Groundwater – Biodiversity – Land use

GNANGARA SUSTAINABILITY STRATEGY FIRE REGIME

A report prepared on behalf of the
Department of Environment and Conservation
for the Gnangara Sustainability Strategy

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Gnangara Sustainability Strategy Fire Regime

Report for the Gnangara Sustainability Strategy and the Department of Environment and Conservation prepared by

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This document has been commissioned/produced as part of the Gnangara Sustainability Strategy (GSS). The GSS is a State Government initiative which aims to provide a framework for a whole of government approach to address land use and water planning issues associated with the Gnangara groundwater system. For more information go to www.gnangara.water.wa.gov.au

GNANGARA SUSTAINABILITY STRATEGY FIRE REVIEW – SCOPE

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Introduction

The Gnangara groundwater system provides approximately 60% of Perth's potable water, and supports numerous significant biodiversity assets, including the largest patch of remnant vegetation south of the Moore River, a number of Bush Forever sites, threatened species and ecological communities, and a suite of approximately 600 wetlands (Reaveley et al, 2009).

The aquifer is directly recharged by rainfall. Reduced rainfall, abstraction, and changes in land use (including changes to fire regimes) have contributed to a decline in the ground water levels.

Prescribed burning is carried out in both native vegetation and pine plantations primarily to reduce fuel loads and so reduce the intensity of wildfires. Modification to the fire
regime on Crown land has been proposed as a cost effective option to enhance water yield (Canci 2005; Batini pers comm.). Xu (2008) has referred to a current interval between burns of more than ten years and has suggested that doubling the burning frequency will increase recharge by approximately 20GL/a.

Separate projects are being undertaken to look at the effects of fire on ground water (CSIRO) and the impact of fire on biodiversity (DEC). The purpose of this study is to review fire management operations on the major areas of Crown Land managed by the Department of Environment and Conservation (DEC) on the Gnangara groundwater system in relation to the impacts of such practices on groundwater recharge and biodiversity. The study will address the matters outlined in the sections below.

The fire planning framework used by DEC and its implementation on the Gnangara system

A hierarchy of plans is involved in fire management on the Gnangara Mound:

Management Plans and Necessary/Compatible Operations

The *Conservation and Land Management Act* 1984 requires land to be managed in accord with management plans prepared under S56 of the Act which prescribes the objectives for such plans for different classes of land. Land management (including fire management) can only be undertaken in accordance with approved plans, or in the absence of such plans as "necessary operations" or "compatible operations" under S33 of the Act.

This report shall review the fire management requirements of

- the Yanchep and Neerabup National Parks and Neerabup Nature Reserve Management Plan,
- the Forest Management Plan 2004-2013
- Any other management plans or interim Guidelines for Necessary/Compatible Operations that may be in force for any land on the Gnangara Mound.

Master Burn Plan and Annual Burn Plans

The report will outline the preparation and review of the Master Burn Plan and Annual Burn plans as detailed in the Fire Operations Manual and Fire Protection Instructions including the timelines involved in the planning, and review their application on the Gnangara Mound.

Burning Prescriptions

The report will outline the detailed process of prescription preparation, including how multiple objectives are considered, and the approvals and review processes.

Environmental conditions impacting fire management on the Gnangara Mound

Weather

The report will:

- Summarize summer weather conditions, including the 95 percentile fire danger indices and extreme values.
- Define the range of conditions suitable for prescribed burning of native vegetation.
- Determine the average annual "burning days" for each fuel type for each 5 year period between 1993 and 2008 by analyzing the Pearce AWS data. (The AWS was established at Pearce in December 1993). The procedure will:
  - Calculate daily SMC (or use existing records if available)
  - Calculate daily maximum FDI (or use existing records if available)
  - Select days where FDI, SMC and wind strength are within acceptable range.
  - Exclude days within the prohibited burning period
  - Exclude days where SDI outside acceptable range
  - Select only days with suitable wind direction.

Slope/Aspect

Examine slope and aspect for lands within the study area and discuss the impact on fire behaviour.

Wetlands, Threatened Species, Reference areas.

Declining rainfall has resulted in many wetlands being dry for long periods. There is an increased risk of peat areas catching alight if the area is burnt (by either wildfire or prescribed fire) whilst dry. This has both fire management and environmental impacts.

There are numerous threatened and priority flora and fauna sites and threatened ecological communities within the study area. Threatened species require permission to take if they are to be burnt by prescribed fire.

Two fire exclusion reference areas (69ha and 57ha) are located within the study area.

The report will review the location and past fire history of the above and discuss the impacts on fire management practices.

Vegetation Types
Review fuel accumulation rates and vegetation structure for the major vegetation types (Banksia, Heath, Tuart, Marri-Jarrah). Relate fuel accumulations to predicted prescribed fire and wildfire behaviour and briefly discuss the implications for fire management.

Land use impacts on fire management

Changes in land use can change both the likelihood of occurrence and consequences of wildfires. They can affect fire behaviour directly through changes in fuels, and indirectly through the effects on fuel management programs.

The report will review changes in land use include rural subdivisions, increased urbanization, changes in plantations, reduction in horticulture, and clearing of native vegetation. DAFW land use information and SOE reports can be used to compare broad changes. The impacts of the changes on fire management will be discussed, including:

- changed fuel condition
- ignition risk
- fire response
- smoke issues
- values at risk
- cost of burning

Other threatening processes

The report shall consider the impact on fire management practices of other threatening processes including climate change, Phytophthora, drying wetlands, bushland fragmentation and linear infrastructure.

Review of burning prescriptions

The current burn prescriptions for Banksia woodland on Bassendean and Spearwood Dunes, Tuart on Spearwood dunes; mixed Marri-Jarrah on Spearwood dunes and Pinjara Plain; and under pine burning will be reviewed with particular reference to the objectives of the burn, the burning conditions, and resources required.

Review the changes that would be required if burning was to be undertaken every 4 or 5 years as proposed for water production. Discuss any limitations, including resources and suitable weather.

Significant economic benefits flowing from increased burning for water production have been claimed (Water Corporation, Batini et al). This report will consider the risks and costs associated with such burning, and discuss possible funding.

Fuel age distribution in native vegetation on DEC managed lands and UCL

There is no comprehensive and accurate record of areas actually burnt. Fuel age data can be derived from hand drawn annual burn plans, however the areas shown as burnt are generally to block boundaries. Not all the area within the block has necessarily been burnt, particularly where fuels are relatively low within the burn area. Any analysis based on these records will therefore be limited in the detail that can be determined.

Techniques have been developed for mapping burn areas from remote sensing with far greater accuracy. Using these techniques, major wildfire scars have been mapped from 1972 to 2004 to provide a historical data set, .however areas burnt by prescribed fire have not been similarly mapped. Currently neither wildfires nor prescribed fires are routinely mapped from satellite data, although this would be highly desirable.

The microfiche records of the hand drawn annual burn plans prior to 1994 have been digitised (Craig Carpenter, pers comm.) and shape files are also available for subsequent years ex FMIS data. This will facilitate analysis in ArcGIS.

The report will review the fire history on the Gnangara Mound over the past two decades. A spatial analysis will be undertaken for current UCL and DEC lands to determine:

- Area burnt annually 1988-2008 on each land system by
  - Wildfire
  - Prescribed fire
  -
- For each year , the percentage area with a fuel age equal to or less than that considered desirable for
  - water production (based on the proposed 4-5 year interval between burns)
  - fire control

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The results will be displayed graphically to illustrate any trends over time.

Snapshots of the fuel age distribution in 1988, 1998, and 2008 will be examined, including the distribution in terms of vegetation types and complexes. The report will discuss the implications of the fuel age distributions for fire protection, biodiversity and aquifer recharge.

Wildfire Occurrence

The DEC wildfire database records fires attended by DEC/CALM/Forests Department crews since 1950. The data base includes date, a spatial reference for the origin of the fire, and a standardized classification for the cause. This will enable analysis of wildfire occurrence according to distribution, cause, and season.

FESA records are only available since 1997. They do not contain an accurate spatial reference, nor identify cause. Location is recorded to the nearest grid square, by suburb, and in urban areas by street. This will enable only limited analysis to be undertaken.

There may be some duplication of records (i.e. fires attended by both DEC and FESA crews) but the lack of common recording methods and spatial accuracy makes it impossible to identify all duplicate records.

Within the limitations of the available data the report will review trends in the occurrence of bush fire by examining:

- Annual number of fires recorded by CALM/DEC (1988-2008) and FESA (1997-2008).
- Locations of fires
- Cause
- Month of occurrence

Pine Plantations

Current under pine burning

One of the objectives for much of the burning in the native vegetation near plantations is to provide protection for this high value resource. This is particularly important where fuel reduction within the plantation is not possible, however the most effective protection is provided where plantation fuels can be kept low.

Needle bed burning under mature pines significantly reduces the risks, particularly in areas with a history of ignitions.

Very high fuel loads occur following silvicultural and harvesting operations (thinning, pruning, clear felling). These fuel loads can be reduced by burning. The report will

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review the distribution and timing of such operations, the conditions under which burning can be carried out.

The report will also review the cost of and funding for burning operations within and surrounding plantations.

Fire management with plantation/land use changes

Under pine burning can be carried out when conditions are unsuitable for burning in native vegetation, and as such increases the burning opportunities. Fuel reduced areas within the plantations can contribute to strategic protection across a broader area, as well as within the plantation. Areas that have been cleared and replanted cannot be burnt for many years, and can include a high grass hazard. Similarly, areas where it is not intended to re-plant to pines can present a high hazard.

This report will review the current situation and proposed changes based on FPC plans. It will canvas options for both patterns of change and future land use in areas not to be re-planted, and discuss the fire management implications of each. Options will include harvesting patterns, re-vegetation to native bush, abandonment, and grass.

European House Borer

EHB infects seasoned pine and Oregon. Logging residue can provide breeding areas as it dries. Fire is one means of removal of such residues. The report will look at the requirements and effectiveness of burning for EHB habitat control.

References

Canci, M. (2005) *Analysis of Fire Effects on Recharge and Growth of Native Vegetation on Gnangara Mound.* Infrastructure Planning Branch, Planning and Infrastructure Division, Water Corporation. May, 2005.

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Reaveley, A., Bleby, K., Valentine, L. and Wilson, B. (2009) *Fire and the Banksia woodlands of the Swan Coastal Plain – Fuel Reduction Burns and Water Recharge on the Gnangara Mound: Preliminary Report.* Department of Environment and Conservation, CSIRO, March 2009