ASSESSING THE STRUCTURE OF DEGRADED FOREST USING UAV

STUDY CASE IN YUNGAS CLOUD FOREST, NORTH ARGENTINA

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Problem

- Many natural forests are degraded and abandoned in Argentina

- Rehabilitation is needed for ecological and economical reasons

- Adapted management needs:
  - Definitions of forest degradation
  - Detailed spatial information

→ which is difficult and costly to obtain

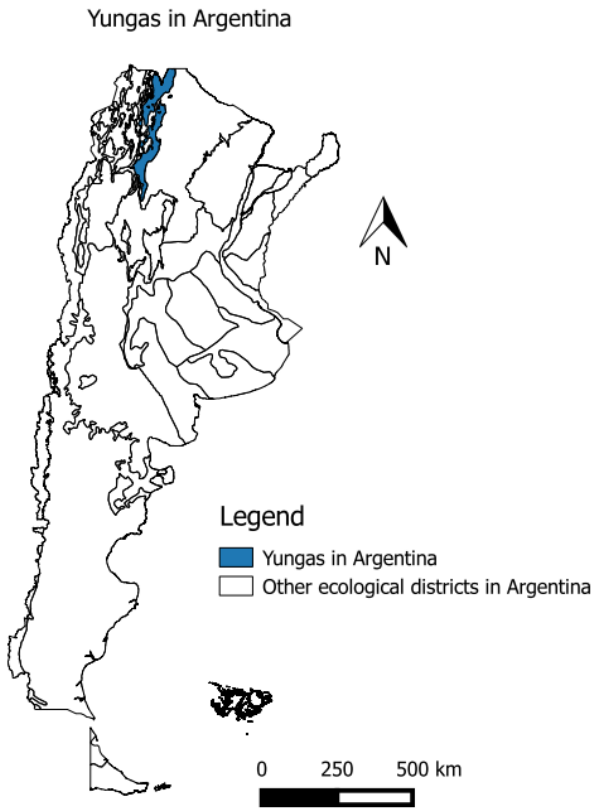
Objective

- Collect terrain and stand information combining UAV and satellite data, validated by ground inventory

- Define the potential and limitations of the use of drones for forest surveying

Materials and Methods- Site description

- Partially degraded native forest in temperate Yungas cloud forest, Northern Argentina
- High grading harvesting. Reduction of stock of valuable species
- Wildfire in 2013 affecting 4,519 ha



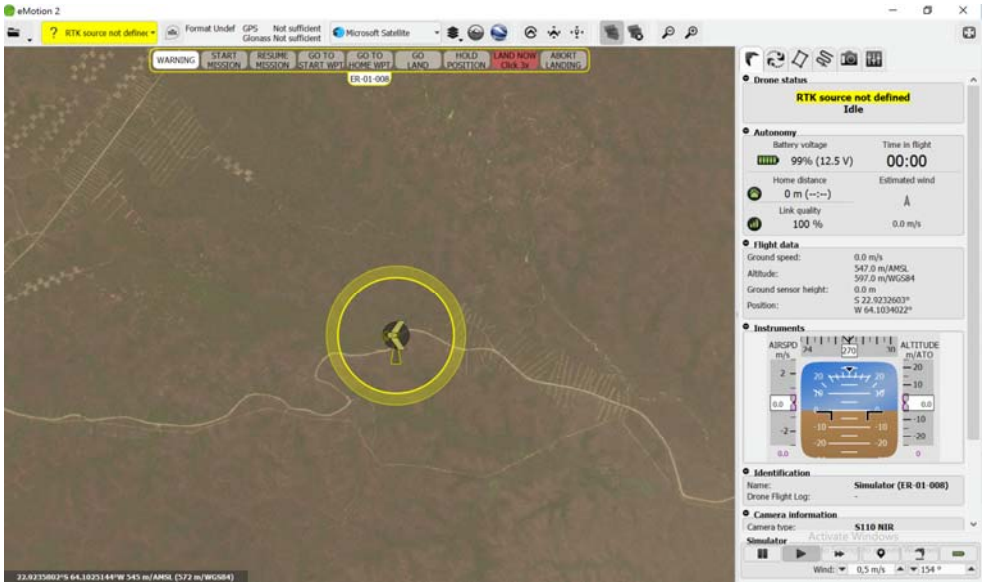
Materials and Methods- Imagery analysis

- Satellite. Delineation of fire on Landsat 8 from. Dec 2013

- Fixed wings (plane type) drone. eBee from Sense fly. Dec 2015

  - Camera: Canon S110. Red- Green- NIR
  - Altitude: 280 m
  - Resolution: 10 cm/pixel
  - 75 % overlap in both directions

Materials and Methods- Drone data acquisition



Materials and Methods - Imagery analysis

- Photoscan 1.2.4 (Agisoft)- Pix 4D- Postflight Terra 3D

  - Initial report

  - Point cloud

  - Orthomosaic- NDVI (normalized difference vegetation index)

- Quantum GIS- Canopy coverage

Materials and Methods- Inventory

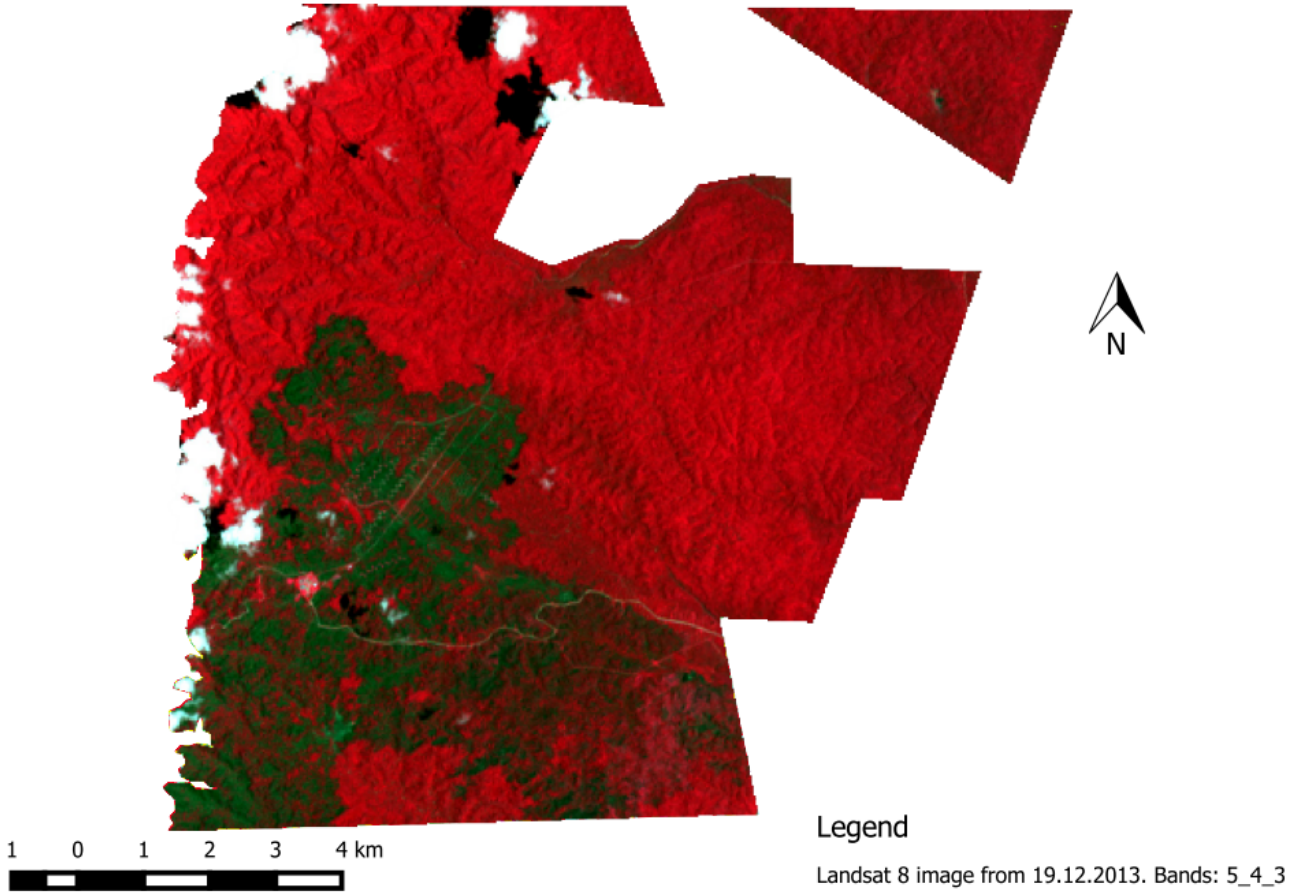
- 77 permanent plots located with differential GPS (Two are compared in this presentation)

- Circular plots size:
  - Outer (>30 cm DBH): 1000 m^2
  - Inner (10-30 cm DBH): 300 m^2
  - Regeneration: 25 m^2

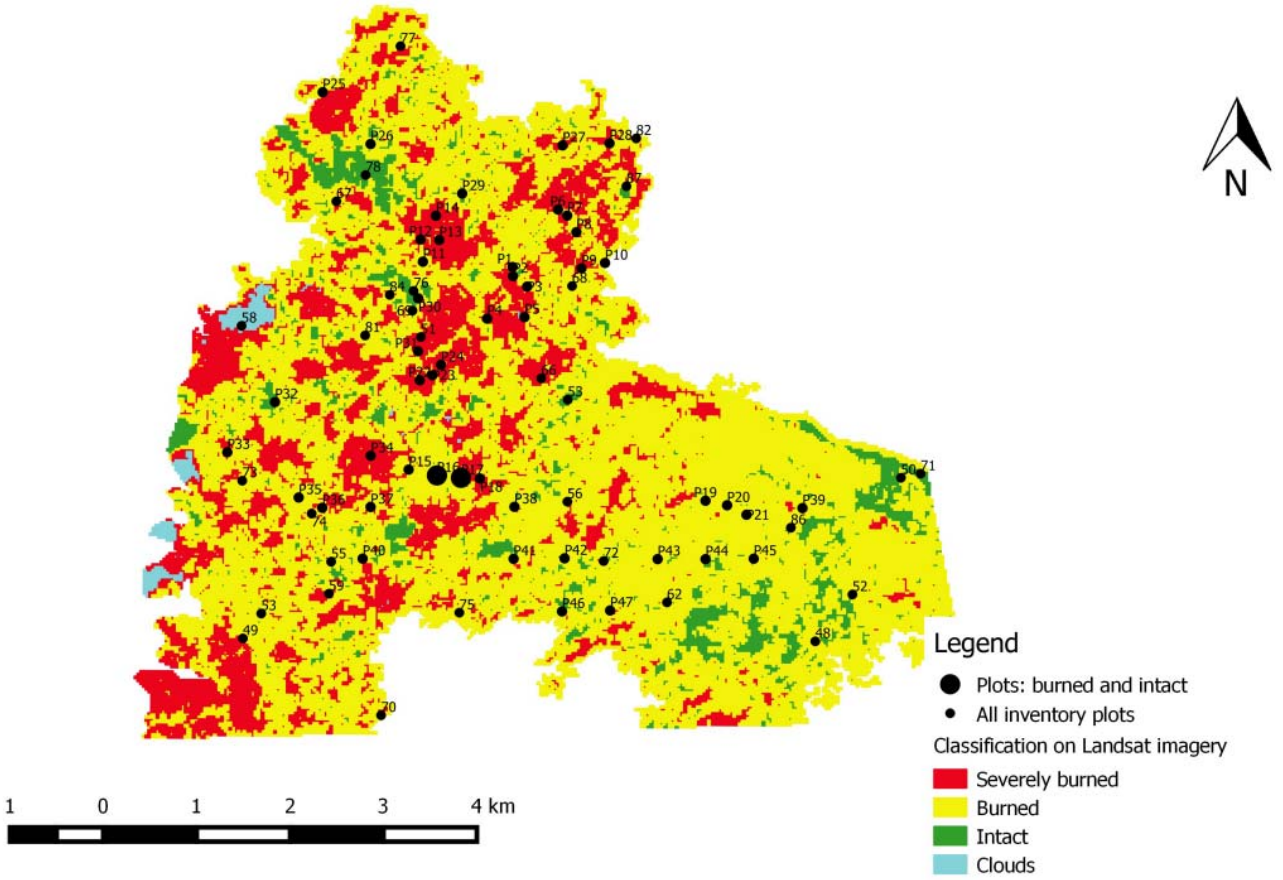
- Tree data: local name, species, stem circumference at BH, tree height, stem height, silvicultural class, health, damage by fire, observations

Materials and Methods- Inventory

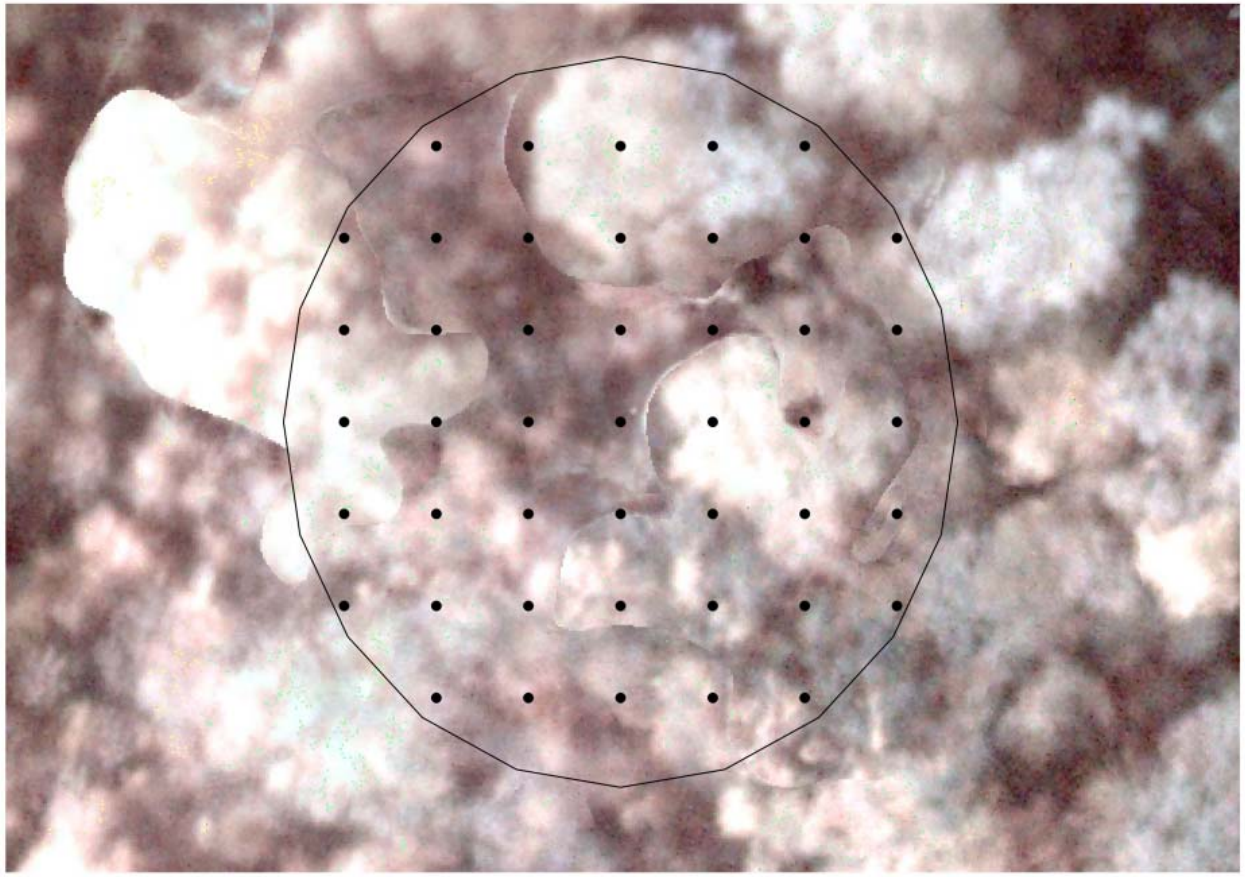
Materials and Methods- Fire detection



Materials and Methods- Plots location

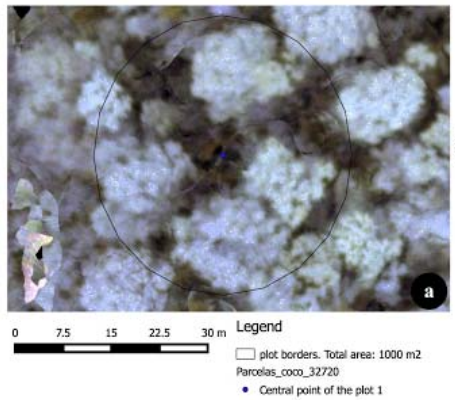


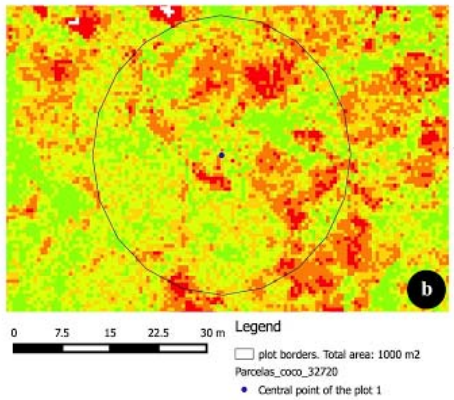
Materials and Methods- Canopy coverage

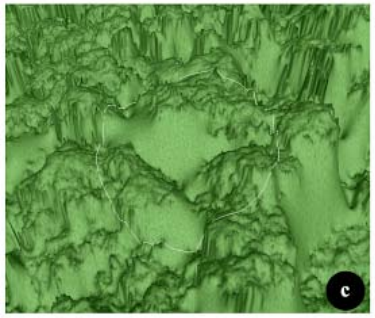


Results

- Intact forest. BA: 19.4 m^2/ha



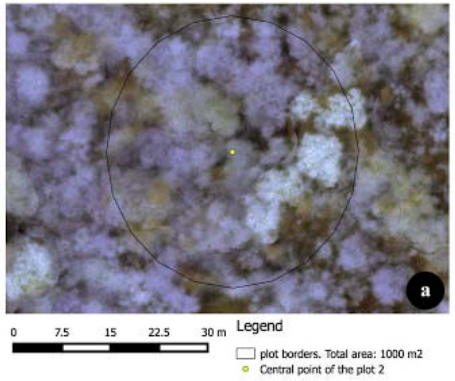


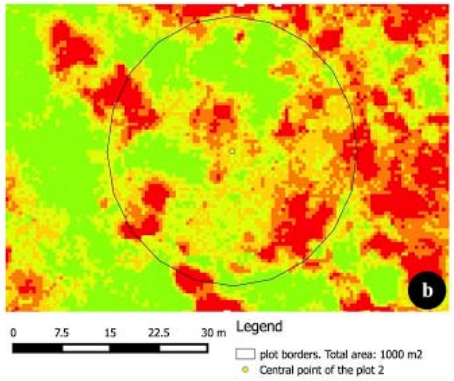


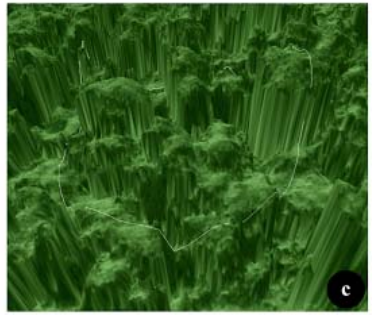
a) Mosaic
b) NDVI
c) 3D

$$NDVI = \frac{\text{NIR} - \text{Red}}{NIR + Red}$$

- Burned forest. BA: 5.8 m^2/ha







Results

- Intact forest (per ha):
  - BA: 19.4 m^2
  - 96 future crop trees
  - 40 mature trees
  - Canopy coverage: 69 %

- Burned forest (per ha):
  - BA: 5.8 m^2
  - 10 future crop trees
  - 10 mature trees
  - Canopy coverage: 13 %

Conclusions

- Manual delineation of a degraded forest based on visual interpretation of the 2-D and 2.5-D visualization is feasible
- NDVI from the drone imagery also allows to identify gaps
- Results must be validated with statistic analysis of larger number of samples

Next steps

- Define thresholds for classes of forest degradation
- DSM – DTM= tree height. → automatic delineation of classes of forest degradation
- Definition of meaningful management units taking into account class of degradation, size and road network
- → to propose adequate rehablitation measures

Recommendations

- Landing areas (40 x 200 m)
- Wind speed lower than 6 m/s (22 km/h)
- Air temperature lower than 40 °C
- Flight the UAV at similar day time
- High resolution imagery also requires high precision for the geolocation

Thank you for listening

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