DEPARTMENT OF ENVIRONMENT AND CONSERVATION
and
CONSERVATION COMMISSION OF WESTERN AUSTRALIA

RESPONSE TO THE REPORT

CALCULATING THE SUSTAINED YIELD FOR THE SOUTH-WEST NATIVE FORESTS OF WESTERN AUSTRALIA[1]

The report of the independent expert panel reviewing the calculation of sustained yields was submitted to the Conservation Commission and the Department of Environment and Conservation (DEC) in March 2013. It contained a number of recommendations, some of which suggested adjustments or refinements to data or analyses prior to the calculation of the sustained yield figures to be included in the Proposed FMP, as well as recommendations for ongoing refinements or considerations to be addressed during the implementation of the next FMP. The following is the response to each of the recommendations of the panel.

Identifying net productive areas

Recommendation 2.1, Area database: *The processes used in maintaining and adjusting the GIS and FMIS databases are mature, flexible, robust and documented well. The Panel is satisfied that the identification and verification of net productive area meets best practice standards*.

This recommendation is noted and the necessity to maintain a high standard is supported.

Estimating the 2014 standing sawlog and other volumes

Recommendation 3.1, Best estimates: *Government agencies involved in calculating the sustained yield should empower staff to take the 'best' and not a conservative path of action in estimating the sustained yield to avoid accumulating a substantial hidden bias. Any adjustment by way of a safety margin is a policy decision to be taken after the sustained yield has been estimated.*

This recommendation is supported. Personnel involved in the data analysis and preparation of all contributing stages to the sustained yield calculations have conducted a further review to ensure there is no systemic bias in the estimation process, and to reinforce the intent of the recommendation.

The issue of an appropriate safety margin is addressed in recommendations 6.5 and 8.1 below.

Recommendation 3.2, Cross-sectional adjustment: *The Panel believes that the upper stem cross-sectional area should be adjusted for growth in proportion to the adjustment of that at breast height.*

---

[1] Ferguson, I.F, Dell, B and Vanclay, J. (2013) Calculating the sustained yield for the south-west native forests of Western Australia. Report for the Conservation Commission and the Department of Environment and Conservation of WA by the Independent Expert Panel. Conservation Commission WA, Perth p. 73

This recommendation is supported in principle. This adjustment is recognised as a sound approach but could not be incorporated in the time available to compute the sustained yields for the Proposed FMP, due to the extensive time required to reprocess the entire inventory datasets and subsequent steps. As a consequence, the volume growth calculated for individual trees over the period 1990 to 2010 will have been slightly underestimated. Ongoing refinement of this approach for inventory update will be examined during the implementation phase of the FMP.

Recommendation 3.3, Further UMA analyses*: The Panel has requested that further work on the UMA data be undertaken to establish the reasons for these differences and obtain the best correction possible. It also believes that routine monitoring along the lines of this study is essential and should be given high priority.*

This recommendation is supported. The further analyses of the Utilisation Monitoring Assessment (UMA) data were conducted. This involved further regression analyses to inform trends and re-examination of the characteristics of potential 'outlier' plots that might be unduly influencing the statistical relationships used to adjust for sawlog utilisation. No subsequent adjustments to the inventory datasets were required for the sustained yield calculations for the Proposed FMP.

The Utilisation Monitoring Assessment process will be maintained by DEC as an essential component of the calculation of sustained yields. This involves the measurement of the utilisation of trees within those inventory plots that are located within areas harvested.

Predicting future yields

Recommendation 4.1, Two-tiered incremental growth*: The Panel believes that best practice requires that the incremental growth from the 2012 re-measurement should be used to predict yields for two-tiered karri forest in the proposed FMP14.*

This recommendation is supported. Estimates of the increment on two-tiered karri stands were computed and have been applied in the calculation of the karri sustained yield for the Proposed FMP. The karri gross bole volume growth measured for the period 2002 to 2012 averaged approximately 3.1 cubic metres per hectare per year, of which the karri sawlog component was 1.8 cubic metres per hectare per year.

Recommendation 4.2, Continuing data collection and analysis*: The Panel believes that, subject to some revised analyses yet to be completed, the present set of yield tables represent best practice but notes the need for continuing data collection and analysis to maintain that position*

This recommendation is supported. These yield tables were applied, with refinements, in the calculation of the sustained yields for the Proposed FMP.

DEC agrees with the need for continuing data collection and analysis, but notes that the extent of further data collection and refinements to the yield modeling will be subject to the resources made available.

The Proposed FMP includes a proposed activity (No. 72) to 'continue to refine the data and methodology used for the sustained yield calculations by maintaining and enhancing the quality and coverage of the datasets, and the methodology, used in sustained yield calculations'.

Adjusting for future climate change

Recommendation 5.1, Further climate change analyses: *The Panel endorses the research done to develop adjustments for climate change for jarrah and karri forests for FMP14. The Panel recommends that further research on the impact of climate change of the productive forest estate should be pursued in the course of the next Plan, noting that any refinements to the approach need to be consistent with the processes used in monitoring and scheduling of yields.*

This recommendation is noted, and the value of further research on the impacts of climate change on the productive forest estate is supported in principle.

The Proposed FMP includes a proposed activity (No. 55) in relation to knowledge of the impacts of climate change on native ecosystems and the sustained yield, and to continue to incorporate climate change predictions into future land management planning.

DEC has identified a number of areas for further yield-related research, including refinement of the 3-PG physiological growth model, correlation and predictive modeling of the site and stand conditions that predispose areas to drought vulnerability, and mortality trends under varying climate projections.

Recommendation 5.2, Remote sensing and permanent monitoring plots: *DEC should extend their remote sensing of vegetation change over the next FMP and should establish large permanent monitoring plots within which individual tree canopy responses can be monitored in the long term. These plots should also be available to researchers outside DEC facilitating greater integrated research, as well as being used by DEC to investigate tree water use and other attributes using the 3-PG model.*

This recommendation is supported in principle. Remote sensing techniques are useful to monitor changes in vegetation extent and condition over multiple time scales. The preferred sample frame and alignment to ground-based monitoring plots is being considered as part of a broader process to review the monitoring of forest health for the next FMP.

Adjusting for pests, diseases and fire

Recommendation 6.1, Best estimates for Phytophthora-infested jarrah sites: *Notwithstanding the recent changes in short-term climate, the Panel recommends jarrah growth on Phytophthora -infested high impact sites be reduced by 20%, and by 5% on moderate impact sites, as used in FMP04.*

This recommendation is supported and these changes were incorporated into the calculations for the sustained yields in the Proposed FMP.

Further measurement and analysis of the long-term trends in growth on dieback-infested sites is continuing.

Recommendation 6.2, Further dieback and disease research: *The Panel strongly urges that further work be undertaken to develop a Phytophthora and Climate Change model that has the capacity to model a wide range of scenarios including disease outbreaks of Phytophthora cinnamomi (and other Phytophthora species if they are shown to be having an impact on the forests) and new infection sites following extreme weather events such as unseasonal storms.*

This recommendation is supported in principle. It is noted that the capacity to undertake further work will depend on available resources and competing priorities. The extension of the current modeling of autonomous spread to incorporate future vectored spread is a major undertaking. DEC commenced preliminary work and data collection for such a model during the current Plan, and will seek to extend this work during the next FMP. It is noted that modelling of the potential spread under a range of climate scenarios would inform the approach used in future woodflow models.

Recommendation 6.3, Armillaria degrade sites: *Although having a negligible effect on sustained yield, the next and later rotations on Armillaria sites should repeat the degrade adjustment of sawlog used in the current rotation in the calculation of sustained yield.*

This recommendation is supported and this change was incorporated into the calculations for the sustained yield of karri in the Proposed FMP.

Recommendation 6.4, Other pests and diseases: *The Panel supports the approach adopted by DEC in making adjustments to reflect karri and jarrah pests and diseases other than Phytophthora. It notes that future seemingly unpredictable episodes of infestation are best taken account through the safety margin to be applied to the final calculated sustained yield, although it believes that this source would be quite a very small contributor, given their nature and likely extent.*

This recommendation is noted. The ongoing research into the occurrence and impacts of these pests and diseases under a drying climate will be used to refine the impacts on growth and yield incorporated into future woodflow modelling.

Recommendation 6.5, Fire adjustments: *The Panel recommends that DEC drop the previous area adjustments, for fire, thereby avoiding deliberate conservatism. DEC should develop adjustments to aggregate standing volumes of sawlogs based on available data. This would enable the approximate adjustments to sustained yield to be calculated and so inform later determination of the safety margin to be applied to the calculation of sustained yield.*

This recommendation is supported. DEC has subsequently examined the historical extent and frequency of bushfire events and potential impacts on standing volumes. The relative risk to future woodflows arising from catastrophic bushfire events is influenced by the geographic and age class distribution of the areas impacted. During the last 30 years the impact on standing volumes has been much lower than the overall safety margins specified in Recommendation 8.1 (which seek to make provision for more than just bushfire events).

Nevertheless, the full safety margins specified in Recommendation in 8.1 – 10 per cent for jarrah and 15 per cent for karri – were adopted in the calculations of the average annual allowable cut for the Proposed FMP.

Scheduling future woodflows

Recommendation 7.1, Strategic planning and step changes in scheduling: *Analyses of sustained yield should be based on strategic planning by DEC and FPC to assist the future development of economically viable timber processors and dependent communities. This may necessitate step changes in scale and timber grade and size, in contrast to a long-term static sustained yield.*

This recommendation is supported. The sustained yields for the Proposed FMP have been based on analyses that recognize the future potential for 'step' changes in the scale of the wood processing industry based on karri and the size and quality of logs associated with the progressive availability of older regrowth stands. The Woodstock™ modelling platform provides an improved basis to model economic parameters more directly.

Recommendation 7.2, Pooling and/or simplification of jarrah strata for scheduling: *The Panel recommends that, where practicable in the time available, the pooling and/or simplification of the jarrah Silvicultural Status used in scheduling be pursued for the proposed FMP14. Further research on this should be pursued in the next plan.*

This recommendation is supported in principle. It is noted the intent of this recommendation is to improve the efficiency of the model, but DEC was not able to simplify the model structure in the time available for calculating the sustained yield figures for the Proposed FMP. Simplification of the number of jarrah strata was a key design consideration in formulating the current Woodstock™ model, but due to the need to cater for the broad range of jarrah silvicultural outcomes there was a limit to the extent of simplification. Further work to refine the strata has commenced and will continue during the next FMP.

Recommendation 7.3, Adjusting for fire and drought: *The potential impact of fire and drought on sustained yield should be analyzed by means other than Woodstock and adjustment for them incorporated in the safety margin to be applied to the final sustained yield calculated from Woodstock.*

This recommendation is supported and this approach was adopted for the calculation of the sustained yields for the Proposed FMP.

Subsequent to the work of the independent expert panel, DEC has trialled the simulation of fire and drought events within a separate pilot Woodstock™ model, and believes it would be prudent during the next FMP to further explore the potential efficiencies and improved precision that may be possible in future model redevelopment, particularly for modeling the range of non-timber outputs.

Recommendation 7.4, Wandoo and marri: *The sustained yields for wandoo and marri should be calculated by means other than Woodstock*.

DEC supports this recommendation in principle. The projected woodflows generated by Woodstock™ include the level of wandoo and marri arising as a consequence of sustaining the jarrah and karri sawlogs. Accordingly, while separate sustained yields were not computed for wandoo or marri using Woodstock™, the projected availability during the period 2014 to 2023 was determined from the Woodstock™ outputs and standing volume to ensure consistency.

Recommendation 7.5, Re-afforested minesites: *The Conservation Commission should ascertain the intentions of the mining companies and Government in relation to thinning of re-afforested minesites and draw their attention to best practice. If this issue cannot be resolved in time for the calculations in the proposed FMP14, this resource will have to be treated as an unresolved option, involving two alternative scenarios (one thinned and the other omitting the resource) for sustained yield. In any event, further research is needed on the frequency and intensity of thinning and the associated economics.*

This recommendation is supported in principle. The Conservation Commission agrees that the responsibilities for management of stand density should be clarified as a part of completion criteria for rehabilitated mine sites and understands that government agencies are working with mining companies on a review of these criteria. Where completion criteria pertaining to existing rehabilitation do not address the management of stand density the Conservation Commission and DEC will seek to ascertain the intentions of the mining companies and Government. Proposed activities 39 and 40 of the Proposed FMP are relevant to this issue.

In accordance with the recommendation, the sustained yield calculations for the Proposed FMP identified separately the relative contribution to woodflows of the resource from the rehabilitated minesites (refer Table 5 in the Proposed FMP).

DEC will pursue further refinement of the current and potential future yields from the rehabilitated minesites during the next FMP.

Specifying safety margins

Recommendation 8.1, Safety margins: *The Panel recommends that safety margins of 10% and 15% be applied to the calculated sustained yields of jarrah and karri respectively to allow for the impacts of seemingly unpredictable events such as fire, cyclones, drought, and pests and diseases.*

This recommendation is supported. The average annual allowable cuts in the Proposed FMP incorporated the safety margins of 10 per cent for jarrah and 15 per cent for karri.

Implementing the Sustained Yield

Recommendation 9.1, Use of Stanley and dual prices: *The Panel recommends that harvest planning be migrated to the Stanley platform following completion of the proposed FMP14. For reasons discussed in Section 7.2, it also recommends that calculation of dual prices be carried out as a matter of course for any penultimate run of the Woodstock scheduling software.*

This recommendation is supported and work has commenced to migrate the harvest planning to the Stanley™ platform.

Sensitivity analyses (the dual prices) of the marginal costs of constraints on the Proposed FMP model were calculated. These analyses provided insights into the formation of the solution. Future work with Woodstock™ will include exploration of additional mathematical approaches for sensitivity analyses.

Recommendation 9.2, Planning horizon and sustainability goals: *The Panel recommends that future planning beyond the proposed FMP14 should focus on a planning horizon for scheduling of about 50 years. Beyond about 50 years, planning should reduce to applying broad trends in growth and harvest levels that enable the sustainability goal of a steady state to be assessed at, say 100 years.*

This recommendation is supported. The sustained yield figures in the Proposed FMP have been based on woodflow projections averaged to the year 2070, which is the timeframe of currently available future climate projections. The projected woodflows beyond this period have less certainty but were also examined to inform the sustainability of forest values over the longer term. Further work will be undertaken during the next FMP to evaluate suitable metrics to assess a 'steady state' condition.

Recommendation 9.3, Environmental goals in next plan: *The Panel recommends that greater attention be given to monitoring and reporting of the broader environmental goals on biodiversity, fragmentation, connectedness, water production and salinity at the end of the 50-year scheduling period of the next Plan, using metrics that can be informed by existing data and processes.*

This recommendation is supported in principle. The Proposed FMP includes a number of new Key Performance Indicators and data acquisition priorities that will provide source data to expand modelling, and hence the projection of some of these metrics, over the longer term.

Recommendation 9.4, LiDAR and multispectral imagery: *The Panel recommends that DEC continue to monitor and test the use of new technologies and, in particular, develop a department-wide plan for the purchase of LiDAR and multispectral imagery for the South-west forest region.*

This recommendation is supported in principle. DEC has successfully trialled the use of LiDAR data for forest inventory and stratification of the karri and jarrah forests. The capacity to expand these trials to purchase data for the whole of the south west forests will depend on available funding.

Recommendation 9.5, Change to economic objective: *The Panel recommends that consideration should be given in the next FMP to developing the scheduling based on an objective of maximizing the discounted net revenue to FPC, to enable better integration of economic factors into the planning and to provide a basis on which estate valuation for accounting purposes could be based.*

This recommendation is supported. DEC notes that in considering the future scheduling approaches, modelling the balance between the maximization of economic objectives and the attainment of environmental goals would be informed by the refinements referred to in Recommendation 9.3.