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Conservation Management with GIS

Pieter Human

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- Conclusion

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Sappi the Company

- **Regions**
  - South Africa
    - 4 Paper Mills
    - 1 Paper and Specialised Cellulose Mill
    - 1 Specialised Cellulose Mill
    - 1 Saw Timber Mill
    - Forestry Plantations
      - Operations supply 70 % of Sappi requirements (approximately 35 millions tons of standing timber – 495 000 Ha of Forests)
      - 150 000 ha of land is set aside to conserve the natural habitat and biodiversity
  - Europe
    - 7 Paper Mills
  - North America
    - 1 Paper Mill
    - 1 Speciality Paper Mill
    - 1 Paper and Specialised Cellulose Mill

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GIS is Green in Sappi

- **Green Management using GIS**
  - Sappi managed 495 000 hectares of commercial timber plantations
    - *Accurate mapping of all standing timber and natural areas*
      - Mapping Important Conservation Areas
      - Accurate data enable accurate planning and cost effective operations
    - *EIA maps for re-establishment of trees*
      - Identifying non-conformance areas
      - Identifying natural areas
    - *Accurate Delineation*
      - Cut back planting areas close to streams and wetlands
    - *Reduce transport cost using route optimisation*
      - Network Analysis
    - *Natural area and erosion management*
      - Catchment management
      - Stream crossing management
      - Flow simulation
    - *Effective operational planning*
      - Identifying correct Timber Extraction Method (terrain, slope, distance to road)
      - Harvesting Maps and Analysis

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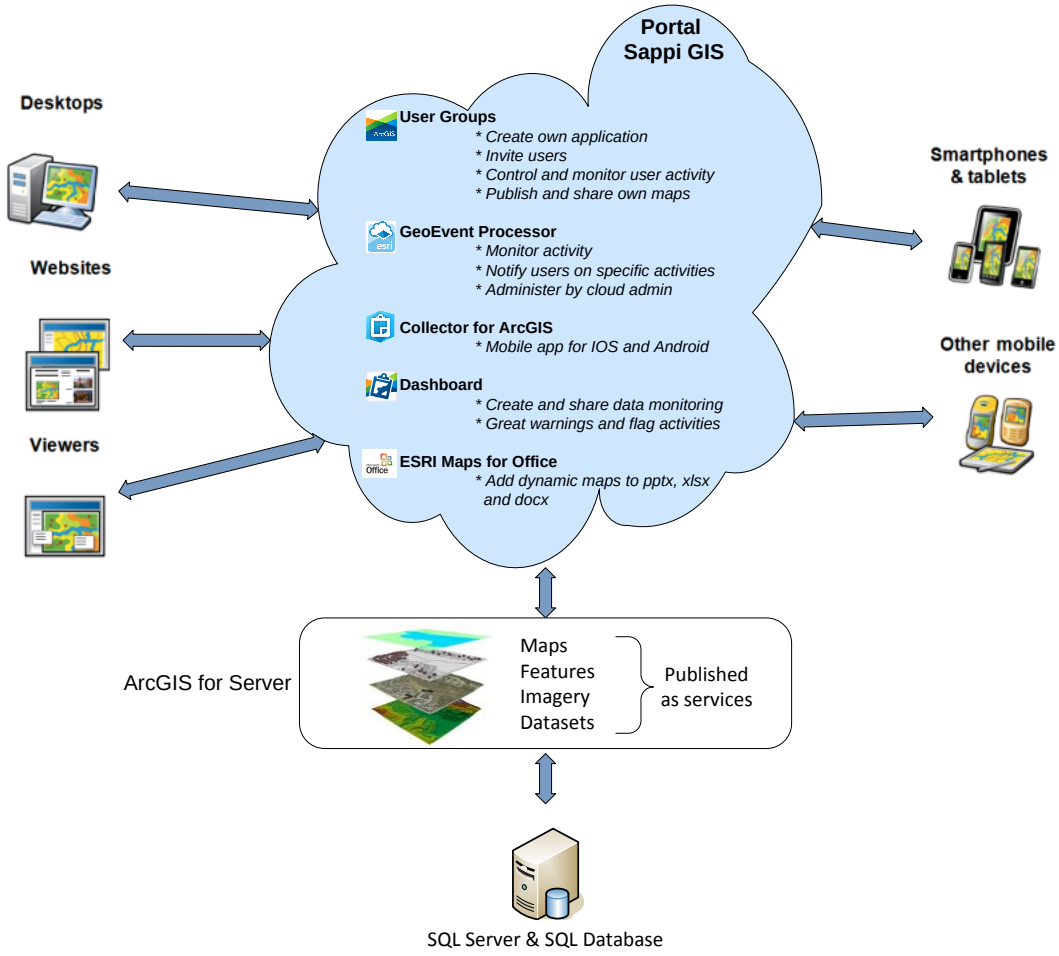
GIS is Green in Sappi

- **GIS Infrastructure**
  - Sappi use an Enterprise GIS
    - *ArcGIS for Server*
      - SQL Database
      - Portal for ArcGIS
      - Web map publishing
    - *Mobile Application*
      - Collector for ArcGIS
      - ArcGIS Mobile
    - *Desktop Applications*
      - ArcGIS Desktop Advanced
      - ArcGIS Flex Viewer



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Land Management

- **Data Management**
  - All land categories (owned, leased and contracted) are mapped and managed in GIS
  - Landuse model consist of Planted Areas, Natural Areas and Roads
  - Data accuracy of sub-meter

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Land Management

- **Data Structure**
  - Landuse Model is representation of what is currently on the ground
    - Boundaries, Planted, Natural, Roads, Structures, Forestry Features, etc.
  - Plantation are mapped and maintained on a continuous basis

- **Other Data**
  - Structures (Houses, Fire Towers, Offices)
  - Stream Crossings
  - Sample Plots (Research)
  - Dams and Dam Walls
  - Depots
  - Non-Conformance Areas

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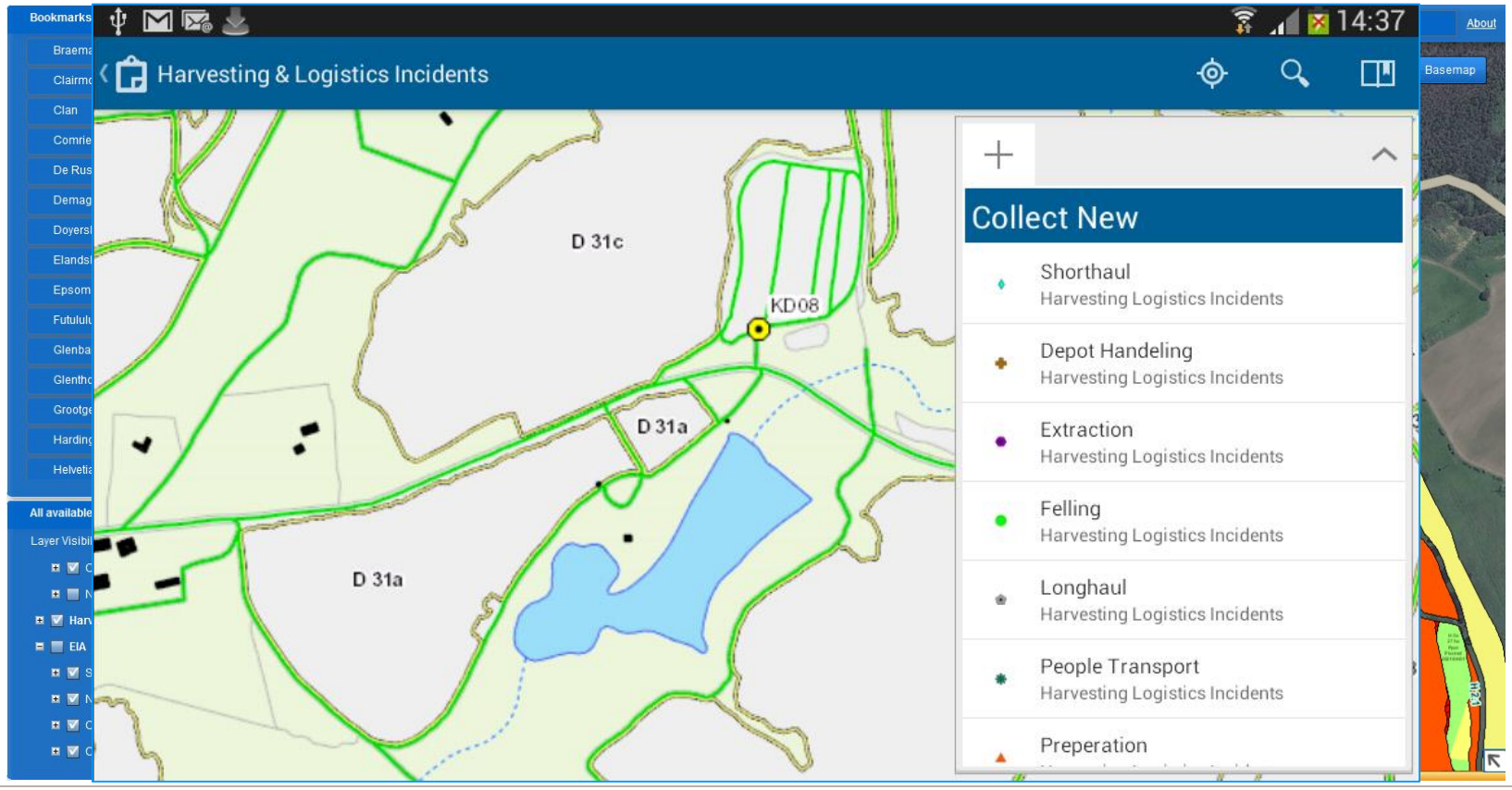
Land Management

- **Data Distribution**
  - GIS web pages
  - Mobile GIS
  - Maps provided by Cartographer
  - **Precision Mapping** – Extraction and Harvesting



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Environmental Management

- **EIA Mapping**
  - EIA's have to be completed before trees can be re-established
  - Cut back planted areas from streams

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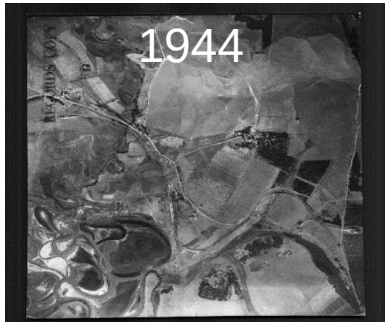
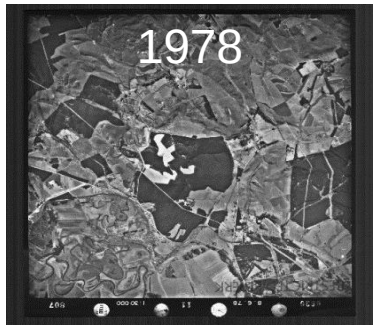
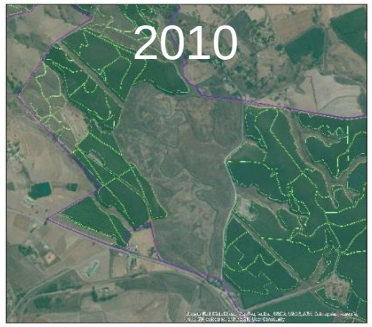
Environmental Management

- **Water/Hydrological Management**
  - Conformance to National guidelines
    - 20m buffer from edge of streams and wetlands (*Delineation of Riparian zones and Wetlands*)
  - GIS allows for accurate conformance and the ability to identify areas best suited for planting trees
  - Wetland conservation on Sappi owned land (Physical field assessment and photography)
  - Historical areal imagery used to asses wetlands as far back as 1940's







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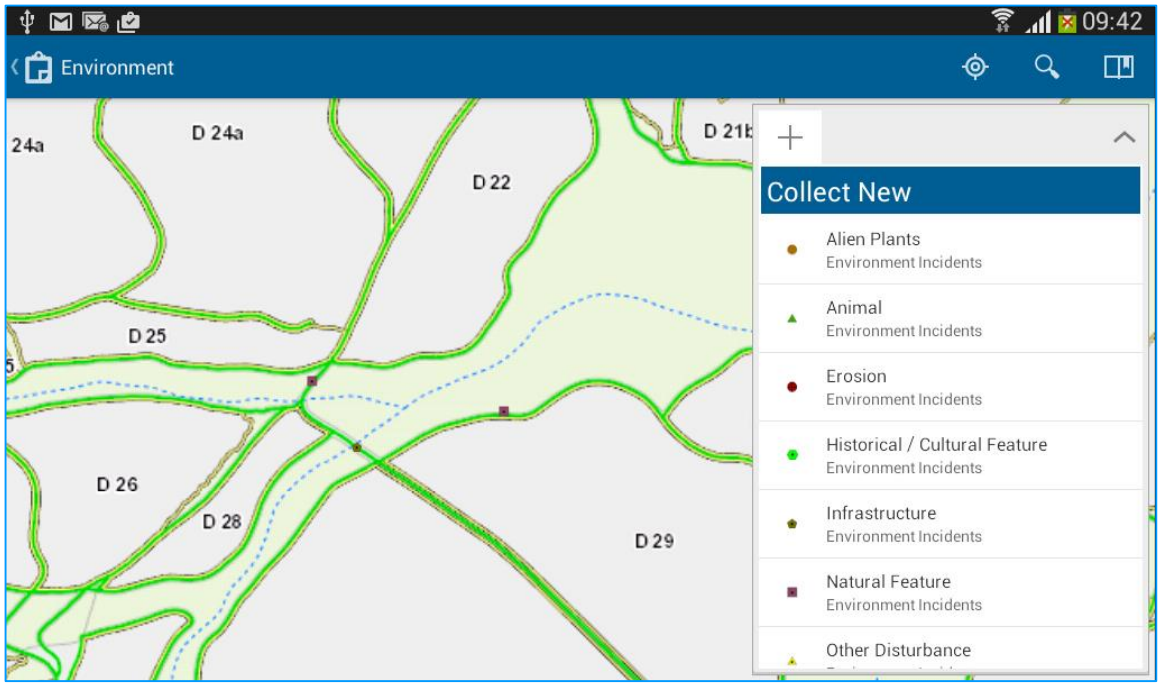
Environmental Management

- **Environmental incident monitoring** – Location and date of incident



- **Sustainable forestry practices**
  - Recording and monitoring of plantation cycles, species, felling dates and felling type (e.g. coppice) for best management of the land

- **GPS Camera Game spotting**
  - Camera sites for wildlife species data capture and in the interest of conservation.

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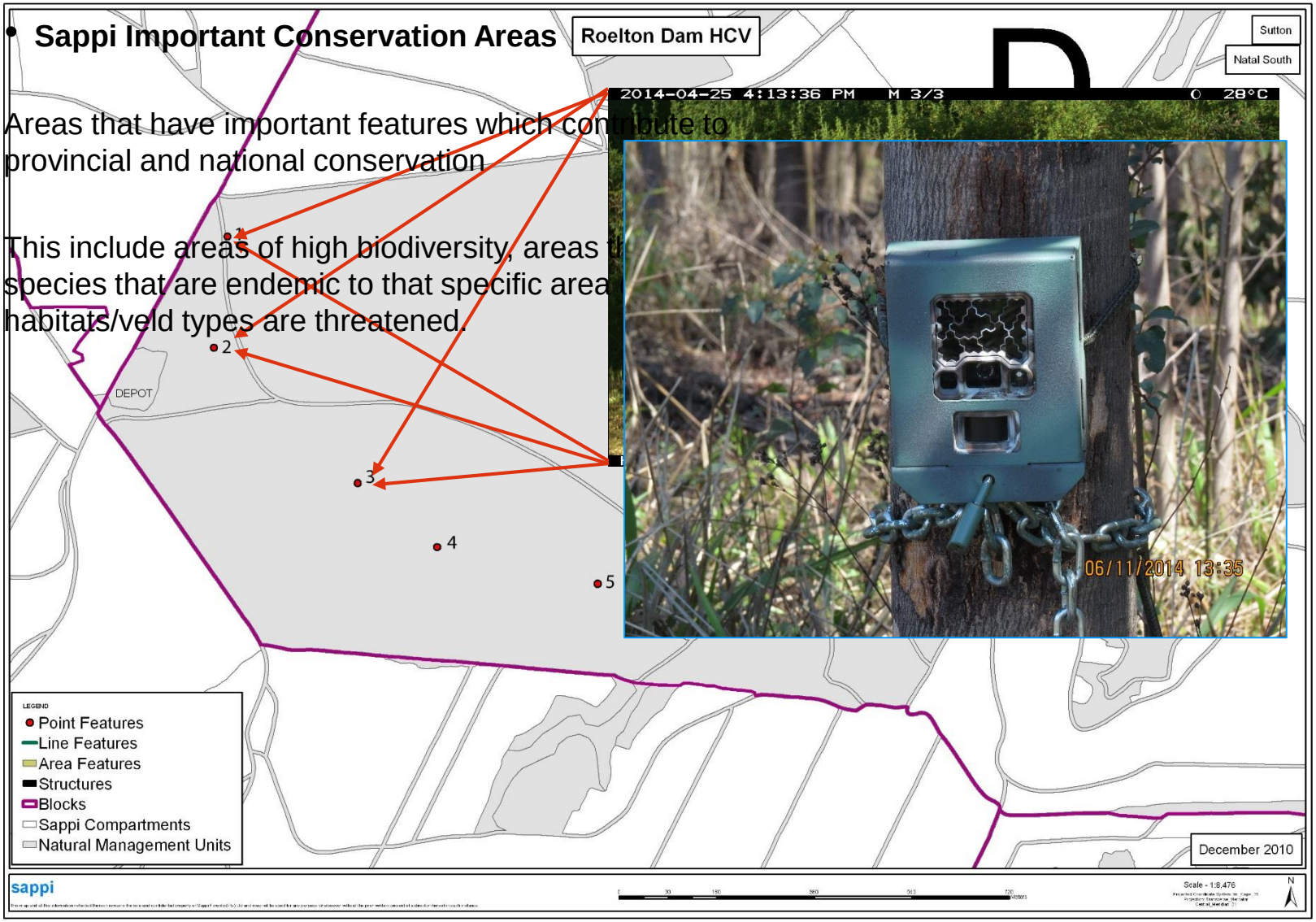
Environmental Management

- **Sappi Important Conservation Areas**

Areas that have important features which contribute to provincial and national conservation

This include areas of high biodiversity, areas species that are endemic to that specific area habitats/veld types are threatened.



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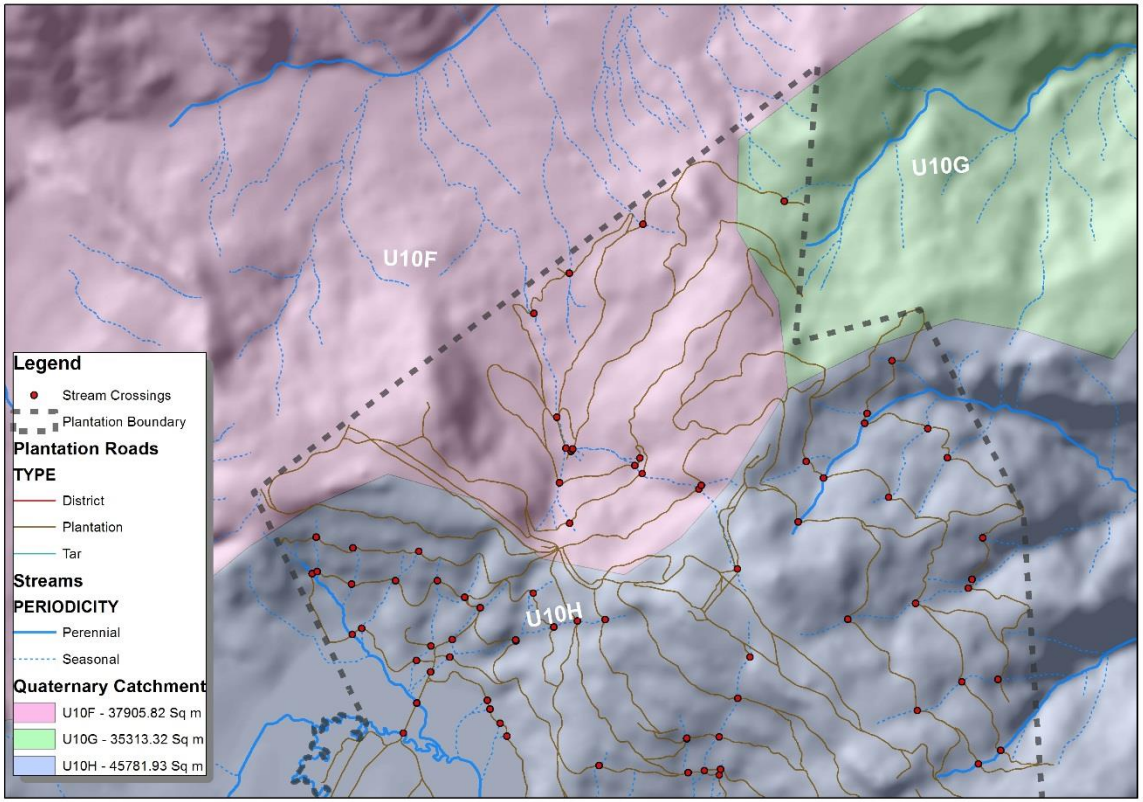
Catchment Management

- **Catchments are managed with accurate and up-to-date spatial data**
  - Flood mitigation (possible flood damage and prevention)
  - Stream crossings are mapped (potential stream blockages and to respond to it)
  - Catchment basins can be monitored and modelled for environmental risk factors (e.g. pollution)



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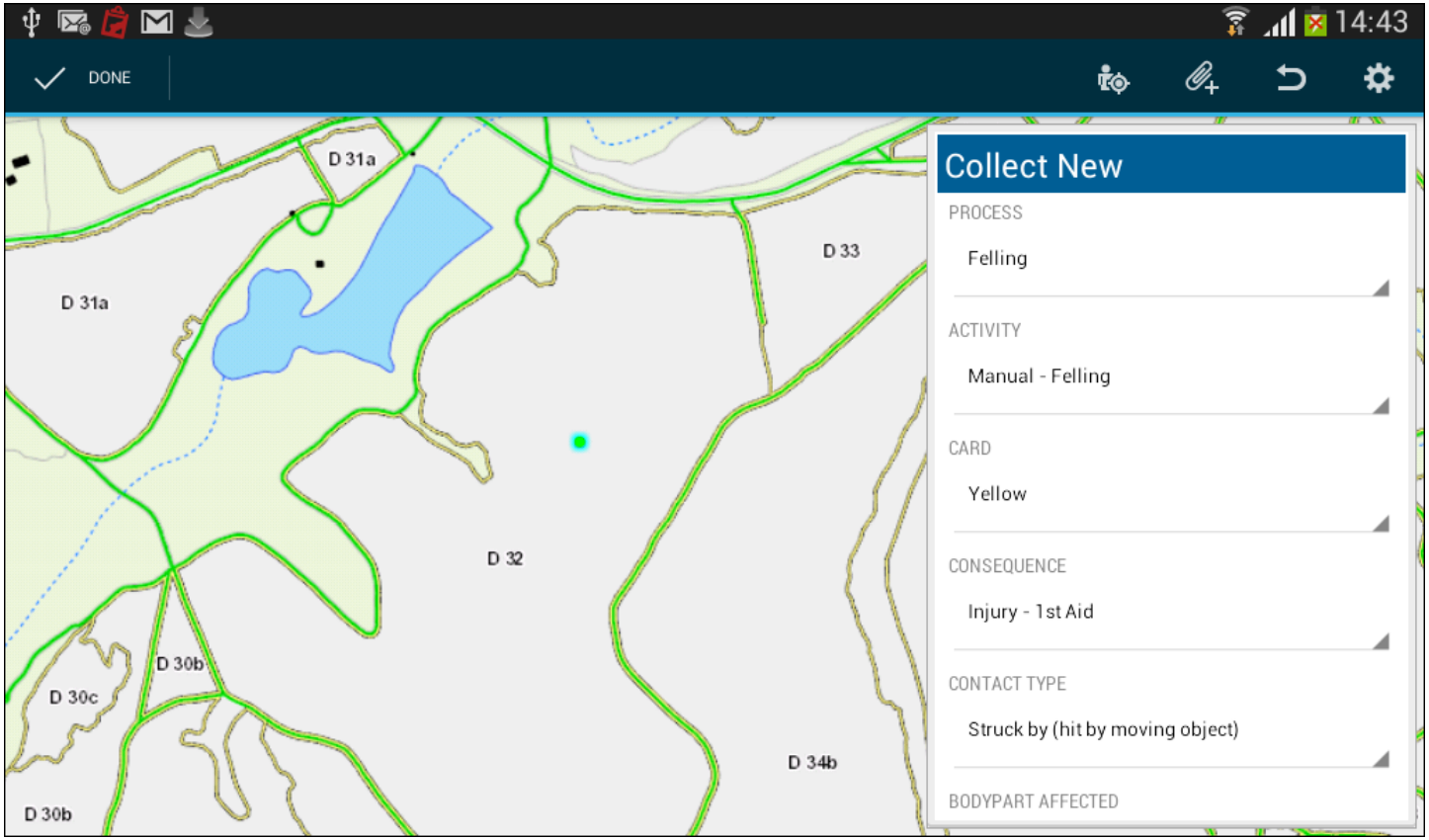
Mobile GIS

- **Incident Logging**
  - Capture events or incidents on GIS Web page or mobile device (reducing waste)
    - Safety incidents
    - Environmental incidents
    - Operational non-conformances



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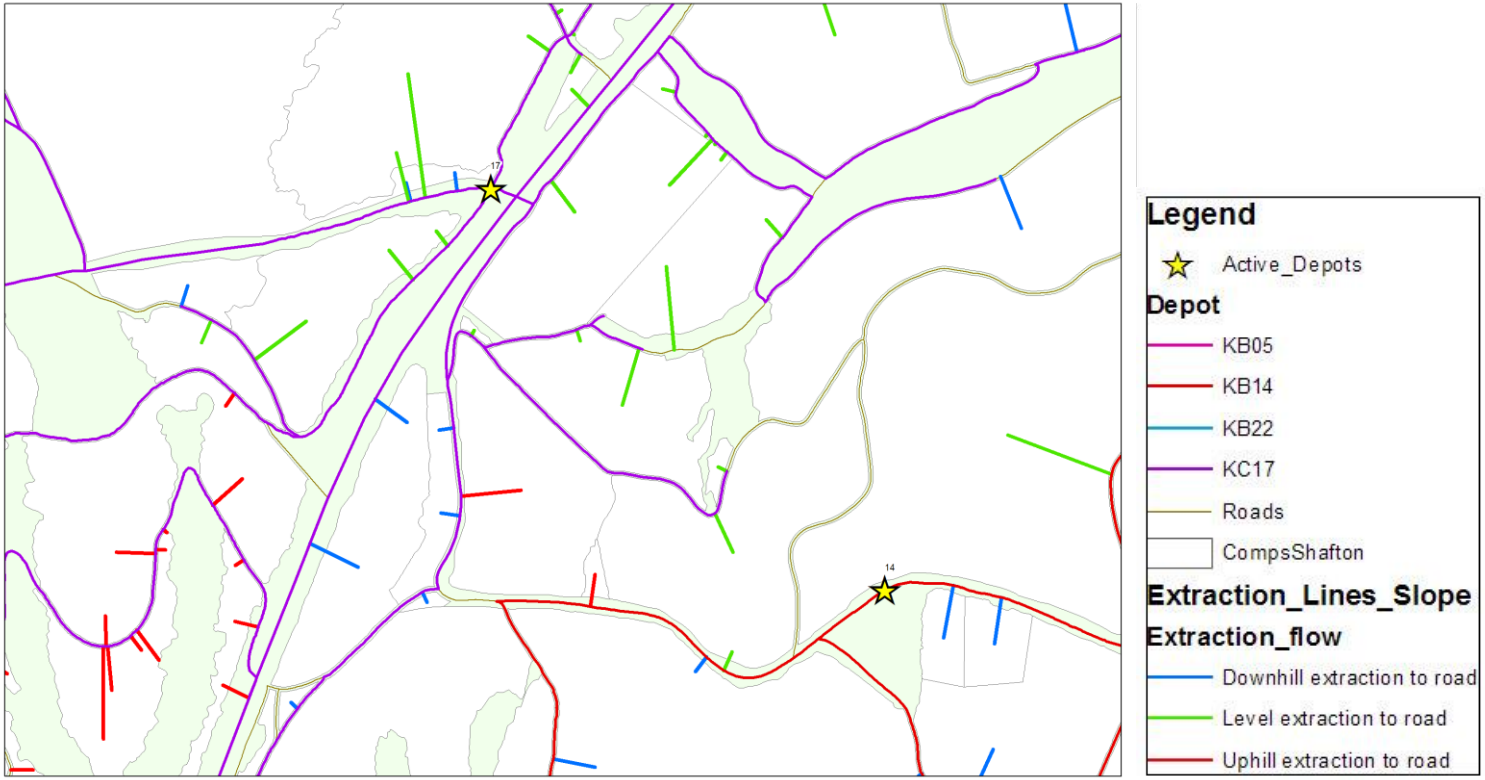
Spatial Analysis

- **Timber Flow Modelling**
  - Shortest distance to depot from each compartment
  - Felling extraction analysis using DEM
    - Provides closest central extraction point to road
    - Extraction length calculations
    - Up Hill and Down Hill extraction modelling for efficient planning (type of equipment)



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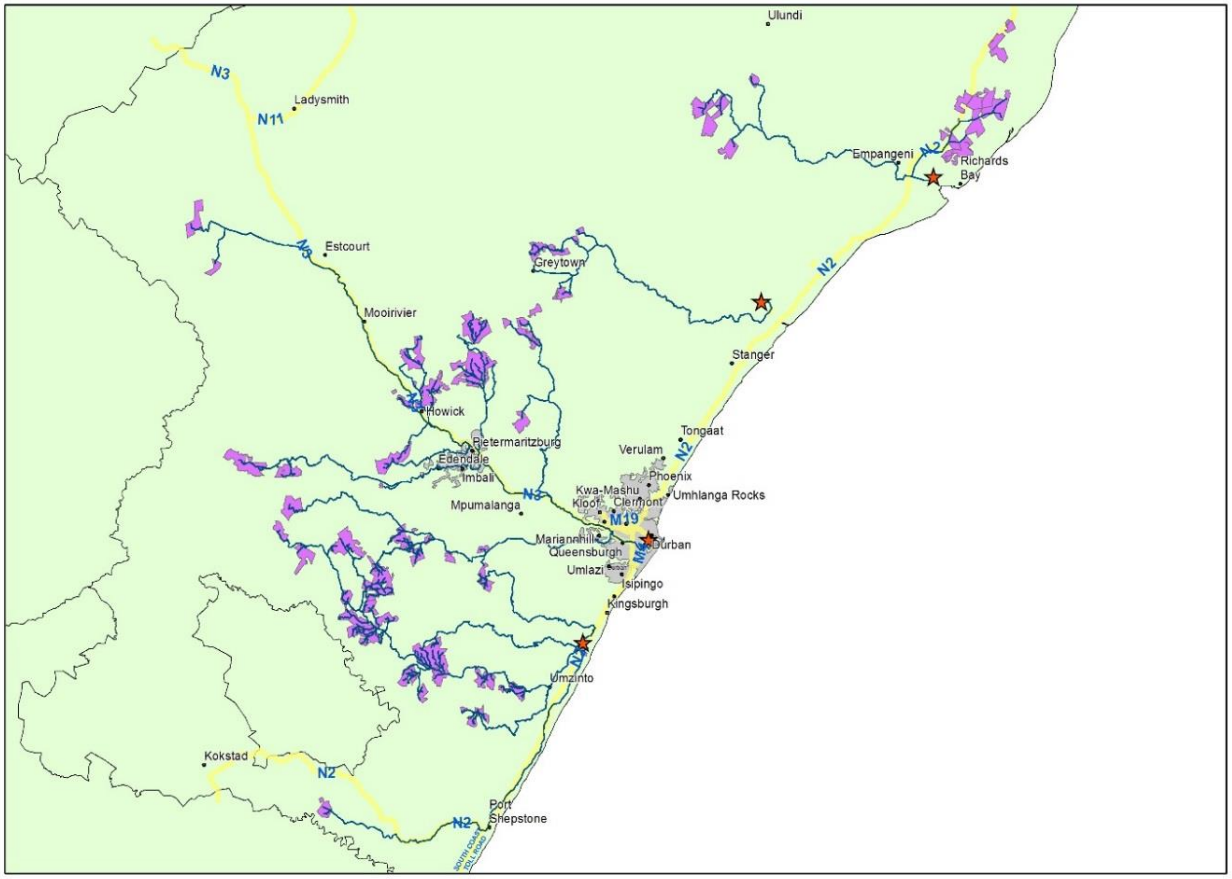
Spatial Analysis

- **Transport Optimization**
  - Transportation of timber is improved with Network Analysis
  - Optimised transport routes to Markets / Mills
  - Cost savings in transport optimisation



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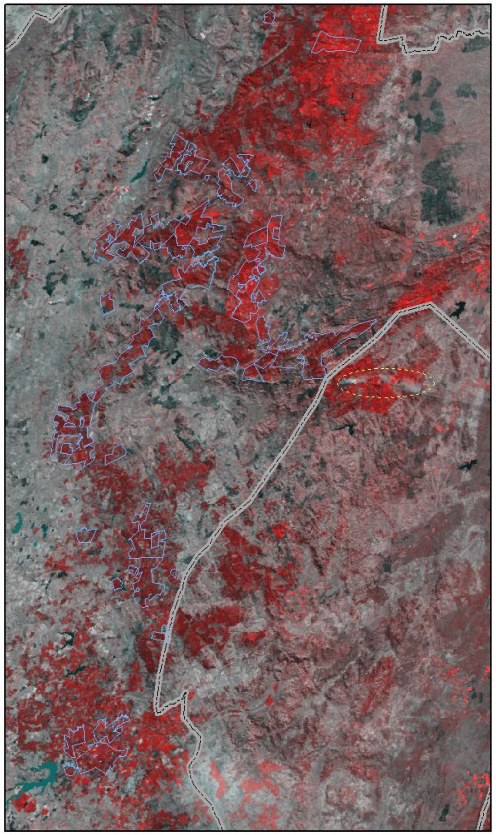
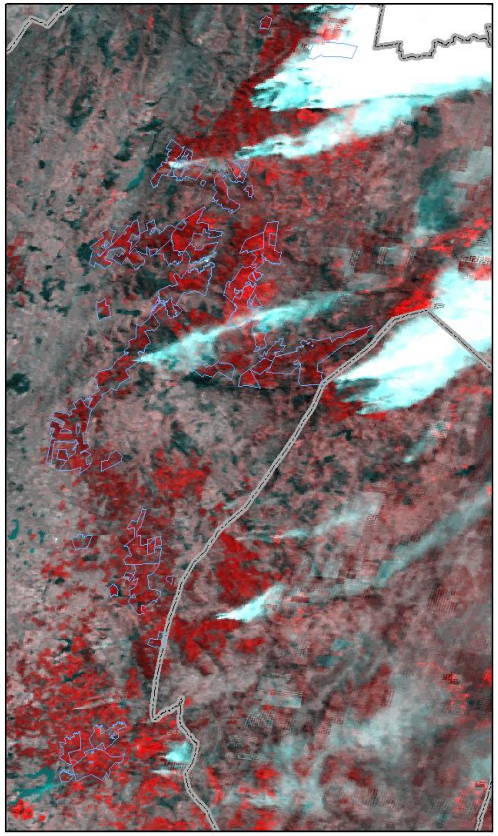
Remote Sensing

- **Disaster Mapping**
  - Post fire analysis
    - Determine where the fire originated
    - The area affected by the fire



MODIS IMAGERY (250M)
27/07/07



MODIS IMAGERY (250M)
28/07/07

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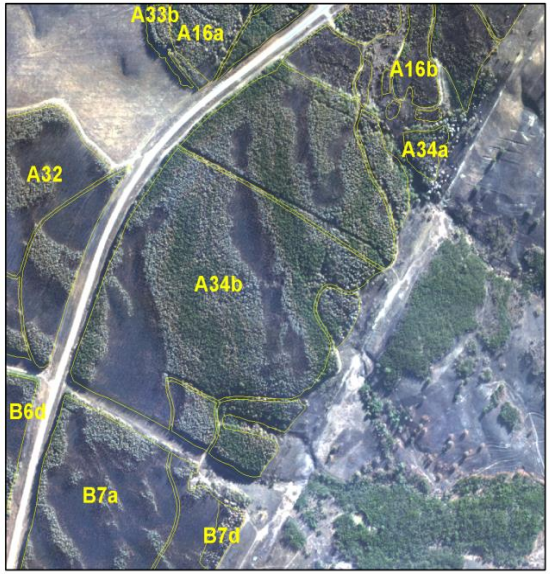
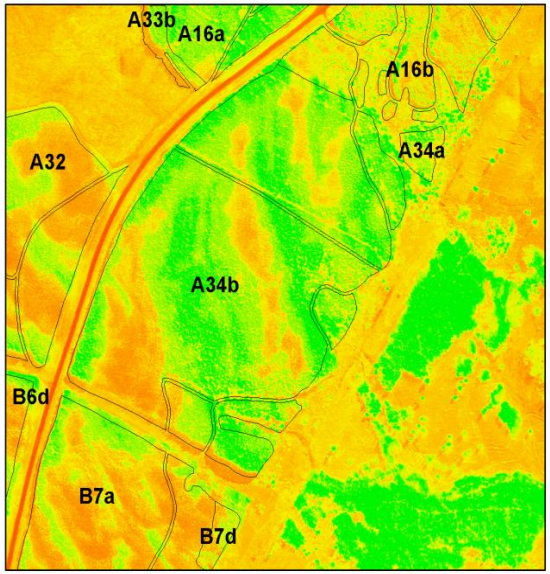
Remote Sensing

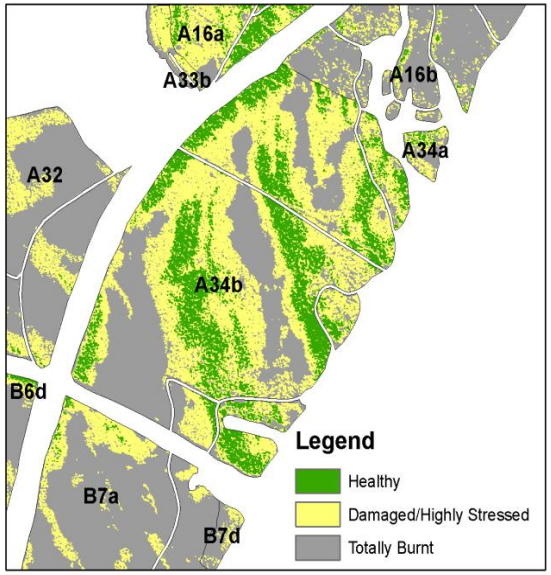
- **Disaster Mapping**
  - Mapping affected areas and severity of fire damage
    - High quality aerial photography to assess and map damaged areas
    - Identify damaged based on severity if fire
    - Classification of burned areas
    - Recovery strategy based on classification



COLOUR IMAGERY



NDVI



CLASSIFICATION

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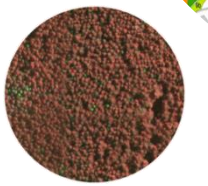
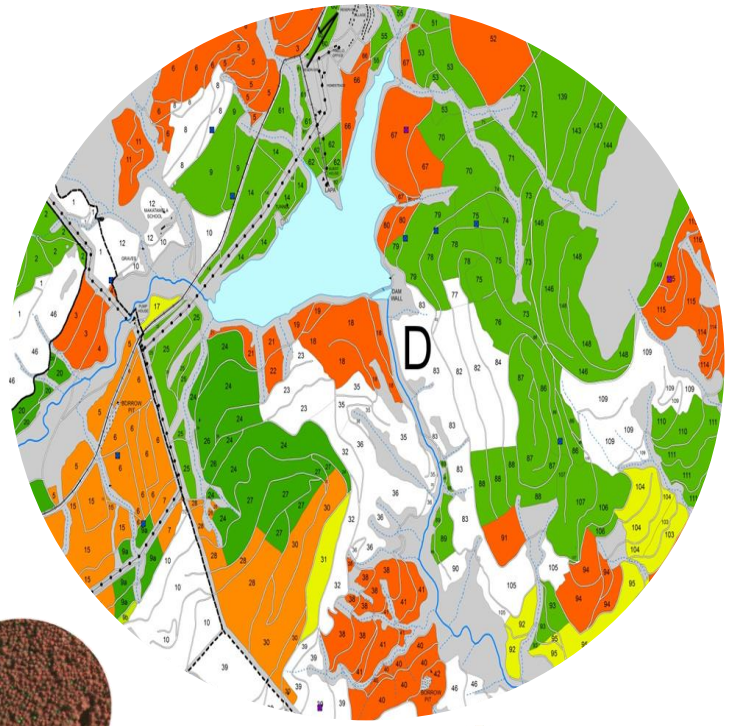
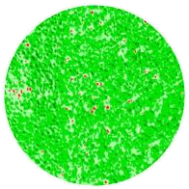
Remote Sensing

- **Predictive Modelling** – Sirex Model
  - Sirex wasp injecting larva into tree.
  - Sirex is identified in the field.
  - Imagery used to predict Sirex risk locations by:
    - Average temperature
    - Rainfall
    - Elevation
    - Aspect
    - Slope
    - Species (*Pine*)
  - Risk areas are identified and classified.
  - Trees at risk are inoculated to prevent Sirex wasp from spreading







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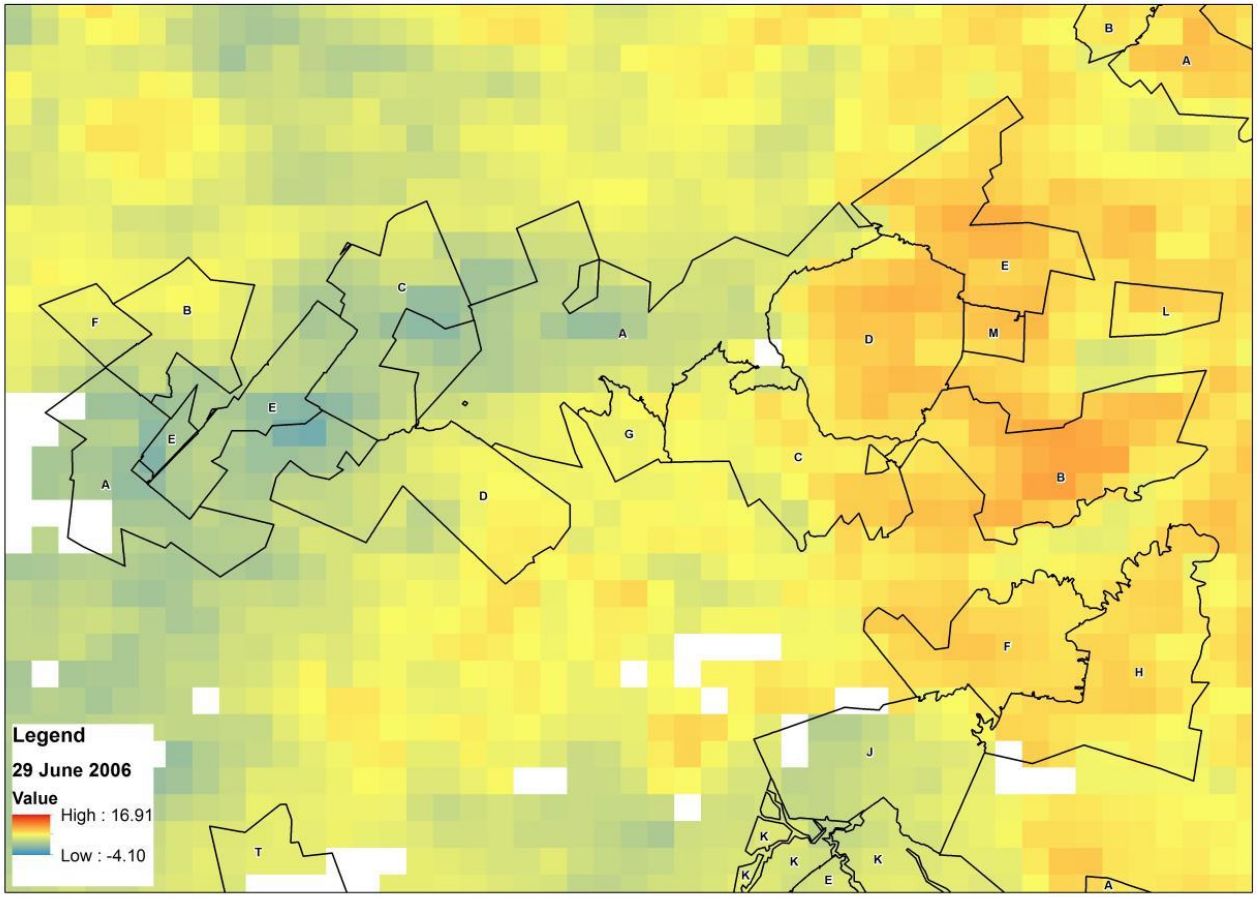
Remote Sensing -

- **Predictive Modelling –** MODIS Land Surface Temperature
  - Land surface temperature can be used to predict various factors using models
  - Frost prone areas identified
    (MODIS, Elevation, Aspect, Temperature and various other factors)



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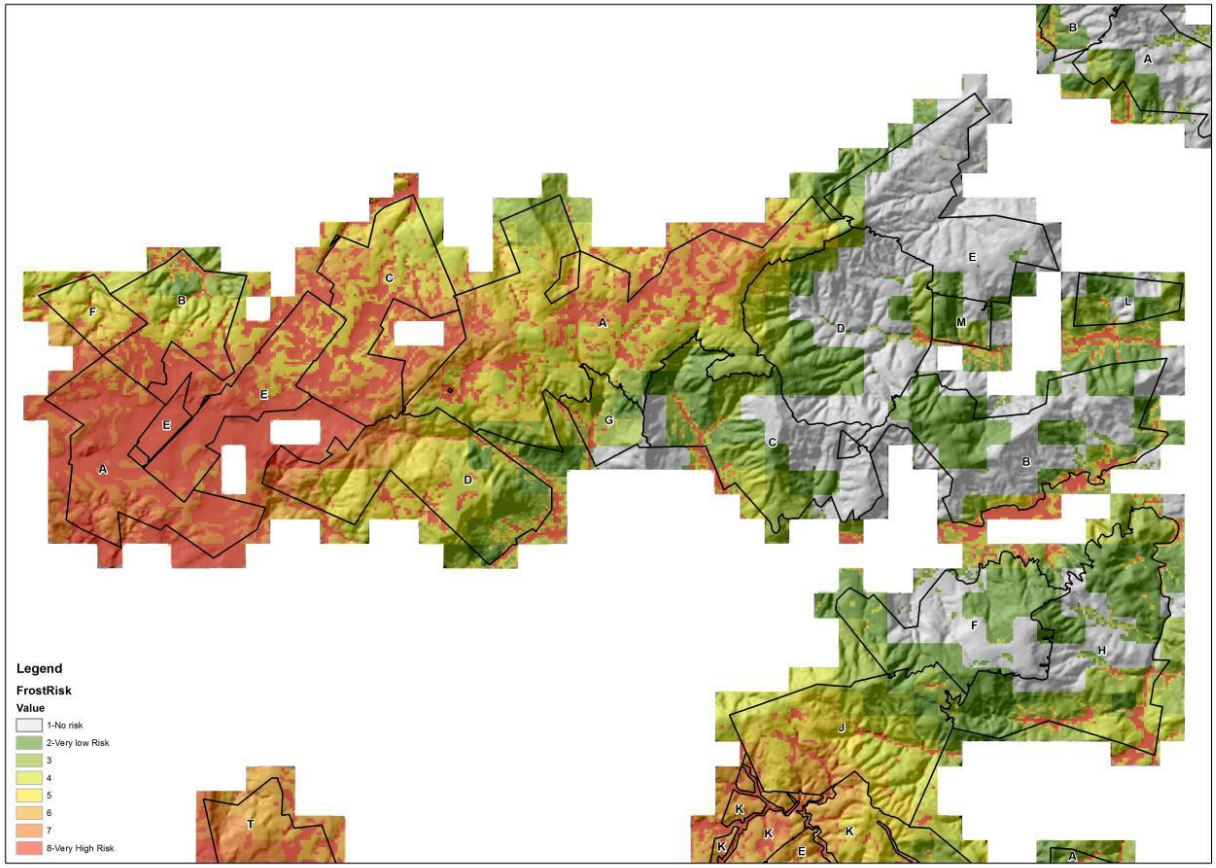
Remote Sensing - Cool Air Pooling Algorithm

- **Predictive Modelling**
  - Cool air pooling algorithm
  - For frost prediction
  - Cold resistant species can be planted accordingly



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Conclusion

- **Using GIS, Sappi Strives to**

  Achieve a high quality of data that is accurate and reliable

  Help manage all plantations in a environmentally friendly manner

  Maintain and conserve our natural and important conservation areas

  Sharing information and knowledge to all Sappi foresters and Contractors

- **Final Thought**

  GIS is the tool to manage accurate and reliable data

  BUT MOST IMPORTANTLY

  Data is the basis for Good Knowledge

  &

  Success is how you implement the Knowledge

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Thank You

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