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Science project 2006-2 Monitoring stream biodiversity (KPI 20 of the Forest Management Plan)

PROJECT PLAN

title and summary

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Science Project Overview

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Part A - Summary & Approval	bla

Contents

Related Science Projects

99/0007

Background

One of the overall aims of the Forest Management Plan 2004-2013 is to protect soil and water resources in forested areas to which the Plan applies. Key performance indicator (KPI) 20 is the percentage of waterbodies (e.g. stream kilometres, lake hectares) with significant variance of biodiversity from the historic range of variability. The intent of KPI20 is to provide a measure of the success of the Forest Management Plan in protecting the ecological integrity and quality of streams.

The rationale behind this project is that logging and fire frequently cause changes to stream conditions and, consequently, their ecology. Sedimentation and opening up of canopy are usually the greatest causes of impact (see Halse and Blyth 1992), with much of the sediment coming from roads crossing streams.

The project addresses KPI20 by monitoring aquatic macroinvertebrates and measuring various aspects of water physico-chemistry at 40-50 sites in spring each year. The protocol being used is based on AUSRIVAS and AUSRIVAS models will be used to assess the degree of disturbance in the streams subject to monitoring (Halse *et al*. 2001).

Aims

The objective of KPI 20 is to assess the success of the implementation of the Forest Management Plan 2004-2013 in protecting the ecological integrity and quality of streams. The specific criteria to be used in assessing success are:

Indicator - *Percentage of water bodies (e.g. stream kilometres) with significant variance of biodiversity from the historic range of variability*

Biodiversity Measure - *The diversity of aquatic macro-invertebrate fauna at a selected number of monitoring sites*

Performance Target - *No sites with fauna significantly different from the reference condition*

Expected outcome

Project will monitor whether CALM is meeting FMP commitments with regard to maintaining forest stream biodiversity. It will also provide information on forest stream biodiversity and add to knowledge of the occurrence and distribution of the States biota.

Knowledge transfer

(1) Monitoring results will be used by SFM and the EPA to assess compliance with the FMP. (2) Information on pattern of aquatic invertebrate occurrence will be used by CALM to examine adequacy of forest reserve system, and to compile lists of Threatened Ecological Communities and Rare or Priority Taxa. (3) Information on response of stream communities to fire, logging and dams will be used by FPC, SFM and Water Corporation to improve management of forestry activities, burning regimes and water harvesting. (4) Project results will be disseminated by: A. circulating progress reports annually to appropriate agency staff B. formal reporting of results to SFM and the EPA every five years C. scientific publications as appropriate

Tasks and Milestones

Annual

Sep-Oct

Oct-Feb
Mar
Sampling
Identification
Analysis/reporting
Five-yearly
Analysis and compilation of formal report of results, incorporating AUSRIVAS model outputs and trends in species richness of selected taxa in relation to activities adjacent to the stream sites

References

Halse, S.A. and Blyth, J.D. (1992). Aquatic fauna of the karri forest. In: Research on the Impact of Forest Management in South-West Western Australia. CALM Occasional Paper No. 2/92. July 1992. Department of Conservation and Land Management, Western Australia, pp. 115-138

Halse, S.A., Scanlon, M.D. and Cocking, J.C. (2001). First National Assessment of River Health: Western Australian Program. Milestone Report 5 and Final Report. Unpublished report to Environment Australia. Department of Conservation and Land Management, Perth, 86 pp

Methodology

Monitoring will occur between August and October in channel habitat. This consists of unvegetated river banks and the central portion of the stream. Macroinvertebrates will be collected by 10 m of sweeping with a pond net, the sample will be washed and elutriated and then sub-sampled using a box sampler until 200 animals have been randomly encountered. All macroinvertebrates will be identified to family level and animals of the orders/families Ephemeroptera, Plecoptera, Trichoptera, Hemiptera, Coleoptera, Odonata and Chironomidae identified to species. These groups are amenable to species identification because keys exist and they are either known to be sensitive to water quality change or species-rich. Family level identifications are used in AUSRIVAS models and the species data will be used to examine biodiversity trends in more detail. Overall, methodology will follow that of Halse *et al.* (2001).

Data on site characteristics has been compiled for all sites. Things documented include tenure, forest type (jarrah or karri), logging and fire history, soil type, slope and expected impacts. In addition to macroinvertebrates, water quality data will be collected, including salinity, nutrients, pH, temperature, turbidity and dissolved oxygen.

The distribution of the 46 sites sampled in 2005 is shown in Figure 1 and Table 1 provides a breakdown of forest type, occurrence in CALM regions, land tenure, reason for monitoring and expected impacts. The initial basis for site selection was to examine sites previously sampled during the 1994-1999 AUSRIVAS program, for which some existing data are available. Only sites where discharge was less than 100,000 ML per annum were included. However, the project required a set of sites that are representative of forest conditions and a series of other selection criteria were imposed. These included that ca 75% of sites should be in jarrah forest, 25% in karri; ca 60% of sites should be in areas subject to logging and 40% in unlogged areas; sites should be spread across the forested area; a small number of sites should examine the impact of dams; a small number of sites should be located in areas that experienced wildfire last summer so that the impact of intense burns could be examined; a small number of sites should be in areas to be logged this year or next year so that the impact of logging could be examined. In order to fulfill the above criteria, it was necessary to include a number of sites not sampled during AUSRIVAS.

A small number of sites will be added to the program in 2006, after consultation with DoE and Water Corporation to examine the impact of Yarragadee extraction. This will include sites on St Johns Brook, Milyeannup Creek and Poison Gully. There will also be consideration of whether sites on bauxite, and other mining, leases should be included.

The framework for reporting and analysis, as stipulated by SFM, is shown below.

The entities to be measured for the KPI are:
Entity
Target

Aquatic macro-invertebrate diversity
No sites with fauna significantly different from the reference condition.

Required data

Required data
Collection & storage method
Custodians
List of monitoring sites where aquatic macro- invertebrate diversity measured.
Sites selected from:
a) within with timber harvesting in their catchments; and
b)sites below dams c)sites that fall within the plan area
Science Division
Reference condition for selected monitoring sites
The reference condition for a site is the expected number of macro-invertebrate taxa according to AUSRIVAS models developed by the Department (see background section). Models are available on the AUSRIVAS website (University of Canberra)
Science Division
Aquatic macro-invertebrates collected from selected monitoring sites
Science Division to conduct assessment of sites annually and report prior to mid-term and final reporting of the number of aquatic macro-invertebrates collected.
Science Division

Calculation method

Entity to be measured
Calculation method
Aquatic macro- invertebrates observed and expected (*O/E* score)
O/E score: Observed macro-invertebrates score divided by expected macro-invertebrates from AUSRIVAS models based on pristine stream condition
Ecological rating
An ecological rating of undisturbed, marginally disturbed, or disturbed will be assigned to each monitoring site on the basis of the *O/E* score (Halse *et al*. 2001).

Entity measurement, calculation and reporting frequency

Required metric
Measurement frequency
Calculation frequency
Aquatic macro- invertebrates *O/E* score
Annual for selected sites
Five-yearly
Ecological rating

Presentation of the entities

Metric
Presentation
Aquatic macro- invertebrate *O/E* score and ecological rating
Data will be presented in Table A showing *O/E* score for each monitoring site and ecological rating with text to describe trends and provide analysis for sites where there is a significant difference from the reference condition. Average *O/E* scores associated with various potential perturbations will also be provided.

Table A. Aquatic macro- invertebrate *O/E* score and ecological rating at selected monitoring sites within the area of the Forest Management Plan.

Observed Macro-invertebrates score divided by expected Macro-invertebrates
Average ecological rating (undisturbed, marginally disturbed or disturbed)
Yr 1 Yr 2 Yr 3 Yr 4 Yr 5
Site 1

Site 2

Table 1. The number of sites sampled in jarrah and karri forest in 2005 separated according to CALM region, land tenure, reason for on-going sampling or expected impact this year.

Jarrah

Karri

CALM region

Swan
12
0
South-west
13
1
Warren
9
11
Land tenure
State Forest
20
8
National/Conservation Park
14
4
Reason for on-going sampling
Baseline site
8
4
Forestry activity
11
3
Logging impact
6
5
Fire impact
3
0
Dam impact
3
0
Road impact
0
2
Stock impact
1
0
Expected impact this year
None
22
6

Logging
6
5
Wildfire
2
0
Flow alteration
2
1
Sedimentation
1
2
Eutrophication
1
0

Biometrician's Endorsement

required

No. specimens

Selected specimens will be incorporated into the Woodvale aquatic invertebrate collection. Over time it is expected several hundred specimens will be vouchered in this way, with details stored on a corporate database on the Woodvale server. Type specimens of any new species will be lodged with the Western Australian Museum.

Herbarium Curator's Endorsement

not required

Animal Ethics Committee's Endorsement

not required

Data management

Data will be incorporated into the MRHI database on the Woodvale server, which is a corporate database for river invertebrate data. All CALM's AUSRIVAS data are held in this database (there has been periodic export to the Commonwealth Government AUSRIVAS database).

Data Manager's Endorsement

None

Operating Budget

None