# Using GIS to Create a 3D Visualization & Terrain Analysis to Prioritize Potential Restoration Sites in the Atherton Tablelands of Queensland, Australia

**Authors:** Scott Schlief (ESM) & Devin Wilde (ESM)

**Abstract:**
The Wet Tropics region of Queensland, Australia is a UNESCO World Heritage site and an ecologically unique part of the world that is home to flora and fauna found only in this region. The focus of this analysis was the Atherton Tablelands, an area adjacent to the official heritage site, that has been subjected to deforestation since the 1880's and where restoration efforts are underway to replant areas that have been impacted by logging or agriculture. Most restoration projects rely on landholders volunteering their land for planting and proactively targeting preferred areas can aid in restoration. Studies have shown that using GIS analyses can increase restoration effectiveness by helping identify parcels of land that increase connectivity of habitats and make best use of limited financial resources. The goal of this project was to utilize GIS terrain analysis tools to identify and prioritize areas in the Atherton Tablelands best suited for restoration and conservation efforts based on specific criteria in order to mitigate against habitat fragmentation and edge effects. Additionally, this project demonstrated the unique geographic features of the Wet Tropics World Heritage Area (WTWHA) using 3D visualization. From the 326 parcels analyzed, 5 parcels of land rated 9.2 or greater out of 10 based on the criteria of parcel size, land-use type, and proximity to the Heritage Area. A total of 9,635 hectares were identified as land that we feel should considered for acquisition and restoration. The results from this project can aid managers in identifying parcels of land that will maximize restoration efforts in the Wet Tropics.

**Keywords:** restoration; multi-criteria decision analysis (MCDA); geographic information science (GIS); priority areas; habitat fragmentation

# 3-D Visualization & Restoration Site-Suitability of Atherton Tablelands, Australia

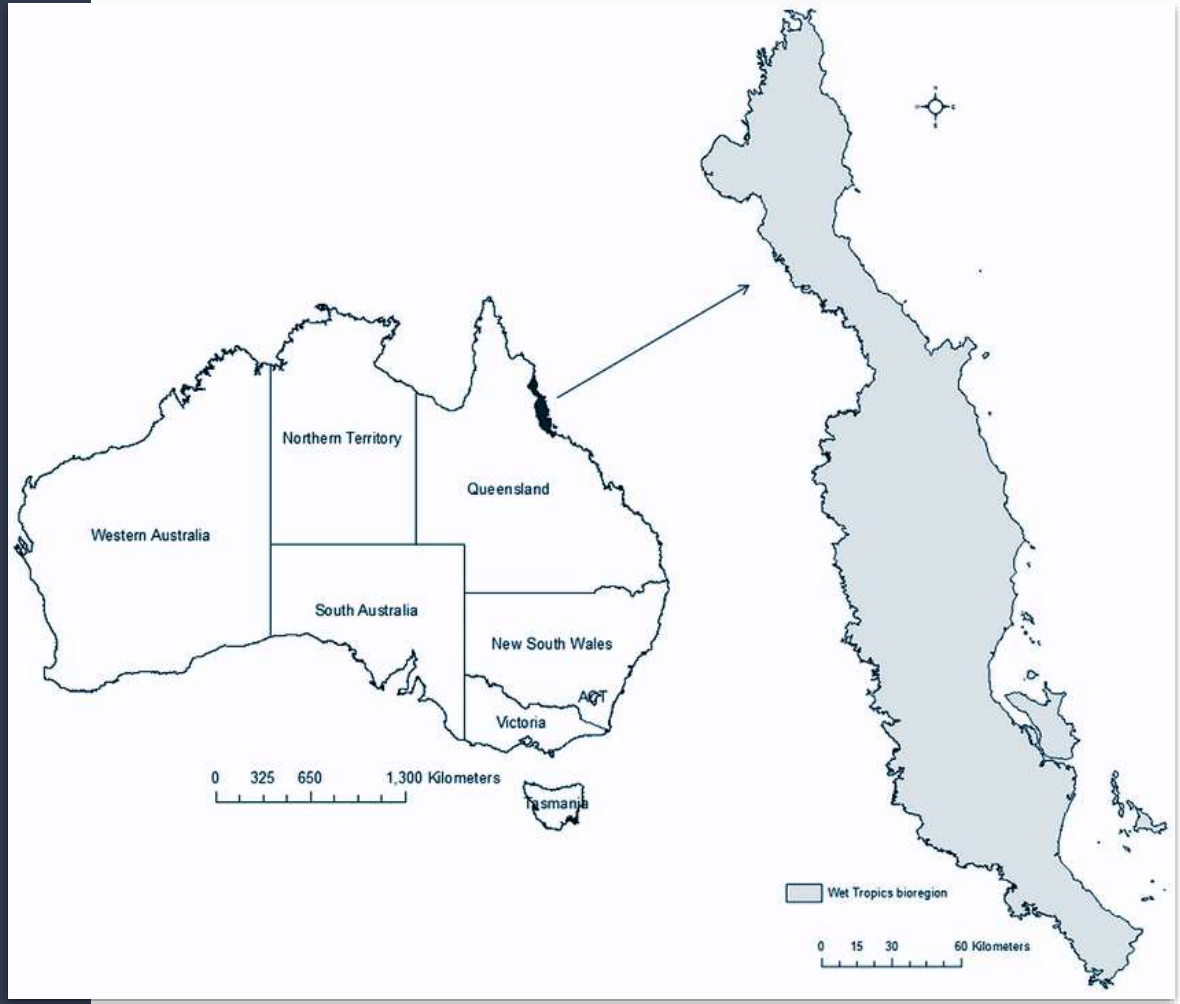
Scott Schlief & Devin Wilde

“To keep every cog and wheel is the first precaution of intelligent tinkering.”

-Aldo Leopold

# Wet Tropics of Queensland Heritage Area

- Contains unparalleled record of evolutionary and ecological history
- 8940 sq km along the northeastern coast line
- Exceptionally high diversity for both flora and fauna



# Impetus for Analysis

- Heavily deforested by agriculture and timber industry
- Community Reforestation project underway to replant native trees
- Planting is done on a voluntary basis
- Identifying ideal sites for planting can move restoration forward

# Analysis Criteria

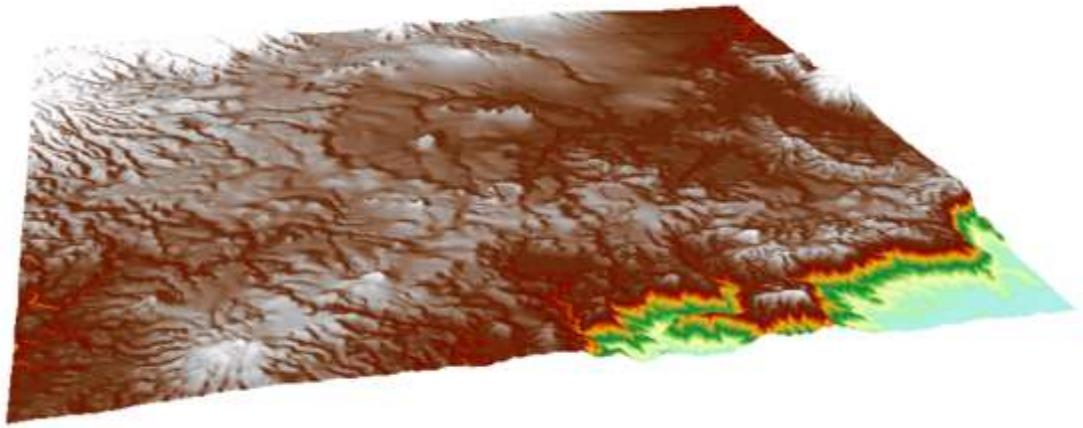
- Rate parcels based on criteria that support successful restoration
  - Pasture land type (non-agricultural pastureland)
  - Size of Parcels (hectares)
  - Proximity to Heritage Site

# Designing the Analysis

- 25 Meter DEM of Queensland Coast
- Land-use classification layer
- Color Imagery of study area
- Analyze terrain using criteria
- Use ArcScene for 3D visualization

# 3D Visualization

- DEM of study area was extracted by mask
- .tif file was imported to ArcScene
- Set base heights to float on custom surface

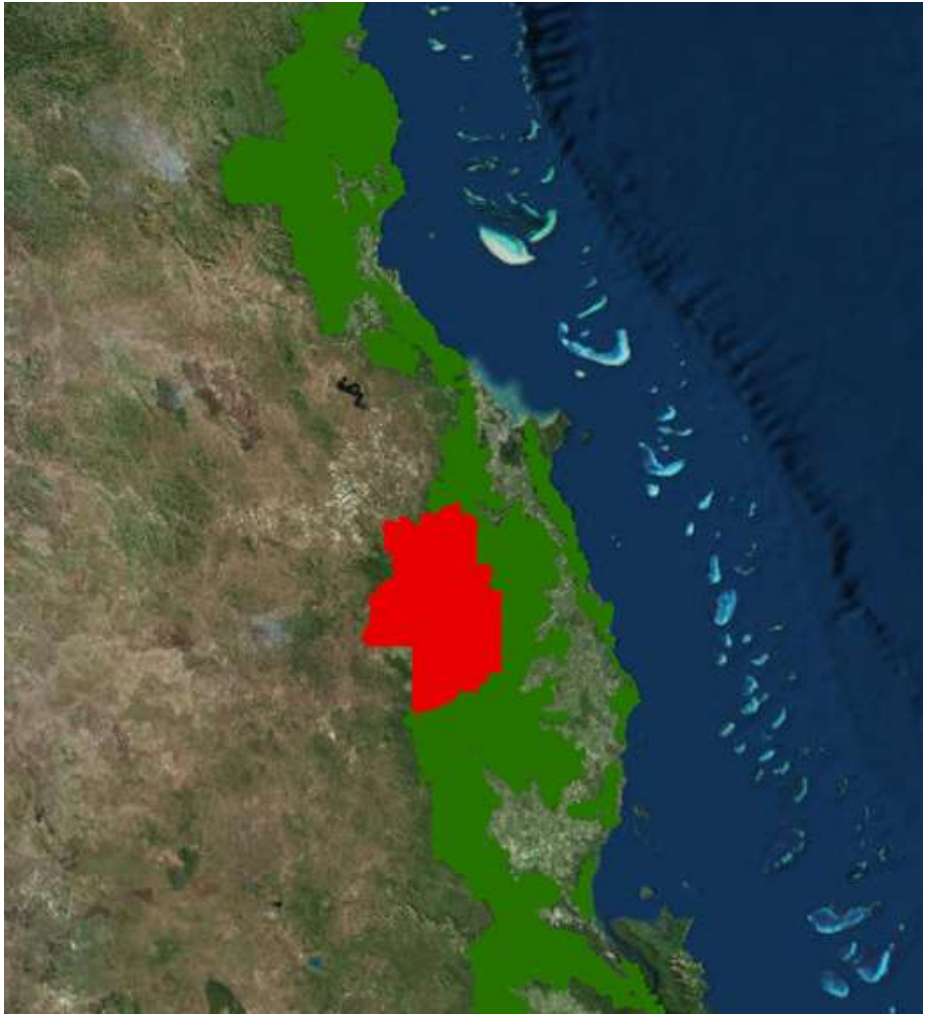


# 3D Visualization

- 2017 Satellite imagery from QNSLD Govt
- 2.4 m resolution
- Imagery “draped” over DEM
- 3D flight recorded in ArcScene

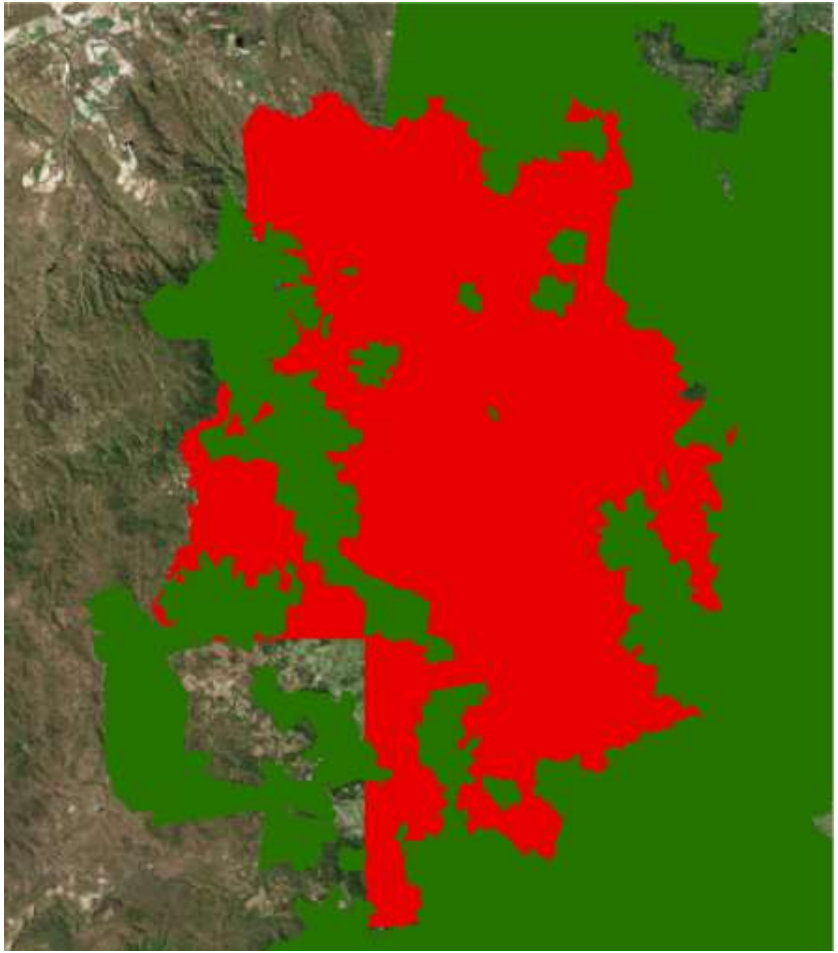
# 3D Video Tour of the TableLands

# Atherton Tablelands abuts the Wet Tropics of Queensland Heritage Area



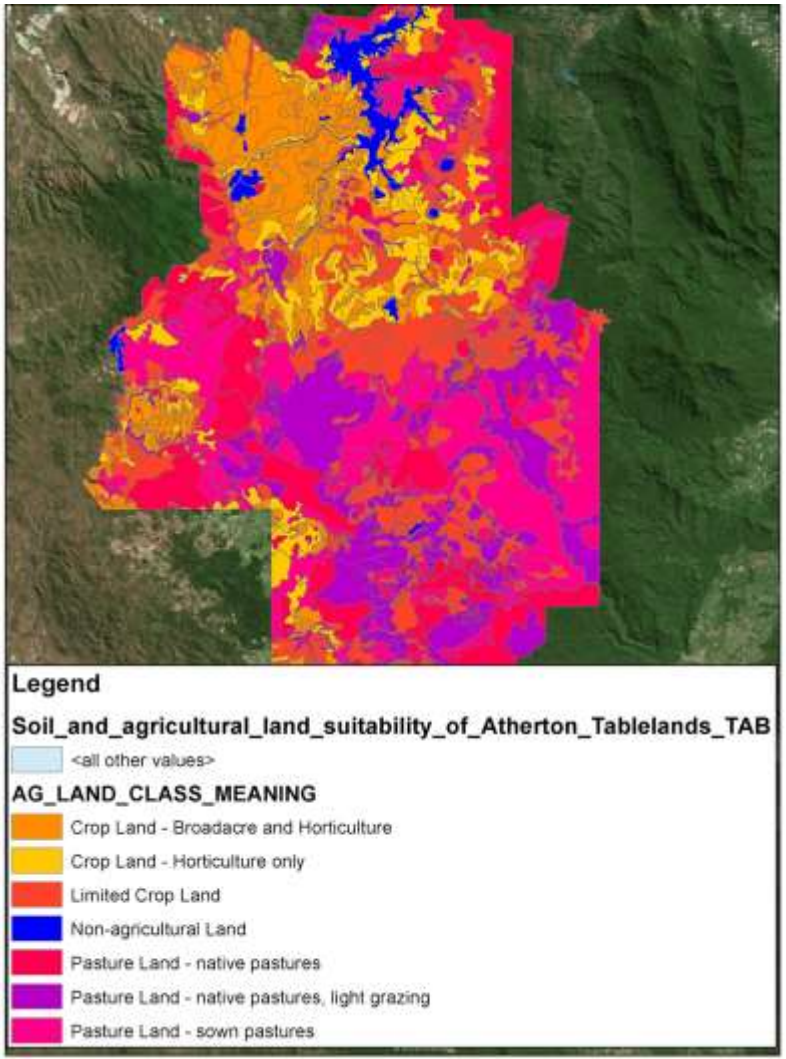
# Atherton Tablelands

- Added all protected areas to one layer
- Some areas within the Tablelands are already protected
- Identify what non-protected lands were ideal for restoration



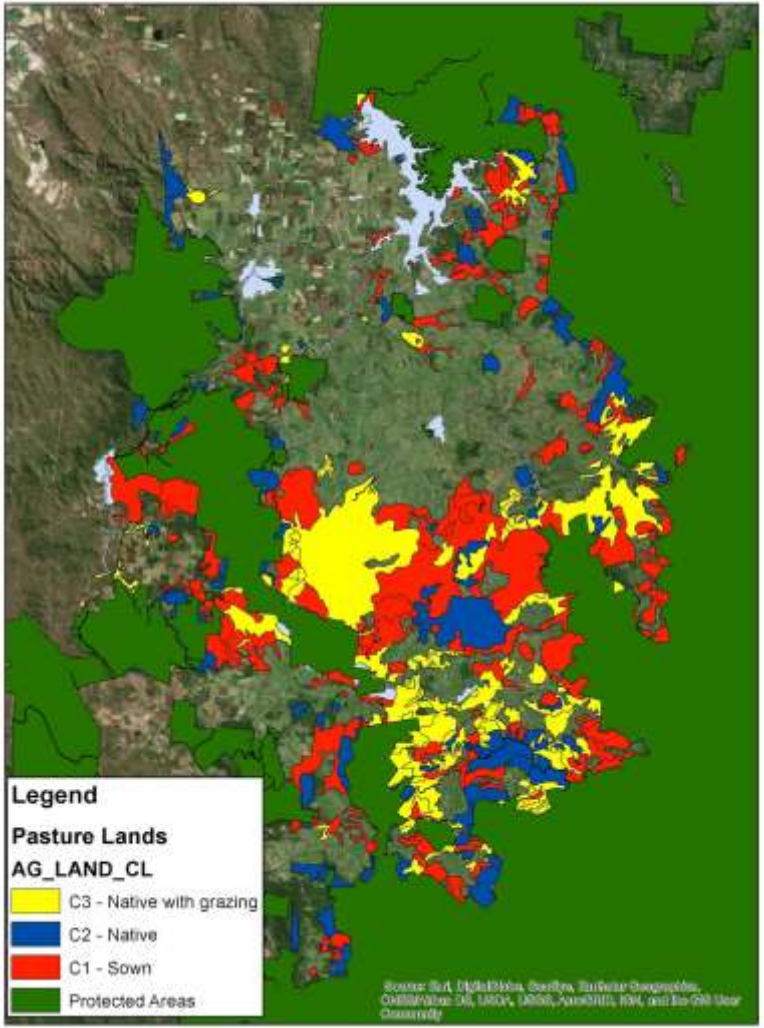
# Soil and Agriculture Land Suitability

- Several different Land classes
- We focused on pasture land
- Non-agricultural land was generally waterways and urban areas



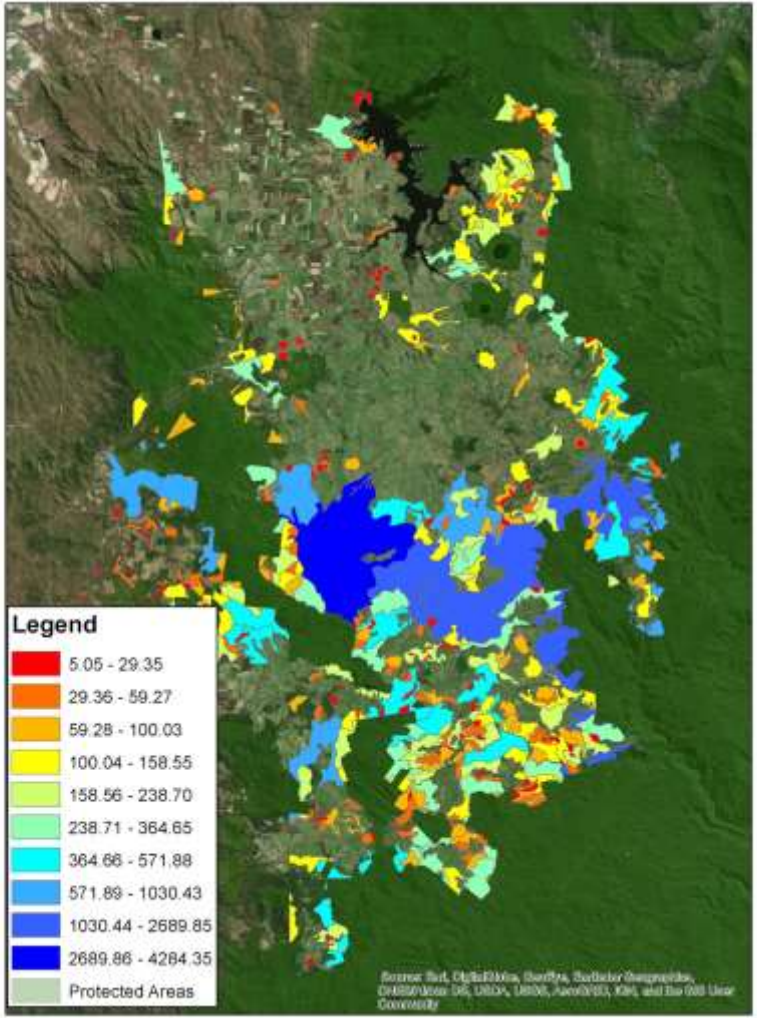
# Suitable Pasture Lands

- We edited the data set to only include pasture lands
- Using this metric only would lead to drastically different results than our final analysis



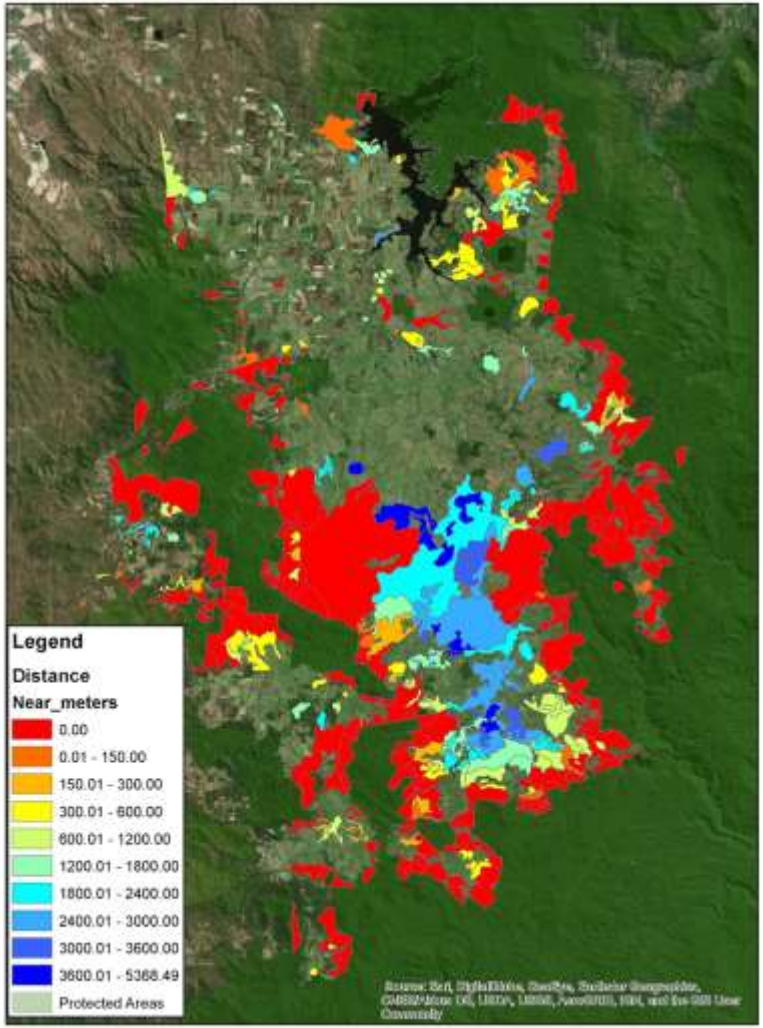
# Area of Each Pasture Land Type

- Added a field, used “calculate geometry” to determine size
- Omitted areas < 5 hectares
- Used Natural breaks with 10 classes



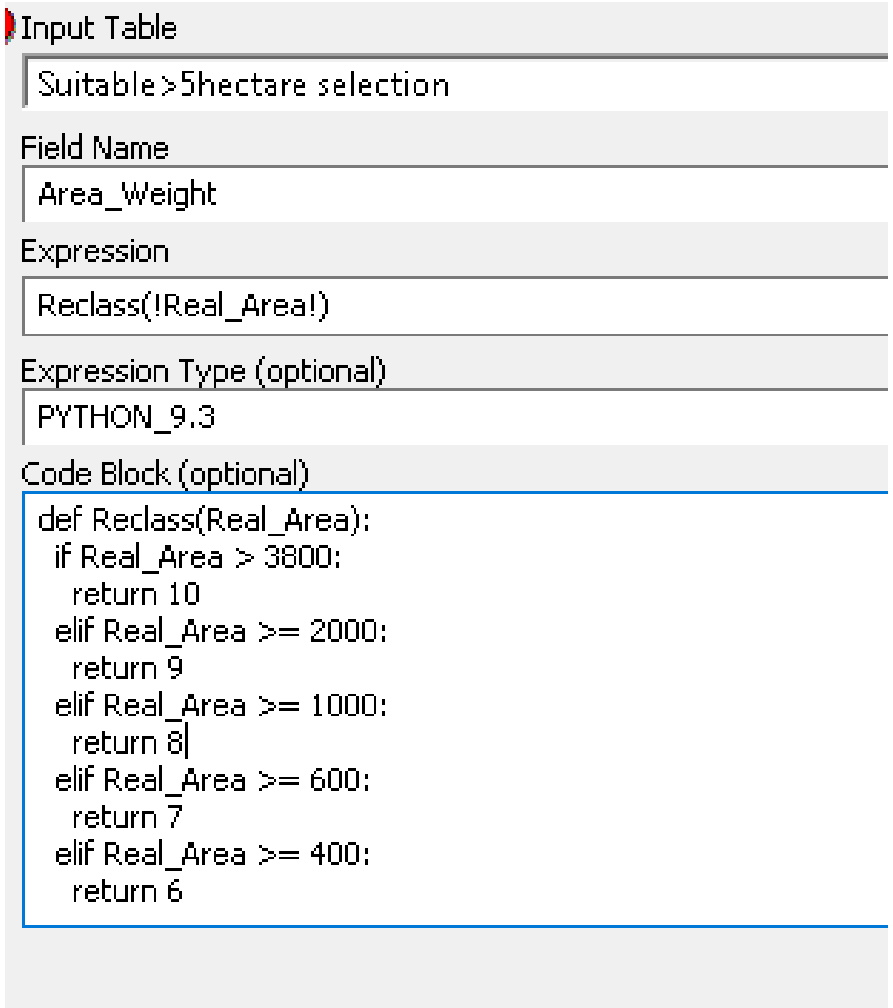
# Distance from Protected Areas

- Important factor when considering “Edge Effects”
- Used “Near” tool to measure polygon to polygon
- Used Natural breaks with 10 classes, switched to manual to account for “0 meter”



# Reclassifying values

- Needed to create a combined index to identify the most suitable locations
- Used Python scripts to reclassify fields



# Reclassifying values

- 326 polygons weighted on 3 factors
  - Distance from protected areas
  - Size of the area
  - Pasture land type
- Weighted from 1 to 10

| Dist_weight | Area_Weight | class_weight |
|---|---|---|
| 10 | 2 | 10 |
| 10 | 5 | 10 |
| 10 | 5 | 1 |
| 10 | 3 | 10 |
| 10 | 10 | 5 |
| 10 | 7 | 1 |
| 10 | 3 | 10 |
| 10 | 4 | 1 |
| 10 | 3 | 10 |
| 10 | 4 | 5 |
| 10 | 4 | 1 |
| 10 | 4 | 10 |
| 10 | 1 | 10 |
| 10 | 7 | 1 |
| 10 | 1 | 1 |
| 10 | 5 | 1 |
| 10 | 7 | 1 |
| 10 | 1 | 1 |
| 10 | 3 | 10 |
| 10 | 5 | 1 |
| 10 | 4 | 1 |
| 10 | 1 | 5 |

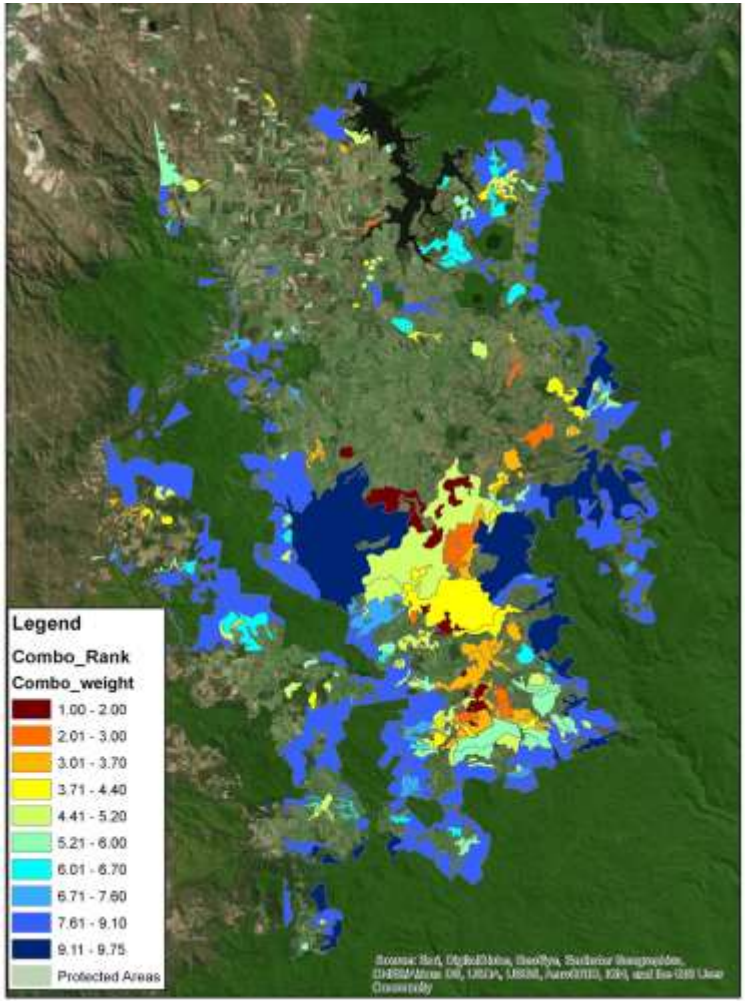
# Reclassifying values

| Weight | Distance | Area (hectares) | Pasture type |
|---|---|---|---|
| **10** | Adjacent | > 3800 | Native |
| **9** | < 150 meters | > 2000 | - |
| **8** | < 300 meters | > 1000 | - |
| **7** | < 600 meters | > 600 | - |
| **6** | < 1200 meters | > 400 | - |
| **5** | < 1800 meters | > 200 | Native - Light Grazing |
| **4** | < 2400 meters | > 100 | - |
| **3** | < 3000 meters | > 60 | - |
| **2** | < 3600 meters | > 30 | - |
| **1** | > 3600 meters | > 5 | Sown |

# Results

- Distance weighted as 75%, Area weighted as 20%, and Pasture type as 5%

- Five parcels of land were identified as having a score greater than 9.2



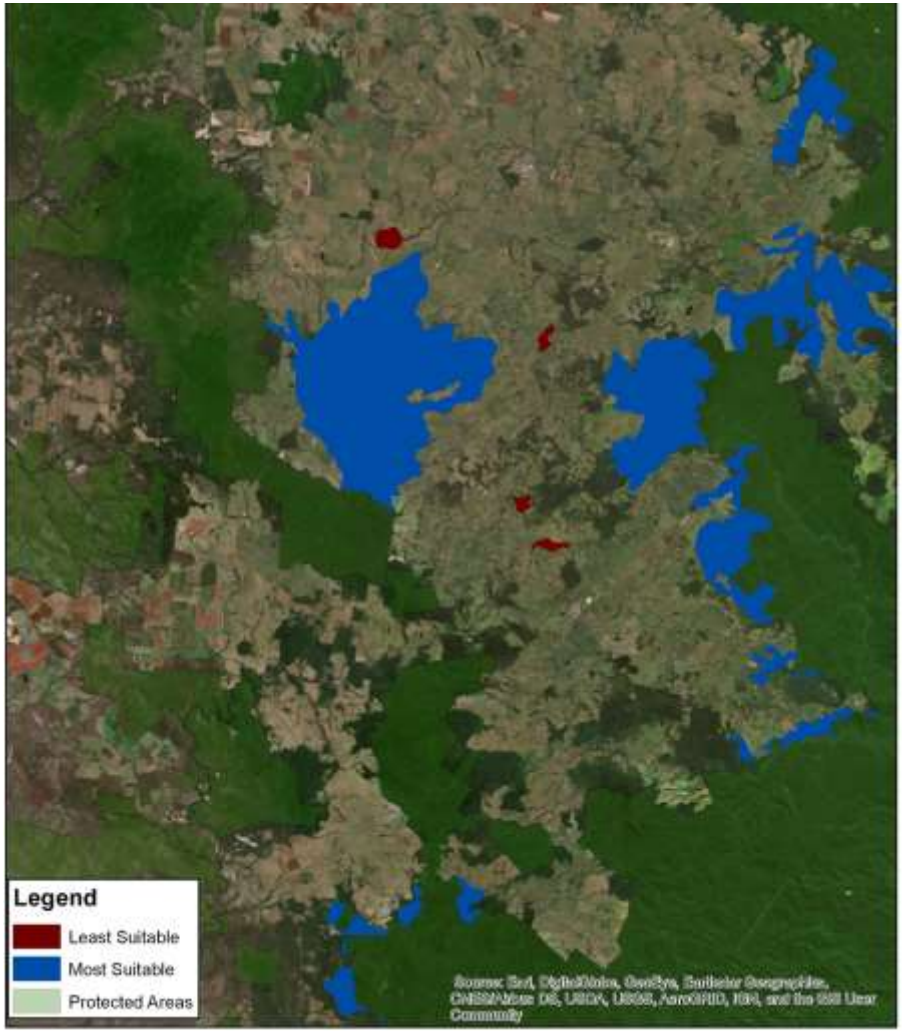
# Results

- Parcels ranked 9.2/10 equate to over 9635 hectares
- Most Suitable

| Dist_weight | Area_Weight | class_weight | Combo_weight |
|---|---|---|---|
| 10 | 10 | 5 | 9.75 |
| 10 | 9 | 1 | 9.35 |
| 10 | 6 | 10 | 9.2 |
| 10 | 6 | 10 | 9.2 |
| 10 | 8 | 5 | 9.35 |

- Least Suitable

| Dist_weight | Area_Weight | class_weight | Combo_weight |
|---|---|---|---|
| 1 | 1 | 1 | 1 |
| 1 | 1 | 5 | 1.2 |
| 1 | 3 | 1 | 1.4 |
| 1 | 2 | 1 | 1.2 |
| 1 | 1 | 5 | 1.2 |



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