

FRAMES Actual vs Predicted Harvest Reconciliation – F2010/11 to F2014/15

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 2010 to June 2015 (“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 is 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

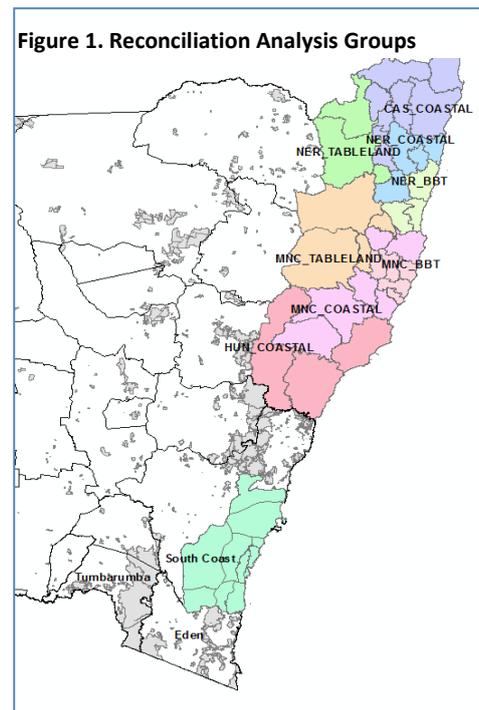
The resource was divided into 9 Analysis Groups that reflect common geographic, species and management features. The spatial distribution of these groups is shown in Figure 1.

Within each analysis group, Single Tree Selection (STS) operations were grouped, with harvesting aimed at enhancing regeneration (known as STS-Regen) being reported separately. Unrepresentative harvesting operations such as Australian Group Selection (AGS), thinning, road-line clearing or crown lease harvesting were excluded. The combined unrepresentative operations represent less than 5% of mapped data. Harvest operations that commenced prior to July 2010 were also excluded. This is because the mapping standard changed in 2014 from events being mapped in their entirety with a final finish date, to a progress based model where events are split to report the extent of harvesting in a given 12 month period ending 30 June.

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 (120 plots in North East Region, 154 in Central Region and 38 in Southern RFA region).



- (ii) The plot measurement record most immediately prior to the completion of harvesting was selected. Plots with a most recent measurement record prior to 2012 (the mid-point of the 5-year Reconciliation Period) were grown forward to 2012.
- (iii) Analysis Groups with few or no strategic inventory plots were excluded. All but three Analysis Groups had at least 20 inventory plots.
- (iv) 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.
- (v) 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 (HUN: Hunter; MNC: Mid North Coast; CAS: Casino Mgt Zone; NER: North East Region; MNC: Mid North Coast; NC: Combined North Coast; SC: Combined South Coast; BBT: Blackbutt). 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
HUN_COASTAL_STS	4,771	44,258	82,055	9.3	17.2	24	± 31%	± 57%
MNC_BBT_STS	4,597	154,636	148,489	33.6	32.3	39	± 21%	± 40%
MNC_COASTAL_STS	3,569	57,373	69,593	16.1	19.5	28	± 34%	± 34%
MNC_TABLELAND_STS	4,896	62,627	97,910	12.8	20.0	15	± 32%	± 53%
CAS_COASTAL_STS	7,436	100,343	110,052	13.5	14.8	47	± 26%	± 21%
NER_BBT_STS	6,578	213,105	238,785	32.4	36.3	42	± 19%	± 33%
NER_COASTAL_STS	3,630	71,256	64,977	19.6	17.9	19	± 35%	± 43%
NER_TABLELAND_STS	2,320	27,030	45,237	11.7	19.5	12	± 29%	± 75%
NC_STS	37,796	730,628	857,098	19.3	22.7	226	± 13%	± 16%
MNC_BBT_Regen	3,070	112,055	153,505	36.5	50.0	40	± 16%	± 27%
MNC_COASTAL_Regen	567	11,019	17,629	19.4	31.1	7	± 54%	± 66%
NC_Regen	3,637	123,074	171,134	33.8	47.1	47	± 17%	± 25%
Combined NC	41,433	853,702	1,028,232	20.6	24.8	273	± 13%	± 14%
Combined SC	6,920	175,479	112,730	25.4	16.3	38	± 17%	± 33%
Combined Total	48,353	1,029,181	1,140,962	21.3	23.6	311	± 13%	± 16%

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. Most actual HQ PLEs are around ±30%, which is slightly higher than the last analysis, however still typical for harvested volumes of this log class in native forests. Higher actual

HQ PLEs in Table 1 are seen in the MNC Coastal Regeneration operations, which has a smaller sample size and higher variability. FRAMES was designed to target PLEs for predicted HQL volumes of $\pm 30\%$, using the full complement of strategic inventory plots. There were only 311 (~13%) of these plots that fell within areas used in this analysis. PLEs for predicted HQ volumes ranged from $\pm 16\%$ to $\pm 54\%$ but were less than $\pm 30\%$ 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 a number of the Analysis Groups where volume differences are apparent at the silviculture 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.

This study has also identified issues with harvest mapping precision and attribution. These challenges are being addressed with the introduction of GPS tracking of harvest equipment. It is expected that the relationship between actual and predicted yields will steadily improve over the next few years 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.