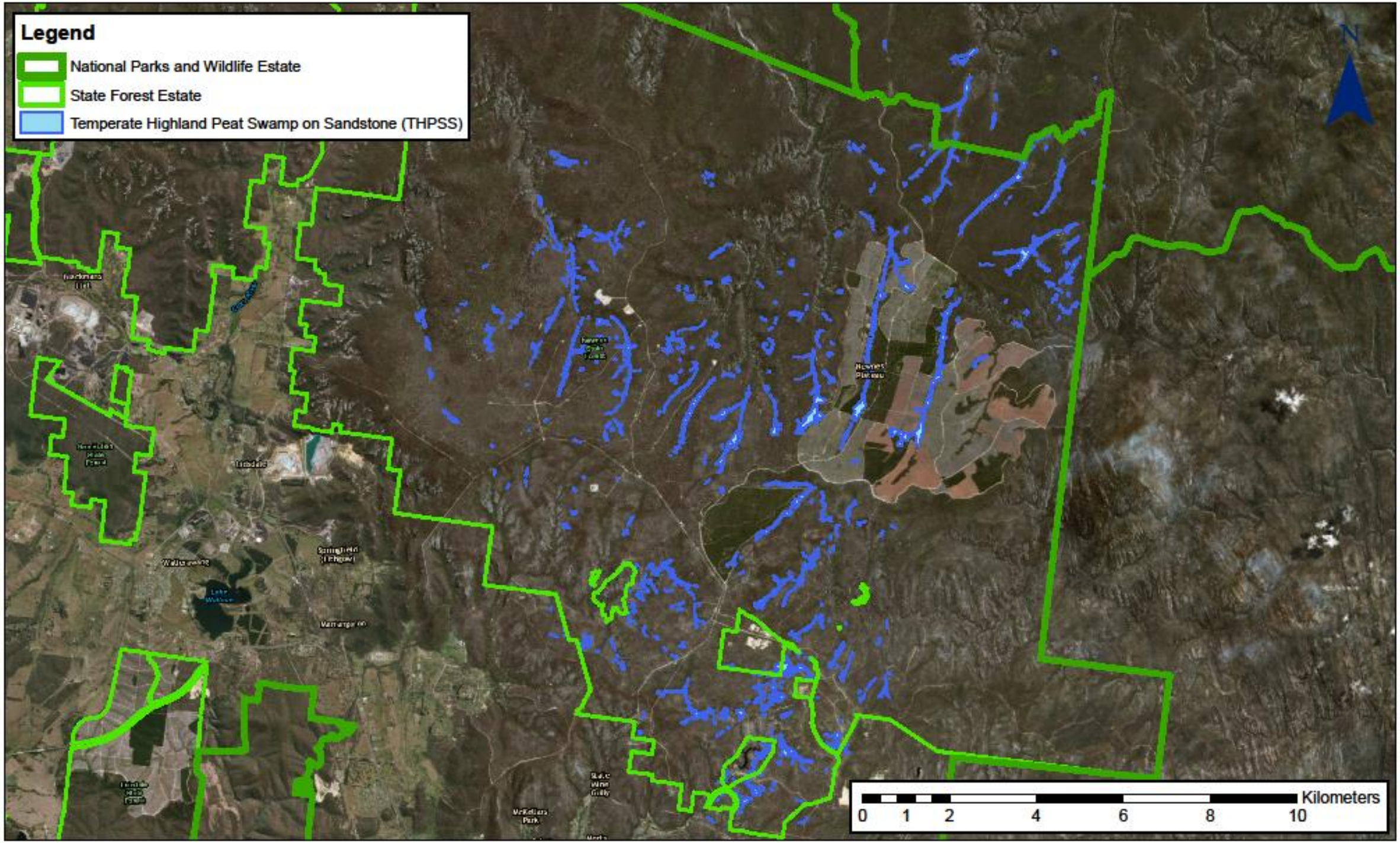
Remote sensing the threatened species *Boronia deanei* across the Newnes Plateau

Arnė Bishop & Kieran Marshall

RPS

Centennial Coal

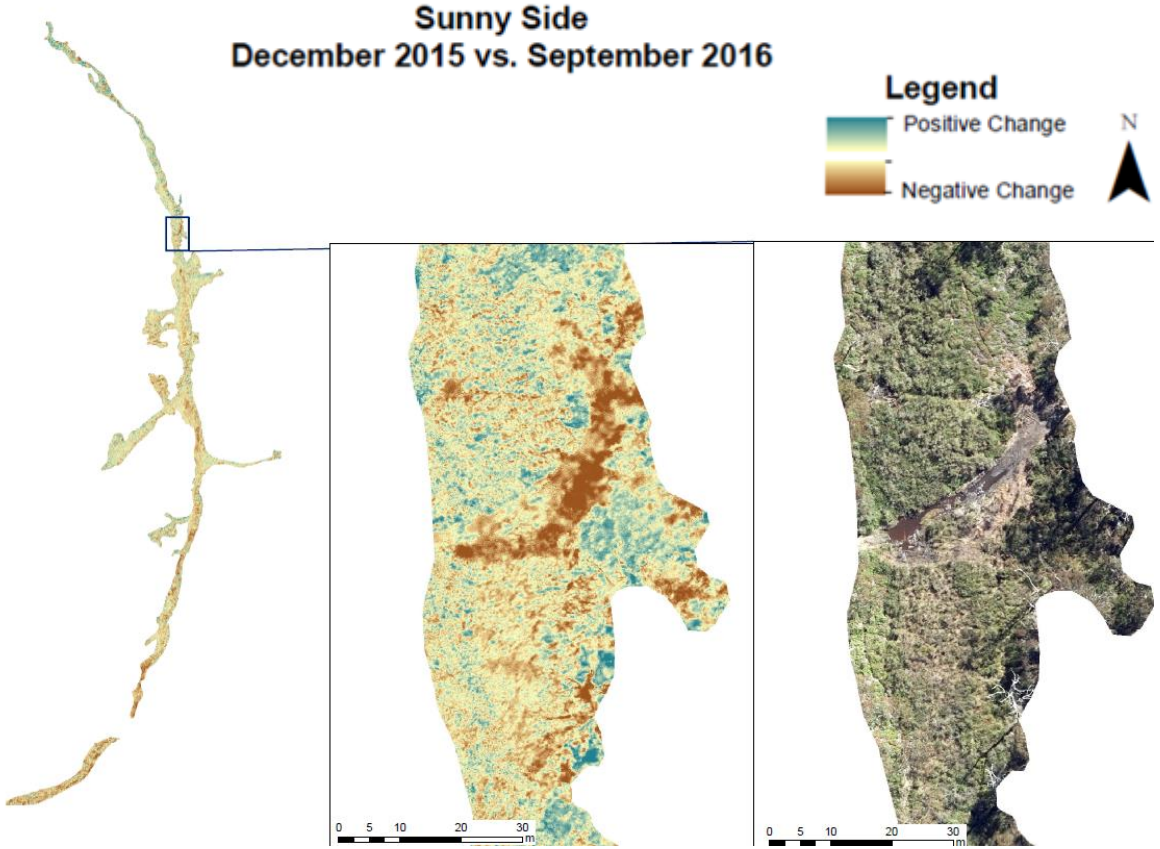

Legend
National Parks and Wildlife Estate
State Forest Estate
Temperate Highland Peat Swamp on Sandstone (THPSS)
N
Kilometers
0
1
2
4
6
8
10

NEWNES PLATEAU MONITORING PROGRAM

- **Field Surveys**
  - Ground Control Points – 250 on ground vegetation assessments – quarterly
  - Transects – 100 vegetation assessment transects – annually

- **Research Programs**
  - *Boronia deanei*
  - Blue Mountains Water Skink
  - Giant Dragonfly

- **Spatial Programs**
  - > Vegetative Health Index Analysis – quarterly
  - > Swamp Boundary Mapping – quarterly
  - > Bare Earth Analysis – quarterly
  - > Blue Mountains Water Skink Habitat Modelling – annually



BORONIA DEANEI

- A small erect shrub to 1.5 m tall
- Pink, four-petalled flowers are borne in clusters of 1 - 3, towards the ends of the stems in late spring and early summer.
- Typically found in high elevation areas of the Blue Mountains, north of Clarence and Kanangra-Boyd National Park, NSW.
- *B. deanei* grows on the margins of high altitude swamps in wet heath on sandstone and in wet heath or drier open forest.
- Listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Biodiversity Conservation Act 2016* (BC Act).

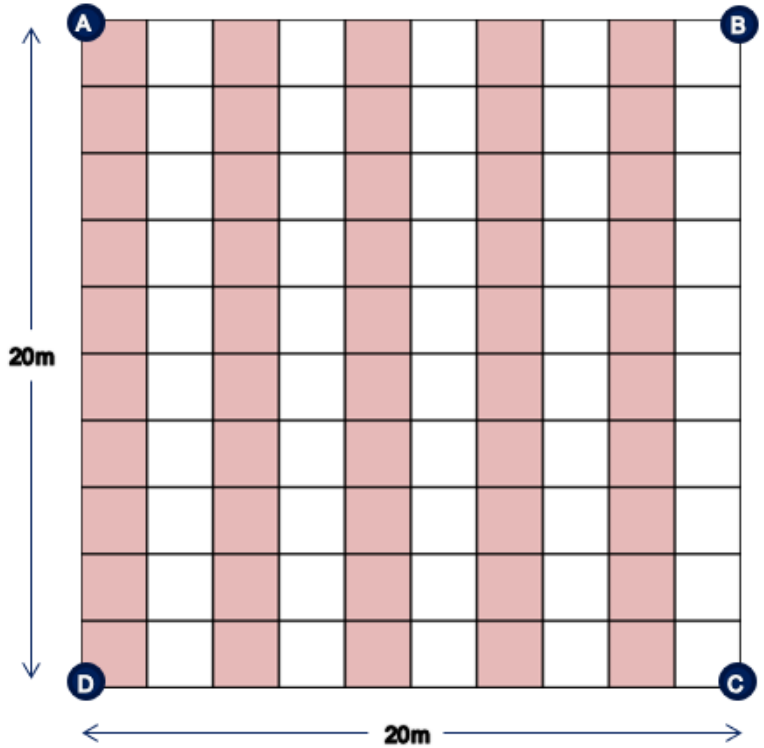
LEGISLATIVE CONTEXT

- EPBC Approval (2013/6881) requires pre-mining surveys
- State Approval (SSD 5594)
- Independent Monitoring Panel
- Each Extraction Plan requires:
  - Biodiversity Monitoring Program (BMP); and
  - Swamp Monitoring Program (SMP).

FIELD METHODOLOGY

PILOT GROUND FIELD STUDY DESIGN

- Before After Control Impact (BACI) monitoring design
  - > 20m x 20m quadrats centred over known populations
  - > Direct populations counts within subsample 2m x 2m quadrats
  - > 25 established plots
  - > 3 weeks for a team of two to service
- Limitations of traditional field sampling methods
  - > Time and labour intensive
  - > Field sampling survey bias
  - > Spatially restricted representative sample



SPATIAL METHODOLOGY

METHODS

- Collection of Red Green Blue (RGB) and Near Infrared Data (NIR).
  - > 216km^2 data capture over the Newnes Plateau.
  - > 7cm^2 resolution

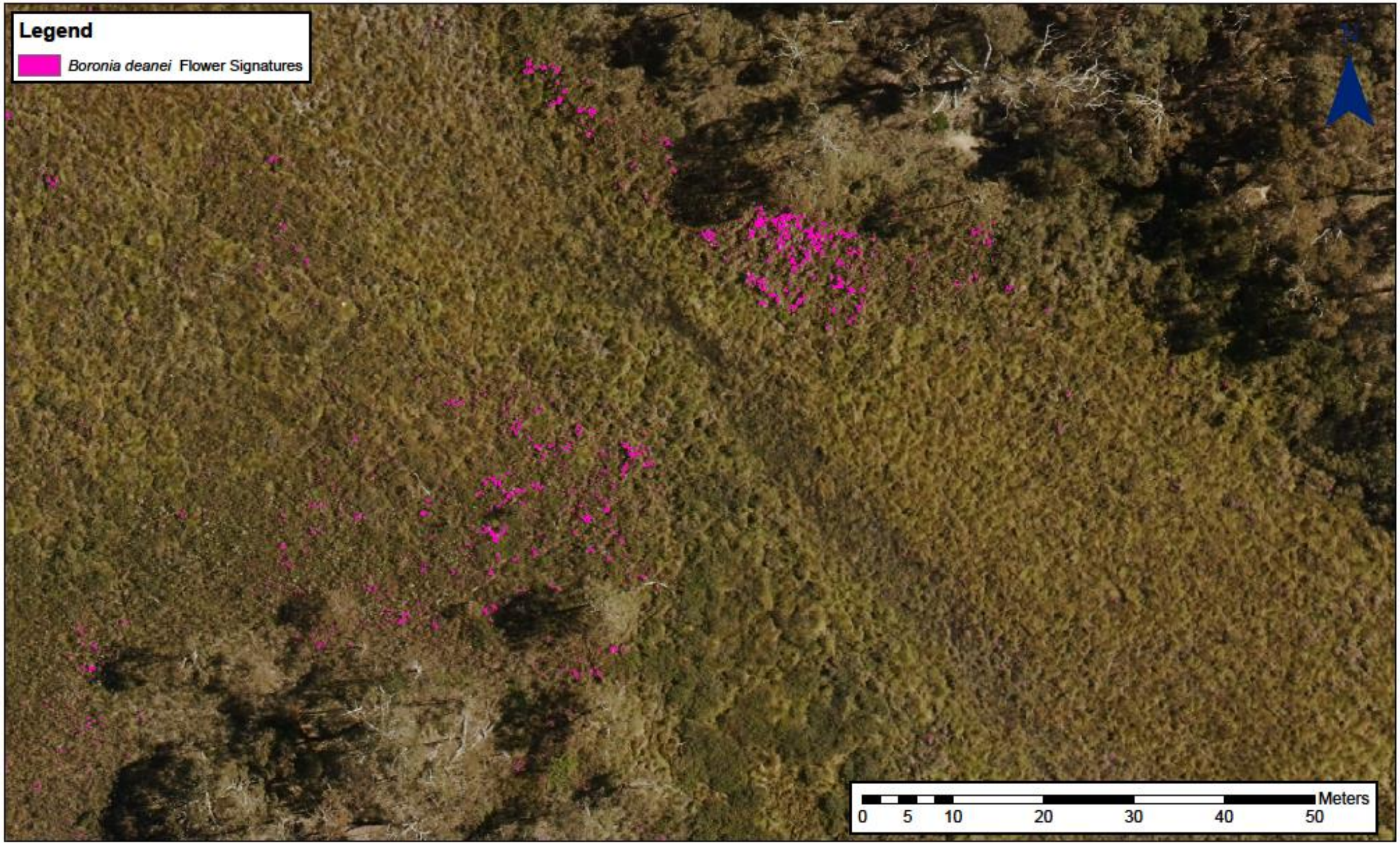
- Development of a unique colour based classifier to detect *Boronia deanei* flowers.
  - > Colour space selection, exponentially corrected RGB vs Hue Saturation Value (HSV)
  - > 1120 pixels selected within known populations >80% flower cover.

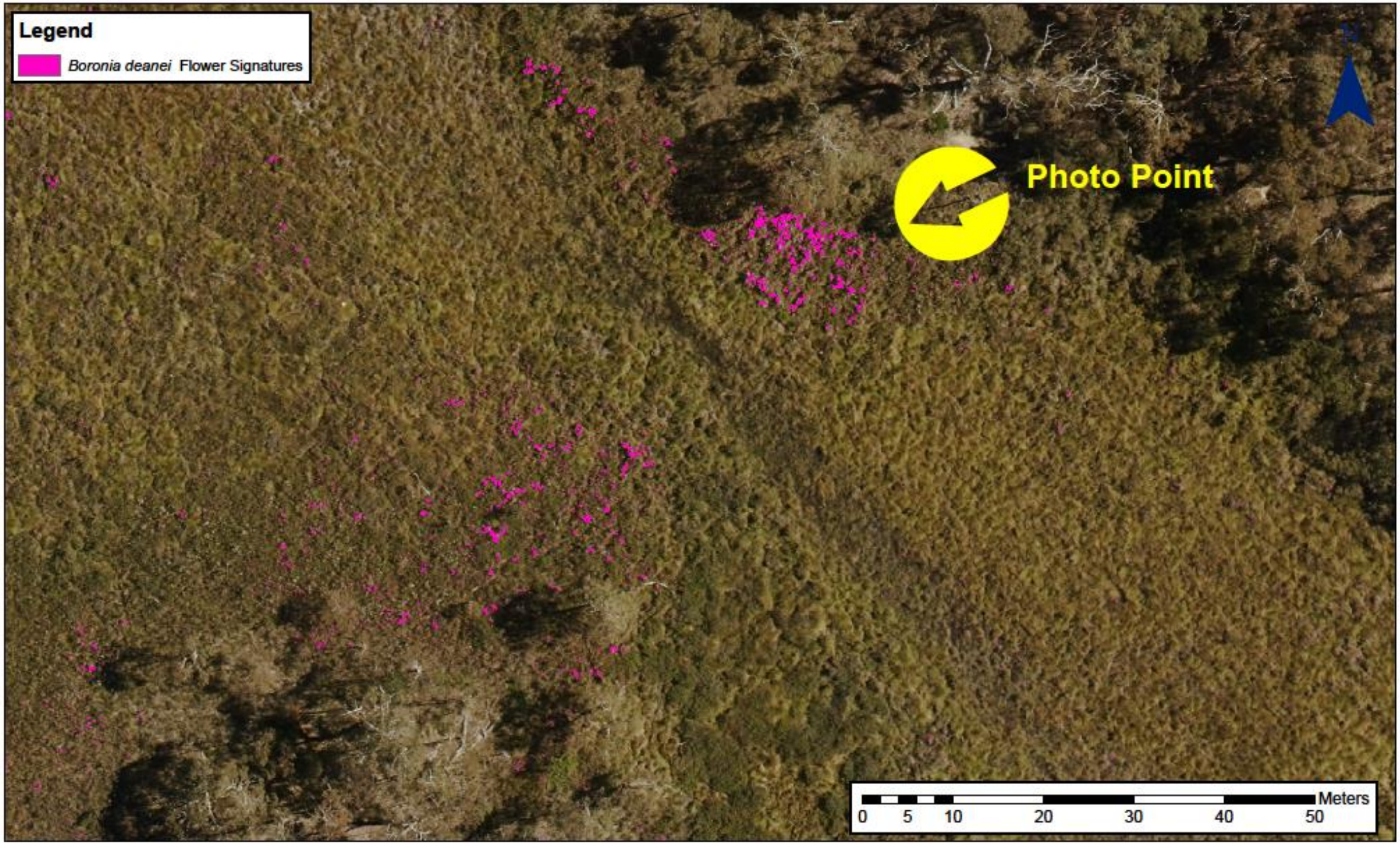
METHODS

- Positive Identification Confidence intervals
  - > Used to reduce noisy and anomalous data
  - > 0.05 threshold applied
- Swamp boundary (canopy drip line) cut
  - > To remove false negative from other boronia species
- Continuum Removal of colour based classifier
  - > Overlapping spectrum removal
    - > Other flowering plants
    - > Bare/dead cover

SPATIAL RESULTS

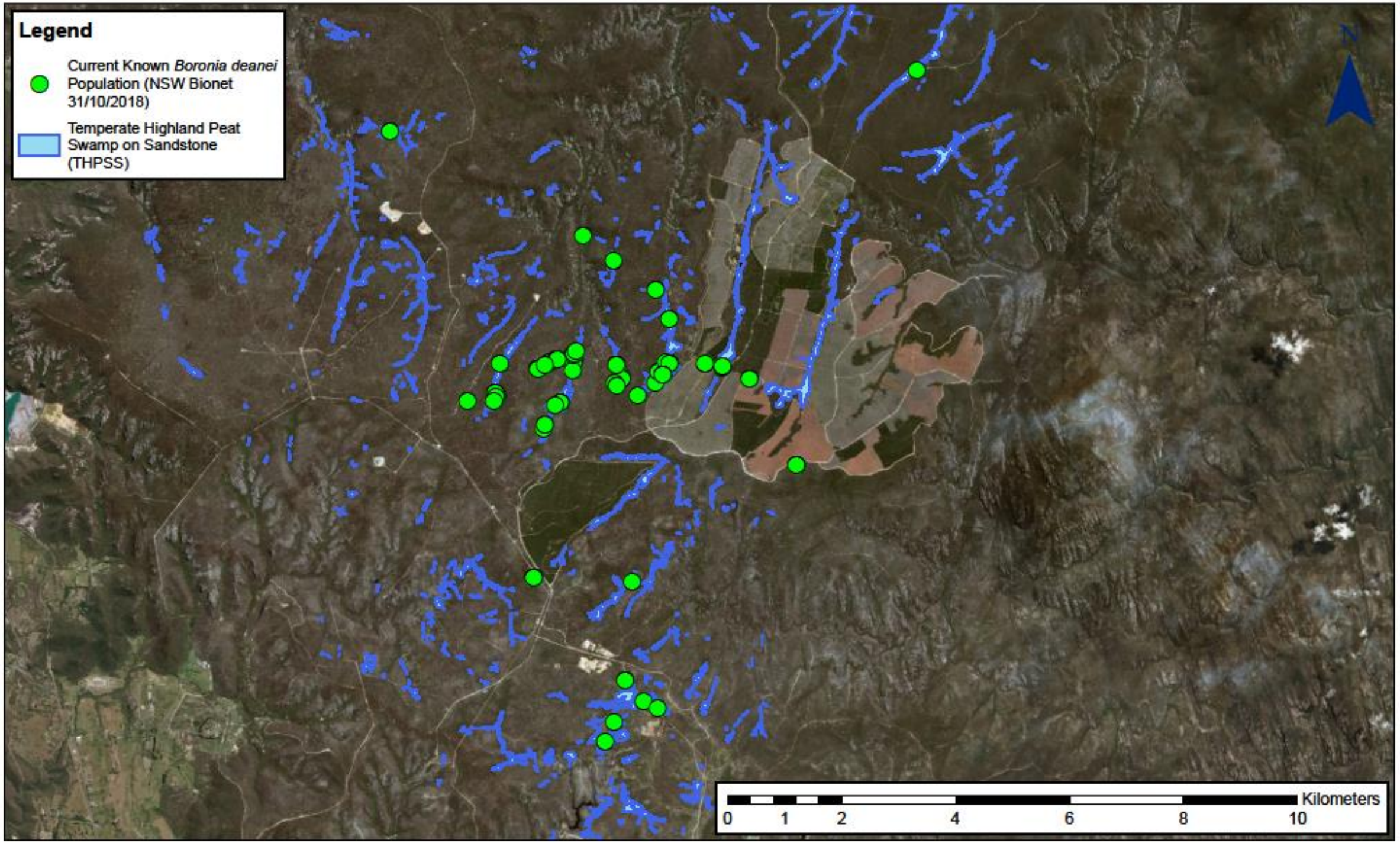

Meters
0 5 10 20 30 40 50

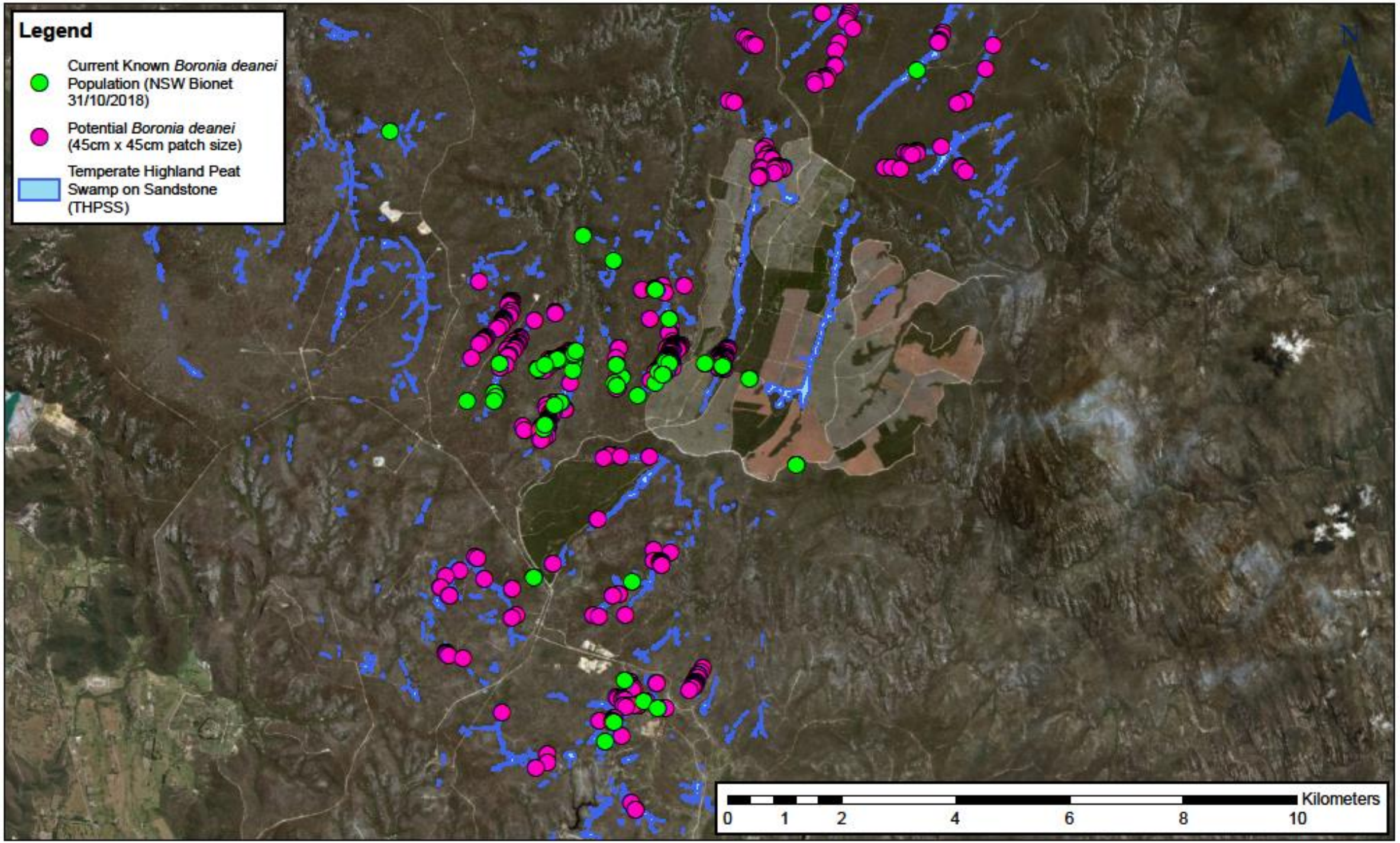

Legend
Boronia deanei Flower Signatures
Meters
0 5 10 20 30 40 50

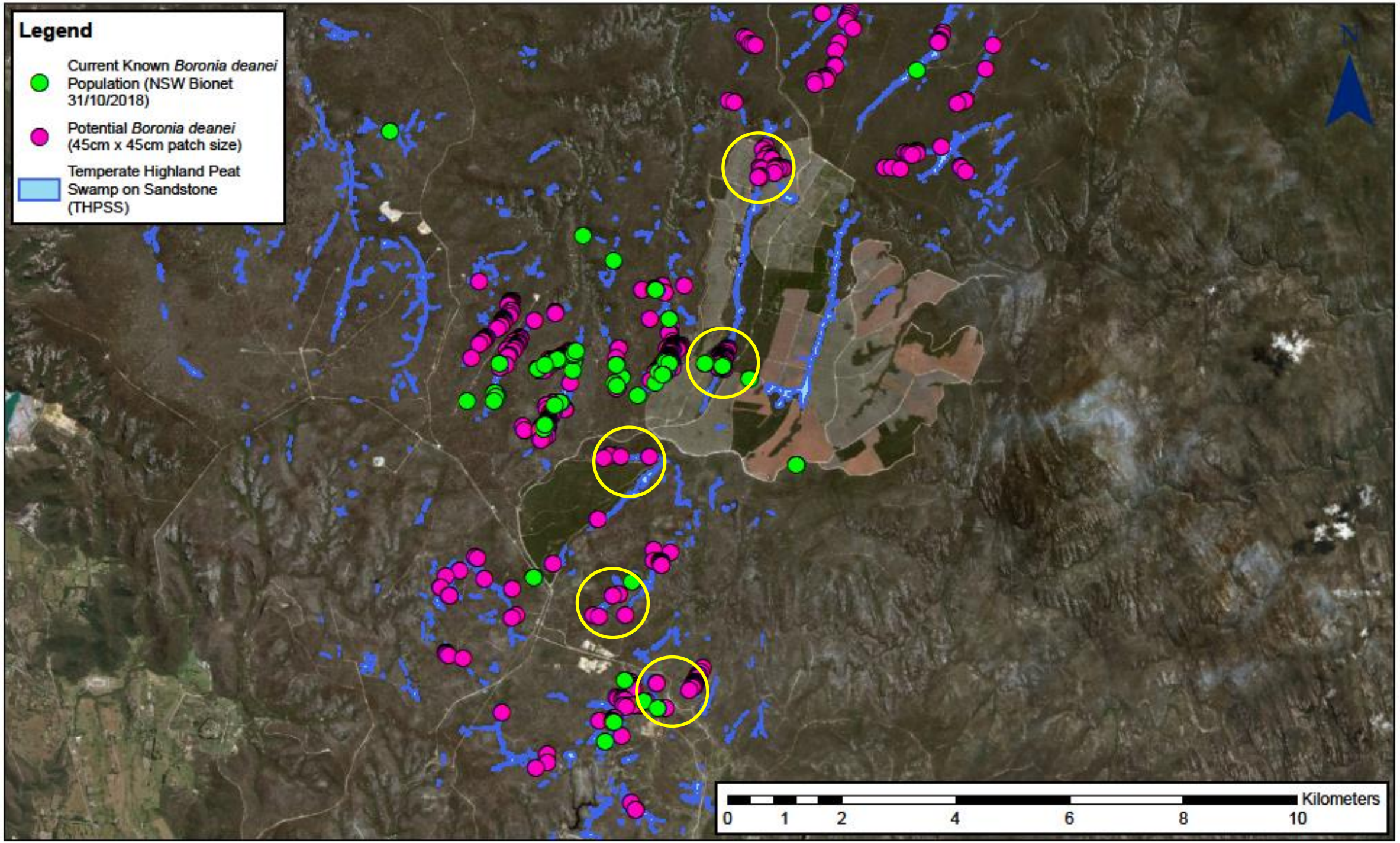

Legend
Boronia deanei Flower Signatures
Photo Point
Meters
0 5 10 20 30 40 50

PRELIMINARY MODEL CONFIRMATION

- Resolution was dropped to a Positive Pixel Density at 40cm^2
- 12 new predicted population site locations selected
- 12 confirmations of *Boronia deanei* presence
- Confirmed within 2 new swamp systems
- Expansion of known population and extent


Legend
Current Known Boronia deanei Population (NSW Bionet 31/10/2018)
Temperate Highland Peat Swamp on Sandstone (THPSS)
N
Kilometers
0
1
2
4
6
8
10


Legend
Current Known Boronia deanei Population (NSW Bionet 31/10/2018)
Potential Boronia deanei (45cm x 45cm patch size)
Temperate Highland Peat Swamp on Sandstone (THPSS)
N
Kilometers
0
1
2
4
6
8
10


Legend
Current Known Boronia deanei Population (NSW Bionet 31/10/2018)
Potential Boronia deanei (45cm x 45cm patch size)
Temperate Highland Peat Swamp on Sandstone (THPSS)
N
Kilometers
0
1
2
4
6
8
10

DISCUSSION

OUTCOMES

- Contributed to identifying new populations containing 5000+ undocumented individuals
- Expanded the population extent into two new catchment systems
- Predicted in an additional 5 catchment systems
- Predicted to double the known population extent

BENEFITS

- Reduction in field survey effort
- Increase in spatial resolution of monitoring programs
- Increase spatial extent of monitoring programs

FUTURE MONITORING PROGRAM

- Compare different spatial resolution imagery (Satellite vs Flights)
- Population estimates will be tested from plot counts
- Detectability rates
- Progress from Quadrats to Spatial Ground Control Points

REGULATORY IMPLICATIONS

- Negligible Environmental Consequences (SSD 5594): '*Small and unimportant, such as to be not worth considering*'
- Trigger Action Response Plan (TARP):
  - > Trigger values - more defined and appropriate
  - > Trigger investigations – quicker and more meaningful
  - > Adaptive management – impact avoidance and minimisation
- Maximum Offset Liability:
  - > Quantitative - whole of swamp mapping
  - > Qualitative – reducing observer bias
  - > Increases confidence in partial impact scenarios – e.g. reduced condition or a reduction in the area of occupancy.