Natural Resources Commission

NSW Coastal Integrated Forestry Operations Approval Monitoring Program

Operational manual for fauna monitoring

May 2023

Forestry Corporation

PRIMARY INDUSTRIES
Forest Science
NSW GOVERNMENT

Enquiries

Acknowledgement of Country

The Natural Resources Commission acknowledges and pays respect to traditional owners and Aboriginal peoples. The Commission recognises and acknowledges that traditional owners have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters. We value and respect their knowledge in natural resource management and the contributions of many generations, including Elders, to this understanding and connection.

Acknowledgements

Cover photo: Spotted-tailed Quoll, by Forestry Corporation of NSW

List of acronyms

CIFOA	Coastal Integrated Forestry Operations Approvals
DBH	Diameter at breast height
FCNSW	Forestry Corporation NSW
HDD	Hard disk drive
GIS	Geographic Information System
GPS	Global Positioning System (GPS)
LiDAR	Light Detection and Ranging
m	metres
NPWS	National Parks and Wildlife Service
PPE	Personal protective equipment

RFA	Regional Forest agreements
SF	State forest
SWMS	Safe work method statements

Document version control

Version	Date	Comments/amendments
1.0	May 2023	Operational manual for fauna monitoring

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1 Introduction

The Natural Resources Commission (the Commission) is overseeing the design and implementation of the Coastal Integrated Forestry Operations Approval (Coastal IFOA) monitoring program. The program delivers evidence to inform continuous improvement of the Coastal IFOA.

The monitoring program will repeatedly collect data on state forests within the Coastal IFOA region to monitor the effectiveness of the conditions and change at the landscape-scale. Remote sensing and ground-based data collection methods will be used.

This document details the methods to collect ground-based data for fauna occupancy monitoring in a consistent manner through time, including standard protocols for device set-up and placement.

These methods build on existing methods developed through forest monitoring activities within NSW and other jurisdictions, including monitoring by NSW Department of Primary Industries, and several pilot programs for forest monitoring undertaken through the NSW Forest Monitoring and Improvement Program. Pilot fauna occupancy monitoring surveys developed and tested methods to collect naïve occupancy data to enable regional scale tracking of species occupancy across the state.

1.1 Sampling design

The fauna trend monitoring program will use occupancy modelling as the method to determine trends in the occupancy of species over time. This method relies on repeat samples and a minimum number of repeat surveys to provide a high probability of detection. The target species will be broadened over time as more species recognisers are developed allowing for re-analysis of existing remotely captured audio data. Further details on survey design are provided in the document *Fauna Occupancy Survey Design*.

Site selection has been based on the following factors:

- Existing or previous long-term monitoring programs
- Analysis of gaps in existing monitoring networks
- Spread of sites over the coastal State Forest estate
- Accessibility and logistics

Three hundred fauna monitoring survey sites are distributed across native state forests within the Coastal IFOA region (see Figures 1-3 in the *Fauna Occupancy Survey Design* document).

1.2 Field survey approach

Fauna monitoring for the Coastal IFOA will primarily use remote survey equipment. This includes:

1 ultrasonic detectors for echolocating bats

2 infrared motion-activated cameras for ground-dwelling fauna

3 acoustic recorders for nocturnal birds and arboreal mammals (and certain diurnal birds).

However, additional species-specific programs will be designed to supplement this program including but not limited to spotlight transects targeting the Greater Glider, which is not able to be detected using the remote devices, and frog species. These will be separate, species or group-specific monitoring programs. FCNSWs pre-harvesting spotlight transect, frog call broadcast locations and other long-term monitoring sites will be included in the design of the additional monitoring programs.

1.2.1   Monitoring site and sub-plot selection

The 300 survey sites consist of two-subplots, "On-Track" and "Off-track", thus a total of 600 subplots will be sampled. Sites are divided into annual sites and 'once-in-five-year site' groupings. Every site will be surveyed at least once every 5 years with a sequence of sampling in spring and autumn. Sites sampled in autumn will also be sampled in spring in other years.

At each of the On-track and Off-track sub-plots an ultrasonic detector for microbats, an infrared motion-activated camera for ground-dwelling fauna and an acoustic recorder for nocturnal birds and arboreal mammals (and certain diurnal birds) are deployed for a minimum of 14 nights. (See **Figure 1**). Deployments aim to sample different topographic locations to ensure each region's complement of 100 sites (200 subplots) sample a variety of topographic positions.

Guidelines for selecting the two sub-plots at each site are as follows:

▪   Each sub-plot should be separated by at least 500 m

▪   Off-track sub-plots are located at least 100 m from the nearest road/track avoiding noisy environments, such as running water from a creek. Each on-track sub-plot is to be positioned within 5-10 m of a road/track with camera and detectors pointed at track. These locations should be spread to sample a variety of topographic positions, including tracks within riparian buffers (but preferably not in noisy locations).

One of the two deployments will be located as close as practical to the sample site location specified in the design. The locations and deployments will be identified using GIS mapping prior to survey locations being determined on the ground. An initial desktop assessment was used to ensure that the survey locations can be suitably accessed within the selected site. However, ground verification and judgement will be required to ensure that the locations chosen are suitable and the above guidelines can be met.

The following definitions are provided to support these guidelines:

▪   a '**track**' for the purposes of the monitoring network includes any 'named' trail or track that is open, and accessible to motor vehicles, but not including sealed roads – device to be located within 5-10 m.

The rationale for two sub-plots is that this approach recognises the heterogeneity in local landscapes, and the different forest types and site productivity that is found, for example, in gullies compared to ridges and fauna that use tracks rather than off-track areas.
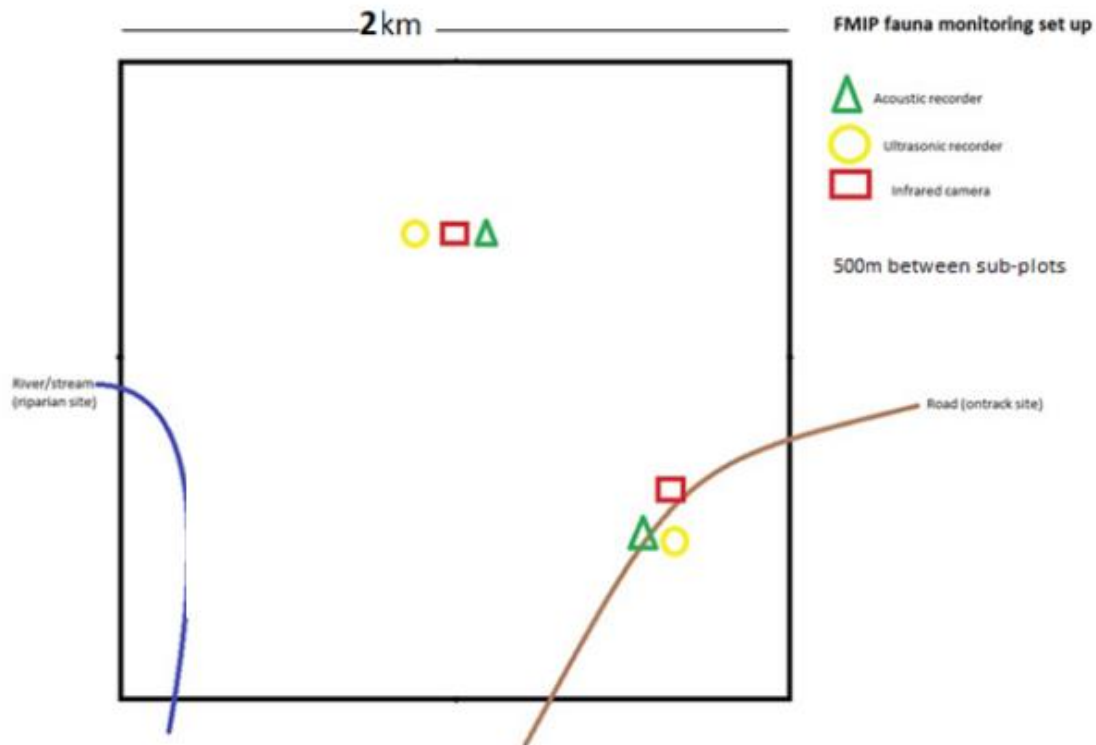
Figure 1. Typical fauna sub-plot set up for the Coastal IFOA monitoring program

1.2.2 Remote survey equipment

At each sub-plot, one camera, one acoustic detector and one ultrasonic detector will be set up. The devices are installed either on the same tree or a tree within 10m.

1.2.3 Timing of data collection

The devices are to be set for a minimum 14-night period in spring, but with a subset deployed in autumn (to target powerful owls), providing 14 days/nights of presence/absence data for each period from which occupancy estimates for each species could be generated.

2 Fieldwork planning

Planning prior to going into the field is essential to ensure data is collected safely and efficiently.

Planning should include obtaining maps and identifying sample sites, assessing potential risks and hazards, assessing access routes and walking routes, preparing equipment and consumables and training field crews.

Some of the information in this section may be available for sites that have been surveyed through previous or current monitoring programs.

For each site location, a grid reference (easting and northing) for the centre point will be provided and displayed as a run-time database in the FCNSW Map app. This site, or close to it, can be used to locate one of the subplots, with the other to be determined as access and location dictates.

Each site will be allocated a unique identifier comprised of the following components:

- Sub-region N (Northern), C (Central) or S (Southern)

- Number. 001 - 100

Each subplot will be allocated:
- to either an on-track site – "ON" or off-track site – "OFF"
- the device acronym:
    - RC – remote camera
    - SM – Song meter mini
    - BA – Song meter mini bat

For example, each sub-plot will be labelled C_031_ON_RC, or S_097_OFF_BA or N_012_ON_SM depending on the device, region and location.

This name will be captured in the device either through the Wildlife Acoustics software (Songmeter Configurator) or direct entry into the Reconyx cameras to enable tracking of the data to the subplot site and census details captured in the FCNSW map app.

2.1 Mapping of sample sites and access routes

A run-time database showing the precise location of the sites has been developed to display the site locations along with the schedule of sampling over the 5 years of the first phase of the program. All teams deploying devices will have access to the information through the FCNSW map app on an IPAD.

2.2 Prepare equipment

Equipment instruction sheets (listed in **Section 7** and available here) list what needs to be checked for each device prior to going into the field. Acquire all required equipment prior to commencement of field work.

Equipment should be checked and setup with the correct settings prior to each sample season (as per instructions). This is important for reliable data quality and sample biases due to equipment quality. Equipment testing should be completed at least one month prior to first deployment to allow time for any equipment repairs and replacement. Adequate resources need to be allocated to allow equipment maintenance and repair both in equipment and personnel time.

2.3 Field crew training

Field crew members should be suitably qualified for their role in fauna monitoring. Key experience and skills required by team members include the use of:

- ultrasonic detectors

- infrared motion-activated cameras

- acoustic recorders.

Training should be provided to all field crews on the specific methods described in this protocol and any equipment used. Training should be centralised prior to fieldwork commencing where feasible or provided on a regional or individual basis as needed by a suitably experienced operator.

3 Monitoring site establishment and information

This section describes how to locate and establish the fauna monitoring sites and sub-plots, the information to be collected on each site, and what to do when leaving the site at the end of each visit.

3.1 Site access and hazard assessment

3.1.1 Navigating to the monitoring site

The location of each fauna monitoring site is specified in the sampling design. Precise location information for the fauna monitoring sites will be captured at the installation of the equipment. The site and census details will be captured in the FCNSW map app via an IPAD and stored in FCNSW mobile feature class managed by the FCNSW GIS team.

The field team will navigate to the fauna monitoring sites using the FCNSW map app using an IPAD. Flagging tape will be used where appropriate and in a manner to avoid attracting attention to the equipment.

Tracking of routes to the monitoring sites will be captured as appropriate.

3.1.2 Safety

Existing FCNSW safety systems will be used for the monitoring project. Site safety plans and standard risk assessment methods for all fieldwork will be applied including the use and wearing of appropriate PPE.

3.1.3 Abandoning a sample site

If a sample site is assessed as inaccessible, it must be highlighted for review. Access may be provided by road maintenance programs or other appropriate processes to enable the site / subplots to be sampled before abandoning the site. If a site is recommended to be abandoned it must be brought to the attention of the program coordinator to determine if it could be swapped as being sampled at a later point or if a replacement site is required. Details are to be recorded about the reasons for abandoning the site and the replacement site.

3.2 Plot establishment

3.2.1 Device set-up

Set up each device following the instructions provided in the relevant appendices.

All devices are to be camouflaged as much as possible and where appropriate, locked to a tree using a python lock to avoid vandalism and theft. When setting up the monitoring site, remove any flagging tape from previous years to avoid drawing attention to monitoring equipment.

3.2.2 Marking the monitoring site

A site and census point will be recorded for each device in the FCNSW map app on an IPAD and will include:

- other useful information such as where tracks are blocked by fallen trees, where there is dry weather access only etc, for the benefit of future teams.

3.2.3 Recording site characteristics

A survey data sheet will be used to record field site characteristics to ensure a standardised output, with an electronic version to be developed for the FCNSW map app. It is required that site information be completed every sub-plot at a point centrally located between the camera and sound recorders.

4 Data management

All data will be collected using SD cards and uploaded to cloud storage.

Data is to be stored following in the folder structure of Device type, year sub-region, Site number, sub-plot.
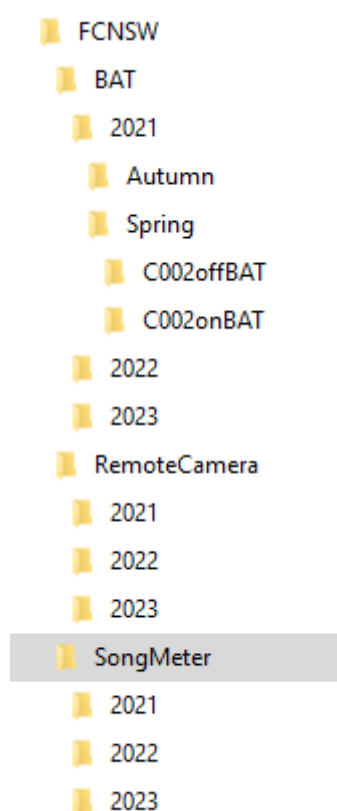
Data storage image structure legend:
- BA = ultrasonic bat call files from Song meter mini bat
- RC = Remote Camera
- SM = Song meter (Song meter mini)

4.1.1 Data export and tagging

Image files recorded will have false triggers removed using artificial intelligence software and managed by the DPI Forest Science team, with tagging to be undertaken by FCNSW ecology teams. Expert validation will occur to identify species recorded.

Species tags, confidence and image names are exported in batches as text files and formatted in Excel. The data will be supplied in the tagged excel format to DPI Forest

Science and the Commission for analysis with the other survey data. Collated data following identification will be stored in the cloud and uploaded in FCNSW BIODATA database and exported to BIONET database.

The photo management software ExifPro is used to process images and edit the text fields ('exif' data) that most digital cameras embed with every image. Photos are stored in site folders (e.g., Site 045) with two camera location sub-folders (e.g., 045A). The following process is followed for each camera location:

Photos are batch renamed with the convention *'camera location_year_photo processing person (surname)_original image number'* (e.g., 045A_2013_Bloggs_IMG237). This allows photos to be tracked back to their source, even if separated from their designated location. It also allows this information to be exported with the exif data.

The process for this is described below.

Using pre-defined tags, image exif data is edited to indicate:

1   camera set-up

2   start and end dates of sampling

3   species name and confidence level (definite, probable, possible)

4   lure disturbance (lure station without lure, entire station missing, lure displaced)

Confidence is assigned to the image identification:

- **Definite (high confidence in species or group identification):** All visible diagnostic features are representative for a taxon, with no degree of uncertainty.

- **Probable (some uncertainty in species or group identification):** Visible diagnostic features are similar to a taxon. e.g., a diagnostic feature is obscured or not present in an individual; an additional feature not representative of the taxon is present; or the species does not have traits that allow for visual distinction from other species in the same genus (such as Australian and Little Raven).

- **Possible (low confidence in species or group identification):** Visible diagnostic features are similar to several taxa e.g., several diagnostic features are obscured or not present in an individual; and/or features are inconsistent with several taxa.

Species tags were taken from a previous list and are added to each time a species has been newly detected by cameras. There are also tags for 'unknowns', where an animal cannot be identified to species but can be identified to type e.g., unknown macropod, unknown mammal, unknown bird, unknown reptile. Some genera can only very rarely be identified to species due to limitations with camera set up. In those cases, images are identified to genus e.g., *Rattus* sp., small dasyurid <500 grams.

Species identifications with a confidence level of 'probable' and 'possible' are reviewed collectively by the analysis team. Identifications that remain uncertain are reviewed by nominated species experts, except those deemed too low in quality for certain identification (e.g., small patch of fur in a corner of the frame, an animal up against the camera lens, or an obscured figure in background).

4.2   Acoustic call recorders (Songmeters – mini and mini bat)

4.2.1   Data export and tagging

Raw data from forest monitoring network sites will be stored in cloud-based storage as well as backed up on hard disk drives (HDDs). This data will be available for analysers through access to the cloud-based storage and or via sharing of HDDs.

Sounds files recorded will be tagged by DPI Forest Science team using recognisers and expert validation to identify species.

Species tags, confidence and image names are exported in batches as text files and formatted in Excel. The data will be used for analysis with the other survey data. Collated data following identification will be stored in the cloud and uploaded in FCNSW BIODATA database and exported to BIONET database.

5   Other considerations

5.1.1   Battery management

Careful consideration needs to be given to battery type used.

Batteries are a substantial annual cost to monitoring programs and there is also the cumulative environmental cost of disposable batteries.

Reconyx cameras require either high quality Lithium or rechargeable NIMH AA batteries at 12 x AA per unit.

Lithium batteries.
Lithium Energiser batteries should get 40,000 – 50,000 images out of a set of 12 in Reconyx cameras and will retain charge over multiple years. In a standard 14-day deployment for this monitoring program, 3,000 images may be taken per camera with some windy false triggers.

Lithium batteries should have more than enough charge to last over 2 years. However, if using over multiple years, we recommend keeping the same set of lithium batteries for each camera. At the end of the season, you may check how many images each camera took (or just search for those that took lots of false triggers) and replace those batteries for the following year to be sure of good battery power. An elastic band wrapped around 12 batteries with one labelled with the camera serial number is an easy way to keep track of batteries between years. Labelling them with the first year of use is also handy so that replacement can be scheduled.

An alternative to lithium batteries for Reconyx is high quality rechargeable AAs such as Eneloop Pro (black version). These do require some more labour in between surveys to recharge batteries, however, they will be able to be used for around 10 years with careful management. This can be a good option if these batteries are only kept for the monitoring program (e.g., not used for headlamps or random things throughout the year that may result in poor recharging regimes). We recommend keeping these in groups per unit (elastic band around 12 batteries) so that poor performing batteries may more easily be detected and replaced. Labelling them with the first year of use is also handy so that replacement can be scheduled so that data loss is avoided.

6   Review

The data collection and analysis methods described in this manual will be regularly reviewed (at least annually) by DPI Forest Science and FCNSW to incorporate learnings from field deployment and data analysis.

6.1   Roles and responsibilities

FCNSW is responsible for implementing field surveys in accordance with this manual. Improvements in methods identified through implementation should be incorporated into this manual by FCNSW.

DPI Forest Science is responsible for analysing data in accordance with this manual. DPI Forest Science should work with FCNSW to incorporate improvements in data analysis methods into their reporting.

The Commission is responsible for overseeing implementation of the fauna monitoring program and will review proposed updates to this manual to ensure methods are scientifically robust and data quality standards are maintained.

7   Instruction sheets

Further details on the set-up and programming of equipment are provided in the equipment instruction sheets:

▪   Reconyx camera instructions

▪   Song Meter Mini Bat instructions

▪   Song Meter Mini instructions

Other monitoring information and instructions include:

▪   Monitoring maps

▪   Site selection instructions

▪   Monitoring field sheet

▪   Monitoring bait station specifications

▪   Annual equipment check instructions.