Adapting the Tasmanian forest practices system to climate change – Results from a practitioner workshop

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FPA Report

FPA

FOREST PRACTICES AUTHORITY

Disclaimers

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Front page photograph: A harvested coupe (photo: Chris Grove).

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Executive summary

- Climate change poses a considerable challenge to forest managers. The ways the forest industry could adapt to climate change need to be considered, consistent with the adaptive management framework used by the Tasmanian forest practices system. A project to undertake this task was initiated by the FPA in 2021.
- The first stage of the project was to seek expert feedback on the impacts climate change may have on Tasmanian production forests, and potential adaptation options to help address these impacts. A summary of this feedback received was compiled into a background report (Koch, 2022).
- The second stage of the project was to convene a practitioner workshop to discuss how the potential adaptation options could be implemented. Attendees invited were selected to represent the different timber production companies and government departments involved with forestry. All attendees were provided with a copy of the background report and were asked to attend an FPA-hosted symposium addressing some of the key issues outlined in the background report.
- On the day of the workshop an agenda was established by inviting participants to 'host' a discussion on one of the adaptation strategies identified in the background report or on a new topic of their devising. Throughout the day participants chose which discussion they wanted to participate in. A total of 23 separate conversations were had on different topics. During the conversations participants discussed how the adaptation strategy could be progressed, constraints or issues to consider, and recommendations to the Board of the FPA.
- The current document provides a synopsis of the 23 conversations had during the workshop, including specific actions that could be taken by the FPA.
- Prior to the workshop, participants were sent the list of potential adaptation strategies outlined in the background report and asked to subjectively rate the importance and achievability of each action. Responses were received from seven participants. These responses were used to rank the potential adaptation strategies identified in the background report. The highest ranked action (top five in the priority list) that was relevant to the FPA but not discussed at the workshop was 'minimise deforestation'.
- The recommendations made in the current report will be considered by the FPA as the organisation seeks to help the Tasmanian forest industry adapt to climate change.

1. Introduction

Tasmania's forest practices system is given legislative power through the *Forest Practices Act 1985*. The objective of Tasmania's forest practices system, as specified in Schedule 7 of the *Forest Practices Act,* is to achieve sustainable management of crown and private forests with due care for the environment, and taking into account social, economic and environmental outcomes in a way that is as far as possible self-funding. The forest practices system recognises the many values that forests have and is designed to ensure the reasonable protection of natural and cultural values of the forest when forest practices are carried out.

Forest practices regulated by the forest practices system include:

- harvesting and regenerating native forest
- harvesting and/or establishing plantations
- clearing forests for other purposes, including agriculture
- clearing and converting threatened native vegetation communities
- constructing roads and quarries for the above purposes
- harvesting tree ferns.

The Forest Practices Authority (FPA) is an independent statutory body that administers Tasmania's forest practices system on both public and private land. FPA's primary responsibility is regulating the conduct of forest practices in forest and threatened non-forest vegetation. The main planning tool for planning forest practices in Tasmania is the *Forest Practices Code* (the Code).

The Tasmanian forest practices system follows an adaptive management framework which includes an emphasis on research, review and continual improvement (Wilkinson, 1999; Munks et al. 2020). The ongoing program of review and improvement of the Tasmanian forest practices system includes review of the *Forest Practices Code* in its entirety, and *ad hoc* reviews of forest management aspects associated with the Code. A review of the biodiversity provisions of the forest practices system (FPS) was completed in 2008, and one of the points emphasised in the final report was the importance of considering and addressing climate change (BERP, 2008).

> *'Climate change is a key issue in the planning and management of biodiversity conservation and there is uncertainty about the exact nature and magnitude of future change. A landscape approach to managing forest biodiversity…… should provide some insurance to allow biodiversity and ecological processes to respond to changing conditions'* (BERP, 2008).

In 2021 FPA initiated a project to explore the issue of climate change and Tasmanian production forests.

The first stage of the project was to seek input from a range of scientific experts on the expected impact of climate change on Tasmanian production forests and potential actions that

could be taken to mitigate these impacts. The responses received were synthesised, including 75 potential adaptation options, in a background report (Koch, 2022) (Figure 1).

Following the expert review, a well-attended symposium was held on the 29 August 2022 to communicate some of the key messages to the in-person and online audience (see FPA website for further details).

This symposium was followed by a workshop to explore "What climate change adaptation options could the forest industry start to progress?' The current report provides a summary of the discussions had and suggestions made in this workshop.

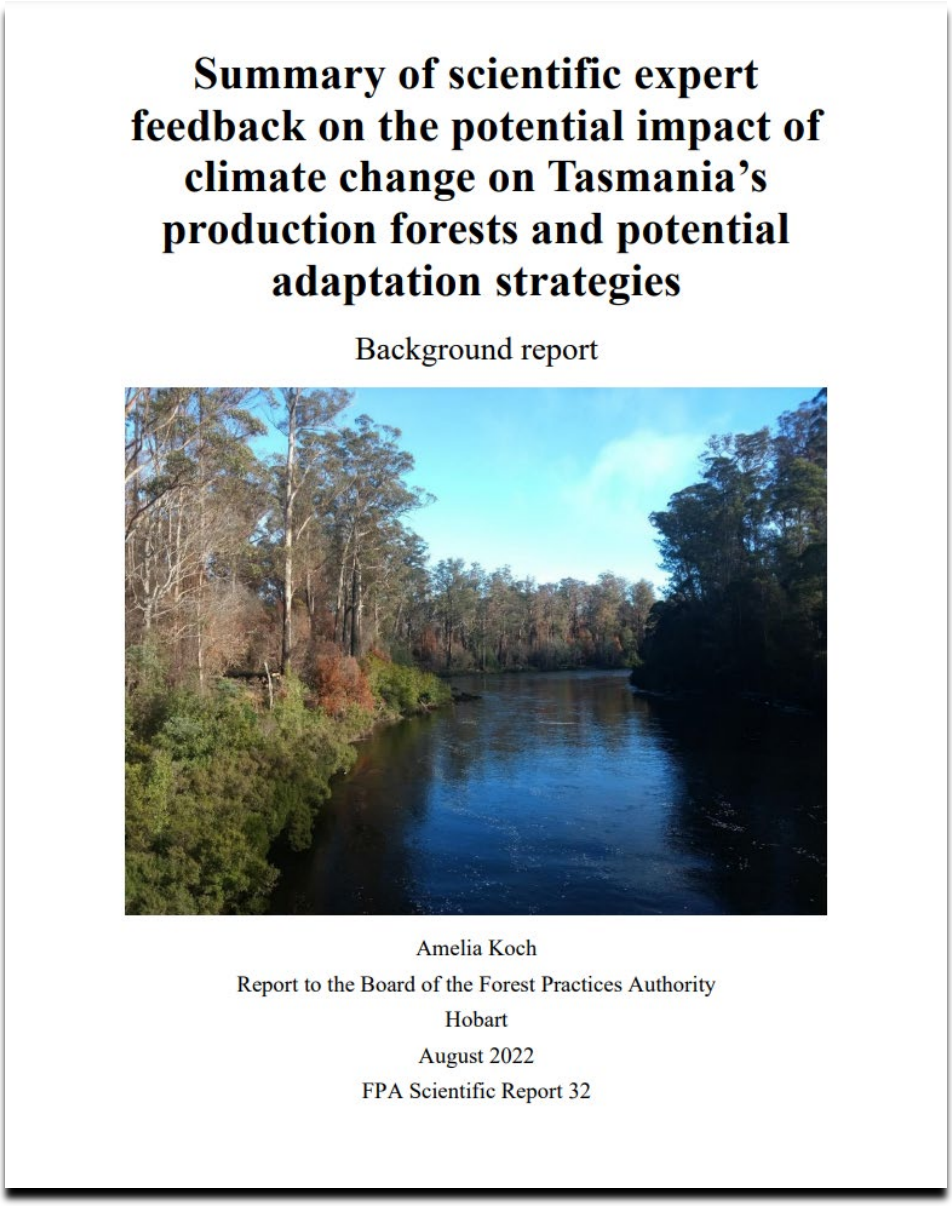

Figure 1. The background report on climate change in Tasmanian production forests compiled from feedback received from scientific experts.

2. Methods

Approximately 30 attendees were invited to attend a workshop held on 12 September 2022 in Hobart, Tasmania. People invited were selected to try and ensure representation of the different forest management organisations, including private Forest Practices Officers (FPOs) and government departments involved in forest management.

Prior to the workshop participants were sent a copy of the background report. Participants were also sent the list of potential adaptation options identified in the background report and asked to rate each option as having a high, medium or low subjective rating for (a) the importance of implementing that strategy and (b) how achievable it is to implement that strategy. Participants were asked to return this assessment to the FPA. A metric was developed for both the importance and achievability ratings by multiplying each 'high' response by three, each 'medium' response by two and each 'low' response by one, and summing the total. The metrics for the importance and achievability were then multiplied together to give a final priority metric for each adaptation strategy.

At the workshop participants were invited to 'host' a discussion on one (or more) of the adaptation options outlined in the background report, or on a new topic they identified (Figure 2). The purpose of the discussion was to do some 'blue sky thinking' on how the adaptation option could be progressed. Concurrent discussions were held meaning numerous topics were covered over the course of the day, although not all adaptation options outlined in the background report were addressed (Figure 3). By selecting which adaptation options participants hosted a discussion on, participants helped prioritise the large number of adaptation options available although it should be noted that attendees may have selected topics by interest rather than by priority alone.

The documentation from the workshop discussions are summarised in the current report, synthesising key points made during the discussion and identifying suggestions on how to implement the potential adaptation options.

Figure 2. Workshop attendees considering the potential adaptation options (coloured cards on the ground), in order to develop the agenda for the workshop (blue banner at the back). (Photo: K. Willing).

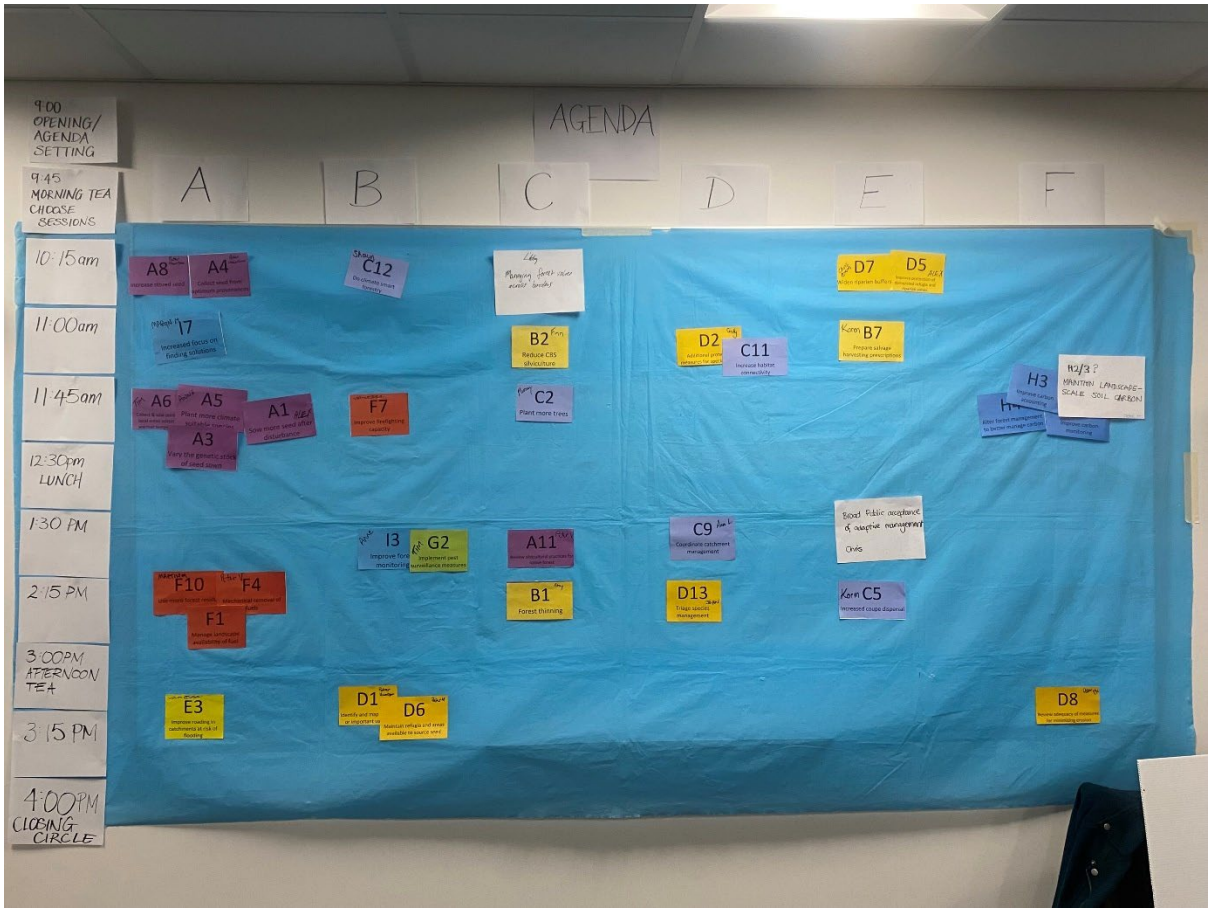

Figure 3. The agenda for the workshop that was developed by workshop participants.

Figure 4. Workshop participants engaged in concurrent discussions.

3. Results: summary of workshop discussions

The order in which adaptation options are covered in this section is determined by the order in which they were reported in the background report (Koch 2022), not by any attempt to prioritise these actions. The results of the prioritisation process are covered in Section 4 of the current document.

The letters and numbers in brackets at the end of each title indicate the reference number of the potential adaptation options in the background report that were relevant to the discussion.

3.1. Forest regeneration (A)

3.1.1. Climatically adapted regeneration options (A1, A3, A5, A6)

Forest health and vigour is known to decline with increasing temperatures and drought conditions, but species and populations within a species will have different tolerances for changing conditions. Therefore, forests may adapt to climate change via natural selection if forest stands are healthy and there is adequate genetic diversity within stands. However, unassisted adaptation to climate change is likely to be a slow process in forests, due to the long lifespan of trees, and it is uncertain if forests will be able to adapt at the rate climatic change is expected to occur.

There are several ways that forest managers may help maintain forest health using regeneration methods.

- Sowing seed at higher densities than is currently done may promote greater selection pressure and help speed up the rate of natural selection if there is genetic variation in the seed sown.
- Using a proportion of seed from areas that currently experience the climatic conditions expected at the recipient site in the future may help produce stands that are pre-adapted to future conditions (i.e. climate adjusted provenancing).
- Local seed could be used from areas that have regenerated under hot and dry conditions where natural selection for future conditions may already have occurred. For example, seed collected from stands that regenerated during a heatwave or that grow on hotter, drier north-facing slopes.

More research is required to understand the effectiveness of these management options. This requires investment now so that robust data will be available to help inform future decisions.

It is also important to start tackling important ethical issues, such as whether it is more important to keep the same species and communities even though they may be unhealthy, or if the ultimate goal should be to maintain healthy trees and forests. This question can apply to the understorey as well as the overstorey. Another important question is how we should respond to grossly affected landscapes, such as fire or disease-impacted landscapes that stop supporting forests. The implications of forest death for the Tasmanian permanent native forest estate and the role of the forestry regulator in this situation needs to be considered.

Recommendations

Research

- Talk to researchers to determine the components of the FPS that inhibit applied research and review relevant planning tools.
- Collaborate with UTAS and industry to conduct research trials.
    - Project 1: Vary the density of seed in plantings and monitor the resilience of the resulting stands.
    - Project 2: Do climate adjusted trials to explore which species and genetic provenances do better under climate change, and how tolerant they are of different climatic conditions.
    - Project 3: Use local seed from stands that have regenerated during warmer temperatures and monitor the resilience of the resulting stand.
    - Project 4: Do studies looking at fire frequency and understorey species composition and health and see how the different components of the forest contribute to forest resilience.
- Do long-term monitoring on the health of Tasmanian forests. This will require good data management systems and a clear measure of forest health. There are numerous remote sensing resources that could contribute to this (e.g. EnMAP, Hyperion, GEDI, UAV at the site level, LiDAR).

Policy and planning tools

- Develop a policy and associated planning tools outlining how to respond to failed forest regeneration. This policy should identify when intervention and an alternative approach is required (such as replanting). This policy should also provide clarity on how to respond to stands that have failed due to fire, weed invasion or disease. The process that should be followed (e.g. a forest practices plan or FPP?) needs to be clearly articulated.
- Review the Code recommendations on stocking rates required in regenerating coupes. There may be benefits in requiring more seed to be sown, in at least a part of the coupe, or having greater protection of seed trees. This action would need to be informed by research.
- Write a technical note that provides greater clarity on the intent of the Code provisions in respect to seed selection. This technical note should discuss the benefits of local and non-local seed and when use of non-local seed may be acceptable.
- FPA should take ownership of and update Technical Bulletin 1 ‘Eucalypt seed and sowing’, and climate change considerations should be incorporated into this document. Training on this technical bulletin and its content should be provided at the FPO Training Course and FPO refresher courses.

Communication / administration

- Liaise with the government and industry about increasing seed storage. This process could be partially publicly funded. The additional seed stored could be made available to increase the seed sown in coupes (thereby promoting greater natural selection and more resilient forests) or used after stand failure due to wildfire or disease (to be applied to all land tenures).

3.1.2. Improve seed storage source and quantity (A4, A8)

A number of potential adaptation options rely on having adequate and appropriate seed stock available. These include creating more resilient forests by using climatically adapted seed sources (either local or non-local), sowing seed at higher densities to create more opportunities for natural selection to filter the genetic diversity represented by the seedling generation, and regenerating areas of forest that have failed either due to natural factors (fire, disease, browsing or weed invasion) or failed regeneration attempts.

Recommendations

Research

- Greater research is required to understand the importance of seed source and sowing density on regeneration outcomes. Collaborate with UTAS researchers on the following projects (some are a repeat of projects outlined in 3.1.1).
    - Review past knowledge underpinning seed zoning such as heightened pest/pathogen sensitivity. Review previous and emerging information on the issues associated with moving non-local seed resources into new areas. Identify knowledge gaps to guide future research.
    - Conduct research testing the effectiveness of (a) increasing seed density, (b) using locally adapted seed and (c) using out-of-area provenances in terms of creating resilient forest stands.
    - Conduct a review to identify priority species for seed management (overstorey and understorey).
    - Review the learnings from past fire events and the impact on regeneration, particularly in rainforest.
    - Continue monitoring regeneration success so the industry can respond if/when standard regeneration methods start becoming less effective.

Policy and planning tools

- As per 3.1.1, review and update Technical Bulletin 1 ‘Eucalypt seed and sowing’.
- Develop a spatial tool that shows the location of critical seed sources. This will require collaboration with UTAS researchers to identify the location of future-climate adapted seed sources. FPA should work with industry to try and manage these critical seed sources to enable future management options.

- Guidelines should be developed to trial seed translocations for specific species. If successful, the guidelines could potentially be extrapolated to other species with similar life history traits and environmental gradients.
- The FPA and forest managers need to determine, probably with insight from research, what actions should be taken if there is insufficient seed available for an area needing re-sowing. That is, should a large area be sown with low seed density, or a smaller area at high density?

Communication / administration

- As per 3.1.1, FPA should consult with government, the Tasmanian Seed Conservation Centre and STT to ensure sufficient seed is stored for both production and conservation requirements. It should also be ensured that the type of seed being stored is the priority seed, in terms of genetic provenancing and forest type (e.g. greater focus on species that are obligate seeders in wet forest rather than species that regenerate from root stocks in dry forest).

3.1.3. Review silviculture prescriptions for native forest (A11)

Having clear and effective silvicultural prescriptions is important for conservation as well as production reasons because intervention may be required in the future to help maintain forest health and resilience in protected areas.

Recommendations

Research

- The FPA should maintain a role in coordinating and driving research for sustainable forest management. In the past, STT (or Forestry Tasmania) were the main agency conducting research on different silvicultural systems. STT no longer have the capacity to do this task. FPA should talk to STT and UTAS/NIFPI to determine the priority for further research in this space, or at least for continuing monitoring of historic research.
- Regeneration monitoring is important to ensure all areas are adequately regenerated. This is particularly important in areas that do not receive a regeneration burn as it will improve our understanding of the role burning has in achieving effective regeneration. Regeneration monitoring occurs as standard practice due to the requirements in the FPP, but consideration should be given to additional assessments to determine if regeneration levels are changing over time.

Policy and planning tools

- Technical Bulletins should be kept/hosted by FPA. Technical bulletin No. 5 ‘Silvicultural systems for native eucalypt forests’ provides an overview of the prescriptions for all the different silvicultural systems. This technical bulletin should be reviewed to ensure it is up-to-date with current research, and any adjustments needed in relation to climate change should be incorporated. Additional edits needed are outlined below. (Note: STT are commencing a review of the Technical Bulletins

that are relevant to their operations and at this stage wish to keep these documents under their responsibility).

- Remove overstorey removal in favour of advance growth retention.
- Emphasise the importance of maintaining mature trees and stands to increase the resilience of our forests. Review all silvicultural systems to consider how mature tree management could be better incorporated.
- Review the regeneration height used in high altitude areas to determine if a coupe is ready for further partial harvesting. (1.5 m stand height is too low on high altitude sites and 3.0 m has been typically employed as an alternative as it appears to anecdotally result in regeneration that has achieved apical dominance and means that removing shelterwood trees are not likely to level regeneration prone to frost damage).
- Develop prescriptions for post-natural disaster recovery (e.g. wildfire, windthrow, floods, pestilence), including infrastructure such as roads and bridges.
- Review fuel management and regeneration prescriptions in partially harvested forest.
- Review the basal area specifications for seed tree retention, as they could be too low to promote optimal regeneration if there are secondary disturbances such as wildfire. Consideration should also be given to retaining the seed trees (i.e. not undertaking seed tree removal silviculture) to create stands more likely to regenerate after wildfire.

Communication / administration

- FPA should revive the Tasmanian Forest Research Council to determine research priorities and have a strategic research plan for Tasmanian forests. Noting that national research priorities are provided by Australian Forest Products Australia (AFPA) and Forest and Wood Products Association (FWPA).

3.2. Silviculture (B)

3.2.1. Thinning (B1)

Ecological forest thinning has been proposed as an adaptation strategy as it increases the resources (water, nutrients, sunlight, space) available for each of the remaining trees. The resulting increase in vigour help trees be more resilient to fire and drought.

Thinning is occurring in Tasmanian forests, but mostly for commercial reasons (to increase the rate of tree growth allowing them to reach target size on shorter rotations). In native forest more thinning is occurring in both wet and dry forest than was done historically, although most commonly in dry forest and *E. delegatensis* forest. Under severe drought conditions current practice is to harvest the stand early rather than thin the stand. Hardwood and softwood plantations are regularly thinned for commercial outcomes.

Most of the tools to make informed decisions on some forms of thinning in native forests are already available (e.g. information on fire, drought, STT technical bulletins). The exception is thinning for the purpose of promoting refugia. However, the incentives and triggers for doing thinning in native forests outside for non-commercial outcomes is currently lacking.

In the future there may be instances where thinning in reserves is appropriate (e.g. thinning dense stands to alleviate drought conditions and promote mature tree forms). Under some conditions thinning reserves could help get forests closer to a pre-European condition that would be more easily managed by traditional indigenous practices. Thinning in reserves adjacent to urban areas and built assets has the additional benefit of improved fire safety.

One issue with thinning retained native forests is that it can be legally difficult to sell products from some areas (e.g. mine sites) due to the forest certification requirements of the customer. Thinning retained forest may also have implications for achieving the certification requirements to maintain and enhance retained native forest values. This could potentially be addressed by using natural capital accounting to show the benefits on water yield.

Recommendations

Policy and planning tools

- FPA should consider their role in promoting thinning of native forest to maintain forest health. If the FPA is determined to have a role, they should model/map priority areas where ecological thinning is appropriate (e.g. fire refugia) and develop a technical note to outline when it is promoted (potentially using STT's technical bulletin on thinning as a starting point).
- FPA should determine if mechanical fuel removal is covered by the FPS (to be an economically viable activity it needs to be covered by the FPS).

3.2.2. Reducing CBS silviculture (B2, B4)

A considerable amount of research was done in the past looking at the best way of achieving regeneration in Tasmanian wet native forests. Clearfall, burn and sow (CBS) was identified as the optimum method. However, there is a lot of public concern about this practice and the carbon emissions from the regeneration burn may cause the practice to come under further scrutiny going forward. An alternative to CBS is variable retention and aggregated retention, but these methods still rely on regeneration burns and it can be difficult to achieve good regeneration outcomes. Alternative options were discussed.

One strategy could be to reduce the fuel loads after harvest, which may reduce the intensity (and potentially emissions?) of the post-harvest burn. Residue extraction could be done by responsibly-managed salvage harvesting, or removing debris for bioenergy. Residue extraction could be particularly effective in plantations at reducing the need to burn.

Another option could be to do a 'land swap'. Areas currently in the production zone that require a burn to achieve regeneration could be swapped for an equivalent amount of product in an area of Future Potential Production Forest that could be regenerated without a high intensity burn. However, if this involves swapping wet forest for dry forest it is likely to

require a larger land area and dry forest is already under-represented in the reserve estate compared to wet forest.

Another option could be to change how the industry is set up and give STT more flexibility in how it sells product. This could be achieved by removing the legislated wood volume and auctioning coupes at the FPP stage. This would ensure that no timber is harvested until the operation is economically viable and the economic implications of different silvicultural options (e.g. CBS vs variable retention) would be reflected in the cost/profit of the operations. FPPs could be sold to the highest bidder and therefore could be bought for timber or conservation values.

Recommendations

Research

- FPA should collaborate with industry and UTAS to review silvicultural options for reducing CBS and regeneration burns. This may involve doing further research on regeneration outcomes following lower-intensity burns or no regeneration burns, regeneration after fire, and alternatives including responsible harvesting of residues.

Policy and planning tools

- Review current management of residue extraction and ensure the FPA facilitates this process appropriately.
- Review the maximum coupe size for a CBS coupe to help promote a more heterogeneous landscape.

3.2.3. Prepare salvage prescriptions (B7)

'Salvage harvest', otherwise known as 'post-disturbance harvest', is typically undertaken for financial gain from the disturbed area, or to aid regeneration. Different harvesting practices may be used depending on the ultimate objective of the post-disturbance harvest.

Areas that have been disturbed, e.g. by high intensity wildfire, can be more vulnerable to a secondary disturbance. For example, soils can become hydrophobic in a high intensity wildfire making them more vulnerable to erosion. Soil erosion is likely to be the issue of greatest concern after a natural disturbance in plantation areas, while there are likely to be varied concerns in native forest due to the array of values managed in these forests. Regardless, a modification of standard practices may be required.

Harvesting after wildfire can involve removing biomass that was alive and dead pre-wildfire. The quality of the product decays rapidly, so there is a narrow window of opportunity to salvage wood after wildfire. Guidelines that set industry expectations post wildfire and facilitate rapid decision making would help the industry respond rapidly to wildfire events.

Examples of potential modifications for post-disturbance harvesting include increasing the number of grips, use of forwarders or ecotracks/rubber tyres to minimise erosion, and restricting the use of skidders which can compact soils and increase erosion, noting that non-standard operations can be more complex and more expensive. The operations allowable may

also depend on the type of disturbance. For example, soils may be more susceptible to erosion after high intensity wildfire, but not after severe windthrow, so any modifications to standard practices should reflect the changes in risk that have occurred from the disturbance.

It is also important to consider the areas that could be available for post-disturbance harvest. It needs to be determined if it is better to concentrate the harvest in the burnt or the unburnt areas. From a biodiversity perspective it would be better to retain the unburnt or lightly burnt areas, but these may be more valuable from a commercial perspective. In many situations it may be better to wait and see how the native forest recovers before a decision on harvesting is made, even if it is ensuring the adjacent regrowth is viable before harvesting fire damaged forest.

Recommendations

Policy and planning tools

- Develop management recommendations for post-disturbance harvesting. The planning tool should differentiate between plantation and native forest, and also wildfire versus other types of disturbance. It should focus on retention of unburnt patches, or at least retaining live patches, and expanding streamside reserves. The tool should potentially outline the time frame after disturbance when the management recommendations apply before standard management resumes.
- When post-disturbance management recommendations are developed, FPA should work with industry to ensure that salvage timber is covered by certification bodies to ensure there will be a market for the product.
- In the event that a severe event has occurred such that there is no timber available to harvest, it needs to be determined what actions will be taken to regenerate these areas and who will be responsible.
- There are instances under the Forest Practices Regulations that exempt an activity from needing an FPP. In these instances, forest products can be cleared and/or harvested but not sold because most certification systems and customers require the presence of an FPP to validate the authorisation to receive the products. Advice received from the FPA is that if the activity fits the provision of an exemption under the regulations, then an FPP should not be generated even if a sale is possible. This can result in perverse outcomes where timber is cleared but not salvaged. Amendments need to be made that allow an FPP to be generated in these instances (or an FPA exempt certificate) so that the product can be sold, which will decrease the demand for product placed on other areas.

Research

- Facilitate research on the duration that soils remain hydrophobic. Is this different for different geology, dry/wet sclerophyll forest, age of forest etc?

3.3. Landscape management (C)

3.3.1. Plant more trees (C2)

Planting trees remains among the most effective and simple methods of drawing carbon out of the atmosphere and therefore trees are a key component of the global carbon capture strategy. Trees also offer multiple co-benefits such as soil and water conservation outcomes, shelter for livestock, habitat for wildlife, timber production and aesthetic benefits.

In Tasmania, the *2021 Update of Tasmania's Emissions Pathway Review – technical report* published by the Climate Change Office, identified tree plantations as one of its best fit emission reduction pathway opportunities for the state. This is based on a goal of increasing the plantation estate (primarily through farm forestry) by around 5% per year to realise additional plantings totalling 30,000 ha by 2050. The intention is that most of these new trees be integrated into the existing farming landscape without compromising agricultural production. If achieved, it would provide an emissions reduction benefit of approximately 300 kt CO_{2e}/year in 2050.

New plantings would comprise both softwood and hardwood plantations, established to primarily produce saw logs to maximise the carbon benefit but also pulp logs and wood fibre. This opportunity aligns with Australia's National Forest Industries Plan (2018), which calls for a substantial increase in new plantation development across Australia (an additional 400,000+ ha by 2030) with an increased focus on farm forestry.

Some farmers will choose permanent environmental plantings over plantings intended for wood production. Environmental plantings increase the variety of species that can be planted but also provide positive carbon outcomes, albeit with a different long term carbon profile.

To achieve these goals will require education, incentives, and the removal of any regulatory barriers. Education can be focussed on the multiple benefits of trees on farms and incentives will include state-based grant schemes that look to cover the initial plantation establishment costs. Continual improvement in the Emission Reduction Fund methodologies will also be required to make it easier and more attractive for small tree lot owners to participate in the scheme.

Regulatory barriers within the forest practices system could also be streamlined so the regulatory requirements are made proportional to environmental risk.

Recommendations

<u>Policy and planning tools</u>

- FPA reviews their requirements for FPPs particularly for small, planted woodlots so they are more aligned to risk.

<u>Communication</u>

FPA could help communicate the following messages.

- The Tasmanian Government, through the Climate Change Office, formally adopts the expansion of the plantation estate as a goal within its Climate Change Action Plan and sector-based Emission Reduction and Resilience Plans.
- Private Forests Tasmania continues to build its Tree Alliance campaign to raise awareness of farm forestry and the benefits of trees on farms, and to encourage and facilitate farmers to plant commercially viable trees in the agricultural landscape.
- The Clean Energy Regulator continues to improve the Emission Reduction Fund methodologies to make it easier and more attractive for small tree lot owners to participate in the scheme.

3.3.2. Increased coupe dispersal (C4, C5)

Heterogeneous landscapes, particularly those that contain old trees and stands, are more resilient (e.g. to fire and drought) than homogenous landscapes. The current coupe dispersal guidelines are limited in how well they will achieve heterogeneous landscapes and some catchments have had concentrated harvesting over relatively short periods.

Coupe dispersal guidelines also have implications for water yield, particularly in plantation landscapes. The current Code provisions for water management are more targeted at water quality and riparian management than water yield, with the exception of the 5% town water catchment threshold (Code D2.2). Any impact on water yield will most likely increase with the proportion of the catchment that is being impacted, so water yield is more likely to be impacted in smaller catchments.

Remote sensing technology offers efficient methods for assessing heterogeneity within catchments and could be used to identify priority catchments that need greater management of stand age distribution. It may even be possible to prescribe the ideal age class distribution of native forest ages within a catchment.

Recommendations

<u>Research</u>

- Initiate further research on the relationship between forest management, landscape heterogeneity and water yield. This research could inform the development of planning tools to help maintain landscape heterogeneity.
- Assess the stand age class distribution of Tasmanian catchments to determine if the reduction in rotation age that has occurred over the last decade or two is having an impact on landscape heterogeneity and potentially water yield. This assessment could potentially be done using PI data or data from three year plans, FPPs and coupe localities. Identify priority catchments that need greater heterogeneity and communicate results to forest managers.
- Facilitate research on the relationship between landscape heterogeneity and biodiversity.

- FPA should liaise with forest managers to obtain more data spatially (e.g. three year plans, coupe boundaries etc). This would help consolidate relevant data that could be used to develop planning tools.

Policy and planning tools

- Review the coupe dispersal guidelines to facilitate greater coupe dispersal. This may involve developing a planning tool or adjust wording in the Code to improve management of landscape heterogeneity. This management should set minimum standards for forest age class distribution, or a rate of change rule similar to the 5% town water catchment provision.

3.3.3. Coordinating catchment management (C9)

The objectives of catchment management are varied and may include the following: (a) limit soil erosion, (b) maintain water quality and yield, (c) provide habitat for biodiversity, (d) provide habitat connectivity and (e) help minimise fire risk.

In Victoria, Catchment Management Authorities specify rules on the amount of disturbance allowed for specific catchments. In Tasmania, the main catchment management currently administered via the forest practices system is the 5% annual limit applied to clearfelling in town water catchments. However, some companies (e.g. Timberlands) have their own catchment management plans. A broader catchment management approach, which limits the amount of harvesting in a catchment or promotes a greater mosaic of stand ages, could help ensure good outcomes are achieved. It may be that at least 30% of a catchment needs to be affected before water supply is impacted, which is more likely to occur in smaller catchments.

There are some complexities in terms of managing catchments. There are numerous 'private intakes' that are not easily accounted for. There are different types of catchments (e.g. CFEV and drinking water catchments) and they might be managed differently. Planting trees is promoted as a strategy for combating climate change, but young trees can use a lot of water and different tree species use water at different rates so the catchment level outcomes of large-scale plantings need to be considered.

Recommendations

Policy and planning tools

- Request the forest management companies supply coupe boundary data rather than point data for the three year plans.
- Review the coupe dispersal provisions for plantations and incorporate in the Code.
- Develop a system to identify catchments most at risk of low water flow under climate change. These priority catchments could be the focus of targeted management. This tool could potentially use the three year plan data from different companies.
- Develop a planning tool that limits harvesting within catchments, over a specified time frame. This could use the FPP database to monitor the submission of FPPs within particular catchments.

3.3.4. Additional protection measures for rare and high value species and habitats, and increase habitat connectivity (C11, D2)

To be effective, management of rare and important values should apply across tenures and apply to all land managers. For example, Tasmania's rivers and streams provide multiple services, such as habitat, connectivity, and a different microclimate, and they extend through multiple landowners and tenures. Expanding the protection of riparian areas is likely to provide multiple benefits and ecological services and it will be most effective if this occurs in all areas regardless of land tenure.

To increase and extend the protection measures for Tasmania's forest values will require changes in policy and agendas across all levels of management and governance, and may require incentives for private landowners to participate. These types of changes will need community engagement, which will then lead to a change in government. Changing community perceptions is typically difficult, but the importance of climate change and the role that forestry can play in this space is an important message to convey. One potential approach is to build a business case demonstrating the benefits of protecting biodiversity, and then running awareness training. Whatever the approach taken, it needs to be adequately funded over the long term to ensure there is follow up to facilitate adaptive management over time.

Recommendations

<u>Policy and planning tools</u>

- Develop a planning tool to facilitate landscape management and connectivity, which takes into consideration climate change projections and issues.

<u>Communication</u>

- FPA should recommend to the government that a policy change is required that allows management to apply across land tenures.
- FPA should communicate to government the role of forestry in tackling climate change, promote the use of carbon credits and natural accounting to help protect special values.

3.3.5. Climate-smart forestry (C12, H1)

Climate-smart forestry refers to a set of practices and strategies that aim to mitigate the impacts of climate change and adapt to its effects in forest management. The approach recognizes that forests play a critical role in the carbon cycle, with trees acting as carbon sinks, absorbing carbon dioxide from the atmosphere and storing it in the biomass and soils.

Climate-smart forestry involves practices such as sustainable forest management, reforestation, and afforestation, which can increase the amount of carbon stored in forests. It also involves reducing emissions from deforestation and forest degradation, which can release carbon into the atmosphere.

In addition to addressing climate change, climate-smart forestry seeks to promote forest resilience, support biodiversity, and provide social and economic benefits to local

communities. This can include sustainable timber harvesting, agroforestry, and the development of forest-based enterprises.

Overall, climate-smart forestry is an integrated approach to forest management that seeks to balance environmental, social, and economic objectives in the face of a changing climate.

Forestry done in Tasmania could be more 'climate-smart' by:

- increasing the use of reduced impact logging for climate (RIL-C) techniques
- reducing fossil fuels used during operations and in the supply chain, including doing more on-island processing
- increasing investment in plantation expansion and native forest restoration, forest health monitoring and management
- using a higher proportion of harvested wood for long-term solid wood products
- using harvest residues for bioenergy
- moving more plantation forests toward longer rotations
- increasing farm forestry
- better utilising planned burns to manage fuel loads and reduce wildfire risk
- communicating the carbon impact of silvicultural regimes.

There are aspects of climate-smart forestry that create additional costs to landowners, with the benefits not yet being realised. There is also a lack of tools and data to plan and manage some values relevant to climate change. Investment in these tools, and promotion of climate-smart forestry could help improve this.

In order to fully realise the potential of climate-smart forestry, greater public understanding is needed on the important role that forests and forestry can play in climate change mitigation via (1) carbon sequestration, (2) carbon storage in both forests and forest products, and (3) using forest residues as replacement for fossil fuels. The language currently used around forestry is largely in relation to the commercial benefit, but the conversation could be shifted to cover the net benefit of the activity including environmental and carbon benefits. The Tasmanian government needs to provide greater clarity on the state's carbon management goals and the role of forests in achieving these goals. This could be delivered in the form of a carbon policy for the state and could be used to determine how our forests should be managed, and to communicate how and why forests are managed as they are. This is being achieved to some extent by the Tasmanian Government's revised draft *Climate Change Act* and Climate Action Plan and the associated Sector based Emissions Reduction and Resilience Plans (under development).

Recommendations

Policy and planning tools

- Support the development of a carbon account model explicitly for Tasmania and turn the result into a planning tool that determines a carbon star rating for individual FPPs. This would potentially impact the market for wood product and thereby provide companies with an incentive to reduce carbon emissions.
- Implement dot points listed above.
- Amend *Forest Practices Code* to include a section on 'carbon' under the Natural & Cultural Values conservation chapter.

Communication

- Promote climate-smart forestry: encourage research in this area and hold a workshop for politicians to promote greater understanding of the benefits and requirements to do this well.

3.4. Protect important values (D)

3.4.1. Maintain important areas, including refugia, seed sources (A3, D1, D6)

Tasmania's forests provide and host many important values, and some values will be more important or at great risk under a changing climate. A tenure-blind spatial layer or tool is needed that outlines the important values that should be considered when managing our forests. This tool should synthesise information from a range of sources including genetic studies of landscape patterns and climate models, and should include values like glacial refugia, future climate refugia, tall trees and where they may grow in the future, critical seed sources etc. It may also be valuable to do an assessment of the robustness of the current reserve system.

In terms of identifying critical seed sources, a rule set is needed to specify how seed should be collected from different stand types and trees. The amount of seed needed and the number of locations it should be collected from should be considered in relation to the proportion of the state in which the species or community are found. 'Leading edge' populations currently exposed to the limit of the climatic envelope a species can tolerate can be particularly important sources of seed, because genotypes in these areas may be better adapted to future climate conditions. Seed sources on public land will be especially important to manage appropriately because important localities on private land may be difficult to access.

Recommendations

Policy and planning tools

- Develop a spatial layer that is accessible across departments that identifies forest values that are important to manage under a changing climate, including critical seed sources.

3.4.2. Improve protection of damp/cool refugia and riparian zones – widen riparian buffers (D4, D7)

Riparian areas are extremely important to manage because they provide valuable and unique habitat, are often the only refuge from fire, maintain the abiotic and biotic conditions, help minimise sediment input in streams and provide a conduit for uphill migration of species affected by climate change. The buffering role of streams may be increasingly important under a changing climate because fire can make soils hydrophobic and more prone to erosion, and the incidence of fire and higher intensity rainfall is expected to increase moving forward. Heavier rain events may require wider riparian buffers to minimise sediment input into streams.

One way to improve protection of riparian areas is to widen streamside reserves. Wider reserves will help maintain more older trees and stands in the landscape, which will improve the resilience of Tasmania's forests. Wider streamside reserves will also help connect different reserved areas and retain a broader range of forest types (i.e. some non-riparian forest is likely to be captured in wider streamside reserves) which is important because not all species are found in the wetter riparian zone. Wider reserves may also be more effective buffers for minimising sediment input in streams. The need for wider reserves may be context dependent, with some geomorphologies or forest types warranting more protection than others. Standard application of wider reserves can remove the need for consultation with FPA on many threatened aquatic species and make the preparation of some FPPs simpler and quicker.

In some instances wider streamside reserves can be easily implemented. For example, if class 4 streams are close together it is not practical or economic to harvest close to the stream. But in many situations achieving wider streamside reserves is likely to be problematic due to the financial impact on timber production companies. This is particularly the case in plantations where widening streamside reserves could only be achieved between rotations. Financial incentives may be needed, such as credits for biodiversity or carbon management. Other creative solutions should also be explored, such as getting local communities involved with rehabilitation efforts (as demonstrated by Timberlands).

Recommendations

<u>Research</u>

- Review the function that streamside reserves serve in our forests and the impact that widening streamside reserves would have on multiple values, including a socio-economic review.

<u>Policy and planning tools</u>

- Review the width of the streamside reserve provisions.

3.4.3. Review adequacy of current measures for minimising sediment movement (D8)

Climate models suggest that in the future eastern Tasmania will have more intense rainfall on the coast, but not necessarily more rainfall overall, while western Tasmania will become

drier. The more intense rainfall expected in eastern Tasmania will increase the erosion risk in these areas. One area particularly at risk is the hilly and steep land in the north-east where gully erosion in the upper catchments is likely.

There are many components of the Code that relate to minimising sediment movement. These were established under historic rainfall patterns and so their effectiveness for more intense rainfall is uncertain.

One major erosion issue for the forest practices system is roads and tracks, which are known to be a potential risk for sediment movement. Road and track establishment is covered by the Code, but roads and tracks can erode outside the life of the FPP under which they were constructed. Some companies (e.g. Reliance FF) do checks after harvest and heavy rain to assess the condition and erosion potential of roads, tracks, drains and culverts. Broad adoption of this practice is recommended to identify areas of risk and management where required.

One of the key Code provisions for minimising sediment input in streams is the application of streamside reserves. However, narrow streamside reserves (e.g. class 4 streams) can be affected by windthrow. Even small windthrown trees can expose soil in the root ball and destabilise the ground from which they were thrown, thus creating a source of sediment which can enter the stream. The prevalence of this issue either across the state or by stream class is uncertain.

Some companies are experimenting with new practices that are expected to help reduce erosion. For example, Reliance FF is experimenting with a dozer-mounted slash cutter which cuts a line through slash (and soil) and separates the cut debris so that planters of the next rotation have a rough path to follow. This new approach is expected to provide greater soil protection and increase moisture retention, and require less fertiliser and weed control than traditional methods of either burning slash or using an excavator to clear and create windrows. However, while retaining slash i.e. (logging residue) on site helps protect soils, care must be taken to keep it out of streams and riparian areas because if carried downstream the logging residue can form large debris dams which cause considerable erosion issues.

Any new measure to try and mitigate sediment movement should be closely monitored and reported on. Without monitoring it is not possible to determine how effective a strategy is. For example, catchment management plans provide a guide for forest managers but there is no monitoring and reporting so there is no capacity to determine the degree to which they are implemented or how effective they are in limiting erosion.

Recommendations

Research

- Do more monitoring to assess the effectiveness of erosion control measures. Some monitoring is done by FPA Earth Sciences, but this is limited in scope and extent. Photo-monitoring was put up as a potential monitoring technique that could be easily used.

Policy and planning tools

- Review the erosion-risk management in the Code and ensure it covers the forestry estate in general, not just how erosion can be managed within coupes during the life of the FPP. This consideration should also be given to other values, such as ensuring stands remain stocked (i.e. who is responsible for regenerating a stand if it fails due to insect attack after the stocking requirements under the FPP are met?)
- The Code needs more emphasis on how roads and tracks can be decommissioned, e.g. culverts at risk of blocking can be replaced by spoon drains, carefully constructed with rocky base so they don't erode.

3.4.4. Managing forest values across borders (D12)

Production forests have numerous important values, including water, carbon and other environmental services. Adequately managing these values often requires a landscape approach that applies across tenures (e.g. catchments). Cross-tenure land management would mean providing neighbours with access to planning information such as GIS data, and potentially collaborating on a management approach for shared resources. It may also mean that some values are allocated to collective or state management rather than individual land managers (e.g. larger water courses).

However, solutions to cross-tenure management issues need to be carefully considered as there can be some challenges with state management that would also need to be addressed. For example, any operation that involves harvesting in a crown land road reserve currently requires crown land services be a signatory to the FPP, and any timber within the reserve is technically owned and should be made available to the crown. Resolving these issues can be so complex that alternative options are taken that may have poorer environmental outcomes (e.g. creating a longer road just to avoid the crown land road reserve).

There are considerable barriers to achieving cross-tenure land management. The willingness of private landowners to share responsibility for values on their land is one obvious consideration. But some barriers are more subtle. For example, forest certification can be a disincentive for forest managers to collaborate with uncertified neighbours, due to concerns over the impact on their certification status.

Cross-tenure landscape management would be assisted by a simplification of terms; public land has too many labels which can be confusing to members of the public. It may be better to refer to all public land as 'crown land' but with zoning for particular land uses. Changing the language used around land tenure could facilitate a review of current land allocation using a climate change lens. Public land could be re-allocated using contemporary information on values that need management/protection under climate change and areas that will be good for growing timber in the future. This may mean that some areas currently allocated for production may be allocated as reserves and vice versa. It may also mean that forests are managed for different priorities (e.g. carbon credits instead of timber), but for this to occur requires customers and investment in infrastructure. It also requires the forest industry to

improve how they engage with other stakeholders that need or value the ecosystem values that they manage.

Despite the challenges, taking the progressive approach of tenure-blind landscape management is an opportunity for Tasmania to demonstrate its 'green' credentials and promote the environmental services we are offering the world.

Recommendations

Research

- Champion a statewide mapping exercise of areas suitable for forestry in the future.

Policy and planning tools

- The three year planning process should be reviewed to incorporate greater input from the regulator, to explore the management potential it offers and to add climate change considerations. The three year time frame should also be assessed to determine if longer planning periods would be more beneficial.
- Review how forest practices planning could be streamlined when non-production public land tenures are involved.

Communication

- Encourage collaboration and information sharing so that neighbouring land managers can work together for better outcomes.
- Create opportunities to make the industry aware of new models or information that could facilitate cross tenure land management.

3.4.5. Triage species management (D13)

In conservation, triage means focusing resources on values or species with a high chance of survival and removing or reducing resources from values or species not expected to survive. Triaging may also occur on a genetic level, where particular provenances or genotypes are prioritised for management as they are expected to be more resilient to future conditions. However, it has been proposed that the priority of conservation efforts should focus on ecosystems and habitats first, then species and then genes.

Triaging species management is a difficult concept for many in the industry and the public because it means accepting that some threatened species will probably go extinct, noting that not investing in species conservation is different to actively destroying individuals. It can also be extremely difficult to identify appropriate thresholds when conservation efforts are abandoned. However, there are widely accepted, evidence-based ways of going about triaging species management, such as the work done by Professor Hugh Possingham and the Australian Research Council Centre of Excellence for Environmental Decisions. Collaborating with these researchers may help identify an appropriate decision-making framework that would make the process more palatable to government and the public. Any process adopted should check whether current knowledge and management actions are adequate before resources are allocated to a particular species. Collaborating with researchers

such as Professor Possingham would require funding, which could be provided by the government, forest industry and environmental organisations.

Recommendations

Research

- Identify gaps in conservation efforts for species, ecosystem and habitats with consideration given to potential impacts from climate change.

Policy and planning tools

- FPA should play its role in triaging within the FPS and be a key stakeholder in triaging species across the broader Tasmanian landscape.
- A rules-based listing process for vegetation communities in Tasmania needs to be developed.
- Review FPA planning tools to determine if any need modification to account for climate change. For example, threatened species range boundaries could potentially be modified to include expected future distributions. Management options for species likely to be vulnerable under climate change could be developed.

3.5. Roads (E)

3.5.1. Improve roading in catchments at risk of floods (E2)

Climate change is expected to create less frequent but more intense rainfall in Tasmania. As a result, some roads may be at risk of flooding in the future, which could lead to damaged infrastructure as well as erosion issues. Greater information on the areas at risk of flooding, such as a flood risk map, may help the industry determine the investment they will allocate the development and protection of roads in different areas. For example, companies may use temporary bridges or crossings to reduce reliance on permanent structures in areas at risk of flooding, or may need to upgrade existing structures to withstand high flood frequencies.

Another concern with roads under a changing climate is that roads can open areas of forest to the public and thus create as a conduit for weeds, disease, fire etc. Mechanisms that encourage decommissioning roads could improve the risk of these events, but the ability of the FPA to regulate the decommissioning of roads is limited.

Roads can also play a positive role by allowing access for firefighting. However, road maintenance is expensive, so the industry often prioritises road maintenance programs seeking to maintain roads which they are actively using. Alternative funding may be required to maintain roads specifically for firefighting.

Recommendations

Policy and planning tools

- Assess whether there is an opportunity to consider road maintenance and decommissioning of roads outside of FPPs.

- Develop/make available a spatial layer to help practitioners understand areas at increased risk to flooding. This would allow adaptation of current roading standards to deal with higher risk of flooding in the future.

3.6. Fire (F)

3.6.1. Landscape management of fuels and residues (F1, F4, F10)

Residues left over from a harvest operation can provide important biodiversity values, but also contribute to fuel loads in production landscapes. Removal of these residues, or at least a proportion of these residues, will help reduce landscape levels of fuel available to burn in wildfires and potentially carbon emissions from fuel reduction or regeneration burns. In plantations, removal of residues may negate the need for regeneration burns altogether.

Residues removed after harvest operations can be used for other markets such as firewood or biofuel. However, there is a cost associated with residue removal, which will depend on the efficiency of the process used. Ideally a market would be developed that pays for the use of the residues to make the process economically sustainable. A government subsidy may also be justified due to the public benefits of residue removal (i.e. reduced fire risk, reduced carbon emissions, alternative energy source, employment, waste management).

There is likely to be some public resistance to the idea of residue removal, although this will probably be less in plantation areas than native forest. An organisation would need to be made responsible for public education on the concept of residue removal, and for developing a market to use the product. Certification could also be a platform for helping demonstrate the sustainability of residue retrieval in a well managed forest, although the potential for achieving this is uncertain.

Recommendations

Policy and planning tools

- Develop environmental laws or policy to prevent negative impacts from residue removal.
- Develop management recommendations for the harvest of residue (e.g. leave foliage and bark onsite). These could potentially be incorporated with the post-disturbance guidelines.

Communication

- Prompt government to hold appropriate information to support the mechanical removal and use of more residues.

3.6.2. Increase firefighting capability (F7)

There are several key components to effective fire management: prevention measures, detection systems and firefighting response.

Fire prevention measures adopted outside the fire season include how prepared the community are for fire, the maintenance of fire breaks and the occurrence of fuel reduction

burns. There can be social barriers to applying these measures. Additional prevention measures relevant to the forest practices system should also be considered. For example, it may be appropriate to change silviculture methods or landscape management practices in landscapes that are highly prone to fire. More guidance would be helpful on how to manage fuels in areas managed under the forest practices system.

Fire prevention measures adopted during the fire season include crew requirement for fire suppression equipment to be on site as specified in the 'FIFMC Preparedness Audit' and the implementation of the 'Fire prevention at Forest Operations procedure'.

In terms of fire detection, there are remote sensing techniques available to help detect fires in a timely manner, including camera and satellite detection methods. FPA does not have a role in fire detection.

With regards to successful firefighting, there are two key elements: the speed and size of the response. Some efficiencies could be made in this space, such as greater collaboration between agencies on planned burns or in firefighting response (e.g. involve Parks and Wildlife Service and STT in burns instead of single agency).

Careful consideration should be given to when a response is required and the scale of the response. The community will have an expectation about the firefighting response required, but the implications of a fire for forest values, forest resilience and community values need to be carefully considered when identifying an appropriate response. The rationale for the response taken then needs to be communicated to the public. Funds to support the firefighting response also need to be available and a different funding model should be considered. For example, the state government could fund a private tanker fleet that can be used by any land manager as required. FPA does not have a role in determining a firefighting response.

Recommendations

Policy and planning tools

- Develop a technical note on managing fuels in the landscape. This technical note should outline a framework for assessing the fire risk in different landscapes and identify a management approach that applies across tenure.
- FPA should take responsibility for maintaining technical bulletins.

3.7. Weeds, pests and disease (G)

3.8. Carbon (H)

3.8.1. Monitoring, managing and maintaining carbon (H2, H3, H4)

It is now recognised that carbon dioxide in the atmosphere is driving the changing climate seen around the world. Therefore, the management of carbon is integral to any discussion about climate change adaptation. Forests and forestry can play an important role in carbon

storage and mitigation, but forestry activities can also emit carbon via planned burns and use of machinery.

The discussion in the workshop generally centred around carbon models, and how the Code could be revised to place more importance on maintaining carbon in the forest landscape and monitoring carbon in products and soil. The carbon models mostly used in Australia are FullCAM and FLINTpro. Neither model specifically caters for climate change scenarios, although both take into account temperature and rainfall.

FullCAM is chiefly used for national carbon inventory, it is not a process model. The assumptions behind FullCAM need to be consistent across Australia so it is essentially a 'top-down' model that it is difficult to apply at a state level (where different assumptions may be more appropriate). However, FullCAM needs to be developed to allow for and accommodate different carbon models in different landscapes, and to incorporate results variously derived by different forest companies or state agencies.

FLINTpro is a commercial product produced by the Mullion Group. It is more easily adapted for state use and at the landscape scale (it has been used to produce carbon maps of NSW) and could potentially be used at the property level. Although it is expensive ($50,000) for individual landowners to purchase, this cost could be shared if landowners formed a collective.

Neither model is strong on soil carbon which can form approximately half of total ecosystem carbon. Restoration of soil carbon in degraded soils can take hundreds, if not thousands of years.

Recommendations

Research

- Collaborate with CSIRO so that FullCAM can be modified to allow incorporation of carbon modelling in various landscapes by different companies.
- Investigate how natural processes (e.g. wildfires) and forest practices (e.g. clearfell burn and sow, burning windrows, cultivation) affect soil and biomass carbon levels.

Policy and planning tools

- The Code needs a separate section on practices that will maintain or increase soil and biomass carbon in the landscape while maximising carbon in long-life products (e.g. structural timber). Example of considerations that could be made by the industry include adjusting rotation lengths, forest types, silvicultural practices such as thinning native forest and burning practices.

Communication

- Advocate for carbon models to be optimised for assessing carbon stocks (losses and gains in biomass and soils) at the landscape level, and for these results to be integrated with forest managers' harvest scheduling tools that have been optimised to maximise carbon sequestration, so as to gain ERF (Emissions Reduction Fund) credits.

- PFT is the appropriate body to encourage small landowners to form collectives to monitor carbon accumulation/loss. FPA could work with PFT to achieve this objective.

3.9. Adaptive management (I)

3.9.1. Improve forest monitoring (I3, G2)

Forest monitoring data are useful for informing many aspects of current and future forest management, for demonstrating sustainable stewardship and helping communicate the role forestry plays in Tasmanian forests. Some data already collected (e.g. STT's forest inventory plots) have proven extremely valuable, but more is needed. The type of attributes that require monitoring to understand the condition of our forests both now and in the future include (but are not limited to):

- commercial values
- structures preserved
- ecosystem services
- forest condition for determining when salvage operations may be required.

Monitoring needs to occur over the long term, which requires sustained investment of research sites, data collection and data storage. This type of activity may require commonwealth investment. However, there are relatively cheap ways of doing this, such as getting citizen scientists involved in monitoring invasive species. There are also new technologies that make monitoring some attributes easier and more cost effective. There are also incentives to promote strong industry engagement, such as certification benefits.

One of the main motivations for doing monitoring, is to facilitate adaptive management. For example, long-term monitoring of forest values means there are baseline data to look at the impact of catastrophic events as they occur, which will help identify appropriate response actions. In order for this to happen effectively, a flexible and adaptive management system needs to be in place. It also means that the objective of the monitoring needs to be clear, the standards of monitoring required need to be clearly communicated, and thresholds at which action will be taken are identified.

One key issue with implementing more monitoring is allocating a responsible agency that will have the funds and capacity to implement an appropriate program over the long term. There are also some technological limitations that may inhibit monitoring, but these are improving all the time, so opportunities exist now that were not possible several years ago.

Recommendations

<u>Research</u>

- Promote more monitoring of forest health and values. The monitoring programs needs to be well designed to address clear questions. The data need to be adequately

managed to ensure it is maintained for the long term and ideally be provided to the commonwealth or other data repositories (e.g. TERN).

Policy and planning tools

- Promote adaptive management, ensuring issues are addressed over time using evidence-based decision making, and that records are maintained of management changes and the rationale behind any changes.

3.9.2. General public acceptance of adaptive management (I5?)

Adaptive management is a term widely used but generally poorly applied. It involves applying different management actions, monitoring their impact, and adjusting management over time. Monitoring is essential to understand the impact of management actions, and FPA are now reporting on adaptive management in their annual report.

Efforts need to be made to improve the credibility of the industry so that governments understand the value of the industry and trusts the people involved to be informed and make good management decisions. This is particularly the case in relation to climate change, where forest management has an important role. Increased trust will help the government turn to the industry for advice, when appropriate. But to develop greater trust requires that good people are employed in the industry, which requires money.

Given the frequently poor image held by many in the public regarding the industry, it can be advantageous to make ideas for change 'someone else's idea'. For example, collaborating with respected scientists can lend credibility to changes being undertaken by the industry.

Natural capital accounting can also be a tool to help communicate good stewardship demonstrated by the industry.

Recommendations

Policy and planning tools

- Regulatory tools need to be developed that promote alternatives to current practice, or active promote best practice for managing carbon, biodiversity etc under a changing climate.

Communication

- Collaborate with external bodies/ community/indigenous owners to develop a framework for adaptive management.
- Promote collaboration between indigenous owners, the community and the industry in managing some areas of the forest estate.

3.9.3. Increased focus on finding solutions (I7)

Complex problems require broad support and engagement by high-level decision makers. Therefore, to adequately address climate change requires both the problem and the solutions to be fully and widely recognised. Forest management and forestry have the potential to be

one component of the solution to climate change, but this is poorly understood by the public and greater communication is required.

Effective communication must consider the target audience and the message that is most relevant to that audience. One way of achieving this is to identify key contacts within each target audience to help the industry understand the topics of interest and inhibitors to understanding. If FPA can identify what is needed to effect change in community understanding then funding resources could be sought to implement a communication program. However, this is a difficult task as the message is complex, there are multiple audiences and many of them have strong pre-established beliefs.

It would be helpful to have an organisation responsible for coordinating the process of finding solutions to complex problems. These problems are likely to affect full supply chains, and all affected will need to work on the solution.

Recommendations

Policy and planning tools

- FPA need to ensure that what they are regulating is consistent with all government policy.
- The importance of climate change and the need for the industry to address it should be embedded in the *Forest Practices Code*.

Communication

- FPA need to integrate climate change into their strategic plan and promote climate change to government and decision makers, including the risks and management options. This will help promote broader understanding of the role forestry can play to mitigate climate change.

4. Results: Prioritisation of adaptation options by attendees

Survey respondents were sent the list of potential adaptation options identified in the background report and asked to rate each option as having a high, medium or low subjective rating for (a) the importance of implementing that strategy and (b) how achievable it is to implement that strategy.

A metric was developed for both the importance and achievability ratings by multiplying each 'high' response by three, each 'medium' response by two and each 'low' response by one, and summing the total. The metrics for the importance and achievability were then multiplied together to give a final priority metric for each adaptation strategy.

Only seven workshop attendants responded, and not all respondents provided a response to each adaptation option, so the following should be taken as indicative only of the priority actions as seen by the industry. The adaptation options discussed in the workshop are highlighted in green.

Table 1. The potential adaptation strategies priorities by importance and achievability by seven workshop attendees. Metric 1 is the importance metric and metric 2 is the achievability metric. The colouring of the metric value cells gets redder the higher the value, and adaptation option numbers highlighted in green indicate the adaptation option was discussed in the workshop. FPA? indicates whether the adaptation option is relevant for the FPA (Y), is not relevant to the FPA (N) or if there is a potential minor role the FPA could play (?).

Metric	No.	Adaptation option	Metric 1	Metric 2	FPA?
357	F6	Improve detection of bushfires	21	17	N
342	D1	Identify and map at-risk or important values	19	18	Y
	H3	Improve carbon accounting	19	18	?
340	C12	Do climate-smart forestry	20	17	Y
323	A3	Vary the genetic stock of the seed sown	19	17	Y
320	C1	Minimise deforestation	20	16	Y
304	B4	Apply alternative silviculture in wet forest that maintains multi-age forest at the stand scale (e.g., variable retention)	19	16	Y
294	B6	Active plantation management: fertilise, weed suppression	14	21	N
	F7	Improve firefighting capacity	21	14	N
285	C4	Maintain older trees and forest patches	19	15	Y
	E1	Maintain roads for improved access for firefighting	15	19	?
266	C2	Plant more trees	19	14	?
	D8	Review adequacy of current measures for minimising sediment movement	14	19	Y
256	D4	Increased reservation/retention of at-risk values (e.g. climate refugia)	16	16	Y
255	B1	Forest thinning	17	15	Y
252	C3	Minimise habitat loss	18	14	Y

Metric	No.	Adaptation option	Metric 1	Metric 2	FPA?
	F2	Increase fuel reduction and/or ecological burns	18	14	N
247	H1	Reduce use of fossil fuels	19	13	?
240	D2	Additional protection measures for rare or high value species and habitats.	16	15	Y
238	B7	Prepare post-fire (salvage) harvesting risk assessment protocols and prescriptions	17	14	Y
	F1	Manage landscape availability of fuel	17	14	Y
225	G3	Develop and apply an industry standard best practice guide for hygiene management	15	15	Y
224	H6	Adopt a price for carbon	16	14	N
	I2	Transparently include bushfire-related loss in timber modelling	16	14	N
221	F10	Use more forest residue	17	13	?
	H2	Improve carbon monitoring	17	13	?
210	A11	Review silvicultural practices for native forest	14	15	Y
	D7	Widen riparian buffers	14	15	Y
	G1	Development and adoption of a weed/feral pest and disease risk assessment and management approach	15	14	Y
208	D5	Improve protection of damp/cool refugia and riparian zones	16	13	Y
	H4	Develop forest management policies and practices to better manage carbon	16	13	Y
204	C11	Increase habitat connectivity	17	12	Y
198	A8	Increase in stored seed	18	11	?
	A9	Regenerate areas that have suffered dieback and cleared areas that are unused (particularly riparian zones).	18	11	Y
196	C7	Increase harvest rotation intervals	14	14	Y
	D6	Maintain refugia and areas available to source seed	14	14	Y
195	C5	Increased coupe dispersal	15	13	Y
	G2	Implement pest surveillance measures and adopt new technologies	15	13	N
192	H5	Produce carbon friendly products	16	12	N
187	D13	Triage species management	17	11	?
182	D3	Reserve areas of old forest and climate vulnerable forest communities	13	14	Y
	F4	Mechanical removal of fuels	14	13	?
180	A5	Plant more climate suitable species	15	12	?
	C9	Coordinate catchment management	15	12	Y
176	I7	Increased focus on finding solutions	16	11	Y

Metric	No.	Adaptation option	Metric 1	Metric 2	FPA?
169	A12	Adjust reforestation regimes to ensure regeneration	13	13	Y
	D9	Improved protection of features retained from harvest	13	13	Y
	G4	Prepare response to outbreak	13	13	Y
168	C8	Limit the amount of forestry occurring in a landscape	14	12	Y
	C10	Greater protection to high-risk catchments	14	12	Y
	F3	Adjust timing and scale of planned burns	14	12	?
	I4	Plan forestry at multiple spatial and temporal scales	14	12	Y
165	B5	Smaller coupes	11	15	Y
	I5	Apply an adaptive and collaborative management approach	15	11	Y
160	I3	Improve forest monitoring	16	10	Y
	I6	Have a flexible, and responsive management system	16	10	Y
154	A4	Collect seed from optimum seed provenances	14	11	?
150	D12	Increase broader efforts to reduce threats to biodiversity	15	10	?
144	F9	Do nothing	8	18	N
140	C6	Reduce harvest rotation intervals	10	14	Y
	I1	Adjust sustainable yield calculations and harvest levels	14	10	?
132	A1	Sow more seed after disturbance	12	11	?
	B3	Reduce post-harvest burns after clearfelling (i.e. use alternative regeneration methods)	11	12	?
130	A6	Collect and sow seed from local areas potentially adapted to warmer temperatures	13		Y
121	B2	Reduce CBS silviculture	11		?
120	A10	Minimise soil compaction during forest operations	12		Y
117	F5	Green fire breaks	13		?
105	D11	Facilitate species translocations	15		N
99	A7	Sow understorey species	9		?
88	D10	Facilitate expansion/ recruitment of habitat	11		N
84	A2	Sow less seed after disturbance	6		Y
81	E2	Minimise road development and use	9		Y
64	E3	Improve roading in catchments at risk of flooding	8		Y
56	A13	Review the benefits of soil fungal inoculations after intensive disturbance	8		?
49	F8	Have one coordinated firefighting organisation	7		N

5. Discussion

In 2021 the FPA initiated a project to identify ways the Tasmanian forest practices system could adapt to climate change. Stage one of the project was an expert review of the ways climate change is expected to impact Tasmanian production forests, and potential adaptation options that could mitigate these impacts (Koch, 2022). The current report provides a synopsis of the second stage of this project, which was a practitioner workshop discussing adaptation options. This workshop was highly successful and productive.

Both the background report (Koch, 2022) and the current report provide a large number of actions that could be taken in response to climate change. Some of these actions are relevant to the FPA, and some are not. Limited resources mean that not all actions will be implemented over the next few years, so a process is needed to try and prioritise these actions. The nature of the workshop itself (participant-selected topics for discussion) provided some level of prioritisation. Further prioritisation was done by asking workshop participants to rate each of the original potential adaptation options for importance and achievability. While this second prioritisation had only limited participation (seven workshop attendees responded) it still provided useful insight. Of note is that one of the highest ranking adaptation options was minimizing deforestation, but this was not discussed during the workshop. It may be that this topic was not addressed as there is a clear management pathway for this action, via the Permanent Native Forest Estate Policy. However the importance of this action for climate change and ongoing low levels of land clearance (largely for agricultural purposes) may need to be taken into consideration as part of a review of the policy.

What is clear from this workshop is that a considerable amount of research is needed to help inform how management should adapt to climate change. Monitoring of a wide range of forest values is also needed to help inform decisions. Investment in planning tools is important to help foresters make informed decisions. Some new or revised policies and legislation may be needed to help the industry and the Tasmanian community adjust to climate change. It was also clear that improving community understanding of the role of forestry in mitigating climate change will make it easier for the industry to fulfill that role, so ongoing clear and informed communication is needed.

Addressing climate change is a huge challenge for forest managers, but it is a challenge that must be met head on for the forest practices system to continue meeting its legislated requirement of doing forestry ‘with due care for the environment’.

6. Attendees of FPA's climate change workshop

Name	Organisation
Peter Volker	FPA
Alex Schaap	FPA
John Hickey	FPA
Peter McIntosh	FPA
Aidan Flanagan	FPA
Anne Chuter	FPA
Elena Tinch	FPA
Chris Grove	FPA
Amy Koch	FPA
Tim Wardlaw	UTAS
Peter Harrison	UTAS
Libby Pinkard	CSIRO
Murray Root	PFT
Ann La Sala	Forico
Finn Adams	Timberlands
Shaun Suitor	STT
Dean Williams	STT
Vanessa Thompson	STT
Darryn Crook	Reliance FF
Ben Curtis	SFM
Sarah Thomson	NRE Forest Policy
Karen Ziegler	Private
Chris Ringk	Private
Martin Moroni	Treasury
Daniel Palmer	NRE Forest policy
Zac Barry	NRE Forest policy
Cindy Hull	NRM South

Others were invited but were unable to attend.

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