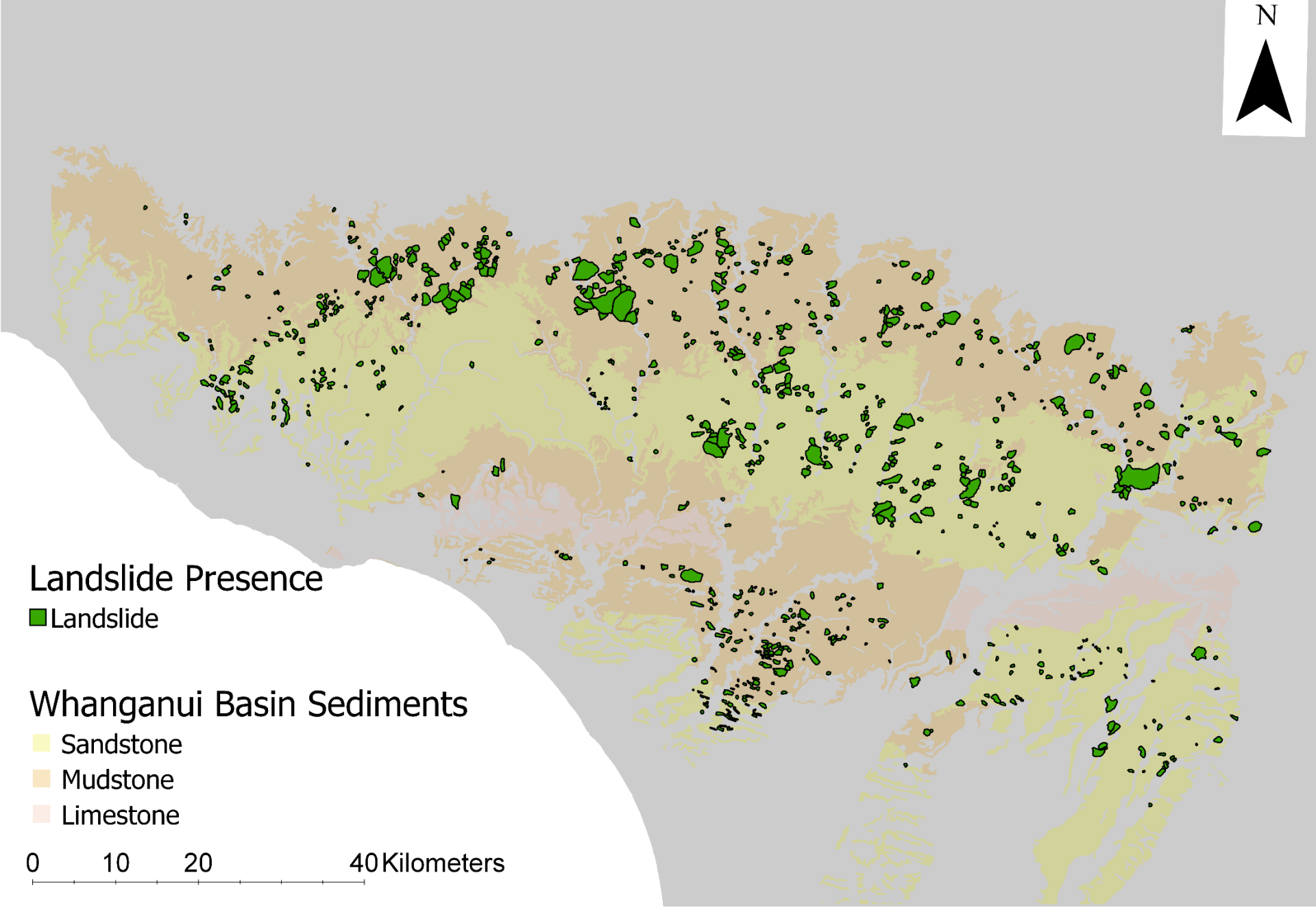


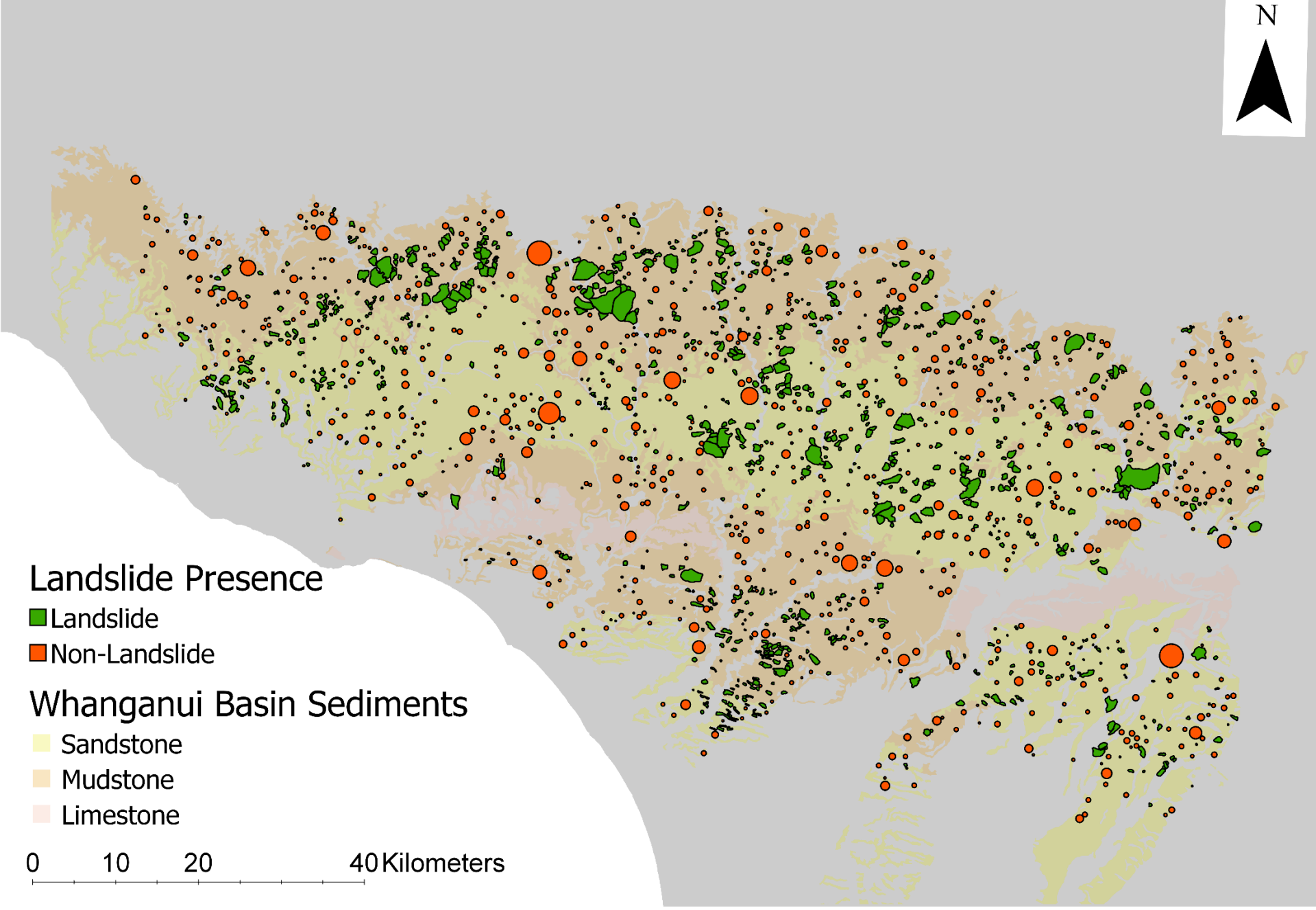
Available Landslide Maps

GNS Large Landslide Inventory:

- Inconsistent methodology
- Landslides missing
- Falsely mapped landslides
- Contains many undifferentiated landslide types




N
Landslide Presence
Landslide
Whanganui Basin Sediments
Sandstone
Mudstone
Limestone
0
10
20
40 Kilometers


N
Landslide Presence
Landslide
Non-Landslide
Whanganui Basin Sediments
Sandstone
Mudstone
Limestone
0 10 20 40 Kilometers

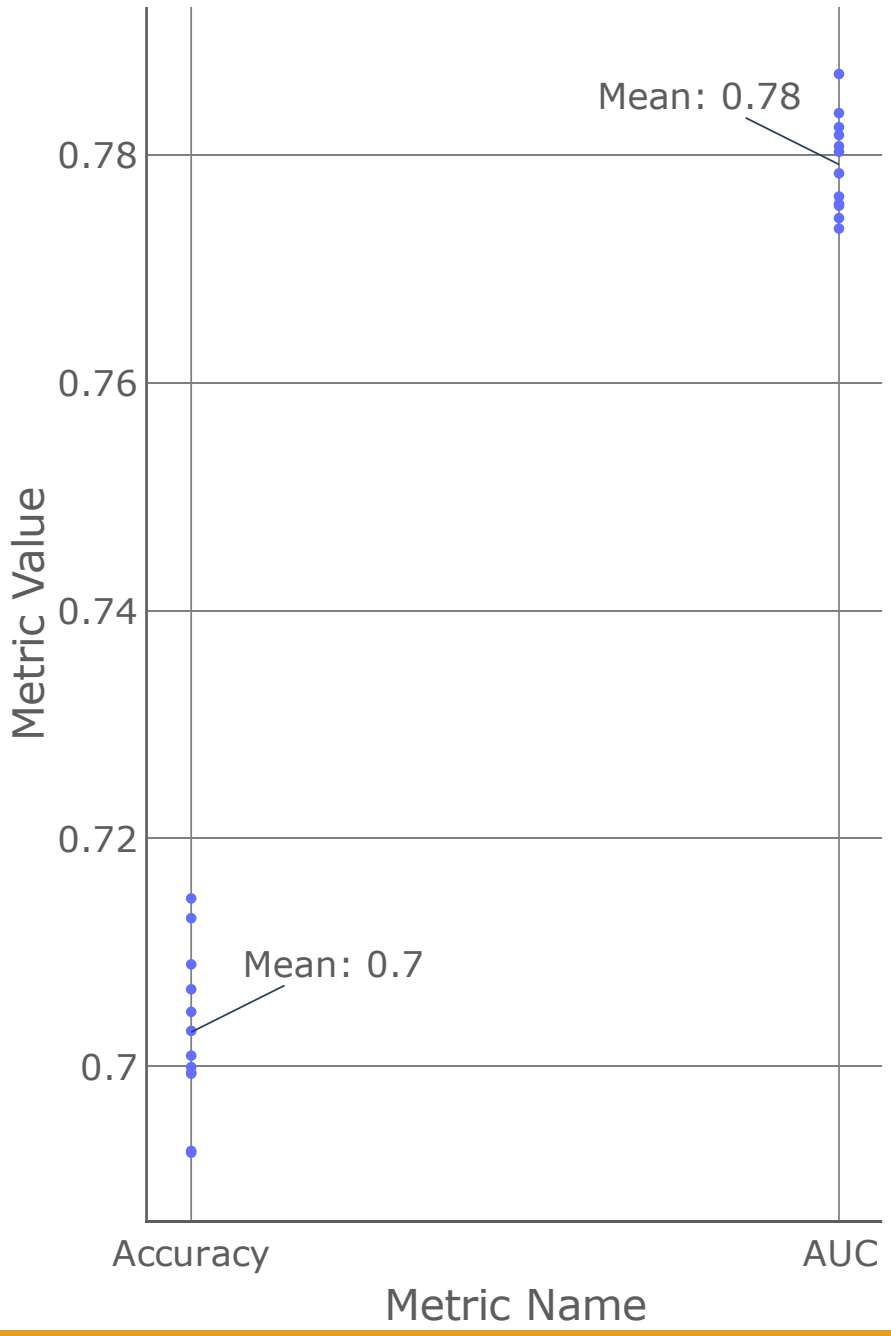
Covariate Preparation:

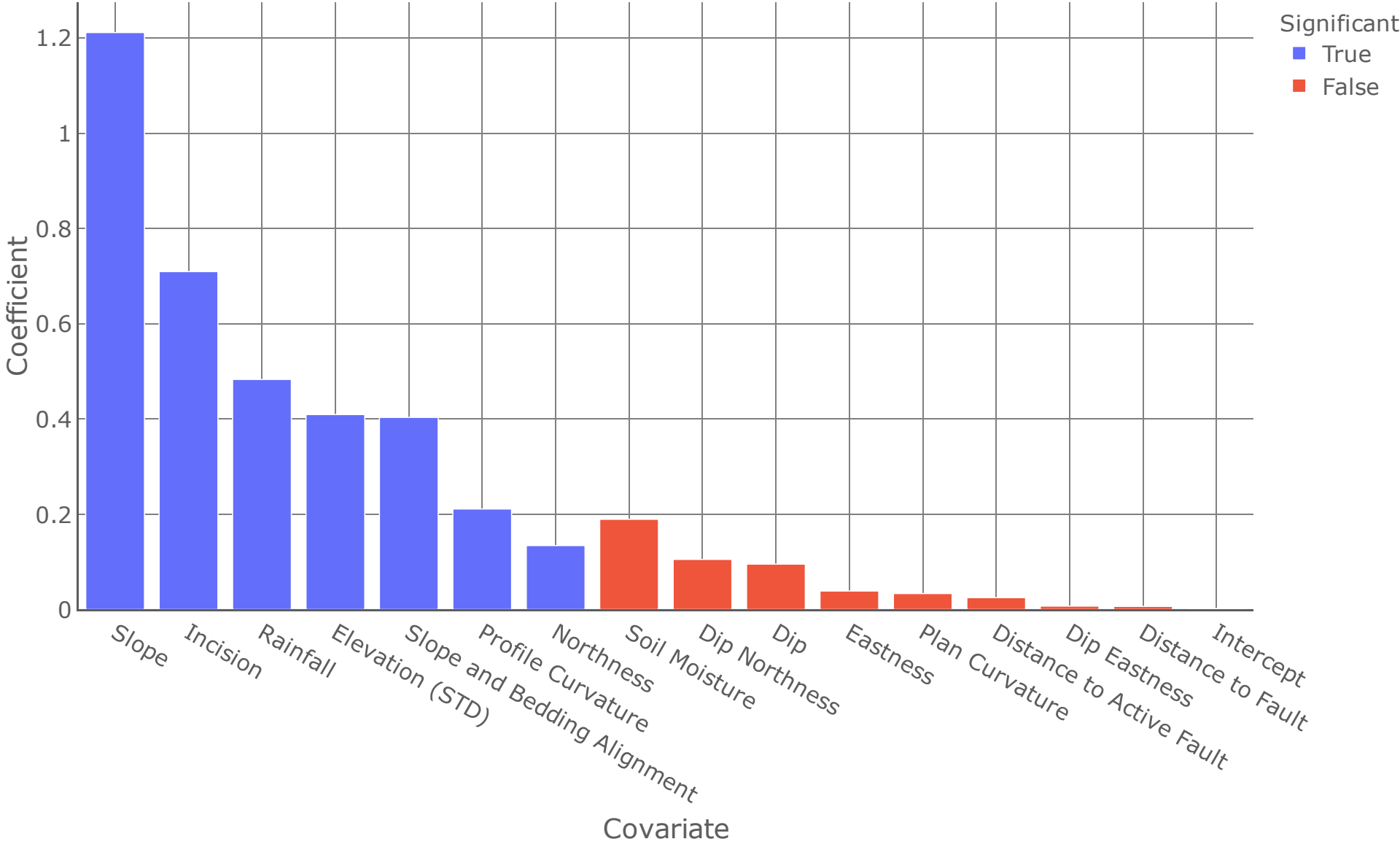
Susceptibility Factor	Class
Rainfall	Climate
Soil Moisture	Climate
Elevation (STD)	Descriptive
Plan Curvature	Descriptive
Profile Curvature	Descriptive
Dip	Geology
Dip Eastness	Geology
Dip Northness	Geology
Distance to Active Fault	Geology
Distance to Fault	Geology
Eastness	Terrain
Incision	Terrain
Northness	Terrain
Slope	Terrain
Slope and Bedding Alignment	Terrain

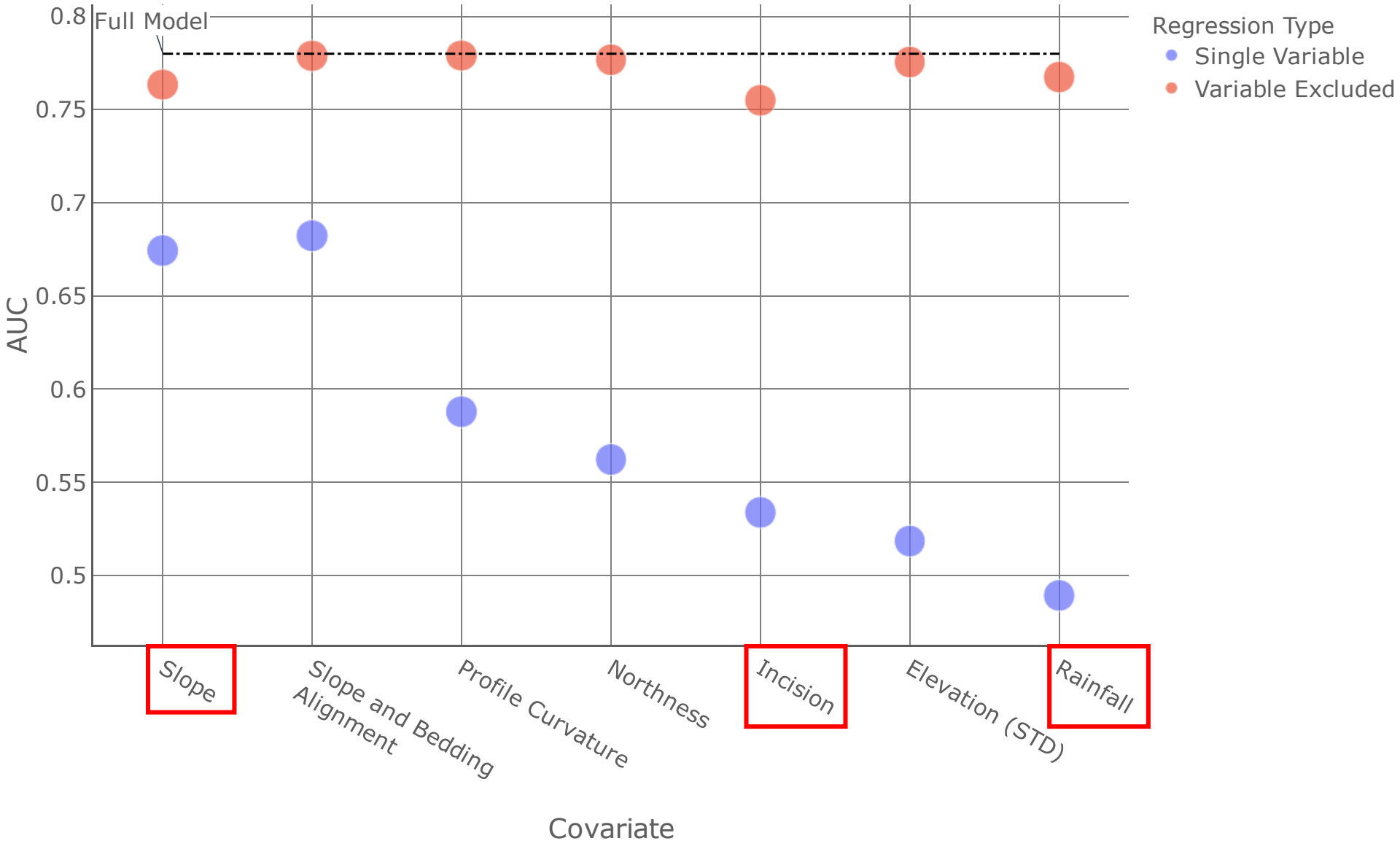
Susceptibility factors (covariates) are associated with each feature, then standardized using the formula:

$$Z = \frac{x - \bar{x}}{\sigma}$$

Standardization allows the regression coefficient magnitudes to be used as a measure of covariate importance


Mean: 0.78
0.78
0.76
0.74
0.72
0.7
Metric Value
Mean: 0.7
Accuracy
AUC
Metric Name


Significant
True
False
Coefficient
1.2
1
0.8
0.6
0.4
0.2
0
Slope
Incision
Rainfall
Elevation (STD)
Slope and Bedding Alignment
Profile Curvature
Northness
Soil Moisture
Dip Northness
Dip
Eastness
Plan Curvature
Distance to Active Fault
Dip Eastness
Distance to Fault
Intercept
Covariate


Full Model
0.8
0.75
0.7
0.65
0.6
0.55
0.5
AUC
Regression Type
Single Variable
Variable Excluded
Slope
Slope and Bedding Alignment
Profile Curvature
Northness
Incision
Elevation (STD)
Rainfall
Covariate

What have we learned?

- Slope, Slope and Bedding Alignment, Rainfall and River Incision predict occurrence of large landslides
- Slope, Slope and Bedding Alignment, Rainfall are preparatory factors that are impossible to influence
- RIVER INCISION IS KEY!!!
- Efforts to control large landslide failure should focus on reducing river erosion

Questions?

Download the Presentation:
forrestfwilliams.github.io/presentations

Thank you to Graham Hancox for the Poroa Landslide photography