Gateway Regeneration Checks for Human Induced Regeneration projects (2024/1)

ANUE Project #1-1035 (Phase 3)

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Summary

This report is the second in a series that independently reviews the process and outcomes of the HIR Regeneration Gateway Checks. The first report reviewed 25 projects that has passed Regeneration Gateway Checks prior to May 2023, while this report reviews 18 Projects that submitted Regeneration Checks after the guidelines had been updated and included new s215 audit processes.

High resolution remotely sensed data (1 – 10 m resolution) was used by proponents to classify areas in non-potential, baseline forest and regenerating Carbon Estimation Areas (CEAs). Independent checks by qualified auditors confirmed good practice methods were used and the strata boundaries were reliable. On average, about 2,000 ha , representing 7.5%, was removed from the CEA of each project reviewed as a consequence of failure to meet the minimum 5-yearly threshold of regeneration. Such removals could be reasonably expected given the heterogenous nature of the original CEA areas.

The projects reviewed in this report include substantial areas, especially in Western Australia, where national-scale models of tree cover were found to be unreliable. National-scale models used spatial resolution data that was 2 – 20 times poorer than the resolution used by project proponents and did not have many (or any) local data points for calibration or verification. Hundreds of georeferenced photographs and *in situ* measurements were used by CER to confirm regeneration thresholds were being met when national-scale models were shown to be significantly biased or unreliable.

The independent audit reports and the CER reviews continue to provide strong assurance that projects are being managed and appropriate methods have been used by the proponents or their agents in classifying the CEA and identifying changes in regeneration canopy cover.

An increased focus on objectively located *in situ* measurements and georeferenced photographs is required until national-scale models of tree cover become more reliable in the areas of large HIR projects.

1. Context

Sequestering carbon in trees and forests is a significant tool for keeping atmospheric levels of carbon dioxide within the thresholds required to avoid dangerous climate change. Under the Australian Carbon Credit Unit (ACCU) Scheme (formerly known as the Emissions Reduction Fund), the Australian Government offers landholders, communities and businesses the opportunity to run projects in Australia that avoid the release of greenhouse gas emissions or remove and sequester carbon from the atmosphere. The ACCU Scheme is legislated under the *Carbon Credits (Carbon Farming Initiative) Act 2011* and is administered by the Clean Energy Regulator (CER).

One method under the ACCU Scheme is the Human-Induced Regeneration (HIR) method, which aims to improve the forest cover on degraded and deforested land. In essence, HIR projects identify land which, although potentially forested, has no current forest cover and can be regenerated back to forest cover through undertaking an approved activity or activities. Successful HIR projects are awarded Australian carbon credit units (ACCUs) for each tonne of carbon dioxide equivalent sequestered by regenerating vegetation.

This report is the second in a series that independently reviews the process and outcomes of the HIR Regeneration Gateway Checks, including the new s215 audits. The first report summarised the regeneration check processes undertaken by CER and auditors[1], then compared the HIR conclusions with independent data for a representative sample of projects that had completed regeneration checks prior to May 2023.

1.1. Conclusions from first report

The first report reviewed 25 projects that had completed their regeneration checks and had been accepted by the CER as meeting requirements of the HIR method. These projects were located in south-western Queensland, western New South Wales and parts of South Australia.

The first report consisted of two parts:

1) Examining the processes and evidence used by CER, in particular those relating to the 6-10 year threshold tests for regeneration;
2) Bringing in additional, independent data to verify that the spatial models being relied upon by CER were reasonable and that processes were in place to minimise the likelihood of threshold checks being inappropriately passed.

With respect to the first part, my report notes that I cited evidence or had access to:

1) *CER maintained document system that allowed storage and retrieval of information for each project under HIR;*
2) *Documents including invoices, sales dockets and other material that demonstrated project proponents had met their requirements to fence; trap or otherwise remove feral animals; reduce grazing to demonstrably safe level; etc.*
3) *Copies of "Reasonable Assurance Estimates" by independent auditors for the projects;*
4) *Initial and final stratification into baseline/pre-existing forest; non-project; and carbon estimation areas (CEA);*
5) *Maps of project CEA, gridded into 100 ha "cells" with estimates of tree cover percentage, alongside commentary on whether all cells met the minimum cover thresholds as specified;*
    a. *Documents and requests for further work, evidence or modelling where 100 ha scale cells did not appear to meet the thresholds. Additional work included field inspections with spatially referenced photographs, higher resolution remote sensing and use of alternative spatial modelling.*

Based on the data described above, the first report concluded:

> *The independent audit reports and the CER reviews provide strong assurance that projects are being managed as per the legislative requirements and that appropriate methods have been*

[1] See Appendix for a copy of the Gateway Regeneration Checks as described in the first Report

used by the proponents or their agents in classifying the CEA and identifying changes in regeneration canopy cover…

The CER reviews utilize multiple information sources (maintained by TERN and other government agencies) to confirm regeneration thresholds at project and 100 ha scales are being met. Where there are substantive discrepancies between sources and/or with the project reports, further information has been required by CER before the regeneration check is accepted.

With respect to the second part of this first report, I inspected 20 – 30 sample points for each of the selected projects. At each sample point, I examined current and historic aerial photographs or satellite imagery. I also examined modelled estimates of canopy cover (through time) from an independent spatial modelling system (embedded in the publicly available Australian Environment Explorer). Detailed observations at these sample points allowed me to verify the reliability of the national scale spatial models (Persistent Green and National Forests and Sparse Woody) that CER had used as part of their threshold checks. I also used the Forest Change model to explore the Projects in their spatial context, noting for example, the presence of existing forests and trees greater than 2 m in height outside the CEAs (to confirm the potential for trees to reach forest level thresholds *in situ*). In this second part of that first report, I was able to verify that:

The accuracy of the stratification by proponents and their agents into excluded/non-credited area and appropriate CEA was 85% or greater;

… the models used in projects and this review have all been peer reviewed, [but] there are discrepancies between estimates of tree canopy cover generated. These discrepancies are due to the use of different remote sensing data, integration of other data sources, underpinning modelling assumptions and other statistical factors. Triangulation with different models is an effective way to gain confidence in results or identify areas where models are defective or being extrapolated beyond their bounds. Acceptance (or rejection) of regeneration thresholds should not be based on a single remote sensing based model and important decisions where models disagree need to be supported by high resolution imagery and/or in situ georeferenced data

There was no evidence that CER reliance on multiple information sources to check CEAs passed the threshold checks was unreliable and there is a greater than 95% probability that the canopy cover is well above the 7.5% thresholds;

Some spatial model estimates were unable to identify regeneration on CEAs that in situ measurements otherwise confirmed had sufficient trees (of appropriate species) to grow on to reach forest level thresholds.

2. Review Approach for 2024

Similar to the first report, CER provided details they had used to evaluate projects due for their 5-year regeneration check. These data included:

- Geospatial data for each project;
- CER assessment of the regeneration checks, including maps of AUSCOVER Persistent Green (PG) and National Inventory estimates of annual National Forest and Sparse Woody Vegetation (NFSW); series of *Wayback* historical remote images. As a consequence of the first report, estimates from Australian Environment Explorer (AEE) were also accessed by CER and supplied;

- Offset reports and follow up reports submitted by proponents;
- Reasonable assurance audit reports (produced by independent auditors).

Since the first report, the independent audit procedures had been updated to include s215 audits, which are classified as “standard” or “expanded” audits. As for audits completed before 2023, the standard audit requires independent auditors to check that approved processes and procedures were followed for mapping, classification of CEAs, boundary definition, modelling and management. Data collected during standard audits include copies of receipts/bills of sale; georeferenced photographs and copies of model inputs/outputs and may include field measurements. The expanded audits require the auditors to undertake additional *in situ* measurements or observations at points selected by CER. These “points of interest” (POI) include where national scale models (e.g., PG and NFSW) substantially contradict the proponent classification or modelling results.

It is anticipated that fifty projects will be reviewed during 2024. This report reviews the first 18 projects that have complete or draft s215 audits at the time of writing[2].

Fifty percent (9) of the projects reviewed in this report were located in Western Australia, 39% (7) where located in Queensland with the remaining 11% of projects in NSW (2).

The Western Australian projects were all located north of Perth and well inland from the coast. National scale models of tree cover do not focus on this area for calibration or accuracy assessment. Maps of the plots used to calibrate AEE[3] and PG[4], for example, include few, if any, points within this region. In the discussion[5] about the model development of the 3-class woody vegetation product (forest, sparse and non-woody) that is the basis of NFSW, it was noted that only 11 tiles (out of the 37 tiles needed for Continental coverage) …*that contribute the most emissions to the national inventory, were used determine the accuracy of the product and to identify areas for improvement*. These tiles did not include the Western Australian project areas. The accuracy for classification of unchanged sparse woody in the 11 tiles covered was only 66%[6] while the accuracy for classifying change in to / out of sparse woody is expected to be much poorer. The relative lack of focus in calibrating, verifying and improving the model in areas that do not “contribute the most emissions” means that model accuracy is likely to be even less reliable in these regions.

Another difference to the first report and process is that I accompanied independent audit teams on their inspections of several Western Australian projects (Figure 1). These teams collected photographs and quantitative data on species distribution, tree heights and canopy cover at CER nominated POI as well as at Temporary or Permanent Observation Points (TOPs, POPs) that they establish as part of their own procedures (see 3.4 below). Each of the auditor’s businesses have developed their own assessment methodologies that include fixed area plots and systematic photo-points. The auditors I observed used 100 m transects of 10 m width (0.1 ha) to collect species data, tree heights and canopy cover (Figure 2).

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[2] If there are any substantive changes once draft reports have been finalised, they will be included in the subsequent report.
[3] Liao, Z., VanDijk, A.I.J.M., He, B., Larraondo, P.R and Scarth, P.F. (2020) Woody vegetation cover, height and biomass at 25-m resolution derived from multiple site, airborne and satellite observations. Int J Appl Earth Obs Geoinformation 93: 102209
[4] Gill, T., Johansen, K., Scarth, P., Armston, J., Trevithick, R., Flood, N. (2015). Persistent Green Vegetation Fraction. In A. Held, S. Phinn, M. Soto-Berelov, & S. Jones (Eds.), AusCover Good Practice Guidelines: A technical handbook supporting calibration and validation activities of remotely sensed data product (pp. 134-154). Version 1.1. TERN AusCover, ISBN 978-0-646-94137-0.
[5] Australian Government (2019) National Inventory Report 2017: Volume 2 [page 149]
[6] Op. Cit. Table 6.A.2 [page 150]

Figure 1: Oblique aerial photograph of the area around a "point of interest" showing the heterogeneity of the Western Australian landscape with patches of woody, sparse and non-woody areas

Figure 2: Orthogonal photograph (20 m above the ground) of a section of a 100 m transect laid out at a "point of interest" in Western Australia. Audit teams measured heights and canopy dimensions from the ground, but these can also be estimated from this aerial photograph (e.g., using the shadow cast by a person of known height)

3. Results

3.1. Management actions

HIR relevant management actions included reducing stock numbers, fencing and using controlled water point management to effectively control over-grazing and other degradations caused by large numbers of (hooved) animals. Evidence of these actions included the auditors' reports, citing copies of relevant bills of sale, invoices for fencing materials and water point maintenance. During my field trip, I observed damage to tree canopies caused by heavy cattle browsing in non-project areas, including canopies over 2 m in height damaged as cattle broke branches to gain access to new/young growth (Figure 3). I also observed areas where over-stocking had impacted the soil chemistry and structure – adding too much urine/nitrogen and compacting the surface into relatively impermeable layers. A significant reduction in stocking numbers reduced the direct damage to canopies as well as allowing for natural restoration of soil chemistry and structure necessary for regeneration.


Figure 3: Example of the leading branch of a tree (originally over 2 m height) in a non-CEA area, broken by cattle as they seek the tender, younger leaves. Note too, the number of other branches broken and on the ground, and lack of any regeneration.

Other management actions included feral animal control (pigs, goats, horses and camels), again as evidenced by the auditors' reports and copies of invoices/sales documents. The controlled water point management also reduced the free availability of water across the entire project area which would help control feral animal numbers inside and outside the CEAs.

3.2. Stratification

All except two of the projects restratified their CEAs as part of their first regeneration check, usually into forest, non-woody and areas that had reached at least 5% increase or more than 7.5% canopy cover. All of these projects used high resolution satellite imagery (SPOT with 1 / 1.5 m resolution or Sentinel 2 with 10 m resolution). Good practice techniques (mainly supervised, but occasionally unsupervised classification) were confirmed as being used to group the project areas into relevant canopy cover classes. Data used in the supervised classification or to group the unclassified classes included high resolution remote photographs, ground plots and tree canopy maps (derived from LiDAR or UAVs). Classifications were only accepted if the accuracy rate was greater than 85%, but usually the accuracy was greater than 90%. This satellite resolution and classification accuracy is superior to NFSW and other national-scale models for these regions.

Independent auditors confirmed the classification methodologies met good practice standards and that boundaries were reliable.

Restratification commonly found parts of a CEA that had not achieved the minimum canopy cover originally predicted as capable of being met within 5 years. These areas (and any previously credited carbon) were removed from the CEA (Figure 4). Such a reduction is not unanticipated given the need to estimate potential growth for 5 – 15 years and procedures for changing the CEA areas and reimbursing any credits are documented.

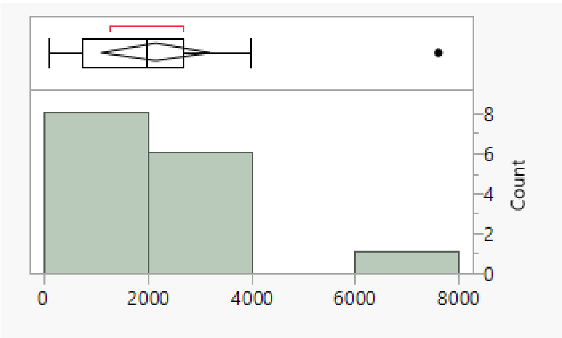
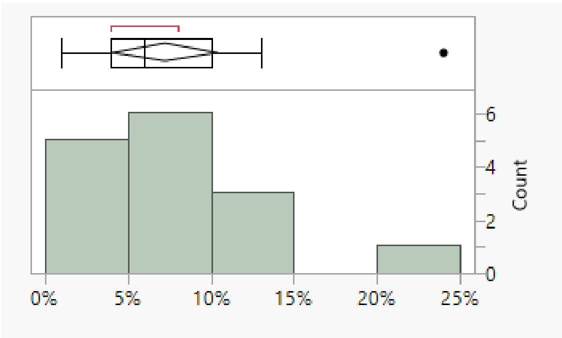
a) Area (ha) of CEA reduced	b) Area (%) of CEA reduced
	

Figure 4: Whiskers diagram and histogram of the reduction in original CEA area as a result of proponent restratification (excluding properties where area change is due to amalgamations or other reasons)

3.3. Regeneration checks

Proponents intersect their (updated) CEA stratification with contiguous 100 ha cells to demonstrate that regeneration is meeting the minimum threshold requirements (e.g., 7.5% minimum canopy cover at 100 ha scale after 5-years).

As per pre-2023 projects, CER compared proponent estimates of regeneration with national-scale models at the 100 ha cell level, however the results were mixed. None of the projects in Western Australia passed the PG / Auscover thresholds at the 100 ha scale, while in Queensland some projects passed with one version of Auscover but not with other versions of the model. Further research by CER found that some 100 ha cells that PG modelled as not meeting modelled cover thresholds had different soil colours than surrounding cells that did pass the threshold.

The canopy cover estimated by NFSW in Western Australian projects was greater than the PG / Auscover estimates although a number of projects still did not exceed 7.5% on all of the 100 ha grids. Often soil colour appeared to be different between adjacent 100 ha cells that met or failed the 7.5% threshold. There was a similar pattern for Queensland projects.

Some Queensland projects were also assessed using Queensland's SLATS / Foliage Projection Cover models. This model is well calibrated for Queensland woodlands, and all the projects assessed passed at the 100 ha scale.

AEE estimates of canopy cover at CER selected POI in Western Australia were almost all less than 4% even where NFSW estimates were over 7.5%. AEE point estimates in Queensland and NSW were higher but still often less than NFSW estimates of canopy cover. The first report found that AEE appeared to significantly underestimate *in situ* measurements of canopy cover for mallee species like those observed in these projects.

CER inspections of Wayback images concluded that, contrary to national-scale models, there was evidence of *positive regeneration trends / evidence of infilling* in all of the projects in Western Australia and NSW, and in two-thirds of projects in Queensland. The remaining projects in Queensland showed *sparse* or *minimal evidence of change* and further evidence of success was required from proponents.

Given the contradictory and unreliable estimates provided by the national-scale models, CER placed greater emphasis on Wayback images, *in situ* measurements and georeferenced photographs. Under standard audits, some of these photographs were taken at POI designated by CER. However, proponents often provided hundreds of additional georeferenced photographs to demonstrate the existence of sufficient trees at, or capable of achieving, 2 m height. Some of these photographs are subjectively chosen where national scale models indicate a failure to regenerate, while others use an objective or statistically-based method of selecting the locations (see Section 3.4 below). These data can be used to estimate the accuracy of national-scale model classifications and proponent-based stratification. Locations with photographs showing enough trees to meet regeneration thresholds are compared to national-scale model estimates of non-woody, sparse-woody or forest classifications. Where these photographs confirm that the proponent's classification of the CEAs (e.g., non-woody, canopy cover greater than 5%, 7.5%, 10%, etc) are more reliable than the national scale model estimates, then those estimates of regeneration threshold success were reasonably accepted by CER.

Where CER determines that an expanded audit is required, *in situ* measurements at POI are required. These measurements allow direct comparison of canopy statistics with national scale model estimates (see 3.4 below). About half the regeneration checks in Queensland and NSW required an expanded audit due to CER observations of potential discrepancies on stratification, unexplained differences to national-scale estimates, or risk of unsuccessfully passing regeneration thresholds.

3.4. Observation Points

While *in situ* measurements and observations (Evidence Level 3) are not a mandatory requirement in the Guidelines for regeneration threshold checks, many of the proponents include field data collected as part of their audit and verification processes. About half the projects in this review included such *in situ* measurements to support their regeneration checks.

In situ data are collected at Field Observation or Temporary Observation Points (FOP or TOP) or, when permanently marked to allow repeated measurements, at Permanent Observation Points (POP). Details vary between proponents and agents and the type of observation point, but they generally include a description of the overstory and understory, plot-based measurements of canopy cover and height, and several photographs taken in pre-determined directions (e.g., Figure 5).

Descriptive data	Canopy and stocking	Photographs
Plot Description: Overstory of broad leaf mulga 3-5m, fine leaf mulga 3-5m, kurara 2-2.5m, wild lemon 3m, flat leaf bowgada 2.5m, hop mulga 4-4.5m. Scattered regen broadleaf mulga 0.6-1.6m, flat leaf bowgada 0.7-1.4m, kurara 0.4-2m, needle bush 0.8m, fine leaf mulga 1m. Majority of regen captured in site under 1m in height and under existing mature canopy. Understory of Wilcox shrub, cotton bush, cottony blue bush, blue bush, warty leaf eremophila, cork screw, tall sida, occasional wooly butt grass. Located on a sandy surfaced hard pan. Regeneration Comments: Scattered regen broadleaf mulga 0.6-1.6m, flat leaf bowgada 0.7-1.4m, kurara 0.4-2m, needle bush 0.8m.	Canopy cover of woody vegetation over 2 m: 17% Regeneration stocking/ha: 489	8 photographs taken in directions: N, NE, E, SE, S, SW, W, NW E.G., 

Figure 5: Example of data collected at one POP in Western Australia

The Western Australian POPs were objectively selected by the auditors (randomly located within the strata but with infeasible access locations filtered out), then precisely located in the field. Queensland projects also provided plot-based information as part of their audit checks and POI observations. The field data for about 100 plots across twelve projects (two states) were compared with national-scale model estimates of tree cover and classification (Figure 6 to Figure 8).

NFSW classifies project cells into non-woody, sparse woody and forest with nominal canopy cover of 2.5%, 12.5% and 20% respectively, which represents class ranges of 0-5%, 5-20% and 20%+. There is no significant difference (p>0.05) in the mean of *in situ* measurements of canopy between the NFSW classes (Figure 6.), which indicates the variation in cover within each class is as great as between classes and that NFSW classes do not adequately correlate with canopy cover. In WA, less than 50% of plots classified as forest did exceed 20% canopy cover as measured on the ground; just over 50% of sparse woody were measured to have measured canopy cover 5% - 20%, but all of the non-woody had cover measured above 5%. In the Queensland projects, 80% of the sparse woody classified cells were in the correct canopy cover range, but only a few non-woody were correctly classified for *in situ* measurements as the measured canopy cover was mostly greater than 0 – 5%.

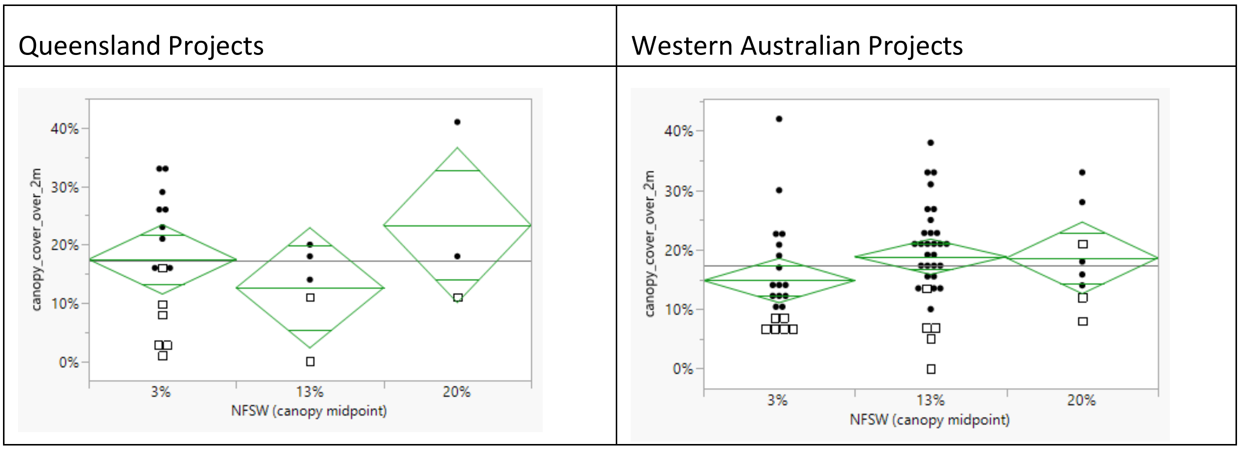


Figure 6: ANOVA for in situ canopy measurements against NFSW classes (Version 6.0 - 2021 Release). The diamonds represent ANOVA means and error ranges. Open squares represent plots where in situ measurements are similar to national-scale estimates

There was no significant correlation (p>0.05) between estimates by PG and *in situ* measurements of canopy cover (Figure 7). Two-thirds of the *in situ* measurements of canopy cover in Queensland and four-fifths on Western Australia were well above estimates by PG.

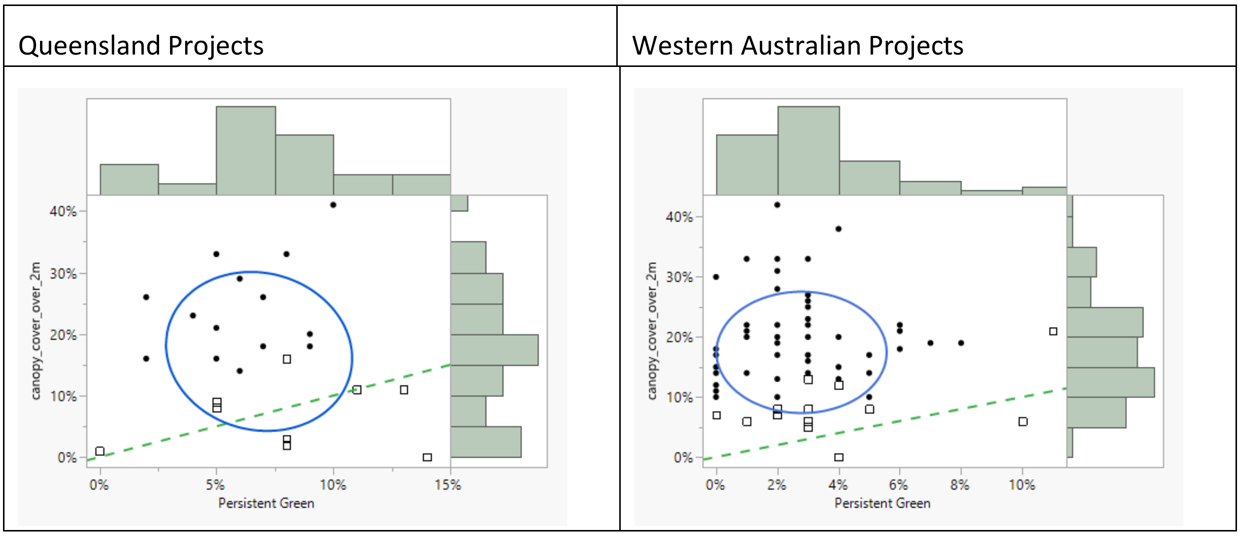


Figure 7: Plot of Persistent Green estimates (Landsat, JRSRP Algorithm Version 3.0 – 2021-03 to 2021-05 layer) against in situ measurements of canopy cover, with histograms of the X and Y distributions. Ellipse represents most compact 50% of data. Dashed line is 1:1. Open squares represent plots within expected distance of 1:1

There was a positive but very weak correlation (r^2=0.06) between AEE tree canopy estimates and *in situ* measurements of canopy cover, but again, most of the plot-based estimates of canopy cover were well above the AEE estimates (Figure 8). Most of the AEE estimates were less than 5%.

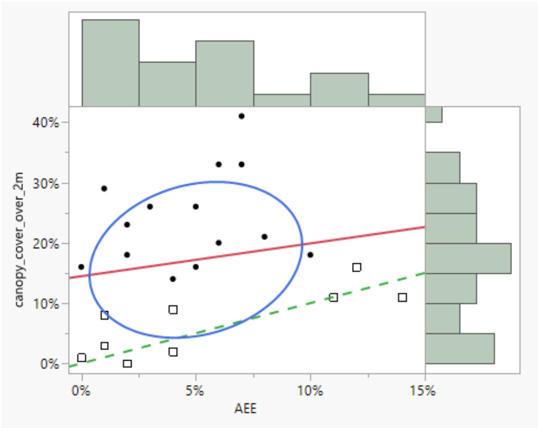
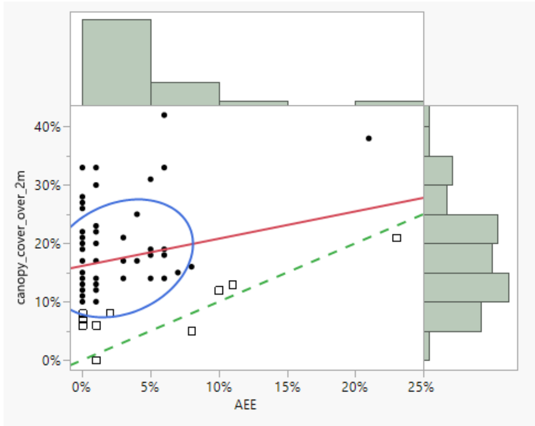
Queensland Projects	Western Australian Projects
	

Figure 8: Plot of AEE estimates against in situ measurements of canopy cover, with histograms of the X and Y distributions. Ellipse represents most compact 50% of data. Solid line is linear fit, dashed line is 1:1. Open squares represent plots within expected distance of 1:1

Further analysis of the relative bias of the national-scale models found that some land systems were significantly more biased than others. These land systems may have different soil colours or trees growing with different canopy architecture than areas where the national-scale models were calibrated and verified. CER observations that PG and NFSW model estimates changed substantially across soils with different colours supports the conclusion that not all the land systems or growth habits have been well represented in the model calibrations.

Different audit and measurement groups have standardized their *in situ* measurements and observations using a diversity of transect sizes and orientations, plot dimensions and tools for measuring canopy cover. Similarly, the national-scale models were developed from a range of satellites with different footprints and wavelengths, underpinning assumptions, use of annual (or other) mean data inputs and classification approaches. It is therefore not unexpected that there is no precise or very strong correlation between the *in situ* estimates and the national-scale models. However, it is surprising that in a number of cases there is not even a significant correlation (e.g. Figure 6 and Figure 7).

Different definitions of cover are used in some national-scale models and by different *in situ* measurement teams. PG, for example, estimates the cover of persistent green vegetation regardless of height. Some *in situ* measurement teams include only the canopy of trees that are 2 m or greater, while the definition likely to include the smallest canopy estimate (e.g., AEE) only counts the cover of the parts of canopies above 2 m. The systematic difference (bias) in cover estimates using these last two definitions may be substantial for trees with a conical habit and only just over 2 m in height, but will reduce with taller trees and more cylindrical or inverse conical habits.

For completeness, the national scale models at each point were compared with each other (Figure 9). NFSW classification as sparse woody, and to a lesser extent as non-woody, largely correlates well with PG and AEE canopy cover for Queensland. In contrast, the NFSW classification of non-woody is compatible with PG and AEE in Western Australia, but the sparse woody and forest classifications mostly contain points with less than the minimum canopy cover for those classes. Linear correlations between PG and AEE are significant ($p<0.01$) but relatively weak (r^2=0.22 and 0.17 for Queensland and Western Australia respectively). The slope of the line relating PG and AEE for Western Australia was not significantly different to 1:1, but was only 0.6 for Queensland (i.e., AEE estimates were about 60% of PG).

There were only seven points where all three national-scale models estimated that the area was sparse woody (5% - 20%) and in all these points except 1, the *in situ* measurement of canopy cover was within the anticipated range. However, there were 22 points when all three national-scale models estimated an area was non-woody, but only two of these areas had *in situ* measurements of less than 5%. There were no points where all three national-scale models estimated an area as forest.

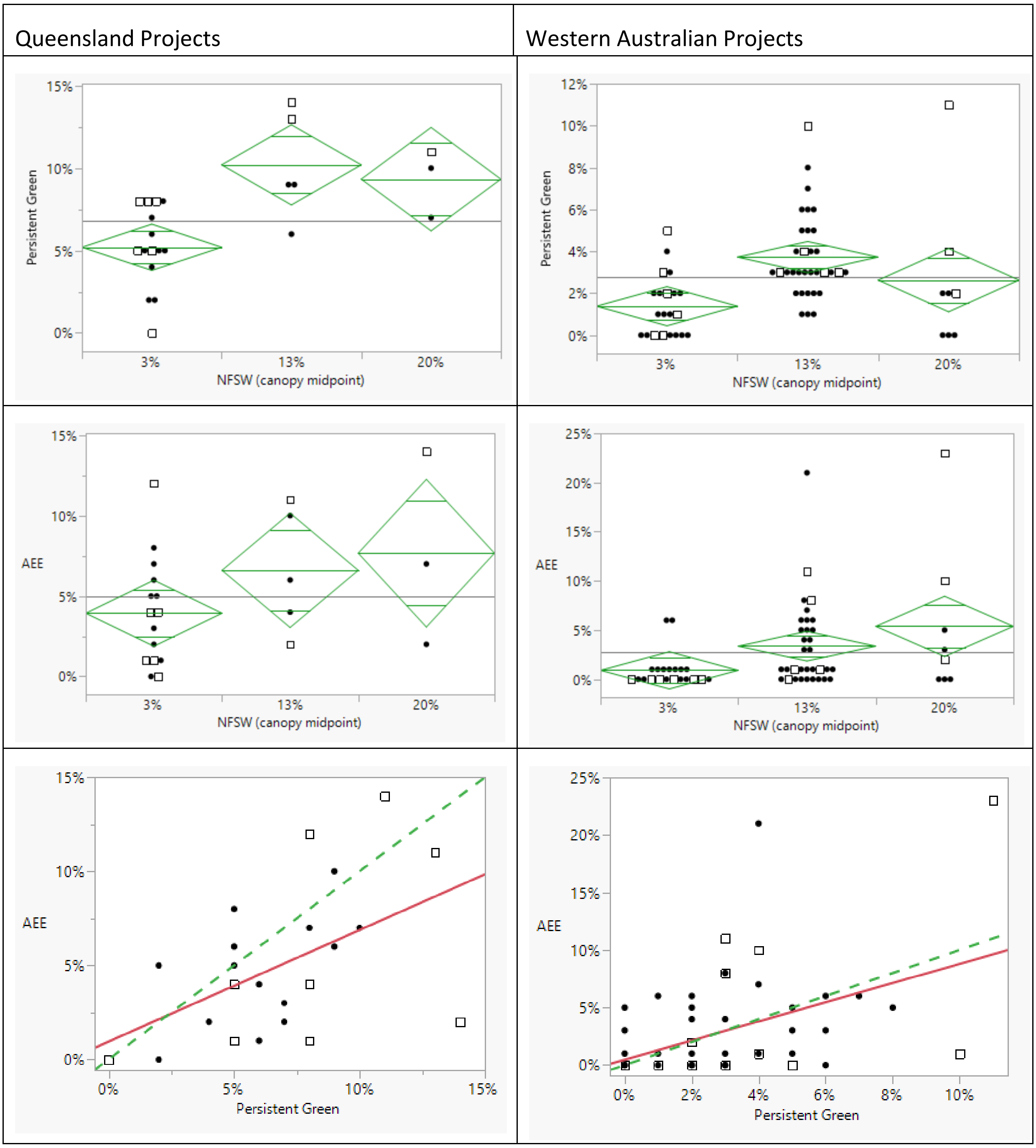


Figure 9: ANOVA means and XY plots comparing national-scale estimates for each plot. Symbols are as for other Figures

These results confirm the conclusions from the original review (see 1.1 above) that no single national-scale model is well suited to making estimates of canopy cover or cover change for these projects. Agreement amongst the national-scale models may depend on the State or location as well as how the relative biases interact. Similarly, using any single national-scale model to classify cells into canopy cover classes greater than 7.5% for regeneration threshold testing is unreliable and must only be used in conjunction with *in situ* measurements or large-scale remote imagery.

3.5. Net abatement

After the independent auditors confirm the reliability of the CEA stratification and FullCAM modelling, they confirm the net abatement calculations for each project (Figure 10). In the 18 reasonable assurance audit reports used for this review, abatement periods ranged from 6 months to 4 years. On average, the net abatement is about 1.1 t CO_{2E} ha^{-1} yr^{-1} for the CEA (or about 0.4 t CO_{2E} ha^{-1} yr^{-1} for the entire project area). There was a slight skew on the net abatement per total project area (Figure 10b) due to a number of projects having significant areas of non-CEA within the project, which may nevertheless benefit from proponent activities like feral animal control and fire protection. The abatement estimates are reduced by buffer and permanence deductions before carbon credits are issued.

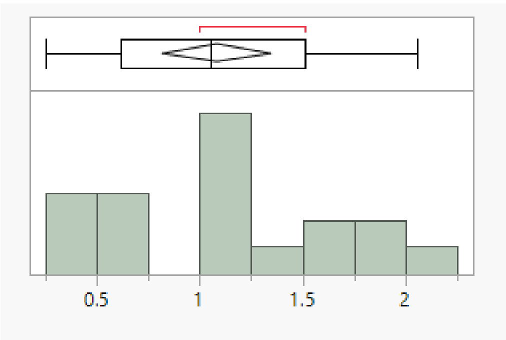
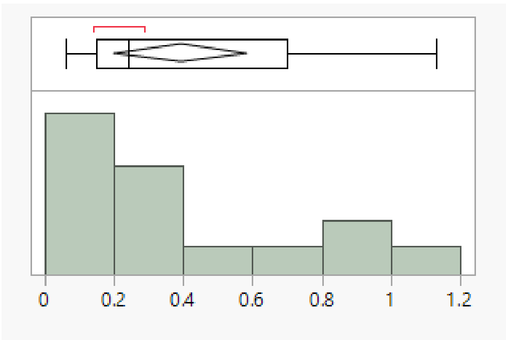
a) Net abatement t CO_{2E} ha^{-1} yr^{-1} of CEA	b) Net abatement t CO_{2E} ha^{-1} yr^{-1} of Project
	

Figure 10: Whiskers diagram and histogram of the net abatement (t CO_{2E} ha^{-1} yr^{-1}) estimated for each project after the independent audit

4. Conclusions

The independent audit reports and the CER reviews continue to provide strong assurance that projects are being managed and that appropriate methods have been used by the proponents or their agents in classifying the CEAs and confirming regeneration canopy cover is meeting threshold levels.

The CER reviews continue to utilize national-scale models to check whether regeneration thresholds at project and 100 ha scales are being met. However, the projects that are the subject of this report are established in areas where the national-scale models do not appear to be well calibrated or reliable. Substantive discrepancies between the models and the high-resolution data being used by proponents in stratification led to further information being required by CER before the regeneration check is accepted. Many proponents are now providing this additional data as a routine part of their regeneration checks and have formal methods to establish POPs, TOPs and FOPs.

On average, stratification into CEA that are regenerating and non-CEA is reliable and accords with good practice.

Appendix 1: Extract from Report 1

Gateway Regeneration checks

Regeneration on HIR projects is anticipated to be slow and patchy, although forest cover (20% canopy cover of trees exceeding 2 m height) is expected to be attained within each CEA within the project's 25-year crediting period. Additional gateway requirements, including 5-yearly regeneration checks and a final forest cover assessment date, were introduced in 2019 to build confidence that HIR projects are on track to meet the final forest classification and justify the allocation of ACCUs.

Regeneration gateway checks must occur about every 5 years after project initiation (or when requested by CER) until at least 90% of the project area is forested. To help reduce the impact of patchy (heterogeneous) regeneration, areas can be analysed in different spatial scales: up to 100 ha contiguous blocks for CEA's over five years since commencement; and 10 ha contiguous blocks for stands over 10 years. Areas identified as no longer on track will be stratified out, assigned a different start date, modelled as having a "growth pause" to reflect the carbon stock attained at the time, or excluded at this point.

While *in situ* field inspections are required for initial stratification, they are not mandatory for regeneration checks. Where field inspections are undertaken for regeneration checks, they must provide evidence that there are sufficient regenerating trees (trees ha^{-1}) that the expected mature canopy cover will exceed 20% of 2 m tall trees. An independent audit is required to provide "reasonable assurance" at the time of initial stratification / project commencement and the regeneration gateway. The proponent's offsets and auditor's reports submitted as part of the Gateway checks are reviewed by CER and proponents may be required to provide additional evidence as necessary.

Regeneration checks must demonstrate woody cover increase of 5%; sufficient trees ha^{-1} that their mature canopy will provide a total of 20% canopy cover; or 7.5% or 10% canopy cover at five or ten years respectively. Although change detection analysis (to demonstrate 5% growth) is preferred, the checks can use remote sensing images (to demonstrate canopy cover at a given time) or other approaches for flexibility.

There has been recent public discussion about the veracity of HIR projects and whether they were on track to deliver the carbon sequestration goals anticipated. This discussion included concerns that proponents were being credited for pre-existing forest, there was no net growth caused by the proponents or that any change in vegetation was just due to the weather. Subsequently, a requirement for an additional, independent review of the Gateway checks was created to "*provide additional information and assurance to satisfy the CER that the forest potential and forest cover attainment requirements under the HIR method have been met for all the CEAs in accordance with sections 9AA and 70(3A) of the CFI Rule and the HIR Guidelines*"