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Science Division

The FORESTCHECK project: Integrated biodiversity monitoring in jarrah forest

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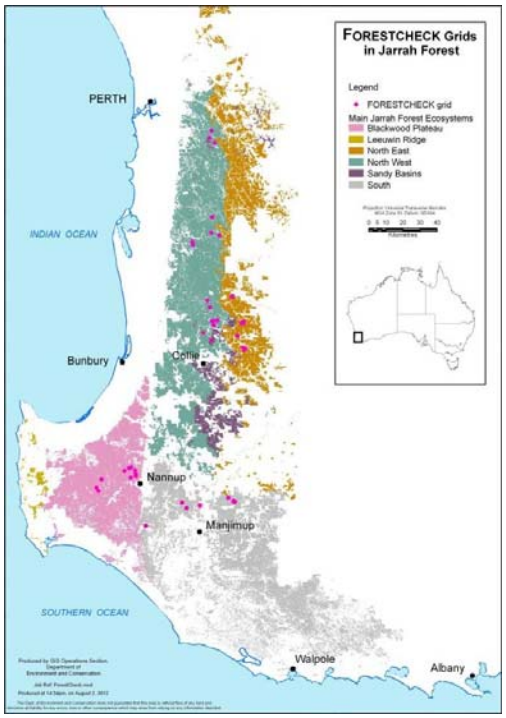
Background

FORESTCHECK is an integrated monitoring system designed to support forest management in the south-west of Western Australia by providing information about changes and trends in key elements of forest biodiversity associated with management activities (McCaw *et al*. 2011). Under conditions of uncertainty and change, monitoring forms the basis for adaptive management. Integrated monitoring is a fundamental component of Ecologically Sustainable Forest Management. The focus of FORESTCHECK is on timber harvesting and silvicultural treatments in jarrah (*Eucalyptus marginata*) forest but the program has potential for a much wider application.

FORESTCHECK is also part of an international network for Long Term Ecological Research that was developed to assess and resolve complex environmental issues of global importance.



There are 48 FORESTCHECK monitoring grids, each 2 ha in size, distributed at five locations within four jarrah forest ecosystems (left) and established in:

- forest that had never been harvested or forest that had not been harvested for at least 40 years (external reference)
- coupe buffers (internal reference)
- shelterwood and/or selective cut treatment
- gap release treatment.

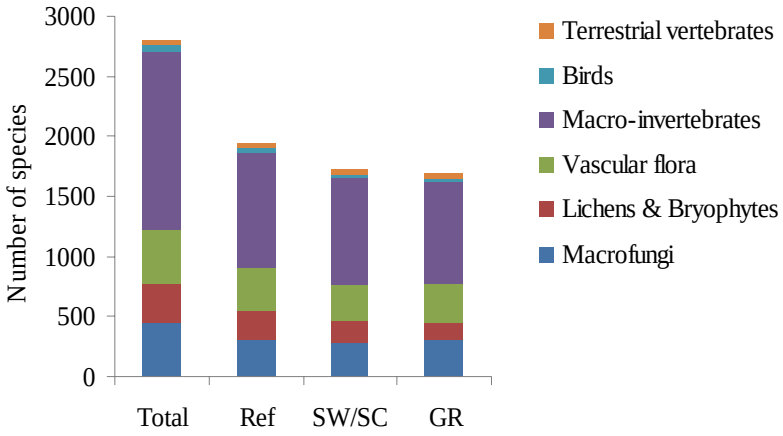
Locations were stratified according to recognised ecological gradients of rainfall, evapo-transpiration and soil fertility and grids are matched according to vegetation complex and time since treatment (silvicultural treatment and/or fire). Each grid was assessed for attributes such as forest structure, soil condition and levels of litter and coarse woody debris, as well as elements of biodiversity including vascular flora, vertebrate fauna (birds, mammals and reptiles), cryptogams (lichens, liverworts and mosses), macrofungi and invertebrate fauna.

Above: Location of FORESTCHECK monitoring grids

Silvicultural treatments were applied during the period 1988-2002 and all grids were monitored between 2001 and 2006; with grids at one location monitored in each year. Sampling protocols are described in the Operations Plan available at www.dec.wa.gov.au.

Findings

- Over 2,500 species were recorded across all 48 monitoring grids.
- Few significant impacts were evident, and most species groups were resilient to the disturbances imposed.
- Harvesting resulted in an average increase of 18% in soil bulk density (soil compaction) and more than 50 years may be needed for biological processes to reverse the increase.
- Silvicultural treatments had little impact on species richness, but species composition of communities was different on harvested treatments.



Left: Species richness of all biodiversity groups recorded in each treatment (Ref = external reference and coupe buffer forest, SW/SC = shelterwood and selective cut treatment, GR = gap release treatment, figure from Abbott and Williams 2011).

- Cryptogams (especially lichens) were the species group most sensitive to disturbance, although recovery of species richness was nearly complete 10 years after disturbance.
- For all species groups studied, species compositions on grids harvested 40 or more years earlier were indistinguishable from that on grids that had never been harvested.
- Silvicultural disturbance (timber harvesting and associated burning) was associated with increased species richness for fungi on wood and terrestrial vertebrates, and decreased species richness of cryptogams.
- Time since the last (prescribed) fire had no long-term impact on any species group.
- Fox baiting had a greater impact on terrestrial vertebrates than did silvicultural treatments.
- Very few taxa were sufficiently widespread or sufficiently responsive to silvicultural disturbance to be of value as bio-indicators, demonstrating the superiority of biodiversity monitoring over bio-indicator monitoring.

Management Implications

Findings from the first five years of FORESTCHECK monitoring support the approaches to protection of biodiversity used in Western Australian forests which include formal reserves, informal reserves and protection of habitat values within areas subject to timber harvesting. These findings relate to examples of silviculture practice implemented prior to the *Forest Management Plan 2004–2013* (Conservation Commission of WA 2004) that introduced additional measures to protect biodiversity at the whole of forest, landscape and operational scales, and to reduce soil disturbance during timber harvesting operations.

FORESTCHECK monitoring provides a sound basis for systematic biological survey of the forest and could also be used to monitor impacts of fire, climate change, disease, insect pests and feral animals on forest biodiversity.

Results from FORESTCHECK can be integrated with those from similar plot-based projects, such as the Kingston (Burrows *et al*. 1994), Walpole Fire Mosaic (Burrows 2006) and Fire Regime (Wittkuhn *et al*. 2011) studies to provide a more holistic understanding of forest ecology and biodiversity in the south-west.

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