Gateway Regeneration Checks for Human Induced Regeneration projects

ANUE Project #1-1035 (Phase 4 part 1 for 2025)

C.L. Brack. Friday, June 27, 2025

Summary

This report continues the series of independent reviews of the process and outcomes of the Human Induced Regeneration (HIR) Regeneration Gateway Checks that began in 2023. To date, including this report, 75 projects that have passed Regeneration Gateway Checks have been formally reviewed. Field measurements from over 300 locations have been analysed and compared with agent stratification classes and estimates based on remotely sensed data. Several hundred geolocated photographs have been inspected for points with unclear classification.

Analyses of data provided in 2025 confirm the conclusions from the 2024 reports that national-scale models of tree cover, by themselves, are unreliable for evaluation of progress of Carbon Estimation Areas (CEAs) for substantial areas, especially in Western Australia. This lack of reliability is significant because relying on national-scale models of forest/tree cover to has led to inappropriate conclusions about the success of the HIR program. The Clean Energy Regulator (CER) does use national-scale models as part of their "*multiple lines of evidence*" approach, but given the unreliability of these national-scale estimates, includes other data and evidence. Field measurements and observations conducted by independent auditors and ecologists under expanded s215 audits are requested when multiple national-scale models indicate there may be a problem with the stratification of the project CEA areas. Although some areas were identified by CER for follow up, the *in situ* measurements found only a small percentage of physically inspected areas were incorrectly classified by proponents/agents; failed to reach regeneration thresholds; or had incompletely excluded non-CEA land.

HIR Proponents are *expected to select techniques that best increase certainty in their situation for assessing pre-existing forest cover, the forest potential and its subsequent regeneration toward forest cover (collectively forest regeneration) and attainment of forest cover (Australian Government (2019), page 9*[1]*).* In many cases, the agents employed by landholders to stratify their land have been improving their approaches and techniques compared to those used in the initial project establishment. These techniques include high resolution remotely sensed data (1 – 10 m resolution), LiDAR, digital photography and locally acquired algorithm training data to classify areas as non-potential, baseline forest or successfully regenerating CEAs. These improved techniques have led to some areas of pre-existing / baseline forests initially included in the CEA being removed. On average, about 1,600 ha or 6.2% was removed from the CEA of each project reviewed as a consequence of improved mapping or a failure to demonstrate meeting the minimum 5-year thresholds of regeneration success. Such removals could be reasonably expected given the scale and heterogenous nature of the original CEA areas. Identification and removal of non-compliant CEA areas adds confidence to the integrity of the methods.

[1] Guidelines on stratification, evidence and records for projects under the Human-Induced Regeneration of a Permanent Even-Aged Native Forest and Native Forest from Managed Regrowth methods. 8 May 2019. https://cer.gov.au/document/guidelines-stratification-evidence-and-records-hir-and-nfmr.

Independent checks by qualified auditors confirm good practice methods were used and CEA strata boundaries were reliable.

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

An increased focus on objectively located, field-based 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 CER.

One method under the ACCU Scheme is the Human-Induced Regeneration (HIR) method. This method aims to improve the forest canopy cover[2] (CC% of CPC) on degraded and deforested land. In essence, HIR projects identify land that has not been forested for at least a decade prior to project commencement but has potential to be regenerated as a forest[3] through undertaking approved activities, including the cessation of activities that were inhibiting regeneration. Successful HIR projects are awarded Australian carbon credit units (ACCUs) for each tonne of carbon dioxide equivalent sequestered by regenerating vegetation. The HIR program is now closed to new projects, but existing projects may continue to be awarded ACCUs provided they continue to meet requirements and maintain legislative compliance.

Proponents of HIR projects often engage commercial agents to undertake the stratification, data collection and modelling on their behalf. Auditors are independent professionals, drawn from a list of accredited organisations with appropriate inventory, ecology or forestry skills, to examine the work of the proponents/agents.

This report is a part of the series that began in 2023 to review the processes and outcomes of HIR Regeneration Gateway Checks. My 2024 report[4] reviewed 33 projects which included expanded data from the new s215 audits that were introduced. The findings from the 2024 report included:

> *…The independent audit reports and the CER reviews continue to provide strong assurance that projects are being managed appropriately and that appropriate methods have been used by the proponents or their agents in classifying the CEA and identifying changes in regeneration cover.*
>
> *An increased focus on objectively located, field-based measurements and georeferenced*

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[2] Canopy cover (CC%) or canopy projected cover (CPC) is the percentage of the ground covered by a vertical projection of the canopy. It assumes the canopies are opaque meaning that no light passes through gaps within the crown border.

[3] A "forest" in Australia is defined as an area of at least 0.2 ha with at least 20% canopy cover (CPC) of trees 2 m or taller. Forests can be further subdivided into "woodland"; "open" and "closed" depending on their CPC and "low"; "medium" or "tall" depending on their potential height.

[4] [Independent review of gateway checks December 2024 | Clean Energy Regulator]

photographs is required until national-scale models of tree cover become more reliable in the areas of large HIR projects…

Despite the above and conclusions by other independent enquiries[5,6], criticism of HIR administration and compliance has been raised, including in national newspapers during 2024 and 2025. This report is the first of two reports expected for 2025 and will discuss some of the public criticisms relating to the methods and identification of successfully regenerating CEAs. It continues the review process with an additional 16 projects that have completed HIR Regeneration Checks since the 2024 report.

2. 2025 Review data and method

Similar to previous reviews, CER provided data and details they had used to evaluate projects completing their 5-year regeneration check (Table 1).

A total of 16 projects were reviewed to date in 2025 (total reviewed in 2024 and 2025) (Figure 1):

- Queensland: 6 projects, mean CEA 15,000 ha (20 projects, mean CEA of 17,000 ha);
- New South Wales: 7 projects, mean CEA 13,000 ha (12 projects, mean CEA of 11,000 ha);
- Western Australia: 3 projects, mean CEA 22,000 ha (17 projects, mean CEA of 38,000 ha)

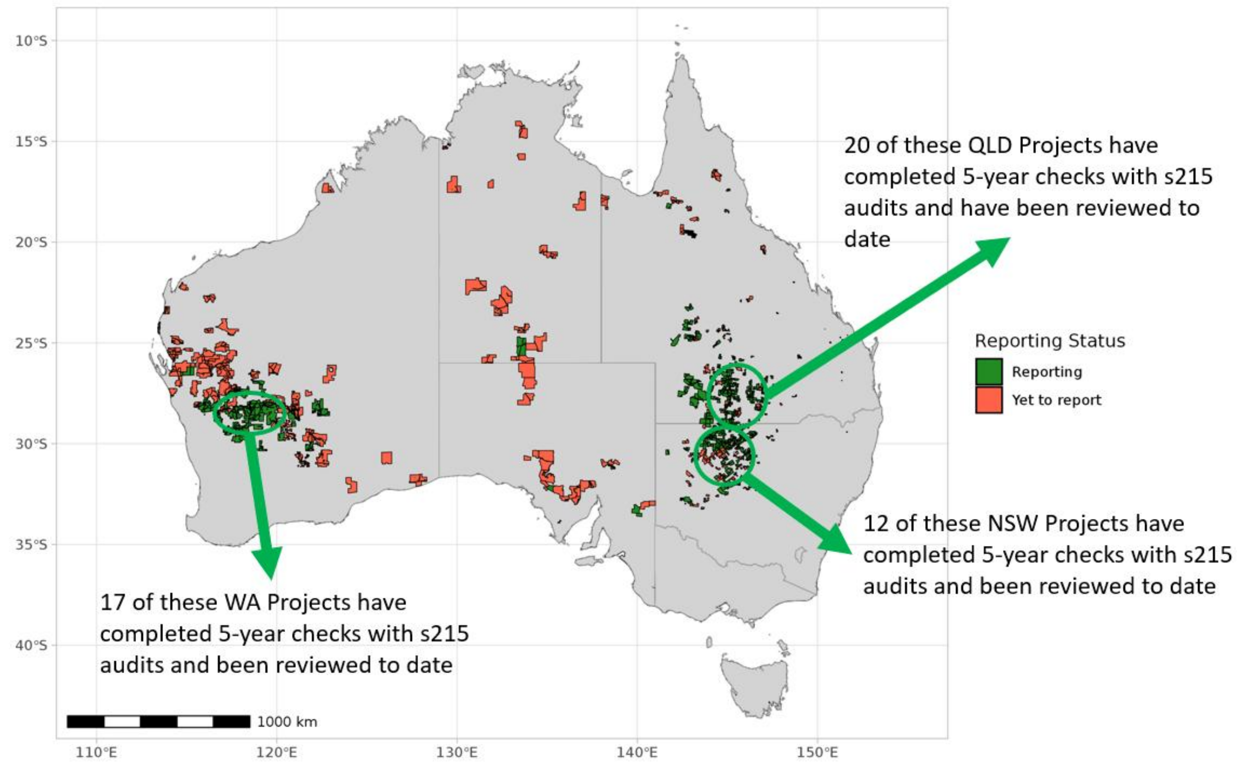

Figure 1: Map of HIR project areas with reporting status and general locations where projects have passed their 5-year reports, s215 audits and been reviewed. "Reporting" projects have submitted an offsets report and have received ACCUs. "Yet to report" projects have not received any ACCUs. A number of additional projects have also been reviewed but are not included as circled areas as they are too isolated to avoid being identified thus break confidentiality requirements.

[5] Chubb I, Bennett A, Gorring A, Hatfield-Dodds A (2022) 'Independent Review of ACCUs.' (Department of Climate Change, Energy, the Environment and Water: Canberra, ACT)

[6] Australian National Audit Office (2024) 'Issuing, Compliance and Contracting of Australian Carbon Credit Units.' (Commonwealth of Australia: Canberra, ACT)

For context, the *TreeChange* model (see Table 1) estimates that in 2023, land across all tenures in the general area of QLD identified in Figure 1 had a Woody Cover Fraction[7] (WCF[8]) of 0.6% – 7.2% and average tree height of about 1.1 m. The general area in NSW had WCF of 0.6% – 7.9% and average height of 0.9 m, while WA had WCF of 0.4% – 5% and height of 1.2 m. These WCF equate to CPC of about 1% – 12.6% for QLD; 1% - 14% for NSW and 0.7% - 9% for WA. *TreeChange* also estimates that since 1990, the mean WCF was around 2% - 6% for NSW and QLD, but steadily decreased from about 2012 until reaching a minimum in 2018 before slowing increasing again (Figure 2). *TreeChange* estimates that WCF for WA remained fairly constant at less than about 4% since 2005 but has been dropping since about 2018. Thus, *TreeChange* estimates that since 1990, on average, the areas around where HIR have been reviewed tend to oscillate between non-woody and the lower canopy cover end of sparse woody NFSW classes. The model does however estimate that there are areas withing the vicinity of the HIR projects reviewed that do exceed 2 m in height and 20% canopy cover thus providing confidence that forest cover can be achieved in some places (Figure 3). If the management regime, on average over these very large areas, has remained relatively constant, the peaks and troughs with 1 – 2% variation around the mean in WCF may be related to rainfall cycles associated with climate patterns like La Nina or El Nino.

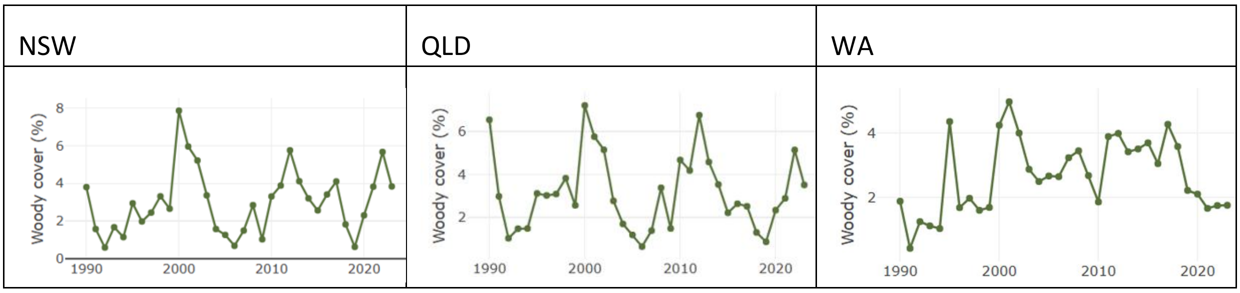

Figure 2: Estimates of WCF from the TreeChange model for the general areas indicated in Figure 1 around the HIR projects reviewed to date.

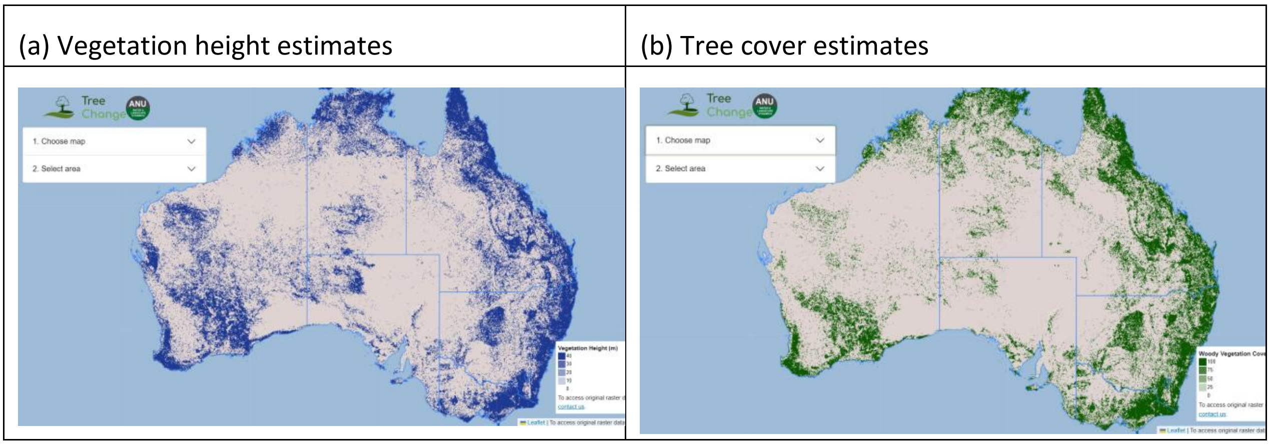

Figure 3: Tree Change estimates of where vegetation (a) exceeds 2 m and (b) WFC exceeds 12% (CPC exceeds 20%). Areas where both exceed the thresholds may be forest

[7] 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

[8] WCF is similar to CPC except that it does not assume the canopy is opaque. Gaps in the canopy do not contribute to the fraction covered and therefore WCF < CPC at any given point

Table 1: List of data / datasets provided for Brack 2023, 2024, 2025 reviews

Data, documents	Description	Source	Use in Brack reviews
Reasonable Assurance Audits of projects Note: Audits are peer reviewed by a third party to "*support the audit approach, findings and conclusions of the Audit Team*"	Auditors review documentation, data and processes to confirm the proponent met requirements of the HIR methodology; reported appropriately; and that the project has been implemented in accordance with the relevant methodology determinations and requirements of the CFI Act and CFI Rule, and associated guidelines (including the CFI Mapping Guidelines and HIR and NFRM Stratification Guidelines.	Independent greenhouse and energy auditors	Audit reports for each project were reviewed and any "issue/risk" identified by the auditors noted and impacts considered. Areas considered by Auditors were extensive and ranged from legal eligibility; stratification; modelling and calculations; documentation; and controls to prevent fraud. No project passed its 5-year review if there were unaddressed medium- or high risk-issues
Documentary evidence of management activities	Various documents, including invoices, sales dockets and other material to demonstrate project proponents met their requirements to fence, trap or otherwise remove feral animals; reduce/manage grazing/browsing to demonstrably safe level; etc.	Proponents (also sighted by auditors)	Examples sighted to confirm evidence that appropriate management action existed
Maps of stratification into baseline/pre-existing forest; non-project; and CEAs	Physical and/or digital maps along with details of map construction: satellite resolution (usually 1.5 – 10 m), supervised/unsupervised techniques, training sites and *in situ* data collection	Proponent / Agents	Physical maps sighted (or GIS layers accessed) to compare/contrast with other sources of evidence, especially AEX. Test accuracy with s215 field data.
Estimation of proponent's map accuracy,	Confusion / error matrix or other description of map accuracy. Description of accuracy analysis.	Proponent / Agents	Confirm accuracy evaluation and that accuracy exceeds acceptable threshold (85%). Noted any "justification" if poorer levels of accuracy were observed. Identified potential areas for further analysis
Maps of CEA strata with canopy cover (CC%)	Maps generated by agent's stratification and modelling. Aggregated into 100 ha cells for comparison with minimum threshold values	Proponent / Agents	Check to confirm CEAs meet 5-year thresholds, i.e. at least 7.5% canopy cover at 100 ha scale; or 5% increase in canopy cover. Access if any restratification occured to exclude portions of CEA that were insufficiently regenerating and failing to meet thresholds

Photographs and field measurements of CEA	Georeferenced photographs, measurements and descriptions of Permanent Observation Points (POPs) or Temporary Observation Points (TOPs) as volunteered	Proponent / Agents	Samples sighted to provide "overall" feeling for the projects [Note TOPs not included in statistical analyses in section 3.3 to avoid perception/potential for biased sample point selection]
Maps of canopy cover estimates derived from NFSW[9] Various versions and release dates to match the reporting period	CPC estimated for 100 ha cells using conservative estimates of average CPC in each NFSW strata.	NFSW / National Inventory through DCCEEW, and accessed via data.gov.au	Compare/contrast canopy cover estimates with the Agent produced maps. Note patterns; any substantive difference in maps; and areas where 100 ha cell fail to meet minimum thresholds.
Maps derived from Persistent Green[10] (PG), (Auscover) Various versions and release dates to match the reporting period	Persist vegetation coverage estimates in 100 ha cells.	TERN, physical maps provided by CER	As for NFSW, but noting PG theoretically includes estimates of vegetation cover regardless of vegetation height
Mega Forest Cover Tool	A purpose-built analytical spreadsheet tool tracking change in vegetation cover within CEAs and project area using multiple data sources including each version of the maps that inform the National inventory from 2015 to present	CER, using National inventory data accessed via data.gov.au	Check whether project meets the 5% increase in canopy cover threshold
Documents and emails on CER comparisons of canopy maps	Analysis and comment on any substantive differences between NFSW, Persistent Green and Proponent values at 100 ha scale, and requests for further evidence as required	CER	Check whether CER analysis agree with mine and what additional evidence would be needed to provide assurance
Historic / archive remote sensing images	Sequences of images for sample areas where there is concern that thresholds not being met	Wayback imagery via CER	Samples checked to see if I agree with CER conclusions about the temporal images indicating increases in cover
Additional evidence provided in	Georeferenced photographs and/or in-situ	Proponent / Agents	Used in statistical analyses (section 3.3) given CER

[9] Australian Government (2019) National Inventory Report 2017: Volume 2 [page 149]

[10] 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.

response to CER identification of "points of interest"	measurements of canopy cover / number of trees capable of achieving 2+ m height for areas, including those selected by CER for follow-up		assign POI locations and proponents/agents have restricted potential to bias sampling.
Australian Environment Explorer (AEX) integrated data visualization and modelling via TERN) Estimates of current/historic weather; soil condition; fire; social/management; environmental condition and Woody Cover Fraction[3] (WCF)	20 – 30 points / project (600 points overall) systematically examined using remotely sensed imagery in 2023 250+ points of interest across about 50 projects in 2024, 2025.	https://ausenv.tern.org.au/aex/ ANU Water and Landscape Dynamics	WCF used in accuracy estimates of agent estimates (2023) and comparisons with all other canopy cover estimates available to CER in 2024, 2025 (section 3.3) AEX also provides comprehensive contextual information to improve interpretation of estimates
TreeChange	Estimates of WCF, vegetation height and biomass over user nominated areas	http://www.wenfo.org/tree/ ANU Water and Landscape Dynamics	Comprehensive contextual information about vegetation dynamics surrounding project areas. Provides confidence forest cover can be achieved if vegetation in neighboring regions has reached minimum heights and cover
Offsets reports	Details of modelling, any changes in stratification, offset calculations and modelling	Proponent / Agents	Data to support statistical analyses (Sections 3.2 and 3.4).
s215 audits	Reports and raw data including georeferenced photographs, in situ measurements of tree canopy, regeneration and comments on likelihood of achieving forests status at Points of Interest (identified by CER) and Temporary or Permanent Sample Points selected by auditors	Independent and registered audit teams (including ecologists/foresters with relevant expertise) 2024, 2025	Used in statistical analyses and independent accuracy assessment of agent stratification (section 3.3) given CER assign POI locations and proponents/agents have restricted potential to bias sampling. Review of auditors' expert assessments on the accuracy of proponent's mapping and whether CEAs are meeting regulation conditions

[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

Permanent Observation Points (POPs) or Temporary Observation Points (TOPs) were provided for most projects (e.g., Figure 4). There are no “HIR standardized” requirements for these observations points and the various teams use different measurement techniques and approaches. Most points collect quantitative data (tree canopy, species and height) along one or more transects at each point. The total transect area at each point is at least 0.10 ha although this can be made up from 1 – 3 transects established as a cluster. Georeferenced photographs are taken from cardinal directions or other systematic approaches. Most observation points are selected using a “restricted sampling” approach that avoids impractical travel time but still covers the heterogeneity of the CEA. Agents use a variety of measurement tools, including LiDAR and Unmanned Aerial Vehicles (UAVs).

I personally attended a field trip in 2024 to Western Australia where I observed teams of auditors establishing their field plots and collecting information about species, canopy, condition and presence/absence of regeneration or pre-project trees. I confirmed that the auditors were using appropriate techniques for their measurements. A similar field inspection scheduled for the first half of 2025 was postponed due to floods, but it is expected to be undertaken in time for the next report.

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 4: Example of data collected at one POP in Western Australia (reprinted from 2024 report. Examples for 2025 are similar)

3. Results

3.1. Management actions

Common sources of degradation include over-grazing or over-stocking of domestic animals, unnaturally high populations of native animals due to artificially plentiful water, altered fire regimes and feral animals. Populations of domestic and native animals compete for palatable grasses and vegetation, but if the population numbers are too high, competition will force animals to consume less palatable vegetation including tree seedlings and regeneration. Feral animals like goats browse woody vegetation, including regeneration and tree canopies, by preference. Overstocking can also lead to soil compaction and changes in soil chemistry that inhibits regeneration. Cattle may trample coarse woody debris on the ground and break it up into smaller pieces that are less resilient to decay. Coarse woody debris influences the microclimate and its loss reduces the chances of the success of seed germination, especially in harsher climates. Removing sources of degradation like excessive animal populations allows the land to "*rest and recover*" – improving soil condition and microclimates necessary for successful seed germination as well as reducing losses through over browsing.

HIR relevant management actions thus includes (but is not restricted to) reducing stock numbers, fencing to restrict animal movements, capture of (humanly) killing feral pests, supplementary feeding and using controlled water point management to effectively control over-grazing and other degradations caused by large numbers of animals. Evidence of these actions are included the auditors' reports and personally sighted copies of relevant bills of sale, invoices for fencing materials and water point maintenance.

Independent auditors also regularly report on the impact on soil of historical stocking levels (Table 3). A significant reduction in stocking numbers reduces the direct damage to canopies as well as allowing for natural restoration of soil chemistry and structure necessary for regeneration.

Management actions may include feral animal control (pigs, goats, horses and camels), again as evidenced by the auditors' reports and personally sighting of copies of invoices/sales documents. Evidence of fire trail construction and maintenance to help ensure permanence of the carbon stock and mitigate against the risk of significant reversal, was also sighted. 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. Similarly, improved wildfire control or management would potentially help reduce potential carbon losses over the entire project area.

One of the public criticisms of HIR is the assertion that only land that has been "comprehensively cleared" (using bulldozers and/or chemical treatment) should be eligible[11] and the only management action of relevance is the cessation of such clearing. In contrast, land that has been degraded, possibly with some remnant trees but less than a minimum canopy cover, are considered potentially eligible HIR projects if management can reduce one or more sources of degradation. The degraded land must have the potential to recover and achieve forest status within the project timeframe. Evidence to support the likelihood of such recovery includes the presence of species in the general area that can contribute to forest cover, site quality[12] that is sufficiently good to support a forest and/or the presence of nearby forests that may not have been subject to the sources of degradation. During field inspections, agents and auditors are expected to note whether there are significant numbers of remnant trees or advanced regeneration likely to have been established in the years before the project that would make the area ineligible as a CEA (Figure 4, Table 3, Table 5).

Anecdotal evidence from participants in HIR supports the argument that removing sources of degradation can lead to successful regeneration of previously grazed land. For example, a landholder interview[13] details how the regeneration on his CEA is growing "*like there's no tomorrow*" once it was protected from grazing.

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[11] The Saturday Age 8/2/2025, pages 31, 34, 35.

[12] Site quality results from the range of environmental factors that influence growth, including: climate, soil and topography. The "M layer" used in FullCAM is one measure of site quality.

[13] The Saturday Age 8/2/2025, pages 31, 34, 35.

3.2. Stratification

Projects are stratified by proponents / agents into CEAs, pre-existing or baseline forests, and areas of non-potential / excluded area at project initiation. These initial strata are based on the best available data at the time but may include inaccuracies due to incomplete history records or the use of imprecise maps. Additionally, CEAs originally identified as having forest *potential* or an *expectation* that they will recover may not eventuate or may be too slow to achieve forest status within the project timeframe. Proponents consequently may need to re-stratify or correct their CEAs as better information becomes available (e.g., improved mapping of baseline forest) or regeneration is observed to fail minimum thresholds. Such re-stratification is expected and the method and HIR guidelines allow for appropriate re-calculation of abatement values.

Many projects used the National Forest and Sparse Woody (NFSW) data to initially stratify into pre-existing/baseline forest; sparse woody; and non-woody. Although NFSW is one of the sources used to support Australia's National Forest Inventory, it is known to have imprecision and bias issues in the poorer site quality and low canopy cover regions due to the resolution of input data and disproportionate calibration away from typical HIR landscapes. Australia's State of the Forest Report (2018) for example found that substantial areas of the Northern Territory were not reported as forest in the 2013 analysis but improvements, including adopting the 'Multiple Lines of Evidence' approach instead of just relying on NFSW, allowed for correction[14].

Projects reviewed in 2025 again used high resolution satellite imagery (SPOT with 1 / 1.5 m resolution or Sentinel 2 with 10 m resolution), which is superior to NFSW and other national-scale forest or vegetation cover models for these regions. 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 classification included high resolution remote photographs and ground plots (including Temporary or Permanent Observation Points - TOPs, POPs). HIR guidelines specify that classifications can only be accepted if the accuracy rate was at least 85%, but often the accuracy was greater than 90%.

Some Agents have increased their use of tree canopy maps derived from LiDAR or UAVs, to either improve stratification or develop more sophisticated models that allow geo-specific canopy cover estimation. When incorporating new technology and approaches like LiDAR, several Agents presented their designs to CER representatives and myself to confirm the method reliability and sampling credibility.

Independent auditors confirmed the classification methodologies met good practice standards and that boundaries were reliable (Table 1).

Restratification commonly found parts of a CEA had not achieved the minimum canopy cover originally predicted as capable of being met within 5 years. For the projects reviewed to date, an average of 1,600 ha or 6.2% of original CEA areas (and any previously credited carbon) were removed due to restratification (Figure 5). Given the original stratification into CEA using poorer resolution information and the imprecision of estimating regeneration over 5 – 10 years, such a reduction is not unanticipated and procedures for changing the CEA areas and reimbursing any credits are documented. Some CEA reduction is the result of improved mapping identifying area as baseline or pre-existing forest that are not eligible CEAs. The systematic identification and removal of non-compliant CEA areas adds confidence to the integrity of the methods.

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[14] Montreal Process Implementation Group for Australia and National Forest Inventory Steering Committee, 2018, Australia's State of the Forests Report 2018, ABARES, Canberra, December. CC BY 4.0 (2018, p 45)

A newspaper article in 2025 included interviews[15] with proponents who were concerned about the restratification and the subsequent loss of their anticipated income – one proponent redefined restratification as "*shrinkage*" while another commented their eligible land "*keeps getting chiselled back and chiselled back*" and "*some of these areas have been cut back by 40 to 50 per cent . . .*" Almost all of the CEA have at least some minor reduction in areas after their 5-yearly checks, however none of the 75 project examined to date have lost over 30% of area while half have been reduced by less than 5% (Figure 5). Essentially, 5-yearly checks can only result in no change or a reduction in CEA if previously included areas are found to be ineligible. If areas previously thought to be ineligible are found to be eligible, they could be included as new CEAs rather than being added to an existing CEA but would only be credited for the remainder of the crediting period.

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

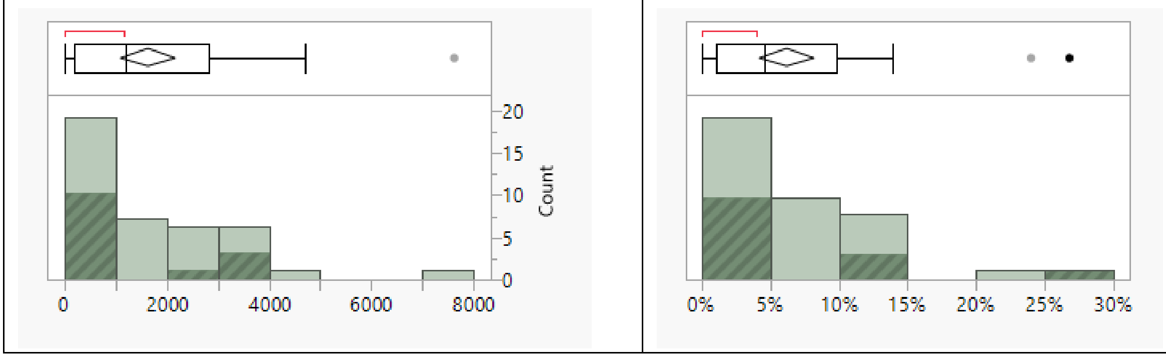


Figure 5: Whiskers diagram and histogram of the reduction in original CEA area as a result of proponent restratification to exclude non-performing areas. Highlighted data were collected in 2025. [The box in the center of Whiskers plot contains 50% of the data – from the 25th percentile to the 75th percentile and is divided by a vertical line at the 50th percentile or median value. The diamond is centered on the mean with a width of ± standard error of the mean. The "whiskers" extend to the furthest observation that is not assumed to be an outlier. The ● is a potential outlier]

3.3. Regeneration checks

The 5– year regeneration checks require proponents to demonstrate that the CEAs have increased canopy cover by at least 5%; or achieved a canopy cover of at least 7.5%; or have sufficient stems of appropriate species that they will be at least 2 m in height and achieve a canopy cover of 20% within the project timeframe.

As detailed in 2024, CER compares proponent stratification of successfully regenerating CEAs with several national-scale models and databases. The area in the (updated) CEA stratification is intersected with cover estimates generated by the national-scale vegetation cover model at a 100-ha cell resolution to provide confidence in the agent estimates and that the CPC is at least 7.5%. However, the national-scale models have different levels of precision, different relative biases, and in some cases are estimating different things. Persistent Green, for example, estimates the cover of persistent (non-annual) vegetation cover, regardless of height, but Gill et al (2017)[16] warn that it may not be reliable when cover is in the range of 3% - 17%.

NFSW identifies three classes based on the canopy cover of trees greater than 2 m height: non-woody (CPC less than 5%, nominally 2.5% average cover); sparse-woody (5% - 20%, nominally

[15] The Sunday Age 9/2/2025, pages 21 – 23.

[16] Tony Gill, Kasper Johansen, Stuart Phinn, Rebecca Trevithick, Peter Scarth and John Armston (2017) A method for mapping Australian woody vegetation cover by linking continental-scale field data and long-term Landsat time series, International Journal of Remote Sensing, 38:3, 679-705, DOI: 10.1080/01431161.2016.1266112

12.5%); and woody (greater than 20%, nominally 20%). The accuracy rates for correctly identifying non-woody and woody classes in NFSW are reported as high (95% or greater), but there is much poorer accuracy reported[17] for sparse-woody (only 66%). Notably, most of the CEAs could be expected to be in the 3% - 17% cover or sparse-woody class during the 5 – 10 year regeneration check period (see also Figure 2). Within 10 – 15 years, all the CEA area should be in the *woody* class with CPC of 20% cover or more.

As reported in 2024, national-scale model estimates were not consistent and often contradictory (Table 2), however the various maps produced could identify areas likely to be above threshold regeneration (i.e., agrees with proponent / agent mapping) as well as potential problem areas and mismatches with agent maps. Some of the locations where CER processes identified possible failures in agent maps of successfully regenerating areas were selected for examination with time series of remotely sensed images (Wayback[18]) and data provided by AEX (Figure 6). If the national estimates were concerning and the Wayback images did not support the agent maps of improving regeneration, additional evidence was required from the proponent. The additional information often included georeferenced photographs[19] of "representative" areas of the CEA which CER could use to identify trees and regeneration success contrary to national-scale estimates. In 2024, studies of Wayback images provided evidence of positive regeneration for the majority of locations where the national-scale models suggested a lack of regeneration. Similar trends were observed for many new projects in 2025 although in one example the Wayback images suggested only "*some regeneration evidence*" when NFSW indicated most cells failed to achieve 7.5% and MegaForest found a "slight positive trend". This project was returned to the proponents for revision.

Table 2: Results from example CER checks where national-scale models resulted in inconsistent predictions about meeting regeneration thresholds at 100 ha scale (Data from 2024 with additional examples from 2025)

State and nominal project number	**CER analysis (sighted) summary**		
	Persistent Green / AUSCOVER at 100 ha grid cells, percentage above 7.5%[20]	**NFSW at 100 ha grid cells, percentage above 7.5% CC nominal[21] threshold**	**MegaForest tool**
NSW #1 2024	Positive trend with all cells > 7.5%	All fail at 7.5%	CEA woody cover increased from almost 0% to 12%
NSW #2 2024	All cells pass in northern CEA, but southern part 50% fail	Increase in cover but most cells fail at 7.5%	CEA woody cover increased over 6%
NSW #3 2024	Positive trend with all cells > 7.5%	94% of cells pass 7.5% check.	Small positive trend with increase 6%-9%
NSW #4 2024	Positive trend with all cells > 7.5%	87% of cells pass 7.5% check. Cover increased by 26%	Positive trend with non-woody decreasing from 48% to 38%

[17] Australian Government Department of the Environment and Energy (2019) National Inventory Report 2017 Volume 2. Figure 6.A.7
[18] https://livingatlas.arcgis.com/wayback/
[19] Some proponents/agents provided over 100 such photographs
[20] PG includes all permanent vegetation regardless of height and would be expected to overestimate CPC
[21] CPC is inferred from the numbers of pixels in the 100 ha in each NFSW class with each class given a conservative value, i.e., non-woody (0-5%) assigned 2.5%; sparse woody (5-19%) assigned 7.5% and woody (20%+) assigned 20%

QLD #1 2024	Negative trend with only 5% of cells > 7.5%	50% of cells pass (but failures appear related to changes in soil colour)	Positive trend with 5% increase QLD SLATS database concludes 100% pass 7.5% cover
QLD #2 2024	Positive trends with 70% of cells over 7.5%	90% pass 7.5% check Cover increases by 6.4%	Positive trend with 4.5% increase QLD SLATS database concludes 100% pass 7.5% cover
QLD#3 2024	No change. Majority of cell < 7.5%.	27% of cells pass 7.5% check Cover increased by 7.7%	Positive trend with cover increasing from 6% to 11%
QLD #4 2024	50% of cells over 7.5% Regeneration evidence and positive trend towards regeneration over the last five years	Most pass 7.5% check, minor areas of concern Regeneration evidence Positive trend towards regeneration over the last five years	woody vegetation increasing from 13% at project start to 25%
WA #1 2024	20% of grids > 7.5%;	80% of cells pass 7.5% check	Positive trend with woody cover increasing 9%
WA #2 2024	No regeneration (stagnant trend)	All except partial boundaries pass at 7.5%	Positive trend with woody cover increasing 10%
WA #3 2024	15% of cells over 7.5% Negative trend	43% of cells pass 7.5% check	positive trend with woody cover increasing 6%
WA #4 2024	10% of cells over 7.5%	80% of cells pass 7.5% check	positive trend with woody cover increasing 6%
NSW #1 2025	No regeneration, negative trend. 9% over 7.5%	Regeneration evidence and positive trend. 94% above 7.5%	Regeneration evidence and positive trend
NSW #2 2025	Regeneration evidence and positive trend. All but 1 cell greater than 7.5%	Some regeneration evidence and positive trend. 63% less than 7.5% with some sparse woody -> non-woody	Regeneration evidence and positive trend
NSW #3 2025	Regeneration evidence and positive trend. 62% above 7.5%	Regeneration evidence and positive trend. 42% above 7.5%	Regeneration evidence and positive trend
QLD #1 2025	Regeneration evidence, 99% above 7.5%	Regeneration evidence and positive trend. 58% above 7.5%	Regeneration evidence and positive trend
QLD #2 2025	Regeneration evidence and positive trend. 100% above 7.5%	Some regeneration evidence, trend towards. 50% above 7.5%	Some regeneration evidence with negative then positive trend over past 5 years
QLD#3 2025[a]	Minimal regeneration, minimal positive trend, most cells fail at 7.5%	Some regeneration evidence, moderate trend towards regeneration. 6% above 7.5%	Some regeneration evidence with moderate trend
WA #1 2025	Minimal regeneration, stagnant trend. 76% of cells less than 7.5%	Regeneration evidence and positive trend. 87% above 7.5%	Regeneration evidence and positive trend

WA #2 2025	Minimal regeneration, positive trend. 64% of cells less than 7.5%	Regeneration evidence and positive trend. 91% above 7.5%	Regeneration evidence and positive trend
WA #3 2025	Limited regeneration, stagnant trend	Regeneration evidence and positive trend. All western portion above 7.5%, some eastern failing	Regeneration evidence and positive trend

[a] *Proponent provided over 700 georeferenced photographs to provide evidence that regeneration of appropriate species was occurring. CER advised proponent to establish a network of formal monitoring sites to improve confidence before next check*.

If substantial concerns remained after these cross-checks, CER required an expanded s215 audit and professional teams of auditors with ecologists/foresters collected field data at points of interest (POI) to clarify regeneration success and forest potential. If the s215 audit or other analyses concluded that areas of a CEA were inadequately regenerating or included baseline / pre-existing forest, the proponent was required to correct their CEAs to only include eligible land before the next review. This correction may include recalibrating the agent's supervised classification model to restratify the project, exclude all similar area around the POI found to be ineligible, or otherwise account for the deficiency.

Field data, collected voluntarily or as a requirement of an expanded s215 audit, includes georeferenced photographs, descriptions by qualified ecologists (similar to Figure 4) and extensive measurements of trees, shrubs and regeneration along one or more transects. Transects were established at POI selected by CER and at Temporary and Permanent Observation Points (TOPs, POPs) established as part of an audit processes.

The POI are primarily selected to provide assurance that the proponent's stratification is reliable. Similarly, other field measurements (POP, TOP) are designed to support the project-scale models and mapping developed by agents.

The POIs are often located at parts of the CEA where CER has identified potential issues with proponent stratification or other issues and so may not be representative of the faster growing or taller and more dense CEAs. However, POP and TOP established by the independent audit team may include a broader range of sites all the geolocated field measurements allow direct comparison of canopy statistics with national-scale model estimates.

Over 300 locations across three States were geolocated and each point was identified in Australia's Environment Explorer (AEX) (Figure 1). The associated remotely sensed imagery and data layers from AEX (Table 1) were examined to check whether the point was in a relatively homogeneous area (Figure 6). If the location was too close to changes in vegetation type or other boundaries it was excluded from this analysis. The CPC measured by the auditors on the transect at each POI were compared with the proponent's strata classification; Persistent Green; NFSW and WCF[22] (e.g. Figure 6).

[22] WCF estimates from Australia's Environmental Explorer were transformed[22] into canopy cover estimates (CPC) using the method of Fisher, A., Scarth, P., Armston, J. and Danaher, T. (2018) Relating foliage and crown projective cover in Australian tree stands. Agricultural and Forest Meteorology 259; 39 – 47

Table 3: Example extracts from s215 audit reports by ecologists with descriptions of sites and comments on likelihood of meeting forest cover in time (subset from POIs with canopy cover measured at less than 7.5%)

Likelihood of achieving forest cover	Description
LOW	*Open low Acacia aneura – Eremophila sp. Woodland. A previously cleared area with more than 80% bare and compacted soil with a sparse shrub and tree cover. Only two woody plant species occurred on this site, Acacia aneura and Acacia brachystachya.*
HIGH	*Dodonaea viscosa (Hopbush) Eremophila clarkei (Turpentine bush) Acacia sibirica (Bastard mulga) Acacia incurvaneura (Narrow leaf wattle) Geijera parviflora (Wilga) Acacia ramulosa (Horse Mulga) correctly mapped as CEA and has the potential to reach 20% based on the number of stems.*
LOW	*only Bloodbush (Senna artemisiodes subsp. oligophylla) that may have the potential to reach 2 m in height, however no species was measuring >1 m at time of survey. With this limitation and the slow growth represented in each of the identified canopy species, it is considered a low likelihood that this zone would reach required future forest cover*
HIGH	*strong native coverage and is considered a high likelihood that this zone would reach required future forest cover*
LOW	*limited native coverage due to most of the present canopy species being dead without any evident regeneration. It is considered a low likelihood that this zone would reach required future forest cover*
MEDIUM	*Fail now, but potential forest. Open low Acacia aneura Woodland. The soil in the area was observed to be much compacted and trampled by livestock in the past. Dieback was present as a result of drought of at least 50% of the Acacia aneura (Mulga) shrubs and nearly all the Eremophila (Emu bushes) shrubs in the area.*
NO POTENTIAL	*NOT potential forest. very sparse tall Acacia aneura Woodland. A previously overgrazed area with less than 10% bare and compacted soil with an open shrub and tree cover. Only one woody plant species occured on this site, Acacia aneura (Mulga) as the dominant species, with an Eremophila sp. as the subshrub dominant species. Many of these subshrubs were dead as a result of past drought periods.*
HIGH	*Likely to achieve forest in 10 years. appear to have been affected by drought dieback that was approximately 10 years or more old. It is comprised of a mulga open shrubland and low open woodland with emergent poplar box trees*
LOW	*Ecological assessment indicates that it is doubtful that forest cover will be achieved in the next 10 years, transect data suggests there may be potential for forest to be achieved in the next 10-20 years at this site based on stem density data.*
LOW	*Open acacia woodland, sandy surfaced. Overstory of sparse mature jam and naked lady. Understorey of cassia, salt bush, jam, naked lady, kurara, broom bush.*
HIGH	*Sparse over storey of eucalyptus mallee at 3-5m, bottle brush hakea at 2.5m, sugar brother at 2-2.5m. Good regen of sugar brother 0.5-2m, eucalypt mallee at 1.5m, needle leaf bowgada at 1m - 1.5m. Understory dominated by thryptomeme shrub, sparse spinifex. Located on a light red sandy loam in fire scar. Occasional standing dead wood. No drone flight conducted as too windy.*
MEDIUM	*Shrub vegetation abundant and dense but below 2 m height. Mature canopy expected to reach forest cover.*
MEDIUM	*Only one stem > 2m height, does not meet canopy cover threshold. Ok density of stems below 2m height, mature canopy expected to reach forest cover.*

In the AEX example in Figure 6, all the national-scale model estimates are similar to the CPC as measured on the 0.10 ha field transect. Although not clearly visible on the remotely sensed image, the ecologist in the audit comments that the transect included "*34 regenerating stems (under 2 m) were observed and composed of Acacia aneura, Eucalyptus populnea, Eremophila sp. and Corymbia terminalis [equivalent to 340 stems ha^{-1}] …. SUFFICIENT STEMS TO REACH 20%*". The NFSW at this location is technically mis-classified (non-woody instead of sparse woody) but it is very close the boundary and not an issue. Note too that the AEX plot of Tree Cover (WCF) is quite variable during 2021-2024 – bouncing from 0% to 6% then 3% and finally 7% (equivalent to CPC rising from 0% to 13%). The difference between CPC and WCF is that CPC includes all the fraction that is contained within the boundary of the outer crown while WCF excludes any "holes" in the crown, thus CPC is greater than WCF. CPC is also more variable than WCF as unfavorable weather may cause leaf drop or changes in leaf angle without equivalent reduction in crown diameter so CPC would not decrease but WFC will as more light penetrates the crown. The drop in WCF in 2023 thus may be an artifact of below average precipitation affecting the leaf angle /drop and therefore biasing the modelling rather than an actual reduction in CPC. Trends of WCF may therefore be more useful than point estimates.

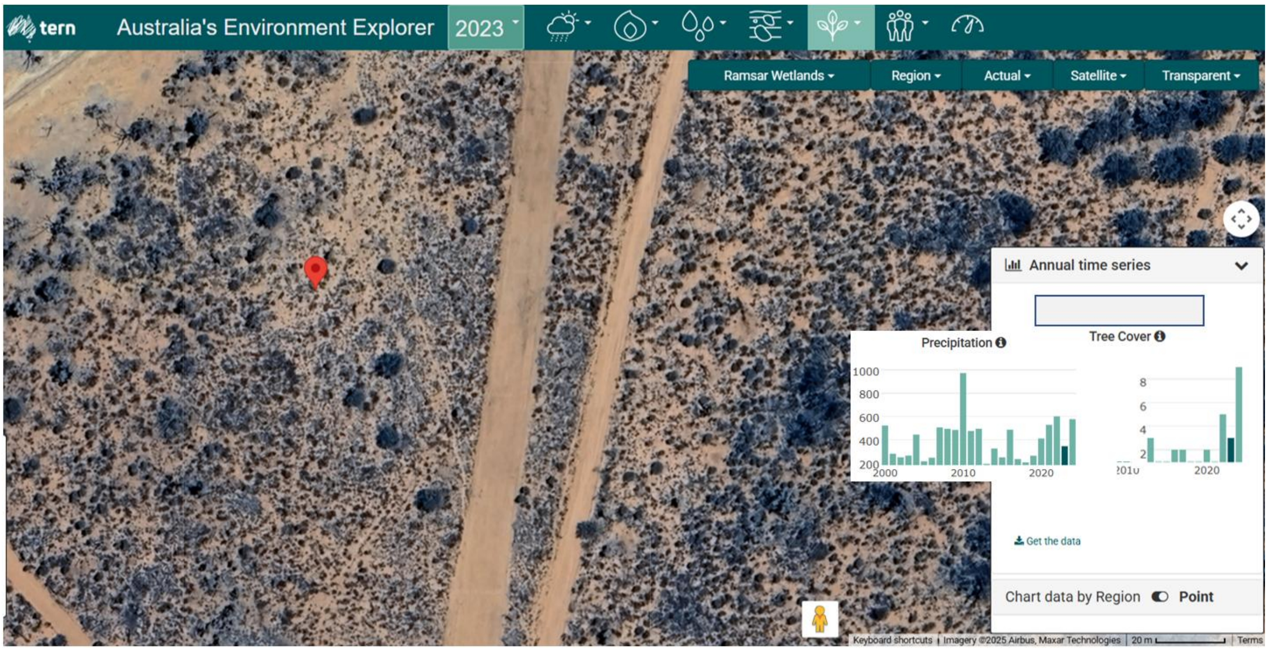


Figure 6: Example of a field measurement site displayed in Australia's Environmental Explorer showing Tree Cover (WCF), Precipitation trends and a recent remote sensing image for an example POI. Auditor's field measured CPC for this point is 7.7% with the comment that "34 regenerating stems (under 2 m) were observed and composed of Acacia aneura, Eucalyptus populnea, Eremophila sp. and Corymbia terminalis. SUFFICIENT STEMS TO REACH 20%". The modelled WCF is 3% (equivalent of 6% CPC); Persistent Green is 6%; and NFSW classifies it as non-woody (0 – 5%).

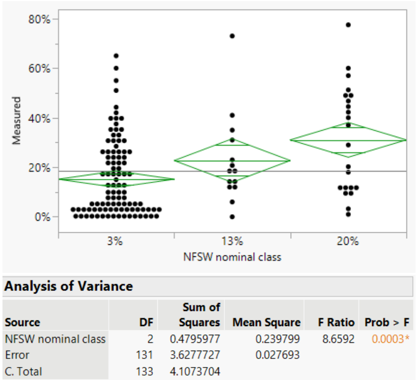
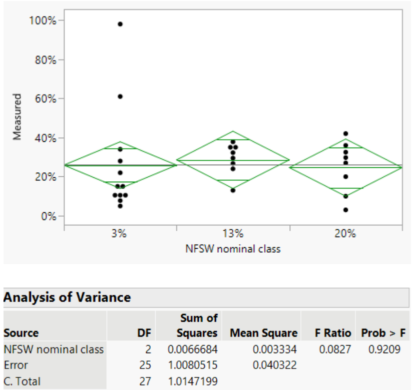
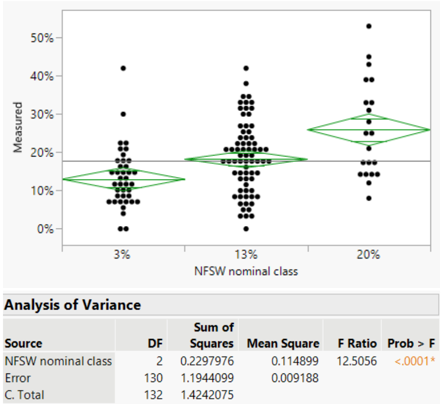
The NFSW class for each sample point was identified and an ANOVA tested for significant differences in CPC between the three classes (

Table 4). Like 2024, each State was tested separately as there was a significant interaction between classes and States ($p<0.05$). The accuracy of NFSW in classifying points into their correct canopy cover class was substantially poorer than reported in the literature, and was as low as 8 – 10% for non-woody. The mean measured CPC for the non-woody strata was 13 – 26% even though the CPC in this stratum should only be 0 – 5%. Similarly, the accuracy of identifying sparse woody is poor (13 – 50% accuracy) although better than the accuracy for non-woody. The mean CPC for POI in this stratum is also higher than expected (about double the nominal 12.5% for Queensland (23%) and NSW (27%)), although within reason for WA (18%). NFSW classification as woody/forest is most accurate (about 60 – 75%) although still less than the published accuracy statistics. In contrast, the auditor's measurements agreed with the proponent's stratification of at least 7.5% CPC at the time of inspection for about 75% of the locations. Further, about half the remaining locations were considered likely to achieve the required 20% CPC within the project timelines. Except for woody/forest, the mean canopy cover for each cell was significantly greater ($p<0.05$) than the nominal canopy cover for each NFSW class.

Overall, the proponent/agent stratification maps had an accuracy of 84% classifying areas as having at least 7.5% canopy cover or enough stems of appropriate species to produce a forest and therefore remaining as legitimate CEA. This accuracy is particularly good given the POI were biased towards locations where CER considered that the national-scale data were suggestive of misclassification.

These findings indicate that NFSW is not a useful estimator of current canopy cover in these POI and representative POPs or TOPs and that the stratification by proponents using higher resolution and locally calibrated data is far superior. Due to the lack of any significant difference in measured canopy cover between non-woody and sparse woody, even moving between these two NFSW classes may not correlate to a change in canopy cover. Canopy cover for woody/forest in Queensland and Western Australia was significantly greater than the other two classes, so movement into this class would indicate an average increase in cover.

Table 4: ANOVA for field measurements of canopy copy against NFSW classes (Version 8.0 – 2023,2024 Release). The diamonds represent ANOVA means and error ranges. Classification accuracy = number of samples within correct canopy cover range / total number classified in that NFSW class.

<table>
<tr><td>Queensland</td><td>New South Wales</td><td>Western Australia</td></tr>
<tr><td>
</td><td>
</td><td>
</td></tr>
<tr><td>Classification accuracy:
Non-woody: 42%
Sparse-woody: 50%
Woody/Forest: 59%</td><td>Classification accuracy:
Non-woody: 8%
Sparse-woody: 13%
Woody/Forest: 75%</td><td>Classification accuracy:
Non-woody: 10%
Sparse-woody: 53%
Woody/Forest: 57%</td></tr>
<tr><td>Canopy Cover (class mean):
Non-woody: 15%
Sparse-woody: 23%
Woody/Forest: 31%</td><td>Canopy Cover (class mean):
Non-woody: 26%
Sparse-woody: 27%
Woody/Forest: 25%</td><td>Canopy Cover (class mean):
Non-woody: 13%
Sparse-woody: 18%
Woody/Forest: 26%</td></tr>
</table>

Similarly, Persistent Green estimates of vegetation cover for each sample point were plotted against the field measurements of canopy cover (Figure 7). Only Queensland demonstrated a significant correlation between measured CPC and Persistent Green estimates ($r^2 = 0.3$, RMSE=0.146, $p<0.0001$). The slope of the regression line for Queensland was 1.4 ±0.18 and the intercept was significantly greater than 0 ($p<0.001$). This relationship indicates that Persistent Green significantly underestimates the canopy cover in these locations. There was no significant correlation between field measurement and Persistent Green in Western Australia or NSW, although almost all of the field measurements of canopy cover were well above Persistent Green estimates. This bias was unexpected as Gill et al[23] (2015) found that estimates of Persistent Green were higher than precisely measured canopy cover at low cover levels. The lack of significant correlation in Western Australia and NSW and the underestimates in Queensland means if Persistent Green estimates are close to the 7.5% threshold then it is highly probable that the threshold has been substantially exceeded.

[23] 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.

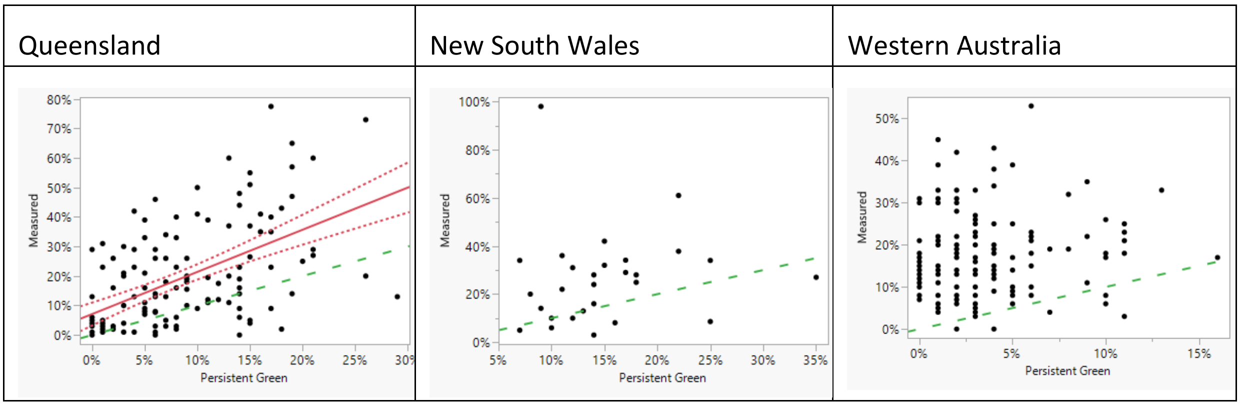


Figure 7: Plot of Persistent Green estimates (Landsat, JRSRP Algorithm Version 3.0, Australia Coverage) against in situ measurements of canopy cover. Dashed line is 1:1. Where present, solid line represents the line of best fit (if p<0.05) and dotted lines are the prediction intervals for the best fit

Finally, the WCF estimates from Australia's Environmental Explorer were transformed[24] into canopy cover estimates (CPC) and plotted against the field measurements of canopy cover (Figure 8). Significant ($p<0.001$), although relatively weak, correlations were observed between field measurements and CPC estimates in all States ($r^2 = 0.26, 0.13, 0.08$ for Queensland, NSW and Western Australia respectively). The slopes of the regression lines for Queensland and NSW were not significantly different to 1 ($p>0.05$) although it was only 0.35 for Western Australia. The regression line intercept estimates were all significantly greater than 0)$p<0.001$) and as high as 16% for Western Australia. These regressions suggest that AEX may be useful for monitoring canopy cover although it is likely to underestimate CPC, especially at lower levels of cover.

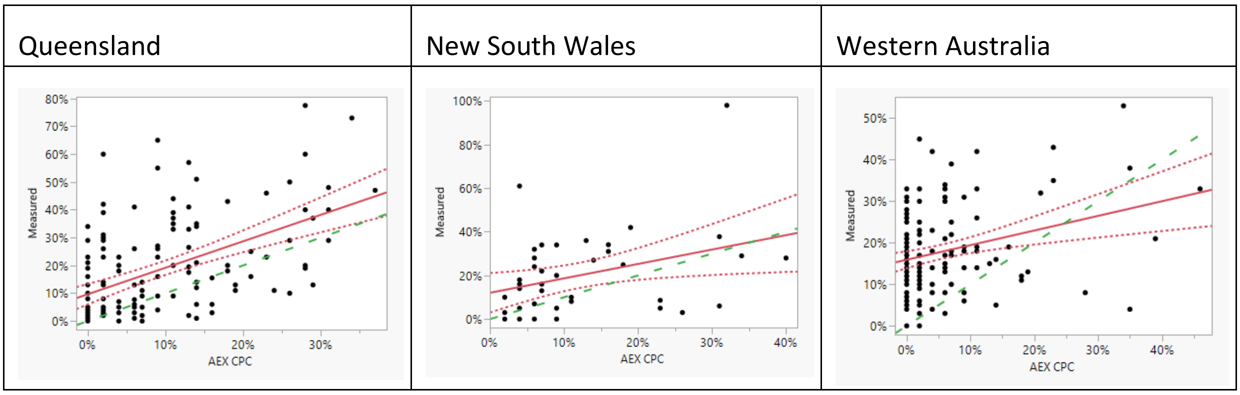


Figure 8: Plot of Canopy Cover estimates (transformed from WCF estimated by Australia's Environment Explorer) against in situ measurements of canopy cover. Dashed line is 1:1. Where present, solid line represents the line of best fit (if p<0.05) and dotted lines are the prediction intervals for the best fit

Even though there are significant regressions with CPC derived from WCF for each state, the state-wide relationships are still very noisy with RMSE as high as 20%. However, when there are sufficient data to fit a regression to individual projects, significant and useful relationships can be developed. In the examples in Figure 9, the regressions are all significant ($p<0.01$) and the slope of the line is not significantly different to 1.0 ($p>0.05$). However, the intercept estimates are greater than 0 ($p<0.01$) which indicates that AEX is consistently underestimating canopy cover at the project stage. Such significant relationships may be useful in two-phase sampling approaches at project level where AEX can estimate CPC over the entire area which is then be corrected for bias.

[24] Fisher, A., Scarth, P., Armston, J. and Danaher, T. (2018) Relating foliage and crown projective cover in Australian tree stands. Agricultural and Forest Meteorology 259; 39 – 47

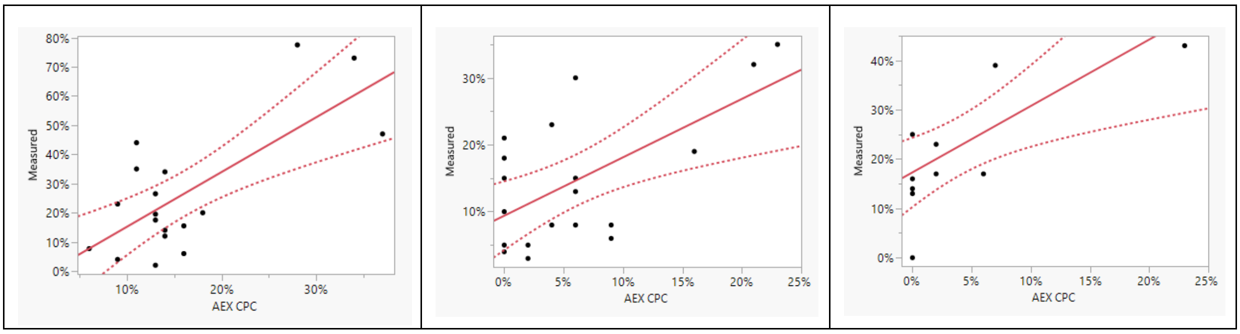


Figure 9: Plots of Canopy estimates (transformed from WCF estimated by Australia's Environment Explorer) against in situ measurements of canopy cover for example projects in different states. Solid line represents the line of best fit (if p<0.05) and dotted lines are the prediction intervals for the best fit

As in 2024, the national scale models at each point were compared with each other (Figure 10). The additional data provided for 2025 does substantively not alter the conclusions made in 2024 in that:

- There were significant ($p<0.05$) but weak relationships between Persistent Green and AEX based CPC estimates of canopy for both Queensland and Western Australia (r^2 of 0.44 and 0.17 respectively) (Figure 10). The relationships for Queensland and Western Australian were not different to a 1:1 line. There was no significant correlation for NSW estimates.
- NFSW classes did not group Persistent Green or AEX based CPC estimates into significantly different groups for NSW. That is, the mean estimates were not different for the non-woody, sparse-woody or woody/forest classes and all classes could use 15% (Persistent Green) or 16% (AEX).
- The mean Persistent Green for non-woody strata was significantly less than the two other NFSW classes for Queensland and Western Australia, although the mean was still significantly greater than the theoretical canopy cover upper boundary of this class. The stratum means for sparse woody and woody were not significantly different from each other.
- The mean AEX based CPC estimates were significantly different for each NFSW class for both Queensland and Western Australia. The means for Queensland were appropriate for each class with non-woody 3-6%; sparse woody 10-18% and woody 17-22% ($p=0.05$). However, the means for Western Australia were significantly less than expected for each NFSW class with non-woody -1-3%; sparse woody 4-8% and woody 7-13% ($p=0.05$).
- Fifty locations had all three national-scale models estimate that the area was non-woody (less than 5% cover) but only 28 (46%) had field measurement of canopy cover at each of these locations was within the anticipated range. Twenty-three locations agreed the area was sparse woody (5 - 20% cover) but only 12 (52%) of field measurement of canopy cover at these location was within the anticipated range. Finally, only four locations (in one project in Queensland) agreed the area was woody (at least 20% cover) three (75%) of the field measurement of canopy cover was within the anticipated range. The remaining 254 locations did not have the three nation-scale estimates agree on the classification with at least one substantially underestimating the field-based measurement of canopy cover. Thus, even when all three national-scale models agree, there appears to be only about a 50:50 likelihood that the measured canopy cover is in the correct NFSW class. The weak relationships between the different national-scale models and localized biases explains the

discrepancies in the 100-ha threshold tests undertaken by CER (Table 2).

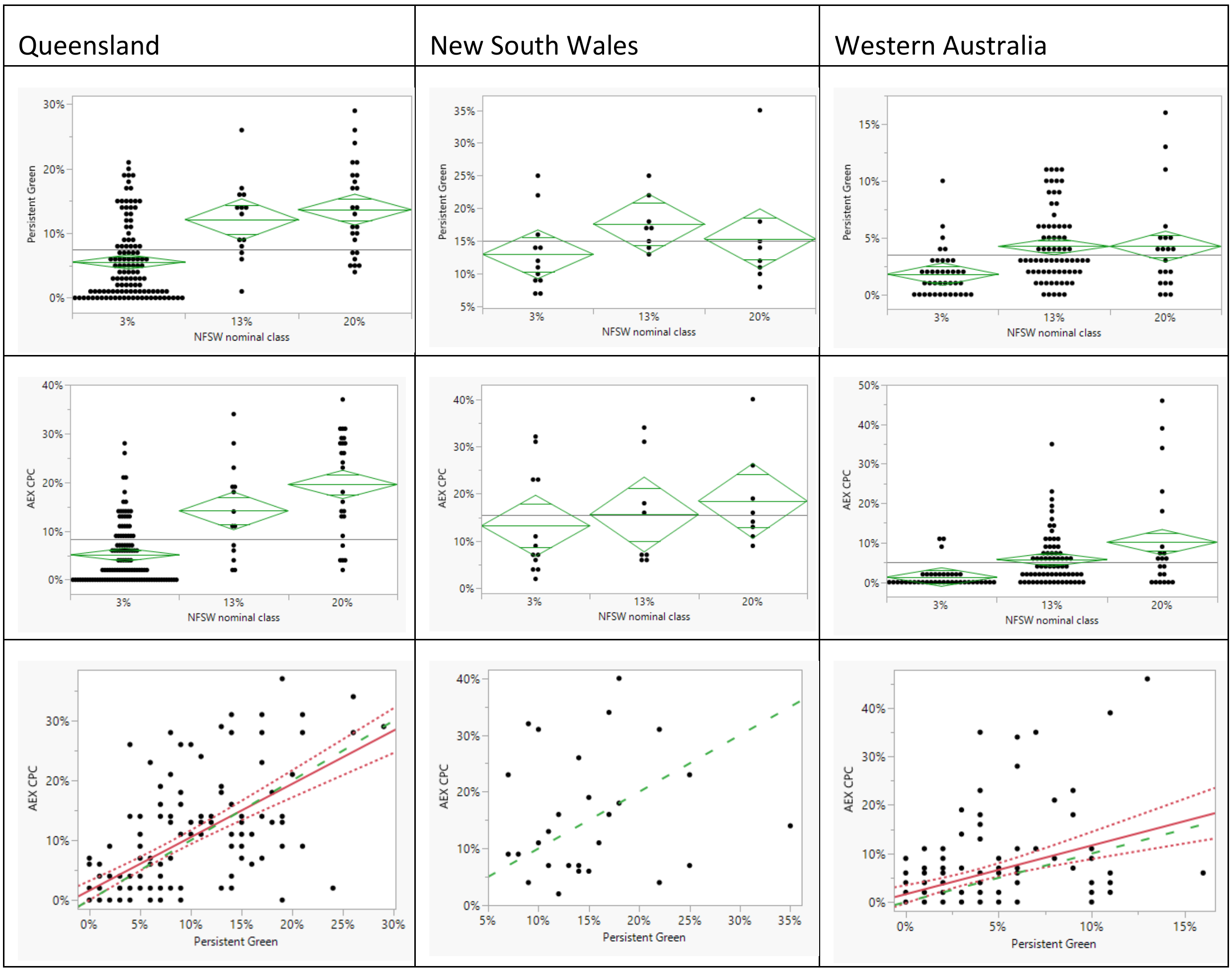


Figure 10: ANOVA and XY plots comparing national-scale estimates for each plot. For XY plots, dashed line is 1:1. Where present, solid line represents the line of best fit (if p<0.05) and dotted lines are the prediction intervals for the best fit

As described above, field measurements by independent auditors confirmed that most of the sample points exceeded the minimum canopy cover threshold despite the national-scale model estimates. Registered ecologists or foresters described the POIs and provided their expert opinions on the likelihood of the sites that had not yet reached 7.5% achieving forest cover in time (Table 3). These s215 audits concluded that just under half of the sites where the 7.5% canopy cover had not been reached still had a medium to high chance of achieving forest cover within the timeframe due to the presence of sufficient stems that were currently too short. A fraction of the reports however did draw attention to potential inclusion of baseline forest or concerns that the site may be too slow to reach the 20% minimum cover within the next 10 years

These results confirm that no single national-scale model is well suited to making estimates of canopy cover or cover change for these projects. These national-scale models rarely agree with each other and appear to be underestimating the canopy cover of areas in the non-woody and sparse-woody classes.

The independent assessments at POIs and other locations indicates that the proponent maps of successful regeneration (achieving threshold levels of canopy cover or number of regenerating species) are much more reliable than the national-scale models and are achieving an accuracy of 80+%.

Table 5: Example extracts from reports by ecologists with descriptions of sites and potential issues (subset from POIs, TOPs and POPs where measured canopy cover above the minimum threshold). Note, not representative of all sample points. Example includes reports from different ecologists and audit teams.

Canopy cover as measured in field	Description or concern
13%	Acacia ramulosa (Horse Mulga) Eremophila clarkei (Turpentine bush) Dodonaea viscosa (Hopbush) Geijera parviflora (Wilga) …. In field site observations noted generally well spread out stands of Horse Mulga and Turpentine Bush within the belt transect. However, it was noted that the general area had either stands of large mature trees or indivduals – see photography labelled 'XXXX' (which were >8 m in height and 20 m+ in canopy cover). These are likely part of previous remnant forest but is not considered to be baseline forest.
13% (mapped as non-woody < 5%)	Acacia ramulosa (Horse Mulga) Eremophila clarkei (Turpentine bush) Dodonaea viscosa (Hopbush) Acacia excelsa (Ironwood Wattle) This area was relevatively sparse with large patches of grass cover. Acacia ramulosa (Horse Mulga) known to have a crown diameter between 2 – 5 m at maturity (Ward et al., 2018). Therefore, whilst this area could reach 20% potential forest based on the upper limit of the crown diameter, it does not have the potential to reach forest cover based on the lower limit. Noting the low stem count when compared to other transects conducted at this property, hence this area is noted as may not having forest potential and should be monitored. This area is categorised as <5% per the crown cover and does not have forest potential.
29%	Large number of pre-existing trees (not CEA). numerous wildflowers and annuals. Species include Acacia and Eremophila including two large Pixie Bush specimens. Significant Wilcox Bush (Eremophila forrestii) understorey.
15%	Likely to achieve [forest]. is [s]parse and rocky, with the last 11m of the transect bare. Small shrubs include Eremophila and larger shrubs include Acacias (Mulga and Hop Mulga)
10%	Doubtful that there is the potential for forest cover to be achieved within the next 10 years. However, the site shows particularly strong recruitment of juvenile vegetation in height cohorts 1 to 4
17%	Potential to reach [forest] with many < 2m regeneration, However, the site contains a large portion of mature vegetation [not considered baseline forest]
32%	older Horse Mulga and dominant pink Eremophila (Wilcox). Old cattle tracks cross the site. high proportion of mature trees which exceed the age of the project. This ecological finding indicates a risk of non-conformance with Section 16 4(a) of the methodology determination…
16%	Forest Cover has not been achieved at this site, and it is doubtful that the site will attain forest cover in the next 10 years. Site is sparse with high density of dead timber, sheltering sparse understorey including bluebush and sida. The soils are mainly bare with scattered quartz
21%	High proportion of mature trees which exceed the age of the project [not baseline forest]. Compacted [soil] (could not get peg in), sparse and had substantial bare ground. Evidence of Grevillea seedlings self-sowing from tree outside transect. Lots of Mulga leaf litter, Mulla Mulla, crowsfoot and bluebush understorey. Old evidence of cattle.
24%	12 trees comprising of Wilga, Turpentine and Brigalow with an average height of 4.0 m within 1,000 m2 area. Along the 100 m transect, five trees approximating 5 m height were found and contributed to 23.6% crown cover. Based on our observations and experience, all five trees appeared to be [predate project]. Hence for this AOI, we refer to our tree count in the 1,000 m² plot to assess whether the 7.5% crown cover would be met based on stocking density. We counted 26 young regeneration trees under 2 m in height within the 1,000 m² area. This stocking density translates to 320 stems per ha, that will eventually achieve forest cover at maturity. We counted 26 young regeneration trees under 2 m height in 1,000 m² area

3.4. 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. On average, the net abatement reported for the projects reviewed to date is about 1.4 tC year^{-1} ha^{-1} for the CEA (Figure 11a). This abatement is reduced by buffer and permanence deductions before carbon credits are issued.

However, the proponents manage the entire project area, including non-project and baseline forests, to control feral animals, fencing and fire control even though they only receive credit for the abatements on the CEA. The abatement received per ha over the entire project area is about 0.5 tC year^{-1} ha^{-1} (Figure 11b).

To put HIR abatement in context, published literature has found that mallee eucalypts, growing in low rainfall[25] or salt inundated land in Western Australia[26], sequestered an average of 0.58 – 5.3 tC ha^{-1} respectively.

Some of the criticism[27] of HIR however does not seem to be related to the validity or quantity of carbon being sequestered, but rather "*…the real problem with this was that emitters would not alter their behavior because they could just buy credits…*" Even a landholder[28] in HIR who agrees that their revised land management *"…will definitely store carbon…"*, worries that "*how is that going to make things better" if "a big company blows smoke into the air and then buys our credits?*" Exploring how to avoid wasting the credits being generated by HIR is outside this report's terms of reference.

a) Net abatement tC year^{-1} ha^{-1} (of CEA)	b) Net abatement tC year^{-1} ha^{-1} (of Property)

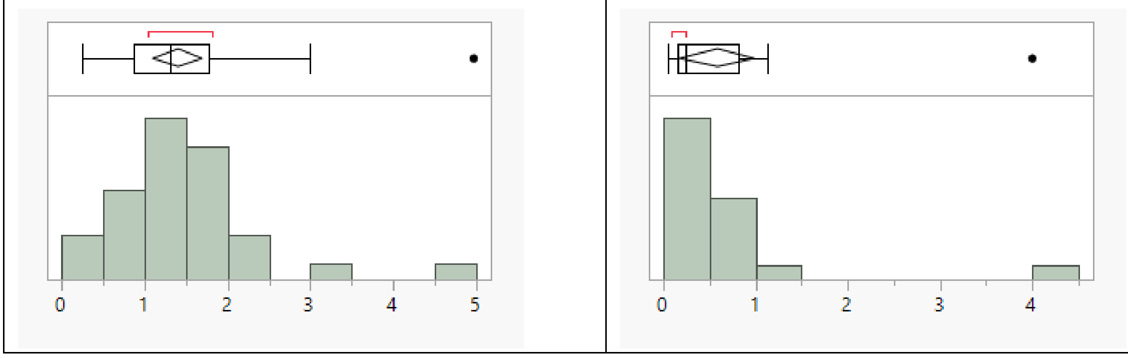


Figure 11: Whiskers diagram and histogram of the net abatement of carbon per year in (a) per CEA ha; (b) per Project ha. [The box in the center of Whiskers plot contains 50% of the data – from the 25th percentile to the 75th percentile and is divided by a vertical line at the 50th percentile or median value. The diamond is centered on the mean with a width of ± standard error of the mean. The "whiskers" extend to the furthest observation that is not assumed to be an outlier. The ● is a potential outlier]

4. Conclusions

The additional data provided to date in 2025, bringing the total number of Projects review after their 5-yearly check to 75 and canopy cover / species information for over 300 independently measured field transects, supports the conclusions made in 2024:

- The independent audit reports, CER reviews and new s215 audits provide strong assurance that projects are being managed as per the HIR requirements;
- Appropriate methods have been used by the proponents or their agents in classifying the CEA and confirming regeneration canopy cover is meeting threshold levels;
- Minor areas of potential regeneration issues identified by ecologists/foresters during the expanded S215 audits appear to be within the guidelines for stratification accuracy but are required to be reviewed and potentially removed before the next reporting period;
- The CER reviews continue to appropriately utilize multiple sources of data, including national-scale models, to check whether regeneration thresholds at relevant scales are being met;

[25] Burrows et al (2002)
[26] Yu et al (2008)
[27] The Age, 11 October 2024. Page 1, 8, 9.
[28] Saturday Age, 8/2/2025 Pages 31, 34, 35.

- National-scale models often result in conflicting conclusions and tend to significantly underestimate the canopy cover in CEAs;
- 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 by proponents or their agents into CEA that are regenerating is reliable with an acceptable accuracy rate and accords with good practice.