2019-2020 Bushfires

Extent of impact on old growth forest

A joint report prepared by 2rog Consulting and the Natural Resources Commission – FINAL

3/04/2020

NSW GOVERNMENT Natural Resources Commission

2rog

DOCUMENT CONTROL

Project name:	2019-2020 Bushfires
Report name	Extent of impact on old growth forest
Date	3/04/2020
Version	4.1
Status	FINAL
Prepared by	Dr Julian Wall and Dr Hanieh Saremi from 2rog Consulting; Kylie Pfeiffer and Liam Hogg from the Natural Resources Commission

ACKNOWLEDGEMENT OF COUNTRY
The Natural Resources Commission and 2rog Consulting acknowledges and pays respect to traditional owners and Aboriginal peoples. We recognise and acknowledge 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.

EXECUTIVE SUMMARY

In November 2018, the Premier asked the Natural Resources Commission (the Commission) to independently oversee a program to reassess existing old growth forest mapping on coastal state forests over a period of four years. In response, the Commission developed and submitted the **draft** Old Growth Reassessment Framework (the framework) to the NSW Government in August 2019. The program has been on hold since August 2019 to allow Forestry Corporation of NSW to conduct further modelling of total hardwood wood supply, including hardwood plantations.

The program was initiated to address a potential reduction in wood supply resulting from stronger environmental protections in the new Coastal Integrated Forestry Operations Approval (IFOA).[1] This was to address the NSW Government's 'twin commitments' that the Coastal IFOA would result in no net change to wood supply and no erosion of environmental values.

The framework is designed to reassess areas currently mapped as old growth once there is a verified wood supply shortfall. Under the framework, only old growth forest ecosystems that have exceeded JANIS[2] old growth and biodiversity reservation targets would be assessable. Further, to be eligible for reassessment, these areas would need to occur in state forest informal reserves or lands protected by prescriptions, not contain old growth forest and not hold special environmental values. The framework is designed to assist decision-makers ensure that all evidence is considered before any mapped old growth boundaries are adjusted.

The 2019-20 fires burnt more than 2.4 million hectares across the north coast, including over 60 percent of mapped old growth forest. The intensity of the fires varied widely. Given the extensive nature of the fires and varying impacts, the Commission sought evidence related to impacts on old growth forest that may have bearing under the framework.

The Commission engaged 2rog Consulting to map the extent of the 2019-20 fires on mapped old growth forest ecosystems. The assessment overlaid fire-scar mapping prepared by the Department of Planning, Industry and Environment (DPIE)[3] with mapped old growth forest ecosystems across the North East Regional Forest Agreement (RFA) region. DPIE's method (Google Earth Engine Burnt Area Map or GEEBAM) has not, to date, been validated with field investigations. It does not determine the recovery potential of the fire affected area.

The Commission used the 2rog Consulting spatial analysis to assess the impact on assessable areas under the assumption that protected old growth with burnt canopy would no longer be assessable under the framework. This analysis is not intended to imply that old growth forest with burnt canopy is no longer old growth or no longer protected. Rather, as a result of changes to canopy cover from the recent wildfires, it would not be possible to accurately remap severely burnt areas using remote sensing, as proposed in the draft old growth assessment methodology, which is one component under the framework.

The initial stage of this draft method uses remote sensing data from LiDAR[4] and aerial photographic interpretation (API) to assess canopy cover of regrowth, mature and senescing growth stage trees, which is then used to indicate the areas of forest that are likely to be structurally mature or not for further field investigation. The 2rog Consulting spatial analysis found that over 525,000 hectares of protected old growth forest (29 percent) occur in the canopy fully or partially burnt fire-scar categories. These categories were

[1] Natural Resources Commission (2018) *Supplementary Advice on Coastal Integrated Forestry Operations Approval Remake Old Growth Forests and Rainforests - North Coast State Forests.* Available at: https://www.nrc.nsw.gov.au/publications.

[2] Commonwealth of Australia (1997), *Nationally agreed criteria for the establishment of a comprehensive, adequate and representative reserve system for forests in Australia*, a report by the Joint ANZECC / MCFFA National Forest Policy Statement Implementation Sub-committee.

[3] DPIE (2020), *Understanding the impact of the 2019-20 fires*, webpage available at https://www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/fire/park-recovery-and-rehabilitation/recovering-from-2019-20-fires/understanding-the-impact-of-the-2019-20-fires

[4] LiDAR – light detection and ranging, a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth

chosen because the burnt canopies would affect the validity and accuracy of the draft method to assess canopy cover and locate mature forest.

The Commission's assessment found 73,600 hectares of assessable old growth forest in informal reserves and lands managed under prescription in north coast state forests. Of this, 42,600 hectares is of commercial forest ecosystem type. If burnt canopy areas are removed from the analysis to determine the assessable area, only 5,800 hectares remains assessable, of which only 3,500 hectares are commercial forest ecosystem types.

In previous advice, the Commission reported there would be an estimated shortfall of 7,600 to 8,600 cubic metres of high quality timber per year, as a result of new conditions under the Coastal IFOA related to mapping threatened ecological communities and koala protections.[5] In supplementary advice, the Commission identified significant errors in old growth forest mapping and reported that 14,600 hectares of incorrectly mapped and over-target old growth in north coast state forests could meet the estimated wood supply shortfall over a twenty year period. [6]

Without the impact of bushfires being considered, the assessable old growth area under the framework may yield enough timber to address the previously estimated wood supply shortfall, subject to a detailed assessment and confirmation that a wood supply shortfall exists. If burnt canopy areas are not able to be assessed under the framework, the significantly reduced assessable area would not yield the previously estimated wood supply shortfall.

Given the extent of canopy fully and partially burnt fire-scar categories, the remote sensing component of the draft old growth assessment method cannot be accurately applied. Remote sensing (LiDAR combined with API) enables a relatively rapid assessment of forest structure across large areas of forest. Without the guidance this provides on where mature forest is likely to occur, field investigations across very large areas of state forest could be used instead. However, a field survey approach would take years to implement at considerable cost. This is not considered feasible under the terms of reference for the program.

Forest recovery times cannot be estimated using the fire-scar mapping currently available. For intensely burnt forest, significant time is needed before the remote sensing component of the method could be applied. Recovery times will vary significantly depending on the forest type, the intensity of the fire and the occurrence of drought during the recovery period. At the landscape scale, post-fire recovery could take five to seven years, or potentially longer.[7] Forest canopies impacted by fire are unlikely to recover within the program timeframe specified in the terms of reference (i.e. the next two years).

The program to reassess old growth forest mapping on coastal state forest can no longer proceed within the allotted timeframe and funding. The elements of the program related to verifying wood supply from coastal state forests are still relevant and could proceed.

[5] Natural Resources Commission (2016), *Advice on Coastal Integrated forestry Operations Approval Remake*.
[6] Natural Resources Commission (2018), *Supplementary advice on Coastal Integrated forestry Operations Approval Remake, old growth forests and rainforests – north coast state forests*.
[7] Heath JT, Chafer CJ, Bishop TFA and Van Ogtrop FF (2016) Post-Fire Recovery of Eucalypt-Dominated Vegetation Communities in the Sydney Basin, Australia, in *Fire Ecology* 12, 53–79, available online at https://doi.org/10.4996/fireecology.1203053

TABLE OF CONTENTS

EXECUTIVE SUMMARY III

01 INTRODUCTION 7

01.1 BACKGROUND 7
01.2 OVERVIEW OF THE ASSESSMENT 7
01.3 WHAT IS OLD GROWTH FOREST? 8
01.4 FIRE-SCAR DATA 8

02 REGION OF STUDY 10

03 APPROACH 12

OVERVIEW OF SPATIAL ANALYSIS 12
03.1 CAR RESERVE TYPES 12
03.1.1 Overview 12
03.1.2 Step 1a – Dedicated reserves 12
03.1.3 Step 1b – Informal reserves 13
03.1.4 Step 1c – State Forest areas protected under prescription 13
03.1.5 Step 1d – Private conservation reserves 14
03.2 STEP 2 – OLD GROWTH FOREST 14
03.2.1 Task 2a - Total area of old growth forest 14
03.2.2 Task 2b - POG with dedicated reserves 14
03.2.3 Task 2c - POG within informal reserves 14
03.2.4 Task 2d - POG within areas managed under prescription 14
03.2.5 Task 2e - POG within private reserves 14

04 OUTPUTS 15

04.1 STEP 1 – PROTECTED AREA NETWORK (CAR RESERVE SYSTEM) 15
04.1.1 Overview 15
04.2 STEP 2 – OLD GROWTH FOREST 16
04.2.1 Step 2a – All old growth forest (also known as candidate old growth) 16
04.2.2 Steps 2b to 2e – Candidate old growth within the protected area network 19

05 DETERMINING ASSESSABLE AREAS OF OLD GROWTH AND THE IMPACT OF FIRES 24

05.1 OVERVIEW OF ASSESSMENT 24
05.2 POTENTIAL IMPACTS OF FIRES ON OLD GROWTH 24
05.3 RESULTS OF THE ASSESSABLE AREA ASSESSMENT 25

APPENDIX 1: SPATIAL LAYERS AND RELEVANT METADATA 29

APPENDIX 2: COMMERCIAL FOREST ECOSYSTEM TYPES APPLIED IN THE ASSESSMENT 30

LIST OF FIGURES

FIGURE 1. PROPORTION OF UNE AND LNE AFFECTED BY 2019 BUSHFIRES....10
FIGURE 2. REGION OF STUDY INCLUDING UNE AND LNE RFA REGIONS AND FIRE-SCAR FOOTPRINT....11
FIGURE 3A PROPORTION OF FIRE-SCAR CLASSES WITHIN THE PROTECTED AREA NETWORK IN THE NORTH EAST RFA REGIONS....16
FIGURE 4. PROPORTION OF FIRE-SCAR CLASSES WITHIN OLD GROWTH FORESTS IN THE NORTH EAST RFA REGIONS....17
FIGURE 5. DISTRIBUTION OF FIRE-SCAR CLASSES WITHIN ALL CANDIDATE OLD GROWTH FOREST IN THE NORTH EAST RFA REGION....18
FIGURE 6. PROPORTION OF FIRE-SCAR CLASSES WITHIN POG IN THE NORTH EAST RFA REGIONS....19
FIGURE 7. PROPORTION OF FIRE-SCAR CLASSES WITHIN POG IN DIFFERENT PARTS OF THE PROTECTED AREA NETWORK IN UNE AND LNE....22
FIGURE 8. DISTRIBUTION OF FIRE-SCAR CLASSES WITHIN POG IN THE NORTH EAST RFA REGION....23

LIST OF TABLES

TABLE 1. FIRE-SCAR CLASSES DERIVED FROM GEEBAM....9
TABLE 2. FIRE-AFFECTED AREAS IN UNE AND LNE (ALL LAND TENURES)....10
TABLE 3. ARCGIS ANALYSES UNDERTAKEN FOR THIS PROJECT....12
TABLE 4 IMPACT OF BUSHFIRES ON THE PROTECTED AREA NETWORK IN UNE AND LNE....15
TABLE 5. FIRE-AFFECTED AREAS OF CANDIDATE OLD GROWTH FOREST IN UNE AND LNE....17
TABLE 6. AREA OF FIRE-SCAR CLASSES AFFECTING POG IN THE NORTH EAST RFA REGIONS....19
TABLE 7. IMPACT OF BUSHFIRES ON PROTECTED OLD GROWTH FOREST IN DIFFERENT TYPES OF RESERVE IN UNE AND LNE....20
TABLE 8: EFFECT OF 2019-20 BUSHFIRES ON CANDIDATE, PROTECTED AND ASSESSABLE OLD GROWTH WITHIN THE NORTH EAST RFA REGION AND NORTH COAST STATE FORESTS....27
TABLE 9: ASSESSABLE OLD GROWTH AREAS IN NORTH COAST STATE FOREST BEFORE AND AFTER THE 2019-20 FIRES....28

ABBREVIATIONS

Abbreviation	Description
CAR	Comprehensive Adequate and Representative
CCA	Community Conservation Area
COG	Candidate old growth
DPIE	NSW Department of Planning, Infrastructure and Environment
FCNSW	Forestry Corporation of NSW
FMZ	Forest Management Zone
GEEBAM	Google Earth Engine Burnt Area Map
IFOA	Integrated Forestry Operations Approval
LNE	Lower North East
NBR	Normalised Burnt Ratio, modelled using GEEBAM
NP	National Park
NPWS	NSW National Parks and Wildlife Service (part of DPIE)
POG	Protected old growth
RFA	Regional Forest Agreement
SCA	State Conservation Area
SMZ	Special Management Zone
SPZ	Special Protection Zone
UNE	Upper North East

01 INTRODUCTION

01.1 Background

In November 2018, the Premier asked the Natural Resources Commission (the Commission) to independently oversee a program to reassess existing old growth forest mapping and associated special environmental values on coastal state forests. In response, the Commission developed and submitted the **draft** Old Growth Reassessment Framework (the framework) to the NSW Government in August 2019. The program has been on hold since August 2019 to allow Forestry Corporation of NSW to conduct further modelling of total hardwood wood supply, including hardwood plantations.

The program was initiated to address a potential reduction in wood supply resulting from stronger environmental protections in the new Coastal Integrated Forestry Operations Approval (IFOA).[8] This was to address the NSW Government's 'twin commitments' that the Coastal IFOA would result in no net change to wood supply and no erosion of environmental values.

The framework is designed to reassess areas currently mapped as old growth once there is a verified wood supply shortfall. Under the framework, only old growth forest ecosystems that have exceeded JANIS[9] old growth and biodiversity reservation targets would be assessable. Further, to be eligible for reassessment, these areas would need to occur in state forest informal reserves or lands protected by prescriptions, not contain old growth forest and not hold special environmental values. The framework is designed to assist decision-makers ensure that all evidence is considered before any mapped old growth boundaries are adjusted.

The 2019-2020 bushfire season was unprecedented, with about 5.3 million hectares of land in NSW affected by fire over a 5-month period from early September 2019 to early February 2020[10]. At the time NSW was in the grip of a serious drought, in some places the worst on record, with very dry catchments and periods of extreme heat. Consequently, some regions were severely impacted by fire, with loss of human life and billions of dollars of damage to infrastructure.

Across the north coast, the fires burnt more than 2.4 million hectares between early September and mid-December 2019, including more than 60 percent of mapped old growth forest. Given the extensive nature of the fires, the Commission sought evidence related to fire impacts on old growth forest that may have bearing under the framework.

01.2 Overview of the assessment

The Commission engaged 2rog Consulting to map the extent of the 2019-20 wildfires on mapped old growth forest ecosystems. The assessment overlaid fire-scar mapping prepared by the Department of Planning, Industry and Environment (DPIE)[11] with the extent of old growth forest ecosystems across the North East RFA region. More information on the fire-scar data is provided in Section 01.4.

The Commission used the 2rog Consulting spatial analysis to assess the impact on assessable old growth areas under the framework as determined considering JANIS reservation targets. Further detail is provided in Section 05.3.

[8] Natural Resources Commission (2018) *Supplementary Advice on Coastal Integrated Forestry Operations Approval Remake Old Growth Forests and Rainforests - North Coast State Forests.* Available at: https://www.nrc.nsw.gov.au/publications.

[9] Commonwealth of Australia (1997), *Nationally agreed criteria for the establishment of a comprehensive, adequate and representative reserve system for forests in Australia*, a report by the Joint ANZECC / MCFFA National Forest Policy Statement Implementation Sub-committee.

DPIE (2020), *Understanding the impact of the 2019-20 fires*, webpage available at https://www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/fire/park-recovery-and-rehabilitation/recovering-from-2019-20-fires/understanding-the-impact-of-the-2019-20-fires

[11] Ibid.

The fire impacts were assessed in the two North East Regional Forest Agreement (RFA) regions in northern NSW - Upper North East (UNE) and Lower North East (LNE). The Southern and Eden RFA regions were not assessed as fire mapping data was not available at the time the analysis commenced.

01.3 What is old growth forest?

Old growth forest is defined as:

> **"Ecologically mature forest where the effects of disturbance are now negligible"**[12]

This definition was developed by the Joint ANZECC/MCFFA[13] National Forest Policy Statement Implementation Sub-Committee (JANIS). It is an agreed national operational interpretation of the definition from the National Forest Policy Statement and is used in NSW RFAs and private native forestry.

In the 1990s, the comprehensive regional assessments (CRAs) prepared ahead of the RFAs, mapped areas of potential old growth forest across the north coast. These areas were mapped as 'candidate' old growth forest, as they were considered as candidates for listing as old growth forest, which warranted field investigations. While these field investigations did not occur, large areas of candidate old growth forest were protected in national parks and reserves, and special management zones declared under the *NSW Forestry Act 2012*.

Any areas of candidate old growth forest that occur in a protected area as defined by the JANIS comprehensive, adequate and representative (CAR) reserve system are referred to as 'protected old growth' in this report. The area of protected old growth, as determined through a contemporary assessment of reserves in the public and private estate, and the area of candidate old growth, as mapped during the CRAs, are used to determine the status of JANIS old growth reservation targets. The status assessment is conducted for each individual old growth forest ecosystem within the upper north east and lower north east regions separately.

Old growth forest ecosystems that have met and exceeded all JANIS old growth and biodiversity reservation targets are referred to as 'assessable' in this report if they occur in state forest informal reserves or lands managed under prescription. Biodiversity reservation targets relate to forest ecosystems as mapped during the CRAs, of which the old growth forest ecosystem is a subset.

In summary, the types of old growth referred to in this report are:

- **candidate old growth** – as mapped during the CRAs and reported in the RFAs
- **protected old growth (POG)** – any candidate old growth that occurs in the CAR reserve system on public and private land
- **assessable old growth** – any old growth forest ecosystem that has met and exceeded the JANIS targets for old growth and biodiversity reservation, and that occurs in state forest informal reserves or land managed under prescription.

More information on the components of the CAR reserve system is provided in Section 03.1 and the full list of JANIS old growth and biodiversity reservation targets used in the assessment are provided in Section 05.

01.4 Fire-scar data

The NSW Department of Planning, Infrastructure and Environment (DPIE) in collaboration with the University of New South Wales has developed a rapid mapping approach to determine where wildfires in NSW have affected vegetation. It is called the Google Earth Engine Burnt Area Map (GEEBAM) and it models Normalised Burnt Ratio (NBR) from near infrared and short-wave infrared wavelengths captured

[12] JANIS (1997) *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia*, p. 14. Available at: http://www.agriculture.gov.au/SiteCollectionDocuments/rfa/publications/nat_nac.pdf.

[13] ANZECC - Australian and New Zealand Environment and Conservation Council; MCFFA - Ministerial Council on Forestry, Fisheries and Aquaculture.

from a time-series of Sentinel-2 satellite imagery, including before and after images. GEEBAM provides a rapid estimate of:

- where fire skipped over an area within the fire ground, leaving it little affected
- where it burned the understorey and some of the canopy
- where it burned the canopy only
- where it appears to have burned all vegetation.

While GEEBAM predicts how severely the tree canopy has burnt, the method has not, to date, been validated with field investigations. It does not determine the recovery potential of the bushfire affected area.

Five GEEBAM burn classes have been established using NBR data (Table 1).

Table 1. Fire-scar classes derived from GEEBAM

Pixel value	Class	Description
0	No data	No data provided (no bushfire activity).
1	Little change	Little change observed pre- and post-fire. These areas represent refuge zones within the mapped fire-scar.
2	Canopy unburnt	A green canopy within the fire ground that is likely to have been burnt in the understorey. These areas may also act as refugia for native fauna, particularly arboreal species.
3	Canopy partially burnt	A mosaic of burnt and unburnt canopy.
4	Canopy fully burnt	The canopy and understorey are most likely burnt.

GEEBAMv2p1 (05 Jan) and GEEBAMv2p2 (23 Jan) were used for analyses. These two versions were overlaid to create a combined layer in which each pixel was assigned the most severe burn class[14]. All RFA areas outside the extent of 2019-2020 bushfire activity were assigned a value of '5' (no bushfire activity).

[14] Most pixels in versions v2p1 and v2p2 had the same value (i.e. the same burn characteristics), however in some cases the values differed (e.g. change from 'canopy partially unburnt' to 'canopy unburnt' on account of foliage regeneration months following the fire). In these cases, the highest level of burn was selected.

02 REGION OF STUDY

The assessment was undertaken within the total extent of UNE and LNE RFA regions, which extend from the Hunter Valley to the Queensland-NSW border, and inland to the north-western slopes. The total areas affected by the 2019 bushfires in UNE and LNE by fire-scar class are listed in Table 2, while the proportion of the UNE and LNE regions burnt is illustrated in Figure 1.

About 28% of the total area of UNE was affected by fire (i.e. within the fire-scar mapping extent consisting of categories 1, 2, 3 and 4) and within the fire-scar 65% of the forest canopy was either totally or partially burnt. The impact in LNE was less, with 23% of the total area of LNE affected by fire, and 52% of the fire-scar area in the canopy fully or partially burnt categories.

The distribution of fire-scar classes within UNE and LNE is shown in Figure 2.

Table 2. Fire-affected areas in UNE and LNE (all land tenures)

Fire-scar class	UNE		LNE		North East RFA regions	
	Area (hectares)	*% area*	Area (hectares)	*% area*	Area (hectares)	*% area*
Canopy fully burnt	280,342	*7.1*	230,992	*4.0*	511,334	*5.3*
Canopy partially burnt	532,297	*13.6*	545,006	*9.4*	1,077,303	*11.1*
Canopy unburnt	307,220	*7.8*	536,932	*9.3*	844,152	*8.7*
Little change	132,223	*3.4*	172,197	*3.0*	304,420	*3.1*
Outside bushfire zone	2,669,437	*68.1*	4,311,663	*74.4*	6,981,100	*71.8*
All	3,921,519		5,796,790		9,718,309	

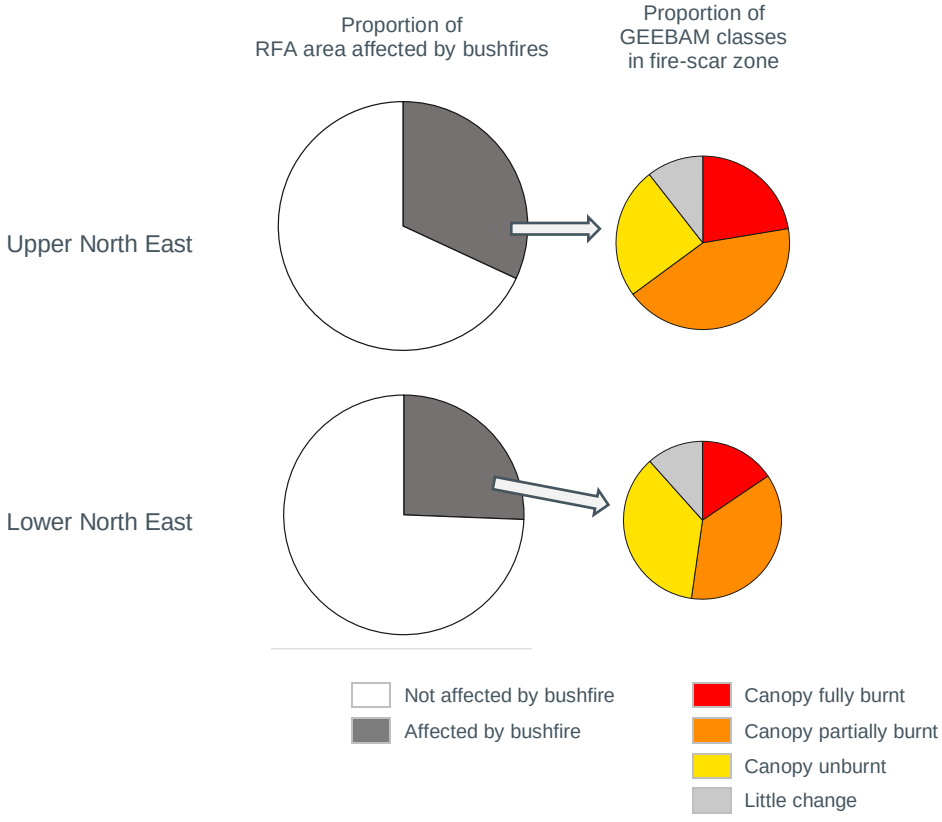

Figure 1. Proportion of UNE and LNE affected by 2019 bushfires

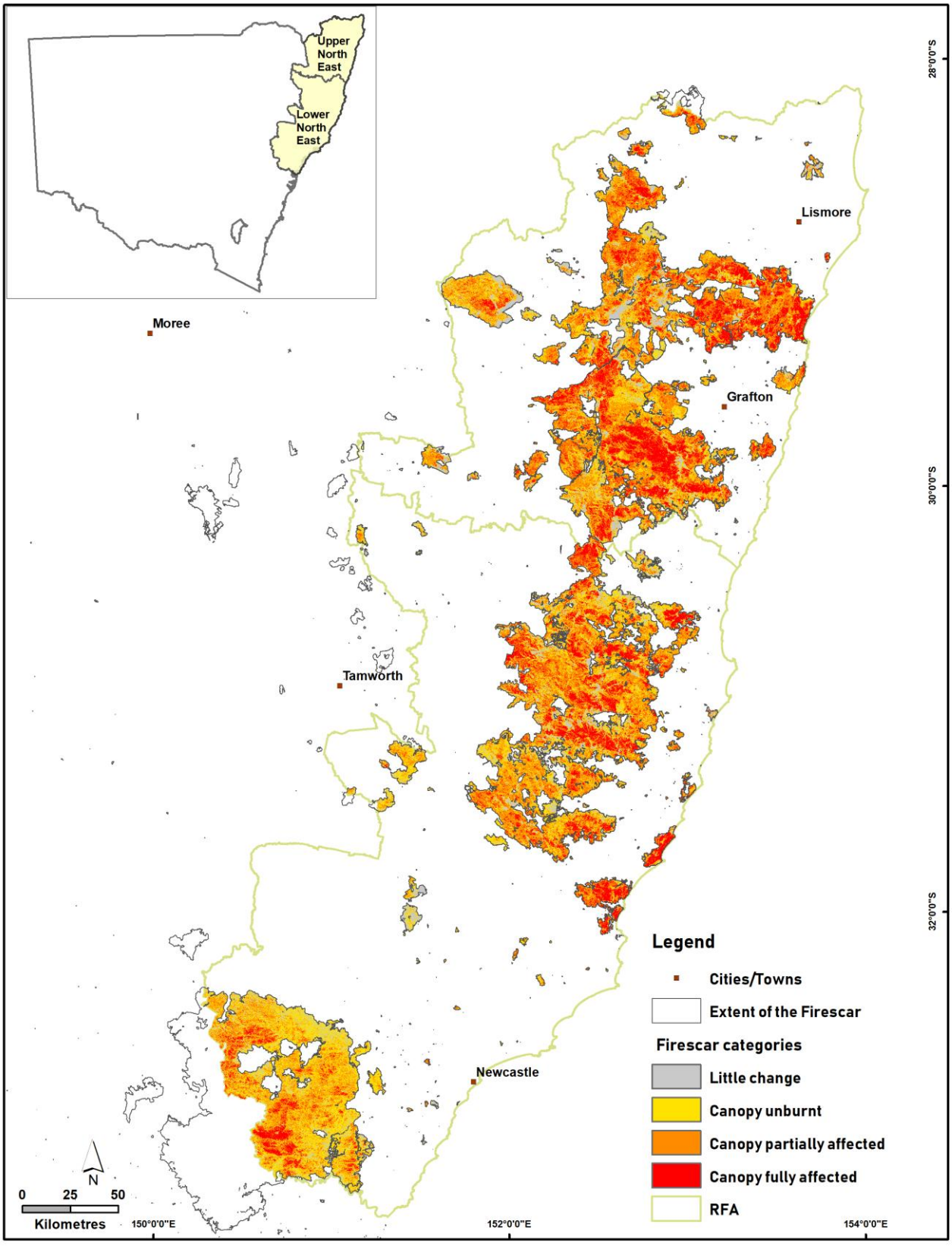

Figure 2. Region of study including UNE and LNE RFA regions and fire-scar footprint

03 APPROACH

Overview of spatial analysis

A total of nine analyses were undertaken within ArcGIS using GEEBAM data and other data layers supplied by the Commission, with an output raster layer developed for each step (Table 3). An excel file entitled "*NRC-011-2rog-v1.xlsx*" was also produced that contained all summary data associated with each of the nine steps.

Table 3. ArcGIS analyses undertaken for this project

Step	Fire-scar Analysis	Output raster file
1a	Dedicated reserves	Dedicated_FS
1b	Informal reserves	Informal_FS
1c	Areas under prescription with state forest	Prescription_FS
1d	Private reserves	Private_FS
2a	Old growth forest	OG_FS_UNE; OG_FS_LNE
2b	POG within dedicated reserves	Dedicated_POG_FS
2c	POG within informal reserves	Informal_POG_FS
2d	POG within prescription-managed lands	Prescription_POG_FS
2e	POG within private reserves	Private_POG_FS

Prior to GIS analyses all spatial data were projected to the GDA_1994_NSW_Lambert coordinate space. The Lambert Conformal Conic projection preserves shape and is effectively equal-area at and near the standard parallels (-30° 45' and -35° 45'). It also avoids issues with transition from UTM Zone 56 to Zone 55, which would be important if similar assessments were undertaken in the southern RFA regions (Southern and Eden).

As all GIS analyses were conducted in raster format (due to data size), the GEEBAM layer was chosen as the reference layer for these analyses. GEEBAM was originally supplied in Geographic or D_WGS_84 coordinates (i.e. decimal degrees), so was projected into NSW Lambert coordinates prior to analyses, resulting in a grid-cell size of about 14.2 m.

All other layers were also projected to NSW Lambert using the GEEBAM parameters (cell origin and size) to ensure cell-on-cell parity.

Specific detail about each analysis is provided in the following sections.

Appendix 1 provides the list of spatial layers used, the spatial layer custodian and date information.

03.1 CAR reserve types

03.1.1 Overview

ArcGIS was used to intersect the four fire-scar classes, plus areas not affected by fire, with the four main components of the comprehensive, adequate and representative (CAR) reserve system:

Step 1a Dedicated reserves
Step 1b Informal reserves
Step 1c Values protected by prescription
Step 1d Private land reserves

03.1.2 Step 1a – Dedicated reserves

GEEBAM fire-scar classes were intersected with dedicated reserves to determine the extent of each GEEBAM class within each type of dedicated reserve. Data were reported by RFA region. Dedicated reserves incorporated the following types:

NPWS-managed land

- National Park
- Nature Reserve
- Aboriginal Area
- Community Conservation Area (CCA) 1 (National Park)
- CCA2 (Aboriginal Area)

State Forest

- Forest management zone[15] (FMZ) 1 Flora Reserves (Special Protection Zone (SPZ)) in state forest

03.1.3 Step 1b – Informal reserves

GEEBAM fire-scar classes were intersected with informal reserves to determine the extent of each GEEBAM class within each type of informal reserve. Data were reported by RFA region. Informal reserves incorporate the following types:

NPWS-managed land

- CCA3 (State Conservation Area) Zone
- Karst Conservation Area
- Historic Site
- Regional Park
- State Conservation Area (SCA)

State Forest

- FMZ2 patches >40 hectares and >200 m wide; or adjacent to dedicated reserves

Other

- Crown Lands managed for conservation
- Commonwealth Defence lands

03.1.4 Step 1c – State Forest areas protected under prescription

GEEBAM fire-scar classes were intersected with areas of state forest excluded from logging under prescription to determine the extent of each GEEBAM class within each type of prescription lands, which incorporate the four types listed below. Data were reported by RFA region.

- FMZ2 patches < 40 hectares and/or < 200 m wide, and not adjacent to dedicated reserves
- FMZ 3a
- FMZ 3b
- Other mapped exclusions in FMZ4 (general management zone where forestry operations are allowed).

Other mapped exclusions under the IFOA that did not overlap any areas of FMZ1, FMZ2, FMZ3a or FMZ3b were identified within the NetHarvestArea vector layer, including the following categories:

- NW Fauna temporary exclusion
- Slope30 Slope exclusion (slopes > 30 degrees)
- XB Buffer exclusion
- XF Flora exclusion
- XH Ridge/headwater habitat exclusion
- XK Rock exclusion
- XN Non-commercial type exclusions
- XO Old growth exclusion
- XR Rainforest exclusion
- XW Fauna exclusion

[15] Forest management zones are defined in the publication, State Forests of NSW (1999), *Managing our forests sustainably – forest management zones in NSW state forests*, operational circular 99/10.

03.1.5 Step 1d – Private conservation reserves

GEEBAM fire-scar classes were intersected with conservation reserves established on private land to determine the extent of each GEEBAM class within each type of private land reserve, which incorporate the five types listed below (noting they must be made under a legally binding mechanism and be in-perpetuity to be included in the CAR reserve system). Data were reported by RFA region.

- Registered property agreements
- Conservation agreements
- Biobank sites
- Conservation land covenants under the Nature Conservation Trust
- Indigenous Protected Areas

03.2 Step 2 – Old growth forest

ArcGIS was used to intersect the four fire-scar classes, and areas outside the bushfire zone, with the following old growth extents in UNE an LNE:

Task 2a Total area of old growth forest (i.e. candidate old growth – COG)
Task 2b Protected old growth (POG) with dedicated reserves
Task 2c POG within informal reserves
Task 2d POG within areas managed under prescription
Task 2e POG within private reserves

03.2.1 Task 2a - Total area of old growth forest

GEEBAM fire-scar classes were intersected with the extent of old growth forests in UNE and LNE (based on candidate old growth forest mapping developed during comprehensive regional assessments in the 1990s) to determine the extent of each GEEBAM class, and areas outside GEEBAM, within the old growth forest footprint. Data were reported by RFA region.

03.2.2 Task 2b - POG with dedicated reserves

Old growth forest ecosystem models were intersected with the fire-scar x dedicated reserve raster developed in Task 1a (Section 03.1.2) to determine the total area of POG within different classes of dedicated reserve subject to different fire-scar classes.

03.2.3 Task 2c - POG within informal reserves

Old growth forest ecosystem models were intersected with the fire-scar x informal reserve raster developed in Task 1b (Section 03.1.3) to determine the total area of POG within different classes of informal reserve subject to different fire-scar classes.

03.2.4 Task 2d - POG within areas managed under prescription

Old growth forest ecosystem models were intersected with the fire-scar x prescription-lands raster developed in Task 1c (Section 03.1.4) to determine the total area of POG within different classes of prescription-managed lands subject to different fire-scar classes.

03.2.5 Task 2e - POG within private reserves

Old growth forest ecosystem models were intersected with the fire-scar x private reserves raster developed in Task 1d (Section 03.1.5) to determine the total area of POG within different classes of private reserves.

04 OUTPUTS

04.1 Step 1 – Protected area network (CAR reserve system)

04.1.1 Overview

The total area of the protected area network in UNE and LNE combined is over 3 million hectares, with most (62%) in dedicated reserves. A summary of the extent of impacts of the 2019 bushfires on the protected area network in UNE and LNE is shown in Table 4 and illustrated in Figure 3a and Figure 3b. A total 688,486 hectares of protected area in UNE was within the fire-scar zone, representing 61% of the protected area network in UNE. In contrast, 1,028,088 hectares of protected area in LNE was within the fire-scar zone, representing 53% of the protected area network in LNE. The severity of the fire-scar was more acute in UNE than in LNE. About 66% of land within the fire-scar zone within the protected area network in UNE exhibited total or partial canopy burnt, compared with 49% in LNE.

Table 4 Impact of bushfires on the protected area network in UNE and LNE

		Area (hectares)			Fire-scar class (hectares)			
Protected Area type	RFA	Total	Within fire-scar zone[1]	*% affected*	Canopy burnt	Canopy partially burnt	Canopy unburnt	Little change
Dedicated Reserve	UNE	608,408	357,797	*58.8*	85,669	145,386	91,923	34,819
	LNE	1,294,909	766,952	*59.2*	108,909	271,272	291,899	94,872
	Both	1,903,317	1,124,749	*59.1*	194,578	416,658	383,822	129,691
Informal Reserve	UNE	278,791	167,170	*60.0*	36,262	75,354	42,644	12,910
	LNE	358,954	138,660	*38.6*	19,815	45,607	54,563	18,675
	Both	637,745	305,830	*48.0*	56,077	120,961	97,207	31,585
Prescription-managed	UNE	231,233	152,669	*66.0*	35,738	69,995	36,865	10,071
	LNE	262,727	118,512	*45.1*	16,265	39,558	44,750	17,939
	Both	493,960	271,181	*54.9*	52,003	109,553	81,615	28,010
Private Reserve	UNE	17,797	10,850	*61.0*	2,199	5,952	2,367	332
	LNE	16,957	4,164	*24.6*	869	1,967	1,146	182
	Both	34,754	15,014	*43.2*	3,068	7,919	3,513	514
All	UNE	1,136,229	688,486	*60.6*	159,868	296,687	173,799	58,132
	LNE	1,933,547	1,028,288	*53.2*	145,858	358,404	392,358	131,668
	Both	3,069,776	1,716,774	*55.9*	305,726	655,091	566,157	189,800

Table notes: (1) 'Within fire-scar zone' includes the four fire-scar categories namely Canopy unburnt, Canopy partially burnt, Canopy unburnt and Little change.

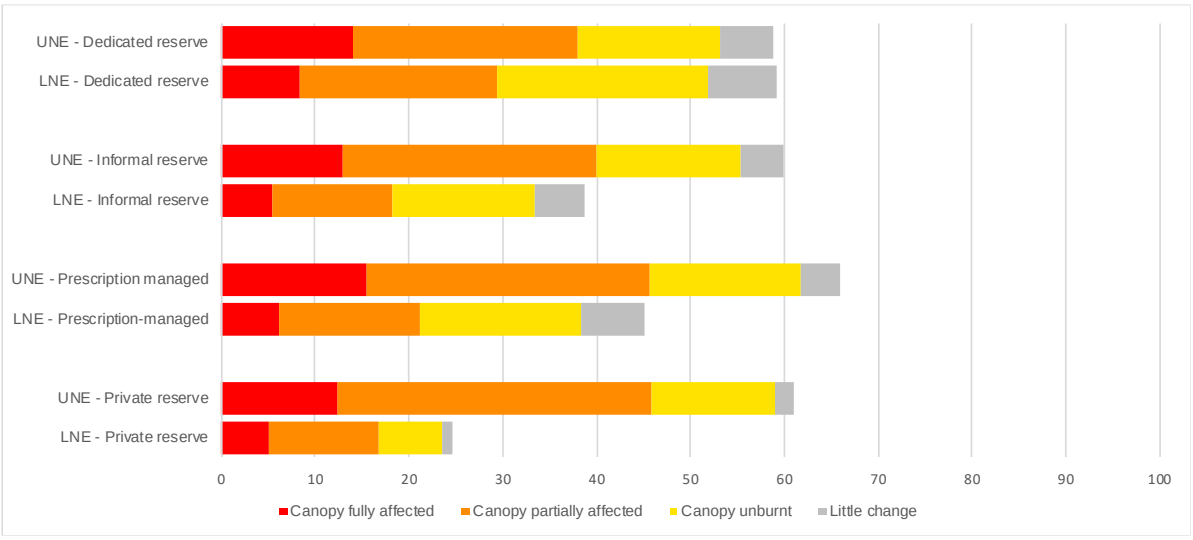

Figure 3a Proportion of fire-scar classes within the protected area network in the North East RFA regions

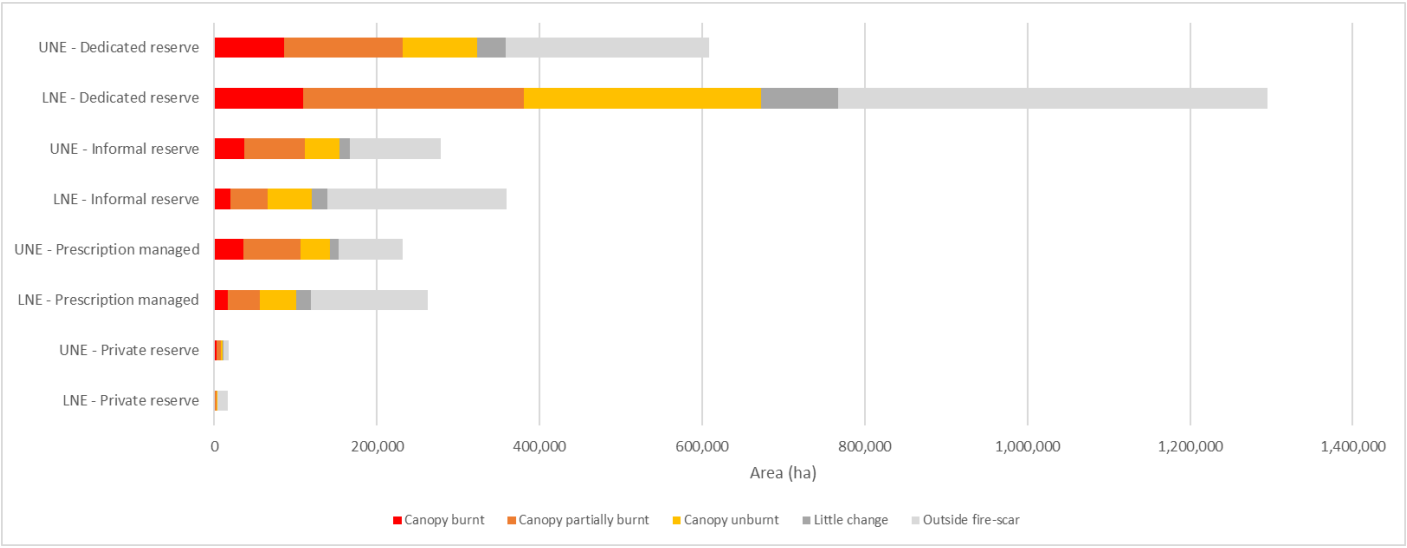

Figure 3b Area of fire-scar classes within the protected area network in the North East RFA regions

04.2 Step 2 – Old growth Forest

04.2.1 Step 2a – All old growth forest (also known as candidate old growth)

The total area of mapped candidate old growth forest in the North East RFA region[16] and the total area impacted by fire is summarised in Table 5, while the proportion of different fire-scar classes across candidate old growth forest is illustrated for each RFA region in Figure 4. Over 1.1 million hectares of candidate old growth forest in UNE and LNE was within the fire-scar zone (including about 670,000 hectares in which the canopy was completely or partially burnt). The total fire-scar area in UNE was 457,250 hectares (70% of the total area of candidate old growth forest in UNE). The total fire-scar area in LNE was 668,833 hectares (65% of the total area of candidate old growth forest in LNE).

Fire-scar categories were generally in the relatively more severe categories in UNE than LNE. About 47% of candidate old growth forest in UNE was mapped in the fire-scar categories canopy fully burnt or canopy partially burnt, compared with 35% in LNE (Table 5). The distribution of fire-scar classes across the old growth forest estate in UNE and LNE is shown in Figure 5.

[16] This includes all candidate old growth forest mapped during the comprehensive regional assessments

Table 5. Fire-affected areas of candidate old growth forest in UNE and LNE

	Upper North East		Lower North East		North East RFA total	
Fire-scar class	Area (hectares)	%	Area (hectares)	%	Area (hectares)	%
Canopy burnt	99,746	*15.2*	105,980	*10.3*	205,726	*12%*
Canopy partially burnt	206,264	*31.5*	257,495	*25*	463,759	*28%*
Canopy unburnt	123,914	*18.9*	246,422	*23.9*	370,336	*22%*
Little change (refuge areas)	27,326	*4.2*	58,936	*5.7*	86,262	*5%*
Outside bushfire extent	197,349	*30.1*	361,190	*35.1*	558,539	*33%*
All	654,599		1,030,023		1,684,622	

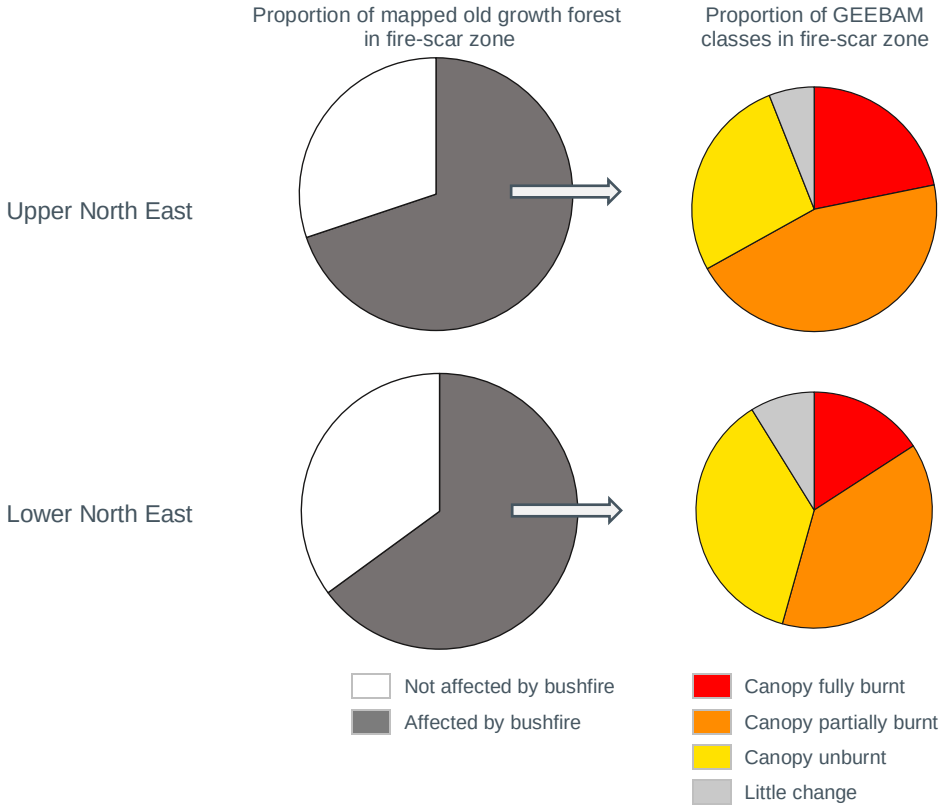

Figure 4. Proportion of fire-scar classes within old growth forests in the North East RFA regions

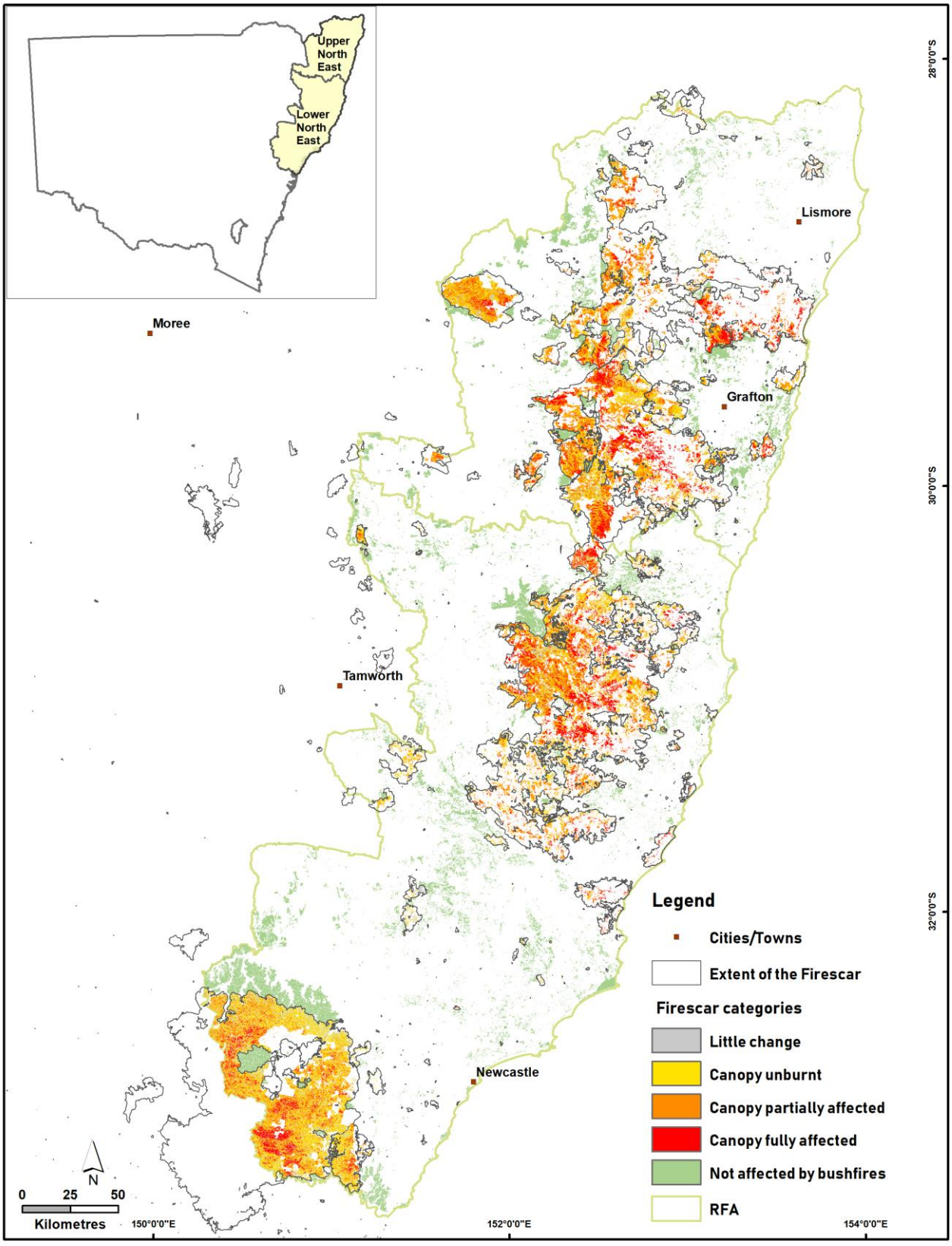

Figure 5. Distribution of fire-scar classes within all candidate old growth forest in the North East RFA region

04.2.2 Steps 2b to 2e – Candidate old growth within the protected area network

Overview

A total of 1.25 million hectares of candidate old growth forest is protected in the UNE and LNE regions, of which 36% occurs in UNE and 64% in LNE. Of this, about 0.91 million hectares of protected old growth (POG) (73%) was within the fires-scar zone. The area of different fire-scar classes within POG in the North East RFA regions is listed in Table 6 while the proportion of fire-scar classes is illustrated for each RFA region in Figure 6. A similar proportion of POG was within the fire-scar zone in UNE and LNE (75% and 72% respectively), however the severity of fires was greater in UNE than LNE. About 67% of the land within the fire-scar zone experienced full or partial canopy burn in UNE, compared with 53% in LNE.

Table 6. Area of fire-scar classes affecting POG in the North East RFA regions

	Upper North East		Lower North East		North East RFA total	
Fire-scar class	Area (hectares)	%	Area (hectares)	%	Area (hectares)	%
Canopy burnt	75,832	*16.9*	86,716	*10.9*	162,548	*13%*
Canopy partially burnt	147,869	*32.9*	214,593	*26.9*	362,462	*29%*
Canopy unburnt	91,286	*20.3*	220,275	*27.6*	311,561	*25%*
Little change (refuge areas)	20,469	*4.6*	52,659	*6.6*	73,128	*6%*
Outside bushfire extent	113,327	*25.3*	224,712	*28.1*	338,039	*27%*
All	448,783		798,955		1,247,738	

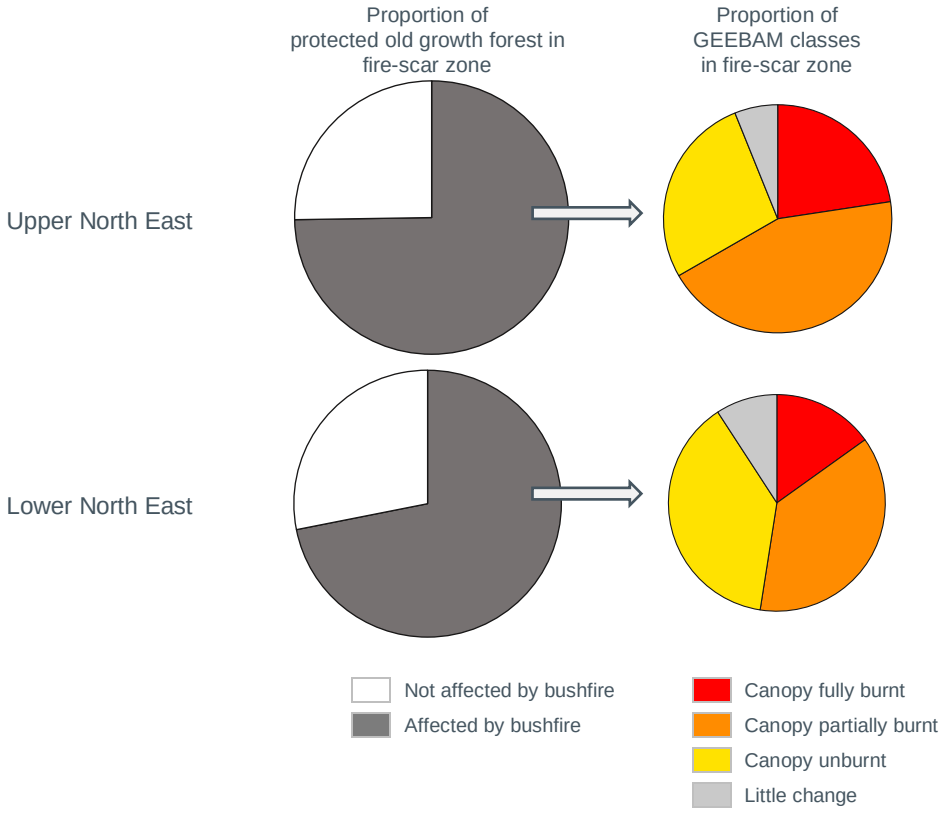

Figure 6. Proportion of fire-scar classes within POG in the North East RFA regions

The extent of POG across dedicated, informal, prescription and private reserve classes and different fire-scar classes in UNE and LNE RFA regions is summarised in Table 7, while the proportion of POG affected by different fire-scar classes is illustrated in Figure 7. POG within the dedicated reserve system and within private conservation reserves were most heavily impacted.

The distribution of fire-scar classes across state forests in UNE and LNE is shown in Figure 8.

Table 7. Impact of bushfires on protected old growth forest in different types of reserve in UNE and LNE

		POG extent (hectares)		POG fire-scar class extent (hectares)				
Protected Area type	RFA region	Total	Within fire-scar zone[1]	Canopy fully burnt	Canopy partially burnt	Canopy unburnt	Little change	Outside fire-scar area
Dedicated Reserve								
National Park (including CCA1 reserves)	UNE	263,301	201,591	42,392	85,490	58,601	15,108	61,710
	LNE	668,137	486,871	69,539	180,784	189,196	47,352	181,266
	Both	931,438	688,462	111,931	266,274	247,797	62,460	242,976
Nature Reserve	UNE	37,646	22,785	9,364	9,259	3,572	590	14,861
	LNE	24,145	14,261	2,097	6,020	5,236	908	9,884
	Both	61,791	37,046	11,461	15,279	8,808	1498	24,745
Aboriginal Area (including CCA2 reserves)	UNE	2	0	0	0	0	0	2
	LNE	94	5	0	3	2	0	89
	Both	96	5	0	3	2	0	91
Flora Reserves (FMZ1)	UNE	1,679	988	63	439	371	115	691
	LNE	3,279	2,047	114	513	1,058	362	1,232
	Both	4,958	3,035	177	952	1,429	477	1,923
All Dedicated Reserve	UNE	302,628	225,364	51,819	95,188	62,544	15,813	77,264
	LNE	695,655	503,184	71,750	187,320	195,492	48,622	192,471
	Both	998,283	728,548	123,569	282,508	258,036	64,435	269,735
Informal Reserve								
Historic Site (NPWS reserve)	UNE	0	0	0	0	0	0	0
	LNE	254	223	56	89	73	5	31
	Both	254	223	56	89	73	5	31
Regional Park (NPWS reserve)	UNE	0	0	0	0	0	0	0
	LNE	0	0	0	0	0	0	0
	Both	0	0	0	0	0	0	0
State Conservation Area (NPWS reserve)	UNE	43,791	37,957	7,453	17,040	10,959	2,505	5,834
	LNE	42,796	34,775	7,933	12,214	12,782	1,846	8,021
	Both	86,587	72,732	15,386	29,254	23,741	4,351	13,855
FMZ2 > 40 hectares and >200 m width, or adjacent to dedicated reserve (state forest)	UNE	25,837	16,413	3,951	7,765	4,110	587	9,424
	LNE	19,116	12,291	1,746	5,270	4,396	879	6,825
	Both	44,953	28,704	5,697	13,035	8,506	1,466	16,249
Defence lands (Commonwealth lands)	UNE	119	0	0	0	0	0	119
	LNE	17	0	0	0	0	0	17
	Both	136	0	0	0	0	0	136
Crown Reserves (Crown Land managed for conservation)	UNE	20	0	0	0	0	0	20
	LNE	745	35	4	10	13	8	710
	Both	765	35	4	10	13	8	730

Protected Area type	RFA region	POG extent (hectares)		POG fire-scar class extent (hectares)				
		Total	Within fire-scar zone[1]	Canopy fully burnt	Canopy partially burnt	Canopy unburnt	Little change	Outside fire-scar area
All Informal Reserve	UNE	69,767	54,370	11,404	24,805	15,069	3,092	15,397
	LNE	62,928	47,324	9,739	17,583	17,264	2,738	15,604
	Both	132,695	101,694	21,143	42,388	32,333	5,830	31,001
Lands managed under Prescription								
FMZ2 < 40 hectares or >200 m width, and not adjacent to dedicated reserve (state forest)	UNE	3,002	1,850	586	858	345	61	1,152
	LNE	1,206	541	61	213	216	51	665
	Both	4,208	2,391	647	1,071	561	112	1,817
FMZ 3a	UNE	54,813	40,254	9,252	20,210	9,734	1,058	14,559
	LNE	22,855	14,062	3,338	5,944	4,153	627	8,793
	Both	77,668	54,316	12,590	26,154	13,887	1,685	23,352
FMZ 3b	UNE	169	82	28	27	24	3	87
	LNE	190	75	11	32	27	5	115
	Both	359	157	39	59	51	8	202
Other exclusions	UNE	14,093	10,276	2,207	4,898	2,774	397	3,817
	LNE	13,427	8,121	1,676	3,038	2,825	582	5,306
	Both	27,520	18,397	3,883	7,936	5,599	979	9,123
All Lands managed under Prescription	UNE	72,077	52,462	12,073	25,993	12,877	1,519	19,615
	LNE	37,678	22,799	5,086	9,227	7,221	1,265	14,879
	Both	109,755	75,261	17,159	35,220	20,098	2,784	34,494
Private reserves								
Registered property agreements	UNE	96	0	0	0	0	0	96
	LNE	240	73	10	44	19	0	167
	Both	336	73	10	44	19	0	263
Conservation agreements	UNE	1,502	1,296	258	712	309	17	206
	LNE	1,744	860	130	419	280	31	884
	Both	3,246	2,156	388	1,131	589	48	1,090
Biobanking sites	UNE	0	0	0	0	0	0	0
	LNE	418	0	0	0	0	0	418
	Both	418	0	0	0	0	0	418
Nature Conservation Trust covenants	UNE	1,561	1,407	134	862	386	25	154
	LNE	234	0	0	0	0	0	234
	Both	1,795	1,407	134	862	386	25	388
Indigenous Protected Area	UNE	1,151	556	142	309	100	5	595
	LNE	58	0	0	0	0	0	58
	Both	1,209	556	142	309	100	5	653
All private reserves	UNE	4,310	3,259	534	1,883	795	47	1,051
	LNE	2,694	933	140	463	299	31	1,761
	Both	7,004	4,192	674	2,346	1,094	78	2,812
All Protected Areas	UNE	448,782	335,455	75,830	147,869	91,285	20,471	113,327
	LNE	798,955	574,240	86,715	214,593	220,276	52,656	224,715
	Both	1,247,737	909,695	162,545	362,462	311,561	73,127	338,042

Table notes: (1) 'Within fire-scar zone' includes the four fire-scar categories namely Canopy unburnt, Canopy partially burnt, Canopy unburnt and Little change.

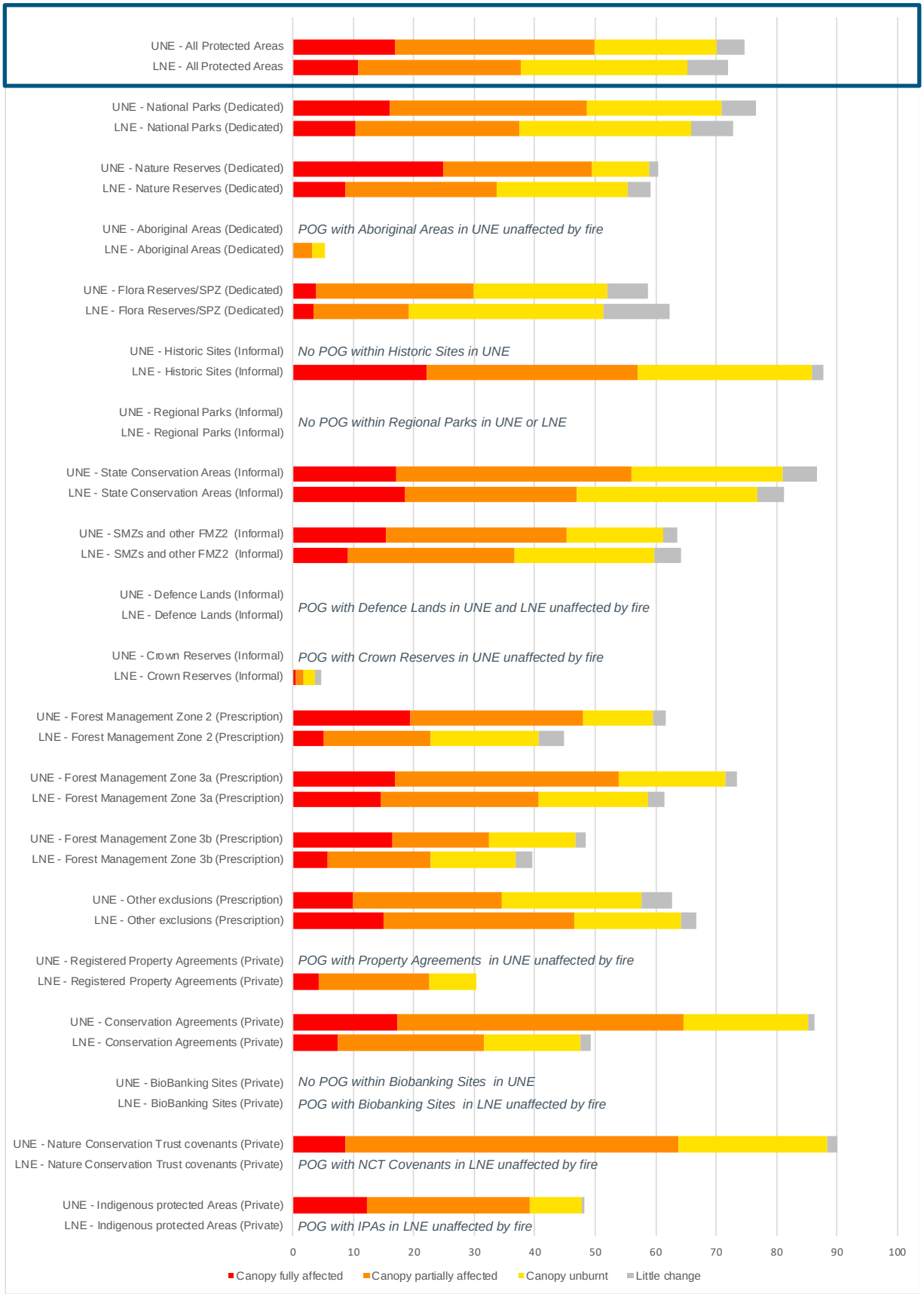

Figure 7. Proportion of fire-scar classes within POG in different parts of the protected area network in UNE and LNE

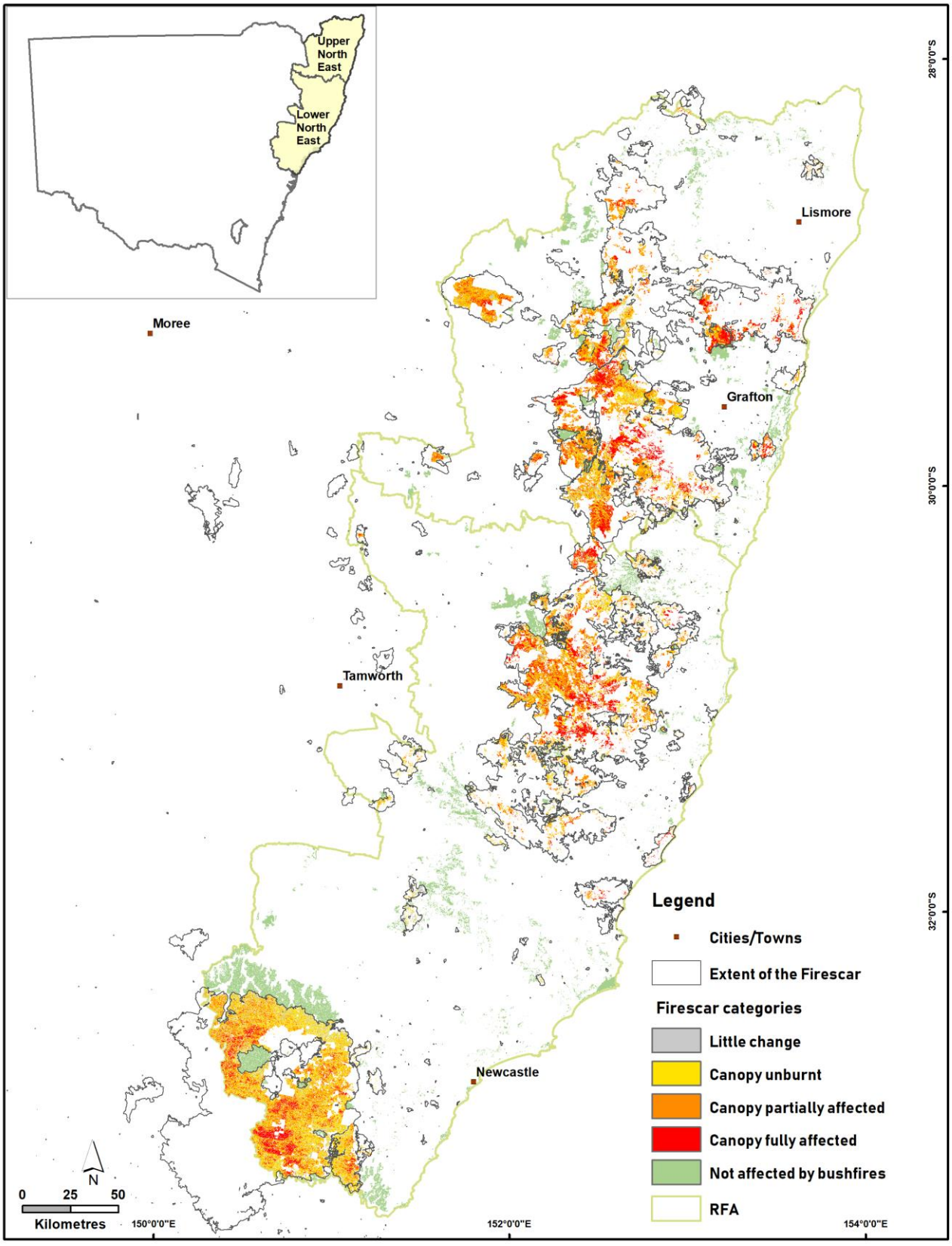

Figure 8. Distribution of fire-scar classes within POG in the North East RFA region

05 DETERMINING ASSESSABLE AREAS OF OLD GROWTH AND THE IMPACT OF FIRES

05.1 Overview of assessment

The Commission used 2rog Consulting's old growth and fire-scar spatial analysis results and data published in the North East RFA region on forest ecosystems and old growth forest ecosystems to determine the 'assessable' area under the framework. The assessable area consists of old growth forest ecosystems that have met and exceeded JANIS targets and that occur in informal reserves and lands managed under prescription in north coast state forests.

The JANIS targets[17] considered in this assessment include the following old growth and biodiversity reservation targets:

- 100% of rare or depleted old growth forest ecosystems
- 60% of the old growth forest ecosystems identified at the time of assessment (i.e. during the comprehensive regional assessments undertaken in the 1990s and reported in the RFAs)
- 15% of the pre-1750 distribution of each forest ecosystem
- 100% or all remaining occurrences of rare, endangered and vulnerable forest ecosystem (noting the target for vulnerable forest ecosystems is for 60 percent protection).

The Commission investigated the impact of removing burnt canopy areas ('canopy fully burnt' and 'canopy partially burnt' fire-scar categories) on the assessable areas, which assumed that these burnt canopy areas would not be assessable under the draft old growth reassessment framework that the Commission submitted to the NSW Government in August 2019. This analysis is not intended to imply that old growth forest with burnt canopy is no longer old growth or no longer protected. Rather, as a result of changes to canopy cover from the recent wildfires it would not be possible to accurately remap severely burnt areas using the draft old growth assessment methodology, which is one component under the framework.

The initial stage of this method uses remote sensing data from LiDAR and API to assess canopy cover, which is then used to indicate the areas of forest that are likely to be structurally mature or not for further field investigation. The 2rog Consulting spatial analysis determined areas of protected old growth forest that occur in the canopy fully or partially burnt fire-scar categories. These categories were chosen because the burnt canopies would affect the validity and accuracy of the method to assess canopy cover and locate mature forest.

To fully understand the impacts to and regeneration potential of old growth forest would require site specific field investigations.

05.2 Potential impacts of fires on old growth

The impact of fires on old growth forest depends on the severity, extent and duration of the event, and the fire adaptation responses of the tree species present. This information cannot currently be gauged from the available rapid assessment of canopy burn impacts, such as GEEBAM produces.

Many north coast forest tree species are well adapted to fires. For example, epicormic growth from eucalypt species is one such adaptation, where new shoots sprout from the tree trunk from buds protected from fire by the bark. This enables the tree to survive even if the canopy has been fully burnt and provides an early

[17] JANIS (1997). *Nationally Agreed Criteria for the establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia*. A report by the Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee (JANIS). Available at: http://www.agriculture.gov.au/SiteCollectionDocuments/rfa/publications/nat_nac.pdf

food source to many forest fauna species. Given the dynamic nature of eucalypt forests in NSW, fires are a regular feature and only a small proportion of trees that are burnt will die.

In very extreme events, living trees may die, dead standing trees may be completely burnt out, and the soil seed store may be damaged. Recovery after such events can take years and the structure and function of the forest are likely to change significantly, either temporarily or permanently. For an old growth forest, an event of this magnitude could alter the ecological characteristics that make it old growth.

Conversely, a fire event can also alter characteristics that make a forest not old growth. In a mature but disturbed forest (i.e. not old growth by definition), a wildfire may burn out the evidence of historic forestry operations, such as cut stumps, or suppress weeds. This could potentially enable the mature forest to be reclassified as old growth on field investigation.

In less extreme fire events, most north coast native forests will regenerate from burnt but living trees and recovery can be relatively quick. The regenerating forest will likely maintain its structure and function, and in some cases, fire will increase function.

Old growth forest that has not been impacted by fires (for example fire-scar categories 'little change' and 'outside the fire-scar area') will provide refugia for fauna species dependent on the structural elements of old growth forest, such as hollow bearing trees. Given the scale of fires, with more than 60 percent of candidate old growth affected, the range of fire impacts and recovery are likely to be varied. Old growth forest is a scarce forest value, and given potential impacts, any in-tact old growth forest will have an increased scarcity value.

05.3 Results of the assessable area assessment

The area of assessable old growth forest ecosystems pre-bushfires was determined to be just under 73,600 hectares, of which 42,600 hectares are commercial forest ecosystem types. If burnt canopy areas (i.e. fully and partially burnt fire-scar categories) are not able to be assessed under the framework, then the assessable area reduces to 5,800 hectares, of which 3,500 hectares are commercial forest ecosystem types.

The fire impacts on candidate, protected, and assessable old growth forest ecosystem areas by RFA region are provided in Table 8. A further breakdown by CAR reserve system components is provided in Table 9. The commercial forest ecosystem types considered in this assessment are supplied in Appendix 1.

The assessable area figure provides a theoretical upper limit on what could potentially be reassessed. There are several reasons why the assessable old growth areas may not be eligible for reassessment under the framework and/or subsequent boundary adjustment[18] including the presence of:

- other mapped environmental values that require the area to remain protected (for example threatened ecological communities)
- genuine old growth forest as determined through field assessment
- special environmental values as defined under the framework and determined through field assessment
- or the area may be inaccessible to forestry operations because of steep slopes or lack of access, or uncommercial in terms of the quantity or quality of timber resources.

In previous advice, the Commission reported there would be an estimated shortfall of 7,600 to 8,600 cubic metres of high quality timber per year, resulting from new conditions under the Coastal IFOA related to mapping threatened ecological communities and koala protections.[19] In supplementary advice, the Commission identified significant errors in old growth forest mapping and reported that 14,600 hectares of

[18] An Act of Parliament would be required to enable boundary adjustments to mapped old growth forest to occur.
[19] Natural Resources Commission (2016), *Advice on Coastal Integrated forestry Operations Approval Remake*.

incorrectly mapped and over-target old growth in north coast state forests could meet the estimated wood supply shortfall over a twenty year period. [20]

Prior to the fires, the assessable area may have yielded enough timber to address the previously estimated wood supply shortfall, subject to a detailed assessment under the framework and confirmation that a wood supply shortfall exists.

If fully or partially burnt canopy areas are not able to be assessed under the framework, the significantly reduced assessable area would not yield the previously estimated wood supply shortfall.

Given the extent of canopy fully and partially burnt fire-scar categories, the remote sensing component of the draft old growth assessment method cannot be accurately applied. Remote sensing (LiDAR combined with API) enables a relatively rapid assessment of forest structure across large areas of forest. Without the guidance this provides on where mature forest is likely to occur, field investigations across very large areas of state forest could be used instead. However, a field survey approach would take years to implement at considerable cost. This is not considered feasible under the terms of reference for the program.

Forest recovery times cannot be estimated using the fire-scar mapping currently available. For intensely burnt forest, significant time is needed before the remote sensing component of the method could be applied. Recovery times will vary significantly depending on the forest type, the intensity of the fire and the occurrence of drought during the recovery period. At the landscape scale, post-fire recovery could take five to seven years, or potentially longer.[21] Forest canopies impacted by fire are unlikely to recover within the program timeframe specified in the terms of reference (i.e. the next two years).

The program to reassess old growth forest mapping on coastal state forest can no longer proceed within the allotted timeframe and funding. The elements of the program related to verifying wood supply from coastal state forests are still relevant and could proceed.

[20] Natural Resources Commission (2018), *Supplementary advice on Coastal Integrated forestry Operations Approval Remake, old growth forests and rainforests – north coast state forests*.

[21] Heath JT, Chafer CJ, Bishop TFA and Van Ogtrop FF (2016) Post-Fire Recovery of Eucalypt-Dominated Vegetation Communities in the Sydney Basin, Australia, in *Fire Ecology* 12, 53–79, available online at https://doi.org/10.4996/fireecology.1203053

Table 8: Effect of 2019-20 bushfires on candidate, protected and assessable old growth within the North East RFA region and north coast state forests

		UNE	LNE	TOTAL
Candidate old growth forest[1]	Area of candidate old growth forest in North East RFA region (ha)	654,599	1,030,023	1,684,622
	Area of fire-affected[2] candidate old growth forest in the North East RFA region (ha)	429,924	609,897	1,039,821
	Proportion of candidate old growth in North East RFA region that is fire-affected	***66%***	***59%***	***62%***
Protected old growth as at 2018	Area of protected old growth forest in North East RFA region	448,783	798,955	1,247,738
	Area of fire-affected[2] protected old growth forest in the North East RFA region (ha)	314,987	521,584	836,571
	Proportion of protected old growth forest in North East RFA region that is fire-affected	***70%***	***65%***	***67%***
	Area of protected old growth forest in north coast state forests (ha)	99,593	60,073	159,666
	Area of fire affected[2] protected old growth forest in north coast state forests (ha)	67,642	34,631	102,273
	Proportion of protected old growth forest in north coast state forests that is fire-affected [2]	***68%***	***58%***	***64%***
	Are of protected old growth with burnt canopy (full and partial) in north coast state forests (ha)	50,284	21,956	72,240
	Proportion of protected old growth in north coast state forests with fully or partially burnt canopy	***50%***	***37%***	***45%***
Assessable old growth forest ecosystems within informal reserves and prescription lands in state forest (hectares)[3]	Area of assessable old growth prior to 2019-20 bushfires (ha)	45,876	27,735	73,611
	Area of assessable old growth if assume only unburnt canopy areas are assessable under the framework (ha)[4]	2,044	3,773	5,817
	Percent reduction in assessable area	***96%***	***86%***	***92%***
	Area of assessable old growth that is of a commercial forest ecosystem type (ha)	28,281	14,321	42,602
	Area of assessable old growth that has unburnt canopy and is of a commercial forest ecosystem type (ha)	1,865	1,649	3,513
	Percent reduction in assessable and commercial area	***93%***	***88%***	***92%***

Table notes:

1) Candidate old growth forest was mapped in the 1990s under the Comprehensive Regional Assessments
2) 'Fire affected' includes the fire-scar categories 1, 2 and 3 (canopy fully burnt, canopy partially burnt and canopy unburnt)
3) The CAR reserve system used for this assessment was that as at 2018
4) The burnt areas used for this assessment included canopy fully burnt and canopy partially burnt only.

Table 9: Assessable old growth areas in north coast state forest before and after the 2019-20 fires

Region	Candidate old growth as at RFA signing (ha)	Total no. OG FEs	Area of old growth forest ecosystems (OG FEs) in the CAR Reserve System as at 2018 (ha)[1]					Assessable OG FEs under the draft old growth assessment framework			
			Dedicated Reserve	Informal Reserve	Prescription	Private Reserve	Total	No. of assessable OG FEs in state forest	Area of assessable OG FEs in state forest (ha)	No. assessable and commercial OG FEs	Area assessable and commercial OG FEs (ha)
All protected old growth as at 2018											
UNE	654,599	144	302,628	69,767	72,077	4,310	448,783	68	45,876	33	28,281
LNE	1,030,023	179	695,655	62,928	37,678	2,694	798,955	64	27,735	15	14,321
North East RFA	**1,684,622**		**998,283**	**132,695**	**109,755**	**7,004**	**1,247,738**	**-**	**73,611**	**-**	**42,602**
Protected old growth within UNBURNT[2] areas											
UNE	As above		155,621	33,558	34,011	1,893	225,083	14	2,044	12	1,865
LNE			436,584	35,606	23,365	2,091	497,646	25	3,773	5	1,649
North East RFA			**592,205**	**69,164**	**57,376**	**3,985**	**722,729**	**-**	**5,817**	**-**	**3,513**

Table notes: (1) Dedicated and informal reserves within NPWS-managed land and state forest, prescription areas only within state forest, and private reserve only within freehold land; (2) unburnt areas include areas outside the bushfire affected area, as well as 'canopy unburnt' and 'little change' fire-scar categories – assumes protected old growth with burnt canopy is not assessable under the framework.

APPENDIX 1: SPATIAL LAYERS AND RELEVANT METADATA

Spatial coverage	Name of layer(s)	Data custodian	Date stamp
Fire-scar	GEEBAMv2p1 GEEBAMv2p2	DPIE-EES	05 January 2020 23 January 2020
RFA regions	FA_regions	ABARES, DPIE-EES	Not supplied
NPWS estate	NPWS_Estate	DPIE-EES	2018 v1
State Forests and FMZs	FCNSW FMZ geodatabase	FCNSW	Jan 2018
Net Harvest Area	NetHarvestArea	FCNSW	April 2019
Crown Lands	CrownReserves	Crown Lands	May 2019
Defence Lands	All regions (Defence_clip)	ABARES	Not supplied
Private Reserves	ConservationAgreements Registered Property Agreements BiobankingSites ConservationLandCovenants	DPIE-EES	Not supplied
Indigenous Protected Areas	Ipa_dedicated_May2018	DoEE	May 2018
Old Growth Forest Ecosystems	ogfe1_crafti ogfe2_crafti	ABARES, DPIE-EES	1998
Forest Ecosystems (extant distribution)	fecraune_3882 fecralne_3883	ABARES, DPIE-EES	1998

APPENDIX 2: COMMERCIAL FOREST ECOSYSTEM TYPES APPLIED IN THE ASSESSMENT

FE No	Forest Ecosystem	Region
26	Coastal Flooded Gum	LNE
32	Dry Foothills Blackbutt-Turpentine	LNE
33	Dry Foothills Spotted Gum	LNE
34	Dry Grassy Blackbutt-Tallowwood	LNE
36	Dry Grassy Tallowwood-Grey Gum	UNE
40	Dry Heathy Sandstone Blackbutt	LNE
52	Foothill Grey Gum-Ironbark-Spotted Gum	LNE
55	Foothills Grey Gum-Spotted Gum	LNE
59	Gorge Ironbark-Grey Gum	LNE
60	Grassy New England Blackbutt-Tallowwood-Blue Gum	UNE/LNE
67	High Elevation Ferny Blackbutt	UNE/LNE
69	High Elevation Moist Open Tallowwood-Blue Gum	UNE/LNE
70	High Elevation Open Spotted Gum	LNE
71	Ironbark	UNE
83	Mid Elevation Wet Blackbutt	UNE/LNE
84	Mid North Coast Wet Brushbox-Tallowwood-Blue Gum	UNE/LNE
89	Moist Foothills Spotted Gum	LNE
90	Moist Messmate-Gum	LNE
91	Moist Open Escarpment White Mahogany	UNE/LNE
95	Northern Moist Blackbutt	LNE
101	Northern Open Grassy Blackbutt	LNE
103	Northern Wet Brushbox	LNE
104	Northern Wet Tallowwood-Blue Gum	LNE
105	Nymboida Tallowwood-Turpentine	LNE
106	Open Coastal Brushbox	LNE
107	Open Messmate-New England Blackbutt	UNE
109	Open Shrubby Brushbox-Tallowwood	LNE
110	Open Silvertop Stringybark-Blue Gum	UNE/LNE
111	Open Silvertop Stringybark-Tallowwood	UNE/LNE
135	South Coast Tallowwood-Blue Gum	LNE
137	Southern Wet Sydney Blue Gum	UNE
146	Tallowwood	LNE
148	Very Wet New England Blackbutt-Tallowwood	UNE/LNE
150	Washpool Brushbox-Tallowwood	LNE
155	Wet Foothills Blackbutt-Turpentine	UNE/LNE
157	Wet Shrubby Brushbox-Tallowwood	UNE/LNE
158	Wet Spotted Gum-Tallowwood	LNE

This page left intentionally blank


NSW
GOVERNMENT
Natural
Resources
Commission

2rog