NSW GOVERNMENT Natural Resources Commission

Coastal IFOA Monitoring Program

2024 Webinar series: Forest monitoring using LiDAR

Questions answered in the panel discussion – see the responses in the webinar video

No.	Question
1	Were you able to (or could you) see changes in the rates of woody biomass growth in response to different management actions (e.g. thinning, weed management, prescribed burning, etc.)?
2	In regards to 'comparable rates of canopy regrowth within different harvesting intensities' - what heights were considered when analysing this data? Was seedling recruitment/regeneration solely assessed?
3	Slides 29 and 30. Harvesting of timber is essentially done by Clear felling. So tree heights drop significantly. But the P95 heights in the graphs don't seem to reflect this. What am I missing??
4	How much ground truthing was undertaken and how? Has the Lidar information been ground-truthed with actual forests.
5	Do you have a metric for canopy depth? NPWS is modelling hazard reduction impacts in Koala habitat and canopy depth could be a useful predictor variable in our simulation model.
6	Which of your findings do you think may not have been possible if you had used satellite-based LiDAR, instead of airborne? What detail would have been lost? And how do you see satellite-based LiDAR technology evolving over the next few years and what this could mean for state-level and potentially continental-level monitoring of forest structure?
7	The 5mx5m Lidar derived understory cover will be very useful for our soil erosion modelling. Are these datasets available? Thanks.
8	How will better data about forests and their capacity to recover from disturbances such as harvesting and fire influence policy decisions regarding forest use and management?
9	Is there any comment in relation to the estimation of error (of prediction) in relation to parameters (including height and structure, and even biomass) across different native forest types?
10	How are the uncertainties associated to the LiDAR measurements (e.g., azimuth rotation error, range uncertainty, interstitial points, beam divergence) taken into account in the predictive models (e.g., biomass estimation)?
11	Early LIDAR, as available from ELVIS.FSDF is not sufficiently dense to analyse structure. This recent data may be dense enough, but actual tree mensuration has required ground-based LIDAR scanning. This is intensive and expensive work. Local sampling is feasible, but very unlikely to be done over the wide areas required for confidence.

Questions not answered during panel discussion

No.	Question	Answer
1	Has there been work to compare Forest canopy with the presence of animals and Fauna generally (as well as biomass)?	This research was focused on: ▪ **analysing forest structural diversity** across a study area on state forests to assess the influence of management (harvesting, prescribed fire, exclusions), natural disturbance and topographic position ▪ **mapping average canopy height and average canopy cover** at the compartment scale and at the local landscape area scale for each LiDAR capture area. This research did not investigate the presence of fauna, however the analyses in this research involved metrics important for measuring and monitoring habitat suitability, including canopy height, canopy coverage and canopy foliage density. The LiDAR-derived metrics are potentially valuable additional co-variates for fauna species occupancy modelling being undertaken under the fauna monitoring on state forests component of the Coastal Integrated Forestry Operations Approval (IFOA) Monitoring Program. Higher density point cloud analysis would allow for improved precision in the estimations of forest height, canopy cover and biomass, and in some cases be used for accurate species identification, or mapping habitats of various fauna.
2	Canopy height at the site level is important as it relates to recovery from disturbance or has reached "climax" but I would have thought doesn't necessarily allow comparison across sites unless it's related to forest type or am I missing something?	Canopy height was not compared between LiDAR capture sites. Patterns of forest height post-harvest were analysed using mean (p95) canopy height within study sites. Differences in p95 height for different slope positions and fire severities were compared within sites. Further analysis could be undertaken using forest type maps to explore relationships between forest type, site conditions and canopy height. The comparison between regions shown in the webinar was just to show that differences in mean canopy height and the distribution of heights in different regions can be quantified. These differences are a function of forest type, site conditions and disturbance histories in each region.
3	Why is it not possible for the audience of this webinar to see all the questions being asked by the audience?	In this webinar all submitted questions were published in the Q&A thread, noting that the moderation process may have resulted in a short delay between submission and publication.

Other statements not addressed during panel discussion

No.	Statement	Response
1	The term harvesting is usually applied to crops which are planted then harvested. I would suggest that its more accurate to describe the forests as having been "logged". This is important because this differentiation represents the intersection of science and politics i.e. in the context of the current public debate about native forest logging it's more publicly acceptable to "harvest" a resource rather than "log" it. So language does matter.	The Coastal IFOA Monitoring Program uses terminology as defined in Coastal IFOA Protocol 39.[1] The term 'harvesting' is defined in the Coastal IFOA. 'Logging' is not used or defined. Protocol 39 defines the terms *harvesting* and *harvesting operations* as being '*the cutting and removal of timber or forest products*'. The international Montreal Process *Criteria and Indicators of Sustainable Forest Management*[2] also uses harvest-based terminology, for example referring to 'annual harvest of wood products' and 'volume harvested each year'. Australian criteria and indicators of sustainable forest management3 align with those from the Montreal Process and use the same terminology, both in the context of native forests and plantation forestry.
2	RE [*answered question No. 3*]: Canopy Height Model is made from LIDAR point cloud by 'Cloth Simulation Filter' (laying a semi-rigid virtual 'cloth' over the Digital Surface Model.) This cloth will 'hang' on the high points (retained trees), depending on user settings.	Under the Coastal Integrated Forestry Operations Approval (IFOA) a substantial number of trees are required to be retained in harvested forests. All retained trees can be detected by the airborne LiDAR and contribute to the p95 height. The methods used are described in the Stage 1 report available on the NRC website. The Canopy Height Model was developed using the 'pit-free' algorithm[4].

1 NSW Environment Protection Authority (2023) *Coastal Integrated Forestry Operations Approval – Protocols – Protocol 39: Definitions*, State of NSW and Environment Protection Authority

2 Montréal Process Working Group (2015) *The Montréal Process (Booklet): Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forest*, Fifth Edition, September 2015

3 Australian Government Department of Agriculture, Fisheries and Forestry (2008) Australia's Sustainable Forest Management Framework of Criteria and Indicators 2008 – Policy Guidelines, published April 2008, Canberra ACT

4 Khosravipour A, Skidmore AK, Isenburg M, Wang T, Hussin YA, (2014), 'Generating Pit-free Canopy Height Models from Airborne Lidar', *Photogrammetric engineering and remote sensing*, 80(9):863–872.