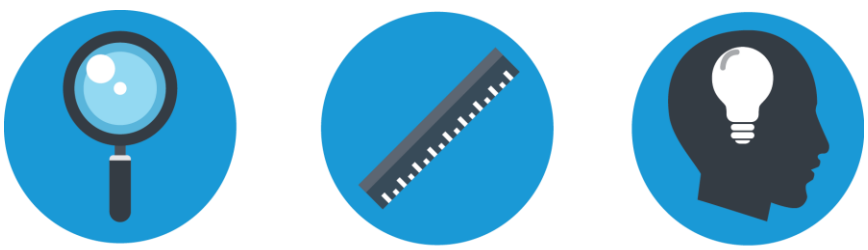
FIRST PERSON CONSULTING

Five-year evaluation of the adequacy of the Coastal Integrated Forestry Operations Approval monitoring program

Prepared for the
Natural Resources Commission



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Executive summary

Overview of the CIFOA Monitoring Program evaluation

The Coastal Integrated Forestry Operations Approval (CIFOA) sets out conditions and protocols to protect the environment during native timber harvesting on state forest and Crown-timber land in coastal NSW. The CIFOA Monitoring Program (the Monitoring Program) aims to ensure the ongoing effectiveness of the approval. It has a range of requirements, outlined under CIFOA Protocol 38.

As set out in Protocol 38, the Monitoring Program is due to be reviewed. As such, the objectives of this evaluation and report were to:

- Assesses the adequacy of the Monitoring Program, including the extent to which it is meeting the requirements of CIFOA Protocol 38 and the approved monitoring program.
- Demonstrate (where relevant) the impact, value and outcomes of the program.
- Ensure there is accountability and transparency associated with the Monitoring Program's design and delivery.
- Identify opportunities for improvement.

The scope of the evaluation was developed in consultation with the NSW Forest Monitoring Steering Committee. Our approach involved:

- A review of key documents (e.g. background material, monitoring plans and outputs).
- Interviews with 25 key stakeholders including research providers, representatives from key agencies, Steering Committee members, Technical Working Group members and representatives from industry and environmental interest groups
- Interviews with the Commission delivery team and senior staff
- Review of eight public submissions to the Commission about the Monitoring Program.

Key findings

The CIFOA Monitoring Program is a complicated and ambitious initiative but one that is critically important in the management of NSW forests. **Overall, the review found the program has been adequate.**

The Monitoring Program's design is well-aligned with its objectives and the obligations outlined in Protocol 38.

All of the requirements of Protocol 38 have been considered as part of the program design, with most having clearly aligned pieces of work complete or in progress. It also has many of the design features that characterise effective monitoring programs. This includes being question-driven, prioritising information needs, having mechanisms for adaptation and working collaboratively and transparently.

The Monitoring Program has been implemented effectively.

There have been a range of significant challenges that the program has faced. This includes the need to adapt to the 2019/2020 fires and funding ceasing for the aligned cross-tenure Forest Monitoring and Improvement Program. This has meant that overall progress, particularly during the early stages

of the Program design, had been slow. However most planned projects have been delivered or are in the process of delivering results.

The Commission has worked well to independently coordinate the program.

This includes fostering collaboration and providing independence in a space that is highly contentious and politicised. The majority of interviewees considered that the Commission has done a good job, some suggesting it was among the best coordination of government agencies they had seen in the public service. The program has adapted through time, with new projects being added as conditions change and findings from early work emerge.

While slow to start, the program's value is accelerating as new monitoring data begins to accumulate and is being analysed and reported on.

Discrete, targeted pieces of research have been completed that complement a range of new long-term monitoring programs. Among these is a network of 300 fauna occupancy monitoring sites across Coastal IFOA state forests. The program has already published more than 30 reports on new data, analysis of historical trends, syntheses of impacts on forest values and trials of new methodologies. Recognition of its long-term value is clearly evidenced in it securing a further 20 years of funding from the NSW Government.

The Monitoring Program is providing useful data that is informing decisions about forest management

Interviewees have highlighted that Monitoring Program data has already helped to inform key policy discussions within the NSW Government. While the details of this are not publicly available, the independence of the Commission and the Monitoring Program's credibility were noted to have been particularly valuable.

There have also been improvements in transparency around forest monitoring activities and in the way that relevant agencies collaborate. The Monitoring Program has also influenced the direction of research activities, data collection and there is early work to adjust on-ground forest management practices.

There has been limited impact, to date, on the CIFOA itself, with this expected to occur as results are considered as part of the 5-year review of the CIFOA conditions. Associated with this, a range of stakeholders are strongly interested in seeing responsible agencies have clearer processes for how they consider and use Monitoring Program results.

With the establishment phase now passed, there are opportunities to further refine and update the Monitoring Program. This will help ensure it continues to make the best use these resources over the next phase of delivery. Some of the key opportunities (discussed further in this report) include:

- **Continue to improve public-facing communication**. While the program has helped improve transparency in this space, there is the potential to further improve public reporting given the high levels of public interest and scrutiny in this space.

- **Review and refresh the program priorities** as part of the 5-year review of the monitoring program. This includes considering and recommending how Protocol 38 is structured and a renewed appraisal of where the uncertainties and risks are for forests into the future.
- **Develop clearer processes for how the Monitoring Program should inform management**. This includes both FCNSW and EPA considering how a more structured adaptive management approach might be implemented to test the efficacy of different approaches to achieving the outcomes outlined in the CIFOA.
- **Continue to improve data management**. This was seen as an area in need of more attention, including the need for a comprehensive data management plan.
- **Consider the structure of the program and how it engages with research partners.** Part of the success of the program so far has been in its targeted use of agency, university and other experts. There is the potential to combine this focus on the 'core' monitoring program work, with a model that also seeks to guide and support complementary (but lower priority) work among researchers, students and others.
- **Improve forward planning to facilitate better participation by agency staff in the design and review of Monitoring Program projects**, which could help agency staff who are often under time and resourcing pressures.

Contents

1 Introduction

1.1 Overview

The Coastal Integrated Forestry Operations Approval (CIFOA) sets out conditions and protocols to protect the environment during native timber harvesting on state forest and Crown-timber land in coastal NSW. The **CIFOA Monitoring Program (or the Monitoring Program) aims to ensure the ongoing effectiveness of the approval.** It was designed specifically to meet the requirements outlined under CIFOA Protocol 38.

The CIFOA Monitoring Program was approved in March 2020. A major review of the Monitoring Program was due in 2024.[1] As set out in Protocol 38, the review is to include:

(i) detailed reporting of monitoring program progress and all results

(ii) detailed analysis of trends

(iii) an assessment of the *adequacy* of the monitoring program.

This document outlines First Person Consulting's findings against point (iii) above – an assessment of the adequacy of the CIFOA Monitoring Program.

1.2 Evaluation objectives

The overarching objectives of this evaluation are to:

- Assess the adequacy of the Monitoring Program, including the extent to which it is meeting the requirements of CIFOA Protocol 38 and the approved monitoring program.
- Demonstrate (where relevant) the impact, value and outcomes of the program.
- Ensure there is accountability and transparency associated with the Monitoring Program's design and delivery.
- Identify opportunities for improvement.

The scope of the evaluation was developed in consultation with the NSW Forest Monitoring Steering Committee, with details outlined in Section 3.

1.3 Structure of this document

Based on the objectives above, **this document includes**:

- A brief background to the CIFOA Monitoring Program (Section 2).
- An outline of our approach to addressing the project objectives (Section 2.3)
- A summary of key findings (Section 4)
- Results relating to:
    - the Monitoring Program's alignment with Protocol 38 and the characteristics of good monitoring programs (Section 5)
    - implementation and coordination of the Monitoring Program (Section 6)
    - outcomes of the monitoring program (Section 7)
    - opportunities for improvement (Section 8).

[1] Noting that some CIFOA elements were considered as part of a mid-term evaluation of the Forest Monitoring Improvement Program in 2021.

2 The CIFOA Monitoring Program

2.1 The CIFOA

The CIFOA is jointly approved by the NSW Minister for the Environment and the Minister for Agriculture. **It sets the minimum thresholds of environmental protection to ensure threatened plants, animals, communities and the protection of water quality are maintained during native timber harvesting operations** in state forests and Crown-timber land in coastal NSW.

The Forestry Corporation of NSW (FCNSW) carries out forestry operations in accordance with the CIFOA. The NSW Environment Protection Authority monitors and enforces compliance against the CIFOA.

The CIFOA requires that the effectiveness of its conditions and the extent to which its objectives and outcomes are achieved are continually monitored. More details of these monitoring requirements are outlined in Section 2.2 below.

2.2 Requirements for and focus of the CIFOA Monitoring Program

Chapter 8 of the CIFOA conditions identifies the outcome for monitoring of the CIFOA to be:

> *Monitoring programs are applied at multiple landscape scales to ensure the ongoing effectiveness of the approval in delivering the objectives of the approval and outcome statements*[2]

In turn, **Protocol 38 of the CIFOA sets out the range of requirements** that the Monitoring Program must address (Box 1). This includes governance, accountability and engagement requirements.

The Natural Resources Commission (the Commission) independently chairs a cross-agency steering committee (the NSW Forest Monitoring Steering Committee (Steering Committee)) that has overseen the design and implementation of the CIFOA Monitoring Program. Protocol 38.2 outlines matters the Committee must undertake in its role under the monitoring program, and notes in reviewing the design and timing of the monitoring program, the Committee will need to consider the priorities listed in Protocol 38.3 and the monitoring program's available budget and resources.

In line with its underlying objectives and requirements, **the Monitoring Program was designed to answer four overarching questions** (and a suite of sub-questions):

- Effectiveness monitoring – are the CIFOA conditions effectively meeting its objectives and outcomes?
- Trend monitoring – is the CIFOA having a neutral, positive or negative impact on landscape-scale environmental values or wood supply?
- Compliance monitoring – are non-compliances compromising the outcomes or the ability to monitor the effectiveness of the CIFOA conditions?
- Adaptive management – can CIFOA conditions, forestry operations, forestry management or monitoring be improved to better meet objectives and outcomes?

[2] NSW Government (2018) Coastal Integrated Forestry Operations Approval – Conditions. Chapter 8, Section 121.1. Emphasis added

The Monitoring Program recognises that these questions are interrelated and that information collected for one question may help in answering other questions.

Box 1 – Requirements from Protocol 38 of the CIFOA (see also Appendix A for full protocol)

The monitoring program must be designed to:

a) monitor and evaluate the effectiveness of the conditions of the approval, including but not limited to:
   - *i. the multi-scale landscape protections;*
   - *ii. drainage feature crossing and road conditions;*
   - *iii. riparian exclusion zones and ground protection zones on class 1 classified drainage lines (Table 6a);*
   - *iv. Exclusion zones for Coastal SEPP wetlands;*
   - *v. Effectiveness of soil and water protection in intensive harvesting forestry operations;*
   - *vi. Protecting and recruiting hollow-bearing trees;*
   - *vii. Koala conditions;*
   - *viii. Effectiveness of selective harvesting limits in achieving regeneration and stocking standards as measures of longer term regeneration;*
   - *ix. Maintaining sufficient levels of coarse woody debris.*

b) Establish a scientifically valid environmental and wood supply baseline to track and evaluate the effectiveness or impacts of the approval on the maintenance of environmental values and woody supply

c) Provide environmental trend monitoring at the landscape scale, including but not limited to:
   - *i. water quality monitoring;*
   - *ii. forest regeneration;*
   - *iii. biodiversity trend monitoring; and*

d) Provide species-specific monitoring, including but not limited to those management plans listed in Protocol 21: Species management plan;

e) Provide species-specific monitoring for other species which require monitoring under existing programs related to the monitoring of threatened flora;

f) Meet Principles of Ecologically Sustainable Forest Management under the NSW Regional Forest Agreements; and

g) Provide linkages to other relevant NSW Government programs and/or review related to the monitoring of State Forest management and the NSW forest estate, including but not limited to:
   - i. NSW Report on Native Vegetation (Office of Environment and Heritage);
   - ii. Saving our Species (Office of Environment and Heritage);
   - iii. DPI-Fisheries Strategic Research Plan 2014-2018 (DPI-Fisheries)
   - iv. NSW Regional Forest Agreements;
   - v. AdaptNSW (Office of Environment and Heritage); and
   - vi. DPI-Forest monitoring program (DPI-Fisheries).

2.3 Conceptualisation of the Monitoring Program and its work to date

The CIFOA Monitoring Program is a coordinated set of monitoring and research projects targeted at addressing the requirements of Protocol 38 and emergent risks. Some of these are related to long-term monitoring of trends and impacts – such as a network of 300 sites (600 plots) that are regularly sampled for focal fauna species occupancy. Some are discrete pieces of work – such as a review of the impact of injuries to retained trees during forestry operations.

The Monitoring Program is guided by a high-level framework that was formally endorsed by the Steering Committee in March 2020 – the Coastal IFOA Approved Monitoring Program 2019-2024 (Figure 1). This framework outlines four high-level questions and a series of monitoring questions that link to key forest values and the elements of Protocol 38. These are organised around 'monitoring strategies', with details about each strategy documented in more detailed Monitoring Plans:

- Forest structure, health and regeneration
- Key habitat features
- Landscape scale trends
- Species occupancy
- Specific fauna species
- Specific flora species
- Waterway and wetland health
- Research and evaluation program
- Baselines and trends in wood supply.

Table 1 outlines the projects that are being delivered or that have been delivered under each of these Monitoring Plans. It summarises the broad approach of each project (i.e. whether it is ongoing monitoring, analysis of existing data or a discrete research project), the current status and links to key outputs that are publicly available.

How well this Monitoring Program aligns with its objectives and the characteristics of good design is discussed in Section 5.

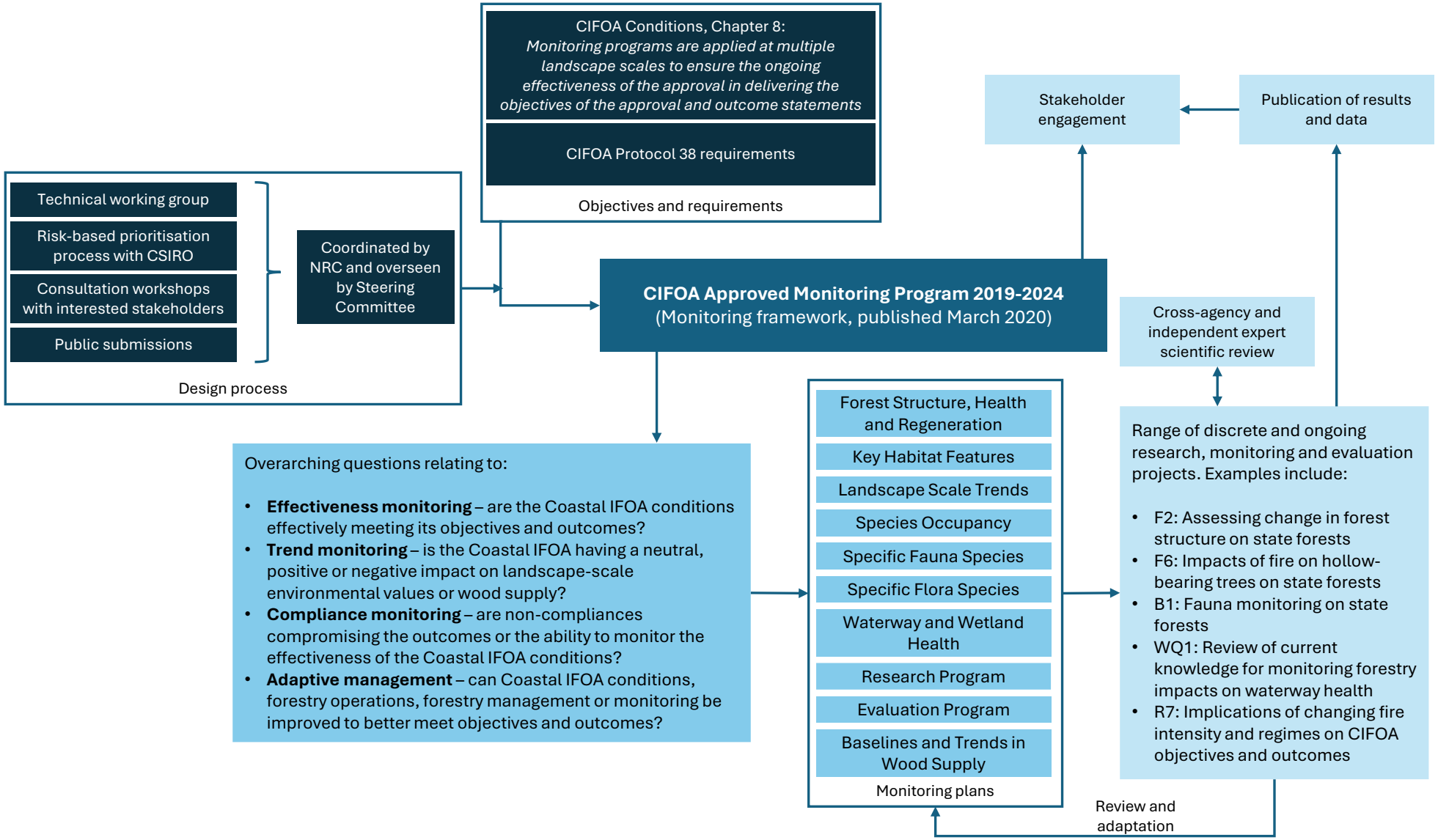

Figure 1. Coastal IFOA Monitoring Program design and key components.

Table 1. Summary of projects being delivered under each of the CIFOA monitoring plans as part of the broader CIFOA Monitoring Program. Based on information on the Commission's CIFOA website (https://www.nrc.nsw.gov.au/ifoa-mer)

CIFOA Monitoring Plan	High-level questions[3]	Projects	Approach	Status
Forest Structure, Health and Regeneration	• 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 forest structure, floristic composition, and coarse woody debris? • Are the conditions effectively promoting regeneration to maintain volume and quality for productive supply?	F1: Managing dieback on state forests	Development and testing of method for assessing whether dieback is impacting performance of CIFOA protections and outcomes	In progress
		F2: Assessing change in forest structure on state forests	Collection of new LiDAR data Longitudinal analysis of data via case studies, exploring changes in canopy height and cover under different harvesting and fire scenarios	Complete – Reported in Brown et al. 2023 and Coates et al. 2024 Potential for ongoing LiDAR data collection
		F3: Assessing change in tree species composition on state forests	Analysis of existing FCNSW data to assess change in tree species composition over time	In progress
		F4 Post-fire forest recovery in the Coastal IFOA region	Development of plan to monitor fire-affected sites, including explicit incorporation of burned/unburned sites in forest plot monitoring and other CIFOA data collection activities Analysis of available data (CIFOA-collected and existing) to explore recovery of key attributes to date.	In progress
Key Habitat Features	• To what extent do retained habitat features maintain their function? • Do the conditions support key habitat features to maintain fauna species within and across the forest?	F5: Hollow use review	Literature review to improve understanding of hollow-use and monitoring methods	Complete – Reported in Goldingay 2021
		F6: Impacts of fire on hollow-bearing trees on state forests	Research on mortality and collapse of hollow-bearing trees and formation of tree hollows following fires in the Coastal IFOA region	In progress

[3] As outlined in Monitoring Plans

CIFOA Monitoring Plan	High-level questions[3]	Projects	Approach	Status
		F7: Perpetuating tree hollows under the Coastal IFOA	Modelling to predict the persistence of hollow-bearing trees under a selection of scenarios and methods for improving future simulations	Initial work complete – Reported in Gibbons and O'Donnell 2023 and Gibbons 2024 Further work in progress to collect additional field data to improve and validate models.
Landscape-Scale Trends	• Is the Coastal IFOA having a neutral, positive or negative impact on landscape-scale environmental values?	Forest Monitoring and Improvement Program: Project FE1	Development of methods and analysis of historical data on trends in forest canopy extent and condition (i.e. changes by year from 1995 to 2019)	Three methods papers complete: Forest extent (2022) Forest condition (2022) Forest loss and recovery (2022) Analysis complete and spatial data for each method published on TERN: Forest extent Forest connectivity Forest loss and recovery
		Forest Monitoring and Improvement Program: Project BD1	Analysis of existing data to explore trends in species occupancy and distribution	Complete – Reported in Kavanagh et al 2022 (see also Commission website) Data published on TERN and the Spatial Collaboration Portal
		Forest Monitoring and Improvement Program: Project SW1	Analysis of existing data to explore tends in water quality and quantity In NSW Regional Forest Agreement areas	Complete – Reported in Guo et al 2021

CIFOA Monitoring Plan	High-level questions[3]	Projects	Approach	Status
				Data published on SEED and the Spatial Collaboration Portal
Species Occupancy	• To what extent do the Coastal IFOA conditions maintain species occupancy in the landscape? • To what extent do the conditions maintain the population status of focal species?	B1: Fauna monitoring on state forests	Field monitoring of fauna occupancy using camera traps and call recordings	Surveys in spring 2022, autumn 2023, spring 2023 and autumn 2024 Monitoring ongoing Design and operational procedures published
		B2: Fauna call recognisers	Analysis of audio recordings to develop call recognisers for fauna species	Call recognisers developed (and continue to be developed), including publication on Commission website. Reported in Thompson et al. 2021
Specific Fauna Species	• To what extent do the Coastal IFOA conditions support the maintenance of fauna species viability in the landscape? • To what extent are the species-specific management plans (SMP) effective in maintaining the viability of that species?	B3: Long-term Greater Glider monitoring	Development of a plan for monitoring population trends across the Greater Glider range in NSW and the effectiveness of site-specific conditions in protecting Greater Glider populations	In progress
		B4: Long-term koala monitoring	Development of a plan for monitoring the effectiveness of koala conditions	In progress, building on work reported in Natural Resources Commission 2022
		B5: Yellow-bellied Glider species management plan	Analysis of existing data and post-fire surveys in the Bago Plateau population to improve the yellow-bellied glider species management plan	Initial review (2020) complete – reported Bilney et al. 2022 and in Gonsalves and Law 2020

CIFOA Monitoring Plan	High-level questions[3]	Projects	Approach	Status
			Analysis of further data (2021-23) collected under the yellow-bellied glider species management plan	Analysis of 2021-2023 data complete and in review Analysis of 2024 data in progress
		B6: Southern Brown Bandicoot species management plan	Analysis of existing data to improve the southern brown bandicoot species management plan Analysis of further data (2020-23) collected under the southern brown bandicoot species management plan	Initial review (2020) complete – reported in Gonsalves and Law 2021 Analysis of 2021-2023 data complete and in review
		B7: Giant Burrowing Frog species management plan	Monitoring by FCNSW in line with Giant Burrowing Frog species management plan Research to trial use of eDNA sampling as part of improved approach to monitoring	Ongoing eDNA pilot in progress
		B8: Using eDNA to detect frog species	Research to trial use of eDNA sampling as part of improved approach to monitoring three frog species listed as 'focal species' under the CIFOA	In progress
		B9: Historical trends in greater glider populations on state forests	Analysis of greater glider data to explore population trends and the influence of environmental and management factors	In progress
Specific Flora Species	• To what extent do the Coastal IFOA conditions maintain flora species viability in the landscape? • To what extent are the species-specific management plans (SMP) effective in maintaining the viability of that species?	B10: Milky Silkpod and Rusty Plum species management plan	Review of Rusty Plum and Milky Silkpod species management plans	Complete – reported in Binns 2021a and Binns 2021b
Waterway and Wetland Health	• To what extent are the soil and water conditions effective in	WQ1: Review of current knowledge for monitoring	Literature review on forestry impacts on waterway health and water quality	Complete – reported in Alluvium 2021

CIFOA Monitoring Plan	High-level questions[3]	Projects	Approach	Status
	minimising the impact of intensive harvesting and roading on waterway condition? • Are the exclusion zone conditions for Class 1 classified drainage lines effective in minimising the impact on waterway condition? • Are the exclusion zone conditions effective in reducing the impact of forestry operations on Coastal SEPP wetlands?	forestry impacts on waterway health		
		WQ2: Post-fire debris flow mapping in the Tumut and Tuross Catchments	Research on relationship between fire severity, terrain and waterway sedimentation	Complete – reported in Jacobs 2023
		WQ3: Monitoring class 1 drainage lines and exclusion zones	Research on the effectiveness of exclusions zones for class 1 drainage lines on waterway condition	Complete – reported in Jacobs 2024 Further work commencing on snig track drainage
		Forest Monitoring and Improvement Program: Project SW3	Development of a risk-based model for assessing road condition and prioritising and planning mitigation measures	Complete – reported in Alluvium 2022
Research program	• How are koalas responding to conditions, including changes in tree retention rates, species, distribution and size? • Can technology improve the probability of detection for a range of species in forestry operations? • What are the implications of changing fire intensity and regimes on the achievement of the Coastal IFOA's objectives and outcomes?	R1: Integrating data to assess CIFOA outcomes	Research to improve integration and management of the large amount of data being collected by the CIFOA Monitoring Program	Report drafted and in review
		R2: Strengthening the evidence base to assess damaged trees	Research to assess the impact of injuries to trees and implications for tree retention conditions	Complete – reported in Bendall et al 2023
		R3: Reviewing the use of temporary log crossings in NSW coastal state forests	Research to assess the effectiveness of temporary log crossings and their impact on waterway health	Complete – reported in Jacobs 2023
		R4: Koala response to harvesting	Research to explore how koalas and their habitat responded to harvesting in state forests on the NSW North Coast	Reported in Natural Resources Commission 2022 Further aligned research in progress
		R5: Novel techniques to detect and monitor Hastings River Mouse	Dog training to detect Hastings River Mouse. Research to test and compare novel survey	Training complete Further work ceased due to COVID-19 and extreme wet

CIFOA Monitoring Plan	High-level questions[3]	Projects	Approach	Status
			methods (detection dogs and small-mammal camera traps)	weather at the time. The work was continued by Canines for Wildlife
		R6: Drones to detect cryptic species	Research to investigate using drones to improve monitoring of koalas and greater gliders	Initial data collection and reporting complete – reported on in Roff et al. 2023 Further planning reported in Witt 2024 Further analysis in progress
		R7: Implications of changing fire intensity and regimes on CIFOA objectives and outcomes	Research investigating the risks posed by changing fire regimes to the CIFOA outcomes	Complete – reported in Bradstock et al 2021
		R8: Expert review of survey and models for *Philoria* frog species	Research on existing habitat models and survey methods to identify ways to improve survey/ and modelling approaches for these species	In progress – draft report received and in review
		R9: Expert review of bird survey methods and habitat models	Research to improve habitat modelling and survey methods for three priority bird species	In progress – draft report received and in review
Evaluation program	• Are drainage feature crossings and road features effectively designed and maintained to reduce the impact of forestry operations on waterway condition? • Is pre- and post-harvesting burning maintaining the function of key habitat features? • Are the species and habitat survey and modelling conditions and practices effective	E1: CIFOA koala browse tree review	Evaluate the CIFOA koala browse tree list and consider amendments based on findings from existing koala research	In progress (final report endorsed, findings to be published shortly)
		E2: Compliance evaluation	Evaluate whether non-compliances are compromising the outcomes of the CIFOA or the ability to monitor the effectiveness of the CIFOA conditions	Phase 1 of evaluation complete. Phase 2 in progress
		E3: Species and habitat survey and modelling conditions and practices	Evaluate the effectiveness of pre-harvest survey and modelling in identifying presence of key species and habitat features	Complete – reported in Munks and Bell 2024, with

CIFOA Monitoring Plan	High-level questions[3]	Projects	Approach	Status
				prioritised actions in Munks and Bell 2024b
Baselines and Trends in Wood Supply	• Is the Coastal IFOA having a neutral, positive or negative impact on landscape-scale wood supply? • Are conditions affecting current commitments to meet wood supply? • Are conditions effectively supporting long-term sustainable wood supply	WS1: Baselines and historical trends in wood supply	Analysis of existing data on wood supply to identify trends and potential drivers	Complete – reported in Indufor 2022
		WS2: Impacts on wood supply	Comparison of modelled sustainable yield under pre and post-CIFOA conditions and protocols.	In progress

3 Overview of evaluation approach

As noted in Section 1, this evaluation centres on the need to assess the *adequacy* of the monitoring program. We have taken adequacy to be a combination of being well-designed, well-implemented and providing useful information for ensuring the effectiveness of the CIFOA (see Appendix B).

This framework for considering adequacy was translated into a series of key evaluation questions that has guided data collection and reporting here:

1. How well does the Monitoring Program's design align with its objectives?
2. How well has the Monitoring Program been implemented?
3. How well is the Monitoring Program meeting the needs of key stakeholders?
4. What other value or benefits, if any, has the Monitoring Program led to?[4]
5. What opportunities are there for improving the Monitoring Program?

These questions and the approach outlined below were developed based on a preliminary round of consultation with the NSW Forest Monitoring Steering Committee.

In terms of addressing these questions, our approach involved:

- **Review of key documents.** We sought to explore what has been delivered by the program, how well the program aligns with its requirements and the characteristics of good design and information delivery and impact. Documents included:
    - General background documentation (CIFOA protocols and conditions, terms of reference, published literature relating to effective ecological monitoring programs)
    - The Approved Monitoring Program 2019-2024, Monitoring Plans and outputs.
    - Reporting by the Commission (e.g. Annual progress reports, Health Checks and community forums).
- **Interviews with key stakeholders.** We interviewed 25 people from a range of stakeholder groups. Interviews were semi-structured and considered people's experiences with the program, observations of its impact and perspectives on how it could be improved. Stakeholders represented a range of organisations and functions, including:
    - Research providers (3)
    - Representatives from key agencies and organisations, including EPA (2), FCNSW (3), DPIRD (3), Local Land Services (1) and DCCEEW (2)
    - Representatives from the Steering Committee, including independent experts (4) and agency representatives (6; agency representation listed above)
    - Representatives from the Technical Working Group (4; agency representation above)
    - Representatives from industry (2) and environmental (4) interest groups.
- **A group interview with the Commission delivery team (five people) and senior staff (2)** to explore their perceptions of the program's key challenges, accomplishments and opportunities.
- **Review of public submissions to the Commission**, received from eight individuals and/or groups in relation to the CIFOA Monitoring Program.[5]
- **Development of this report,** including review and refinement based on feedback.

[4] Note questions 3 and 4 are reported on together in Section 7 in terms of the overall outcomes
[5] The Commission called for submissions via the Commission website and the NSW 'have your say' website.

4 Key findings

The CIFOA Monitoring Program is a complicated and ambitious program but one that is a critically important program in the management of NSW forests. **Overall, the review found the program has been adequate.**

The review found:

- **Its design is well-aligned with its objectives and the obligations outlined in Protocol 38.**
    - All of the requirements of Protocol 38 have been considered as part of the program design, with most having clearly aligned pieces of work complete or in progress.
    - It also has many of the design features that characterise effective monitoring programs. This includes being question-driven, prioritising information needs, having mechanisms for adaptation and working collaboratively and transparently.
    - A key area for improving the design is the lack of detail in how the program plans to manage and use the data created by the program.
- **It has been implemented effectively**.
    - There have been a range of significant challenges that the program has faced, including the need to adapt to the 2019/2020 fires and program funding ceasing for the aligned cross-tenure Forest Monitoring and Improvement Program.
    - This has meant that overall progress, particularly during the early stages of the Program design, had been slow. However most planned projects have been delivered or are in the process of delivering results.
    - The program has adapted through time, with new projects being added as conditions change and findings from early work emerge.
    - The Commission has worked well to independently coordinate the program, foster collaboration and provide independence in a space that is highly contentious and politicised. The majority of interviewees considered that the Commission has done a good job, some suggesting it was among the best coordination of government agencies they had seen in the public service.
- **While slow to start, the program is delivering useful results and its value is accelerating as new monitoring data begins to accumulate and is being analysed and reported on**.
    - The program has already published more than 30 reports on new data, analysis of historical trends, syntheses of impacts on forest values and trials of new methodologies.
    - Discrete, targeted pieces of research have been completed that complement a range of new long-term monitoring programs. Among these is a network of 300 fauna occupancy monitoring sites across Coastal IFOA state forests.
    - Interviewees have highlighted that Monitoring Program data has already helped to inform key policy discussions within the NSW Government. While the details of this are not publicly available, the independence of the Commission and the Monitoring Program's credibility were noted to have been particularly valuable.
    - There have also been improvements in transparency around forest monitoring activities and in the way that relevant agencies collaborate.

  - In terms of the organisations involved in forest management, the Monitoring Program has influenced the direction of research activities, data collection and there is early work to adjust on-ground forest management practices.
  - The results have had limited impact, to date, on CIFOA conditions. This is expected to change as results are considered as part of the 5-year review of the CIFOA.

The overall value of the Monitoring Program is most clearly evidenced in it securing a further 20 years of funding from the NSW Government, setting it up to provide an invaluable source of information for forest management into the future. With the establishment phase now passed, **there are opportunities to further refine and update the Monitoring Program.** This will help ensure it continues to make the best use of these resources over the next phase of delivery. Some of the key opportunities (discussed further in this report) include:

- **Public-facing communication**. Good effort has gone into communication around the Monitoring Program, with stakeholders recognising improvements in transparency as a key benefit. However, the program is under high levels of scrutiny and there is the potential to further improve public reporting.
- **Review and refresh the program priorities** as part of the 5-year review of the monitoring program. This includes considering and recommending how Protocol 38 is structured and a renewed appraisal of where the uncertainties and risks are for forests into the future. There is the potential to use the prioritisation process to more clearly set expectations about what the monitoring program might be able to test and achieve over what timeframes this is likely to happen.
- **Develop clearer processes for how the Monitoring Program should inform management**. The current 5-year review process will be critical for translating Monitoring Program findings into improvements in the CIFOA. It sits alongside annual health checks that, to date, have not led to substantive changes in the management of coastal state forests. There is thus potential to consider whether there are other ways in which findings from monitoring projects might flow through to improved management. This includes both FCNSW and EPA considering how a more structured adaptive management approach might be implemented to test the efficacy of different approaches to achieving the outcomes outlined in the CIFOA.
- **Continue to improve data management**. This was seen as an area in need of more attention, including the need for a comprehensive data management plan.
- **Consider the structure of the program and how it engages with research partners.** Part of the success of the program so far has been in its targeted use of agency, university and other experts. There is the potential to combine this focus on the 'core' monitoring program work, with a model that also seeks to guide and support complementary (but lower priority) work among researchers, students and others. This could bring additional benefit to the monitoring program by leveraging external resources and funding.
- **Improve forward planning to facilitate better participation by agency staff in the design and review of Monitoring Program projects**, which could help agency staff who are often under time and resourcing pressures.

5 Design of the monitoring program and alignment with requirements

5.1 Overview

This section considers:

- How well the CIFOA Monitoring Program has been designed in terms of alignment to the requirements of Protocol 38 and how much progress is being made in each area (Section 5.2)
- How well the Monitoring Program aligns with the characteristics of effective monitoring programs (Section 5.3).

The results show that, overall, the CIFOA Monitoring Program is well-aligned with its objectives and the obligations outlined in Protocol 38. It also has many of the design features that characterise effective monitoring programs. This includes being question driven, having mechanisms for adaptation and prioritising information needs.

5.2 Alignment with the requirements of Protocol 38

The CIFOA Monitoring Program has been designed specifically to address Protocol 38, as directed under the same protocol. There was extensive work during the development of the Program to consider these requirements and how they might be addressed. This included a detailed prioritisation process led by the CSIRO (see Section 6.2). Table 2 outlines:

- the clauses and requirements of Protocol 38
- the extent to which there are clearly aligned monitoring program components (see Appendix C)
- a coarse assessment of the level of progress with these components (noting that while this is more relevant to program implementation (Section 6) it is presented here for clarity).

The results show there is good alignment with the requirements of Protocol 38, with most clauses having clearly aligned components in the monitoring program. Furthermore, good progress is being made against most of these areas. Example components that stakeholders highlighted as being particularly well-designed and progressed include:

- the establishment of fauna occupancy monitoring
- work on better understanding hollow-bearing trees
- improved techniques for monitoring particular species of interest
- work on koala browsing preferences.

Some areas have been lower priorities and have had, correspondingly, less work (such as monitoring of coastal SEPP wetlands because of the lack of forestry in these areas). More noteworthy are select cases where the initial design of the Monitoring Program has been impacted by subsequent changes to the broader forest monitoring context (i.e. cross-tenure monitoring ceasing under the FMIP). In particular:

- coarse woody debris is not currently monitored (originally scoped under cross-tenure forest plot monitoring)
- trends in water quality are not currently monitored (originally part of a cross-tenure program)
- monitoring of forest structure and regeneration is being redesigned to use existing FCNSW plots and LiDAR data, rather than being part of the original cross-tenure forest plot monitoring.

Table 2. Alignment of Monitoring Program with the clauses of protocol 38 and feedback on delivery so far. See Appendix C for rubrics relating to alignment and progress.

Protocol 38 clauses	CIFOA Monitoring Program element	Strength of alignment	Level of progress	Additional notes
38.1 Introduction - This *protocol* supports Chapter 8 of the *approval*, which imposes requirements on *FCNSW* in relation to a *monitoring program*				
The conditions of the *approval* must be monitored to ensure they are effective in achieving the *objectives* and *outcome statements* set by the *approval*.	Clear overarching question on effectiveness. Most elements listed below are relevant to assessing the effectiveness of the conditions, the objectives and outcomes.	Clearly aligned work	Early progress	There are likely to be significant complexities and challenges in disentangling the effectiveness of different conditions but both long-term monitoring and discrete research and evaluation projects are important in this.
38.2 Monitoring steering committee				
(1) *FCNSW* must participate in a monitoring steering committee, as required under condition 122.1 of the *approval*, with the following composition:	Steering committee established with FCNSW participation	Clearly aligned work	Good progress	-
a) a minimum of four independent and suitably qualified scientists that have demonstrated expertise in: (i) ecology; (ii) soil *erosion* and water quality/*pollution*; and (iii) forest *regeneration* and ESFM	Steering committee includes: • Professor Patrick Baker (iii) • Professor Phillip Gibbons (i, iii) • Associate Professor Tina Bell (i) • Dr Peter Hairsine (ii) Former members included: • Assoc. Professor Jackie Schirmer (expertise in social science within NRM) • Bhiame Williamson (expertise in Indigenous governance)	Clearly aligned work	Good progress	The membership of independent scientific advisors is well-aligned with the required expertise and needs of the Steering Committee.
(b) NSW Government agency representatives responsible for other programs relating to monitoring of the environment	Steering committee includes representation from: • FCNSW • Environment Protection Authority (EPA) • Department of Climate Change, Energy, the Environment and Water (DCCEEW) • Department of Primary Industries and Regional Development (DPIRD) • The Office of Aboriginal Affairs • National Parks and Wildlife Service (NPWS)	Clearly aligned work	Good progress	Membership aligns with requirements across government.

Protocol 38 clauses	CIFOA Monitoring Program element	Strength of alignment	Level of progress	Additional notes
	• Local Land Services • Crown Lands			
(2) The monitoring steering committee must: (a) ensure the *monitoring program* is designed to meet the requirements in condition 38.3 below;	Steering committee oversaw design of monitoring program. Monitoring program approved by DPIRD and EPA in 2019 as proposed by Steering Committee	Clearly aligned work	Good progress	The Steering Committee was involved in the design and will be involved in review and refinement of the Monitoring Program
(b) oversee the implementation of the *monitoring program*;	Regular meetings of steering committee	Clearly aligned work	Good progress	-
(c) review the effectiveness of the *monitoring program* and inform necessary amendments to ensure it is progressing and providing scientifically robust results;	Annual health checks with DPIRD, EPA and FCNSW to review progress, and identify new research priorities 5-yearly review in progress	Clearly aligned work	Good progress	-
(d) review and analyse the *monitoring program* data and provide expert scientific advice to the *EPA*, *DPI* and *FCNSW*; and	All projects reviewed by cross-agency technical working groups 5-yearly review in progress	Clearly aligned work	Good progress	-
(e) engage with community, environment and industry stakeholders on the *monitoring program.*	Regional stakeholder meetings during design of monitoring program. Call for public submissions during design and review phases. Annual forums/webinars held; Commission website updated on regular basis[6]	Clearly aligned work	Good progress	-
38.3 Design and contents of a monitoring program - *The monitoring program* must be designed to:				
(a) monitor and evaluate the effectiveness of the conditions of the *approval*, including but not limited to: I. the *multi-scale landscape protections*;	Monitoring program designed to deliver monitoring/research at site-scale (e.g. habitat features plan) and at landscape scale (e.g. landscape scale trends plan). Effectiveness of the "multi-scale landscape protections" not yet	Clearly aligned work	Early progress	Likely to be significant complexities and challenges in disentangling the effectiveness of the multi-scale protections versus the effectiveness of conditions at a single scale.

[6] See also Appendix D

Protocol 38 clauses	CIFOA Monitoring Program element	Strength of alignment	Level of progress	Additional notes
	analysed directly but planned to be assessed to extent possible during 5-year review.			
II. *drainage feature crossing* and *road* conditions	Relates directly to: • R3: Reviewing the use of temporary log crossings in NSW coastal state forests • WQ1: Review of current knowledge for monitoring forestry impacts on waterway health • FMIP Project SW3: Evaluating forest road network to protect forest waterways	Clearly aligned work	Good progress	Potential for more work to be done here, depending on priorities. This could be particularly focused on evaluating road conditions in the CIFOA.
III. *riparian exclusion zones* and *ground protection zones* on class 1 *classified drainage lines* (including, but not limited to, areas where Table 6a of the *approval* should apply);	Relates directly to: • WQ3: Monitoring class 1 drainage lines and exclusion zones	Clearly aligned work	Good progress	Second phase of work has commenced.
IV. *exclusion zones* for *Coastal SEPP wetlands;*	Documented in water monitoring plan. However, plan also notes no harvesting operations are planned to occur within state forest that contain SEPP wetlands.	Clearly aligned work	N/A	Monitoring will be triggered if any future harvesting plans are approved where SEPP wetlands occur.
V. the effectiveness of soil and water protection in *intensive harvesting forestry operations*;	Documented in water monitoring plan. FCNSW have advised no intensive harvesting has occurred, or is planned to occur in north coast state forests.	Clearly aligned work	N/A	Issue will be revisited if intensive harvesting is planned to occur.
VI. protecting and recruiting *hollow-bearing trees*;	Relates directly to: • F5: Hollow use review • F6: Impacts of fire on hollow-bearing trees on state forests • F7: Perpetuating tree hollows under the Coastal IFOA • R2: Strengthening the evidence base to assess damaged trees • F2: Assessing change in forest structure in state forests	Clearly aligned work	Good progress	-

Protocol 38 clauses	CIFOA Monitoring Program element	Strength of alignment	Level of progress	Additional notes
VII. Koala conditions;	Relates directly to: • B1: Fauna monitoring on state forests • E1: CIFOA koala browse tree review • R4: Koala response to harvesting	Clearly aligned work	Good progress	A substantial Koala Research Program overseen by the Commission commenced in 2019 under the NSW Koala Strategy, and reported findings in 2022. The research program continues as requested under the koala strategy. This program directly aligns with CIFOA monitoring questions, as well as informing a specific Koala Monitoring Plan, which is yet to be approved.
VIII. the effectiveness of *selective harvesting* limits in achieving *regeneration* and stocking standards as measures of longer term *regeneration*; and	Relates directly to: • F2: Assessing change in forest structure in state forests • F3: Assessing change in tree composition on state forests • Forest Monitoring and Improvement Program: Project FE1 • WS2: Impacts on wood supply	Some aligned work	Early progress	Reports have been drafted analysing historical data and the impacts of previous harvesting regimes on forest structure and composition. Statewide, cross-tenure forest monitoring was originally planned to address this clause. The Commission are currently adapting the monitoring plan focused solely on production forests which will use long-term FCNSW permanent growth plots and native forest strategic inventory plots. A regular program of ongoing remote sensing is also being explored.
IX. the maintenance of sufficient levels of *coarse woody debris*	Coarse woody debris sampled as part of piloting of cross-tenure forest plot monitoring. Piloting showed that it was costly/time-consuming data to collect. Coarse wood debris data is collected at monitoring sites as part of the fauna occupancy monitoring. Alternatives are also being considered for future projects.	Some aligned work	Limited progress (identified as low priority)	Although several stakeholders identified this as a gap relative to the requirements of Protocol 38, none raised it as a priority area of concern. Indeed, research suggests selective harvesting in NSW state forests results in higher levels of coarse woody debris than unharvested sites.[7] EPA, FCNSW and independent experts agreed at November 2024 forest structure, health and regeneration monitoring workshop this is low priority given the high cost to collect data This component will be considered as part of the 5 year review of the monitoring program.

[7] E.g. see: Threfall C., Law, B. & Peacock, R. 2019. Benchmarks and predictors of coarse woody debris in native forests of eastern Australia. *Austral Ecology,* 44**,** 138-150; Threfall, C. , Law, B. & Colman, N. 2021. The effects of harvest frequency on coarse woody debris and its use by fauna. *Wildlife Research*

Protocol 38 clauses	CIFOA Monitoring Program element	Strength of alignment	Level of progress	Additional notes
(b) establish a scientifically valid environmental and wood supply baseline to track and evaluate the effectiveness or impacts of the *approval* on the maintenance of environmental values and on wood supply	Relates directly to: • WS1: Baselines and historical trends in wood supply • WS2: Impacts on wood supply As well as work done under the FMIP: • FE1: Baselines, drivers and trends for forest extent, condition and health • BD1: Baselines, drivers and trends for species occupancy • SW1: Baselines, drivers and trends for forest water catchments • SW2: Baselines, trends and drivers for soil stability and health in forest catchments	Clearly aligned work	Good progress	Work on baselines and trends here relates to analysis of historical trends/data. Environmental trend monitoring is noted below. Work on wood supply impacts is in progress (proposed modelled sustainable yield approach currently under review by Technical Working Group).
(c) provide environmental trend monitoring at the landscape scale, including but not limited to: (i) water quality monitoring;	Trend monitoring identified in Waterway and Wetland Health monitoring plan but detailed design not progressed once funding ceased for the FMIP. Discrete projects on water quality noted above, along with Forest Monitoring and Improvement Program: Project SW1, which explored trends in water quality in NSW RFA areas	Some aligned work	Limited progress	Two factors have impacted progress here: • Program funding ceasing for under the cross-tenure FMIP • The loss of a cost -effective and scientific sound way of monitoring water in the absence of the cross-tenure program (i.e. because of an inability to compare between management types) Trend monitoring for water quality will need to be considered as part of the 5-year review and any reprioritisation that gets done.
(ii) forest *regeneration*; and	Relates directly to: • Forest Monitoring and Improvement Program: Project FE1 (forest health / canopy extent baselines) • F2: Assessing change in forest structure in state forests	Some aligned work	Early progress	Loss of the FMIP cross-tenure forest plot monitoring had a significant impact on this component of the monitoring program. It required the Commission to totally revise its monitoring approach. Data collected for post-harvest regeneration monitoring by FCNSW (high level reporting in FCNSW's annual Sustainability Report) is being considered for integration into a revised CIFOA forest structure, health and regeneration monitoring plan currently being developed.

Protocol 38 clauses	CIFOA Monitoring Program element	Strength of alignment	Level of progress	Additional notes
				Current work is exploring role of FCNSW permanent growth plot monitoring in combination with Geiger-mode LiDAR, which has the potential to deliver substantial improvement in forest structure data at lower costs. Initial reporting on this work is expected in the first half of 2025.
iii) *biodiversity* trend monitoring; and	Relates directly to: • Forest Monitoring and Improvement Program: Project BD1 (species occupancy baselines) • B1: Fauna monitoring on state forests	Clearly aligned work	Good progress	Substantial effort has been put into this component and it is widely acknowledged as a key achievement of the Monitoring Program
(d) provide *species*-specific monitoring, including but not limited to those management plans listed in Protocol 21: Species management plan;	Relates directly to monitoring being done by FCNSW under the species management plans listed in Protocol 21 for: • Southern Brown Bandicoot • Giant Burrowing Frog • Yellow-bellied Glider • Eastern Bristle Bird • Smoky Mouse[8] Analysis of data under these plans was done in 2020, with this analysis currently being updated: • B6: Southern Brown Bandicoot species • management plan • B7: Giant Burrowing Frog species management plan • B5: Yellow-bellied Glider species management plan Additional species-specific monitoring has also been explored through: • B3: Long-term Greater Glider monitoring	Clearly aligned work	Good progress	Work to consider the adequacy of some of the species-specific monitoring has led to expert review and recommendations for improving how several threatened species are monitored under the CIFOA. Species management plans are the responsibility of FCNSW to implement and the EPA to approve - not all SMPs that are in effect are publicly available and it is unclear how they are being used and updated by FCNSW and EPA. More transparent communication around this would help clarify and communicate their use and value. The CIFOA monitoring program has been analysing historic datasets related to this monitoring data (e.g. for the Southern Brown Bandicoot and Yellow-bellied Glider, with publication of results in progress).

[8] Note no SMP was publicly available for Smoky Mouse or Eastern Bristle Bird but they are noted to have been reviewed during development of the Species-specific fauna monitoring plan (2020)

Protocol 38 clauses	CIFOA Monitoring Program element	Strength of alignment	Level of progress	Additional notes
	• B4: Long-term koala monitoring • B8: Using eDNA to detect frog species • B10: Milky Silkpod and Rusty Plum species management plan • R5: Novel techniques to detect and monitor Hastings River Mouse • R6: Drones to detect cryptic species • R8: Expert review of survey and models for Philoria frog species • R9: Expert review of bird survey methods and habitat models • E3: Species and habitat survey and modelling conditions and practices			
(e) provide *species*-specific monitoring for other *species* which require monitoring under existing programs relating to the monitoring of threatened flora;	Joint monitoring on Dungowan starbush between FCNSW and NSW Saving our Species program[9]	Some aligned work	Early progress	This element was not mentioned by stakeholders as a priority area of concern
(f) meet *Principles of Ecologically Sustainable Forest Management* under the *NSW Regional Forest Agreements*;	Relevant principles the Monitoring Program should meet include: • Principle 2 - Ensure public participation, access to information, accountability and transparency • Principle 4 - Apply precautionary principles for prevention of environmental degradation • Principle 5 - Apply best available knowledge and adaptive management processes There is evidence of Principle 2 being applied in the design stage and in the continued reporting of the program (including publication of data on TERN, SEED and the Spatial Collaboration Portal) over the last five years.	Clearly aligned work	Good progress	Requirements here are unclear. The clause "The monitoring program must be designed to … meet the Principles of Ecologically Sustainable Forest Management…" led to confusion during consultation on the original Approved Monitoring Program 2019-2024. The focus was clarified to be on the efficacy of CIFOA conditions and objectives, which mostly relate to environmental values, rather than all ESFM principles and forest values. As such, we take this clause to mean that the Monitoring Program itself should meet the relevant principles of ESFM (identified here) such as public participation and transparency.

[9] As documented in internal Natural Resources Commission document

Protocol 38 clauses	CIFOA Monitoring Program element	Strength of alignment	Level of progress	Additional notes
	Principle 4 is embedded in the underlying monitoring program rationale (i.e. addressing uncertainty), while Principle 5 is featured in the continual refinement of the monitoring program through processes such as the Annual Reviews.			
(g) provide linkages to other relevant NSW Government programs and/or reviews relating to the monitoring of *State Forest* management and the NSW forest estate	Collaboration and engagement occur through Steering Committee and cross-agency technical working groups. Most of the projects have some cross-over between key researchers and/or organisations (see Appendix D). This particularly includes work under Saving Our Species (DCCEEW) and the Koala Research Program. The Program also contributes into state and national-level forest reporting requirements (see notes). The key mechanism for cross-tenure monitoring across the forest estate – the FMIP – was discontinued in 2022.	Clearly aligned work	Good progress	The program feeds into 5-yearly reporting as part of Australia's State of the Forests Report, as well as 5-yearly reviews for Regional Forest Agreement (RFA) reporting. The program reports/contributes annually as part of the RFA process considering research priorities and progress. The Commission team are also involved in reviewing DPIRD's updates to Overview of the Forest Management Framework in NSW.
38.4 Monitoring program review and reporting				
(1) The *monitoring program* required under Chapter 8 of the *approval* must incorporate reviews and public reporting of results and progress including: (a) an annual forum and review of the *monitoring program* must be provided by the monitoring steering committee to the *EPA* and must include: (i) *monitoring program* results; (ii) *monitoring program* progress; and (iii) an assessment of the adequacy of the *monitoring program*	Relates directly to:[10] • Annual forums • Annual reports that include summaries of the results of monitoring program activities and progress • Annual health check reviews • Publication of all reports/findings on the Commission website	Clearly aligned work	Good progress	-

[10] See Appendix D for details

Protocol 38 clauses	CIFOA Monitoring Program element	Strength of alignment	Level of progress	Additional notes
(b) a major review of the *monitoring program* must be completed with each formal review for the *approval* and must include: (i) detailed reporting of *monitoring program* progress and all results; (ii) detailed analysis of trends; and (iii) an assessment of the adequacy of the *monitoring program;*	Major review in progress	Clearly aligned work	Early progress	-
(2) The reviews of the *monitoring program* must be overseen by the monitoring steering committee.	Annual progress reports tabled to Steering Committee for endorsement Steering Committee involved in planning and scoping the five-year review.	Clearly aligned work	Good progress	-
(3) Reviews of the *monitoring program* must be provided to the *EPA* and *DPI* and will be published on the *EPA* website, or other locations as approved by the *EPA*.	Annual progress reports published and provided to DPIRD, EPA and relevant Ministers	Clearly aligned work	Good progress	-

5.3 Alignment with characteristics of effective monitoring programs

As outlined above, the design of the CIFOA Monitoring Program aligns well with the requirements of Protocol 38. To further explore its adequacy, this section considers how well the design aligns with the characteristics of effective monitoring programs.

Table 3 outlines a range of characteristics of effective monitoring programs as sourced from a brief literature review that included Burns et al. 2014[11] and Lindenmayer and Likens 2018[12]. These characteristics are assessed in the context of and compared to the CIFOA Monitoring Program.

The comparison shows that, **overall, the Monitoring Program has been designed well and has most of the features that are characteristic of effective monitoring programs**. It has a clear rationale, it is driven by questions, it carefully considers priorities and it seeks out appropriate expertise. Its limitations relate to:

- Absence of a conceptual model in the program documentation that articulates how the CIFOA is expected to function and, in turn, how the Monitoring Program is expected to consider its effectiveness.
- A lack of detail in how the program plans to manage and use the data created by the program. These issues were also raised by key stakeholders and are discussed more in Section 7.4.

Table 3. Alignment of the CIFOA Monitoring Program design with the characteristics of effective ecological monitoring programs.

Characteristic of effective monitoring program[13]	Alignment of CIFOA Monitoring Program	Additional comments
Clear rationale	Clear alignment	The program's rationale is clearly articulated in Chapter 8 of the CIFOA conditions: "to ensure the ongoing effectiveness of the approval in delivering the objectives of the approval and outcome statements".[14] The caveat here is that while responsibility for design and coordination of the Monitoring Program rests with the Commission and the Steering Commitee, the decisions that make use of the monitoring data to "ensure the ongoing effectiveness" rest with the relevant Minister and the agencies that advise the Ministers (i.e. the EPA and DPIRD).
Driven by questions	Clear alignment	The Monitoring Program centres on four key questions, with sub-questions nested at lower levels within Monitoring Plans and within individual projects. Several interviewees suggested that, as the program evolves, there is room for a more refined set of questions. These questions could be more clearly linked to definitions of success

[11] Burns E, Lindenmayer D, Tennant P, Dickman C, Green P, Hanigan I, Hoffmann A, Keith D, Metcalfe D, Nolan K, Russell-Smith J, Wardle G, Welsh A, Williams R, Yates C (2014). *Making ecological monitoring successful: Insights and lessons from the Long Term Ecological Research Network*, LTERN, Australia

[12] Lindenmayer D and Likens G (2018). *Effective ecological monitoring.* CSIRO Publishing, Australia

[13] Based on Burns et al. 2014 and Lindenmayer and Likens 2018

[14] NSW Government (2018) Coastal Integrated Forestry Operations Approval – Conditions. Chapter 8, Section 121.1.

Characteristic of effective monitoring program[13]	Alignment of CIFOA Monitoring Program	Additional comments
		– as described by Lindenmayer and Liken "offer[ing] unambiguous signposts for measuring progress".[15]
Considers statistical principles in design	Clear alignment	As appropriate, statistical principles are considered at the level of individual monitoring/research projects rather than at the higher, program-level. This includes consideration of sampling effort and the appropriate design for making statistical inferences (e.g. use of controls, sampling through time etc.). Examples include work on class 1 drainage lines, on potential survey methods for koalas and recent work on detection probability and power for the fauna monitoring program (See https://doi.org/10.7882/AZ.2024.033 Importantly, the loss of funding for cross-tenure forest monitoring (under the FMIP) has meant that there are some elements of the CIFOA program that lost potentially comparable 'control' sites on other land tenures. This has, for example, impacted monitoring of water quality (which has to date been discontinued) and required other monitoring initiatives to include sites on formal and informal reserves in state forests.
Includes a conceptual model	Not included in program documentation	"A conceptual model, developed at the beginning of a study, forces the collection of ideas to formulate theory about how an ecosystem or target entity works, and helps to ensure that the relevant components are captured in the program design".[16] The CIFOA Monitoring Program is based on a theory of how the forest system works – one in which the CIFOA provides protections for environmental values. However, this model has not been articulated in the Monitoring Program documentation. This might help in communicating a range of features of the program design, including: • The way in which CIFOA conditions operate at different scales • The factors outside of forestry operations that influence forest values • The way in which the components of the Monitoring Program are interrelated to provide different insights at different levels/scales on questions of effectiveness.
Has a data management plan	Some alignment	There is minimal reference to data management within the Approved Monitoring Program document or the underlying Monitoring Plans. This has led to challenges in managing the very large volumes of data produced by some of the projects, particularly those relating to remote sensing. A clearer strategy for and approach to managing program data is being developed under project R1: Integrating data to assess Coastal IFOA outcomes.
Documents protocols	Clear alignment	Monitoring / data collection protocols are clearly documented at the project level. This includes a separate field manual and instructions for the Fauna occupancy monitoring project.
Prioritises information needs	Clear alignment	Substantial effort was put into prioritising the information needs across Protocol 38 during the design phase of the CIFOA Monitoring

[15] Lindenmayer D and Likens G (2018). *Effective ecological monitoring.* CSIRO Publishing, Australia. p 98.
[16] Lindenmayer D and Likens G (2018). *Effective ecological monitoring.* CSIRO Publishing, Australia p. 100

Characteristic of effective monitoring program[13]	Alignment of CIFOA Monitoring Program	Additional comments
		Program. This included extensive work by CSIRO and key stakeholders that helped to prioritise program elements based on: • their ability to detect that outcomes are not being met • the consequence of not detecting that the outcome is not being met • the cost of monitoring required to detect that the outcome is not being met • their potential to inform changed management practices to improve Coastal IFOA performance Further prioritisation of activities is then built into the review process for the Monitoring Program and include recent work around prioritising improvements around species surveys and habitat models.
Appropriate levels of governance and clear leadership	Clear alignment	The Natural Resources Commission has responsibility for coordinating the Monitoring Program, with oversight occurring through the Steering Committee. All interviewees who commented on it noted that the Steering Committee function was appropriate.
Use of partnerships appropriate to skills and resources	Clear alignment	A broad range of researchers and organisations are involved in varying aspects of the Monitoring Program. This ranges from specialists in individual species (brought on board to review particular species plans) through to forest management generalists involved in higher levels of program design and oversight. More than 34 different lead researchers and 26 organisations have been involved to date (See Appendix D).
Potential for adaptation	Clear alignment	Adaptation and refinement of the Monitoring Program is built into its governance processes, including the annual health checks and five-year review.
Clear plan for use of data	Some alignment	The annual health checks and the five-year review are the key mechanisms intended to lead to the use of data and updates to the CIFOA or forestry practices. However, details of how changes might be considered by the relevant authority (e.g. EPA) are not well-articulated. Interviewees see this as a key gap for the broader decision-making framework related to the CIFOA and its interaction with the Monitoring Program.

6 Implementation of the Monitoring Program

6.1 Overview

In considering the adequacy of the CIFOA Monitoring Program, this section explores how well the program has been implemented. It focuses on:

- **The prioritisation process and feedback on the priorities going forward** (Section 6.2)
- **Delivery challenges and the effectiveness of coordination by the Commission** (Section 6.3).

6.2 Process of prioritisation

The monitoring requirements outlined in Protocol 38 are extensive and the literature on effective monitoring programs highlights the importance of prioritising information needs. This was also well-recognised among key stakeholders interviewed for this evaluation, virtually all of whom, unprompted, commented on the importance of a prioritisation process

> *… at the outset, there's a recognition that any one particular program can't meet everything (Interviewee – Agency stakeholder)*

Protocol 38 itself also recognises the need to prioritise what the Monitoring Program covers:

> *In reviewing the design and timing of the monitoring program, the monitoring steering committee will need to consider the priorities listed in condition 38.3 and the monitoring program's available budget and resources (Note in 38.2 of Protocol 38)*

As outlined in Section 5.3, this need for prioritisation was **well-recognised and implemented throughout the design process**, including dedicated support from CSIRO's Conservation Decisions Team that considered:

- the ability to detect that outcomes are not being met
- the consequence of not detecting that the outcome is not being met
- the cost of monitoring required to detect that the outcome is not being met
- their potential to inform changed management practices to improve Coastal IFOA performance.

The question, however, is **whether the current set of priorities are appropriate** now that the program has reached its five-year point. Key pieces of feedback here were opportunities to put more attention on:

- **The effectiveness of the conditions**. This was raised in particular by representatives from environmental organisations who were keen to see the Monitoring Program deliver tangible insights on whether the approval is leading to the outcomes it intends. People specifically suggested:
    - the effectiveness of tree-retention clumps
    - the need to assess whether the outcomes-based nature of the regulations is itself effective
    - a general interest in shorter-term work that would test and deliver results

Short term research that actually shows us where to start, what to change, because if we're going to wait to start changing things in the long term, it might be too late (Interviewee – Key stakeholder group representative)

These comments on 'quick wins' are interesting, as short-term research that has validity at the forest scale is difficult and often costly. They should, therefore, be taken as evidence of the high level of interest in the results of the monitoring program and the perceived value in supporting forest management.

- **The impacts and implications of fire and climate change** and their overlapping impacts with forestry impacts. This included commentary on environmental values, but also on wood supply and availability.
- **Wood supply**, with feedback from industry representatives that the impacts of the CIFOA on wood supply is not being assessed in enough detail.
- **Soil attributes**, with feedback from one independent expert and one public submission that this is an important area for the monitoring program to consider (noting that Protocol 38 does not require any focus on soil health).
- **Doing more analysis of data that has already been collected**. This includes the vast array of data collected by FCNSW as part of their pre-harvest monitoring and the associated data on retained trees. It also included statistical analysis of whether sampling programs can be scaled back while still giving similar levels of information and insight.
- **Making the prioritisation process from the Annual Health Checks clearer**. Several external interviewees indicated that the reasons for new projects being identified and selected were unclear, particularly in terms of how they were prioritised among other options.

Importantly, there was also **a clear caution from two interviewees that further prioritisation might be needed to ensure the scale of the program is sustainable**:

On balance, if you look at the monitoring literature, it's a key point of failure of monitoring programs is they try to be too ambitious (Interviewee – Independent Steering Committee member)

6.3 Delivery challenges and the effectiveness of coordination

There have been two major challenges to delivery of the CIFOA Monitoring Program:

- **The Program design was proposed in December 2019, just prior to the height of the 2019-20 bushfires**. The Monitoring Program was approved and published in March 2020. Although late changes were made to the program to incorporate more work on the impacts from the fires, the scale of those impacts was only just emerging.
- **The CIFOA Monitoring Program was designed around having the FMIP working in parallel.** This was expected to include monitoring work such as a statewide series of on-ground forest monitoring plots that could explore factors such as forest health and soil condition. Funding for the FMIP was discontinued in 2022, dropping the cross-tenure monitoring program as well as a range of other monitoring components that were expected to provide useful data against the

CIFOA monitoring questions. The full implications of the FMIP ceasing will need to be considered and incorporated into the five-year review of the program.

Other challenges to delivery identified by stakeholders included:

- **The scale and ambition of the program**. This was highlighted by almost half the interviewees and noted as a risk to the program. The challenge, however, is that many of those same interviewees identified where more work needs to be done – be it more detailed work on existing components or additional avenues of exploration. This highlights the importance of a re-assessment and re-prioritisation process going forward (with a further point here being that the current program design and coverage is partly driven by Protocol 38's broad requirements – something that may need to be assessed at the same time as the program scope).

  I think they are trying to do what they can with their resources and the scope of the project. It's a huge project. It's a huge undertaking … They're taking on this behemoth of a project in a critical time period where the forests and forest values are extremely stressed. And so I can understand that predicament that they're in a very difficult situation. (Interviewee – Stakeholder group representative)

- **The diverse nature of the program requires a diverse set of expertise**. The Commission was generally seen to have done well in drawing on a range of university researchers, independent experts and consultants to address the various needs of the program (see Appendix D). This, however, was noted to be a challenging process:
  - It requires time – including time to develop briefs and commission work even before projects start collecting or analysing data.
  - It can lead to fragmentation of knowledge, with three interviewees highlighting that although external expertise can be valuable, it can also have inefficiencies.

  Most of the projects were one to three years. So what this means is that there's not necessarily a repository, an accumulation of expertise. The data is there. We're quite transparent about the data, but it's not like an organization like, for instance, CSIRO or one of the government departments with a steady accumulation of expertise in the methods developed, the maps are maintained. That's a concern. It is fragmented in that way and that we're using many providers. (Interviewee – Independent Steering Committee member)

  - It requires expertise to manage, with some interviewees reinforcing the importance of having agency input on design and reporting (and the need for agencies themselves to allow the time and resources to provide this input).
- **The challenges of working across agencies**, sometimes with different levels of interest, different drivers and different levels of familiarity with the details of forest monitoring.

In the context of these challenges, **the Monitoring Program has been well coordinated by the Commission**. Key points here are that:

- Although there have been delays, much of the Monitoring Program as originally scoped has started to be delivered, including key components such as LiDAR surveys, establishment of baselines and the fauna monitoring program. Most interviewees acknowledged that overall **progress, particularly during the early stages of the Program, had been slow. However, they considered the program was now in a good position to start delivering meaningful results**.

  There's been some delays in getting the program up and running post-fire … it's [been] a big learning curve and whilst it probably looks as though it's a little behind schedule … it's well set up for success going forward. (Interviewee – Key agency representative)

- **Most interviewees (17 of the 20 who spoke to it) considered that the Commission has done a good job in coordinating the program**. They highlighted, in particular:
  - The team's ability to bring agencies and stakeholders together in a productive and collaborative setting.
  - The professionalism and integrity with which projects were managed – including the generally high levels of transparency and communication.

  They bring a lot of skill and expertise into it. I was on the steering committee originally in the design phase and they're good at managing the different organisations and their viewpoints. There's often … a very different perspective of what's important or where priorities sit or the practicalities of doing things. And the NRC are very good at trying to find the right balance. (Interviewee – Key agency representative)

  Some stakeholders acknowledged there were opportunities for improvement (e.g. in how expectations in other agencies could be better managed - see Section 8), but that, overall, the organisation has done a good job.
- While adaptation of the CIFOA itself has been limited (see Section 7.4), **the Monitoring Program itself has been adapted throughout its delivery**. This has either been in response to external factors (such as the 2019-20 bushfires), or to identified gaps or learnings that have emerged. Some of the key examples include:
  - In relation to the 2019-20 fires:
    - Development of a Monitoring Plan for harvesting in fire-affected sites
    - Review of the implications of changing fire intensity and regimes on CIFOA objectives and outcomes (R7 – see Table 1)
    - Post-fire debris flow mapping in the Tumut and Tuross Catchments (WQ2)
    - Investigation of the impacts of fire on hollow-bearing trees on state forests (F7) and predicting hollow perpetuity (F8).
  - Commissioning of a review of temporary log crossings (R3) in response to a need identified in the 2021 Annual Health Check.
  - Commissioning of a review of koala browse trees listed in the CIFOA (E1) as a result of findings on koalas from related research (R4)

- Commissioning reviews of species-specific monitoring methods (i.e. of *Philoria* frog species (R8) and three bird species (R9)) based on the findings from a broader review of species habitat survey and modelling (E3).

It is also important to recognise that **some stakeholders were critical of the Commission's execution of its coordination role.** Three out of seven public submissions from environmentally focused organisations or individuals criticised the Commission's implementation of the Monitoring Program, as did two of the three interviewees who represented environmental groups. Key issues they cited were:

- The lack of adaptive management (discussed in Section 7.4).
- Criticisms of select individual projects, particularly related to the findings from Koala research.
- A perceived lack of progress in addressing the efficacy of the CIFOA conditions (see Section 6.2).
- Perceptions of bias.

On this last point, **several lines of evidence indicate that, rather than being biased, the Commission has worked exceptionally well in a contested space to ensure the Monitoring Program is objective**:

- The limited submissions from the forestry sector suggest the opposite to the above perspective – that the CIFOA Monitoring Program and governance is weighted towards the environment and environmental expertise. This includes calls for more industry representation on the Steering Committee and a greater focus on social and economic monitoring.
- Among criticisms from environmental groups, they single out a key individual researcher who sits on the Steering Committee as being biased towards forestry interests. However, within the same submission, they cite and advance the perspective of a different researcher as an arbitrator of appropriate forest management. This researcher also sits on the Steering Committee. Thus, even taking at face value accusations of bias among the researchers, there is evidence that effort has been put into ensuring there is a balance of perspectives.
- Key stakeholders involved in the Steering Committee process – including those mentioned above with an environmental background – reflect that the balance of representation and the way in which differing views are managed by the Commission is, in fact, balanced, fair and driven by evidence.

> *I've been working in the sector for 40 years and this is probably one of the two best groups that I've ever worked with in terms of its effectiveness of process. The meetings are well chaired, the papers are good. People listen to each other … the level of discussion about the strategy in the committee meeting, be it in the meetings itself or in the papers, is excellent. (Interviewee – independent steering committee member)*

The suggestion that the Commission has acted with bias, despite evidence to the contrary, highlights the contentious nature of forest management, including the associated science. As such, it further reinforces the value of the program in generating evidence and for continuing to do this as transparently as possible.

7 Outcomes from the program to date

7.1 Overview

The key test of the Monitoring Program's adequacy is whether it helps inform decisions that ensure the effectiveness of the CIFOA conditions. The challenge here is that this is a long-term proposition - the CIFOA Monitoring Program has been funded for 20 years (at least) and many of the questions about the CIFOA's effectiveness will take time to address. Moreover the program has taken some time to design and initiate – something that interviewees acknowledged but also considered to be reasonable.

That said, the program is at a stage now where:

- A broad suite of research and monitoring activities have been established.
- Early data is flowing in for longer-term monitoring projects, while discrete pieces of research (e.g. exploring historical trends or select practices) have already generated useful data and outputs.
- The value of the program and its outputs is accelerating as these different pieces of work start to come together.

In aggregate, the outcomes from the program to date include:

- Improvements in the extent and quality of the information base for forest management (Section 7.2).
- Improvements in the methods being used for collecting forest data (Section 7.3).
- Contributions to decisions about forest management – particularly key discussions about forest management policy (Section 7.4) with decisions about the CIFOA approval itself likely to occur during the 5-year CIFOA review (Section 7.6).
- Informed practices among other agencies (Section 7.5).
- Enhancements in the way in which agencies are collaborating to manage forests (Section 7.7).

7.2 Improved information

One of the key outcomes of the CIFOA Monitoring Program to date has been **the development of an improved set of information about forest values and how a range of factors influence them**. The breadth of the data being collected or used as part of the Monitoring Program is outlined in Figure 2, while Table 1 (Section 2.3) outlines the array of projects and outputs from the Monitoring Program. Among the publicly available reports alone, this includes:

- 10 reports or peer-reviewed papers analysing or reviewing baseline conditions or similar
- 11 reports synthesising or analysing findings about key themes or conditions (e.g. the risks posed by fire or testing the efficacy of drainage line exclusion zones).

> *It's taken a while to really get it up and going but, that said, it is now actually starting to really roll along … there's been a good solid foundation laid and it's now starting to produce really solid results based on basically time series data … it's just such a huge bank of evidence around forestry (Interviewee – Agency staff member)*

Among this work, some of the key improvements in information as highlighted by interviewees include:

- **Development of baselines for threatened species occupancy and establishing landscape-scale trend monitoring**, including for example, baseline insights on species such as the southern brown bandicoot and greater glider. This program alone was estimated to produce over 30 TB of data annually.
- **Baseline analysis and insights on forest structural changes using LiDAR**
- **Consolidating the evidence base on the critical role of hollow-bearing trees** for NSW species and methods for improved modelling.
- **New information on koala browse-tree preferences**.
- **Assessment of the risks to the CIFOA outcomes posed by fires**.
- **Insights on the efficacy of log-crossings** and their potential use during forestry operations.

The flow-on benefits of having this improved evidence base is discussed in Section 7.4.

The key issue here, as noted by several interviewees, is that as information is collated against key questions, it often leads to more questions.

> *That's the challenge, is it's the kind of classic research problem - you start tackling a problem and all it does is open up more questions. (Interviewee – Steering Committee member)*

7.3 Improved data collection activities and methods

Stakeholders also highlighted that the value of the Monitoring Program is not just in the data it has collected, but in the new monitoring activities and methods that it has initiated. This includes collecting data on elements of forests that were not systematically monitored in state forests, such as fauna occupancy and forest structural components (e.g. hollow-bearing trees).

It also includes the development and application of new methods and technologies that have fundamentally improved the efficiency and effectiveness of forest data collection. Among the Monitoring Program publications there are 11 reports dedicated to methodological trials or innovations – for example, enhancements to call recognisers for fauna monitoring. Most notable in this area is the extensive investment in exploring and refining LiDAR technology and data, which has included:

- Trialling LiDAR data as a means of analysing forest structure
- Trialling terrestrial LiDAR data capture as part of investigations into forest-plot monitoring
- Most recently, exploring Geiger-mode LiDAR collection, which is expected to provide higher resolution data at lower costs. The aim would be for this method to replace the limited sampling done through the forest inventory plot work with data collection at the forest estate scale (for which the forest plot work would still provide a useful tool for calibration).

> *Ultimately, they're monitoring a lot more than they ever have in the past, and they're monitoring it a lot more carefully. They're monitoring a lot more technologies, sophisticated technologies that give you a lot more information. I think we're light years ahead of where we would have been 15 years ago. (Interviewee – key stakeholder)*

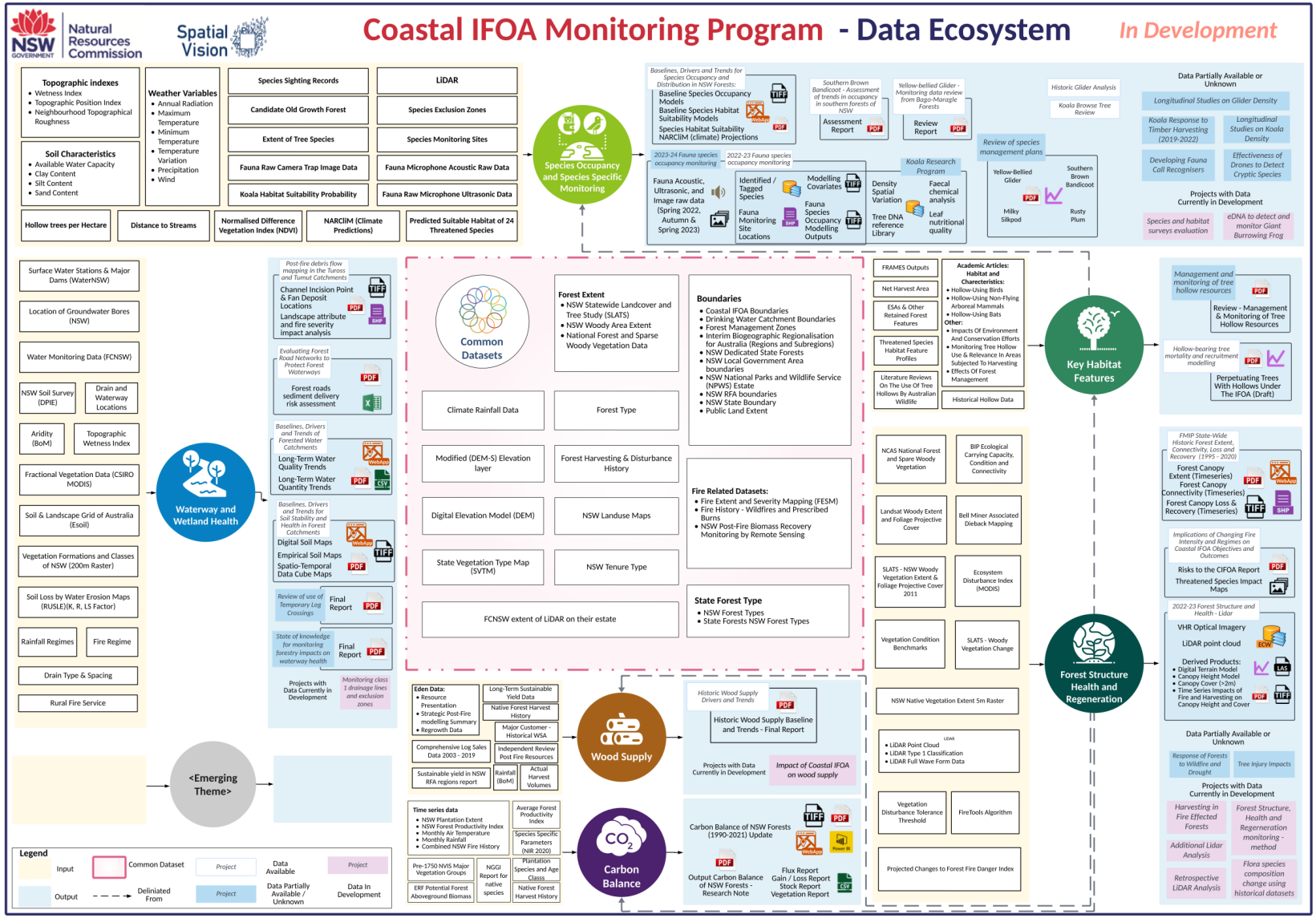

Figure 2. Overview of the range of data sources being generated and used under the CIFOA monitoring program. Sourced from *Final draft report FLINTpro (2024) Coastal IFOA monitoring integration review. Report to the NSW Natural Resources Commission.*

7.4 Informed key government decisions

Ultimately, much of the value of the CIFOA monitoring program will be in its contribution to informed and evidence based decision-making. Although there have been limited changes in the CIFOA itself so far (see Section 7.6), **information from the monitoring program has been used in a range of significant government decision-making processes about the native forestry sector**.

Much of this has been in confidential government-led processes, limiting the evidence that can be discussed in this report. What feedback there has been from relevant interviewees, however, is that evidence from the CIFOA monitoring program has played a critical role in informing discussions and decisions.

A key publicly available example here is the Commission's presentation to the Independent Forestry Panel for the Forestry Industry Action Plan. Around half of the information about forest management and conditions in this presentation was drawn from work done under the CIFOA monitoring program (or associated work under the FMIP)[17].

Some of the key observations and pieces of feedback from stakeholders involved in discussions and presentations have been that:

- The information from the CIFOA Monitoring Program is a well-recognised and trusted evidence source that, although recognised as incomplete, has helped "cut through" discussions with contested viewpoints.

> *In some cases it [findings from the CIFOA Monitoring Program] have validated stakeholder concerns. Or, in other times, stakeholder concerns have been on 'X' and the research shows, 'well, no, that's not the case'. (Interviewee –Commission staff)*

- Work under the CIFOA Monitoring Program and by the Commission has been effective in synthesising results and bringing clarity to a complex space. One interviewee, for example, cited an example where a NSW Minister acknowledged the value and clarity of a briefing package based on the monitoring program findings.
- It has contributed directly to decisions:

> *I have been involved in projects … where information gathered as part of the monitoring program has actually been very important and used instantly. So there are examples where that pathway to delivery has been very, very quick, usually driven by a Ministerial level interest. (Interviewee – Monitoring Program partner)*

7.5 Informed other agencies' practices and approaches

Information from the monitoring program has also influenced a range of NSW forest management agencies and organisations. Though these impacts often appear to be diffuse and difficult to pinpoint, examples cited by interviewees include:

[17] Based on the number of slides presenting data on forest management or conditions and the proportion of those slides that relied on CIFOA Monitoring Program outputs.

- **Guiding the direction of organisational research programs**. This not only includes agencies contributing to and collaborating on CIFOA Monitoring Program projects but using the findings from the monitoring program to identify and target future work in this space.
- **Providing insights that will help in reviewing the Private Native Forestry (PNF) codes**. These codes are reviewed on a five-yearly basis. Interviewees noted that findings from the Monitoring Program have already flagged key areas that could be updated (e.g. in relation to creek crossings and riparian buffer zones) and that it will likely be information from the CIFOA that will be used to make those updates, as no comparable data set is available or feasible for PNF.

> *So we are currently, we've kicked off a process to develop a new greater glider protocol that's got a bunch of experts and involves the NRC and others. So when we get to the code review, we've hopefully got something that is reflective of that science (Interviewee – Agency stakeholder)*

- **Updating forestry operations to accommodate findings on key species**. FCNSW staff indicated that results from the Monitoring Program have already provided a range of opportunities for updating forestry practices (e.g. in relation to koala browse tree retention, practices to support greater glider populations and temporary log crossings). While these have yet to be formalised, other changes include refinement of species management plans to better suit their biology:

> *[There are] a couple of plant species … they have a real disturbance adapted biology … they require disturbance, and without the disturbance they die off and senesce, and then you don't get that seed pack regeneration. So that has helped changes in management application of a handful of plant species. (Interviewee – Agency stakeholder)*

- **Updating surveying practices within FCNSW,** such as the re-introduction of data collection about hollow-bearing trees in permanent growth plots and native forest strategic inventory plots.

7.6 Limited influence to date on the CIFOA itself

The five-year review of the CIFOA will be a key point at which Monitoring Program results are expected to influence changes to the CIFOA conditions and protocols. Importantly, these changes are outside the responsibility of the Monitoring Program (i.e. they are the responsibility of the EPA and the relevant Ministers).

Mindful of those responsibilities, a range of key stakeholders (six interviewees and half (four) of the public submissions) indicated a need for the Monitoring Program to be more clearly and tightly linked to decisions about the CIFOA.

> *One thing that could be done more is translating that monitoring the results from the monitoring program into practice. So that's one thing I think hasn't been done well and is very important. (Interviewee – independent Steering Committee member)*

By way of example, interviewees highlighted **several pieces of work that could be useful in refining conditions and processes** including:

- koala tree retention protections, including browse trees
- tree retention conditions and survey methods for greater gliders
- work on the effectiveness of log crossings

We've got an improving evidence base but it hasn't flowed through to improve conditions yet (Interviewee – Key agency stakeholder)

Interviewees suggested that **some of the key reasons why results had not flowed through to changes included**:

- The EPA is waiting until the five-year review to consider changes. This has been complicated and further delayed by higher-order discussions by the NSW government on the future of native forestry.
- Outside of the five-year review, there is not a clear process (visible outside the EPA at least) for how changes might be considered and implemented. While the Annual Report and Health Check were acknowledged, they were noted to be focused on the Monitoring Program rather than the IFOA itself.
- Several stakeholders suggested a continual 'tinkering' of the regulations is inappropriate – potentially causing confusion within industry and impacting on the conclusions that can be drawn from monitoring work.

Related to these points, three interviewees highlighted a specific need for both:

- **A more formally structured process for integrating monitoring information into decision-making**, potentially including development of triggers and thresholds for action.
- **A more formal and considered approach to adaptive management** – one that is more deliberate about testing and trialling different management actions at meaningful scales.

That's the big thing that this monitoring should drive management. Management shouldn't drive monitoring. Getting to that flip, I think is the key thing (Interviewee – key independent expert)

7.7 Enhanced relationships and other outcomes

Improved information and the potential to lead to improved decisions are key outcomes that would be expected from any monitoring program. Feedback from key stakeholders has highlighted a range of other benefits that the CIFOA Monitoring Program has contributed to. These include:

- **Improved transparency** – notwithstanding some delays in publication and opportunities for improved communication, several stakeholders emphasised how the current approach to monitoring was much more transparent and data much more readily available than had been the case previously.
- **Improved trust and collaborative relationships among agencies.** A range of interviewees highlighted this as one of the Commission's key strengths and achievements during the development of the CIFOA Monitoring Program – that they have successfully built relationships with and brought agencies together into a collaborative setting where there is an opportunity to discuss and progress projects together and with the support of researchers.

To me it works incredibly well. I can't imagine almost any other area of government endeavour with up to eight agencies piecing the puzzle together, working collaboratively in the way they have. I think it's done incredibly well and a huge credit to the team in the NRC. (Interviewee – Steering Committee member)

- **Built strong partnerships with and between universities, technical experts and agency researchers**. More than 50 researchers and organisations have been directly involved in Monitoring Program projects (Figure 3), with many more involved indirectly. This has helped to tap into particular expertise for key projects, but has also worked to strengthen the networks, discussions and interactions between these practitioners that will help support further work in this space in the future.

The actual collaboration at the scientific level has been really, really positive. It's time consuming and difficult, because everyone has a legitimate question and that's the nature of science; it spurs more questions and more ideas. But at that level there has been, over time, increased trust and credibility through this process. So when people find that they've already got very busy day jobs but they are participating in this collaborative process, they are seeing rewards for their time invested. So that's important (Interviewee – Key agency stakeholder)

- Beyond the value of establishing a range of baseline data sets and monitoring (see Section 7.2), the Monitoring Program also appears to have **been valuable in providing a focal point for stakeholders to engage in forest-management.** The program's focus on transparency and engagement has meant that it is one of the few ways in which interested stakeholders can actively engage in activities relating to the management of forests. While this has meant that people have had high – and perhaps unrealistic – expectations of what it might produce or achieve, this role is something that could be built on into the future.

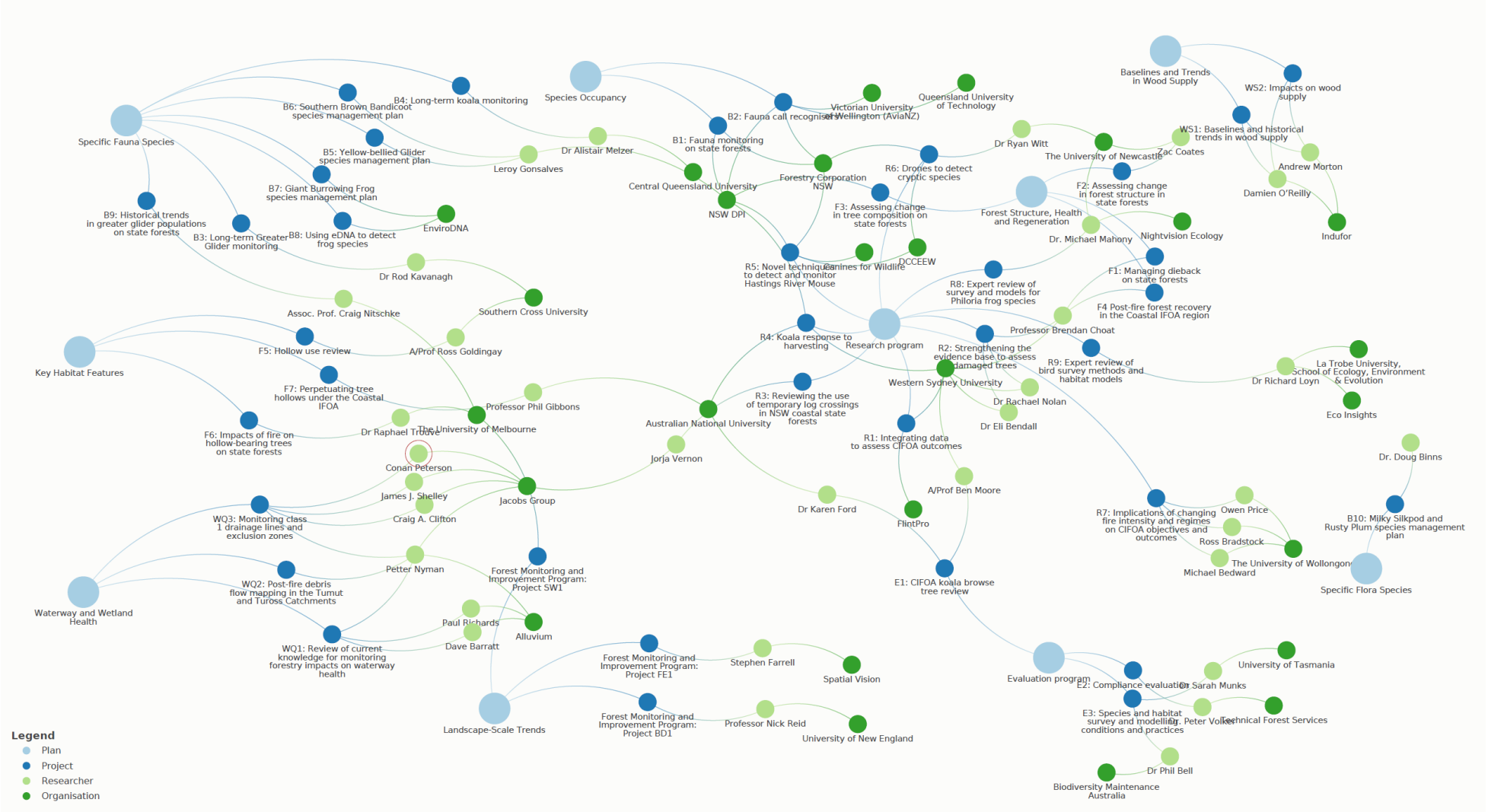

Figure 3. Network map of primary researchers and organisations involved in CIFOA Monitoring Program projects. Information drawn from published researchers and projects on Commission website.

8 Areas for improvement

The CIFOA Monitoring Program was generally recognised as having been a strong step in the right direction and that it is collecting invaluable data for the improved management of NSW's forests. That said, there was also widespread recognition that **there are a range of important ways in which the program could be improved**. This aligns well with one of the underlying principles of the program design – that it would be refined and improved over time.

The key areas identified for potential improvement are:

- **Public-facing communication**. Good effort has gone into communication around the Monitoring Program, with stakeholders recognising improvements in transparency as a key benefit. However, the program is under high levels of scrutiny and several submissions highlighted both the conflicting perspectives in this space but also some misinterpretations of what is and has been done under the program. Part of the solution here is, as noted by almost half of the interviewees, improved public reporting. Some of the specific ways in which the program could do this might include:
    - Clarify project progress and timelines. There was some frustration among interviewees about the lack of clarity about what project had finished and why reports were delayed. The Annual Report provides a simple summary of projects and progress but this could be turned into a more detailed 'dashboard' on the website that outlines the projects, their timeline and current status.
    - Consider publishing a set of clear information on NSW forests and forestry practices on the Commission website. This could help to both leverage the Commission's independence to address widespread misperceptions about how forests and forestry is managed in NSW.
    - Improved transparency of how priorities are set through the Annual Health Check (noting that a reprioritisation of the program overall is needed – see below).
    - Continue to improve data sharing processes, including timelines for release.
    - Development of a conceptual framework for the program (as discussed in Section 5.3), which might help communicate how the program elements relate to each other and the broader plans for addressing the Monitoring Program's underlying objective.
- **Review and refresh the program priorities** as part of the 5-year review. Key points to note here are:
    - The potential to review and revise Protocol 38 to itself be clearer about priorities for monitoring.
    - The need for any reprioritisation process continues to be driven by risks and gaps in knowledge, rather than popular sentiment. Where issues are already well understood, monitoring effort/expenditure can be deprioritised.
    - The need for the prioritisation process and any future design work to explicitly consider how the effectiveness of CIFOA conditions will be tested and explored.
    - Given the critical role that fire and climate change has been demonstrated to have, the need to more fully and explicitly integrate these factors into the questions and focus of

monitoring projects (focusing on the interplay of these factors with forestry operations). As noted by Bradstock et al (2021)[18]:

> *The monitoring program for the CIFOA needs to … focus on rapidly changing extremes of disturbance regimes (e.g. fire and harvesting) plus interactions with drought. This is needed to better understand likely responses of forest regeneration, structure, threatened species and other aspects of biodiversity to increasing fire frequency, driven by likely warming and drying. This will supply information crucial for understanding adaptation and intervention.*

  - The need to consider any gaps left by the loss of the FMIP and whether they are priorities to address moving forward.
  - The potential to use the prioritisation process to more clearly set expectations about what the monitoring program might be able to test and achieve over what timeframes. Some frustration with the current program's lack of tangible results may be addressed in future iterations through clearer expectation-setting.

- **Develop clearer processes for how the Monitoring Program should inform management**. At present, the expectation is simply that this will occur during the 5-year review process. There is, however, potential to consider whether there are other ways in which findings from monitoring projects might flow through to improved management. This is a key area of interest for stakeholders ranging from FCNSW to environmental groups. More broadly, FCNSW and EPA should consider how a more structured adaptive management approach might be implemented to test the efficacy of different approaches to achieving the outcomes outlined in the IFOA.
- **Continue to improve data management**. This was seen as an area in need of more attention, including the need for a comprehensive data management plan.
- **Consider the structure of the program and how it engages with research partners**. Part of the success of the program so far has been in its targeted use of agency, university and other experts. As the program evolves, there is the potential to combine this focus on the 'core' monitoring program work, with a model that also seeks to guide and support complementary work by researchers, students and others, and leveraging other resources and funding to do so.
- **Improved forward planning to facilitate better participation by agency staff in the design and review of Monitoring Program projects**. Feedback from interviewees suggested that agency staff are often under time and resourcing pressures. They suggested that the consultation process might be improved simply through having more time and a clearer schedule for reviewing and commenting on documentation.

[18] Bradstock R, Bedward M and Price O (2021). Risks to the NSW Coastal Integrated Forestry Operations Approval posed by the 2019/2020 fire season and beyond: A report to the NSW Natural Resources Commission. p. 3.

9 Appendix A – Protocol 38

Protocol 38: Monitoring program

Version 1: Approved by the EPA Chair and CEO on 3 October 2018

38.1 Introduction

(1) This ***protocol*** supports Chapter 8 of the ***approval***, which imposes requirements on ***FCNSW*** in relation to a ***monitoring program***.

(2) The conditions of the ***approval*** must be monitored to ensure they are effective in achieving the ***objectives*** and ***outcome statements*** set by the ***approval***.

38.2 Monitoring steering committee

(1) ***FCNSW*** must participate in a monitoring steering committee, as required under condition 122.1 of the ***approval***, with the following composition:

(a) a minimum of four independent and suitably qualified scientists that have demonstrated expertise in:

(i) ecology;

(ii) soil ***erosion*** and water quality/***pollution***; and

(iii) forest ***regeneration*** and ***Principles of Ecologically Sustainable Forest Management***; and

(b) NSW Government agency representatives responsible for other programs relating to monitoring of the environment (for example Saving our Species, NSW Koala Strategy or the NSW Scientific Committee).

(2) The monitoring steering committee must:

(a) ensure the ***monitoring program*** is designed to meet the requirements in condition 38.3 below;

(b) oversee the implementation of the ***monitoring program***;

(c) review the effectiveness of the ***monitoring program*** and inform necessary amendments to ensure it is progressing and providing scientifically robust results;

(d) review and analyse the ***monitoring program*** data and provide expert scientific advice to the ***EPA***, ***DPI*** and ***FCNSW***; and

(e) engage with community, environment and industry stakeholders on the ***monitoring program.***

*Note: In reviewing the design and timing of the **monitoring program**, the monitoring steering committee will need to consider the priorities listed in condition 38.3 and the **monitoring program's** available budget and resources.*

38.3 Design and contents of a monitoring program

(1) ***The monitoring program*** must be designed to:

(a) monitor and evaluate the effectiveness of the conditions of the ***approval***, including but

not limited to:

(i) the ***multi-scale landscape protections***;

(ii) ***drainage feature crossing*** and ***road*** conditions;

(iii) ***riparian exclusion zones*** and ***ground protection zones*** on class 1 ***classified drainage lines*** (including***,*** but not limited to, areas where Table 6a of the ***approval*** should apply);

(iv) ***exclusion zones*** for ***Coastal SEPP wetlands;***

(v) the effectiveness of soil and water protection in ***intensive harvesting forestry operations***;

(vi) protecting and recruiting ***hollow-bearing trees***;

(vii) Koala conditions;

(viii) the effectiveness of ***selective harvesting*** limits in achieving ***regeneration*** and stocking standards as measures of longer term ***regeneration***; and

(ix) the maintenance of sufficient levels of ***coarse woody debris***;

(b) establish a scientifically valid environmental and wood supply baseline to track and evaluate the effectiveness or impacts of the ***approval*** on the maintenance of environmental values and on wood supply;

(c) provide environmental trend monitoring at the landscape scale, including but not limited to:

(i) water quality monitoring;

(ii) forest ***regeneration***; and

(iii) ***biodiversity*** trend monitoring; and

(d) provide ***species***-specific monitoring, including but not limited to those management plans listed in **Protocol 21: Species management plan**;

(e) provide species-specific monitoring for other species which require monitoring under existing programs relating to the monitoring of threatened flora;

(f) meet ***Principles of Ecologically Sustainable Forest Management*** under the ***NSW Regional Forest Agreements***; and

(g) provide linkages to other relevant NSW Government programs and/or reviews relating to the monitoring of ***State Forest*** management and the NSW forest estate, including but not limited to:

(i) *NSW Report on Native Vegetation* (Office of Environment and Heritage);

(ii) Saving Our Species (Office of Environment and Heritage);

(iii) ***DPI****-Fisheries Strategic Research Plan 2014–2018 (DPI-Fisheries);*

(iv) NSW Regional Forest Agreements;

(v) AdaptNSW (Office of Environment and Heritage); and

(vi) ***DPI***- Forest monitoring program (***DPI***-Fisheries).

38.4 Monitoring program review and reporting

(1) The ***monitoring program*** required under Chapter 8 of the ***approval*** must incorporate reviews and public reporting of results and progress including:

(a) an annual forum and review of the ***monitoring program*** must be provided by the monitoring steering committee to the ***EPA*** and must include:

(i) ***monitoring program*** results;

(ii) ***monitoring program*** progress; and

(iii) an assessment of the adequacy of the ***monitoring program***;

(b) a major review of the ***monitoring program*** must be completed with each formal review for the ***approval*** and must include:

(i) detailed reporting of ***monitoring program*** progress and all results;

(ii) detailed analysis of trends; and

(iii) an assessment of the adequacy of the ***monitoring program;***

(c) recommendations of any necessary changes required to the ***approval***.

(2) The reviews of the ***monitoring program*** must be overseen by the monitoring steering committee***.***

(3) Reviews of the ***monitoring program*** must be provided to the ***EPA*** and ***DPI*** and will be published on the ***EPA*** website, or other locations as approved by the ***EPA***.

10 Appendix B – Evaluation framework for adequacy

Protocol 38 directs the evaluation to assess 'the *adequacy* of the monitoring program'. It is therefore essential to define what 'adequate' means and what it applies to.

The most straightforward interpretation of adequacy is whether the Monitoring Program is meeting its core objectives – i.e. providing information that can be used to "ensure the ongoing effectiveness of the approval".

The evaluation will assess this as far as possible during this evaluation. However, it is important to note that, for many components of the approval, effectiveness is something that will only emerge in the medium- to long-term through continued monitoring and analysis. It is not necessarily something that can be established in the relative short-term (i.e. at this five-year review point and of an approval that has effect for a period of 20 years[19]).

As such, our assessment of the adequacy of the Monitoring Program will consider three criteria based on a conceptual model for how the Monitoring Program should work (Figure 4), i.e.:

- its design
- its implementation
- its use (or potential use).

This follows the logic that 'if the Monitoring Program is well-designed', 'if the Monitoring Program is implemented well' and 'if there is evidence of it being or likely to be useful', then it can be considered adequate.

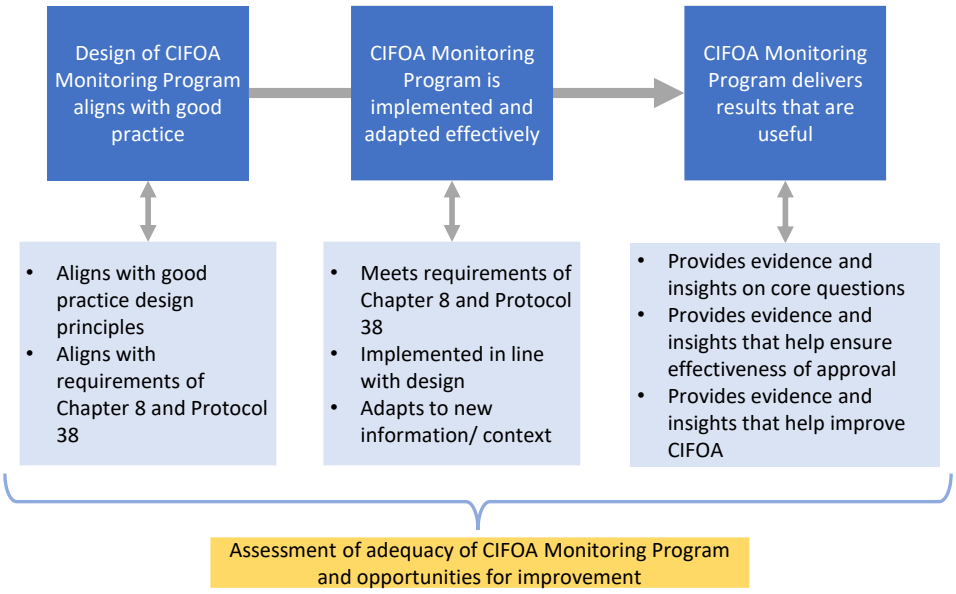

Figure 4. Conceptual model of how the CIFOA Monitoring Program, if designed and implemented adequately, should lead to it achieving its objective.

[19] CIFOA conditions – Division 2, 11.2

11 Appendix C – Assessment rubrics

Summary of alignment	Description
Clearly aligned work	There is a set of activities that are clearly aligned to this clause. The activities should, in time and if implemented appropriately, ensure that this clause is addressed. This might include analysis of existing data, discrete research or a plan for ongoing data collection/ monitoring.
Some aligned work	There might have been some work – or some work is planned – but it does not directly address the clause or it only addresses a particular element of it. It is unlikely to, on its own, address the requirements of the clause.
No or limited aligned work	There does not appear to be any work aligned to this clause, or at least none of direct relevance or significance.

Summary of progression	Description
Good progress	Activities related to this clause have been established and are delivering meaningful results. This could include specific reports or other outputs that are directly relevant to the clause.
Early progress	Activities have commenced but are yet to deliver useable results. There may be data available that has not been analysed or there could be outputs or reports that are indirectly relevant.
Limited progress	There has been minimal on-ground work in relation to this clause. Data has not been collected or collated and there are no immediate plans for action.

12 Appendix D – Additional evidence

Annual stakeholder forums:

- 2021: Interactive group session with stakeholders at the 2021 Institute of Foresters Australia National Conference. Program partners presented a range of work, including emerging findings from the IFOA monitoring program to date. Delegates from the government, industry, Aboriginal groups and the community attended the session, either in person or remotely.[20]
- 2022: A series of webinars and community forums presenting work from both the FMIP and CIFOA Monitoring Program:
    - Webinar 1 - Baselines, drivers and trends for species occupancy and distribution - October 2022
    - Webinar 2 – Carbon balance of NSW Forests - October 2022
    - Webinar 3 - Baselines, drivers and trends for forest water catchments - November 2022
    - Webinar 4 – Baselines and trends for forests extent, condition and loss - November 2022
    - Webinar 5 – Future forest scenarios - December 2022
- 2023: Three webinars presenting results from different components of the Monitoring Program. More than 155 people attended these events:[21]
    - Webinar 1 - Forest waterways - November 2023
    - Webinar 2 - Fauna monitoring in NSW state forests - December 2023
    - Webinar 3 - Forest carbon of NSW forests - December 2023
- 2024: A webinar presenting research on forest structure based on LiDAR data.

Annual Health Checks:

- August 2021:
    - reviewing the use of temporary log crossings on coastal state forests
    - determining the number and size of trees retained in clumps through analysis of existing data to support further hollow analysis
- October 2022:
    - initiated a project to address knowledge gaps and uncertainties in the application and interpretation of the Coastal IFOA definition of damage to trees
- November 2023
- December 2024 – annual health check conducted and will be reported in the 2024-25 Annual Progress Report

[20] CIFOA Monitoring Program - Annual Progress Report, July 2022
[21] CIFOA Monitoring Program - Annual Progress Report, October 2024