

FRAMES Actual vs Predicted Harvest Reconciliation – F2012/13 to F2016/17

Background

The Auditor General’s Performance Audit “Sustaining Native Forest Operations: Forests NSW” of April 2009 required Forests NSW (now Forestry Corporation of NSW - FCNSW) to “compare harvest results against its yield estimates over five year periods as a means of testing the accuracy of estimates” and “report the results annually starting June 2010”.

This report covers the reconciliation of actual harvested volumes versus harvestable volumes predicted by FRAMES (the FCNSW Forest Resource And Management Evaluation System) for the period July 2012 to June 2017 (“Reconciliation Period”), for FCNSW North East and Central Regions plus the Southern Regional Forest Agreement (RFA) region. The Eden RFA Region was excluded from this study because FRAMES was not used during the reconciliation period in that area for prediction of current and future harvestable volumes. A major review of the Eden regrowth resource was completed in 2016 and the results of that analysis will be incorporated into the reconciliation process when the modelled regrowth harvest commences in 2019.

FRAMES is the set of tools used to predict the strategic level harvestable volumes of high quality large (HQL), high quality small (HQS) and low quality (LQ) sawlogs as well as pulpwood (Pulp) within areas of native forest. Volumes are estimated on a per hectare basis for specified silvicultural treatments and applied to the area of forest potentially available for harvesting. As the combined HQ volumes (HQL & HQS) are the main driver for harvesting operations in the analysis localities, this combined category is used as the focus of comparison of actual and predicted harvest yield.

Methodology

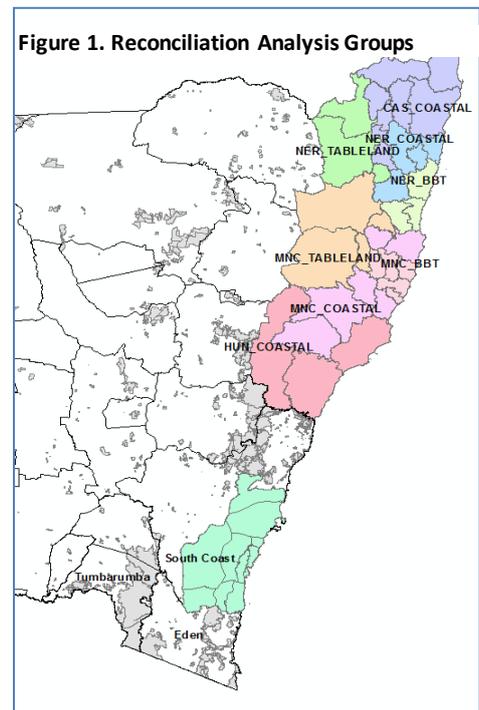
The resource was divided into 8 Analysis Groups that reflect common geographic, species and management features. The spatial distribution of these groups is shown in Figure 1.

For the F2013-17 study, the majority of areas were harvested with Single Tree Selection (STS) operations. Less than 2,000 hectares were treated with intensive harvesting. Due to this small sample size, these areas could not be analysed separately. The area of unrepresentative harvesting operations (Australian Group Selection (AGS), thinning, road-line clearing etc) totalled less than 100 hectares and were excluded. Operations on other tenures (Crown lease harvesting etc) fall outside the FRAMES sampling schema and were also excluded. Operations in this category total less than 200 hectares per year.

Actual harvested volumes by log class for the Reconciliation Period were drawn from the FCNSW sales system (SCION). SCION is linked to the FCNSW Event Management (EM) system, a GIS-based system introduced in 2011 that includes mapped harvest plans and post-harvest maps at compartment level.

FRAMES estimates of harvestable volume per hectare for the analysis areas were determined as follows:

- (i) Strategic inventory plots that fell within the harvesting tracts as mapped in the EM system were selected (229 plots on the North Coast and 33 on the South Coast).
- (ii) The plot measurement record most immediately prior to the completion of harvesting was selected. Plots with a most recent measurement record prior to 2014 (the mid-point of the 5-year Reconciliation Period) were grown forward to 2014.



- (iii) The FRAMES Growth and Yield Simulator was used to model harvest volumes for the plots within an Analysis Group, using a single silvicultural treatment and applying the suite of rules for trees modelled as harvested that were specified by Regions for that locality. The volumes were then averaged to produce a predicted volume per hectare by log class.
- (iv) Mapped harvested areas were adjusted by the ratios of mapped to actual harvest determined from the 2011 Net Harvest Area Modifier Study. Predicted yields per hectare were calculated using the actual harvest volumes divided by the area derived by this process.

Results

Analysis results have been summarised in Table 1 (CAS: Casino Mgt Zone; COF: Lower North East Region; MNC: Mid North Coast; HUN: Hunter; TBL: North Coast Tablelands; NC: Combined North Coast; SC: Combined South Coast). The shaded rows are sub-totals.

Table 1: Actual versus Predicted Yields by Analysis Group

Analysis Area	Harvested Area (ha)	HQ Volume Harvested (m3)	HQ Volume Predicted (m3)	HQ Volume per Hectare Harvested (m3/ha)	HQ Volume per Hectare Predicted (m3/ha)	No. FRAMES Plots in Prediction	Actual HQ PLE	Predicted HQ PLE
CAS_COASTAL_STS	8,743	120,293	113,612	13.8	13.0	52	± 14%	± 27%
COF_BBT_STS	5,366	180,413	168,545	33.6	31.4	34	± 17%	± 31%
COF_COASTAL_STS	2,732	62,427	82,862	22.9	30.3	12	± 37%	± 61%
HUN_STS	4,506	53,182	82,004	11.8	18.2	18	± 83%	± 85%
MNC_BBT_STS	7,015	265,616	228,979	37.9	32.6	67	± 17%	± 28%
MNC_COASTAL_STS	4,283	64,963	104,827	15.2	24.5	38	± 50%	± 36%
TBL_STS	2,773	47,852	24,612	17.3	8.9	8	± 23%	± 55%
NC_Combined_STS	35,418	794,747	868,121	22.4	24.5	229	± 14%	± 16%
SC_Combined_STS	8,063	218,449	205,195	27.1	25.4	33	± 14%	± 41%
Combined Total	43,481	1,013,196	1,073,315	23.3	24.7	262	± 11%	± 20%

This study demonstrates that overall FRAMES predicted HQ volumes are very similar to the volumes of HQ actually harvested across the 5-year Reconciliation Period. Despite some variability, there was no statistical difference between actual and predicted HQ volumes per hectare.

A Note on Errors

Probable Limits of Error (PLE) indicate the likelihood of statistically significant differences between actual and predicted volumes per hectare. When area weighted most actual HQ PLEs are under ±30%, which is similar to the last analysis, and typical for harvested volumes of this log class in native forests. Higher actual HQ PLEs in Table 1 are seen in the Hunter and MNC Coastal operations, which have smaller sample areas and a complex mix of species. FRAMES was designed to target PLEs for predicted HQ volumes of ±30%, using the full complement of strategic inventory plots. There were only 229 (~10%) of these plots that fell within areas used in this analysis. PLEs for predicted HQ volumes ranged from ±27% to ±85% but were less than ±20% at a more aggregated levels, an acceptable outcome.

Conclusion

The Forestry Corporation utilises FRAMES derived strategic models to determine its annual harvest levels. The field data that contributes to these models is updated after harvest events. Harvest yield simulation is refined by studies of silviculture, yield recovery and area utilisation.

It is widely acknowledged that it is difficult to undertake a reconciliation study between a model such as FRAMES, which is designed to predict volumes by log class at the strategic level, and actual harvesting operations. This difficulty is reflected in several Analysis Groups where volume differences are apparent at the localised level. These issues may in part be linked to the nature of the SCION sales system, where recording of sub-compartment silviculture level details is not possible. Further, there are known errors where sales information is recorded but may not be assigned to the correct compartment.

Previous iterations of this study also identified issues with harvest mapping precision and attribution. These challenges have been addressed with the introduction of GPS tracking of harvest equipment in 2018. It is expected that the relationship between actual and predicted yields will improve as the more accurate harvest extent data comes on stream.

Noting these difficulties, it is important to see the results are consistent with the previous studies and that at broader, more strategic level, volume differences are reduced. This study demonstrates that overall FRAMES predicted HQ volumes are very similar to the volumes of HQ actually harvested across the 5-year study period. Despite the variability noted, there was no statistical difference between actual and predicted HQ volumes per hectare at the Analysis Group level.