EDEN CRA/RFA

PROJECT SUMMARIES

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These projects have been jointly funded by the New South Wales and Commonwealth Governments. The work undertaken for these projects has been managed by the joint NSW / Commonwealth CRA RFA Steering Committee and overseen by the Environment and Heritage, Economic and Social, ESFM and FRAMES Technical Committees.

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INTRODUCTION

During 1997 the Commonwealth and New South Wales Governments undertook comprehensive regional assessments (CRAs) of the Eden CRA/RFA Region. These assessments covered the range of environmental, biological, economic, social and cultural values of the Eden forests.

There are four broad assessment streams:

- environment and heritage assessments
- economic and social assessments
- ecologically sustainable forest management assessments
- Forest Resource and Management System (FRAMES) assessments

Technical Committees were established to manage the assessments. Details of these committees and an overview of the assessment streams are provided in the *Towards an Eden Regional Forest Agreement* report.

In total, 54 separate projects were undertaken as part of the Eden CRA, for which detailed scientific and technical working papers were produced. These working papers can be viewed at exhibition sites in the Eden Region and in Sydney and Queanbeyan. They can also be viewed at the following internet address:

www.rfa.gov.au

The following project summaries provide an outline of each project undertaken including the objective of the project, the methodology applied, and the key results and products of the work.

For further information in relation to the above contact the:

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GENERAL PROJECTS

EDEN REGIONAL FOREST FORUM (NA05/MUL)

Project objectives

- To provide a local consultative focus to assist the joint State and Commonwealth Steering Committee to carry out Comprehensive Regional Assessments (CRAs) and develop a Comprehensive, Adequate and Representative (CAR) Reserve System and a viable and ecologically sustainable timber industry.
- To serve as a communication channel between the Steering Committee and Regional Communities.

Methods/ Process

Meetings were structured as a mix between providing access to information for a better understanding of the CRA/RFA process and the identification of regional issues through the Forums for advice of the Steering Committee.

Involvement in projects

- regular briefings on progress of projects
- briefings on technical frameworks
- clarification of issues on request by the Forum
- access to reports and key output maps prior to scenarios development
- demonstration of C-plan, integration software used to develop scenarios
- access to technical staff to clarify issues
- workshops on Ecologically Sustainable Forest Management
- Community Heritage workshops

Dissemination of information on the CRA/RFA process in the Region

- access to information on the CRA/RFA process by stakeholder groups and the community through representatives on the Forum
- media releases informing the community on the work of the Forum
- access for the community to the Forums as observers

Key results and products

Advice was provided to Steering Committee on all issues raised in the Forum through

- oral reports by the Regional Liaison Officer and other State and Commonwealth representatives
- Status Reports, summarising the main points of discussion in the Forum
- minutes of each Forum meeting

Regional issues were referred to technical committees during scenarios development for information and consideration. The forum

- identified issues of concern in the region
- developed regional recommendations.

These issues and recommendations are described in chapters 6 and 11 of the report *Towards an Eden RFA.*

API (AERIAL PHOTOGRAPHY INTERPRETATION) MAPPING (NE 21/MUL)

Project objective

The objective was to undertake aerial photography interpretation (API) for the Eden CRA/RFA Region (as required for the old growth and biodiversity assessments) in order to produce digital layers and associated maps of:

- special vegetation classes, mainly rainforests and non eucalypt forests;
- broad and rare eucalypt forest classes;
- validate and refine forest growth stages;
- broad forest disturbance history.

Methods

Aerial photography techniques were used to delineate forest canopy floristic classes, forest growth stage classes and broad historical forest disturbances. Each layer was transcribed onto clear acetate overlay and captured using either scanning or single photo digitising techniques. Final layers were merged to create polygon and grid files. An expert API working group under the EHTC approved API pathways, field and desktop validation procedures and accuracy checking of digital layers.

Forest canopy floristics were defined from 1:25 000, 1990 and 1994 photography using ground truthing and known floristic data already captured. A minimum polygon size of ten hectares for some eucalypt forests and two hectares for rainforest and rare forest types was specified. The final layer was checked for accuracy to within 37 metres of 1:25 000 topographically mapped linear drainage features. Forest canopy floristics were mapped according to a three tiered classification.

Forest growth stage classes used 1990 and 1994 1:25 000 photography to validate and refine the Interim Forest Assessment (IFA) Digital Growth Stage Map created in 1995. The final layer was overlaid with coupe logging history data provided by State Forests of NSW to account for logging that had occurred since the photography. Additional field checking and code validation occurred which was independently validated at the conclusion of the project.

Key results and products

Changes to a layer previously developed for the NSW Interim Forest Assessment (IFA) included:

- new rainforest definitions;
- increased field validation of growth stage classes;
- disturbance attributing recorded logging and fire disturbances only when obvious and visible from photography; and
- a reduction in the minimum polygon size from ten hectares to two hectares rainforest and from 25 hectares to ten hectares for certain classes of eucalypt forests.

The application of changes resulted in an improved map of forest growth stages since the 1995 IFA map. The final layer is considered accurate to within 37 metres of 1:25 000 topographically mapped linear drainage features.

Broad forest disturbance history was the last API assessment to be completed. Obvious and visible logging and wildfire disturbances were delineated on black and white, 1:40 000, 1962 and 1967 aerial photography. Regrowth forests were not delineated. Capture was rapid with minimal field checking. Digital capture was by AUTOCAD. No accuracy check has been completed for the layer and it is provided for contextual information only.

Outputs of the project were: canopy floristics layer, forest growth stage layer, historical disturbance layer and a project report. Digital layers were used to assist in the derivation of forest ecosystem and old growth maps for the Eden CRA.

ENVIRONMENT AND HERITAGE

COMPILATION AND VALIDATION OF STATE FORESTS FLORA DATA FOR THE EDEN CRA/RFA REGION (NE03/EH)

Project objective

The objective of this project was to compile and validate all flora data collected by State Forests of NSW (SFNSW), or consultants to SFNSW, from the Eden CRA/RFA Region, and to make this data available for use in other CRA projects.

Methods

- Establish preliminary list of data sources through consultation with district and research staff. Data sources included research plots, district surveys, environmental impact statement and forest resource surveys and miscellaneous flora surveys and observations.
- Compile data and ensure all is available in digital format.
- Convert data to format compatible with the flora component of SFNSW Environmental Database.
- Validate data by determining:
  - whether the AMG co-ordinates accurately place the record within NSW and within the recorded administrative unit;
  - whether the species recorded is within its known/accepted distribution range.
  - Add validated data to SFNSW Environmental Database from where datasets can be extracted for use in other CRA projects.

Key results and products

The project enabled data from fifteen systematic plot-based flora surveys to be compiled and validated prior to incorporation into the SFNSW Flora Environmental Database. This process resulted in a total of 57 617 validated records of 824 species from 15 surveys - an increase in records of over 1000%.

Prior to the commencement of this project there were no miscellaneous records of flora species in the Eden region available through the SFNSW' Flora Environmental Database. This project has assisted in the compilation and validation of nearly 30 000 miscellaneous records of around 940 species.

In total, this compilation project has resulted in the addition of more than 80 000 records of flora species in the Eden CRA/RFA Region to SFNSW' Flora Environmental Database.

The data compiled and validated through this project has been used for various other CRA projects. The Eden vegetation mapping project (refer Project NE18/EH) has made extensive use of the dataset and the response to disturbance of forest species project (refer Project NA17/EH) has used the data to establish the spatial database and guide the application of the reservation and management targets.

VEGETATION MAPPING (NE18/EH)

Project objective

The objective was to prepare a map of forest ecosystems for the Eden CRA/RFA Region. Forest ecosystems are required to be: representative of biodiversity; defined in terms of floristic composition in combination with substrate and position within the landscape; recognisable in the field; able to be mapped; and able to have their pre-1750 distribution modelled or mapped (JANIS 1997).

Methods

A vegetation classification was derived, as agreed during project approval, by modification of an existing classification derived from multivariate analysis of vegetation samples. A total of 1590 samples were used in the CRA analysis.

Vegetation types were defined by interpreting floristic, structural, environmental and geographic uniformity of dendrogram lineages (see Keith & Sanders 1990). It was necessary to modify the existing classification to accommodate seven vegetation units within Wadbilliga-Numeralla, an area of 140 000 hectares not previously analysed.

One further unit (46A Timbillica Dry Shrub Forest (Yertchuk)) was discriminated in the Timbillica area to accommodate comments on a previous map and patterns indicated in new data. A total of 47 eucalypt-dominated units and 25 terrestrial non-eucalypt units were recognised as ecosystem map units. The pre-1750 spatial distribution of ecosystem units was mapped using a hybrid approach based on decision tree modelling and an expert system applied to 1450 samples and spatial data on parent material, climate, terrain and remote sensing. Rainforests, grasslands, wetlands and heathlands were delineated using aerial photography interpretation and ecosystems within these structural groupings were mapped using the decision tree/expert system.

Draft maps were examined by experts from NSW National Parks and Wildlife Service and State Forests of NSW and modified where necessary to ensure appropriate relationships between vegetation types and landscape variables. A map of extant ecosystem units was derived by overlaying a coverage of extant native vegetation cover derived from analysis of a 1994 Landsat image and a coverage of pine plantations provided by State Forests NSW. Accuracy was assessed using 140 independent samples (i.e. withheld from modelling) allocated to vegetation types with a high level of certainty. This analysis yielded 92% accuracy at a spatial scale of 100 hectares, the approximate size of planning units used in integration.

Key results and products

Outputs of the project were: GIS coverages of pre-1750 and extant forest ecosystems; field guide to map units; and a report on vegetation analysis and forest ecosystem mapping.

Reference

Keith, D.A. and Sanders, J.M. (1990). *Vegetation of the Eden region, South-eastern Australia: species composition, diversity and structure. Journal of Vegetation Science* 1, 203-232.

OLD GROWTH FOREST RELATED PROJECTS (NE29/EH)

Project objective

To define, identify and map old growth forest and other successional stages within the Eden CRA/RFA Region. In particular, the project aimed to define ecological maturity and identify areas where the current effects of disturbances are now negligible as required by the old growth definition in the JANIS reserve criteria report (1997).

Methods

Old growth forest ecosystems are referred to as 'candidate old growth' because time constraints did not allow for the full assessment of values characteristic of old growth forest (e.g. the condition/maturity of the understorey, compositional, functional and aesthetic values). This meant that a full assessment of the effects of disturbances was not possible as part of this project.

Aerial photography interpretation (API) specialists classified Myrtaceous species according to their ease of interpretability into three classes: Easy (Jacobsian), Difficult (Non - Jacobsian) and Variable interpretability. This classification also accorded with how these species 'behaved' across qualitative classifications of environmental site quality. Vegetation units were then allocated to one of the above classes based on the expected dominant canopy species.

An expert panel considered available data (and its limitations) on API growth stage and disturbance together with other geographic information system (GIS) information on logging and fire history. It formulated rules for the allocation of growth stage and disturbance information to candidate old growth forest and other successional stages. The expert panel was not able to completely resolve the issue of old growth definition rules as there was not consensus amongst stakeholders concerning the allocation of some API growth stage codes to the 'candidate old growth class'.

The chairs of the Environment and Heritage Technical Committee resolved the old growth code allocation problem by deciding that sA, in addition to the codes tA, tB & tC nominated by the expert panel (and agreed to by stakeholders), would be considered candidate old growth forest. Post photo logging disturbance and rainforest were overlaid to complete the derivation of the layer.

Key results and products

Within the Eden CRA/RFA Region 20% (106 536 hectares) of the area was identified as candidate old growth forest, 1% (7555 hectares) as disturbed old forest, 32% (171 489 hectares) as mature forest, 4% (22 969 hectares) as disturbed mature forest, 23 % (124 855 hectares) as young forest, 8% (44 551 hectares) as recently disturbed forest and 2% (11 154 hectares) as rainforest.

Candidate old growth forest was comprised of the following growth stage codes (see below for coding explanation): tA (16.4%), tAF (0.5%), tB (51.3%), tBF (0.6%), tC (16.9%), tCF (0.1%), sA (10.9%) and sAF (2.1%).

Much of the candidate old growth forest has a fragmented distribution within the Eden CRA/RFA Region, with most stands occuring in a complex mosaic of mature and younger forest.

The main outputs of the project are:

- a GIS layer of candidate old growth forest, disturbed old forest, mature forest, disturbed mature, young forest and recently disturbed forest, and some areas not growth staged together with rainforest;
- a GIS layer of interpretability classes; and
- a report on identification and delineation of candidate old growth forest.

Note: (Regarding growth stage coding):
t = < 10% regrowth, s = 10-30% regrowth,
A = > 30% senescence, B = 10-30% senescence and C = < 10% senescence. F = fire disturbed.

VERTEBRATE FAUNA SURVEYS FOR CRAS - EDEN REGION (NA01/EH)

Project objectives

- To conduct a comprehensive data audit to collate currently known information on the distribution of fauna in the Eden CRA/RFA Region, in order to conduct a gap analysis to ascertain environmental and taxonomic gaps in the data.
- To provide new data, using systematic surveys, on the distribution and abundance of forest vertebrate fauna in the Eden area, and to fill information gaps on endangered forest-dependent fauna using targeted surveys.
- To provide data for the fauna modelling project and to contribute to the biodiversity assessment component of the CRA process and the development of Ecologically Sustainable Forest Management practices.

Methods

Species of particular conservation and forest-dependency significance were selected through a consultative process involving relevant agencies, experts and the Environmental and Heritage Technical Committee, to receive concerted attention in the data audit and fauna surveys.

Existing datasets on the distribution and abundance of fauna in and around the Eden area were collated. Environmental GIS layers were obtained or derived according to the standards set by a Data Management Group. An environmental stratification using rainfall, lithology, temperature and vegetation type was derived and used to conduct a gap analysis to identify environmental and taxonomic gaps in the data.

To fill the identified gaps, survey sites were selected using a stratified random approach. 158 systematic survey sites were selected in the Eden CRA area and 93 sites in the adjoining areas of the Southern CRA/RFA Region, to provide extra data to enhance the Eden modelling. Standardised survey methods were used at all sites. Some sites were designated as targeted survey sites to gain further information on the selected high priority species.

The new survey data were entered onto the NSW Wildlife Atlas and exported into *MS Excel* with the collated external data. The complete survey database was extensively validated by experts.

Key results and products

A total of 251 sites were surveyed during the period January to April 1997.

The validated survey database, containing both formal (presence-absence) and incidental (presence-only) data, was exported for use in the fauna modelling project and to support CRA biodiversity assessment components.

Metadata statements were completed for all groups of data used in the database. A full report on fauna data audit and survey was prepared. Improvements to the audit and survey methodologies have been noted for incorporation into the Southern CRA process.

FAUNA MODELLING (NE24/EH)

Project objectives

- To produce valid vertebrate fauna models to predict the range of, and quality habitat for, fauna species of the Eden CRA/RFA Region.
- To use the above models for assessment of high quality habitat for significant priority species, and to provide digital information for other project areas for use in satisfying JANIS criteria relating to centres of endemism, significant refugia, and areas of high biodiversity.

Methods

External fauna survey data collected during the fauna audit process, and data collected on the CRA summer 1996/97 surveys, were extensively validated by contracted experts.

Abiotic and biotic environmental GIS layers were obtained. Various biotic indices (i.e. tree hollows, foliage nutrient, decorticating bark, nectar, shrub, ground cover and growth stage) and abiotic indices (mean annual rainfall and temperature, ruggedness, topographic position, wetness, solar radiation and fertility) were derived by contracted experts. Contextual variables based on old growth, clearing and rainforest were also derived.

All survey fauna data were designated as formal (presence-absence) or incidental (presence-only), and survey method and effort covariates assigned to the formal data.

The complete dataset and GIS layers were modelled for each species and models fitted for each species. The model results were used to extrapolate species' distributions across the entire Eden CRA area using *Arcview*.

Key results and products

For each species the model results comprised statistical viability analysis and assessment of the significance of each variable used in the model. The maps produced in *Arcview* indicated the probability of occurrence of each species across the Eden area from 1 - 100%.

Models and maps for priority species were evaluated by expert modellers and ecologists and revisions to the models made as necessary. The probability classes for each species' map were grouped to reflect areas considered to be core, intermediate or marginal habitat.

The final priority species' modelled maps were assessed and revised as needed by the Response to Disturbance expert workshops. A number of species did not produce viable models due to lack of data or poor quality data. For these, a model was either compiled by the experts using the vegetation map and current known habitat preferences, or using known point locations to delineate target areas.

The resultant modelled maps from the Response to Disturbance workshop were used for integration. Metadata statements were completed for all GIS layers and databases used in the modelling. A full report on fauna modelling was also prepared. Improvements to the modelling process have been noted for incorporation into the Southern CRA process.

BERMAGUI/MURRAH KOALA HABITAT MODEL (NE04/EH)

Project objectives

The project objectives were to build on existing data on koala habitat preferences in the Bermagui Murrah Forests and produce a robust model of koala use in this area.

Methods

The South East Forests Koala Research Project had already gathered data on the environmental characteristics of 75 active sites used by koalas in the study area. The information was analysed by stratifying according to slope position, aspect, growth stage and disturbance history. This revealed that few data existed on areas that had been subjected to integrated harvesting. Further surveys were undertaken, primarily in these areas. Plots that were representative of slope, aspect and vegetation were sampled. Analysis of tree species and forest growth stages preferred by koalas was then completed and overlaid with vegetation and forest succession maps to provide a GIS layer of modeled koala habitat in the study area.

Key results and products

Analysis of the data established that the most preferred tree species in the study area were Woollybutt (E. longifolia) and Mountain Grey Gum (E cypellocarpa). Other species receiving comparable but less significant levels of use included White Stringybark (E. globoidea), Yellow Stringybark (E. muelleriana) and Coast Grey Box (E. bosistoana).

The range of preferred tree species revealed that koalas prefer all eucalypt species most commonly found in the Vegetation Types 32, Coastal Dry Shrub Forest (Woollybutt) and 34, Brogo Dry Shrub Forest. Mature trees in relatively undisturbed areas were also preferred. This information provided the primary basis of the model.

Preliminary analysis of the regrowth data demonstrates significant changes in overstorey species composition in areas subjected to integrated harvesting. If the preliminary analysis is confirmed, then this draft report concludes that these changes pose a significant threat to the long-term viability of koalas in production forests.

Preliminary regional model

In the absence of a regional model of koala habitat for the CRA, advice was provided to the NPWS on appropriate vegetation types and growth stages that could be selected to develop a preliminary model. Although the information was primarily derived from quantifiable data on koalas' tree species preferences from several study areas in the Region and appears to correlate powerfully with koala records, current information is insufficient to confidently model koala habitat for the entire Region.

RESPONSE TO DISTURBANCE OF FOREST SPECIES IN NSW CRA/RFA REGIONS (NA17/EH)

Project Objective

The Response to Disturbance Project was undertaken to identify and synthesise the conservation requirements of forest species. This information will assist in ensuring the reserve system meets the JANIS criteria pertaining to the conservation of forest species.

Methods

The methods used in this project aimed to answer the following questions for the Eden CRA/RFA Region:

- Which species of flora and fauna are at a high risk of extinction?
- What are their habitat requirements?
- What disturbances affect their populations?
- How big an area should be reserved or managed for priority species?
- How should these species be managed?
- Should their habitat be placed in dedicated reserves?

There were six primary steps in conducting the project:

1. Drawing up a list of forest-dependent species. This was put together from existing schedules of endangered or threatened species under State and Commonwealth legislation, as well as species considered by experts to be of regional concern.
2. Gathering information on the risk of extinction for each species. This information was obtained by asking expert ecologists to complete carefully structured proformas. The risk of extinction was assessed according to rarity, population trends, and habitat requirements.
3. Documenting disturbances that adversely affect the species. This information was compiled from proformas.
4. Estimating the area that needs to be reserved or managed in order to conserve the species. Simple formulas were developed for these estimates, one for fauna and one for flora. The fauna formula takes into account life history and home range parameters, while the flora formula considers the size and probability of threatening events such as fire. In addition to the areas estimated for flora, experts agreed on rule sets for protecting known populations of rare plants.
5. Evaluating existing management. Expert advice was sought on whether existing management practices adequately caters for the conservation needs of species.
6. Selecting areas to be reserved or managed. This step was undertaken at a workshop and required bringing together the outputs of steps 1 to 5 with information on where the priority species and their habitat occur. That information came from the Eden Fauna Modelling Project which was conducted by NSW National Parks and Wildlife Service and from the Service's flora databases.

Key results and products

The project provided the following information about forest dependent species that is needed to create a reserve system and fulfill other JANIS criteria:

- Lists of priority flora and fauna species.
- Estimated areas that need to be reserved or managed to ensure the conservation of each priority species of fauna.
- Rule sets for reserving populations of priority plant species.
- A compendium of expert advice on the sensitivity of flora and fauna species to disturbance and recommendations for management both on and off reserve.

WILDERNESS ASSESSMENT (NE25/EH)

Project objective

To collate and validate mapped disturbance information for use in the refinement of the National Wilderness Inventory (NWI), and to identify and map areas of wilderness which meet the criteria of the *NSW Wilderness Act 1987* and the JANIS reserve criteria report (1997).

Methods

Within the Eden CRA/RFA Region, three areas (Brogo, Nadgee and Genoa) were found to meet the JANIS criteria for defining "high quality wilderness" (minimum NWI rating of 12 and a minimum size of 8000 hectares) (NWI >12). Although Genoa fell below the minimum size threshold, it was accepted in accordance with the JANIS reserve criteria as it adjoins a wilderness area in an adjacent region.

Delineation of these three areas was guided by the technical framework for environment and heritage assessments in the NSW CRA/RFA process which emphasises the desirability of identifying rational and manageable boundaries for wilderness areas. This principle is further expounded in the JANIS reserve criteria report which recognises the need to consider viability and shape, and the usefulness of topographic features, water catchment boundaries, and roads and other transport routes to delineate boundaries.

Although the delineation process aimed to capture all land of "high quality wilderness" within wilderness boundaries, in some instances small areas were excluded due to shape and viability considerations. Conversely, in other places, small areas of relatively low wilderness quality were incorporated within boundaries for practical management reasons.

The method of determining if the JANIS reserve criteria in the Eden CRA/RFA Region were met was achieved by a process of intersecting the delineated NWI with the current reserve tenure layer. The target for wilderness has been clearly defined in the JANIS reserve criteria, being 90% or more if practicable of NWI 12+ wilderness quality (and a minimum size of 8000 hectares).

Key results and products

From this integration there is approximately 90 877 hectares of "high quality wilderness" of which 87 142 hectares is located within the existing dedicated reserve system, with only 3735 hectares of high quality wilderness located outside these areas. Therefore, 96% of the delineated NWI 12+ is located within the existing dedicated reserve system. While the minimum wilderness reservation requirements of the JANIS reserve criteria have been met, the technical framework for environment and heritage assessments in the NSW CRA/RFA process requires that, "a practicability [or justification] assessment will need to be conducted if a reservation level less than 100% is sought".

STATEWIDE INDIGENOUS CONSULTATION PROCESS FOR THE CRA/RFA PROCESS (NA10/EH)

Project Objectives

To ensure a coordinated approach across the NSW CRA/RFA regions to the management of consultation with Indigenous peoples and the preparation of assessment projects relating to Indigenous communities' values within forested areas.

Methods

- Appointment of two project officers to coordinate and manage the Indigenous consultation process.
- The formation of Aboriginal Management Committees in each region.
- Dissemination of information to Indigenous communities on the CRA process in each CRA/RFA Region.
- The development of projects associated with the assessment of Indigenous forest values in consultation with Aboriginal communities and relevant CRA/RFA technical committees/working groups.
- Oversight of management of the consultation process, consultants and preparation of draft reports in relation to consultation and assessment projects.
- Oversight of the presentation of final reports to the Aboriginal Management Committees for approval.
- Oversight of the presentation of reports for signing off and preparation of information and data protocols.

Key results and products

A comprehensive consultation process in the Eden CRA/RFA Region was implemented through:

- Formation and operation of the Bega Eden Merrimans Aboriginal Forest Management Committee.
- Indigenous community involvement in the development and undertaking of assessment projects in the Eden Region including the Assessment of Places of Aboriginal Significance in the Eden CRA/RFA Region project.
- Submission of project proposals to the Bega Eden Merrimans Aboriginal Management Committee for the Committee's consideration and approval
- Participation of Indigenous representatives during the development of scenarios
- Preparation and submission of an Indigenous Scenario Paper to the major stakeholders participating in the CRA/RFA process (see Chapter 10 of the report *Towards an RFA for Eden*).
- Indigenous community involvement in the implementation of the Social Assessment with Aboriginal Communities in the Eden CRA/RFA Project, conducted by the Economic and Social Technical Committee.

ASSESSMENT OF PLACES OF ABORIGINAL SIGNIFICANCE IN THE EDEN CRA/RFA REGION (NE32/EH)

Project objectives

The objectives of this project were:

- Documentation by Aboriginal communities of Aboriginal interests and places of significance.
- Identification of areas of land requiring special management prescriptions or reservation as Aboriginal protected places.
- Identification of Aboriginal concerns relating to land management practices.

Methods

Community workshops were held to identify places/areas of significance to the Aboriginal communities in the Eden CRA/RFA Region. Places/areas identified included:

- places with cultural significance (spiritual, customary use);
- places considered important for community access for cultural activities (access to bush foods and medicines, teaching places); and
- areas the Aboriginal communities have an interest in for economic development.

Documentation of places/areas identified through the workshops was undertaken through site visits and discussions with custodians of information relating to these places and in conjunction with a registered surveyor. Documentation centred on highlighting matters of concern to Aboriginal communities that will need to be addressed in future management and ownership arrangements.

Places/areas of significance were mapped and digitised to form the basis of community determined GIS data layers for use in the CRA/RFA integration and scenarios development phase.

Key results and products

- A series of GIS layers delineating:
  - Places of Aboriginal significance
  - Places for Aboriginal Ownership
  - Places for Aboriginal Ownership with Leaseback to the Crown
  - Places for Aboriginal joint management
- A report from the Eden Region Aboriginal Management Committee which reflects the communities' inherent rights, needs and aspirations for the future management and tenure of these places.

See chapter 10 and appendices10.1, 10.2 and 10.3 of the report *Towards an RFA for Eden.*

NATIONAL ESTATE EXTENSIVE NATURAL VALUES - EDEN REGION (NE36/EH)

Project objective

The objective of this project was to identify the extent of land having the following natural values that are extensive in nature and operate at the landscape scale:

- Natural landscapes
- Undisturbed catchments.

Methods

The assessment was undertaken using the National Wilderness Inventory (NWI), the Wild Rivers Database and resources of the Wilderness and Wild Rivers Unit, Environment Australia. Issues of threshold determination and application were consistent with that used in Tasmanian and Victorian CRAs and were undertaken in consultation with Wilderness and Wild Rivers Section of Environment Australia and the NPWS.

Natural landscapes

The assessment of this value is derived from using the NWI biophysical naturalness indicator. Thresholds are set at BN=5 (on a scale of 1-5), where five equals areas that are free of logging or grazing and other known non-natural disturbance. Natural landscapes are delineated as undisturbed areas of 1000 hectares with less than 5% fragmentation (or less than 5% BN<5).

Undisturbed catchments

With the Wild Rivers database, maintained by the Wilderness and Wild Rivers Section of Environment Australia it is possible to identify rivers and streams with wild river values, ie. those with catchments and flow regimes which remain essentially undisturbed since European settlement. Delineation of undisturbed catchments was made using expert advice from John Stein, the creator of the wild rivers database. Thresholds were set at those sub-catchments with little to no disturbance. On a scale of 0 to 1 the threshold was set at 0.01.

Key results and products

Natural landscapes

Fifteen natural landscapes areas of national estate significance were identified. These areas cover a total of 219,549 hectares and ranged in size from 1,162 to 86,159 hectares.

Just over 70% of the total natural landscape area occurs in national park or nature reserve while 11% of the total area is in state forest (Table 1). Also, approximately 60% of total area currently occurs in places already listed in the Register of the National Estate.

TABLE 1: LAND TENURE OF THE AREA OF NATURAL LANDSCAPES ASSESSED AS MEETING THE THRESHOLD FOR NATIONAL ESTATE SIGNIFICANCE

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park or Nature Reserve	153,235	70
Private Land	31,460	14
State Forest	23,627	11
Reserved Crown Land	2,929	1
Leasehold Crown Land	2,792	1
Other Crown Land	2,764	1
PMP 1.3*	931	<1

*PMP 1.3 is the State Forests of NSW Preferred Management Priority Classification for areas reserved as Flora Reserves and Forest Preserves (Forestry Commission of NSW 1993)

Undisturbed catchments

Fifty seven areas were identified as undisturbed catchments, covering a total of 110,965 hectares and ranging in size from 7 hectares to 59,209 ha. These 57 areas were made up of 320 sub-catchments which range in size from just over one hectare to 5,590 hectares.

Approximately 87% of the total area of undisturbed catchments occurs in national park or nature reserve and 9% of the total area is in State forest.

After applying the size threshold of 1,000 hectares, thirteen areas of national estate significance were identified.

Approximately 89% of the identified undisturbed catchment areas occurs in national park or nature reserve, 7% of the total area is in State forest (Table 2). Nearly 84% of the total area occurs in places currently listed in the Register of the National Estate.

TABLE 2: LAND TENURE OF THE AREA OF UNDISTURBED CATCHMENTS ASSESSED AS MEETING THE THRESHOLD FOR NATIONAL ESTATE SIGNIFICANCE

Tenure	Approximate Area (ha)	Proportion of Total (%)
National Park or Nature Reserve	91,387	89
State Forest	7,336	7
Private Land	2,753	3
Leasehold Crown Land	405	<1
PMP 1.3*	274	<1
Other Crown Land	139	<1
Reserved Crown Land	77	<1
State Forest Plantation	47	<1

*PMP 1.3 is the State Forests of NSW Preferred Management Priority Classification for areas reserved as Flora Reserves and Forest Preserves (Forestry Commission of NSW 1993)

STATE-WIDE CULTURAL HERITAGE DATA AUDIT INTEGRATION AND ANALYSIS (NON-INDIGENOUS) (NA02/EH)

Projective objectives

- To investigate and assess available non-indigenous cultural heritage information across the NSW CRA/RFA regions;
- To integrate the available information into datasets for ongoing use throughout the CRA process; and
- To identify gaps in information to allow targeting of future cultural heritage investigations.

Methods

- Preparation of an annotated bibliography of sources relating to the history and non-indigenous cultural heritage of the forests of the NSW CRA regions.
- Identification of existing datasets and reports relating to non-indigenous heritage places within the forests of the NSW CRA regions.
- Development of recommendations for integrating this information into a database for ongoing use throughout the CRA process.
- Integration of information into appropriate databases and GIS coverages, focussing initially on the Eden CRA Region and then the remaining CRA regions.
- Analysis of the resulting datasets to highlight deficiencies and gaps in the data and develop recommendations for a strategic approach to future data collection and management.

Key results and products

The following results have been achieved:

- A computer database bibliography, with over 6000 entries, of sources relating to the history and non-indigenous cultural heritage of the forests of the CRA regions.
- A report identifying existing non-indigenous heritage databases and reports relating to heritage sites and places in the NSW CRA regions.
- GIS coverages showing the location of recorded non-indigenous heritage places within the forests of the NSW CRA regions.

PROTECTING CULTURAL HERITAGE VALUES AND PLACES IN NSW FORESTS (NA03/EH)

Project objectives

- To provide a comprehensive overview of current protective mechanisms and management practices for the conservation of cultural heritage values and places (Indigenous and non-Indigenous) in NSW forests.
- To assess the adequacy and efficiencies of current protective mechanisms and management practices, and identify issues associated with the management and protection of cultural heritage values and places in NSW forests.
- To establish workable conservation principles and guidelines for the protection and management of cultural heritage values and places in NSW forests.
- To provide information and material to contribute to the Ecologically Sustainable Forest Management assessment process.

Method

The project is being undertaken in a series of stages as follows:

- Stage One (in progress) – overview and analysis of current framework (legislative and non-legislative) for the protection and management of cultural heritage values and places in NSW forests.
- Stage Two – broad consultative and site inspection process in each CRA/RFA Region to examine the application of current protective mechanisms and identify further issues associated with the management of cultural heritage values and places in the NSW forests.
- Stage Three – development of a set of workable conservation principles and guidelines for the protection and management of cultural heritage values and places that address land resource managers, Indigenous communities, and other relevant stakeholders needs and requirements, including State and Commonwealth legislative requirements.

Key results and products

- Report detailing current protective mechanisms for cultural heritage values and places (in prep).
- Report identifying issues raised through site visits/inspections, and issues and needs of each agency associated with the protection and management of cultural heritage values and places raised by land /resource managers (yet to be undertaken).
- Report identifying issues and needs associated with the protection and management of indigenous cultural heritage values and places raised by Indigenous communities (yet to be undertaken).
- Report detailing workable conservation principles and guidelines in a form suitable for use by land/resource managers for the protection and management of cultural heritage values and places in NSW forests (yet to be undertaken).

Management options suitable for inclusion in the Regional Forest Agreements for each CRA/RFA Region (yet to be undertaken).

EDEN REGION FOREST HISTORY AND HERITAGE ASSESSMENT (NON-INDIGENOUS) (NE16/EH)

Project objectives

The objectives of this project were to identify, document and assess places of State and national estate cultural heritage value (non-indigenous) in the Eden CRA/RFA Region, and to establish an historical context for the identified values to assist in ensuring the conservation of those values through the Eden Regional Forest Agreement.

Methods

The methodology for this project involved:

- collection, documentation and analysis of primary and secondary sources related to Eden forest history through a statewide data audit.
- interrogation of existing historical evidence to identify key themes of historic activity which took place within – and associated with – forests of the Eden Region. This task also encompassed the identification of themes/areas to be targeted for further research and field validation.
- community heritage workshops to identify places of value to the local community.
- targeted research and field investigation of places representing key historic themes in the Region.
- significance assessment of all places identified against State heritage and National Estate criteria.
- Creation of GIS coverages of places of significance.

Key results and products

- An overview report of regional forest history, land use and key historic themes (non-indigenous) in the Eden CRA/RFA Region.
- Community heritage workshop report for each workshop.
- Inventory of places significant to the local community.
- Community heritage assessment report.
- Targeted historic place identification, documentation and assessment report (in prep).
- Inventory of historic places subjected to field validation and further research.
- GIS layers of places of historic and social heritage value.

Assessment of places and areas against the criteria for the Register of the National Estate and State Heritage criteria; and preparation of information in a form suitable for listing in the Register of the National Estate and inclusion in the State Heritage Inventory (in prep.)

ASSESSMENT OF PLACES OF AESTHETIC SIGNIFICANCE IN THE EDEN CRA/RFA REGION (NA15/EH)

Project objectives

The objectives of this project were the identification, documentation and assessment of places of National Estate and State heritage aesthetic value in the Eden Region, to assist in the conservation of those values through the Eden Regional Forest Agreement.

Methods

The method for this project has involved:

- Identification of places of potential aesthetic significance through analysis of existing information compiled in the Statewide Cultural Heritage Data Audit (non-indigenous.) project; limited collection of art, literature and tourism information; interviews with state agency land managers; and places identified through the Eden Region community heritage workshops.
- Assessment of identified places against state heritage and national estate criteria to identify significant places.
- Documentation and some field verification of significant places.
- Creation of GIS coverages of places of significance.

Key results and products

- Aesthetic value identification and assessment report for the Eden Region (in prep)
- Inventory of places of aesthetic value.
- GIS layer of places of aesthetic value.
- Assessment of places and areas against the criteria for the Register of the National Estate and State Heritage criteria; and preparation of information in a form suitable for listing in the Register of the National Estate and inclusion in the State Heritage Inventory (in prep.)

OVERVIEW OF ARCHAEOLOGICAL RESOURCE ON FORESTS (NA16/EH)

Project objectives

The two main aims of the project were to give a clear indication of the nature of the forest archaeological resource and to stimulate discussion between natural resource and cultural heritage managers on archaeological identification and management issues for the CRA/RFAs.

The project dealt with the scientific values of the resource as opposed to the cultural values held by Aboriginal people, which must be also be assessed for management purposes.

Methods

A report was produced which collated and synthesised existing archaeological forest studies. Qualitative assessment of methods and outcomes was undertaken. Issues discussed include:

- the nature and extent of research undertaken;
- possible future data requirements;
- the analytical potential of the resource and its implications for management;
- technical issues pertaining specifically to defining the empirical nature of the resource;
- the range of natural and cultural impacts to the resource and implications for the management of minimally disturbed areas;
- different models of management in terms of their operational viability and effectiveness to maintain a 'representative' sample of the resource; and
- options for the management of archaeological values in NSW forests.

Key results and products

- A report providing an overview of the extent and nature of forest archaeological research and implications for future data and research requirements.
- Increased awareness of management issues based on adequate understanding of the empirical nature of the resource.

The report will provide background information to be used as a basis for technical discussions during the Protecting Cultural Heritage Values and Places in the NSW Forest Estate CRA project (Project NA03/EH) and to assist the ESFM project management group in their assessment of management issues regarding the archaeological resource in forests.

IDENTIFICATION OF PLACES OF NATURAL HISTORY SIGNIFICANCE - EDEN REGION (NA24/EH)

Definition

Areas which may be identified as possessing natural history value (National Estate Criteria C.1) including places important for information contributing to the wider understanding of Australian natural history, by virtue of its use as a research site, teaching site, type locality including flora and fauna type locality, reference or benchmark site.

Project Objective

- To identify and assess sites of national estate significance in NSW CRA/RFA Regions that have the potential to contribute to a wider understanding of Australian natural history.
- To assess and document the national estate values of identified places against the national estate criteria.
- To provide information regarding appropriate protection and management of the identified areas and values for incorporation in the CRA/RFA process.
- Contribute to the conservation of flora and fauna 'type' localities in the development of the CAR reserve system.

Methods

Step 1

Compile preliminary data sets of information for each CRA/RFA Region listing potential Research Sites, Teaching Sites and Reference or Benchmark Sites identified from the following sources:

- State Government Department data bases (National Parks and Wildlife Service, NSW State Forests) providing information of sites, places of special significance or zones in management plans for purposes consistent with the above criteria;
- Consultation with experts, leading scientists, academics, researchers and universities, in natural science areas;
- Comprehensive literature review; and
- Community heritage workshop reports.

The data sets should include descriptions of clearly defined boundaries for each site.

Step 2

Determine those sites of national estate significance from the places identified in Step One by assigning a significance rating for each location. The significance rating will be used to develop thresholds against which the identified sites can be assessed; only those sites above threshold would be considered of potential national estate significance.

Step 3

Develop conservation guidelines relating to the nature of places and values identified in Step 2.

Step 4

Prepare a draft report documenting all sites of potential national estate value. The report should include:

- a full description of all site attributes relevant to site assessment, listing and advice in relation to the Register of the National Estate; and
- draft conservation guidelines relating to the nature of places and values identified.

The project methodology will be described in detail. All decisions regarding the application of thresholds and national estate criteria will be fully and clearly documented. Sites identified during the project, but considered below threshold for national estate purposes, will also be noted in the report. All sources of information relating to the identification of national estate places are to be fully documented and a complete bibliography provided.

Step 5

Prepare a final report that includes:

- documentation of the places which meet the thresholds to the required standard for listing in the Register of the National Estate and mapping of the identified places adequate for incorporation within a GIS at 1:100,000 scale; and
- documentation of specific recommendations relating to the conservation management requirements of the identified places and values.

Key results and products

This project area is being undertaken as a statewide project covering all of the NSW CRA/RFA Regions. The project did not produce

results within the timeframe of the Eden CRA, and hence data was not available for the integration and scenarios development process.

When completed in early 1998, the project will provide information about the location and protection requirements of these national estate values. This information will be used to inform the finalisation of the Eden RFA. The nature of these values means that informal and off-reserve management is usually adequate to protect the value. A process for protecting these values in an appropriate way needs to be set out in the Eden RFA.

NB: The approved National Estate Flora and Fauna Type Localities Project (NA26/EH) has been combined with this project and with the approved Identification of Places of Geoheritage Significance project (NA25/EH). This decision was made to avoid apparent duplication between the two projects so that the projects could be managed more efficiently and cost-effectively.

IDENTIFICATION OF PLACES OF GEOHERITAGE SIGNIFICANCE - EDEN REGION (NA25/EH)

Project objective

- To collate existing information on places of geoheritage significance.
- To assess the national estate significance of geoheritage places.
- To develop conservation management guidelines for national estate geoheritage places.

Areas which may be identified as of geoheritage value (National Estate Criteria A.1, A.2, A.3, B.1, C.1 and D.1) including places important:

- in the evolution of Australian landscapes or climate;
- in maintaining existing processes or natural systems at the regional or national scale;
- in exhibiting unusual richness or diversity of landscapes;
- for rare, endangered or uncommon natural landscapes or phenomena;
- for information contributing to a wider understanding of Australian natural history by virtue of its use as a research site, teaching site, type locality, reference or benchmark site.
- in demonstrating the principal characteristics of the range of landscapes, environments or ecosystems, the attributes of which identify them as being characteristic of their class.

Methods

It is anticipated that the project will be undertaken through a consultancy that shall identify, assess and document the national estate values relating to geoheritage in the NSW CRA/RFA Regions.

All three branches of the earth sciences (geology, geomorphology and soils) will be considered. Representative as well as outstanding places where the characteristic elements of geodiversity of a region are represented will be identified.

The crucial role of expert review processes in making robust and defensible assessments of geoheritage values will be facilitated through consultation with experts familiar with the regional geodiversity. Expert consultation will be critical in assessing site significance and for thresholding purposes.

Key results and products

This project area will be undertaken as a statewide project covering all of the NSW CRA/RFA Regions. The project did not produce results within the timeframe of the Eden CRA, and hence data was not available for the Integration and Scenarios Development process. When completed in mid-1998, the project will provide information about the location and protection requirements of these national estate values. The nature of these values means that informal and off-reserve management is usually adequate to protect the value. A process for protecting these values in an appropriate way needs to be set out in the Eden RFA.

NB: The approved National Estate Flora and Fauna Type Localities Project (NA26/EH) has been combined with this project and with the approved Identification of Places of Natural History Significance project (NA24/EH). This decision was made to avoid apparent duplication between the projects so that the projects could be managed more efficiently and cost-effectively.

NATIONAL ESTATE FLORA AND FAUNA TYPE LOCALITIES - EDEN REGION (NA26/EH)

Type localities are relevant in relation to national estate sub-criterion C1: 'Importance for information contributing to a wider understanding of Australian natural history, by virtue of its use as a research site, teaching site, type locality, reference or benchmark site.'

Project objectives

- To ensure that flora and fauna 'type' localities are taken into account in the national estate assessment component of the CRA assessments in NSW.
- Contribute information on national estate values to the integration process.
- Contribute to the conservation of flora and fauna 'type' localities in the development of the CAR reserve system and the RFA.
- Provide information to assist in the design of the CAR reserve system.

Methods

Stage One

Interrogate the APNI, the Zoological Catalogue and other relevant data sets (including State data sets) to determine flora and fauna species with type localities in the NSW CRA/RFA Regions: Eden; Upper North East, Lower North East; and Southern.

Stage Two

Review the list of type localities with respect to current taxonomical usage and the veracity of available location data.

Stage Three

Develop a GIS layer of type localities, taking into account requirements in terms of positional accuracy.

Stage Four

Integrate the type locality layer with biophysical naturalness, or other disturbance, data to assesses whether the integrity of site attributes relevant to the type locality function are likely to be intact.

Stage Five

Derive a GIS layer, on the basis of Stage Four outcomes, representing national estate type localities.

Key results and products

This project area will be undertaken as a statewide project convering all of the NSW CRA/RFA Regions. The project did not produce results within the timeframe of the Eden CRA, and hence data was not available for the Integration and Scenarios Development process. When completed in early 1998, the project will provide information about the location and protection requirements of these national estate values. This will be used to inform the finalisation of the Eden RFA. The nature of these values means that informal and off-reserve management is usually adequate to protect the value. A process for protecting these values in an appropriate way needs to be set out in the Eden RFA.

NB: The approved National Estate Flora and Fauna Type Localities Project (NA26/EH) has been combined with the approved Identification of Places of Geoheritage Significance project (NA25/EH) and with the approved Identification of Places of Natural History Significance project (NA24/EH). This decision was made to avoid apparent duplication between the projects so that the projects could be managed more efficiently and cost-effectively.

WORLD HERITAGE (NATIONAL COMMONWEALTH PROJECT)

Project objectives

To undertake a process within the CRA/RFA which satisfies the Commonwealth's obligations under the World Heritage Convention to identify and assess World Heritage values.

Methods

A methodology used in the CRA/RFA process has been developed and agreed to in discussions between the Commonwealth and the States.

Places on the World Heritage List are defined as those which have outstanding universal value. The methodology used in the RFA forest process to identify and assess places which may have this level of value is based on a thematic approach. The methodology assesses significance by developing themes of outstanding universal value, and then testing places against these themes by working through a series of steps. The thematic methodology is being used for identifying World Heritage values in forested areas as part of the RFA process. This approach is only one of those being used by the Commonwealth to ensure the protection of Australia's World Heritage.

The thematic methodology involves the use of an Expert Panel and provides a systematic means of identifying a list of places that meet the criteria and operational guidelines of the World Heritage Convention. The first step (Step A) of the thematic methodology involves the Expert Panel providing advice to Governments on themes of outstanding universal value relevant to Australia. These themes are then used in the second step (Step B) to develop a list of places that might include those that best represent the identified themes in a global context.

These potential places are then further examined against the Operational Guidelines for the World Heritage Convention to determine whether they have World Heritage value. They are tested using a series of sieves where the places identified at Step B are assessed for authenticity and integrity (Step C), and adequacy of management and legal protection (Step D), prior to formal assessment against the World Heritage criteria in the final step (Step E). Places that do not meet the required criteria are eliminated at each step of the assessment process.

Key results and products

The Expert Panel met in October 1997 to undertake Steps A and B of the methodology for NSW, including the Eden Region. Further details of this methodology and outcomes for the Eden Region and NSW are in the report of the World Heritage Expert Panel which was released early January.

Work is continuing to progress the development of the continental Eucalypt theme, the key forest-related theme identified by the Expert Panel.

JANIS AND NATURAL NATIONAL ESTATE CONSERVATION REQUIREMENTS (NE35/EH)

Project objectives

The primary aim of this project was to derive the JANIS conservation requirements for all elements of biodiversity, old growth and wilderness according to the JANIS national reserve criteria. A further aim of this project was to identify and assess the natural National Estate.

Methods

Rule sets for obtaining conservation targets for forest ecosystems, old growth, flora species, fauna species, and wilderness were derived according to JANIS. Rule sets were then applied to the various data layers and conservation targets determined. Expert panels from each area reviewed target tables, ranked species and ecosystems in terms of their vulnerability to threatening processes and advised of any other considerations relevant for conservation. An expert workshop was held to facilitate the development of rule sets to identify areas of high biodiversity, refugia, relictual species, centres of endemism and disjunct species.

The identification of National Estate values was divided into three broad categories based on their degree of correspondence with the JANIS criteria and assessments.

Key results and products

This project produced an agreed process for determining conservation targets for forest ecosystems, old growth, fauna and flora species, wilderness and for the identification of National Estate values for the Eden CRA/RFA Region. Final tables were produced detailing the derived conservation targets for each forest ecosystem, old growth type, wilderness and priority species of flora and fauna. These tables identified hectares required for meeting JANIS criteria, relative ranking of vulnerability to threatening processes and management recommendations.

Results from expert panel workshops, contained in the appendices of the project report, further detail management recommendations. Final target areas accompanied by GIS layers for forest ecosystems, old growth, wilderness, rare plant locations and edited fauna habitat models were integrated in C-Plan for reference and scenario development.

Consideration of natural National Estate values produced GIS layers which included refugia, centres of endemism, flora communities (forest ecosystems), relictual species, species with disjunct populations and areas of high flora community diversity. Centres of endemism was a mandatory layer in C-Plan having a target area and the others were contextual layers.

ECONOMIC AND SOCIAL

POST IMPACT STUDIES ANALYSIS AND REGIONAL PROFILE (NE01/ES)

Project objectives

- To provide a review of social impact studies conducted within the Eden CRA/RFA Region.
- To provide a review of national and international studies relating to social impacts in resource-based communities.
- To develop a regional population profile for the Eden CRA/RFA Region and selected service sectors within that Region.

Methods

A literature search was employed to identify any previous social assessment work within theCRA/RFA Region or studies of comparative communities which resemble the current impact context.

The profiling project involved the collection of statistical and historical data for communities within the Eden Region using existing databases such as the Australian Bureau of Statistics and the IRDB (Integrated regional database) as well as other data sources such as local shire histories. Statistical data was based on the 1996 ABS Census of Population and Housing.

Data was also obtained from relevant State agencies and local government authorities in regard to the provision of infrastructure services throughout theCRA/RFA Region.

Key results and products

An assessment report was produced and is publicly available through the "Post Impact Analysis and Regional Profile" project report undertaken for the NSW CRA/RFA Steering Committee.

The following is a very brief regional community profile of the EdenCRA/RFA Region:

- EdenCRA/RFA Region comprises the whole of the Bega Valley Shire, Bombala township, and the south eastern corner of the Cooma Monaro local government area
- in 1996, the total population for the Eden Region was 30,225. Bega Valley Shire's population is expected to increase to 32,200 in 2001 and 34,600 in 2006
- the unemployment rate in the Bega Valley in 1996 was 12.2%
- Bega Hospital is the major hospital servicing the area, and hospital services are also provided at Pambula and Bombala Hospitals
- in 1996, the largest industry employer was the retail sector (15% of total employed) followed by the agriculture, forestry and fishing industries (14%)
- other major employers were accommodation, cafes and restaurants (10%) and the manufacturing sector (9%).

For the purpose of post impact analysis, significant environmental, economic and social studies have been conducted in the Eden Region since the early 1970's. The most significant studies regarding the social context have been the numerous environmental impact statements between 1986 and 1994, the reports associated with the 1995 Woodchip Export Licences decision, and the NSW Interim Forest Assessment Process (IFA), 1996. These studies show declining employment in the native timber industry over the last ten years. Current baselines of service provision in health, transport, education and the regional population are documented.

SOCIAL VALUES OF FORESTS (NE 02/ES)

Project objectives

The objectives of this project were to:

- document the main issues of concern to stakeholders in the RFA process regarding social values of forests;
- conduct a random telephone survey in the Region to address social values in regard to forested land use;
- select a diverse range of communities within the Region and construct comprehensive baseline profiles of the social conditions within these case study areas;
- identify and survey forest-related industry groups for the purpose of linking community dependence to areas of forested land and the social values of forests held by these groups, establishing the impact felt to date by these groups from changes in forested land decisions and to identify the social use values of forests held by these groups.

Methods

A number of different methods were employed at the regional and local level. These include:

- Networking and participant observation;
- A random community attitude telephone survey;
- Community workshops and focus groups;
- An action research method to collect localised community infrastructure data in each case study area;
- Surveys of occupational communities. (Occupational community is a term used to underline occupational attachment which may transcend attachment to residential community. Cross-sectional surveys cover all forest industry groups.)

Key results and products

An assessment report was produced and is publicly available through the "Social Values of Forests" project report undertaken for the NSW CRA/RFA Steering Committee.

Community case studies

Community workshops were conducted in Eden, Bega, Merimbula, Bombala, Cobargo, Pambula, Wyndham and Wonboyn Lake to explore significant events in the community in the recent past, community attachment and community aspirations. A demographic profile of each case study area was also developed. Detailed profiles and workshop outcomes of each case study township can be found in the project report. Data was used to assess the vulnerability and adaptability of these communities to change.

Surveys of occupational communities

Timber industry workers are predominantly male and on average, aged between 37 and 44 years. Fifty percent of chipmill workers left school at or before year 10 while 13 percent had tertiary qualifications. Over 75 percent of contractors left school at Year 10.

The majority of chipmill workers earn between $25,000 and $40,000, approximately 80 percent of sawmill workers earn less than $25,000 and bush crew employees mainly earn between $25,000 and $60,000 per annum.

All survey respondents said that the scenic beauty of the area, the clean healthy environment and recreational opportunities were aspects they most liked about living in the area. The lack of employment opportunities and the lack of services and facilities were cited as the major dislikes.

Community attitude survey

A random sample telephone survey undertaken in July 1997 found that respondents noted unemployment (47.4 percent), the health system (43.3 percent) and the environment (35.1 percent) as the most important social issues facing Australia at the present time. Community responses to a wide range of survey questions can be found in the project report.

SOCIAL ASSESSMENT WITH ABORIGINAL COMMUNITIES IN EDENCRA/RFA REGION (NE39/ES)

Project objectives

To seek views from the three Aboriginal Land Council areas on uses and social values concerning public forests in the Eden CRA/RFA Region (not including site specific cultural heritage).

Methods

The project involved determining the history of social benefits obtained by Aboriginal use of the forests, Aboriginal employment in forest industries, and any social consequences of forest policy in the Eden Region for Aboriginal communities.

Information was gathered through three workshops, one being held in each of the Land Council areas within the Eden Region.

The workshops involved all those people appropriate and as advised by the local Land Council appointed consultant. Within the scope of the project, an appropriate format for the workshops was developed with each local Land Council consultant.

The workshops were managed by the DPIE Social Assessment Unit with assistance from a community consultant nominated by each of the local Aboriginal Land Councils that make up the Eden Aboriginal Management Group.

Key results and products

An assessment report was produced and subject to clearance by the Aboriginal Management Committee will be available through the “Social Assessment with Indigenous Aboriginal Communities in Eden RFA” project report undertaken for the NSW CRA/RFA Steering Committee.

Three social and economic workshops were conducted in the Eden Region including representatives from the Bega, Eden and Merriman’s Local Aboriginal Land Councils.

The three workshops indicated, inter alia, that aboriginal people were historically involved in every aspect of the timber industry from sleeper cutters to benchmen. Current employment in the forest industries is limited to firewood cutting as part of a Community Development Employment Program (CDEP). The three workshops also reported very high unemployment rates in the Aboriginal communities with CDEP providing the major employment potential.

Future visions for the social and economic development of Aboriginal people in the Eden Region combined cultural tourism, partnerships in forest management across all tenures and a potential for some employment in partnership with the existing timber industry.

REVIEW OF RECENT STRUCTURAL ADJUSTMENT AND MITIGATING PROCESSES (NE 23/ES)

Project Objective

The purpose of this project is to provide baseline data for a longer term longitudinal analysis of some of the social impacts of recent structural adjustment and mitigative processes in the Eden and Bombala areas.

Methods

The method involves interviews and other data collection techniques with the following aims:

- To provide a situation analysis of the current status of workers and business owners in the timber industry, including those who have recently exited the industry in the Eden and Bombala areas.
- To provide a situation report on the quantum and nature of mitigative measures accessed by workers and businesses in the native hardwood industry in the Eden and Bombala areas.
- To undertake case studies to understand the individual experiences both of the social impacts of recent structural change and of the mitigation measures that have been implemented in the native hardwood industry in the Eden CRA/RFA Region.
- To compare the predicted social impacts of previous studies against the outcomes of the current study.

Key results and products

A report which identifies:

- the current status of workers and businesses in the Eden Region, focusing on those that have exited the industry since January 1996;
- the nature and quantum of assistance provided to date to workers and businesses in the area; and
- the social impacts of structural adjustment and mitigative measures to date.

MODELLING AND SOCIAL IMPACT ASSESSMENT (NE31/ES)

Project objectives

To model potential social impacts of land use scenarios on communities in the study Region for the purposes of integration.

Methods

A stand alone social impact assessment model, "i think" (High Performance Systems Inc), was developed by the project consultant to inform possible social impacts related to changes in land use and management based on quantitative and qualitative data collected in social projects NE 01/ES, NE/02 ES and NE 30/ES.

"i think" responds to employment changes and indicates the likely impacts on a community. The model utilises a number of key inputs (eg. industry employment by type, by community of residence). Key inputs are able to be adjusted by an estimate of the number of timber jobs lost or gained from changes in resource availability and its impact on the community employment of the town. Any changes to employment resulting from reserve design scenarios can then be modelled to produce a summary of impacts categorised by the identified list of social indicators.

Mitigation and industry development data can be incorporated into the model along with accompanying employment predictions.

A variety of simulations have been undertaken to test the confidence of the model and ground-truthed against other primary and secondary data sources.

Key results and products

A separate report detailing the modelling methods used will be available.

A computer based dynamic systems model (i-think) was developed to assess potential social implications of each land use and management scenario. A 'base flow' of timber jobs in each community was established from survey results.

The projected change in hardwood timber jobs by township of residence was used as the primary impact variable. The model used historical change, adaptive responses and vulnerability to predict community well being under various industry development land use and management scenarios.

An analysis of the likely community impacts, such as job losses or gains, arising from a variety of wood product flows has been completed using data provided by the FORUM model on timber industry employment changes over time. An analysis of the likely community impact is reported for each scenario presented in the report *Towards an Eden Regional Forest Agreement*.

VISUAL DISPLAY OF SOCIAL IMPACT ASSESSMENT (NA20/ES)

Project objectives

To provide officials, negotiators and stakeholders with a visual display of social assessment and impact data to inform the integration process.

Methods

For project NE 31/ES a stand alone social impact assessment model, "I Think" (High Performance Systems Inc), was developed by a consultant to inform possible social impacts related to changes in land use and management based on quantitative and qualitative data.

During the negotiations of the Eden RFA, social assessment and impact data was developed as part of project NE 31/ES, and a detailed social implications report was prepared to inform trade-offs between conservation and wood resources information.

A consultant was engaged to:

- co-ordinate data inputs from social impact and modeling project
- deliver responsive visual display of social impact models
- maintain technical systems through the integration phase

Key results and products

The consultant identified visual display components of the "i-think" model as the most suitable method for displaying social impact analysis.

The "I Think" software, through the use of parallel flow diagrams illustrates the changes in forest use through measures of the economic effect on the community and the scope of changes in hardwood employment. Mitigation factors are also illustrated.

A visual display of the analysis undertaken as part of project NE31/ES was used at the time of integration by officials, negotiators and stakeholders.

NATIVE FOREST WOOD RESOURCES AND WOOD BASED INDUSTRIES (NE05/ES)

Project objectives

To produce a benchmark report which will locate and review information required for use in the assessment of wood resources and wood based forest industries.

Methods

A review of data concerning the forest resource, wood produce, management regimes was undertaken and considered the:

- nature and extent of native forests
- availability and productivity of forested lands
- current and historic management regimes
- quantities and specifications of harvested wood products in an historic context and current output

An economic profile of forest industries was developed by reviewing data regarding the contribution of wood based industries to the regional and State economy.

Information was gathered on wood based industries for the following areas:

- Processing centres and description of mills: source of timber (crown or private; native or plantation), product type, input and output volumes (recovery rates), number of employees.
- Logging and transport contractors: source of timber (crown or private; native or plantation), product type, recovery rates, number of contractors and employees.
- Financial aspects for sawmills and contractors: estimated gross and net value of production, investment, labour costs, debt.
- Description of markets: locations, product types, values.

Key results and products

An assessment report of existing wood resources and wood based industries in the Eden CRA/RFA Region is available as part of the “A Report on Forest Wood Resources and Wood Based Industries in the Eden Region” project report undertaken for the NSW CRA/RFA Steering Committee.

REPORT ON 'OTHER' FOREST USES IN THE EDEN FOREST REGION (NE06/ES)

Project objectives

To produce a benchmark report which will locate and review information required for use in the assessment of other forest resources and uses in the Eden CRA/RFA Region such as water, firewood and grazing.

Methods

Information to develop a report for the Eden Region on other forest uses and minor timber products was collected from a range of sources. Existing information on forest uses such as water catchments, grazing, water and minor forest products was obtained from appropriate State and Commonwealth agencies, and non government organisations. Information on conservation use of the forests was obtained from the environmental and heritage assessments.

Assessments of minerals, apiculture and tourism and recreation were undertaken under separate projects.

Key results and products

An assessment of minor forest products such as firewood and grazing is available as part of the "A Report on Forest Wood Resources and Wood Based Industries in the Eden Region" project report undertaken for the NSW CRA/RFA Steering Committee.

The assessment of water values was undertaken on a larger scale than that for minor forest produce and a separate report was produced. The assessment of water values is available through the "Hydrology of the Eden CRA/RFA Region" report undertaken for the NSW CRA/RFA Steering Committee.

Firewood accounts for the highest value of minor forest produce in the Eden RFA. Other products include fencing materials, poles and posts, landscape timber and eucalypt seed. SFNSW royalties from these activities have not exceeded $14,000 in total in recent years. There is, however, insufficient data to determine the current value of production.

Grazing in the state forest areas of the Eden Region is conducted under either grazing leases or occupation permits issued by SFNSW. SFNSW records shows the level of grazing activity in the Region in 1996/97 was minor, with 6 occupation permits and 24 long standing leases, covering 5266 hectares with a capacity of 728 cattle.

Limited hydrological data was available on which to base detailed economic assessments of possible changes to water supply associated with changed land management in the Region.

The Bega and Towamba catchments have agricultural production reliant on irrigation from rivers within the Region. Impacts of timber harvesting on available water within these catchments was difficult to determine. Typically, there is an increase in water availability within the first few years following harvesting, then an overall decrease, but this effect is masked at the catchment level. Any impacts are likely only in times of drought, and at a sub-catchment level.

ASSESSMENT OF MINERAL RESOURCES (NE08/ES)

Project objective

The objective of the project was to assess known and potential (undiscovered) mineral resources of the Eden CRA area to provide input to the design of a reserve system for the RFA.

Methods

The assessment of the geology, known and potential mineral resources, required compilation of data in 'themes' suitable for use in a GIS environment and the application, and/or development, and/or supplementation of data sets to enable mineral potential analysis to be undertaken.

The mineral occurrences database was used to classify deposit types and styles of mineralisation according to a combination of indicative attributes based on specialist understanding of the nature of mineralisation and a scheme suitable for use in mineral potential analysis has been produced.

Geological tracts which have potential for given types of mineral deposits were delineated by identifying coincident thematic signatures characteristic of the type of deposit selected.

Key results and products

An assessment report was produced and is publicly available through the "Eden Region Mineral Assessment" project report undertaken for the NSW CRA/RFA Steering Committee. The project report also contains a number of maps.

There are 13 quarries currently in operation in the Region, involved in the extraction of construction materials, including hard rock, sand, silica and pyrophyllite.

While the geology of parts of the Eden CRA/RFA Region, particularly in heavily forested areas, is still poorly known, the basic conclusions of the study was that the potential for future discoveries is for, epithermal gold-silver, slate-belt gold and granite hosted gold deposits. No quantitative assessment of actual mineral resources was undertaken for the Region.

ECONOMIC VALUE OF RECREATION AND TOURISM IN NSW FORESTS OF THE EDEN CRA (NE33/ES)

Project objectives

To provide information on the uses and economic values of forests in the Eden CRA/RFA Region for tourism and recreation and the sensitivity of these uses and values to changes in land tenure.

Methods

A consultant was engaged to:

- develop a conceptual framework to estimate visitor expenditure and consumers' surplus value for recreation and tourism visits to forested areas, and determine any likely changes to these estimated values as a result of changes in land tenure.

The consumer's surplus values were calculated on the basis of:

- estimates of current and future visitation levels to the Region's national parks and State forests; and
- application of the results of previous studies of consumer surplus per visit to forested areas.

The visitor expenditure was estimated through the use of:

- a 'micro' approach under which data obtained from site specific studies on expenditure per visit was applied to estimates of visitor numbers to forested lands provided by NPWS and SFNSW. (This approach did not distinguish between recreation and tourism).
- a 'macro' approach under which Bureau of Tourism Research estimates of total expenditure in the Region were apportioned to forested lands. This approach provided information on domestic and international tourism only. Recreational expenditure by residents could not be disaggregated in the BTR data.

There are essentially two phases to this project. The first involved identifying existing and potential forest-based recreation and tourism opportunities within Eden CRA/RFA Region and the economic and financial values associated with these. The second phase involved assessment of the extent to which existing and potential forest based recreation and tourism opportunities might change as a result of land tenure changes.

Key results and products

An overview report on the economic value of tourism and recreation in the forests of Eden CRA/RFA Region containing:

- data on tourism and recreation expenditure in the Region to be used as input to the Threshold Values Analysis Project and the Regional Economic Impact Study being undertaken separately.
- discussion of the impacts of changes in land tenure on deferred forest areas.
- background information on currently proposed tourism development opportunities in the Region, including proposed initiatives by NPWS and SFNSW.

CONSULTANCY REPORT ON APIARY IN NSW (NA06/ES)

Project Objective

To provide a profile of the apiary industry within the context of the "Other Forest Uses" project.

Methods

This is a consultancy project which involved the preparation of a report to provide:

- Profile the apiculture industry in Eden/NSWCRA/RFA Regions, including a summary of the nature, location, size and characteristics of the industry. Included in this summary would be an indication of the demand and supply of products of the apiculture industry including an outline of the dependency of the industry on native forest in theCRA/RFA Regions.
- Identify the values of the industry (in both direct monetary and descriptive terms), and indications of the multiplier effects where possible.
- Outline the relationship to other forest uses and users, and the sensitivity and capacity of the industry to changes in land tenure and management practices and feasibility of relocation from areas that may become unavailable in the future (eg proposed park or wilderness).

Key results and products

- Map showing-apiary sites located in forest areas; known forest areas of high value to apiary industry, other forest areas used for apiary.
- Apiary value for regional Eden input/output tables
- A report profiling the industry structure across eastern coastal areas of NSW, including Eden.

IDENTIFICATION OF PLANTATION EXPANSION OPPORTUNITIES IN NEW SOUTH WALES - EDEN CRA (NA07/ES)

Project objectives

The objectives of the project were to review, consolidate, develop and extend existing studies into land suitability and wood flow projections for plantation development options on cleared private lands, having regard to:

- physical land capability (topographic and edaphic);
- climatic suitability;
- potential productivity;
- economic potential;
- environmental sensitivity;
- scale and proximity to existing and potential markets; and
- social and demographic factors.

Methods

The basic concept underlying capability modeling is that vegetation has a potential growth and yield that is determined by the site and the vegetation type. The site includes climatic, edaphic (soil) and radiation factors. Vegetation types exhibit different growth rates depending on the species and the age mixes.

Stages of method:

- investigate previous studies
- assemble appropriate spatial data
- develop growth and yield functions from site based information
- model capability
- model suitability
- link with market, economic and social analyses

Key results and products

A report was produced and is publicly available through the "Identification of Plantation Expansion Opportunities in New South Wales - Eden CRA" project report undertaken for the NSW CRA/RFA Steering Committee.

The project report includes a series of maps indicating existing plantations, potential site productivity and net present value of land for existing agricultural uses and alternative plantation uses.

There are 35,510 hectares of commercial plantations in the Eden Study Area, of which 1,070 hectares are hardwood and 34,440 hectares of softwood species concentrated in the Bombala SFNSW Management Area. The current (1997) harvest from the softwood resource is 50,000 cubic metres of sawlog and 35,000 tonnes of pulpwood a year.

The area of land physically capable of plantation development for native hardwood species, *Eucalyptus nitens* and exotic softwood species *Pinus radiata* are:

Site Productivity Class	***E.nitens* *(hectares)***	***P.radiata* *(hectares)***
low	61,000	24,000
medium	5,200	171,000
high	600	3,000

Economic analysis to determine areas of plantation suitability indicated that there are significant areas of the Eden Region where the potential land values from plantations are greater than the existing estimated land values. However, it was also found that any returns were sensitive to changes in the market price for plantation products and yields associated with plantation management regimes.

DEVELOPMENT OPPORTUNITIES FOR WOOD-BASED FOREST INDUSTRIES (NA08/ES)

Project objective

The objectives of the project were to:

- identify likely wood based industry development opportunities in Eden and Southern NSW CRA/RFA Regions over the next 25 years;
- provide a baseline industry outlook which can be used to assess the implications of changes to wood resource availability.

Methods

Consultants "Margules Poyry Pty Ltd" were engaged to, in consultation with industry:

- review the long term market potential for a range of hardwood and softwood products relevant to forest industries in southern NSW.
- review current plans for industry expansion and restructuring. The consultants held workshops with representatives from the timber industry and the Social and Economic Committee to identify a range of industry strategies for growth
- provide quantitative analysis of the competitive advantages wood processing industries in southern NSW have at present and could have in the future
- with regard to the information and analysis from the above, provide a competitive and technical feasible industry structure in the years 2010 and 2020. Projections of costs of production for possible future wood processing industries were also undertaken.

Key results and products

A consultants report was produced and is available as part of the "Industry Development Opportunities for the Southern NSW Forest Industry to 2010 and 2020" project report undertaken for the NSW CRA/RFA Steering Committee.

The consultants developed two woodflow scenarios as an indication of resources availability as at 2010 and 2020.

Based on these woodflow scenarios the following industry development scenarios were identified by the consultants:

- a new hardwood sawmill based at Eden, processing a combined total of 40 000 cubic metres a year of sawlogs and pulplogs;
- mobile mills processing up to 3 000 cubic metres of hardwood a year;
- a softwood sawmill of 400 000 cubic metres a year capacity constructed by 2010;
- a plywood/laminated veneer lumber plant at Bombala of 120 000 cubic metres a year softwood sawlog capacity; and,
- by 2010 a medium density fibreboard (MDF) plant with an intake of 250 000 to 300 000 cubic metres a year, expanded to around 500 000 cubic metres by 2020. The plant would be predominantly based on softwood but would also draw some hardwood.

The development of scenarios, together with the existing industry structure formed the basis for predicting the direct impact on the timber industry of the different resource scenarios developed in scenarios development.

REGIONAL ECONOMIC IMPACT STUDY - EDEN REGION (NE19/ES)

Project Objectives

The purpose of the study is to assess the economic impacts of different land use configurations and silvicultural regimes in the Eden Region being considered within the CRA/RFA process on the forestry industry and downstream industry in the region. The objectives are:

- To identify the current status of the industry and its contribution to the regional economy.
- To assess the economic impacts of forest scenarios.
- To assess the development options for the region.

Methods

1. Build an economic data base, in conjunction with other studies being conducted as part of the RFA, reflecting the current status of the industry and its contribution to the regional economy. This includes:
   - Identification of all of the activities related to forest areas on a regional basis such as logging, apiary, tourism and recreation and grazing. Values are to be drawn from linked studies.
   - Updating the logging/milling information to take account of the 1 July 1996 levels of harvesting.
   - Construction of a specific and up-to-date input output table for the Eden Region, including Bombala.
   - Combining the above information into a statement of the current economic contribution of forestry-based activities to the Eden region economy.
2. Assess the economic impacts of forest options. This work is to be integrated into the processes of identifying and specifying the options.
3. Assess the development options for the Region that may occur alongside adjustments to forestry, logging and milling operations. This task has some similarities to Task 1 (above) and requires developing a projection of the economy taking account of the following:
   - The adjustments to the forestry-based activities. These may include some reductions in activities and some new activities such as additional or different usage of residues.
   - Other economic developments that have occurred. This should include both new activities that might be planned or under way and some activities that have been reduced.
   - Consideration of the overall economic condition of the Region including growth trends, employment/unemployment, other demographic trends, households and their expenditure and other available trend information.

Key results and products

Within this study, there are a number of defined deliverables which fall into two categories of analytical reports and processes. The first output is essentially a statement of the base case. This involves:

- Constructing an input-output model for the specified region;
- Describing the economic structure of the forestry-based industries in the Region and their current contribution to the regional economy;
- Analysing recent changes in the forestry-based industries and assessing their impact on the regional economy;
- Identifying the main trends and the likely causal factors influencing the regional economy; and
- Identifying other economic development opportunities that are available to the regional economy.

The second output will be a focus on the analytical work to report on:

- the combinations of changes in the forestry-based industries that are included in the selected options to be analysed;
- the selected economic development scenarios which provide the context within which the options are analysed;
- the results of the analyses.

ADAPTATION OF FORUM MODEL FOR THE EDEN FOREST REGION (NE07/ES)

Project objectives

The objectives of this project were to:

- adapt the Australian Bureau of Agriculture and Resource Economics' FORUM model to the Eden CRA/RFA Region
- estimate the direct economic impacts to wood based industries resulting from changes to wood resource availability (and/or quality), industry structure and market outlook
- use the industry development opportunities identified in the 'Development opportunities for wood-based forest industries (NA08/ES)' project in the FORUM model to assess the implications of these opportunities for regional economies and communities.

Methods

The Forest Resource Use Model (FORUM) is the primary tool to analyse the broad timber industry and product implications of land allocation options. FORUM, developed by the Australian Bureau of Agriculture and Resource Economics (ABARE), enables estimates to be made of the direct economic impacts to wood based industries resulting from changes to wood resource availability (and/or quality), industry structure and market outlook. The time frame for the analysis is 1997 to 2020, reflecting the intended duration of the Eden RFA.

The model has been adapted to simulate the wood based forest industries in the EdenCRA/RFA Region, incorporating the flow of wood resources from the forest to processing centres (for example sawmills and MDF plants) and in turn to final product markets.

ABARE surveyed hardwood processing mills for information such as, physical capacity, employment and cost profiles, using 1995-96 as the base year. Data have been adjusted, where necessary, to reflect changes to key variables, such as the reduced number of sawmills operating in the Region since 1995-96.

Key results and products

No report was produced for this project.

Analysis of a variety of wood product flows was undertaken by FORUM and a range of possible mills (as described in the "Development opportunities for wood-based forest industries - NA08/ES" project report) and their locations is reported for each scenario presented in the "Towards an Eden Regional Forest Agreement" report.

THRESHOLD VALUE OF PROPOSED FOREST RESERVES IN EDEN CRA (NE17/ES)

Project objectives

The objectives of the project were to:

- estimate the value of benefits from protecting ecosystems in reserves that would need to be achieved, for the community's best interest to be realised through reserve establishment.
- provide information to support the decision-making process.

Methods

A consultant was engaged to carry out a study of specific forest options using the Threshold Valuation Approach (TV), which seeks to identify whether the benefits of protecting the forests in question are greater than the value of the extractive benefits that will be given up if the reserves were established. This is done by estimating the opportunity costs (foregone benefits) of forest production.

These costs are defined as the producer and consumer surpluses that are lost when the forests under consideration as conservation reserves are taken out of production. (Producer surplus is defined as the difference between the price received for a unit of output and the marginal cost of its production. Consumer surplus is defined as the difference between the price people are willing to pay for an extra unit of a product (their marginal value) and the price that is actually paid).

Data used in this project was drawn from the following sources:

- scenarios resulting from the Eden CRA scenarios development process
- output from the FORUM model
- output from FRAMES
- information generated by the 'Other Forest Uses' project undertaken for ESTC; and
- the Regional Economic Impact Study.

Key results and products

The outcomes of the study were:

- information on the opportunity costs of adopting different CRA/RFA outcomes, for inclusion in the *Towards an Eden RFA* Report.
- discussion of how this information could be used to assist in the decision-making process.

The output of the study was a written report outlining the background methodology, data analysis and findings of the study. Threshold values for land use scenarios are reported in Chapter 9 of the report *Towards an Eden RFA*.

ECOLOGICALLY SUSTAINABLE FOREST MANAGEMENT

CRITERIA, INDICATORS, TARGETS AND MONITORING PROCESSES FOR THE EDENCRA/RFA REGION (PROJECT AREA 3) (NE26/ESFM)

Project objectives

The main objectives of the project were:

- to produce criteria, indicators and targets for the Eden Region which could be used to measure the ecologically sustainable forest management of forests both quantitatively and qualitatively;
- to recommend the appropriate mechanisms for measuring, monitoring and reporting on each indicator; and
- to recommend specific target levels for each of the criteria and indicators.

Methods

The project comprised the following major components:

- Workshops of local stakeholders and experts via the Eden Regional Forest Forum to inform the community of current thinking with regard to indicators, and to guide discussion to obtain meaningful input on indicators relevant for Eden. Membership of the Eden Regional Forest Forum comprised the relevant stakeholders required for the discussion.
- Preparation of an expert report which drew together resource material on current international and national trends and the state of information on the use of criteria and indicators.
- The ESFM Group used input from the Regional Forest Forum and the expert report to develop a draft set of indicators in 3 categories according to ease of implementation, to meet the requirements of ecologically sustainable forest management.

Key results and products

Criteria and indicators provide a mechanism with which to assess changes in the extent or number of identified forest values. Taken together, the indicators help assess the sustainability of forest management. Targets are set to measure indicators against and monitoring systems are used to generate the necessary data for this. Criteria, indicators, targets and monitoring systems are therefore part of a dynamic process aimed at improving the sustainability of forest management.

The following criteria are used to assess ecological sustainable forest management in the Eden Region: biodiversity, productive capacity of forests, ecosystem health, soil and water quality, social and economic values and natural and cultural heritage values. A series of 22 indicators were developed for the above criteria. For example, *the extent of forest/vegetation type by growth stage* is one indicator developed to monitor biodiversity. Specific targets and monitoring systems for each indicator are being developed by the Ecologically Sustainable Forest Management Technical Committee.

ASSESSMENT OF FOREST MANAGEMENT PRACTICES FOR THE EDENCRA/RFA REGION (PROJECT AREA 4) (NE27/ESFM)

Project objectives

The project assessed the impacts on forest values of key forest practices that are either in use, or that may be applicable as innovations for future use in the Eden RFA area. The objectives of this project were:

- To conduct an assessment of forest management practices, of all types, on all tenures, in the context of their interaction with the criteria, indicators and targets set for the EdenCRA/RFA Region.
- To identify innovations in management practices that would assist in achieving desirable targets for proposed indicators.
- To examine ways of achieving improved implementation of existing or new management practices.
- To develop rules to enable translation into algorithms or mathematical models of the likely effects on forest values.

Methods

Experts were engaged to identify and describe significant forest practices. Practices examined included timber harvesting, thinning, fire prevention and prescribed burning, road construction and maintenance and recreational site development, with the focus on timber harvesting and forest fire management These were assessed in terms of their impact on a range of forest-related values and rated as high, medium or low in terms of the interaction or impact of the practice on the value. Values considered include flora, fauna, soil, water, timber production, recreation usage, use for grazing, bee keeping and mining, and contribution to global geo-chemical cycles (particularly carbon and implications for greenhouse gases).

Key results and products

Detailed assessments of about 50 selected value/practice interactions were made under the following headings:

- nature of impact (including impact mechanism, importance to EdenCRA/RFA Region, scientific commentary, gaps in knowledge and currently applied ameliorative measures)
- potential innovations
- assessment statement
- guidelines/rules/limits for application of practice.

MANAGEMENT OPTIONS AND SCENARIOS TO GENERATE ESFM TARGETS FOR THE EDEN RFA (PROJECT AREA 5) (NE28/ESFM)

Project objectives

To assess implications of management scenarios in relation to indicators of ecologically sustainable forest management in the Eden CRA/RFA Region using a framework of dynamic or landscape level assessment and outputs from other CRA projects.

Methods

Two workshops were held to consider data and modelling requirements including:

- data covering digital elevation models (DEM), productivity, prescriptions, timber volumes, fauna and flora distributions, growth stages, fire history and plantation potential
- models of key processes covering vegetation dynamics, scheduling prescriptions in time and space, fire, biodiversity, productivity and growth, silvicultural regimes, soil and water, ecosystem structure, heritage and ecosystem health and vitality
- modelling of tree/vegetation growth, fire, harvesting systems and prescription systems.

The ESFM Group agreed to develop two computer modelling tools (Whatif?/LUPIS and SPECTRUM) as prototype tools for developing option and scenario models. These tools were designed to address issues of ecologically sustainable forest management outside of conservation reserve tenures.

There is an almost infinite variety of possible management scenarios which could achieve targets determined for wood supply, habitat, water yield and quality and other values. The nature of the distribution of forests among the forms of tenure will have, however, some implications for what the objectives of management should be.

The tools were designed to help facilitate objectives of management such that the design of the reserve system and choice of achievable management objectives across tenures is an inter-connected process.

Whatif?/LUPIS, through specification of guidelines (commitment, exclusion, preference) enables management intentions to be spatially presented and balanced. Guidelines were developed using as a basis the outcomes from the indicators (Project Area 3) and practices (Project Area 4) projects. SPECTRUM provides the capability to model silvicultural regimes and prescriptions and their consequent temporal effects on a range of values that can be linked to indicators. Together they can explore and design the types of practices and prescriptions required to realise management objectives from particular ESFM perspectives (conservation or industry oriented).

A contingency plan was also developed based on modifier indices applied to FRAMES and quantitative and qualitative assessment using GIS overlays.

Key results and products

Because of data and operational constraints and the inability to reach agreement on guidelines and practices to be used in analyses, the contingency plan was used for Eden. Assessments of impacts of different land allocation scenarios was carried out either qualitatively or quantitatively in relation to harvesting intensities of 70%, 30% and 10% canopy removal for the following indicators:

- extent of forest/vegetation type by growth stage
- extent of connectivity in the forest landscape in relation to threatened species habitat; conservation reserves; general retained habitat
- management measures in place to maintain species extent and abundance
- proportion of catchment likely to be harvested from 1997-2019 by harvest system as an immediate proxy determination of water quality
- change in the level of growth stages from 1997-2019 by catchment as an immediate proxy rating of water quantity.

Full assessment of the impacts of a wider range of combinations of harvesting and silvicultural practices was not undertaken because of time and data constraints.

Work has been undertaken to make Whatif?/LUPIS and SPECTRUM operational.

STATE-WIDE AND REGIONAL ASSESSMENT OF NSW MANAGEMENT SYSTEMS AND PROCESSES FOR DELIVERY OF ESFM (PROJECT AREA 6) (NA18/ESFM)

Project objectives

To provide the basis for joint Commonwealth/ State development and Commonwealth accreditation in the Eden RFA, of statewide NSW forest management systems and processes, including those for the EdenCRA/RFA Region, for delivery of ecologically sustainable forest management.

Methods

- Develop principles of ESFM for NSW and an environmental management system (EMS) framework to describe and assess NSW forest management systems and processes. Adapt the generic management system structure for NSW from the national guidelines of the Comprehensive Regional Assessment Implementation Forum and use the ISO 14004 Environmental Management Systems General Guidelines on principles, systems and supporting techniques as a guide for developing an ecologically sustainable forest management system.
- Identify and define assessment criteria for the assessment of the state-wide management system based on (a) NSW ESFM Principles and (b) the guiding principles of ISO 14004 for a quality management system.
- Describe existing forest management systems and processes for NSW in relation to the individual components of the agreed EMS framework, including commitment, legislative and policy framework, planning, implementation, monitoring and evaluation, and review and improvement.
- Appoint experts to form a working group to guide the description of the existing forest management systems and processes and undertake an assessment of NSW forest management systems and processes according to Terms of Reference developed by the ESFM Group.
- Provide opportunities for stakeholder comment on drafts of the report for incorporation by the expert working group into a final report.
- Use recommendations from the independent report as a basis for improving NSW forest management systems and processes for Commonwealth accreditation and the delivery of ESFM in the Eden RFA.

Key results and products

- Independent report on the assessment of NSW management systems and processes with recommendations for change where weaknesses and deficiencies are identified.
- Recommendations for improvement of the forest management systems and processes which achieve ecological sustainable forest management for NSW on a statewide basis including the EdenCRA/RFA Region.

FOREST RESOURCE AND MANAGEMENT SYSTEM

REVIEW OF RESOURCE DATA FOR MULTI-AGED FOREST AND REGROWTH IN THE EDEN CRA/RFA REGION (NE09/FRA)

Project objectives

The objective of this project was to quantify the reliability and limitations of work which had been undertaken to predict the resource available per hectare in the current multi-aged and regrowth forests in the Eden CRA/RFA Region.

Methods

Existing available SFNSW data on wood resources included:

- the results of a 1987 timber inventory which formed the basis for the 1994 Eden Environmental Impact Statement (EIS) predictions and the 1996 Interim Assessment Process (IAP) Wood Resources Study; and
- actual historical yields for harvested coupes dating back to 1970.

The 1987 inventory was built up in recognition that the management practice of alternate coupe harvesting in the Eden CRA/RFA Region allowed for actual volumes per area and species and size mix to be cross-referenced to adjoining unlogged coupes. As a result, future wood volumes could be estimated in adjacent unlogged coupes, recognising that corrections need to be made for differences between current and historical net harvestable area and tree retention prescriptions.

The review of this existing resource data was carried out by a consultant ("Validation of Eden Wood Resources Data", Forest Essentials Pty Ltd, 1997a). The review involved quantifying the reliability and the limitations of work which had been undertaken to predict the resource available per hectare in the current multi-aged and regrowth forests. For the multi-aged forest, the project involved:

- documentation and review of the derivation of resource data, and
- a statistical analysis per hectare of the relationship between predicted yields (from the 1987 inventory) and actual yields per hectare.

Volumes per hectare were then multiplied by net harvestable area (see Net Harvestable Area project) in the yield estimating toolbox (see Yield Estimation and Scheduling project) to produce total harvestable volume per multi-aged forest coupe.

For the regrowth forest (both fire and harvesting), it was recognised that existing information was not adequate and additional information needed to be obtained from field plots to develop an adequate knowledge of the young stands. State Forests has measured around 1,000 field plots. Most plots were established in areas that are likely to be thinned in the next 10 to 15 years as these areas will provide the bulk of the regrowth sawlogs prior to 2040. Sampling of the regrowth resource is an ongoing process and plot measurement is continuing so that more detailed information will be available for post RFA reviews.

The extent of fire regrowth was derived from aerial photograph interpretation (API) of compartments and from compartment history records elsewhere. The area of harvesting regrowth was derived from compartment history records.

The regrowth forest was stratified into areas of similar site quality classes (based on the forest types and Site Productivity Index project), by general location (tablelands/coast), and whether arising from wildfire or harvesting and age class.

Each of the strata has a yield table generated from STANDSIM (see Development of a Growth and Yield Model for Regrowth project). The volume yield by stratum was then calculated by multiplying the volume per hectare at the time of operation from the yield table by the net thinnable area of regrowth. This occurs in the yield estimating toolbox (see Yield Estimation and Scheduling project).

Key results and products

The method used to derive data for the multi-aged forest was found by the consultant to be acceptable and to produce confidence limits that are consistent with the variability of multi-aged forests of the type found in Eden (Forest Essentials Pty Ltd, 1997a). A comparison of predicted yields against actual yields over the period 1977 to 1996 yielded confidence ranges in most years of +/- 30% of the mean. The multi-aged and regrowth forest resource data reviewed and validated by this project was entered into the Eden FRAMES database (see Compilation and Documentation of the Database project). Results are available in the FRAMES project report.

RETAINED TREE INVENTORY (NE11/FRA)

Project objectives

Timber harvesting during some periods has resulted in significant numbers of trees left standing in harvested coupes to provide seed trees, fauna habitat and some future sawlogs. The level of tree retention in harvested areas was studied with the objective of assessing:

- possible future sawlog volumes available from previously retained trees; and
- potential impact on regrowth growth rates.

Methods

This project involved capturing the harvesting prescriptions which related to each harvesting event.

As the records in compartment histories often give only a general description of what was retained and not an actual figure of how many trees or what volume was retained, the following data was collated and reviewed:

- actual measurements from compartment histories and Permanent Growth Plots (PGP) in harvested areas was used to determine the stocking rate and basal area of trees retained after harvesting;
- assessment in 1996-7 of retained trees for sawlog volume in a sample of harvested coupes, classified in terms of current tree retention prescriptions;
- a collection of retained tree surveys over the past 20 years, collated and analysed to the extent that the information was compatible. Although different parameters were collected in surveys over the 20 year period, basal area could be calculated as a variable common to all surveys.

Key results and products

The descriptions of harvesting prescriptions combined with actual measures of tree retention provided a trend in harvesting events. These trends show an increase in tree retention rates over time. This information helps to explain changes in volumes per hectare over time and is used to refine multi-aged forest volume estimates.

As part of the Interim Forest Assessment (IFA), a separate study was conducted to examine the level of tree retention after previous harvesting to explore whether any previously retained trees were likely to be available for harvesting for sawlogs once the surrounding regrowth was well established. This study concluded that these previously retained trees were likely to be required for ongoing habitat, and were thus unable to significantly contribute to sawlog volume during future harvesting operations. This information informed the multi-aged forest volume estimates.

Retained tree rates (number per hectare) for each coupe were entered into the Eden FRAMES database (see Compilation and Documentation of the Database project).

DEVELOPMENT OF NET HARVESTABLE AREA (NE12/FRA)

Project objectives

The objective of this project was to develop a quantitative and repeatable assessment of the net area available for harvesting under current prescriptions at the coupe level and across the Eden CRA/RFA Region.

This assessment was required to convert gross harvestable area into net harvestable area so that future yields from thinning and harvesting operations could be predicted. The project also allowed for an assessment of the variation that future management prescriptions might cause to the net harvestable area.

Methods

The net harvestable area project generated a digital layer of areas available/unavailable for harvesting within State forests under current management prescriptions. Exclusions from harvesting are:

- some categories of State Forests' preferred management priority (PMP) zones;
- rainforest and a protective buffer;
- rocky areas and buffers;
- swamp (wetlands) and buffers;
- heath and buffers;
- excessive slope (slope > 30 degrees);
- fauna stream buffers; and
- areas of extreme erosion hazard.

These exclusions constitute 'hard exclusions' to harvesting (ie those exclusion areas that can be readily mapped); 'soft exclusions' (exclusion areas that cannot be easily mapped) include additional areas for soil and water protection that do not show on maps of the area.

The data allows determination of the impact of changes in prescriptions or moratorium areas on available areas for harvesting.

Key results and products

An accredited fully documented geographic information system (GIS) database has been generated at 1:25 000 scale. This mapping of excluded areas allows calculation for each coupe of a quantitative statement of net harvestable area according to current prescriptions including the cumulative impacts of each type of prescription. Tabular summaries were also generated for the whole CRA/RFA Region.

An A3 overview and detailed A0 maps will be produced.

Current net harvestable area without excluding fauna moratorium areas was calculated as around 75% of the total State forest area. The areas of exclusion are as follows in Table 1a.

TABLE 1A: EXCLUSIONS IN THE EDEN CRA/RFA REGION

Exclusions	Area	Cumulative Area	
	(ha)	(ha)*	(%)
Preferred Management Priority**	22 914	22 914	11.56
Rainforest and buffers	5 061	26 731	13.49
Rocky areas and buffers	2 122	27 711	13.99
Swamp (wetlands) and buffers	754	28 320	14.29
Heath and buffers	2 166	29 590	14.93
Slope>30^{o}	3 456	31 746	16.02
Fauna stream buffers	14 350	40 987	20.69
Pollution control stream buffers	16 804	44 416	22.42
High erosion risk	5 236	45 493	22.96

* Due to overlap of areas these figures are not simply a sum of exclusion areas.

** PMP exclusions were:

1.1.2:	Special Emphasis (Recreation)
1.1.7:	Flora and Fauna Protection
1.1.9:	Aboriginal Sites
1.2:	Undeveloped Natural Forest
1.3:	Preserved Natural Forest
3.1:	Cleared
3.2:	Special Development

A table of net harvestable area was generated from the GIS layers. The net harvestable area information was entered into the Eden FRAMES database (see Compilation and Documentation of the Database project).

DEVELOPMENT OF SITE PRODUCTIVITY INDEX (NE13/FRA)

Project objectives

This project aimed to develop a quantitative and repeatable site productivity index that would identify the potential productivity of the regrowth forest for use in growth modelling.

It sought to provide a mechanism to quantify variability in relation to productivity within compartments in order to more accurately assess the impacts current or future prescriptions may have on potential yields.

Methods

The project was based around the mapping of environmental factors that contribute to forest growth. These factors were broadly: nutrients, moisture, temperature and light.

The project was split into three components:

- The development of the generalised site productivity index (GSPI) which incorporated monthly radiation, rainfall, evaporation, minimum temperature, and topographic position.
- The re-classification of forest types into yield associations.
- The development of a low, average and high mean annual increment for each yield association. These were qualitative estimates based on limited plot data.

Within each yield association, the GSPI was then used to assign a low, average or high mean annual increment (MAI) by reclassifying the frequency distribution into three equal interval classes. This generally resulted in exposed northerly aspects and ridges being assigned a lower MAI and sheltered southern aspects and gullies being assigned a higher MAI.

Key results and products

The project produced an MAI for each coupe and regrowth forests were stratified using this MAI value, whether the regrowth was derived from logging or fire and whether the coupe was located within the coastal or tablelands part of the management area.

This dataset has not been validated through field checking and is only an interim dataset. An A3 overview and detailed A0 maps will be produced.

Different STANDSIM yield tables applied to each stratum. The stratum for each coupe was included in the Eden FRAMES database (see Compilation and Documentation of the Database project).

Yield information was passed to the yield scheduling tool (see Yield Estimation and Scheduling project).

DEVELOPMENT OF A GROWTH AND YIELD MODEL FOR REGROWTH (NE14/FRA)

Project objectives

The objective of this project was to develop growth and yield models for regrowth stands regenerated from harvesting and/or fire in the Eden CRA/RFA Region. The project also aimed to test the model using growth data from permanent or temporary growth plots measured in the Eden CRA/RFA Region and modify the model further if necessary to achieve realistic results.

Methods

It was assumed that the multi-aged forest resource is not growing (this has been verified by a small scale study undertaken by SFNSW). For the regrowth resource, estimation of growth rates (by developing growth models based on actual forest growth) was required to estimate future yields of wood products from the regrowth component of the forest. STANDSIM, a stand simulator developed for Victorian stands of *E.sieberi* (Silvertop Ash), and other species, was modified and adopted for use in the Eden CRA/RFA Region. Some of the models in STANDSIM were modified using SFNSW growth and yield research work from permanent and temporary plots.

Available data for growth model development included:

- 1968 Mumbulla State Forest, spacing trial in 1964 *E. sieberi* fire regrowth;
- 1977 East Boyd State Forest, commercial thinning trial in 1952 *E. sieberi* fire regrowth;
- 1988 East Boyd State Forest, thinning/fertiliser trial in 1952 *E. sieberi* fire regrowth;
- 1970 Bruces Creek State Forest, thinning trial in 1939 *E. sieberi* fire regrowth;
- 1969 East Boyd State Forest, thinning trial in 1952 *E. sieberi* fire regrowth;
- various years and forests, Permanent Growth Plots in harvesting regrowth of 16 to 26 years of age; and
- 1991-97 Glenbog State Forest, extensive series of temporary plots including growth ring analysis.

The STANDSIM model was modified by including height, age, tree volume and maximum stocking functions into the model and by changes to the existing function estimating basal areas at age 15.

Testing was carried out progressively to isolate the changes resulting from the introduction of each new function and the results produced by the modified model were assessed by comparison with temporary and permanent plot data measured in the Eden CRA/RFA Region.

The project methodology and results were independently reviewed ("Modification of the STANDSIM Model for the Eden Management Area", Forest Essentials Pty Ltd, 1997b).

Key results and products

The independent expert recognised that STANDSIM, as modified, was most suitable for the *E. sieberi* dominated stands in the Eden CRA/RFA Region and would produce less accurate, but estimated as conservative outputs (particularly when yield tables were varied by site productivity class) for other forest types.

The available plot data gives a reasonable coverage of age and thinning response in fire regrowth stands and of age in harvesting regrowth stands.

The limited time available for work meant that:

- functions for tablelands species have not been included;
- taper functions have not been included;
- the model underestimates growth for understocked stands younger than 15 years of age; and
- estimation of growth in stands thinned after age fifteen is conservative.

Despite these shortcomings, the project has produced a growth model that can be used to provide conservatively based yield tables for use in the yield scheduler (see "ield Estimation and Scheduling"project) for the period up to around 2040.

Further work is recommended to improve the accuracy of the model and to fully utilise the SFNSW research programs in progress in the Eden CRA/RFA Region.

DEVELOPMENT OF MODIFIER MODELS (NE15/FRA)

Project objectives

This project aimed to develop a suite of modifier models that would take into account the effects of thinning of the regrowth forest, and other forest management practices that could affect growth and future yields in all forest types.

Methods

STANDSIM (which includes growth and modifier models as adopted for Eden) has the ability to evaluate yields from various thinning regimes for the stands. Commercial thinning regimes, with thinnings around ages 30 years and 45 years across the thinnable area were assumed. Because of insufficient data, STANDSIM as used did not reflect growth responses to thinning. Furthermore, STANDSIM was not able to evaluate management intensification practices, such as fertilising, in Eden.

Key results and products

The effects of other management practices (eg various intensities of selective harvesting) were assessed by the Ecologically Sustainable Forest Management Technical Committee.

SAWLOG SPECIES MIX (NE20/FRA)

Project objectives

The objective of the project was to determine, for the multi-aged forest, proportions of species and size class within each compartment and coupe.

Methods

The method used in this project was as follows:

- Sawlog volumes since 1979 were extracted from State Forests of NSW' sales systems (FORSALE and FORPRAC) by compartment, species and diameter classes. Some data prior to this date was available from paper records.
- For compartments with the alternate coupe harvested, the percentage of species of the total coupe volume was calculated. These percentages were included in the Eden FRAMES database (referCompilation and Documentation of the Database project NE10/FRA) and applied to the predicted total volumes (refer Review of Resource Data for Multi-aged Forest and Regrowth project NE09/FRA).
- For compartments with the alternate coupes not harvested (approximately 15% of compartments), the percentage of species of the management section's total volume was calculated. These percentages were included in the Eden FRAMES database and applied to the predicted total volumes.
- For diameter classes, the percentage diameter classes were calculated for each management section. These percentages were included in the Eden FRAMES database and applied to the predicted total volumes.

Key results and products

The expected species and size class sawlog percentages for each coupe were included in the Eden FRAMES database (see Compilation and Documentation of the Database project). This data enables volume information to be subdivided into species and indicates the volume of the species and size class of sawlogs that have value-adding potential.

COMPILATION AND DOCUMENTATION OF THE DATABASE (NE10/FRA)

Project objectives

The aim of this project was to collate the spatial and tabular data on the resource so that it could be utilised by growth and yield models and integration projects.

Methods

The following methods were used:

- Collate outputs from other projects; resource data , retained tree information , net harvestable area , site productivity and available volumes by species.
- These are linked in a GIS resource layer (1:25,000 scale) which may be intersected with attributes including:
  - digital elevation model (DEM) (for site characteristics);
  - land tenure, compartment and coupe;
  - site productivity;
  - harvesting and fire history;
  - predicted volume by species and product;
  - mapped stand area (regrowth);
  - net area estimator;
  - net area suitable for thinning operations.

The collected data was compiled into a Microsoft Access database.

Key results and products

The Eden FRAMES database stores all of the above data, including yield tables generated from the models specified in project NE14/FRA (Development of a Growth and Yield Model for Regrowth) and project NE 15/FRA (Development of Modifier Models). The database utilises a set of queries to analyse the data, to schedule annual harvesting and to demonstrate whether or not the annual volumes decline over the analysis period.

DEVELOPMENT OF A YIELD ESTIMATING AND SCHEDULING TOOLBOX (NE22/FRA)

Project objectives

The objective of the project was to integrate the forest resource data and growth models into a package which estimated yields from each coupe in the forest and enabled a program of future harvesting to be simulated, with volumes scheduled during each year to ensure a predictable resource supply to wood-based industries during the RFA period.

Methods

Yield estimator

To develop the yield estimator, volume estimates were produced for the multi-aged forest and the fire and harvesting regrowth areas.

- **Multi-aged forest**: The outputs from the review and validation of the multi-aged forest data project were used to provide volume per hectare of sawlog and pulpwood. This unit volume is then multiplied by the net harvestable area for each coupe.
- **Fire and harvesting regrowth**: For areas of regrowth resulting from past wildfire and harvesting events, the volume per hectare data for sawlogs and pulpwood was generated from the modified STANDSIM model for each stratum. These product volumes are then multiplied by the net thinnable area for each coupe to yield total product volume by year and coupe.

Yield scheduler

The yield scheduler combines the wood flow from the multi-aged forest and regrowth forests (including thinnings) into a nominal annual wood flow. The yield scheduler indicates when yield becomes available, rather than specifying the particular future harvest year for each coupe.

Because the multi-aged forest is assumed to have zero net sawlog growth, a simple average of the total available volume up to 2019 inclusive gives the annual harvest volume for this period.

Regrowth sawlogs do not become available in significant volumes until about 2020. Sawlogs between 2020 and 2040 are drawn predominantly from harvesting of 1952 and 1960s fire regrowth and second thinning of regrowth from later fires and from harvesting. These are also averaged for an annual wood flow.

Key results and products

A series of tables were built into the Eden FRAMES Access database. This comprises a set of base data tables and a range of queries to generate the various components of wood flow and to join them together. A description of the sets of queries is provided below:

- **Multi-aged forest** - This query predicts the total sawlog volumes (m^3) and total pulp volumes (t), disaggregated by species and size class, for each unlogged coupe.
- **Fire regrowth** - This query calculates the predicted future sawlog and pulp volumes from areas of regrowth resulting from past wildfire events.
- **Harvesting regrowth** - This query calculates the predicted future sawlog and pulp volumes from areas of regrowth resulting from harvesting events.
- **Regrowth summary** - This query compiles the fire and harvesting regrowth volumes into one table.
- **Eden CRA/RFA Region summary** - This query compiles the regrowth and multi-aged forest volumes into one table.
- **Scenarios** - This query excludes compartments for different scenarios/options and calculates the remaining volumes for each year scheduled by operation type.

The outputs of the yield scheduling for Eden show:

- when coupes should be/are best harvested in future years;
- expected yield by species, volume and size class for the multi-aged forest;
- volume by products available from the regrowth forest; and
- yields smoothed to provide similar yield each year to 2019.

DATA MANAGEMENT

TENURE AND PLANNING UNIT DERIVATION (NE 34/DM)

Project Objectives

This project aimed to provide the base tenure information for all Eden CRA/RFA Region projects by:

- identifying digital land tenure information;
- creating a common land tenure layer for State Forest and National Parks and Wildlife Service (NPWS) Estate;
- identifying other crown land; and
- reviewing available tenure selection units.

Methods

Sources of tenure data were identified and collated. Datasets were then transferred to a Geographic Information System (GIS) for manipulation. Currency of data was validated in coordination with custodians.

A suitable selection unit breakup was identified as compartment / coupe boundaries on State Forest, and subcatchment boundaries of equivalent size to compartment boundaries on private land and non-NPWS Estate crown land. NPWS Estate was not further subdivided.

The subcatchment coverage was derived and joined to the State Forest and NPWS Estate GIS layer.

Each individual selection unit was given a unique identifier (numerical) which became the selection unit label.

Key results and products

- A common tenure / selection unit layer based on coupes and subcatchment boundaries was produced to be used as base information for Eden CRA projects in digital form.

COLLATION OF DIGITAL DATA SETS FOR INTEGRATION AND DEFINITION OF CONTEXT DATA (NE 37/DM)

Project Objectives

- To scope the requirements of the decision support integration system for the Eden RFA.
- To identify and collate a suite of GIS context coverages to be used for integration and scenarios development over the Eden CRA/RFA Region.
- To prepare and load integration and scenarios development tools with digital data from project outputs.

Methods

Digital project data was collated from all contributing agencies and assembled into context data and data required for the C-PLAN system.

Digital data was written to CD-ROM and forwarded to the Resources and Conservation Division for distribution to all stakeholders. Five cumulative data sets were distributed.

Context data included:

- National Estate Values;
- Catchments;
- Mineral Potential;
- Leasehold;
- Apiary;
- Wood Volume Information *list of types needed.*

Data identified for use in C-PLAN included:

- Forest Ecosystems;
- Identified Fauna Models,
- Old Growth Forest Ecosystems;
- High Quality Habitat Old Growth;
- Rare Flora sites;
- Centres of Endemism and
- National Wilderness Inventory.

Data identified for use in C-PLAN was intersected with the final planning unit layer.

Key results and products

- Comprehensive collation of digital project data was produced for the Eden CRA/RFA, with a data matrix of each C-Plan data category by planning units. This data was used in C-Plan in the integration process.
- Contextual data informed the integration process.

CRA DATA MANUAL (NA19/MUL)

Project objectives

The main objective of the *Data Manual* is to provide information to CRA/RFA participants on:

- data issues associated with the CRA/RFA process; and
- specifications, guidelines and standards for data including:
  - metadata
  - spatial data
  - spatial referencing
  - data transfer
  - mapping (i.e. hardcopy mapping presentation).

Methods

Specifications, guidelines, standards and methods were developed by the Data management Group for adoption in the CRA/RFA process. Where acceptable or widely recognised standards etc existed they were adopted, or modified slightly to reflect CRA/RFA needs.

Key results and products

The final draft of the *Data Manual* contains the relevant sections as outlined below:

- key data integration and information issues
- metadata guidelines for CRA data
- process for data supply
- process for data distribution
- process for data updates
- data quality standards
- data transfer standards
- principles for development and maintenance of negotiation databases for NSW RFA regions
- hardcopy mapping standards for reporting
- RFA data archive
- data access
- fundamental datasets

In addition, the Manual also includes:

- metadata examples from the ANZLIC Metadata Guidelines
- the Data Audit Process Document
- the NSW CRA/RFA Data Access Principles
- CRA/RFA Dataset Request Form

The manual will soon be finalised. The latest version is currently being edited by the Data Management Group.