Forest Vulnerability Assessment
A Preliminary Assessment of the Vulnerability of Australian Forests and Plantations to the Impacts of Climate Change

Introductory Paper
for the Stakeholder Engagement Workshop
18-19 November 2009 - Brisbane

Content

Introduction ............................................................................................................................. 2
1. The Forest Vulnerability Assessment (FVA) Project ....................................................... 3
2. The FVA Work Packages ............................................................................................... 4
3. Purpose of the Workshop ............................................................................................. 7
4. Useful Definitions ......................................................................................................... 7
5. Some Scenarios of Climate Change .............................................................................. 8
Introduction

Thank you for agreeing to attend the Forest Vulnerability Assessment (FVA) Stakeholder Workshop. Your willingness to contribute your time and expertise is much appreciated by the researchers in the project.

This short document sets out the background of the Workshop, in five sections, as follows:

1. A brief overview and outline of the project.
2. More detail on the individual projects in the FVA;
3. The purpose of the Workshop
4. Some definitions, hopefully helpful;
5. Some background scenarios of climate change relevant to the Australian forest.

We hope that you will find the Workshop useful. The agenda has been structured to provide opportunities to:

- Understand the potential impacts of climate change on Australia’s forests and their management;
- Share understanding of the adaptation options and barriers that exist for forests and forest-dependent communities;
- Ensure your agency’s concerns and interests are represented;
- Ensure stakeholder relevance of the Final Report;
- Network.
1. The Forest Vulnerability Assessment (FVA) Project

1.1 Introduction
This project is part of the Synthesis and Integrative Research component of NCCARF activities.

- It will address the knowledge gap with regard to our understanding of the implications of climate change for Australia’s forest estate including native forests, plantations, farm forestry and environmental plantings.
- It will provide us with information to assist governments, Natural Resource Management (NRM) managers and the business sector to adapt to the changing climatic environment in a manner consistent with principles of sustainable forest management.

1.2 Aim
The aim of the project is to provide governments, NRM managers and the business sector with:

- an improved understanding of current knowledge of the likely biophysical and socio-economic consequences of climate change for Australia's native and planted forest regions,
- an assessment of the vulnerability of Australian forests from the perspectives of both resource use and ecosystem services - identifying particularly vulnerable forests and communities in major forest areas,
- an understanding of what is already being done in Australia in relation to understanding and managing climate related risk in relation to forests, and
- guidance on key gaps to assist climate change adaptation.

1.3 Approach
Using the same definition of forests as used in the 2008 Australia’s State of the Forests Report (SOFR) which includes Australia’s diverse native forests and plantations, this project will provide a synthesis of current knowledge and understanding of the implications of climate change for Australia’s forests. It will also identify key gaps that need to be addressed to improve the capacity of forest and NRM managers to manage climate risk.

1.4 Classification of forests
Australia's forests may be considered as a continuum with large-scale industrial plantations at one extreme and native forests at the other. The classification used in this project is:

1. Plantation/farm forests
2. Productive native forests
3. Conservation native forests
4. Environmental plantings

1.5 Outcome
Enhanced awareness of, and engagement with, climate change issues by managers of Australia’s native and plantation forests used for timber production, forests for carbon sequestration and forests for NRM outcomes.

1.6 The Work packages
The Forest Vulnerability Assessment has been divided into five work package programs.

WP1 Establishing the need and stakeholder consultation
WP2 Scene setting and biophysical impacts
WP3 Socio-economic impacts
WP4 Adaptation
WP5 Synthesis
2. The FVA Work Packages

The relationship of the five work packages in the FVA project is shown below.

![Diagram of work packages]

Figure 1: How the Work Packages of the FVA inter-relate

**Work Package 1 - Establishing the need and consultation with key stakeholders**

Led by the University of the Sunshine Coast

*Introduction*

Australia has a total forest cover of around 19.4% of land or 149 million hectares (ha). Native forests make up the majority of this estate at around 147 million ha, and plantations make up the remainder. The majority of the forest estate occurs on Crown Land covering an area of 107 million ha (ABARE 2008).

Forests and the industries associated with them are vulnerable to the impacts of climate change. Australia’s forests are managed for production for forest and wood products, and as conservation and heritage areas. Forest and wood product industries have a total value to the Australian economy of around $2 billion. Australia’s plantation estate is around 2 million ha, and there is currently a boom in plantation investment. The plantation estate has seen a 17% increase in the last five years, partly fuelled by federal tax incentives in managed investment schemes.

Tourism connected with forest conservation areas is also a major contributor to regional and local economies. Forests are also managed for conservation and heritage values, for example by regulating visitors and by controlled burning. Forest conservation management has impacts on the wider community, for example by managing fire frequency and risk. It follows that the key stakeholders in forest management include:
• Natural resource managers of conservation forests and native forests
• Government plantation companies
• Private plantation companies, including managed investment schemes
• Private farm forestry representatives
• Managers of environmental plantings and restoration forests

Work Package 1 seeks to:
• Scope the key areas of issues with respect to adapting commercial and native forests to increasing climatic variability and change
• Engage stakeholders and gain collaborative support for the project
• Confirm the strategic information needs of the stakeholders

Objecdtes

1. To identify key issues to be addressed in the forest vulnerability assessment to determine to what extent climate change adaptation is being considered in current planning and management.

2. To determine the type of information that is needed by forest managers and policymakers (to be included in the synthesis report).

Work Package 2 – Scene setting and bio-physical impacts review

Led by Macquarie University and Murdoch University

Introduction

The purpose of this component is to provide a summary of current scientific understanding of climate change impacts on Australian forests. This component will give a sound scientific basis to underpin discussion of forest management adaptation to climate change.

This review will summarise current scientific understanding gained from research worldwide but will have a strong focus on the implications for the Australian forest estate. In particular, the review will incorporate important recent research into climate change impacts on forests funded through the Australian Greenhouse Office (now Department of Climate Change) Greenhouse Action in Regional Australia program.

This work package is conducted by both Macquarie University and Murdoch University. It covers the following areas (chief responsibility for each section is indicated):

Department of Biological Sciences, Macquarie University

Introductory scene setting:
• The Australian forest estate
• Ecosystem services
• Climate change scenarios including extreme events

Climate change impacts on carbon, water and nutrient balances:
• impacts of CO2, increased temperature, altered rainfall
• effects on forest productivity and carbon sequestration
• effects on water use and water availability
• impacts on nutrient cycling
• consideration of impacts on production and conservation forests
• Climate change and management issues principally relating to biotic changes, examining specifically the impacts of increased temperatures, altered rainfall and enhanced variability on the following:
  o impacts on biodiversity
  o weed invasions
  o vulnerability to pests and pathogens
  o vulnerability to bushfire
  o impacts on other ecosystem services e.g. pollination
• Examine and review the existing and developing remote sensing technologies (e.g. Hyperspectral and Multispectral, Lidar) with potential for measuring impacts of climate change on the above factors. Such technologies allow for accurate quantification of change in forest health spatially and temporally across sites, regions and landscapes.

Work Package 3 – Socio-economic impacts review

Led by the University of Southern Queensland with significant contribution from Queensland University of Technology

Introduction

This work package will review what is known about the socio-economic impacts of climate change for forested regions and the wider social implications of this change. This includes the effects on yields of forest products, the effects on global markets, regional economic impacts, forest employment, Indigenous use, tourism and recreation as well as the perceptions and attitudes of individuals and communities with connections to the Australian forest estate.

Objectives

• To identify, collate, review and synthesise studies of:
  o socio-economic impacts of changes in forest area, locations, composition and tree growth rates,
  o changes in national and regional economic output, regional populations and regional business and social institutions,
  o net carbon value,
  o impacts on recreational activities, non-market benefits and cultural practices, especially where these may affect Indigenous peoples,
  o ecological impacts and consequent changes in ecological value.
• To develop scenarios of how future landscapes may change, based on current land use trajectories and climate change scenarios.
• To describe the opinions and attitudes of forest-dependent communities and the likely social changes arising in response to climate change on forests.
• To share preliminary findings, through a whole-of-project workshop, from the impacts studies, as preparation for the work on adaptive capacity.
• To survey the socio-economic impacts of changes in forest areas and locations.
• To identify likely changes in regional and national economic output, regional populations and regional business and social institutions.
• To explore climate change impacts on communities based on scenarios modelled on changes in landscape and land use trajectories.

Work Packages 4 (Adaptation) and 5 (Synthesis)

The purpose of the workshop is (a) to share with stakeholders the preliminary findings of the first three work packages and then (b) to use the expertise and experience of the workshop participants to contribute to the activities of Work Packages 4 and 5. This being the case, we will reserve explanation of the activities of these work packages until the workshop.

3. Purpose of the Workshop

The reasons why this workshop is being held are:

a) to share preliminary findings from the first three Work Packages (see Figure 1), and more importantly
b) to inform the work of Work Package 4 (Adaptation) by tapping into the expertise of the workshop participants

We hope to learn from you:
• your concerns with regard to climate change and forests;
• what climate change impacts you observe and anticipate to observe in the future;
• your understanding of forest vulnerability to climate change;
• the available adaptation options; and,
• the barriers to adaptation.

4. Useful Definitions

These definitions are based on Inter-governmental Panel on Climate Change definitions

Adaptation and mitigation

Adaptation is the adjustment, in natural or human systems, in response to actual or expected climatic change and its impacts; adaptation moderates harm, or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation:

Anticipatory adaptation – Adaptation that takes place before the impacts of climate change are observed. It is also referred to as proactive adaptation.
Autonomous adaptation – Adaptation that does not constitute a conscious response to the impacts of climatic change, but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. Also referred to as spontaneous adaptation.
Planned adaptation – Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.
**Adaptive capacity**, in relation to climate change impacts, is the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

Possessing adaptive capacity does not necessarily translate into action to address the impacts of climate change. Understanding why this translation does, or does not, occur, and the reasons, is an active area of research.

**Mitigation** is an anthropogenic intervention to reduce the anthropogenic forcing of the climate system; it includes strategies to reduce greenhouse gas sources and emissions (for example, replacing coal-fired power stations with renewable energy sources) and enhancing greenhouse gas sinks (for example, through planting forests and sequestering carbon in deep geological formations).

**Adaptation** and **mitigation** are two responses to climate change which can interact either directly or indirectly.

**Vulnerability, sustainable development and maladaptation**

**Vulnerability** is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including extremes. Vulnerability is a function of the character, magnitude, and rate of climate change to which the system is exposed, its sensitivity, and its adaptive capacity.

Actions taken to adapt to one risk may increase the vulnerability of other sectors’ actions. This possibility of ‘an adaptation that does not succeed in reducing vulnerability but increases it instead’ is called **maladaptation**. Maladaptation also occurs when an adaptive action contributes to the problem, for example, increased use of air conditioning to address increased occurrence of heatwaves due to climate change will be a maladaptation when supported by coal-fired power generation.

**Sustainable development** is development that meets the cultural, social, political and economic needs of the present generation without compromising the ability of future generations to meet their own needs.

5. **Some Scenarios of Climate Change**

There will be a presentation at the Workshop on the climate change scenarios which set the context for the Forest Vulnerability Assessment.

Again using definitions from the Inter-governmental Panel on Climate Change, a **scenario** is a plausible and often simplified description of how the future may develop, based on a coherent and internally consistent set of assumptions about driving forces and key relationships.

The scenarios used in the FVA have the following characteristics:

- Taking into consideration the timescales relevant to Australia’s forests, they are for two time periods, the decade of the 2030s, and the decade of the 2070s.
- They assume that emissions of greenhouse gases will continue to increase at the present rate (business-as-usual). In the IPCC classification, this is known as the A1FI family of scenarios, where FI stands for ‘fuel intensive’. In fact, the rate of increase in emissions, is gradually steepening, so this is if anything a conservative estimate.
• They are based on the results from 21 General Circulation Models (GCMs). GCMs are computer-based representations of the climate system based on physical, chemical, and biological properties, their interactions and feedback processes.

• They have very high spatial resolution (see the following maps), created by interpolating from the original GCM output which has a much coarser resolution.

It is important to bear in mind that any scenario is simply one plausible visualisation of the future. Particularly with rainfall, there is a high associated level of uncertainty which must always be borne in mind when interpreting scenario results.

On the next two pages, we show examples of scenarios for:

• Annual mean precipitation for the decade of the 2070s. This shows the baseline (present-day, top left) rainfall amounts, the change in absolute and percentage terms (bottom left and top right), and the modelled amount of rainfall in the 2070s (bottom right).

• Maximum temperature in February – an indicator, for example, of forest fire risk. Again, top left shows the baseline. top right shows the change between present-day and the 2070s, and bottom right shows the new modelled temperature climatology for February. In addition, at the bottom left we have maps showing the change in the area of Australia in which the highest modelled temperature exceeds 39°C.

These are simply examples – there will be a more in-depth presentation at the workshop.
Australia
Annual Mean Precipitation
High Scenario: 21 GCM Ensemble median, SRES A1FI, High Climate Sensitivity

Precipitation (mm)
Baseline

Precipitation (mm)
2070

Precip change (%)
2070

Precip change (mm)
2070

Precipitation (mm)
2070
Australia
February Maximum Temperature
High Scenario: 21 GCM Ensemble median, SRES A1FI, High Climate Sensitivity

Tmax (deg C)

Baseline

Change in Tmax (deg C)

2070

Tmax > 39 deg C)

Baseline

2070