

SPECIES MANAGEMENT PLAN

SOUTH EASTERN NSW

GIANT BURROWING FROG *(Heleioporus australiacus)*



IFOA SPECIES MANAGEMENT PLAN No. 2

Forests NSW

2008

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INTRODUCTION

The Threatened Species Licence (TSL) within the Integrated Forestry Operations Approval (IFOA) for the Eden Region regulates the management of threatened species and their habitat. Many species are deemed to be appropriately protected by routine timber harvesting prescriptions such as the retention of habitat trees, drainage feature exclusion zones, heath exclusion zones and rainforest exclusion zones. There is also a group of species where information regarding the lifecycle, distribution, abundance and threats posed by forestry activities is relatively limited. The Giant Burrowing Frog (*Heleioporus australiacus*) is one such species which, at the time of IFOA gazettal in 1999, was thought to be particularly rare. As a consequence, IFOA prescriptions were implemented requiring pre-logging surveys for Giant Burrowing Frog (GBF) to detect individuals and to enable the implementation of protective measures (200 ha exclusion zones around a record, or group of records within 500 metres).

The IFOA also specified that following the implementation of 15 GBF exclusion zones, Forests NSW (FNSW) may apply for a review of this condition. The review was triggered in 2004. The agreed outcome of the review process is the Eden IFOA Amendment No.4 (2006). This is a two year interim arrangement which refers to new exclusion zones set aside for the protection of three population management zones within the FNSW estate. These are located within Yurammie, Broadwater and Yambulla State Forests. In addition, an agreed outcome of Amendment No.4 (2006) is the development of a Species Management Plan (SMP) which will outline the strategic management framework for the species and provide the basis for a review of the Eden TSL GBF provisions. The format of this SMP is as agreed between FNSW and the Department of Environment and Climate Change (DECC) on 3 August 2006.

OBJECTIVES

The overall objective of the GBF SMP is to provide a framework for the management of the GBF in State forests within the Eden IFOA Region that is complementary to the management of the species across other public land tenures within south-eastern NSW.

A major component of the SMP is a monitoring program that is designed to assess the suitability of the SMP for the medium-term conservation of GBF's in the Eden region. This will be determined by assessing GBF occupancy within the interim exclusion zones and in adjacent areas that have been subject to recent disturbance or might be subject to managed disturbance during the monitoring program.

The SMP also establishes an adaptive management framework to identify and respond appropriately to potential threats to the species, such as impacts from predation by pest animals, inappropriate fire regimes and timber harvesting.

Finally, the SMP identifies a number of research goals that will advance understanding of the conservation biology of the species in the region. It is acknowledged that many of the research goals cannot be achieved within the life of the plan.

PLANNING AREA DESCRIPTION

The Planning Area includes coastal and foothill forests within the Eden Regional Forest Agreement (RFA) Region (refer Figure 1). The Planning Area represents a high proportion of the known GBF distribution on the far south coast of NSW as at 2007, based on surveys

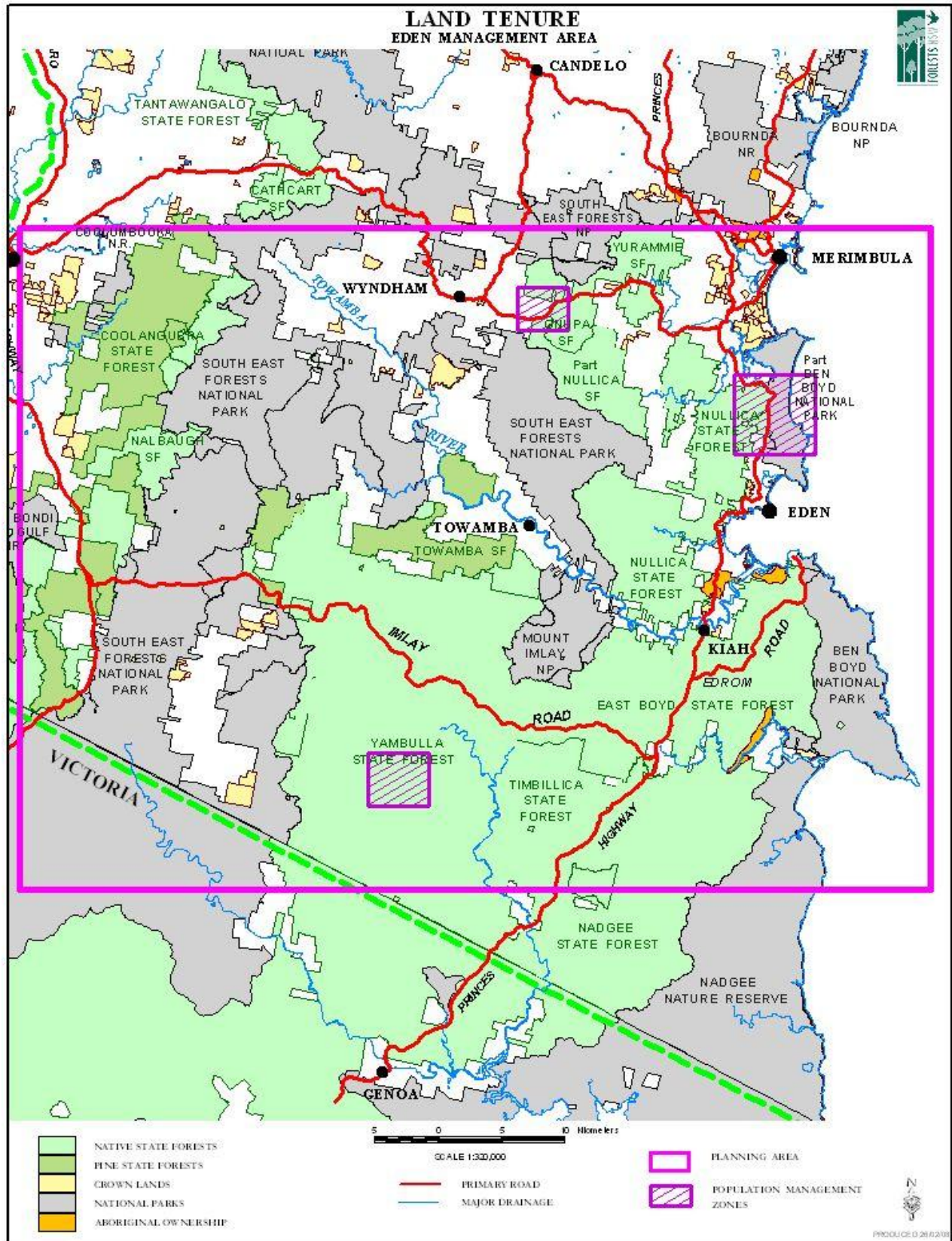


Figure 1. Giant Burrowing Frog Species Management Planning Area.

undertaken by FNSW and DECC, and encompasses the three population management zones identified within Yurammie, Broadwater and Yambulla State Forests.

The Eden region experiences mean daily minimum temperatures during July of between 1° and 4° and mean daily maximum temperatures during February of between 25° and 27° (SFNSW 1998). Frosts are relatively common during winter as distance from the coast increases. Rainfall is highly variable from year to year, with much of the annual volume occurring during a small number of long duration storms. Coastal areas experience an average annual rainfall of between 750 and 900 mm (SFNSW 1998).

The geology of the region is dominated by granites and granodiorites of the Devonian Bega Batholith, sediments of the Late Devonian Merimbula Group and the metasediments of the Ordovician Adaminaby Group. A range of soil types are derived from these geological units including Red, Yellow and Brown Dermosols and Kandosols, Red and Yellow Chromosols, Kurosols and Tenosols from the granites and granodiorites; and Stony Red and Yellow Kandosols, Red and Brown Dermosols and Red and Yellow Kurosols from the sediments and metasediments.

The forest ecosystems within the Eden region are broadly classified into 6 ecosystem groups: Rainforest, Wet Layered forests, Moist forests, Intermediate Shrubby forests, Dry Shrubby forests and Dry Grassy forests (SFNSW 1998). The Dry Shrubby forests contain the most likely habitat for *H. australiacus* within the planning area, where a range of understorey associations occur (Penman *et al.* 2005b). Lower order (1st and 2nd order) drainage features appear to be key habitat components, where pools persist on rocky and sandy substrates often associated with coral fern, *Gleichenia sp.*, spreading fan fern *Sticherus lobatus* and *Gahnia sp* (Penman *et al.* 2006a).

DISTRIBUTION & ABUNDANCE

The giant burrowing frog (*Heleioporus australiacus*) is a large threatened myobatrachid frog species in south-eastern Australia. Throughout its range the giant burrowing frog is considered rare, or at least rarely encountered. Records of the species are from the coast and adjacent ranges from Singleton through to approximately 100 kilometres east of Melbourne (Martin 1997; Gillespie and Hines 1999). A disjunction of 100 kilometres occurs in the records of the species between Ulladulla and Narooma (Lemckert *et al.* 1998). It has been argued that populations to the north and south of this disjunction represent separate species (Penman *et al.* 2004; Penman *et al.* 2005a) but this remains to be confirmed.

Within the Planning Area it is unclear whether the GBF occurs in scattered or widespread populations due to difficulties in detecting the species. Populations are known from Broadwater, Yurammie, Bermagui, East Boyd, Timbillica and Yambulla State Forests (Figure 2). The distribution of existing GBF records is largely a function of the concentrated survey effort on State forest due to requirements of the original IFOA pre-harvest survey prescription and significant research effort in these areas (Lemckert and Brassil 2003; Penman 2005). Some of the records mapped below are greater than 20 years old and suffer from the inaccuracies of the recording methods employed. Some attempts have been made to relocate these populations with no success and therefore these records may not represent current presence of the species.

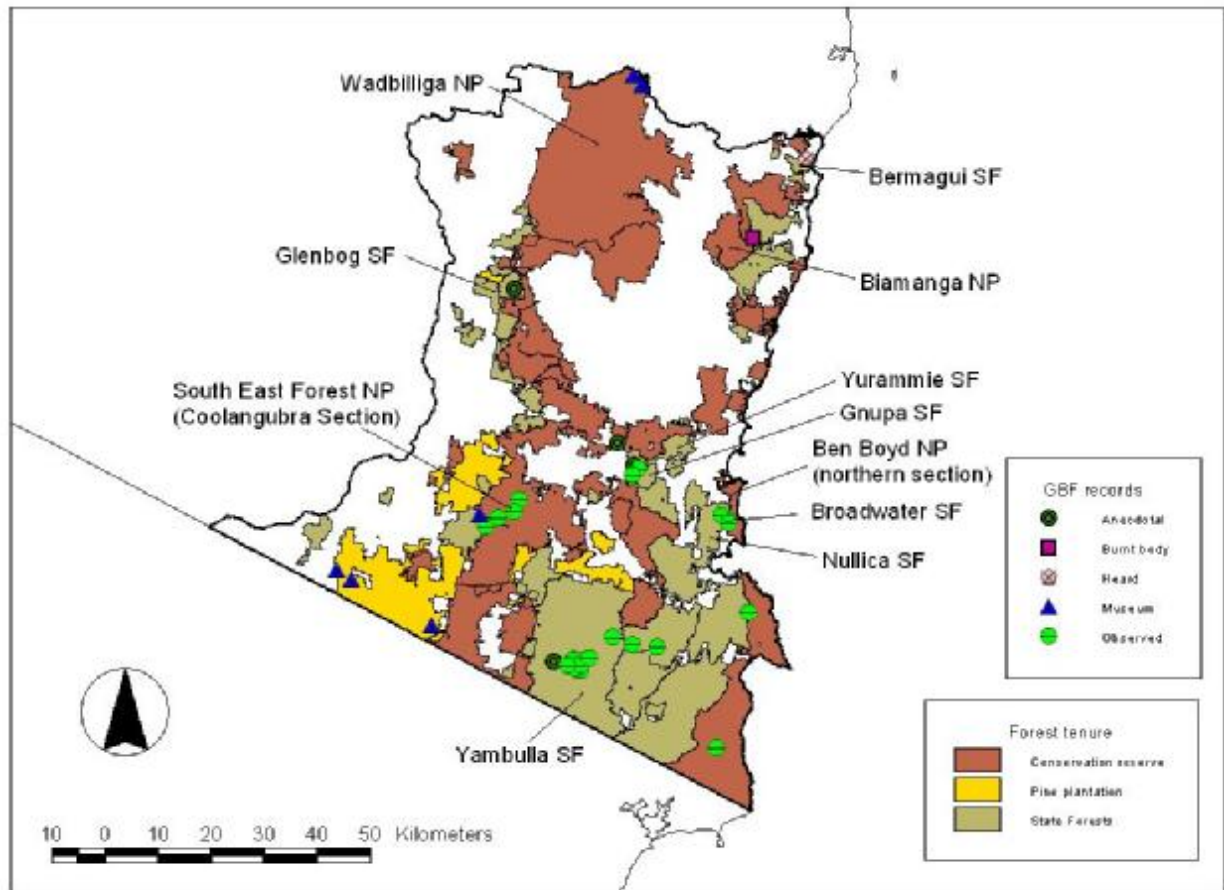


Figure 2 - GBF records in the Planning Area. Source Penman (2005).

SPECIES ECOLOGY

Presented below is a summary of the species ecology. Much of this information has been taken from a review of the species biology by Penman *et al.* (2004).

The giant burrowing frog (*Heleioporus australiacus*) is a large threatened myobatrachid frog species in south-eastern Australia. It is a large rotund chocolate brown to bluish black frog (Barker *et al.* 1995; Cogger 2000). Body lengths range from 60.0 - 89.9 mm for males and 66.7 - 97.0 for females (Littlejohn and Martin 1967; Barker *et al.* 1995). The skin is warty with variable yellow spotting along the sides, around the cloaca and occasionally on the limbs (Lee 1967). Males and females can be distinguished by characteristics of the forearm and hand. Mature males have enlarged muscles on the forearms with black conical nuptial spines on thumbs, and small spines on the second and third fingers (Barker *et al.* 1995). The tadpoles are unspecialised (Watson and Martin 1973) with a dorsal colour from a dense dark brown through to slaty grey or black (Harrison 1922; Lee 1967; Daly 1996; Anstis 2002). The abdomen is usually shiny grey-blue (Anstis 2002). Tadpoles can be large (to a total length of 85mm) with a blue-grey iris and gold around the pupil (Anstis 2002). Throughout its range the giant burrowing frog is considered rare, or at least rarely encountered (Penman *et al.* 2004).

Reproductive Biology

Breeding period

Calling is generally confined to the period between August and May, with a peak in the autumn months (Gillespie 1997; Penman 2005), although individuals have been heard calling even in winter (J. Rescei *pers. comm.*, C. Slade, *pers. comm.*). Animals migrate to the calling sites during or immediately after moderate to heavy rains and occupy the breeding site for up to 10 days before returning to the non-breeding habitat areas (Penman 2005).

Vocalisation

While three vocalisations are attributed to the Giant Burrowing Frog, it appears that only the first described here is associated with breeding. This is the male advertisement call, an owl like “oo-oo-oo” (Robinson 1995). The second call is an extended “woooooop” with an upward inflection. It is rarely heard, but is presented on the sound recordings of Stewart (1998). This call is considered to be a territorial response call (Lemckert 2001). The third is a distress call that has been described as an “electronic-sounding call like a whining cat, although much louder” (Daly 1996; Lemckert 2001) that has been heard while animals are being handled.

Development period

No specific studies have been conducted on the duration of the tadpole phase for this species. Observations in the field suggest that tadpoles of this species may take between three and twelve months to complete development (Watson and Martin 1973), depending on whether they are from eggs laid in autumn (tadpoles develop more slowly over winter and metamorphose in late spring) or from eggs laid in spring (tadpoles metamorphose late summer).

Metamorphosis

Newly metamorphosed frogs measure 19.5 - 30.0 mm (mean 26 mm; Anstis 2002). Juvenile frogs have been recorded at lengths of 25 - 32 mm snout - vent length (Penman *unpubl. data*). Juveniles, like the adults, have been captured some distance from water, and this may indicate similar habits to the adults. This behaviour is in contrast to the Western Australian *Heleioporus* species where juvenile frogs appear to occupy areas immediately adjacent to breeding sites for the first year of their lives (Lee 1967).

Patterns of behaviour and habitat use

Broadly speaking the species occupies dry sclerophyll forests with little ground vegetation (Penman *et al.* 2005b). Individuals spend the majority of the year (greater than 97%) in naturally vegetated areas away from the breeding site. In these areas, individual frogs occupy discrete non-overlapping activity areas that average 500 m² (0.05 hectares) with no difference between the sexes. Activity areas are defined by a series of “home burrows”, although they also occasionally burrow at points that are used just once. The frogs burrow to depths ranging from one to 30 cm with a mean depth of 10 cm (Penman 2005). These “burrows” are not defined holes but points in the landscape where an individual has to excavate each time they visit the site. However, these points are known to the individual and they return to within 2cm of the original site even after absences from a burrow of up to six months (Penman 2005). Burrowing sites have higher shade and lower vegetative cover than unused areas (Penman *et al. in review*).

Known breeding sites for the species in the area are general semi-permanent pools within first and second order streams, all within dry forest areas (Penman *et al.* 2006a). The breeding site is occupied for only short periods and not all individuals enter the breeding site every year, probably because these areas represent the highest mortality risk for the species

(Penman and Lemckert 2007). Frogs enter the breeding site either immediately after heavy rains, or within 10 days when the water flow slows sufficiently for the species to enter the site (Penman *et al.* 2006a). The species tends to oviposit in small pools under vegetation or in disused yabbie burrows, which later flood and move the tadpoles down stream to larger more permanent pools (Penman *et al.* 2004; Penman *et al.* 2006a).

The species has long been thought to be only active, or at least visible, after heavy rains (Webb 1987; Mahony 1993). In the southern group, a detailed study of the species behaviour found that animals are active under a broader range of conditions (Penman *et al.* 2006b). However, these data suggested that frogs are most likely to leave their burrows when:

- relative humidity is above 60 %;
- minimum temperature is above 8° C;
- a minimum of 5 mm rain has fallen in the previous 12 hours; and
- there is little or no wind.

Diet

Adult GBF's are generalist predators (Gillespie 1990). Adult frogs primarily consume ground dwelling invertebrates including ants, beetles, spiders, scorpions, centipedes and cockroaches (Littlejohn and Martin 1967; Rose 1974; Webb 1983; Webb 1987). Occasionally the diet has included aerial invertebrates such as moths (Webb 1987). The diet of sub-adults and juveniles is not known, although it is likely to be the same as that seen in adults.

While the diet of the tadpole phase remains unstudied, the oral morphology indicates tadpoles are probably generalist benthic feeders. The diet of the tadpole is likely to be comprised of algae and bacteria on the pond base or attached to submerged objects, as well as decaying vegetative matter (Penman *et al.* 2004).

ACTION PLAN

Introduction

A program of survey and monitoring for the GBF will occur in native vegetation within the Planning Area. The program will replace the survey effort previously prescribed under the TSL for the Eden Region. It will aim to establish the ongoing presence of GBF's within three Population Management Zones (PMZs) and to monitor occupancy of the species over time. Survey and monitoring within the PMZs but outside FNSW tenure will be dependent on consultation with landholders.

Aims

The aims of this program are to:

1. Determine the extent of breeding sites within the PMZs in order to develop and implement a meaningful species monitoring program.
2. Document the habitat features of GBF breeding sites within the PMZs as representative of habitats within the planning area in order to predict potential habitats outside the PMZs.
3. Determine the extent of breeding sites in areas adjacent to the PMZs, particularly in those areas subjected to managed disturbance (timber harvesting and/or burning). These sites will form the basis of future research efforts into the impacts of forest management practices on populations of the GBF.
4. Document changes in the extent of GBF breeding within the PMZs and adjacent disturbed areas over time. Such information will assist in determining whether additional research or surveys are required, and how management within the PMZ's might adapt to accommodate the needs of the GBF.

The outline of the action plan is as follows:

- The need to determine the most efficient and appropriate survey techniques is outlined (see 'Identifying survey methodologies').
- A detailed monitoring plan is described (see 'Distribution survey and monitoring program').
- Finally, future research opportunities are identified (see 'Future Research').

Identifying survey methodologies

The success or otherwise of a monitoring program for the GBF is contingent upon developing a reliable censusing technique including the locating of suitable breeding sites. Commonly available frog survey methods include pitfall trapping, nocturnal road transects, auditory surveys and tadpole netting (Penman *et al.* 2004). Survey techniques previously applied to this species are unlikely to provide sufficient data for an efficient monitoring and management program, and alternatives need to be developed.

Detection rates for this species using common amphibian survey techniques are extremely low (Penman 2005). Using pitfall traps in known population areas have resulted in detection rates ranging from 1 in 800 trap nights (Penman *unpublished data*) up to 1 in 3000 trap nights (Kavanagh and Webb 1998). Gillespie (1990) reported capturing no frogs in 5400 pitfall trap nights of surveys for the species in suitable habitat in eastern Victoria. The rate of detection using nocturnal road transects varies widely according to a number of factors including

habitat traversed, experience of the observer and vehicle speed. While nocturnal road transects are one of the main techniques utilised in pre-logging surveys for this species, few have detected the species. In approximately 250 nights of targeted surveys only 11 frogs have been detected ten of which were in one area on one night (Chris Slade *pers. comm.*, Regional Ecologist, Forests NSW; Adam Fawcett *pers. comm.*, Regional Ecologist, Forests NSW; Kelly Rowley *pers. comm.*, Acting Regional Ecologist, Forests NSW).

Auditory surveys are another commonly used technique for amphibian surveys. The GBF calls irregularly and does not appear to respond to call playback. Using automated call recorders in suitable breeding streams within areas known to be occupied by the frog, Penman *et al.* (2006d) failed to detect one GBF call despite 120 hours of recordings. Pre-logging surveys in NSW also involve auditory surveys and call playback targeting this species. In over 350 nights of auditory surveys across the three management regions, no calls of this species have been recorded (Forests NSW *unpublished data*).

A potentially useful method of censusing the GBF is netting for tadpoles. GBF tadpoles are relatively distinct, however skill is required to identify a GBF tadpole from other species, such as the Eastern Banjo Frog (*Limnodynastes dumerili*) and Striped Marsh Frog (*L. peroni*). If species are difficult to identify during a netting census, then the site must be revisited fortnightly until a more reliable identification is possible.

Netting for tadpoles not only offers information on the occupancy of the site by the species but also allows for the interpretation that a viable breeding population exists within the vicinity of the monitoring sites. Consequently it is recommended that the tadpole survey methodology be used for the monitoring of GBF populations.

If the methods are not providing sufficient records for meaningful interpretation, and an additional method of trapping is developed or spotlighting proves to be required, DECC and FNSW must modify the monitoring methodology to improve data collection.

Distribution Survey and Monitoring Program

Three PMZs will be monitored throughout the program. Monitoring will extend to forested areas adjacent to the PMZs where timber harvesting and/or burning activities have recently been undertaken or are programmed to occur early in the monitoring period. The occupancy model approach will provide a mean level of occupancy of GBF within each PMZ. In the future, critical action thresholds can be developed and agreed to by FNSW and DECC. The critical action thresholds will provide a trigger for action if the relative mean levels of site occupancies drop below this value.

An “occupancy model” has been identified as an appropriate means of undertaking the distribution survey and monitoring program (See Tyre *et al.* 2003; Bailey *et al.* 2004; Wintle *et al.* 2005; Wintle *et al.* 2004 and Mackenzie and Royle 2005 for general context on the concepts and methods of estimating detectability). A major strength of the occupancy model is that there can be flexibility within the sampling design throughout the life of the programme. Accordingly, decisions can be made at any time to enhance or reduce the survey effort without compromising the power of the analyses. The exact nature of the analytical approach will be finalised after the first round of monitoring (see *Timing of Survey*). Once developed, the approach will be documented and included as an appendix to this report.

Selection of Sites

Initially, monitoring sites will be defined as discrete series of pools covering up to a 100 metre stretch of drainage lines. Ideally, sites will be separated from each other by a minimum distance of 100 metres, but in some circumstances this may need to be reduced to 50 metres. Flexibility is needed in site selection due to the paucity of information about the breeding sites for the species in the region. It is envisaged that during the first year of the monitoring program, the sites will be established as permanent monitoring sites within all PMZs based on either the presence of tadpoles or presence of suitable habitat. Sites within the forest adjacent to the PMZs should be established as soon as practicable where disturbance has recently occurred, or ahead of any planned future disturbance. It is important to ensure that the initial design is comprised of both occupied and unoccupied (with suitable habitat) sites, as choosing only occupied sites for the monitoring will not enable population increases and will generally only result in decreases.

Timing of Survey

For each round of monitoring all sites should be monitored within a two week period on three occasions each year. Nominally, these surveys should be conducted in autumn, winter and spring, however as breeding is reliant on heavy rains, some flexibility in the timing is required. A series of indicator sites should be developed, in consultation with DECC, during the first year of the monitoring to inform the monitoring effort. The indicator sites will be areas where tadpoles have been reliably recorded in the past. Prior to any monitoring event, the indicator sites should be surveyed and if tadpoles are not present in any of these sites the monitoring event should not proceed until after suitable breeding conditions occur. The assumption is that breeding in these sites will be indicative of the total collection of monitoring sites. The monitoring will continue for a minimum of three years.

Survey Effort

During each survey period, 30 sites within each PMZ will be surveyed for GBF tadpoles. An initial site inspection with quiet observing of the pool/stream for a period of one minute, actively looking for tadpoles, will be followed by targeted dip netting of any tadpoles observed. If no tadpoles are observed or captured initially a sweep of the pond with dip nets will be undertaken for a period of 5 minutes. The same 30 sites will be used during each survey.

Monitoring of recently disturbed areas, or those where harvesting or burning are scheduled, will be undertaken at a similar sampling intensity to that within the PMZ's, and will reflect the extent of the coverage of the past or proposed disturbance. The timing and conduct of the sampling will be the same as that described above for PMZs.

Data recording

A generic pro forma will be developed to be used across all study sites. Data to be collected at each survey location will be consistent with Penman *et al.* (2006a) and include: monitoring site, topography, stream order, and principal forest types within the catchment. Information will also be available on management history in each catchment, including harvesting, burning (including wildfire) and predator control. At each survey period additional information on the pool characteristics will be collected which will include depth, area, substrate, pool edge cover, canopy shading and the weather conditions leading up to the sampling periods to ascertain when likely breeding events may have occurred. The tadpole life cycle is thought to take between three and 12 months to complete (Daly 1996). It is

therefore important that notes on the tadpole size classes are made to ensure breeding events are not double counted between surveys.

Data analysis

Following the first round of monitoring, the data will be assessed to determine the magnitude of trends in occupancy that can be detected within the PMZs and, where relevant, within the adjacent disturbance areas. Pending the outcome of this assessment, monitoring effort or methods may be altered to improve the rate of detectability of individuals and the magnitude of changes which the program is able to detect. In the first instance, a confidence interval approach as described by Walshe *et al.* (2007) will be applied. More complex multivariate regression approaches may be applied when sufficient datasets are available.

Animal Care and Ethics

The survey and monitoring program will be conducted under the NPWS Scientific Licence S11203 and Animal Care and Ethics Licence 03/05. The proposal will be assessed by the NSW Department of Primary Industries (DPI) Animal Care and Ethics Committee. Work conducted by staff outside of Forests NSW will need to obtain similar permits and approvals.

Future research

While this plan does not bind Forests NSW to completing the future research listed below, this section identifies areas of research that better inform the management of this species.

1. A study examining the distribution of the species on a regional level in all potential habitat areas. The results of this study would determine whether the PMZs represent the true range of the species within the Eden area and whether the species is as sparsely scattered as current records indicate. These results may also indicate where populations are currently protected within the existing conservation reserve system.
2. A study examining the direct impact of hazard reduction burns on individuals of the giant burrowing frog using surrogate and direct measures. These results would determine the appropriateness of conducting hazard reduction burns within and adjacent to PMZs; and
3. A study examining the direct impact of forestry operations (both integrated and thinning operations) on individuals and populations of the giant burrowing frog using surrogate and/or direct measures. These results would determine whether there is a detrimental impact of harvesting within PMZs for this species.

MANAGEMENT ACTIONS AND IMPACTS

The primary objective of this Plan is to determine the ongoing presence of Giant Burrowing Frogs within the State forests of the study area, and to monitor changes in occupancy over time with reference to the Eden IFOA Amendment No.4 (2006) prescriptions.

Supplementary objectives include the identification of threats to the species, and an assessment of the role of management in threat abatement. The monitoring program should be supplemented by additional research programs, reviewing in greater depth aspects of the ecology of the species and of the manageable impacts on its distribution and abundance. A summary of threat abatement issues would include:

POTENTIAL THREAT	MANAGEMENT ACTION	POTENTIAL IMPACT OF ACTION	PERFORMANCE MEASURE	LEARNING OUTCOME
Use or Exclusion of Low Intensity Fire (Hazard Reduction Burning)	Conduct low intensity burning according to agency prescriptions (e.g. frequency, intensity, coverage, etc.).	Mosaic of low intensity burnt and unburnt forest achieved within planned burn units within each PMZ.	Existing survey data analysed in context of known burning history.	GBF occupancy and persistence monitored over time within both low intensity burnt and unburnt forest. Monitoring results used during future development of low intensity burning strategies.
	FNSW and DECC to reach agreement on prescriptions for low intensity burning within GBF PMZs.	Greater risk of spread of high intensity wildfire within contiguous areas of unburnt forest.	Burning undertaken within PMZs as agreed between agencies. Monitoring sites established in areas adjacent to PMZs where burning is planned.	
High Intensity Fire (Wildfire)	Conduct low intensity burning and other fire protection methods (e.g. strategic fire breaks) within the Planning Area according to agency guidelines (including the FNSW Corporate Fuel Management Plan).	Mosaic of low intensity burnt and unburnt forest maintained within the Planning Area. A network of strategic fire breaks established and maintained within the Planning Area.	Spread of high intensity wildfire reduced by managing fuel loads and distribution, and provision of access for fire suppression.	Assessment of the effectiveness of fire protection strategies in minimising the extent of high intensity wildfire, and the consequent damage to GBF populations and habitat.

Timber Harvesting	Integrated Logging conducted in available multi-aged compartments (those released from exclusion as part of the IFOA Interim Amendment 2006 and others with identified suitable habitat within the Planning Area).	Mosaic of integrated logged coupes within scheduled compartments with logging intervals ranging from a minimum of five years up to fifteen years (alternate coupe system under the IFOA).	Existing survey data analysed in context of known integrated logging / thinning history.	GBF occupancy and persistence assessed to determine relative presence in regrowth and mixed age catchments
	Thinning conducted in suitable regrowth forest compartments.	Mosaic of thinned and unthinned regrowth forest within scheduled thinning compartments.	Where required, monitoring plots to be established in areas adjacent to PMZs where integrated logging / thinning is planned or has been completed since 2002.	Monitoring results used to assess future access for timber harvesting within the three PMZs.

ADDITIONAL RESEARCH

Details of the ecology of the GBF requiring further investigation include habitat requirements, the effects of forestry activities and a more accurate picture of the distribution of the species both within the study area and more widely.

Analysis of outcomes from the monitoring program outlined above will also provide useful indications of areas requiring further investigation.

Linkages with higher education institutions will be sought, and post graduate student projects developed, in order to provide more information about GBF's response to disturbance.

Research question

Response of GBF's to hazard reduction burning

Response of GBF's to integrated harvesting and thinning operations

Develop an improved understanding of the species distribution throughout the region

Context

Research indicates that GBF's are able to survive low intensity hazard reduction fires. In a simulated study soil temperature increases below the soil surface and the fire dwell time were insufficient to seriously impact on replicated frogs. A more in-depth understanding of the effects on populations and their continued access to breeding sites is required.

GBF populations are persisting in areas that have been subjected to integrated harvesting and thinning. It remains unclear however whether significant short-term impacts on populations have occurred. A more in-depth understanding of the impacts of timber harvesting over time is desirable.

As indicated above, there is a poor understanding of the distribution of the species throughout the Eden Management Area. Once techniques are developed for monitoring the species through this plan, these techniques should be applied over a broader area in order to determine the true distribution of the species in the region.

ADAPTIVE MANAGEMENT

After each survey episode a progress report will be developed by FNSW. The report will detail the survey effort, results, problems encountered, and any preliminary inferences from the collected data. This will be used to assess the need for monitoring design modification and provide feedback for the SMP review process. The periodic reporting process will be agreed and formalised between FNSW and DECC to provide transparency should the process be subject to external scrutiny.

The information obtained through the monitoring program will help to ascertain whether the current prescription for the species is adequate for conserving the species.

Results from supplementary monitoring sites and additional research will provide information on GBF response to forest management activities, and inform DECC's decision regarding the management of excluded multi-aged compartments within State forest. Should the initial survey and monitoring provide insufficient data to address the objectives of the SMP then FNSW and DECC will jointly review the SMP and IFOA conditions and seek amendments as necessary. Any review of the conditions applying to the management of GBF's on State forest under the Eden IFOA Amendment No.4 (2006) on the basis of monitoring results, will require agreement between FNSW and DECC and will take into account potential effects on sustainable timber supply from the Eden RFA Region. Collected and analysed data from the

monitoring program will also refine research questions and generate new directions where additional information may be required.

REPORTING AND SMP REVIEW

In addition to the periodic survey progress reports (see *Adaptive Management* section above), reporting will be undertaken annually by FNSW. This will be in the form of a written report detailing survey results, other activities undertaken, recommendations and a formal meeting between FNSW and DECC. Outcomes of the annual report and forum will include review of completed activities, performance measured against the SMP objectives and monitoring program aims, endorsement of proposed upcoming activities and the general direction of the SMP.

A formal review of the SMP between FNSW and DECC will be undertaken every three years. The review will form part of the adaptive management process with results being used to provide future direction for GBF management under the SMP. If issues arise in the period between formal SMP review forums, then reviews shall occur as part of the survey progress report process, the annual reporting forums or on an as needs basis.

ACTIONS, ACCOUNTABILITIES AND TIMEFRAMES

Action	Description	Time-frame	Responsibility
Existing Data Review	Collate and analyse existing data held by FNSW	Year 1	FNSW (DECC review)
Occupancy survey site selection	Selection of sites within the PMZs.	Year 1	FNSW
Site selection outside of PMZs	For adjacent areas harvested and burnt since 2002, sites should be identified in the first year, while areas of future planned disturbance should be monitored for 12 months prior to the management activity.	Year 1 and ongoing	FNSW (DECC review)
Occupancy survey	Conduct surveys each autumn, spring and summer	Years 1-3	FNSW
Develop research questions and projects	With reference to the recovery plan for the GBF, develop a set of additional research objectives to provide details on gaps in the understanding of the GBF biology, habitat use and response to disturbance. Seek linkage with learning institutions to facilitate post graduate student projects.	Year 1	FNSW & DECC
Data Analysis and Reporting	Compile reports following each survey episode, incorporating analysis of outcomes as appropriate.	Years 1-3	FNSW
Annual report and review forum	Prepare an annual report on progress and outcomes of SMP actions and meet with DECC to discuss refinements if required.	Years 1-3	FNSW & DECC
SMP Review	Review direction of, and results obtained from, surveys outlined in SMP.	Year 3	FNSW & DECC

REFERENCES & FURTHER READING

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APPENDIX 1.

SCHEDULE 1 – AMENDMENTS TO THE INTEGRATED FORESTRY OPERATIONS APPROVAL FOR THE EDEN REGION

[1] **Clause 10 (13) Definition of relevant exclusion zone**

Insert, in appropriate order, the following matter in the definition of “relevant exclusion zone” in clause 10 (13):

condition 6.2A (“Giant Burrowing Frog (Interim arrangement)”)
condition 6.5A (“Southern Brown Bandicoot (Interim arrangement)”)
condition 6.8A (“Smoky Mouse (Interim arrangement)”)

[3] **Terms of licence under the *Threatened Species Conservation Act 1995* set out in Appendix B**

Condition 5.1 (b) (Operational requirements)

Insert “6.2A Giant Burrowing Frog (Interim arrangement),” after “6.2 Giant Burrowing Frog and Stuttering Frog,” in condition 5.1 (b). Insert “6.5A Southern Brown Bandicoot (Interim arrangement),” after “6.5 Southern Brown Bandicoot,” in condition 5.1 (b). Insert “6.8A Smoky Mouse (Interim arrangement),” after “6.8 Smoky Mouse,” in condition 5.1 (b).

[4] **Condition 5.19 (c) (Miscellaneous forestry operations)**

Insert “6.2A Giant Burrowing Frog (Interim arrangement),” after “6.2 Giant Burrowing Frog and Stuttering Frog,” in condition 5.19 (c). Insert “6.5A Southern Brown Bandicoot (Interim arrangement),” after “6.5 Southern Brown Bandicoot,” in condition 5.19 (c). Insert “6.8A Smoky Mouse (Interim arrangement),” after “6.8 Smoky Mouse,” in condition 5.19 (c).

[5] **Condition 6.2A**

Insert after condition 6.2:

6.2A Giant Burrowing Frog *Heleioporus australiacus* (Interim arrangement)

Note: The following condition (condition 6.2A) was developed as a result of a review of the operation of condition 6.2 in the Eden region, which provides for the establishment of exclusion zones for the protection of the Giant Burrowing Frog and Stuttering Frog. (Forests NSW may request such a review under conditions 2.1 (b) and 6.2 (e)). Condition 6.2A operates only for two years, while a species management plan is being developed for the Giant Burrowing Frog in the Region. The condition identifies those areas of land that are to be set aside as exclusion zones for the protection of the Giant Burrowing Frog during this period. It is envisaged that the terms of the licence will be amended before the expiry of the condition to reflect provisions of the species management plan.

- a) This condition (condition 6.2A) has effect on and from its commencement until 29 February 2008. Condition 6.2 does not apply during that period in relation to

exclusion zones for the protection of the Giant Burrowing Frog. However, that condition continues to apply in relation to exclusion zones for the protection of the Stuttering Frog.

- b) A Giant Burrowing Frog Exclusion Zone must be established for any area of land:
 - i. depicted in the Geographic Information System theme in ESRI shapefile format called “Giant Burrowing Frog Exclusion Zones”, in the sub-directory called “Giant Burrowing Frog Exclusion Zones” on the CD-Rom, lodged with the Department of Natural Resources and having the volume label “Eden TSL species Exclusion Zones for GBF, SBB and SM (9 February 2006)”; and
 - ii. further described in the corresponding metadata on the CD-Rom.

- c) Despite conditions 7 and 8:
 - i. surveys in accordance with condition 8.8 (and, in particular, conditions 8.8.3.1, 8.8.3.2 and 8.8.3.3) are not required for or in relation to the Giant Burrowing Frog before a harvesting operation is carried out; and
 - ii. the identification and recording of indications of the Giant Burrowing Frog in accordance with condition 8.6 (Incidental Threatened Flora and Fauna Records) is not required.

