NSW GOVERNMENT

Coastal IFOA: Monitoring plan

Forest structure, health and regeneration

October 2020

Monitoring strategy summary	
Monitoring strategy	Monitoring Forest Structure, Health and Regeneration
Version 1.0	8 October 2020

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Part 1: Monitoring strategies in the approved monitoring program

1.1 Strategy title

Monitoring Forest Structure and Health

Monitoring Regenerating Forests

1.2 Protocol 38

- Protocol 38.3 (1)(a)(i) – Multi-scale landscape protections
- Protocol 38.3 (1)(a)(viii) – The effectiveness of selective harvesting limits in achieving the regeneration and stocking standards as measures of longer-term regeneration
- Protocol 38.3 (1)(a)(ix) – The maintenance of sufficient levels of coarse woody debris

1.3 Coastal IFOA condition and associated outcome statements

C20 (Regeneration)

Harvested areas are adequately stocked with a natural floristic composition to maintain ecological function and sustainable timber supplies

C45 (Intensive harvest limits), C46 (Selective harvest limits), C47 (Mixed intensity harvest limits) and C48 (Alternate coupe harvest limits)

Harvesting operations are distributed across the landscape over time to support a mosaic of forest age-classes and maintenance of forest structure in the operational area or local landscape area.

C49 (Category 1 and 2 Environmentally Significant Areas) and C52 (Ridge and headwater habitat)

Habitat and environmental features are identified and retained to provide refuge, connectivity and to support forest regeneration.

C63 (Tree retention clumps) and C64 (Retained trees)

Environmental features, habitat, and risks are identified, and site-specific protections and management practices are developed to mitigate the impact of the forestry operation.

1.4 Monitoring questions

- Do harvesting conditions establish a mosaic of forest age classes at the landscape scale?
- Do the conditions maintain functional connectivity for focal fauna species to move within and across the forest?

- Are the conditions effective in ensuring regenerating forests meet benchmarks for:
  i. floristic composition
  ii. forest structure
  iii. coarse woody debris
- To what extent are the conditions effectively managing the risk of new or existing areas subject to dieback?
- Are the conditions and practices effectively managing risks of invasive plant species in regenerating forests?
- Are the conditions effectively promoting regeneration to maintain volume and quality for productive supply?

1.5 Monitoring plan objectives

- Identify the approaches, metrics, and scale to cost effectively measure and monitor forest heterogeneity, as a surrogate for retention of habitat and environmental features, and forest regeneration.
- Establish benchmarks at the site and local landscape area scales that represent distributions of different harvesting limits the support a mosaic of forest age-classes and maintenance of forest structure, based on all components of the Coastal IFOA monitoring program.
- Develop a site-based monitoring method to assess the performance of regeneration practices following different silvicultural treatments across a range of temporal scales to inform the ecological condition of different regenerating forest ages.
- Measure the appropriateness of the current Protocol 37 benchmarks, regeneration approaches and remedial actions for maintaining stocked coupes.
- Develop a landscape-scale monitoring of forest condition, structure and regeneration.

1.6 Strategy summary

In order to cost effectively monitor the effectiveness of the multi-scale landscape protections and to answer the monitoring questions, two streams of monitoring will be implemented:

- Operational monitoring: using existing harvest operations vector data collected by FCNSW and a heterogeneity index derived from plot validation monitoring to give a real-time picture of forest heterogeneity and connectivity across the Coastal IFOA estate.
- Validation monitoring: using remotely sensed data products developed as part of the State-wide program and supplemented by a ground-based forest and stocking plot network. This will be implemented under the Coastal IFOA monitoring program so that it validates the heterogeneity index used and also provides ecological condition and regeneration response in post-harvest areas.

Operational monitoring

Under the Coastal IFOA, local landscapes comprise a mosaic of:

- harvest zones (intensive harvest, selection harvest, mixed harvesting, and (in the case of the Eden subregion) alternate coupe logging)
- environmentally significant areas (ESAs) (including category 1 and category 2 areas)

- wildlife and tree retention clumps.

Using the vector data collected by FCNSW during harvest operations, a 'forest strata' layer will be created to calculate the area of different post-harvest/reserved vegetation formations mapped in the local landscape and surrounding State Forest. The forest strata layer will be created by intersecting structural features, such as harvested areas, ESAs and retained features with the vegetation formation.

Validation monitoring

Forest plots

The validation monitoring will use the three tiers of observation consistent with the State-wide remote sensed plot network. This will firstly, generate vegetation integrity scores that will be used to develop a heterogeneity index for the forest strata created in the operational monitoring.

Furthermore, in order to validate the structural condition of forest strata the monitoring strategy will undertake high-resolution monitoring utilising the approaches developed under the baselines, drivers, and trends project under the state-wide program. These methods will enable the program to validate the modelling used in the operational monitoring approach as well as inform the landscape-scale monitoring the feeds into the State-wide program.

Stocking plots

Protocol 37 stocking assessment plots information will be collected along with the forest plots in early regenerating forest strata (0-10 years post-harvest), the outputs from this monitoring strategy will seek inform landscape-scale trends in regeneration for trend monitoring.

Validation monitoring sampling strategy

Validation monitoring will be implemented using the rotating panel of Local Landscape Areas that uses the three-tiers of observation approach developed as part of the State-wide program.

Analysis and evaluation

Using the forest strata layer and a forest heterogeneity index, the program can develop benchmarks to evaluate the performance of the multi-scale landscape protections across local landscape areas and management zone scales.

Results of the stocking plots will enable broader sampling across harvesting types including mixed, intensive, and alternate coupes, and be set at varying distances from the non-harvested forest edge in regenerating coupes. Results from stocking plots against the ecological condition data from forest plots will evaluate the effectiveness of Protocol 37 regenerating benchmarks in delivering both ecological and timber supply outcomes.

Landscape scale monitoring

The method for monitoring landscape-scale indicators in forest structure, health and regeneration is being developed as part of the baselines, drivers, and trends in forest extent, condition and health project being delivered by a consortium containing representatives from DPI, DPIE, FCNSW, University of NSW, University of New England, Spatial Vision, RMIT and PF Olsen.

This will include historical trends in forest extent, condition and health, including time-series analysis of regeneration and areas of forest dieback on state forests, as well as the indicators required to be collected as part of state-wide plot network.

1.7 Outline of methods and approach

Local Landscape Areas (LLAs)

Local landscape areas are made up of a mosaic of different forest age classes, stages of regeneration and post-harvest management units that provide different habitat resources for species to occupy and move through the landscape. To account for those differences, we will model the heterogeneity and functional connectivity of each of those patches to provide a landscape picture of the effectiveness of the multi-scale landscape protections implemented by the Coastal IFOA.

Operational monitoring: Monitoring heterogeneity and connectivity using vector data

Functional connectivity for each location is its ecological condition and connections between habitats. Each forest fauna species responds to connectivity differently, with functional connectivity comprising various elements including, not only standing trees, but for many species also hollow-bearing trees, dead standing trees, shrubs, understorey plants, logs, litter, rocks, moisture and soil (collectively these elements contribute to forest structural heterogeneity). However, it is difficult and costly to monitor the spatial distribution of many of these elements over time and across the landscape, so the monitoring approach proposed uses mosaics of silvicultural features and vegetation formations as the key surrogate for structural heterogeneity and connectivity at the compartment, local landscape and management zone scales.

In addition, this monitoring approach seeks to utilise the NSW Biodiversity Assessment Methodology outputs of vegetation integrity as a way of quantifying the ecological condition of a silvicultural feature and an LLA.

Forest canopy heterogeneity can be defined as the complexity of forest structure within a nominated area, quantified by the proportion of different canopy age-class cohorts in the stand, and the number of 'parcels' represented by each cohort. A parcel in the context of heterogeneity is a parcel of land in the LLA that has a distinctive combination of silviculture treatments and vegetation formations. The vegetation formation will be used to establish the ecological condition benchmarks to create the heterogeneity index.

In a compartment setting, it is possible for harvest limits to be distributed across the landscape to provide refuge, feeding and dispersal habitat for a range of species at an LLA scale to maintain connectivity. For example, the closer two patches of 'suitable' habitat (e.g., retained mature or over-mature forest) are in a local landscape in which forestry activity is the focus, the more likely a species is able to cross the gap between them via other forest elements (e.g. retained trees and clumps) that may act as stepping stones.

Stratifying a Local Landscape Area

A number of spatial datasets will be sourced from FCNSW within the local landscape, plus a 1 km buffer around the local landscape (confined to state forest only). These are:

- retained trees (as defined under the Coastal IFOA)
- retained wildlife clumps
- ESA 1 and ESA2 areas

- harvest footprints (intensive, selective, mixed, alternative couple)
- for each harvest footprint, year of most recent harvest
- vegetation formation mapping.

A spatial map of the following features in the local landscape will then be developed, where each feature is represented by a unique map polygon:

- early regeneration harvestable forest (0-10 years)
- advanced regrowth harvestable forest (11-20 years)
- early mature harvestable forest (21-30 years)
- mature harvestable forest (>30 years)
- category 1 ESA
- category 2 ESA
- retained clump
- retained tree.

Each of the map polygons captured above will be intersected with the following vegetation formations to create a forest strata layer (suggest a minimum polygon area of 0.01 hectares):

- rainforest
- wet sclerophyll forest (WSF)
- dry sclerophyll forest (DSF)
- swamp forest
- wetland
- heathland
- grassland.

The spatial footprint of this 'structural feature x vegetation formation' (forest strata) mosaic may change over time as, for example:

- the retained trees or clumps are replaced
- regrowth forest advances to mature forest
- mature forest is harvested, new fauna exclusions are established
- vegetation formations gain or lose extent as a result of factors such as bushfires, floods or dieback events.

At the time of assessment, the total area (hectares) and number of parcels of each of the features in **Table 1** will be calculated. Under the Coastal IFOA, vegetation types determined to be rainforest, wetland, heathland or grassland are not subject to harvesting and these boxes are shown in grey.

Table 1. Forest strata used to monitor forest heterogeneity and connectivity

			Vegetation formation						
			Rainforest	WSF	DSF	Swamp or riverine forest	Wetland	Heathland	Grassland
Structural feature	Early regenerating forest (0-10 yrs)	Intensive/Coupe							
		Selective							
	Advance regrowth forest (11-20 yrs)	Intensive/Coupe							
		Selective							
	Early mature forest (21-30 yrs)	Intensive/Coupe							
		Selective							
	Mature harvestable forest (> 30 yrs)	Intensive/Coupe							
		Selective							
	Non-harvested feature	ESA Cat 1							
		ESA Cat 2							
		Retained clump							
		Retained tree							

For each ESA1, ESA2, retained clump and retained tree polygon in the local landscape (including all its assigned vegetation formations) a functional connectivity score will be generated using the ecological carrying capacity coding outlined in the NSW Biodiversity Indicators program.

An example forest strata map is shown in figure 1 below.

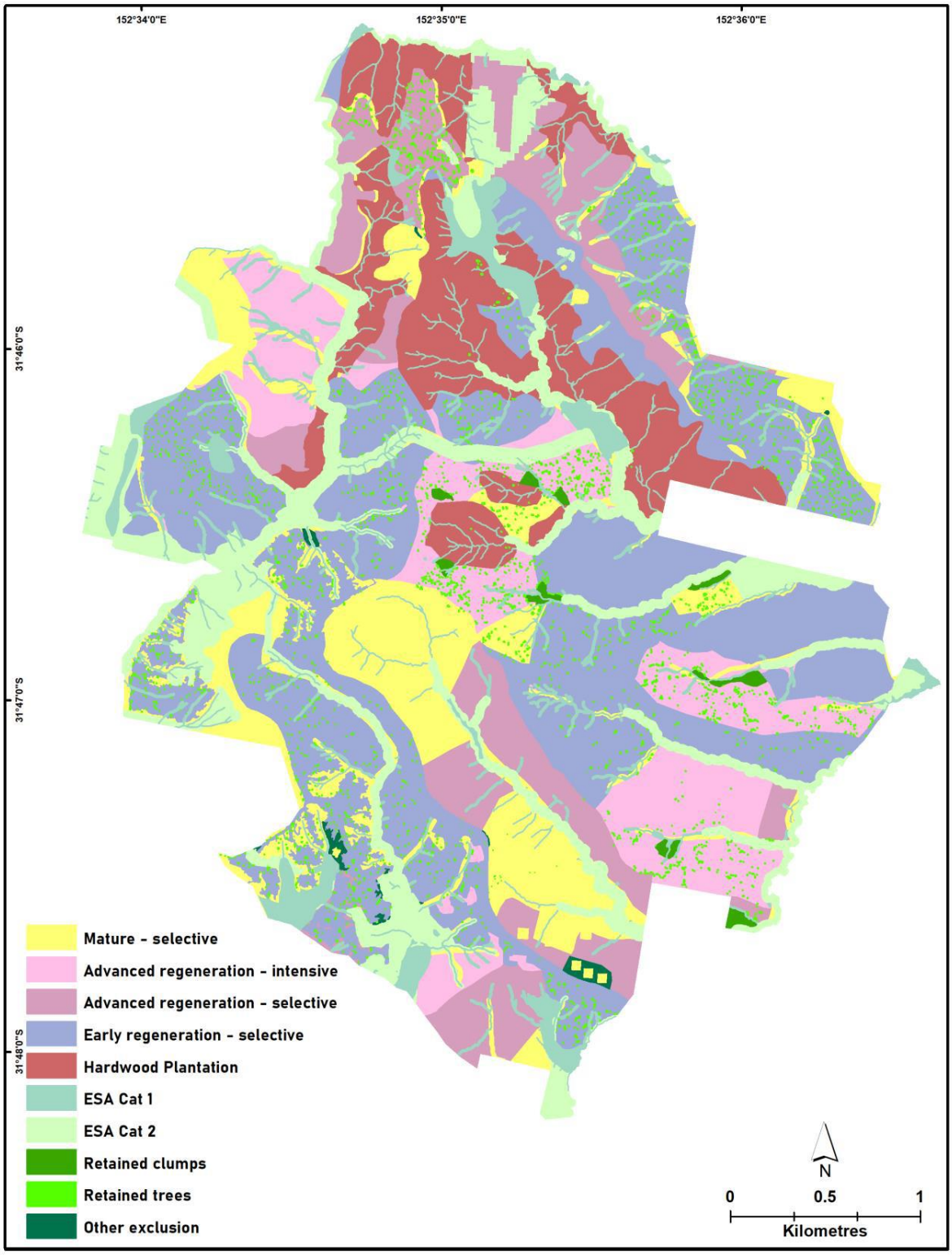


Figure 1. *Forest strata map produced in a proof of concept trial for Lansdowne local landscape area*

Validation monitoring: Remote sensing and field validation

The Coastal IFOA forest structure and health monitoring will be conducted using spatial products and ground plots developed through the state-wide plot network.

This part of the monitoring strategy will aim to validate the accuracy of the inferred monitoring through high-resolution imagery of ground plots.

Field validation

Forest plots

As part of the State-wide program, a network of plots will be implemented for verifying structural attributes collected by remotely sensed data products. This monitoring strategy will use the metrics determined by the State-wide plot network.

Plot sampling for the Coastal IFOA monitoring program is likely to be required at a higher density than that required in the State-wide component. These plots will be established in conjunction with the requirements of State-wide plot network and will be used to collect the metrics relating to monitoring forest structure, health and regeneration and to derive the vegetation integrity scores to validate the heterogeneity indices used in the forest structure and health operational monitoring.

Experimental design of the forest plot network for both the requirements of the Coastal IFOA monitoring and the State-wide program will be conducted under the guidance of the panel of expert biostatisticians and forest mensurationists engaged by the NSW Forest Monitoring and Improvement Program.

Table 4. Proposed metrics for use in Coastal IFOA forest plots

Metric	What is it measuring?
Tree diameter at breast height (DBH) (cm)	▪ Age/DBH class diversity ▪ Individual and stand tree growth, volume and mortality
Stand basal area and stocking density **(Collected for the purposes of the regenerating forest monitoring strategy)**	▪ Basal area (m^2/ha) and stocking density (stems/ha) of ages/DBH classes of regenerating trees
Vegetation stratum heights and cover	▪ Canopy heights (m) ▪ Mid-story heights (m)
Tree species regeneration and recruit type (Collected for the purposes of the regenerating forest monitoring strategy)	▪ Recruitment (tree additions due to natural and harvest-related regeneration) maintenance of tree species composition
Floristic composition	▪ Floristic composition of shrubs and trees ▪ Foliage cover (percent) by growth form ▪ Weed composition and cover

Growth stage (Jacobsian[1])	▪ Regenerating, regrowth, mature and senescing ▪ Senescent trees as a surrogate for hollow bearing
Coarse woody debris (CWD)	▪ Total length of fallen logs >10 cm diameter and decay stage
Dead stems/stags	▪ Density of dead stems per DBH class
Evidence of dieback	▪ Record occurrences of canopy dieback due to drought, fire, pathogens or bell miner associated dieback

Stocking plots

In conjunction with the forest plots, stocking assessment plots will be used in early regeneration forest strata (0-10 years post-harvest) that monitor the regeneration response and regeneration practices so that harvest areas that are appropriately stocked post-harvest.

By using stocking plots, it enables broader sampling across harvesting types including mixed, intensive, and alternate coupes, and be set at varying distances from the non-harvested forest edge in regenerating coupes. By conducting stocking plots for forest plots it also enables the monitoring program to evaluate the effectiveness of Protocol 37 regenerating benchmarks.

Under protocol 37, benchmarks are established for composition (65 percent of natural composition) and basal area (14 m^2). Where a regenerating coupe does not meet these benchmarks, this triggers the requirement for regeneration redial and rehabilitation actions under Protocol 37. The results of the site-based monitoring will be used to validate the adequacy of these benchmarks in maintaining future ecological condition whilst supporting adequate stocking of state forests for sustainable wood supply.

Remote Sensing

Remote sensing approaches and modelling from the State-wide program will be used to inform this monitoring strategy.

Methods to derive the metrics for these landscape-scale indicators of forest structure and health on coastal State Forests will be developed as part of the baselines, drivers, and trends in forest extent, condition, and health project, a joint project between the FMIP and Coastal IFOA monitoring programs. This project is being delivered by a consortium with representatives from DPI, DPIE, FCNSW, University of NSW, University of New England, Spatial Vision, RMIT and PF Olsen.

Under the landscape-scale monitoring, spatial data will be collected using three tiers of observation linked through a modelling framework. The three tiers are:

- ground plot data, which captures data on forest structure, composition, function and regeneration
- high-resolution remote sensing data (e.g., LiDAR) across a subset of the total forested landscape area
- synoptic (wall-to-wall) moderate resolution imagery, such as GEDI, Landsat and Sentinel-2 for structural data and basal area through ALOS Palsar and ESA P-band radar biomass modelling.

1 Jacobs, M.R., (1955). Growth Habits of the Eucalypts. Forestry and Timber Bureau, Dept. of the Interior, Canberra

In addition, and where available and feasible to do so, this monitoring strategy will be supplemented by existing LiDAR and LiDAR Voxel provided by Forestry Corporation of NSW (FCNSW) where it has been captured, with any additional LiDAR that is required to validate remotely sensed data products to be captured as part of the State-wide program.

To assess whether new or existing areas of dieback are having an impact on the performance of the multi-scale landscape protections, remote sensing and time series analysis of a range of causes for changes in forest health such as pest, diseases, drought and fire will be used. This analysis will be incorporated into the evaluation of forest heterogeneity and connectivity to assess where there are reductions in those values not directly related to forestry activities. Methods to monitor areas of dieback are being developed by the baselines, drivers, and trends of forest extent, condition, and health project under the State-wide program.

Analysis and evaluation of forest strata layer

To support monitoring the effectiveness of the multi-scale landscape protections, it is important to establish benchmarks against which to assess the interaction of multi-scale landscape protections.

In order to derive vegetation integrity scores from the plot data, the monitoring will utilise benchmarks for the ecological attributes[2] of the vegetation formations from the NSW BioNet of vegetation classification.

To develop benchmarks that trigger management actions will require the first years of monitoring data from all Coastal IFOA monitoring strategies to be brought together and analysed. This will enable the program to make sense of how the landscape protections contribute to forest heterogeneity, connectivity as well as the presence of key habitat features and species occupancy.

Determining forest heterogeneity and functional connectivity

Forest heterogeneity could be established by considering a combination of:

- the complexity of mapped forest strata within the local landscape (e.g. ratio of number of patches to number of forest strata); and
- a heterogeneity index for each forest strata that is derived from the vegetation integrity scores from the validation plots.

The heterogeneity index is derived from the vegetation integrity scores from the validation plots. Vegetation integrity scores are a condition score against the benchmark value for that forest type and that value represents the 'best-attainable' condition of that forest type, acknowledging that native vegetation has been subject to both natural and human-induced disturbance.

The forest strata units, heterogeneity index and subsequent heterogeneity and connectivity scores will be used to give both an LLA wide view of the ecological function of different forest types at different stages of regeneration. The heterogeneity indices and the outputs of the operational monitoring will be validated, and accuracy improved, through the plot-based validation monitoring across the different regions of the Coastal IFOA.

[2] Composition, structure and function

Functional connectivity

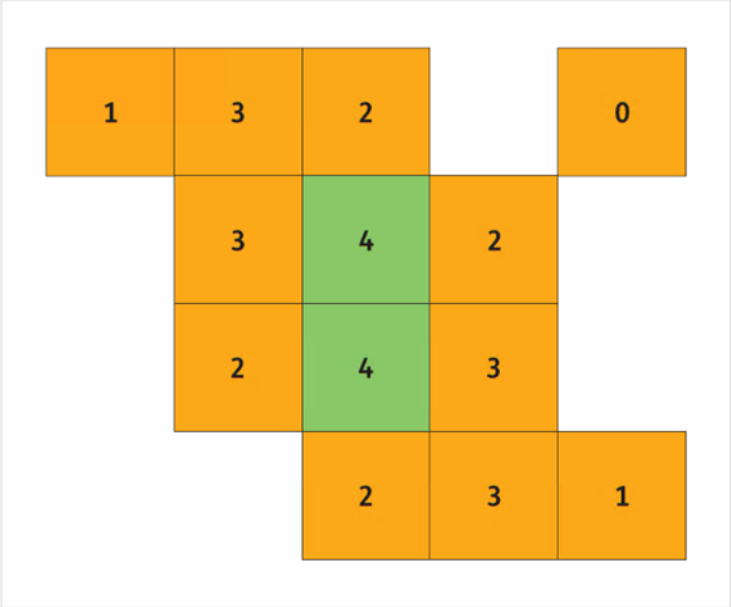
The forest strata layers and heterogeneity index associated with that forest strata are intersected with the ecological connectivity codes developed as part of their NSW Biodiversity Indicators Program (BIP).

Under the BIP, the concepts of connectivity and carrying capacity are used to provide detail into the analysis of forest heterogeneity and functional connectivity.

Patches of forest that exhibit high connectivity are integral in the landscape to allow for the movement of species and dispersal of seeds and genetic information. Reduced connectivity or fragmentation in the forest estate can lead to loss of genetic diversity, bottlenecks in species movement, and possible monocultures in some forest stands.

Fragmentation, the opposite concept of connectivity, can be measured in the forest estate by assessing the relative position of a forest patch to other forest patches across the landscape.

Figure 2 below shows the concept of assigning fragmentation values under the BIP.



Notes: Diagrammatic representation of a small area of forest. White, non-forest; orange, forest-exterior cells; green, forest-interior cells (same colour scheme as Figures 1.18–20). The figures in each forest cell are the number of neighbouring (edge) cells that are forested. Each cell is one hectare (100 metres x 100 metres).

The area comprises two patches of forest. The top-right cell is a patch containing just one hectare of forest, not being edge-connected to any other forest cell, while the remaining forest cells are all edge-connected and make up a 12-hectare patch of forest.

The 13 cells in this area of forest comprise 11 forest exterior cells (coloured orange) and 2 forest interior cells (coloured green and containing the number '4'): the latter are the cells that have all four of their neighbouring (edge) cells as forest. In this area of forest, the mean number of neighbouring cells forested is 2.3, and the proportion of forest interior cells is 2/13 = 15%.

Figure 2. *Example of how forest fragmentation is assigned*

Figure 3 is an example output from a proof of concept assessment conducted by NSW DPIE of the forest strata with the lighter areas showing relatively low levels and darker areas with higher levels of heterogeneity.

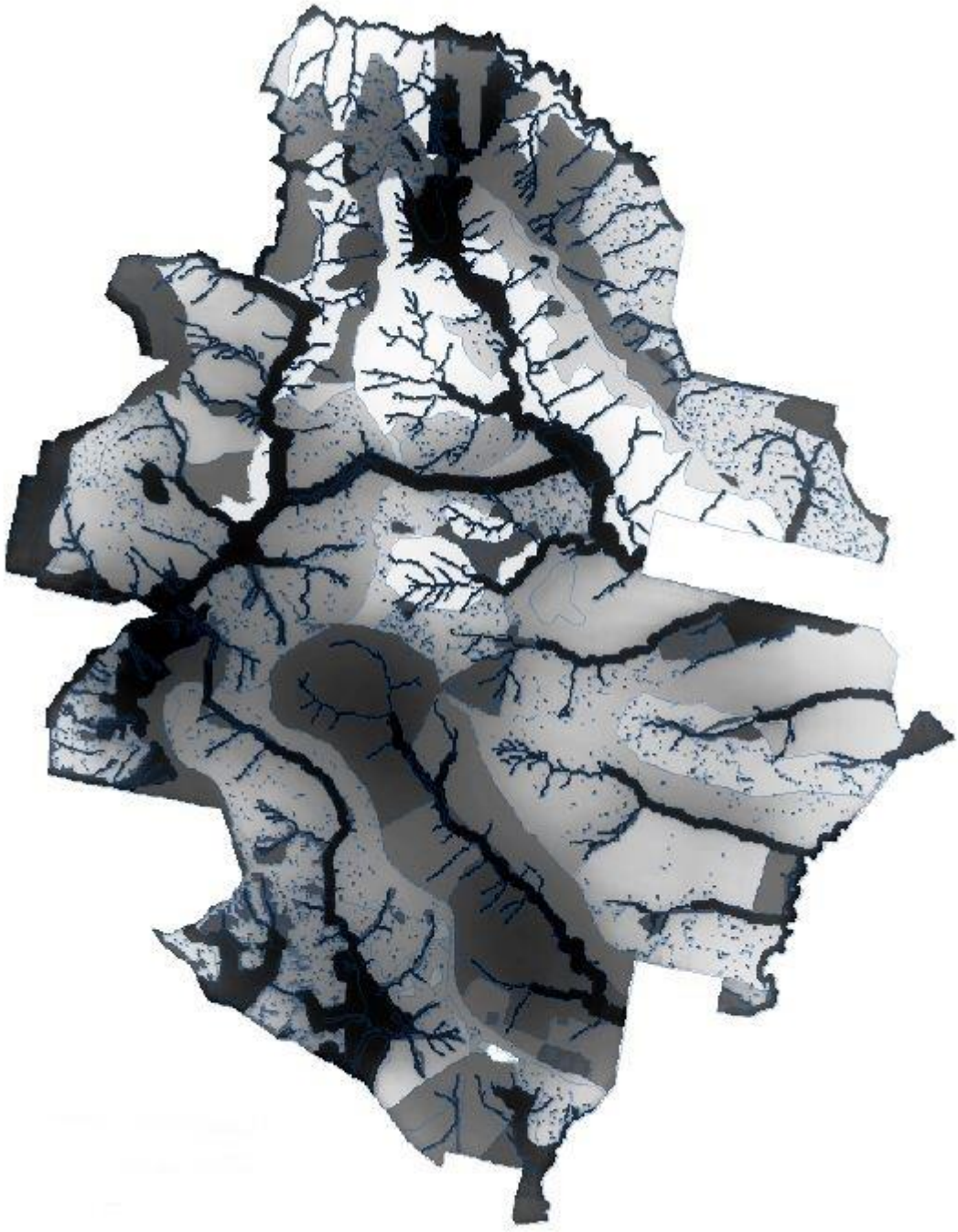


Figure 3. *An example map produced for Lansdowne local landscape area used to determine forest heterogeneity and connectivity*

Regeneration

The results of all Coastal IFOA monitoring strategies will be combined and analysed by a technical specialist team appointed by the FMIP Steering Committee to identify trends in the data.

Analysis and evaluation will be used to determine the regeneration responses against different vegetation types, silvicultural practices and regeneration approaches. The analysis will be based on a subset of different aged harvested coupes that represent all different forest types and silvicultural practices.

The evaluation of regeneration responses uses the same forest strata used in the forest structure and health monitoring strategy will be conducted to review the regenerating structure of:

- early regeneration harvestable forest (0-10 years post-harvest)[3]
- advanced regrowth harvestable forest (11-20 years post-harvest)
- early mature harvestable forest (21-30 years post-harvest)
- mature harvestable forest (>30 years post-harvest)
- category 1 ESA
- category 2 ESA

This evaluation will able the determine the regeneration response[4] of areas harvested whether they are likely in the medium to long-term, to retain ecological condition whilst maintaining the area as meeting stocking standards.

Under the methods developed by the baselines, drivers and trends in forest extent, condition and health project, spatial modelling will be derived from the data collected in the ground plots. The models will seek to predict future regeneration condition of areas harvested under the Coastal IFOA using the indicators of composition, coarse woody debris, forest structure, crown cover and invasive weeds.

To develop benchmarks that trigger management actions will require the first years of monitoring data from all Coastal IFOA monitoring strategies to be brought together and analysed. This will enable the program to make sense of how the landscape protections contribute to forest heterogeneity, connectivity as well as the presence of key habitat features and species occupancy.

Monitoring local landscape areas

To ensure that the validation monitoring is cost-effective and fit-for-purpose, it is proposed that this monitoring will occur within a rotating schedule of local landscape areas.

In any given year, there will be a minimum number of local landscape areas that will be subject to validation monitoring, spread across the IFOA sub-regions. For example:

- Three LLAs in the Upper North East
- Three LLAs in the Lower North East
- Two LLAs in Eden
- Two LLAs in Southern

The local landscape areas will be rotated on a five-year cycle so that the monitoring will return to each validation area every five years.

The following monitoring strategies will be informed be the rotating panel of LLAs:

[3] Harvested under Coastal IFOA conditions and protocols
[4] Composition, structure and coarse woody debris

- Forest structure, health and regeneration
- Key habitat features
- Species occupancy
- Waterway and wetland health

The number of local landscape areas, as well as the intensity of field monitoring will be determined during the experimental design of the Coastal IFOA monitoring program.

To test the validation monitoring approach, there will be a fieldwork campaign to ground-truth the landscape-scale indicator metrics that can be determined through high-resolution remote sensing and synoptic imagery. This will be conducted in spring/summer 2020 as part of the forest extent, condition and health baselines, drivers and trends project with the fieldwork campaign led by the DPI/DPIE team involved in that project.

Following the conclusion of the fieldwork campaign, a pilot of the validation monitoring will be undertaken to determine the effectiveness of the approach, finalise the experimental design of the monitoring, and the likely costs associated with that monitoring.

1.8 Summary of approach to develop baselines and benchmarks for adaptive management

Condition effectiveness baseline:

Baselines for metrics related to forest structure, health and regeneration are being developed as part of the baselines, drivers and trends in forest extent, condition and health project. It is anticipated that the first three years of data will be used to establish baselines for the implementation of the Coastal IFOA.

Benchmarks:

A key objective for this monitoring strategy would be to set a benchmark score for both heterogeneity and connectivity that allows change in heterogeneity and connectivity to be measured and monitored. In addition, this monitoring strategy will set a benchmark for forest regeneration that maintains ecological condition and wood supply in the medium to long-term.

A benchmark would have to be set at a level that is appropriate for multiple-use native forests which are managed for both timber production and environmental values. To be consistent with ESFM ecological benchmarks developed for this monitoring, benchmarks need to relate to existing benchmarks and those emerging from the FMIP, as well as to the relevant forest structure, health and regeneration (monitoring strategy) baselines established for coastal state forests.

The results of all Coastal IFOA monitoring strategies will be combined and analysed by a technical specialist team appointed by the FMIP Steering Committee to identify trends in the data. Benchmarks will be established on completion of further LLA assessments that comprise different area proportions and different spatial/temporal arrangements of silvicultural zones and informed by field assessments. It is likely that the program will require the several years of data to establish benchmarks for management action triggers.

Trends in the data will be analysed annually as part of the monitoring programs annual review with the benchmarks set in the first program evaluation in 2024.

Adaptive management

The process to establish performance benchmarks, analyse the monitoring results and the adaptive management activities that are triggered to adapt the Coastal IFOA to better meet its desired outcomes for forest structure, health and regeneration will be described in the program's adaptive decision-making framework.

Given that the outputs of this monitoring program are spatial FCNSW can apply these in operational planning to improve the location of tree retention clumps and retained trees to maximise the distribution of forest age classes and ecological connectivity without eroding timber supply from that LLA.

1.9 Existing programs and data that will inform the strategy

- State-wide remote sensed plot network
- NSW State-wide Landcover and Trees Study (SLATS)
- Biodiversity Indicators Program
- Environmental Trust Dieback Project
- Australian Government Dynamic Land Cover Dataset
- TERN AusPlots

1.10 How the data will be stored, analysed and presented

Data will be collected and initially stored on FCNSW systems to the standards set out in the Forest Monitoring and Improvement Program data management system, including analysis and presentation, then made available for integration with the state-wide forest monitoring program analysis platform. The Coastal IFOA requires all data and information is made publicly available on SEED or similar.

1.11 Expected strategy outcomes

To establish if harvesting operations are sufficiently distributed across the landscape and over time, to support an ecologically relevant mosaic of forest age-classes, and to maintain forest structure across the local landscape area

1.12 Linkages and uses with the overall NSW Forest Monitoring and Improvement Program Framework

The State-wide program has the following evaluation questions that guide the program:

- What is the extent, condition and health of NSW forests, and what are the predicted trajectories?

To establish the current trends in values associated with these questions the following studies are to be undertaken within forests of the NSW Regional Forest Agreement regions:

- NSW Forest Monitoring and Improvement Program project to determine baselines, drivers and trends in extent, condition and health of forests – including establishing landscape-scale biodiversity monitoring in coastal state forests.

- An overarching resilience framework for NSW forest. This framework aims to look at how drivers including climate change, fire and drought impact forest attributes including forest structure and health.

Part 2: Timeline

Milestone description	Start date	End date
1. Site-base and landscape-scale method design	**February 2020**	**October 2020**
2. Proof of concept trial of operational monitoring approach	**July 2020**	**September 2020**
3. Experimental design of monitoring program	**October 2020**	**February 2021**
4. Pilot LiDAR acquisition	**November 2020**	**December 2020**
5. Remote sensed indicators fieldwork trial	**December 2020**	**January 2021**
6. Pilot of monitoring strategies	**February 2021**	**June 2021**
7. Pilot data and cost analysis	**June 2021**	**July 2021**
8. First year local landscape areas field monitoring	**September 2021**	**March 2022**
9. Data analysis	**March 2022**	**June 2022**
10. Reporting	**June 2022**	**August 2022**