Deforestation for agriculture in Queensland 2018 to 2020

A report prepared for the Australian Conservation Foundation

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Executive summary

Governments and industries around the world have promised to remove deforestation from supply chains but have taken few concrete steps until recently when the European Union legislated to require importers

> *"to prove that the products are both deforestation-free (produced on land that was not subject to deforestation after 31 December 2020) and legal (compliant with all relevant applicable laws in force in the country of production)."*

Using Queensland Government data we quantified deforestation in Queensland over the period 2018 to 2020 under strict and broad variants of two definitions:- the Kyoto Protocol definition used by Australia and the European Union (EU) definition under which forest must have tree dominated canopy, 10% cover or more, and at least 5m high in the natural state. The EU definition is based on the UN Food and Agriculture Organization (FAO) definitions as are other deforestation monitoring systems such as the Accountability Framework and Science-Based Targets initiatives.

We found a significant range of variation in areas of estimated original forest cover in Queensland from 41% (EU strict variant) to 68% (EU broad variant) of the state's land area. Areas deforested for agricultural purposes (crops or pastures) over the 2018-20 period ranged from 0.519 (EU strict variant) to 0.657 million ha (EU broad variant). The ranges of total areas deforested for Australian Kyoto strict and broad variants fell within the EU range.

Over 97% of agricultural deforestation was for livestock pasture development regardless of definition, and over 85% was of forests that were mature or, if regrowing forests, were more than 15 years old. Very little clearing was of young regrowth forest. Eucalypt forests in Queensland that are 15 years or older can already be tens of metres tall depending on local climatic conditions although the formation of tree hollows vital for wildlife and characteristic of "old-growth" forest takes over a century.[1]

Agricultural deforestation remains widespread in Queensland even after the tightening of restrictions in 2018. There were at least 8,969 land parcels with deforestation above the minimum area thresholds[2] under one of the definitions from 2018 to 2020. Beef was the dominant driver of agricultural deforestation, accounting for at least 73% by area.

However, a small minority of beef producers accounted for the majority of deforestation. As few as 205 properties with the highest forest clearing accounted for half of all deforestation under the strict EU definition.

Legality of production is the other key restriction placed on imports by the new EU legislation. This goes beyond deforestation to all aspects of production. This proved difficult to assess for state legislation. Nearly three quarters (73%) of woody vegetation clearing was exempt from any clearing restrictions under state law.

Under national law the *Environment Protection and Biodiversity Conservation Act* it is an offence to have a "significant impact" on a listed threatened species or ecological community without first seeking and obtaining approval. Applying for approval is called "referral".

We identified agricultural operators whose clearing (including both total or partial clearing) of remnant or 15 years and older forests under the strict EU definition destroyed likely-to-occur habitats for species and

[1] Gibbons P et al. 2000. Hollow formation in eucalypts from temperate forests in southeastern Australia. *Pacific Conservation Biology,* 6(3), p.218.
[2] 0.2 ha for AU Kyoto definition and 0.5ha for EU definition.

ecological communities listed as threatened under the Act. In addition, we confined analysis to instances where forest habitat clearing exceeded indicative thresholds of significance (based on averages of past decisions of the regulator) and where no referral for approval was in evidence.

Likely significant but unreferred and unapproved agricultural destruction of forest habitat for threatened species and ecological communities was widespread in Queensland in the 2018-20 period. A total footprint of 364,221 ha of forest habitat combined across all MNES and parcels was cleared from 2018 to 2020 under the EU strict definition which was also in excess of indicative thresholds of significance for MNES and yet were not referred or approved. This was distributed over 5018 parcels—4,442 parcels under 2,645 known owners and another 576 parcels with owners unknown. Half of this total footprint was attributable to just 267 parcels, 207 belonging to 181 owners and 60 with unknown owners, which had the highest areas cleared. Almost all these high clearing properties fell south and east of Townsville.

The footprint was predominantly in the over 30 year old non-remnant age class in 2018 (52%), with 33% in the 15-30 year old non-remnant class and 15% remnant forest.

There were 217 threatened species (158 plants and 59 animals) as well as 10 threatened ecological communities which lost likely-to-occur habitats in this clearing footprint. The threatened mammals losing the greatest areas of likely forest habitat in just those two years were the vulnerable[3] Greater Glider (124,323 ha) and the now-endangered[4] Koala (191,893ha). The ecological community losing the most likely-to-occur habitat was the endangered Brigalow community (7,492 ha).

[3] The southern and central populations of Greater glider were uplisted to Endangered on 5 July 2022. The northern population is listed as Vulnerable.
[4] The Koala (Qld, NSW and ACT population) was uplisted from Vulnerable to Endangered on 12 February 2022.

Introduction

Ongoing deforestation is a major problem for Australia, and in Queensland in particular. Eastern Australia is the only global deforestation front in a developed country.[5]

Tree clearing rates in Queensland remain high, despite tightening of state laws in 2018 after nearly 6 years of increases due to the Newman LNP state government "taking the axe" to the laws in 2012/13.[6]

Governments and industries have promised to remove deforestation from supply chains.

- In 2010 the Consumer Goods Forum, a global peak body of 400 major food industry companies *"pledged to mobilise their collective resources to help achieve zero net deforestation by 2020."* [7]
- The 2014 New York Declaration on Forests announced a *"private-sector goal of eliminating deforestation from the production of agricultural commodities such as palm oil, soy, paper and beef products by no later than 2020"* and is endorsed by over 50 governments, and over 50 of the world's biggest companies including Unilever, McDonalds, Nestle and Cargill. In 2021 the private sector goal to eliminate deforestation was postponed to *"well before 2030"*.[8]
- In 2021, at the Conference of Parties to the UN Framework Convention on Climate Change (UNFCCC), 144 parties including Australia and the European Union, released the *Glasgow Leaders' Declaration on Forests and Land Use* in which they committed to *"working collectively to halt and reverse forest loss and land degradation by 2030"*[9]
- As part of the UNFCCC's Climate Champions initiative, in 2022 international financial institutions with US$8.7 trillion in assets under management committed to eliminate agricultural commodity-driven deforestation after 2020 from their investment portfolios by 2025.[10]

These commitments are "in principle" rather than operational, but they have given rise to a number of deforestation definitions and detection systems so that deforestation-free claims can be tested objectively such as Science Based Targets and the Accountability Framework Initiative which draw on UN FAO definitions[11] as well as various efforts aimed at reducing financial support for deforestation.[12]

Recently, the European Union (EU) legislated to impose trade import restrictions whereby:[13]

> *"Operators and traders will have to prove that the products are both deforestation-free (produced on land that was not subject to deforestation after 31 December 2020) and legal (compliant with all relevant applicable laws in force in the country of production).*"

The EU definitions are also based on FAO definitions. A US Bill to restrict import of commodities that involve illegal deforestation was also introduced in 2021.[14]

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[5] https://wwf.panda.org/discover/our_focus/forests_practice/deforestation_fronts_/

[6] https://www.brisbanetimes.com.au/national/queensland/cripps-defends-loosening-of-tree-clearing-laws-20130417-2i08v.html

[7] https://www.theconsumergoodsforum.com/press_releases/consumer-goods-industry-announces-initiatives-on-climate-protection/

[8] https://forestdeclaration.org/about/new-york-declaration-on-forests/

[9] https://ukcop26.org/glasgow-leaders-declaration-on-forests-and-land-use/

[10] https://racetozero.unfccc.int/system/nature-and-tackling-deforestation/

[11] https://sciencebasedtargets.org/; https://accountability-framework.org/

[12] https://climatechampions.unfccc.int/system/nature-and-tackling-deforestation/

[13] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_7444

[14] https://www.globalcitizen.org/en/content/what-is-the-forest-act/

Queensland beef is the biggest single driver of deforestation in Australia accounting for 73% of deforestation in Queensland[15] and beef producers either in Queensland or elsewhere who deforest can expect to be shut out of the EU market by the new rules.

The EU restrictions impose both a practical test - deforestation free, but also a legality test which goes beyond deforestation.

Even the practical test of whether a producer has deforested is subject to considerable uncertainty due to ambiguities in definitions and accuracy limits of remotely sensed data.

Legality of clearing to produce a product is not confined by the EU regulation to deforestation. Degradation of forests or destruction of non-forest habitats for endangered biodiversity generally could fail this test if it is done with disregard for "*relevant applicable laws"*.

In this study we

- quantify deforestation by agricultural producers in Queensland since August 2018 under the amended state law of 2018 and also
- examine the extent to which observed tree clearing disregards the national biodiversity law, the *Environment Protection and Biodiversity Conservation Act 1999*.

Methods

We mapped agricultural deforestation over the study period using two different definitions of forests and deforestation (Table 1).

- Australian Government's implementation of the Kyoto Protocol definition ("AU")
- The European Union definition ("EU", which in turn is very close to those of the Accountability Framework Initiative and the FAO).

These definitions confine deforestation to a footprint of ecosystems which are classified as "forests" in the primary or mature state. The forest footprint is not confined only to what is forest now, but what may have been cleared in the past and which could regrow and once again meet the definition if allowed to do so.

The main issues in mapping these definitions for Queensland are:-

- Lack of a state or national original/pre-clearing forest footprint. This means that existing state regional ecosystem maps had to be converted to forest footprints for respective definitions on the basis of "structural formation" classes to which they belonged (Table 1).
- Ambiguities about whether structure classes actually fit with definitions meant that we had to deal with structure classes that only *may* fit the definition of forest as well as those that definitely do. To do this we developed two variants: A Strict variant excluding maybes and a Broad variant including maybes. This was difficult for the EU definition because structure codes used by the Queensland Herbarium revolve around the 2m/20% canopy cover thresholds used in Australia (Table 2).
- The presence of a large area of mixed polygons with multiple ecosystems and structural classes present in different percentages in the Queensland Regional Ecosystem base layer. This meant we had to classify these polygons by their percentage forest cover under different definitions.

[15] The Wilderness Society 2019 *Drivers of Deforestation and land clearing in Queensland.* (https://www.wilderness.org.au/images/resources/The_Drivers_of_Deforestation_Land-clearing_Qld_Report.pdf)

- Ambiguities around the meaning of "deforestation" with EU and Kyoto definitions requiring "conversion" from "forest" to "agricultural land use" (EU) or "alternate land use" (Kyoto). We interpreted these to mean that forest had to be removed to the point it was non-forest to count as deforestation. We further differentiated deforestation by forest age if the forest was a regrowth or secondary forest (Table 1).

Mapping the pre-clearing forest footprint

We based the pre-clearing forest footprint on the *Pre-clearing Regional Ecosystems* v12.2 ("RE" with currency of 2019) shapefile published by the Queensland Government.[16]

The *Regional Ecosystems Descriptions Database* ("REDD" v12.1 currency 2021*)* contains the structural formation classes for each of 1,572 regional ecosystems that appear in the RE shapefile.[17] Regional ecosystems in the preclearing maps were converted to forest or non-forest based on the structure class and four definitional variants matching structure classes to forest definitions (Table 2):-

1. AU strict (excluding maybes)
2. AU broad (including maybes)
3. EU strict (excluding maybes)
4. EU broad (including maybes)

For polygons composed of mixtures of different REs we calculated percentages of each polygon with forest cover under the five possible definitional variants. All polygons were then reclassified for each of the five definitional variants and converted to rasters as follows:-

- 100% forest (raster value 4)
- 51-99% forest in mixed polygons ("dominant", 3)
- 11-50% forest in mixed polygons ("subdominant", 2)
- 1-10% forest in mixed polygons ("minor", 1)
- No forest (0)

Rasters were derived for each of the four definitional variants of the two definitions (Figs. 4-6). Finally, the range of values across all variants was mapped (Fig. 7).

For purposes of mapping deforestation, we confined the footprint of "forest" under each definition to the first two categories 100% forest, and 51-99% forest in mixed polygons following the practice in the 2019 *Drivers* report.

[16] Department of Environment and Science 2022, *Biodiversity status of pre-clearing regional ecosystems* – Queensland. (spatial data https://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={22E1BC4E-BDFA-470A-AED8-04F38B4FCFC3})
[17] https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/descriptions/download

Table 1. Different definitions of forests and deforestation and how estimated in this study

Element	EU regulation[18]	AU Kyoto Protocol[19]
Forest definition	*'forest' means land spanning more than 0,5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach those thresholds in situ, excluding agricultural plantations and land that is predominantly under agricultural or urban land use;* [20]	*all vegetation with a vegetation height of at least 2 metres and crown canopy cover of 20 per cent or more and lands with systems with a woody biomass vegetation structure that currently fall below but which, in situ, could potentially reach the threshold values of the definition of a forest. Young natural stands and all plantations which have yet to reach a crown density of 20 per cent or tree height of 2 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of either human intervention, such as harvesting, or natural causes, but which are expected to revert to forest. Australia has adopted a minimum forest area of 0.2 ha*
Composition	Trees only	'*systems with a woody biomass vegetation structure'*
Method	Exclude shrubland ecosystems in Qld *Regional Ecosystems* layer	Include tall (2m+) shrubland ecosystems
Canopy cover	10%	20%
Method	Only forest ecosystems that naturally have or may have 10%+ canopy cover	Only forest ecosystems that naturally have or may have 20%+ canopy cover
Height	Potential for 5m	Potential for 2m
Method	Only pre-clearing forest ecosystems that have or may have 5m+ canopy height	Only pre-clearing forest and tall shrubland ecosystems that have or may have 2m+ canopy height
Patch size	0.5ha	0.2ha
Method	Exclude all isolated (non contiguous) forest polygons below these thresholds.	
Land use	*"excluding agricultural plantations and land that is predominantly under agricultural or urban land use"*	Includes tree plantations

[18] European Commission 2021. Proposal for a regulation of the European Parliament and of the Council. Brussels, 17.11.2021 COM(2021) 706 final 2021/0366 (COD). https://environment.ec.europa.eu/publications/proposal-regulation-deforestation-free-products_en

[19] Appendix 6.A Land cover change in Australian Government Department of Industry, Science, Energy and Resources 2022. *National Inventory Report 2020: The Australian Government Submission to the United Nations Framework Convention on Climate Change* v1 & 2 (https://www.dcceew.gov.au/climate-change/publications/national-inventory-reports)

[20] Accountability Framework allows for national variations *"Quantitative thresholds (e.g., for tree height or canopy cover) established in legitimate national or sub-national forest definitions may take precedence over the generic thresholds in this definition."*https://accountability-framework.org/the-framework/contents/definitions/

Element	EU regulation[18]	AU Kyoto Protocol[19]
Comments	The **Accountability Framework** is similar but includes tree plantations.[21] Exclusion of agricultural land use is confusing. Livestock grazing in largely undeveloped land is the most widespread agricultural land use in Australia. It is assumed that the definition means to exclude land already developed for crops plantations or settlements and to include only land which has natural forest present.	Unlike the EU definition includes tree plantations.
Method	Land use filter used to include only land under largely natural or naturally recoverable forest, excluding plantations, croplands, and other developed lands. Although Kyoto definition includes tree plantations the focus of this study is on deforestation for agriculture not forestry, so plantations, as well as already protected lands in national parks and forestry (non agricultural) lands in state forests were excluded.	
Deforestation	*"conversion of forest to agricultural use, whether human-induced or not"*	*"Deforestation under the KP is a subset of forest conversion and includes only lands where there has been direct human-induced conversion of forest to alternative land uses since 1 January 1990."*
Comments	The **Accountability Framework** is similar but also allows for inclusion of *"severe degradation"* as a cause of forest loss.[22] See also comments at right regarding land use *"conversion"* test.	1) Confuses vegetation cover with land use. Most tree clearing is to grow more fodder for livestock without changing primary land use. However we interpret this to fit the definition since it is a change in land use intensity if not type. 2) Much pasture clearing removes partial canopy cover reduction but not enough to go over threshold from forest to non- forest. This could be classed as degradation under the **Accountability Framework** definition see below at left.
Method	Any SLATS woody clearing where SLATS Foliage Projective Cover went from 6%+ to below 6% (equivalent to 10% canopy cover) at the end of the study period.	Any SLATS woody clearing where SLATS Foliage Projective Cover went from 11%+ to below 11% (equivalent to 20% canopy cover) at the end of the study period.
Forest degradation	EU definition seems only to pertain to logging:- *"harvesting operations that are not sustainable.. long-term reduction of ... wood, biodiversity and other products or services"* The **Accountability Framework** allows degradation to be accounted more	Undefined

[21] *"It does not include land that is predominantly under agricultural or other land use. Forest includes natural forests and tree plantations."*

[22] *"Loss of natural forest as a result of: i) conversion to agriculture or other non-forest land use; ii) conversion to a tree plantation; or iii) severe and sustained degradation."*

Element	EU regulation[18]	AU Kyoto Protocol[19]
	generally for but definition is qualitative and general.[23] Nonetheless, reduction of canopy cover from 100% down to 20% would surely qualify as degradation under that definition even if deforestation does not.	
Method	Partial clearing other than for forestry where forest remains above threshold for forest despite reduction in canopy cover due to tree clearing.	

[23] *"Changes within a natural ecosystem that significantly and negatively affect its species composition, structure, and/or function and reduce the ecosystem's capacity to supply products, support biodiversity, and/or deliver ecosystem services."*

Table 2. Queensland Regional Ecosystem database vegetation structure codes[24] and assignments to forest or not under two different definitions and variants (structure codes for low shrubland /heath/ grasslands are not shown, as all are classified non-forest under both definitions. Assignments for EU definition are from this study).

Code	Description	Growth form	Crown cover	AU strict[25]	AU broad[26]	EU strict	EU broad
TCF	Tall closed forest	Trees >30m	>80%	Forest	Forest	Forest	Forest
TOF	Tall open forest	Trees >30m	>50-80%	Forest	Forest	Forest	Forest
TW	Tall woodland	Trees >30m	20-50%	Forest	Forest	Forest	Forest
TOW	Tall open woodland	Trees >30m	<20%	Not	Maybe	Not	Maybe
CF	Closed forest	Trees 10-30m	>80%	Forest	Forest	Forest	Forest
OF	Open forest	Trees 10-30m	>50-80%	Forest	Forest	Forest	Forest
W	Woodland	Trees 10-30m	20-50%	Forest	Forest	Forest	Forest
OW	Open woodland	Trees 10-30m	<20%	Not	Maybe	Not	Maybe
LCF	Low closed forest	Trees 2-10m	>80%	Forest	Forest	Not	Maybe
LOF	Low open forest	Trees 2-10m	>50-80%	Forest	Forest	Not	Maybe
LW	Low woodland	Trees 2-10m	20-50%	Forest	Forest	Not	Maybe
LOW	Low open woodland	Trees 2-10m	<20%	Not	Not	Not	Maybe
CSC	Closed scrub	Shrubs 2-8m	>80%	Forest	Forest	Not	Not
OSC	Open scrub	Shrubs 2-8m	>50-80%	Forest	Forest	Not	Not
TS	Tall shrubland	Shrubs 2-8m	20-50%	Forest	Forest	Not	Not
TOS	Tall open shrubland	Shrubs 2-8m	<20%	Not	Not	Not	Not
Other categories non-forest under all definitions not shown							

[24] Table 28 in Neldner VJ et al 2022. *Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 6.0.* Updated April 2022. Queensland Herbarium, Queensland Department of Environment and Science, Brisbane.
[25] As per Table 8 in The Wilderness Society 2019 *Drivers of Deforestation and land clearing in Queensland.* (https://www.wilderness.org.au/images/resources/The_Drivers_of_Deforestation_Land-clearing_Qld_Report.pdf)
[26] Ibid.

Mapping agricultural forest clearing using SLATS

Shapefiles of detections of woody vegetation clearing for the two years from 2018/19 and 2019/20 are published by Queensland Government *Statewide Land and Tree Study* (SLATS).[27]

To identify woody clearing polygons that were a) for agriculture and b) were deforestation we applied a series of filters.

Purpose filter

The SLATS "purpose of clearing" field was used to exclude SLATS woody clearing that was non-agricultural (Table 3). SLATS woody vegetation change for the two study years was converted to 30m rasters aligned to a shared template and clipped to include only agricultural clearing as above taking the values shown in Table 3.

Table 3. SLATS clearing purpose categories and filtering to exclude non-agriculture clearing. Categories marked * were retained, because the purpose was not specified and could be agricultural.

			Clearing raster values[28]	
Agriculture	Type (SLATS)	Description (SLATS)	FPC forest change to non-forest	Forest remains above canopy cover threshold (partial)
Include	Crop	Cropping or horticultural purposes.	6 Crop deforestation	3 Crop degradation
Include	Pasture	All clearing to pasture including internal property roads and tracks fence lines and fire breaks. As well as clearing for single house pads in rural and semi-rural areas and golf courses.	5 Livestock deforestation	2 Livestock degradation
Include	Partial clearing major - Pasture	Clearing where at least 50% area of vegetation removed within a patch and greater than 10% crown cover remaining.	5 Livestock deforestation	2 Livestock degradation
Include	Partial clearing minor	Clearing where less than 50% area of vegetation removed and greater than 10% crown cover remaining.	4 Unknown deforestation	1 Unknown degradation
Include	Missing	Clearing detected in 2019/20 that occurred in 2018/19 but was missed from that product.	4 Unknown deforestation	1 Unknown degradation
Exclude	Timber plantation	Clearing within State forests or exotic and native plantations.		
Exclude	Partial clearing major - Forestry	Clearing to forestry where at least 50% area of vegetation removed within a patch and greater than 10% crown cover remaining.		
Exclude	Natural disaster damage	Non-human induced change.		
Exclude	Infrastructure	Dedicated roads (incl CSG)		
Exclude	Mine	Mining activities including CSG pads (but not roads between WTF!)		
Exclude	Settlement	Urban development including housing estates shops and hospitals.		

[27] https://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={5300BA40-F1DF-4E8E-9A84-99364B8DECDF}

[28] Forest to nonforest or remaining forest determined from FPC separately for AU and EU definitions.

State land use filter

Despite the purpose classification from SLATS, we ensured that any deforestation derived from SLATS fell only in undeveloped land uses prior to clearing, or were in land uses specifically prohibited to clearing for agricultural purposes, that is, National Parks and State Forests.

According we constructed a statewide filter to exclude

- overlaps with already developed land uses, by clipping to land uses deemed still undeveloped in the *Queensland Land Use 2019* release, which is current in the year range 2011-2017;[29]
- overlaps with state forests or national parks by erasing the product of the above with the *Protected Areas of Queensland* spatial layer archive from March 2018 which was a few months before the commencement of the study period.

FPC forest filter

We used the Queensland Government's *Foliage Projective Cover* products for 2018, 2019 and 2020 to apply this filter, and a conversion between FPC and Canopy Cover (CC) provided by Scarth 2019 where 6% FPC is equivalent to 10% and 11% FPC to 20% CC.

Where a pixel of woody clearing went from forest to non forest in respective years, based on canopy cover alone where canopy cover thresholds were 20%+ to <20% CC for Kyoto and NFI definitions, 10%+ to <10% CC for EU definitions, we recorded that pixel as deforestation. These took values 4, 5 and 6 for unknown, livestock and crop clearing respectively, with separate rasters for each year and for EU and Australian (AU) definitions respectively (Table 3).

We classed a pixel as "Degradation" if it was above the forest canopy threshold before clearing, was detected as cleared by SLATS, but remained above the forest threshold after clearing.These pixels took values 1, 2 and 3 for unknown, livestock and crop clearing respectively (Table 3).

Examples of the rasters resulting from these filters for both AU and EU definitions are shown in Fig. 1.

[29] These were 1.n.n Primary category "Conservation and Natural Environments", and the following tertiary categories 2.1.0 Grazing native vegetation, 2.2.0 Production native forests, 2.2.1 Wood production forestry, 3.1.4 Environmental forest plantation, 5.4.2 Rural residential with agriculture, 5.4.3 Rural residential without agriculture, 5.4.4 Remote communities, 6.5.0 Marsh/wetland, 6.5.1 Marsh/wetland - conservation, 6.5.2 Marsh/wetland - production, 6.5.4 Marsh/wetland - saline.

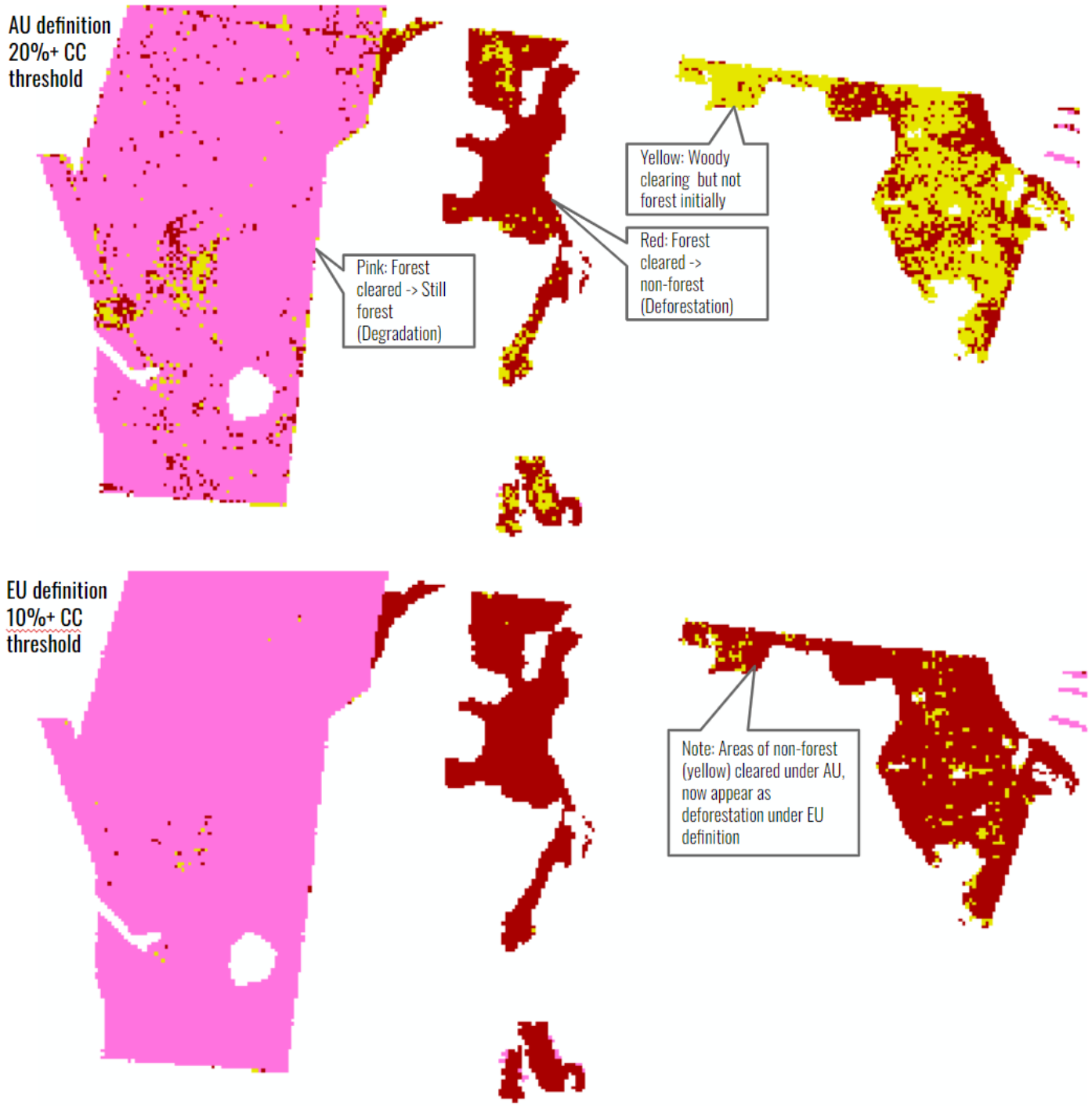

Fig. 1. Example of agricultural deforestation (red), forest degradation (pink) and non-forest woody clearing (yellow) under AU and EU forest definitions derived from SLATS woody change and FPC source data. CC means canopy cover.

Mapping vegetation age classes

One concern with a strict reading of either definition is that although a given clearing pixel may occur within the footprint of original forest, and although it may have been at or over the forest canopy cover threshold prior to clearing, if may in fact have been comprised of short, young regrowth cleared previously within the recent past.

There is no information from remote sensing which enables us to determine vegetation height in 2018 or 2019. Instead the SLATS woody clearing record from 1988 to 2020 along with the Herbarium's *Extant Regional Ecosystems v.11* (current to 2017 just prior to the 2018-20 clearing epoch), were combined to determine if vegetation that appeared to be forest in 2019 was remnant or regrowth (according to the Regional Ecosystems data), and if the latter how long ago was it last cleared, which provides a proxy for the age of the regrowth, in turn a proxy for height. We converted *Extant Regional Ecosystems v.11* to a raster aligned to the 30m template with a value of 2 for remnant and 1 for non-remnant woody vegetation, initially without regard to whether it was forest or not.

SLATS woody vegetation loss layers were likewise converted to template aligned age rasters in years since 1980 base year to the year commencing the epoch cleared, ranging from 8 for the 1988/91 SLATS woody vegetation loss layer to 39 for 2019/20. All woody cover losses detected by SLATS including natural disaster and drought were included.

Using the mosaic tool on this stack of rasters we derived rasters with each pixel classed by years since the start of the most recent clearing epoch for 2018 and 2019 separately.

From these we derived two age class rasters for the beginning of 2018/19 and 2019/20 SLATS years respectively (Table 4). We intersected these arithmetically for the deforestation/degradation 6 level rasters above for each year and each forest definition and summed areas for tables.

Table 4. Method of deriving vegetation age class rasters

Raster value	Description	Calculation
4	Remnant	Remnant in *Extant Regional Ecosystems v.11* AND no woody vegetation loss over the entire SLATS record from 1988. Remnant is not the same as undisturbed, "old-growth" or primary forest but does include such forests. Regrowth forests may have regrown sufficiently to be deemed remnant under the Queensland definition.[30]
3	Advanced regrowth*	Non-Remnant in *Extant Regional Ecosystems v.11* AND no woody vegetation loss recorded over entire SLATS record from 1988. Note that this includes pixels of treeless or bare ground continuously since 1988. Whether also forest or not was determined in a separate step. Note* that advanced regrowth may have regrown sufficiently to be deemed remnant once again under the Queensland definition.
2	High value regrowth	Loss in the SLATS record, but more than 15 years ago (from 2018 and 2019 respectively), regardless if remnant in *Extant Regional Ecosystems v.11*
1	Young regrowth	Loss in the SLATS record, but 15 or fewer years ago, regardless if remnant in *Extant Regional Ecosystems v.11*

Deforestation by agricultural property owners

The same parcel database as used in the 2019 *Drivers* report was used here with some changes to correct owners names that are different only due to punctuation or spelling, so that ownership of multiple parcels was not underestimated.

We found a total of 148.9 million ha of agricultural land on parcels over 30 ha in size. Of this 78% (116.2 mha) was under 32,654 identifiable owners, the remainder under unknown ownership. In these cases, the cadastral lot and plan parcel descriptor was substituted for the owner's identity.

Large areas also were under state (549,238 ha) or federal (27,586 ha) ownership. Although government ownership may be under different departments, they were all pooled as under a single government owner. A single owner may have multiple parcels each with different agricultural land uses attributed by the Valuer General. In such cases, the land use occupying the most land area within the portfolio of parcels was attributed to that owner.

The areas deforested under different definitions were summed for each owner (or parcel if owner unknown).

[30] Vegetation Management Act 1999 Schedule dictionary:- "***remnant vegetation*** *means vegetation—*
...
(b) forming the predominant canopy of the vegetation—
(i) covering more than 50% of the undisturbed predominant canopy; and
(ii) averaging more than 70% of the vegetation's undisturbed height; and
(iii) composed of species characteristic of the vegetation's undisturbed predominant canopy."

Thresholds of significance for clearing of MNES forest habitats

In earlier work, we compiled a database of 436 referrals that were deemed to be controlled actions by the regulator of the Act and 19 compliance actions taken against unlawful habitat destruction for 116 threatened species (TS) and 43 threatened ecological communities (TEC) for which planned or actual habitat destruction was reported.[31] Each instance for each MNES is referred to as a "case" here. For each case the planned or actual destruction of habitat of MNES was implicitly deemed significant by the regulator.

There an MNES had at least three cases, we took the geometric mean of areas for the cases for these individual MNES as the threshold for significance of any action in regard to each MNES with two exceptions.

- If the mean was below 1ha we set the threshold to 1ha.
- If the mean area was greater than the mean for the class to which the MNES belonged, the class mean prevailed.

To calculate class means, we conducted classical Analysis of Variance (ANOVA) on ln-transformed areas of the 1028 total cases with independent variables Status (Critically Endangered, Endangered or Vulnerable) and taxon group (TECs, plants, invertebrates, frogs, reptiles, birds, mammals).

Property level clearing of likely forest habitats for protected matters

We filtered areas of SLATS detected woody vegetation clearing to retain only instances:-

- That were for agricultural purposes on an agricultural property;
- That were forest by the EU strict definition in 2018 prior to 2018/19 clearing and in 2019 prior to 2019/20 clearing;
- That were also remnant or if regrowth, at least 15 years of age in 2018 prior to 2018/19 clearing and in 2019 prior to 2019/20 clearing; and
- Included both deforestation (full clearing of forest to non forest) and degradation (partial clearing or forest to less forest transitions).

This rasterised forest clearing layer was converted back into shapefiles. Isolated polygons less than 0.5ha were eliminated using the EU definition threshold for patch size (Table 1). These polygons were intersected with agricultural parcels layer, excluding any parcels that were national parks or state forests where agricultural clearing is not permitted, but retaining any parcels owned by local, state or federal governments.

These parcel-specific forest clearing instances were then intersected with likely-to-occur habitats mapped in public grids for *Species of National Environmental Significance* (current at 22 Nov 2022) and *Ecological Communities of National Environmental Significance* (current at 10 Dec 2022) and overlap areas calculated and tabulated by parcels and owners.[32] May-occur habitats were deemed too generic to be useful for the purposes of this study and were excluded.

[31] Taylor MFJ and Schoo A 2022. *Double standard: The failure of Australia's national environment law to prevent the pastoral industry bulldozing threatened species habitat in Queensland.* ACF report, November 2022.
[32] Downloaded from http://www.environment.gov.au/fed/catalog/main/home.page

Non-threatened species, shorebirds, marine and fish species, as well as species and ECs not yet listed in August 2018 at commencement of the study period were excluded.[33]

The current EPBC Act Referrals spatial database was downloaded (current to Dec 2022). The database was filtered to retain only referral area polygons for referrals that were:-

- for an agricultural purpose (excluding referrals for rabbit biocontrol and removal of flying fox habitats);
- either approved or deemed not to be a controlled action;
- lodged on or before 2019 (the middle of the study period); and
- in Queensland.[34]

Any agricultural forest clearing overlapping these referral areas was deemed to have been referred and so was excluded from analysis.

The total area of likely forest habitat as defined above for any one MNES that was cleared by any given owner was compared with indicative thresholds for that MNES. If the area was below the indicative threshold, that combination of owner and MNES was excluded. Also in collections of parcels for a single owner, parcels MNES combinations with less than 1 ha of habitat cleared for that MNES were also excluded. Only instances of clearing of MNES habitat aggregated by owner that were also over thresholds for that MNES were retained as likely to be unreferred significant actions in the meaning of the Act. Once the combinations of owners, parcels and MNES habitats cleared were filtered and lists of species and ecological communities areas cleared that were above thresholds on each parcel and owner were tabulated. Lastly these polygons were dissolved for each parcel to derive a footprint of combined MNES habitats cleared that were unreferred but over significance thresholds.

[33] Source for list:- *Declaration under s178, s181, and s183 of the Environment Protection and Biodiversity Conservation Act 1999 - List of threatened species, List of threatened ecological communities and List of threatening processes.* Australian Government Legislative Instrument F2018C00700 dated 29 August 2018.
[34] There are 20 such referrals:- 2001/482, 2002/725, 2003/1090, 2003/924, 2003/962, 2003/988, 2004/1335, 2004/1473, 2005/1982, 2005/2152, 2005/2284, 2006/2658, 2006/2745, 2008/3974, 2010/5514, 2015/7440, 2016/7838, 2017/7876, 2017/7905, 2017/8108, 2019/8426

Results and discussion

Original forest cover extents

The AU Kyoto Protocol strict and broad definitions only differed by two structure classes and so forest extents were very similar (Fig 2a, 3).

The EU broad definition had the greatest forest extent of all variants, and the strict definition the least (Figs. 2b, 3). This extreme range of values from strict to broad EU definition reflects the difficulty of aligning the definition to the Herbarium's structural classes which have thresholds more useful to the AU Kyoto definition (2m height, 20% canopy cover, Tables 1, 2).

The EU definition is based on the UN FAO definition, which is also used by other global forest agreements such as the *Glasgow Leaders Declaration on Forests and Land Use* and the UNFCCC's *Race to Zero* campaign. Non governmental monitoring proposals such as the Science Based Targets and Accountability Framework Initiatives also use the UN FAO definition.

The areas of greatest and most widespread disagreement (largest range of raster values) among definitional variants fell in the Gulf savannahs and the arid and semi-arid woodland belt west of the Brigalow Belt forests (Fig. 4).

Mixed polygons represent between 18 and 25% of the state area depending on definition (Fig. 3), creating an additional source of uncertainty. Yet further uncertainty derives from the fact that many Queensland regional ecosystems (REs) do not appear in practice to fit neatly into the structural classes which form the basis of mapping forest definitions in this study (Figs 5-8).

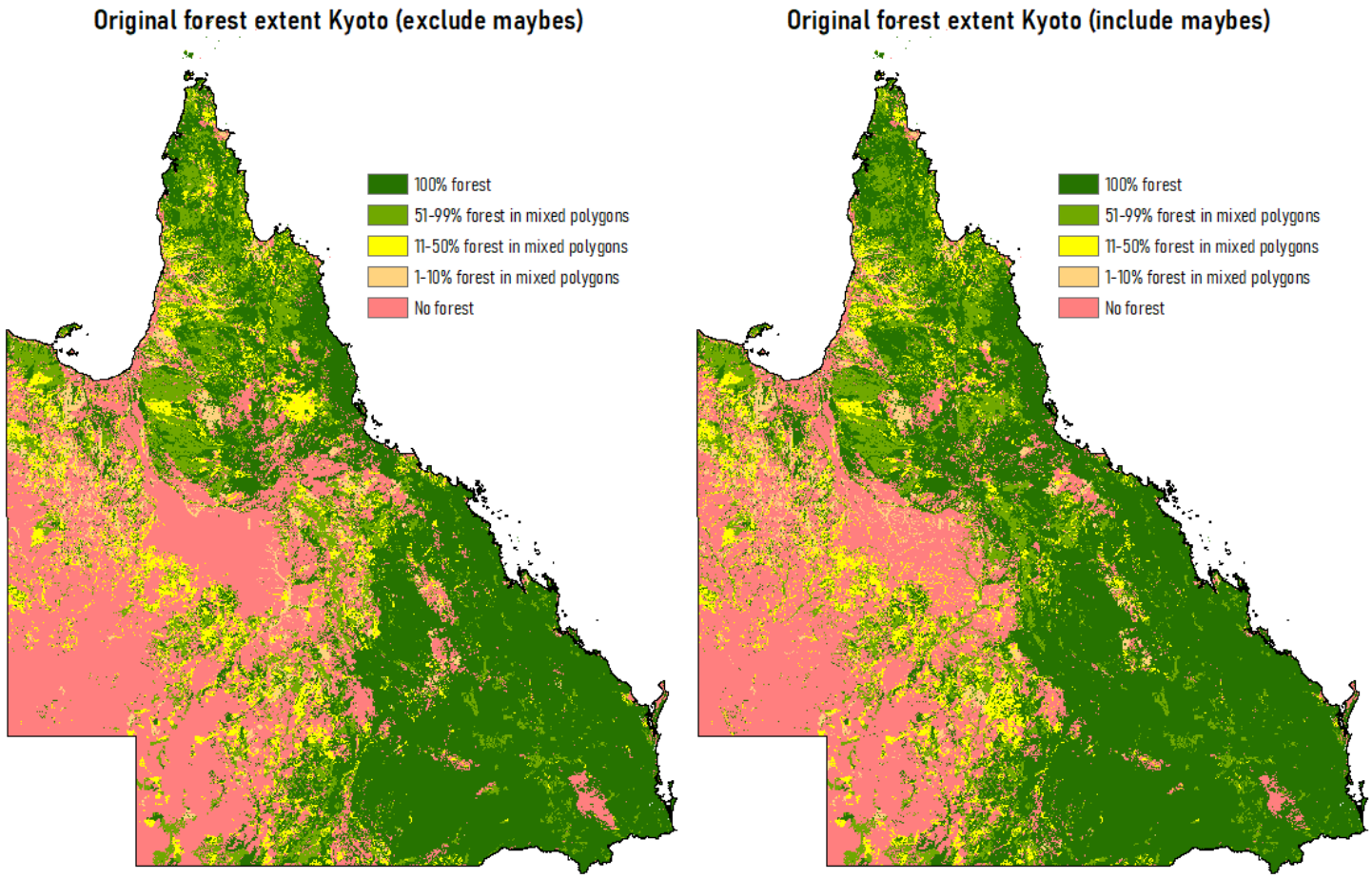

Fig. 2a. Forests under the AU Kyoto strict (L) and broad (R) forest definitions in Queensland.

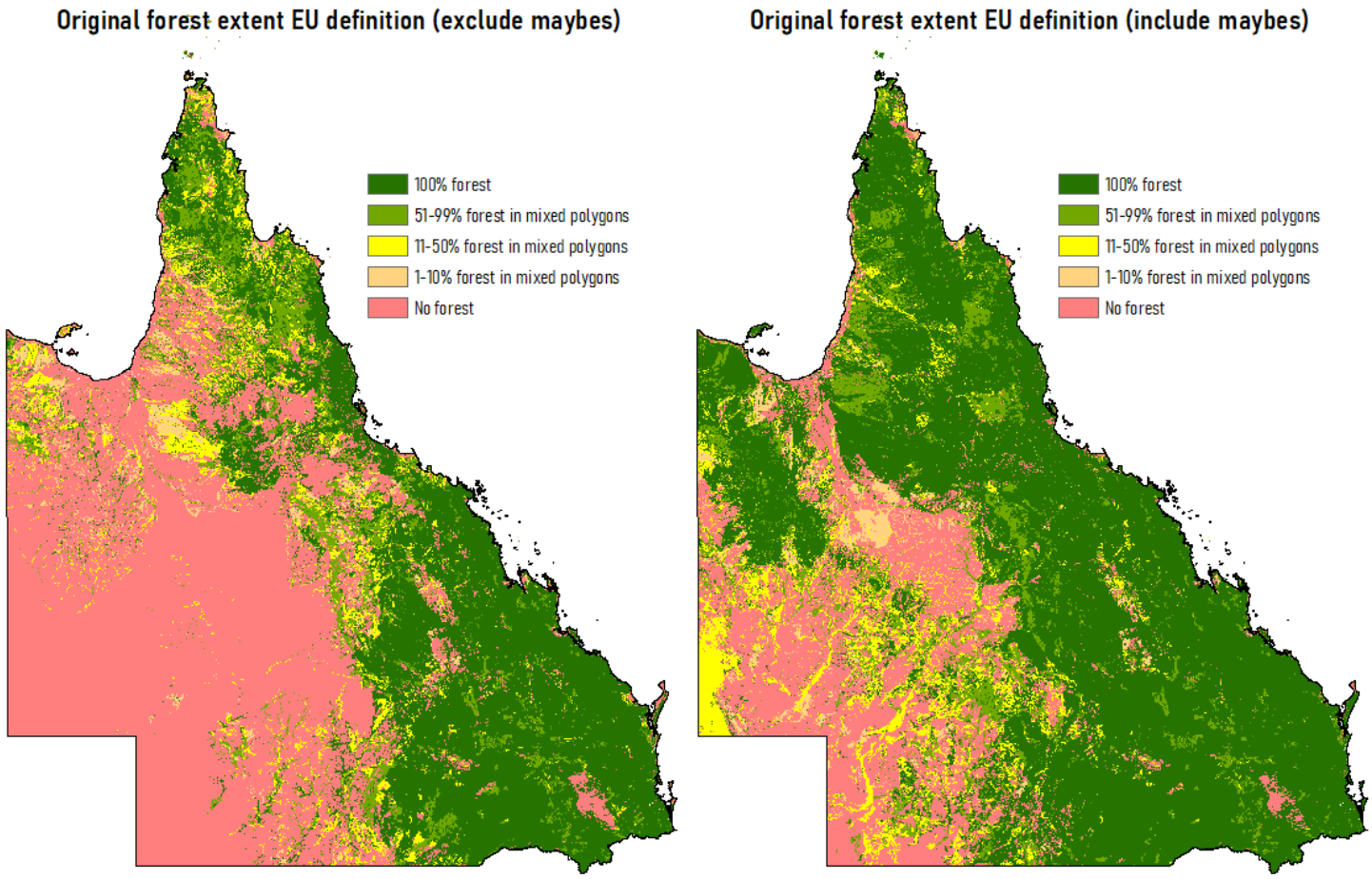

Fig. 2b. Maps of forests under the EU strict (L) and broad (R) forest definitions in Queensland.

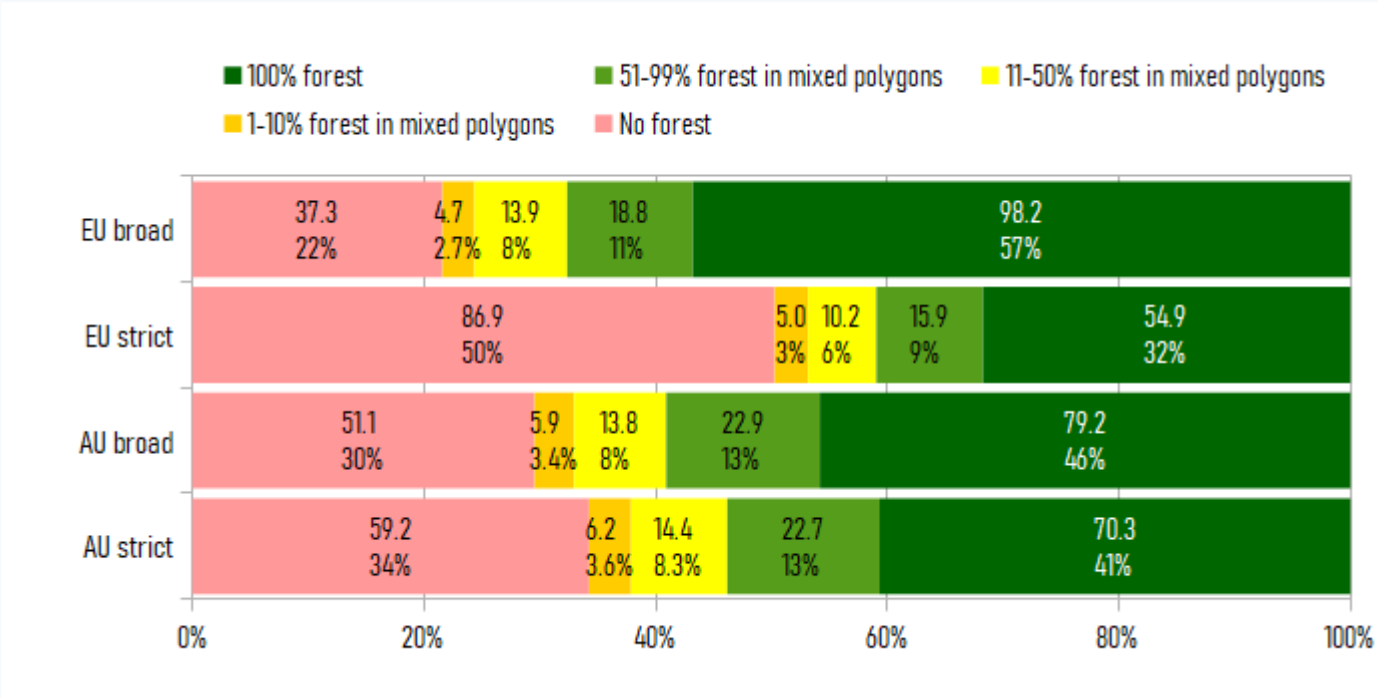

Fig. 3. Aggregate areas of polygons with differing coverages of forest under respective definitions (See previous Figures. Units are millions of hectares).

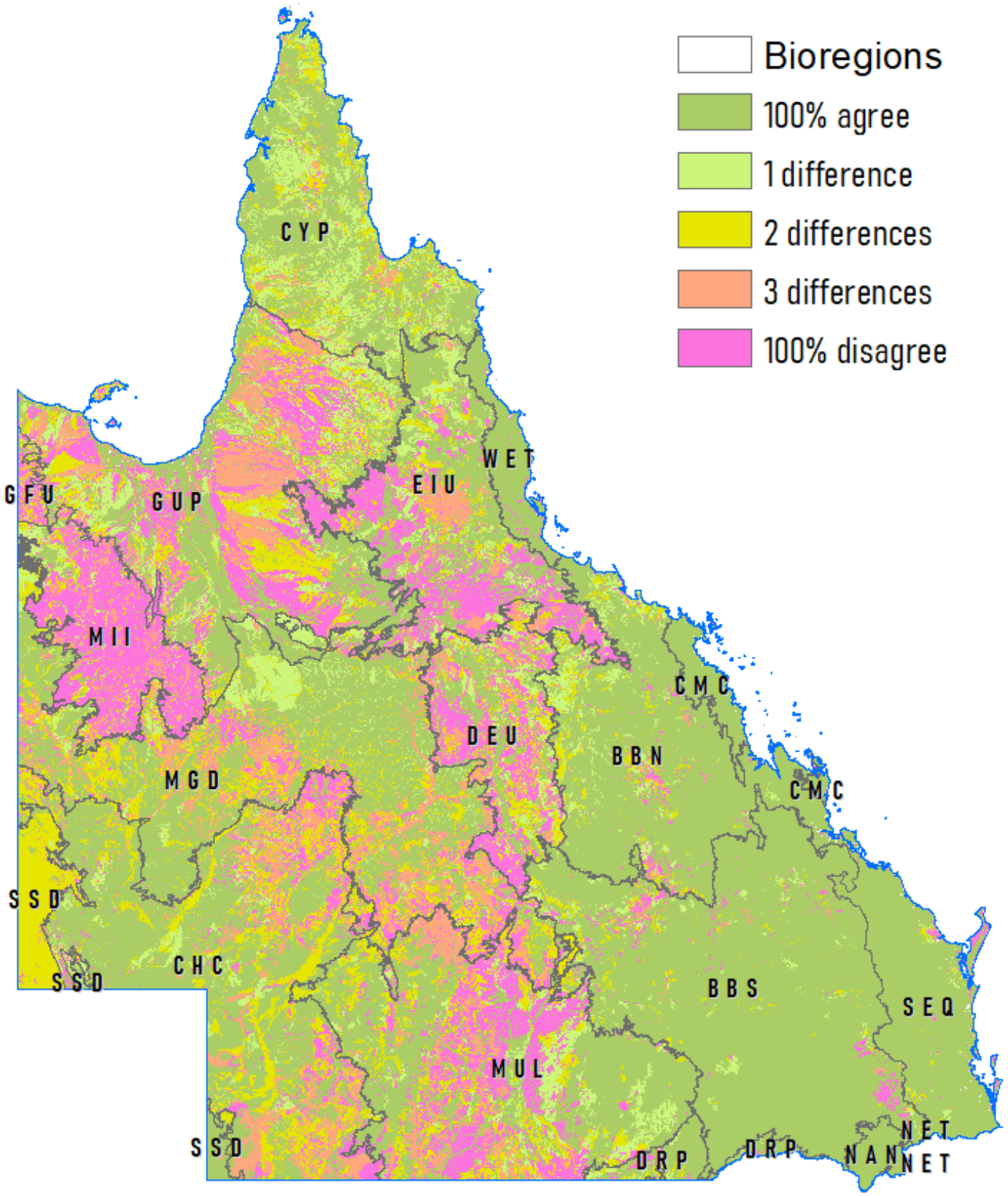

Fig. 4. Range of values for the four definition variants (Figs 1-2) from 100% agreement to complete disagreement (that is, one is 100% forest and another 100% non forest).

Photo 217 *Eucalyptus normantonensis* tall shrubland with *Triodia* spp., 5.7.3. Near Flodden Hills CHC. (D Richter)

Photo 260 *Acacia cambagei* tall open shrubland, 4.9.16. East of Stonehenge, MGD. (VJ Neldner)

Photo 226 *Melaleuca citrolens* and *Grevillea pteridifolia* low woodland on an alluvial flat, 3.3.52a. South of Laura, CYP. (MR Newton)

Fig 5. Examples of REs mapped as forest under the AU narrow and broad definitions but as non-forest under the EU definition. These photos and captions in this and following figures taken from *Vegetation of Queensland*.[35]

In particular:

- The RE 5.7.3 Tall Shrubland example does not look like forest under any definition with mostly low sparse shrub cover and spinifex ground cover (Fig.5 upper left). This does not fit the EU definition as interpreted here (Table 2) to exclude all shrubland, but is accepted as forest by the AU definition which accepts tall shrublands . Although this example is classed as Tall Shrubland, the canopy is very sparse and so should probably be excluded even from the AU definition.
- RE 4.9.16 also described by the Regional Ecosystems Description Database (REDD v12.1) as Tall Shrubland (although as Tall Open Shrubland in the caption Fig.5 upper right) has a species dominating the canopy *Acacia cambagei* which looks in this example like and is recognised

[35] Neldner VJ et al 2021. *The Vegetation of Queensland. Descriptions of Broad Vegetation Groups.* Version 5.0. Queensland Herbarium, Queensland Government Department of Environment and Science, Brisbane.

elsewhere in REDD as a tree, not a shrub. This RE could arguably be described as low forest which should perhaps fit both definitions (Fig. 5 upper right).

- Although RE 3.3.52 is classed as shrubland in the REDD, variants of it such as 3.3.52a may it seems be classed otherwise, in the caption above as low woodland, which is included in the Broad EU definition, although this RE is excluded at present as shrubland (Fig. 5 lower left).

Photo 182 *Eucalyptus brownii* open woodland on Cainozoic clay plain, 10.3.6ax2. Helenslee Station, DEU.
(EJ Thompson)

Photo 220 *Angophora leiocarpa* open woodland, 11.10.6. North of Mitchell, BRB.
(VJ Neldner)

Fig. 6. Examples of REs mapped as forest under AU and EU broad definitions, but as non forest under strict definitions.

- Open woodland (RE 10.3.6) is excluded from the strict Kyoto and EU definitions but not from the broad definitions. The canopy cover in this example is unlikely to rise above 20% and so the Kyoto definition may be incorrect here although perhaps not for the EU broad definition (Fig. 6 left).
- On the other hand the RE 11.10.6 example described in REDD and the caption as open woodland, looks to be definitely composed of tall trees with medium canopy density and so should meet all forest definitions (Fig. 6 right).

Photo 130 *Eucalyptus shirleyi* low open woodland with scattered *Erythroxylum ellipticum* and *Petalostigma banksii* in mid-layer, 9.12.27. NE of Gilberton, EIU. (MR Newton)

Photo 207 *Eucalyptus leucophloia* open woodland with *Triodia* spp. dominated ground layer, 1.11.2a, near Mt Isa, NWH. (DT Kelman)

Fig. 7. Examples mapped as forest under the EU broad definition, but as non-forest under all others.

- The example RE 9.12.27 mapped as low open woodland (Fig. 7 left) looks to have similar canopy heights as the example 1.11.2a (Fig. 7 right) which is described in REDD as open woodland, although both appear to have very sparse cover. These forest definition assignments seem to be appropriate for these REs.

Photo 30 *Pisonia grandis* low closed forest, 12.2.21a. Wreck Island, Capricornia Cays NP, SEQ. (GN Batianoff)

Photo 176 *Eucalyptus microtheca* and *Grevillea striata* low woodland on alluvial plain, 2.3.11. Van Rook Station, NE of Normanton, GUP. (CN Appelman)

Fig. 8. Examples mapped as forest under all definitions except for the EU strict definition.

- The EU definition has a higher height threshold (5+m) than the AU (2+m) definition. This may apply even to dense and closed forests such as RE 12.2.21 (Fig. 8 left). However, for other RE's excluded from the EU narrow definition RE's in the Low categories such as 2.3.11 may have canopy up to

10m high (Fig. 8 right) and so are included only in the broad definition even though their canopy looks to be at least 5m high and so could be deemed to meet the strict EU forest cover as well.

Agricultural deforestation estimates

A total of 1.065 million hectares of woody vegetation was cleared in Queensland in the two years 2018-2020 (August to August) for agricultural purposes according to SLATS data (Fig 10, Tables 3, 4). Woody clearing was overwhelmingly (93%) for pasture expansion for livestock but was likely even higher because much of the 5.7% that was unattributed (unknown) was likely also for pasture.

Between 53% (EU Strict) and 71% (EU Broad) of all woody clearing was deforestation depending on definitions, and between 62% and 83% of all forest clearing including degradation or partial forest clearing. The range of values was much narrower between the AU strict and broad definitions (Table 4).

Deforestation greatly exceeded degradation under all definitions ranging from 84.7% of all forest clearing for EU Broad to 85.4% for EU Strict (Table 4).

Pasture accounted for almost all (98%+) agricultural deforestation under any definition (Table 4). In contrast, unattributed or unknown purpose clearing had a much greater contribution to degradation (partial clearing) ranging from 33% (EU Broad) to 41% (EU Strict) (Table 4). This is not surprising as unattributed minor partial clearing is a major component of Unknown clearing.(Table 3).

Combined forest clearing was higher in 2018/19 than in 2019/20 with 2018/19 areas representing about 65% of total clearing across both years regardless of the forest definitions used (Fig. 10).

Table 4. Areas estimated cleared in the two years 2018-2020 for SLATS attributed agricultural purposes, all woody clearing and filtered for deforestation or forest degradation (partial clearing) under four different forest definition variants on mostly undeveloped land uses, excluding National Parks and State Forests (units are 1000s ha).

				Unknown	Pasture	Crops		Total
SLATS all clearing				60.4	990.6	14.4		1,065.4
				5.7%	93.0%	1.4%		
	Degradation[36]			Deforestation				
	Unknown	Pasture	Subtotal	Unknown	Pasture	Crops	Subtotal	
	% of subtotal	% of subtotal	% of total	% of subtotal	% of subtotal	% of subtotal	% of total	
AU strict	41.2	68.4	109.6	4.1	603.6	9.1	616.8	726.4
	37.6%	62.4%	15.1%	0.7%	97.9%	1.5%	84.9%	
AU broad	41.9	69.6	111.6	4.3	637.6	9.9	651.8	763.3
	37.6%	62.4%	14.6%	0.7%	97.8%	1.5%	85.4%	
EU strict	38.6	53.7	92.3	3.1	507.1	9.0	519.3	611.6
	41.8%	58.2%	15.1%	0.6%	97.7%	1.7%	84.9%	
EU broad	41.9	72.2	114.1	4.1	642.9	9.9	656.9	771.0
	36.7%	63.3%	14.8%	0.6%	97.9%	1.5%	85.2%	

[36] Note Degradation for cropping is unexpected and largely absent. Only 2 pixels fell in this category and they are likely to be pixelation errors. They were added to the Deforestation for Crops column..

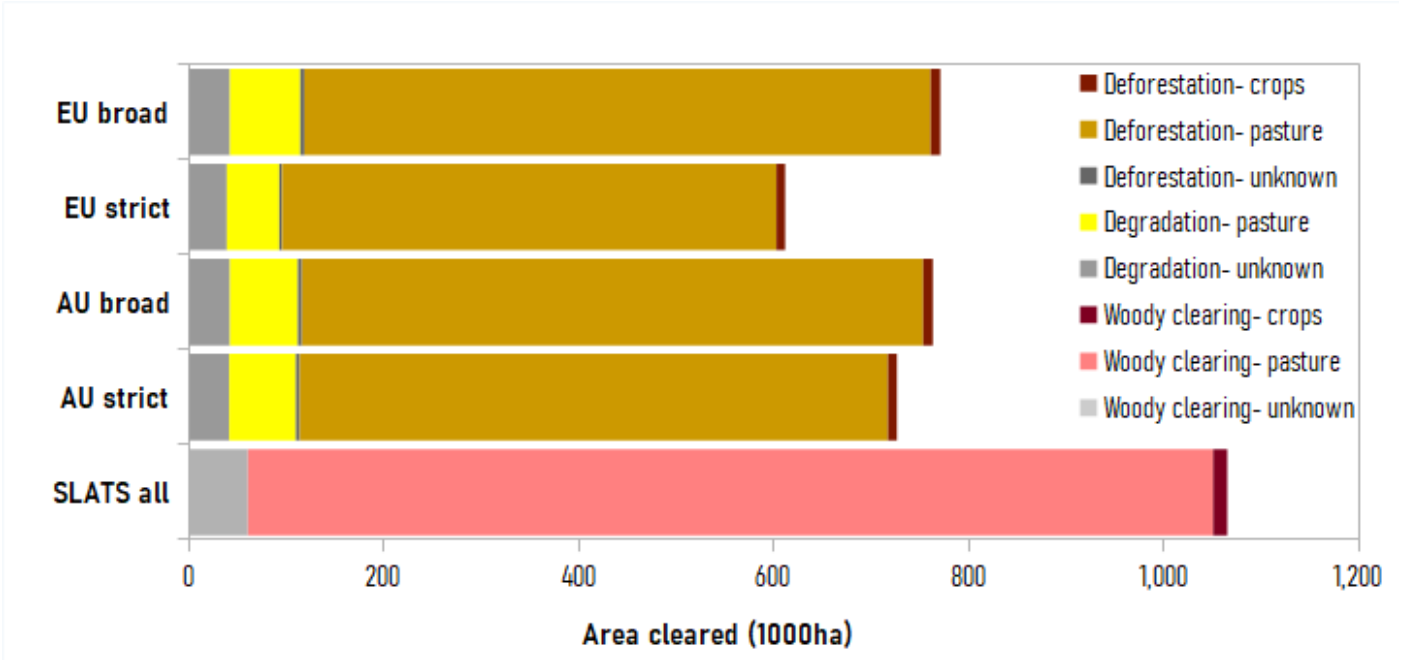

Fig. 9. Areas estimated cleared in the two years 2018-2020 for SLATS attributed agricultural purposes, unfiltered including all woody vegetation, or filtered for deforestation or forest degradation (partial clearing) under four different forest definition variants on mostly undeveloped land uses, excluding National Parks and State Forests (units are 1000s ha). (See Table 4 for numbers).

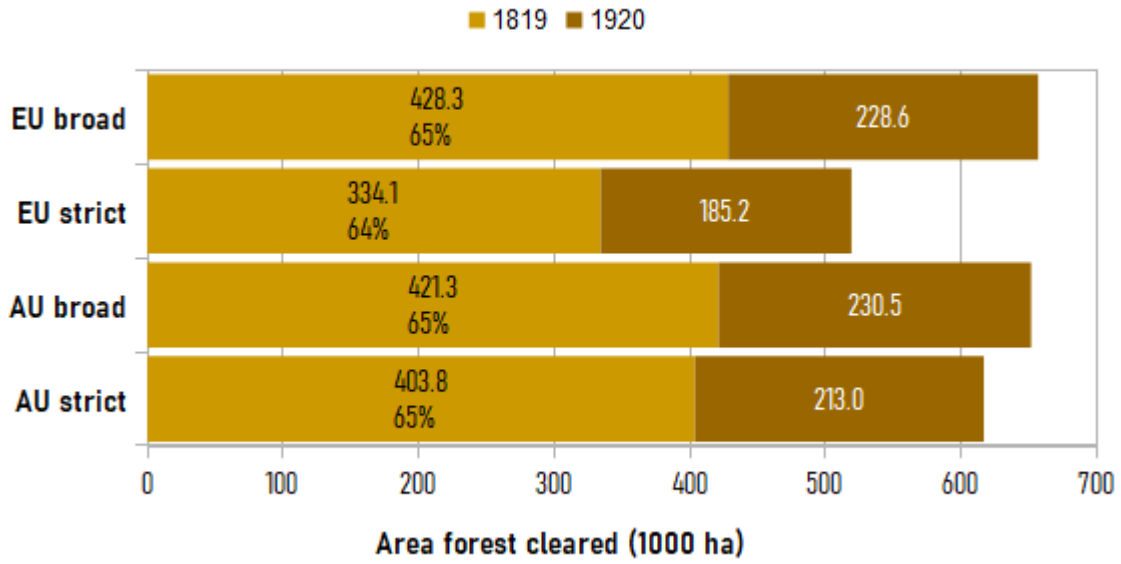

Fig. 10 Areas of forest cleared (deforestation and degradation and all agricultural purposes combined) in 2018/19 and 2019/20 under different forest definitions and variants on undeveloped land uses, excluding National Parks and State Forests (units are 1000s ha).

Age of forests cleared

The distributions of areas of forests cleared across the two years by age class did not differ greatly among definitions (Fig. 11). Only the EU strict definition showed a lower percentage of forest cleared that was remnant (15%) compared with other definitions which ranged from 19-20% (Fig. 11).We therefore averaged areas of forest cleared across definitions and examined distributions by age and type of clearing.

There were dramatic differences. The majority of unknown partial forest clearing or degradation was of remnant forest, while half of all thinning for pasture was of remnant (Fig. 12). For deforestation in contrast, unknown deforestation was split almost equally among the four forest age classes, the majority of pasture deforestation was of non-remnant forest that had been regrowing at least 15 years (74%) and within that most had not previously been detected as cleared by SLATS since 1988. These are advanced age forests being cleared to pasture. Of deforestation for crops, 61% was composed of non-remnant regrowing forests not detected as cleared since 1988 (i.e. over 30 years old in 2018) (Fig. 12).

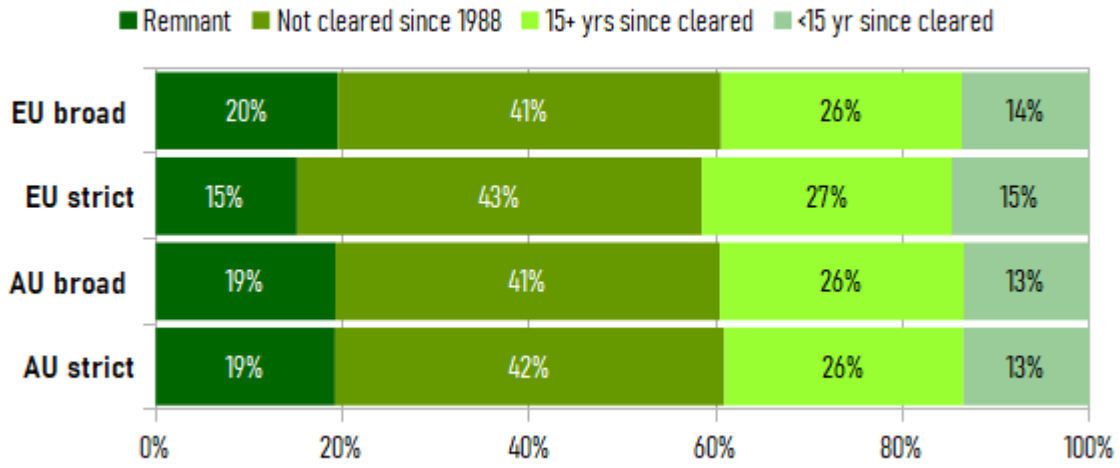

Fig. 11. Distribution of all agricultural forest clearing over the two years 2018-20, among different forest age classes for different forest definitions.

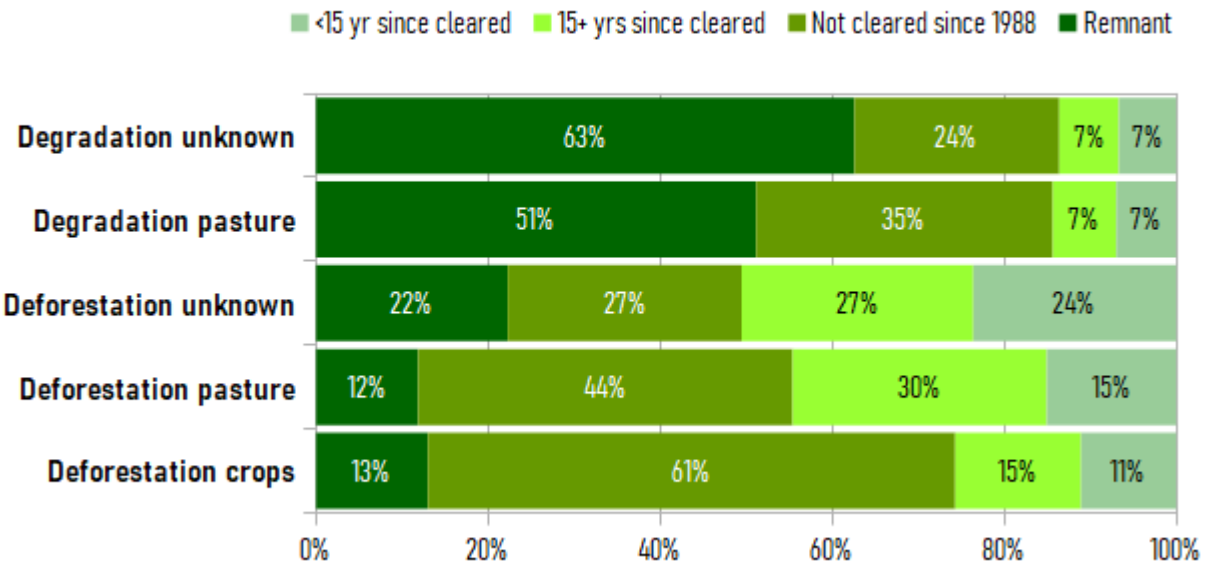

Fig. 12. Distribution of different types and purposes of agricultural forest clearing over the two years 2018-20, among different forest age classes, averaged across different forest definitions.

Deforestation on agricultural properties

A total of 8,538 properties with known owners and 2,051 parcels with unknown owners had some deforestation or degradation (at least one 30 m pixel or 0.09 ha) under any of the definitions over the two year period.

Beef was the dominant driver of deforestation, accounting for between 59 and 62% of all forest clearing (including partial clearing or degradation of forest), or between 72.8 and 76.6% of all deforestation on agricultural properties. This is consistent with the estimated 73% attribution to beef in the 2019 *Drivers* study.[37] Almost all the remaining deforestation is due to other livestock operations such as sheep. Very little agricultural clearing is for crops (Fig. 13).

As documented earlier for the 2014 to 2019 five year period, deforestation is almost entirely undertaken for livestock, and within that for beef, and remains widespread in Queensland, occurring on thousands of properties.

Whilst deforestation is a widespread practice, small numbers of properties account for the lion's share of deforestation and the numbers involved have not changed greatly since 2014.[38]

As few as 168 owners along with 37 parcels with unknown owners had the highest areas of deforestation (excluding degradation) accounting for half of all deforestation under the EU strict definition.

[37] The Wilderness Society 2019 *Drivers of Deforestation and land clearing in Queensland.* (https://www.wilderness.org.au/images/resources/The_Drivers_of_Deforestation_Land-clearing_Qld_Report.pdf)
[38] Taylor MFJ and Fletcher R, 2022. *What's at Steak: Deforestation for beef widespread in Queensland.* Report for the Queensland Conservation Council.

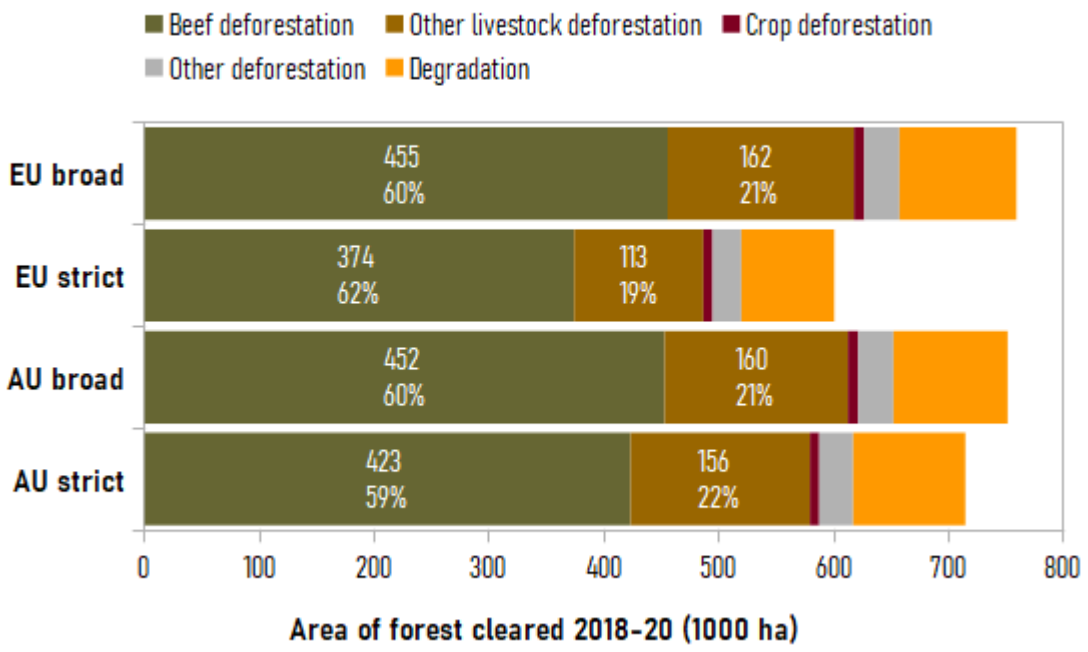

Fig. 13. Agricultural forest clearing by the main land use of properties and land parcels under different definitions, over the two year period.[39]

[39] Notes: On beef properties beef is either a primary or secondary land use. Similarly on other livestock properties, livestock use may be secondary. This includes dairy. Crop deforestation was only attributed to properties or parcels where cropping was the dominant use. Other deforestation was attributed by SLATS to agriculture but falls outside of the footprint of agricultural properties over 30 ha in size.

Legality of clearing under state law

We intersected SLATS agricultural clearing (of all woody vegetation not just forest) with the state *Regulated Vegetation Map* (using an archived version from June 2018 prior to the 2018-2020 clearing events). Nearly three quarters (73%) of clearing was of exempt vegetation for which no permit or restriction is applicable under the state *Vegetation Management Act.* Nonetheless, 27% of clearing was of restricted categories and of that mostly of remnant vegetation (Category B) (Fig. 14).

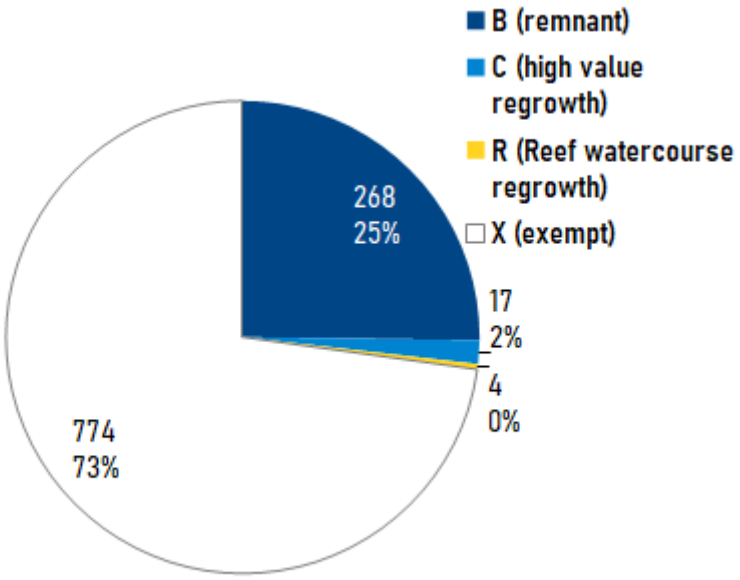

Fig. 14. State regulated vegetation categories of all woody vegetation clearing for agricultural purposes (crops and pastures) from 2018 to 2020 (Units are 1000s of ha).

Clearing of restricted categories B (remnant), C (high value regrowth) or R (Reef water course regrowth) may proceed in one of three ways:-

- If conducted for an exempt purpose (for minor essential works such as firebreaks and fences);
- If notified and conducted according to an "Accepted Development Code" or a code within an "Area Management Plans" for certain allowed purposes.
- Under a development approval previously applied for and approved for "relevant" or allowed purposes;

There are no digital spatial data published by the state government for areas subject to development approvals. Paper maps and lists of coordinates of developments may exist on a state register but in a highly dispersed, difficult to access and incomplete form which requires laborious project by project digitisation.[40]

There is a register of parcel numbers where notifications have been made invoking a particular code, but no spatial data are published for the actual footprints of these clearing actions.[41]

It is difficult therefore to identify the state legal authority for instances of clearing of restricted vegetation categories B, C or R with any clarity.

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[40] https://planning.statedevelopment.qld.gov.au/planning-framework/state-assessment-and-referral-agency/sara-application-material

[41] https://www.qld.gov.au/environment/land/management/vegetation/clearing-approvals

Legality under national law

Under the national *Environment Protection and Biodiversity Conservation Act 1999*, it is an offence to take an action that has or will have or or is likely to have a significant impact a "Matter of National Environmental Significance" (MNES) unless the action has been approved or is exempt (Act Part 3). The list of MNES includes threatened species, marine species, threatened ecological communities, migratory species, World Heritage areas and Ramsar wetlands. Only threatened species and ecological communities were considered in this study.

An action with a significant impact on MNES is called a "controlled action" (Act sect. 67) and is prohibited unless approved (Act sect 67A). It is an offence to take an action that has had, will have or is likely to have a significant impact on MNES without approval (Act Part 3).

The Australian Government Department of Environment (currently the Department of Climate Change, Energy, the Environment and Water or DCCEEW) is responsible for administering the EPBC Act--including monitoring, investigating and taking action against non-compliance. The relevant offences are strict liability offences, meaning the proponent's subjective understanding of whether or not the action required approval does not change legal liability.

Exemptions apply for actions with a "specific environmental authorisation that predates the Act", which continues to be in force, and where no further specific environmental authorisation is required before the action can be proceed; or for actions which constitute a lawful ongoing use of land that was occurring before the commencement of the Act (for example, livestock grazing at the same stocking rates). The exemption for lawful ongoing use does not apply to the expansion or intensification of operations. Some clearing of regrowth is likely to be exempt under the Act. However the fact that vegetation is regrowth is insufficient evidence alone that the action constitutes a lawful ongoing use.[42] Referral is prudent for legal certainty.

In this analysis, we attempt to identify actions that were not referred, but nonetheless are likely to have had a significant impact on threatened species and ecological communities as a result of clearing forest habitats for species and communities in excess of indicative area thresholds for significance based on decisions made by the regulator for other similar actions that were deemed to be controlled actions.

Derivation of significant impact thresholds

First we derived area thresholds for clearing of likely-to-occur habitat that may confidently be deemed to constitute a significant impact.

We conducted ANOVA on our database of 436 referrals that were deemed to be controlled actions by the regulator of the Act and 19 compliance actions taken against unlawful habitat destruction for 116 threatened species (TS) and 43 threatened ecological communities (TEC).[43]

We conducted ANOVA on ln-transformed areas of 1028 total cases with known areas of habitat clearing for particular MNES as described in Methods. The independent variables were EPBC Act Status (Critically

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[42] *"Continuation of native regrowth clearance at a regular, uninterrupted interval (for example, a ten-year cycle)"* See Departmental guidance Department of Agriculture, Water and the Environment 2020, *Agricultural actions exempt from approval under national environmental law* (webpage https://www.dcceew.gov.au/environment/epbc/publications/agricultural-actions-exempt-from-approval-under-national-environmental-law)

[43] Taylor MFJ and Schoo A 2022. *Double standard: The failure of Australia's national environment law to prevent the pastoral industry bulldozing threatened species habitat in Queensland.* ACF report, November 2022.

Endangered, Endangered or Vulnerable) and taxon group (TECs, plants, invertebrates, frogs, reptiles, birds, mammals).The interaction term was significant and some cell counts were small. Accordingly we grouped into classes combining status and taxon group to ensure class case counts over 10 and conducted one-way ANOVA on these classes. Combining smaller classes with no significant differences we derived final thresholds for a reduced set of six status by taxon group classes (Table 5).

There are two clear patterns emerging from this analysis. First, the area threshold for significance is greater for less threatened than more threatened MNES, being smallest for Critically Endangered and greatest for Vulnerable. This was at odds with significant impact guidelines promulgated by the regulator, under which critically endangered and endangered species are ostensibly subject to the same rules.

Second, TECs, plants invertebrates and frogs had small mean area thresholds, while reptiles, birds and mammals had much greater thresholds (Table 5).

Table 5: Geometric means for areas of habitat destruction deemed significant in controlled action and enforcement decisions made by the regulator for six classes based on taxon groups and EPBC Act status. Note that this analysis is Australia-wide not just confined to Qld. CE means critically endangered, EN endangered and VU vulnerable.

Class	Significance threshold (ha)
1 TEC[44]/Plants/Inverts/Frogs CE	4.4
2 TEC/Plants/Inverts/Frogs EN/VU	7.7
3 Reptiles/Birds CE/EN	23.4
4 Reptiles/Birds VU	28.7
5 Mammals CE	23.0
6 Mammals EN/VU	48.1

There were only 34 individual threatened species and 15 TECs with at least three cases Australia wide. We took the geometric mean of areas of the cases for these individual MNES as the threshold for significance of any action in regard to each MNES with two exceptions.

- If the mean was below 1ha we set the threshold to 1ha.
- If the mean area was greater than the mean for the class to which the MNES belonged, the class mean prevailed.

The thresholds for individual MNES are shown in Table 6.

Properties with unreferred but significant clearing of MNES forest habitats

We intersected agricultural land parcels with SLATS detected agricultural forest clearing 2018-20 with likely-to-occur Australian Government maps for threatened species and ecological communities that were listed as of August 2018 to include only:-

[44] Threatened ecological community

- Forest in 2018 or 2019 prior to clearing in respective years, using only the EU strict definition of forest.
- Forest was remnant or if regrowth, at least 15 years old prior to clearing.
- Forest could be either cleared to non-forest in 2018/19 or 2019/20 (deforestation) or cleared but remained above the canopy cover threshold for forest (partial clearing or degradation).
- At least 0.5 ha of forest was cleared for any one MNES.
- Areas falling outside the boundaries of any EPBC Act referral areas for agriculture that had been referred in any year prior to and including 2019, and had not otherwise been withdrawn.[45]

Areas of likely forest habitat cleared were aggregated for each MNES, land parcel and owner. If the total area cleared exceeded thresholds for significance for each MNES and owner the intersection area was retained. In addition where a single owner held multiple parcels, the habitat area cleared on any one given parcel for any given MNES had to exceed one hectare.

A total footprint of 364,221 ha of forest habitat combined across all MNES and parcels was cleared from 2018 to 2020 under the EU strict definition which was also in excess of indicative thresholds of significance for MNES and yet were not referred or approved. This was distributed over 4,442 parcels under 2,645 known owners and another 576 parcels with owners unknown.

Thus on a large number of agricultural properties in Queensland, threatened species and community forest habitats were cleared from 2018-2020 using the strict EU forest definition, and were in excess of conservatively high thresholds to be considered significant without any EPBC Act referral in evidence. All such properties by failing to seek approval are at risk of being unlawful under section 18 of the Act.

Whether or not particular cases are actually unlawful will depend however on the particularities of the case and would require considerably more effort beyond this desktop analysis to establish. Indeed that is the chief purpose of referrals:- to determine using appropriate ground surveys and assessments whether a proposed clearing action is likely to be a controlled action which will require approval.

A small minority of high-clearing properties accounted for much of the MNES habitat clearing. Half of this total MNES loss footprint was attributable to just 267 parcels, 207 belonging to 181 owners and 60 with unknown owners, which had the highest areas cleared. Almost all these high clearing properties fell south and east of Townsville (Fig. 15).

The forest MNES habitats cleared were predominantly in the over 30 year old non-remnant age class in 2018 (52%), 33% in the 15-30 year old non-remnant class and 15% as remnant forest.[46]

[45] There are 20 such referrals:- 2001/482, 2002/725, 2003/1090, 2003/924, 2003/962, 2003/988, 2004/1335, 2004/1473, 2005/1982, 2005/2152, 2005/2284, 2006/2658, 2006/2745, 2008/3974, 2010/5514, 2015/7440, 2016/7838, 2017/7876, 2017/7905, 2017/8108, 2019/8426

[46] That is, had not been cleared since before 1988.

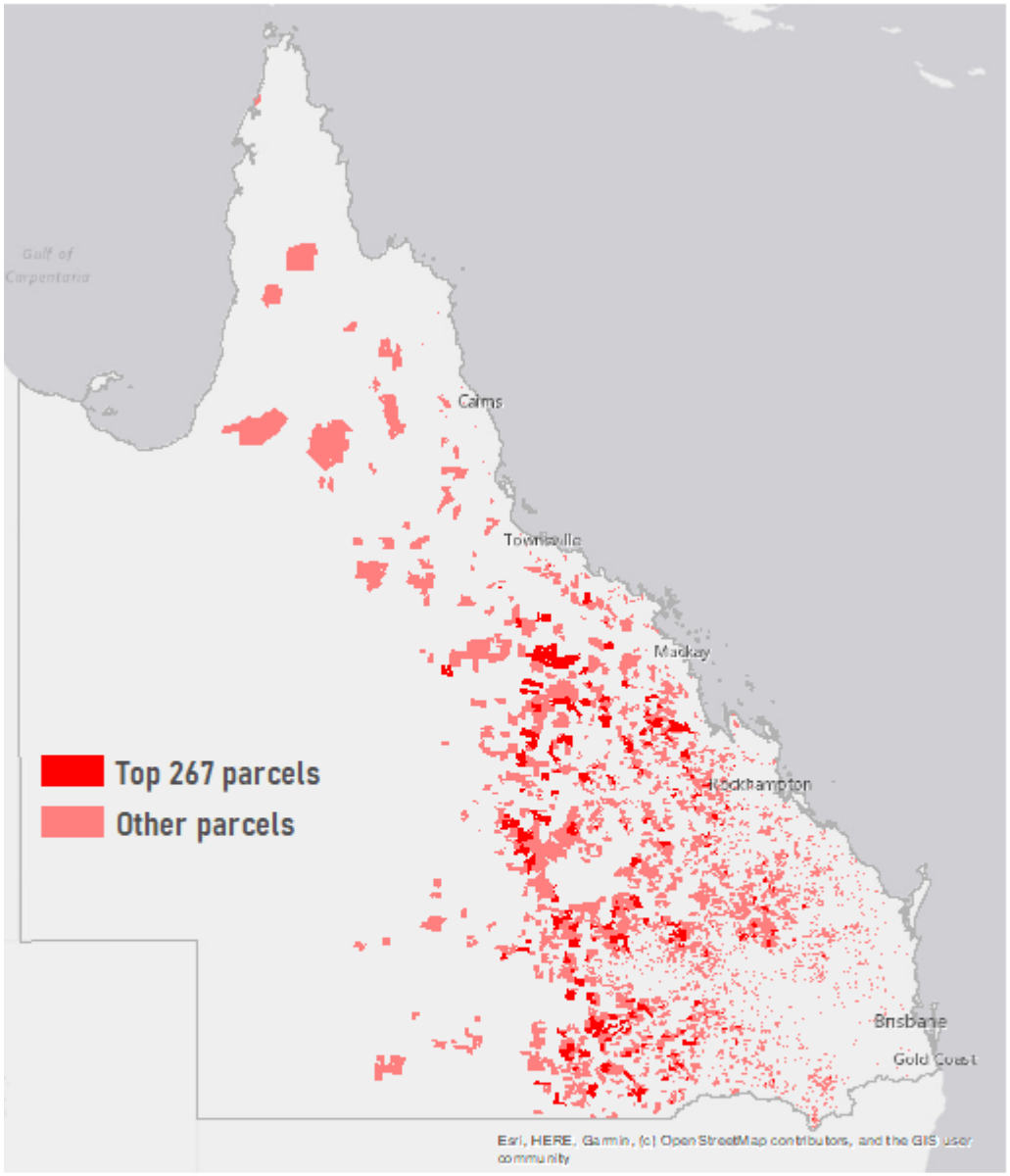

Fig.15. 5,018 land parcels in Queensland with likely-to-occur EU strict forest habitats 15 years or older cleared for agriculture 2018-2020 in excess of significance thresholds for MNES, with no evidence of referral. Parcels are divided into the top 267 parcels where more than 288 ha of combined forest habitat was cleared on each parcel and collectively accounting for half of all such habitat cleared, and all other parcels with less than 288 ha cleared. Note: the areas mapped are the entire parcel areas not the areas cleared within the parcels.

MNES losing habitat to agricultural forest clearing

There were 217 threatened species (158 plants and 59 animals) as well as 10 threatened ecological communities which lost likely-to-occur habitats in this clearing footprint. The threatened mammals losing the greatest areas of likely forest habitat in just those two years were the vulnerable Greater Glider (124,323 ha) and now-endangered Koala (191,893 ha). The ecological community losing the most likely-to-occur habitat was the endangered Brigalow community (7,492 ha) (Table 6).

Table 6. Total areas of likely-to-occur forest habitats (EU strict definition 15+ year old) cleared for agriculture in Queensland 2018-2020 on properties where clearing was in excess of significance thresholds but was not referred for approval under the Act, for threatened species and threatened ecological communities.

Group	ID	Name	EPBCA	Total (ha)	Threshold	Cleared (ha)	Cleared (%)
0 TEC	28	Brigalow	EN	1,057,809	7.7	7,492	0.71%
0 TEC	98	Weeping myall woodland	EN	2,633,341	7.7	7,432	0.28%
0 TEC	24	Semi-evergreen vine thicket	EN	378,448	7.7	541	0.14%
0 TEC	66	Coolibah - Black Box	EN	2,225,652	7.7	2,179	0.10%
0 TEC	26	Artesian springs	EN	1,143,335	7.7	820	0.07%
0 TEC	88	Basalt grasslands	CE	6,267,951	4.4	3,743	0.06%
0 TEC	122	Broad leaf tea-tree woodland	EN	54,352	7.7	24	0.04%
0 TEC	99	Central Grasslands	EN	519,959	7.7	141	0.03%
0 TEC	101	Subtropical Rainforest	CE	906,969	1.0	146	0.02%
0 TEC	43	Box grassy woodland	CE	4,466,998	4.4	681	0.02%
1 Plants	68391	Proston Lasiopetalum	CE	9,419	4.4	103	1.09%
1 Plants	84820	Solanum johnsonianum	EN	254,746	7.7	2,255	0.89%
1 Plants	15931	Three-veined Hakea	VU	98,685	7.7	864	0.88%
1 Plants	75720	Solanum dissectum	EN	258,471	7.7	2,255	0.87%
1 Plants	2705	Pultenaea setulosa	VU	104,262	7.7	867	0.83%
1 Plants	19748	Queensland White Gum	VU	41,060	7.7	320	0.78%
1 Plants	55597	Bulberin Nut	EN	100,970	7.7	773	0.77%
1 Plants	20849	Pimelea leptospermoides	VU	182,683	7.7	1,328	0.73%
1 Plants	64021	Glen Geddes Bloodwood	VU	109,140	7.7	769	0.70%
1 Plants	64582	Macrozamia conferta	VU	152,267	7.7	1,014	0.67%
1 Plants	18106	Small-leaved Denhamia	VU	584,621	7.7	3,839	0.66%
1 Plants	9828	Ooline	VU	17,020,086	7.7	108,569	0.64%
1 Plants	56761	Zieria verrucosa	VU	86,576	7.7	530	0.61%
1 Plants	13375	Neoroepera buxifolia	VU	51,789	7.7	314	0.61%
1 Plants	4822	Westringia parvifolia	VU	544,061	7.7	3,259	0.60%
1 Plants	81869	Mt Berryman Phebalium	CE	897,646	4.4	5,224	0.58%
1 Plants	4146	Xerothamnella herbacea	EN	464,602	7.7	2,656	0.57%
1 Plants	21632	Key's Boronia	VU	10,961	7.7	61	0.56%
1 Plants	55151	Pomaderris clivicola	VU	6,120	7.7	34	0.56%
1 Plants	3566	Acacia grandifolia	VU	278,426	7.7	1,432	0.51%
1 Plants	3066	Cossinia	EN	3,280,456	7.7	16,559	0.50%
1 Plants	64682	Macrozamia parcifolia	VU	166,900	7.7	822	0.49%
1 Plants	55794	Cycas megacarpa	EN	2,077,424	7.7	10,025	0.48%
1 Plants	64681	Macrozamia cranei	EN	205,622	7.7	969	0.47%
1 Plants	56320	Bean's Ironbark	VU	36,662	7.7	155	0.42%
1 Plants	10181	Eucalyptus virens	VU	1,333,206	7.7	5,630	0.42%
1 Plants	13792	Bertya opponens	VU	430,183	7.7	1,763	0.41%
1 Plants	16344	Black Ironbox	VU	4,906,658	7.7	19,247	0.39%

Group	ID	Name	EPBCA	Total (ha)	Threshold	Cleared (ha)	Cleared (%)
1 Plants	3205	Wedge-leaf Tuckeroo	VU	1,911,775	7.7	7,422	0.39%
1 Plants	4165	Tara Wattle	VU	91,756	7.7	330	0.36%
1 Plants	2406	Belson's Panic	VU	21,144	7.7	75	0.35%
1 Plants	55729	Plectranthus omissus	EN	80,535	7.7	269	0.33%
1 Plants	5481	King Blue-grass	EN	3,178,238	7.7	10,542	0.33%
1 Plants	29708	Quassia	VU	4,255,719	7.7	13,388	0.31%
1 Plants	82772	Polianthion minutiflorum	VU	103,552	7.7	317	0.31%
1 Plants	55797	Cycas ophiolitica	EN	1,010,729	7.7	2,954	0.29%
1 Plants	17906	Aristida annua	VU	520,101	7.7	1,426	0.27%
1 Plants	8738	Penda	VU	79,500	7.7	214	0.27%
1 Plants	14159	Qld bluegrass	VU	36,019,253	7.7	95,526	0.27%
1 Plants	14928	Hando's Wattle	VU	108,712	7.7	285	0.26%
1 Plants	64590	Plectranthus leiperi	VU	32,849	7.7	81	0.25%
1 Plants	6649	Hoop Pine Orchid	VU	2,254,977	7.7	5,323	0.24%
1 Plants	10584	Button Grass	EN	136,899	7.7	317	0.23%
1 Plants	64583	Macrozamia machinii	VU	206,567	7.7	478	0.23%
1 Plants	7326	Smooth-shelled Macadamia	VU	1,777,099	7.7	4,112	0.23%
1 Plants	22647	Austral Cornflower	VU	1,579,348	7.7	3,631	0.23%
1 Plants	12673	Blotched Sarcochilus	VU	329,371	7.7	745	0.23%
1 Plants	12836	Acacia deuteroneura	VU	39,108	7.7	88	0.23%
1 Plants	64593	Triplarina nitchaga	VU	32,154	7.7	70	0.22%
1 Plants	64585	Marsdenia brevifolia	VU	1,508,833	7.7	2,912	0.19%
1 Plants	3322	Boonah Tuckeroo	VU	66,237	7.7	126	0.19%
1 Plants	24241	Calytrix gurulmundensis	VU	79,841	7.7	140	0.18%
1 Plants	16091	Yellow Satinheart	VU	1,632,587	7.7	2,718	0.17%
1 Plants	55406	Macrozamia lomandroides	EN	234,641	7.7	388	0.17%
1 Plants	24039	Fontainea rostrata	VU	159,757	7.7	262	0.16%
1 Plants	10690	Acacia attenuata	VU	322,291	7.7	520	0.16%
1 Plants	6416	Isis Tamarind	EN	16,306	7.7	26	0.16%
1 Plants	6021	Capparis thozetiana	VU	49,400	7.7	76	0.15%
1 Plants	55231	Tylophora linearis	EN	1,832,673	7.7	2,706	0.15%
1 Plants	14069	Germainia capitata	VU	116,654	7.7	170	0.15%
1 Plants	5712	Pineapple Zamia	EN	1,045,407	7.7	1,496	0.14%
1 Plants	17533	Medicosma obovata	VU	16,772	7.7	23	0.14%
1 Plants	55145	Durikai Mallee	VU	9,130	7.7	12	0.13%
1 Plants	14035	Wandering Pepper-cress	EN	382,854	7.7	477	0.12%
1 Plants	64586	Omphalea celata	VU	1,642,916	7.7	1,893	0.12%
1 Plants	56133	Ozothamnus eriocephalus	VU	47,434	7.7	53	0.11%
1 Plants	3412	Macrozamia platyrhachis	EN	326,713	7.7	364	0.11%
1 Plants	24040	Fontainea venosa	VU	42,738	7.7	47	0.11%
1 Plants	3160	Swamp Stringybark	EN	53,502	7.7	58	0.11%
1 Plants	7214	Gympie Nut	VU	666,880	7.7	700	0.10%

Group	ID	Name	EPBCA	Total (ha)	Threshold	Cleared (ha)	Cleared (%)
1 Plants	17340	Shiny-leaved Condoo	EN	55,492	7.7	55	0.10%
1 Plants	64651	Grevillea quadricauda	VU	97,296	7.7	95	0.10%
1 Plants	20433	Goodwood Gum	VU	92,482	7.7	89	0.10%
1 Plants	64581	Waxy Cabbage Palm	VU	644,502	7.7	563	0.09%
1 Plants	9338	Hairy-joint Grass	VU	8,586,406	7.7	7,429	0.09%
1 Plants	15961	Satin-top Grass	VU	100,879	7.7	87	0.09%
1 Plants	10838	Paspalidium grandispiculatum	VU	57,317	7.7	47	0.08%
1 Plants	17140	Rusty Desert Phebalium	VU	69,459	7.7	56	0.08%
1 Plants	9074	Pterostylis bicornis	VU	43,472	7.7	35	0.08%
1 Plants	3567	Daviesia discolor	VU	249,688	7.7	194	0.08%
1 Plants	5872	Lesser Swamp-orchid	EN	4,329,581	7.7	3,272	0.08%
1 Plants	56188	Mt Stuart Ironbark	VU	16,031	7.7	12	0.07%
1 Plants	7718	Apatophyllum olsenii	VU	24,164	7.7	16	0.07%
1 Plants	64584	Macrozamia occidua	VU	75,705	7.7	50	0.07%
1 Plants	21315	Border Boronia	EN	13,986	7.7	9	0.06%
1 Plants	6494	Small Helmet-orchid	VU	54,398	7.7	35	0.06%
1 Plants	64072	Corymbia clandestina	VU	44,684	7.7	26	0.06%
1 Plants	15002	Lloyd's Olive	VU	150,350	7.7	85	0.06%
1 Plants	82016	Aponogeton prolifer	EN	82,258	7.7	43	0.05%
1 Plants	56312	Astrotricha roddii	EN	133,293	7.7	67	0.05%
1 Plants	16839	Tall Velvet Sea-berry	VU	1,784,339	7.7	883	0.05%
1 Plants	84115	Prostanthera sp. Dunmore	VU	45,715	7.7	22	0.05%
1 Plants	3908	Curly-bark Wattle	VU	817,311	7.7	353	0.04%
1 Plants	20842	Lindsaea pulchella blanda	VU	210,155	7.7	88	0.04%
1 Plants	13451	Bacon Wood	VU	147,627	7.7	55	0.04%
1 Plants	4311	Stream Clematis	VU	691,148	7.7	240	0.03%
1 Plants	15202	Austral Toadflax	VU	17,892,123	7.7	5,861	0.03%
1 Plants	14747	Glossy Spice Bush	EN	288,574	7.7	87	0.03%
1 Plants	10839	Hawkweed	VU	408,129	7.7	114	0.03%
1 Plants	55186	Homoranthus decumbens	EN	322,432	7.7	89	0.03%
1 Plants	18598	Granite Boronia	EN	137,518	7.7	35	0.03%
1 Plants	12764	Diplazium pallidum	EN	294,311	7.7	73	0.02%
1 Plants	15762	Possum Nut	VU	376,254	7.7	90	0.02%
1 Plants	14767	Tectaria devexa	EN	71,870	7.7	17	0.02%
1 Plants	55728	Plectranthus torrenticola	EN	36,855	7.7	8	0.02%
1 Plants	4124	Blue Knob Orchid	VU	293,530	7.7	56	0.02%
1 Plants	55796	Cycas platyphylla	VU	1,582,915	7.7	286	0.02%
1 Plants	8836	Sophora fraseri	VU	913,746	7.7	153	0.02%
1 Plants	8029	Rhaphidospora bonneyana	VU	304,503	7.7	49	0.02%
1 Plants	11852	Ant Plant	VU	2,531,042	7.7	387	0.02%
1 Plants	52955	Floyd's Walnut	EN	287,449	7.7	43	0.01%
1 Plants	11976	Stinking Laurel	VU	484,339	7.7	72	0.01%

Group	ID	Name	EPBCA	Total (ha)	Threshold	Cleared (ha)	Cleared (%)
1 Plants	14659	Native Jute	EN	331,635	7.7	47	0.01%
1 Plants	8299	Aponogeton bullosus	EN	493,518	7.7	69	0.01%
1 Plants	20992	Narrow-leaved Peppermint	VU	2,721,900	7.7	349	0.01%
1 Plants	87494	Middle Filmy Fern	EN	717,193	7.7	90	0.01%
1 Plants	23956	Canarium acutifolium	VU	271,503	7.7	34	0.01%
1 Plants	15585	Diplazium cordifolium	VU	587,802	7.7	73	0.01%
1 Plants	83552	Oreogrammitis reinwardtii	VU	71,012	7.7	8	0.01%
1 Plants	86555	Square Tassel Fern	VU	400,332	7.7	43	0.01%
1 Plants	20199	McKie's Stringybark	VU	781,213	7.7	81	0.01%
1 Plants	83507	Tomophyllum walleri	VU	259,367	7.7	26	0.01%
1 Plants	55581	Callistemon pungens	VU	2,037,796	7.7	198	0.01%
1 Plants	61156	Purple-flowered Wattle	CE	107,823	4.4	10	0.01%
1 Plants	20859	Black-clubbed Spider-orchid	EN	86,530	7.7	8	0.01%
1 Plants	24603	Chingia australis	EN	482,617	7.7	43	0.01%
1 Plants	46794	Velvet Jewel Orchid	VU	481,642	7.7	42	0.01%
1 Plants	22564	Phaius pictus	VU	2,140,341	7.7	186	0.01%
1 Plants	24178	Carronia pedicellata	EN	395,509	7.7	34	0.01%
1 Plants	82771	Thin Feather Orchid	VU	400,315	7.7	34	0.01%
1 Plants	78893	Dwarf Butterfly Orchid	EN	483,269	7.7	38	0.01%
1 Plants	86551	Rat's Tail Tassel-fern	EN	506,490	7.7	38	0.01%
1 Plants	12431	Euphorbia carissoides	VU	1,368,269	7.7	99	0.01%
1 Plants	3763	Acacia ammophila	VU	361,772	7.7	23	0.01%
1 Plants	55189	Homoranthus lunatus	VU	128,569	7.7	8	0.01%
1 Plants	10577	Spiny Gardenia	EN	185,662	7.7	11	0.01%
1 Plants	18229	Lastreopsis walleri	VU	553,175	7.7	26	0.00%
1 Plants	19131	Ravine Orchid	VU	806,359	7.7	36	0.00%
1 Plants	5780	Cycas cairnsiana	VU	537,841	7.7	23	0.00%
1 Plants	56400	Red Silky Oak	VU	194,496	7.7	8	0.00%
1 Plants	66351	Hakea maconochieana	VU	1,128,133	7.7	39	0.00%
1 Plants	16946	Tephrosia leveillei	VU	260,539	7.7	9	0.00%
1 Plants	6581	Rough-shelled Macadamia	VU	1,119,786	7.7	37	0.00%
1 Plants	86553	Water Tassel-fern	VU	788,992	7.7	26	0.00%
1 Plants	87153	Androcalva procumbens	VU	1,513,525	7.7	48	0.00%
1 Plants	6765	Slender Darling-pea	VU	28,688,971	7.7	890	0.00%
1 Plants	19533	Leafless Tongue-orchid	VU	4,229,215	7.7	130	0.00%
1 Plants	78894	Cooktown Orchid	VU	3,804,758	7.7	91	0.00%
1 Plants	16152	Sclerolaena walkeri	VU	15,543,545	7.7	304	0.00%
1 Plants	9003	Macropteranthes montana	VU	1,155,297	7.7	22	0.00%
1 Plants	5831	Knotweed	VU	842,927	7.7	15	0.00%
1 Plants	86550	BlueTassel-fern	EN	1,237,394	7.7	18	0.00%
1 Plants	9190	Winged Pepper-cress	EN	9,203,811	7.7	120	0.00%
1 Plants	2794	Clear Milkvine	VU	1,156,782	7.7	15	0.00%

Group	ID	Name	EPBCA	Total (ha)	Threshold	Cleared (ha)	Cleared (%)
1 Plants	11289	Dendrobium nindii	EN	915,925	7.7	8	0.00%
1 Plants	13585	Chocolate Tea Tree Orchid	VU	8,212,791	7.7	46	0.00%
1 Plants	20503	Tylophora woollsii	EN	2,281,901	7.7	12	0.00%
1 Plants	78700	Cepobaculum carronii	VU	3,657,300	7.7	8	0.00%
2 Invertebrates	67458	Boggomoss Snail	CE	40,356	4.4	488	1.21%
2 Invertebrates	83885	Dulacca Woodland Snail	EN	554,508	7.7	3,598	0.65%
2 Invertebrates	83886	Brigalow Woodland Snail	EN	171,904	7.7	250	0.15%
2 Invertebrates	88056	Australian Fritillary	CE	281,960	4.4	30	0.01%
2 Invertebrates	84159	Antbed Parrot Moth	EN	1,065,322	7.7	59	0.01%
3 Frogs	1889	Kroombit Tinker Frog	CE	123,574	4.4	197	0.16%
3 Frogs	1887	Eungella Day Frog	EN	805,228	7.7	1,251	0.16%
3 Frogs	25960	Fleay's Frog	EN	1,537,632	7.7	713	0.05%
3 Frogs	64385	Magnificent Brood Frog	VU	281,517	7.7	94	0.03%
3 Frogs	1944	Giant Barred Frog	VU	3,976,989	2.7	860	0.02%
3 Frogs	86707	Lace-eyed Tree Frog	VU	1,855,830	7.7	131	0.01%
3 Frogs	1820	Mountain Mistfrog	CE	610,449	4.4	21	0.00%
4 Reptiles	1378	Retro Slider	EN	329,747	23.4	3,156	0.96%
4 Reptiles	1761	Fitzroy Turtle	VU	4,317,009	28.7	37,633	0.87%
4 Reptiles	1193	Ornamental Snake	VU	8,670,548	28.7	64,994	0.75%
4 Reptiles	81648	White-throated Snapping Turtle	CE	478,948	23.4	2,832	0.59%
4 Reptiles	59254	Dunmall's Snake	VU	1,058,176	28.7	5,437	0.51%
4 Reptiles	1420	Yakka Skink	VU	12,644,412	28.7	51,364	0.41%
4 Reptiles	1308	Mt Cooper Striped Skink	VU	178,663	28.7	697	0.39%
4 Reptiles	1656	Adorned Delma	VU	1,146,936	23.9	3,149	0.27%
4 Reptiles	59550	Nangur Spiny Skink	CE	44,312	23.4	116	0.26%
4 Reptiles	64389	Mary River Turtle	EN	531,777	23.4	457	0.09%
4 Reptiles	84578	Granite Belt Thick-tailed Gecko	VU	3,099,682	28.7	1,265	0.04%
4 Reptiles	25934	Long-legged Worm-skink	VU	1,419,713	28.7	223	0.02%
5 Birds	64440	Squatter Pigeon	VU	27,502,952	28.7	167,754	0.61%
5 Birds	26027	Star Finch	EN	43,787,838	23.4	119,930	0.27%
5 Birds	64447	Southern Black-throated Finch	EN	10,128,296	23.4	23,155	0.23%
5 Birds	923	Black-breasted Button-quail	VU	5,251,642	28.7	8,012	0.15%
5 Birds	470	Painted Honeyeater	VU	90,497,617	28.7	116,724	0.13%
5 Birds	77037	Australian Painted Snipe	EN	123,716,780	23.4	139,142	0.11%
5 Birds	67090	Capricorn Yellow Chat	CE	465,994	23.4	372	0.08%
5 Birds	59714	Coxen's Fig-Parrot	EN	955,950	23.4	708	0.07%
5 Birds	942	Red Goshawk	VU	61,967,994	28.7	20,046	0.03%
5 Birds	906	Plains-wanderer	CE	27,711,999	23.4	4,185	0.02%
5 Birds	82338	Regent Honeyeater	CE	33,965,104	23.4	4,720	0.01%
5 Birds	67033	Palm Cockatoo	VU	4,358,617	28.7	270	0.01%
5 Birds	59293	Buff-breasted Button-quail	EN	3,369,079	23.4	200	0.01%
5 Birds	25986	Cassowary	EN	2,521,472	2.6	124	0.00%

Group	ID	Name	EPBCA	Total (ha)	Threshold	Cleared (ha)	Cleared (%)
5 Birds	720	Golden-shouldered Parrot	EN	2,088,356	23.4	59	0.00%
5 Birds	26048	Masked Owl	VU	37,326,992	28.7	1,048	0.00%
5 Birds	413	Gouldian Finch	EN	47,780,866	23.4	372	0.00%
5 Birds	1001	Australasian Bittern	EN	23,206,850	23.4	169	0.00%
6 Mammals	254	Greater Glider (southern and central)	EN	39,412,755	48.1	124,323	0.32%
6 Mammals	85104	Koala	EN	76,481,458	48.1	191,893	0.25%
6 Mammals	186	Grey-headed Flying-fox	VU	28,275,335	42.7	23,432	0.08%
6 Mammals	239	Bridled Nail-tail Wallaby	EN	251,746	48.1	204	0.08%
6 Mammals	331	Northern Quoll	EN	100,453,198	48.1	81,355	0.08%
6 Mammals	83395	South-eastern Long-eared Bat	VU	32,683,233	48.1	20,764	0.06%
6 Mammals	96	New Holland Mouse	VU	10,712,131	48.1	2,000	0.02%
6 Mammals	174	Ghost Bat	VU	89,870,153	48.1	13,158	0.01%
6 Mammals	75184	Tiger Quoll	EN	26,368,606	37.9	3,173	0.01%
6 Mammals	183	Large Pied Bat	VU	12,103,156	24.3	1,151	0.01%
6 Mammals	66889	Bare-rumped Sheathtail Bat	VU	20,847,115	48.1	1,657	0.01%
6 Mammals	66	Water Mouse	VU	10,138,228	48.1	694	0.01%
6 Mammals	225	Brush-tailed Rock-wallaby	VU	4,227,372	48.1	126	0.00%
6 Mammals	305	Julia Creek Dunnart	VU	2,784,496	48.1	61	0.00%
6 Mammals	87639	Large-eared Horseshoe Bat	VU	16,333,425	48.1	356	0.00%
6 Mammals	87608	Yellow-footed Rock-wallaby	VU	3,024,595	48.1	61	0.00%
6 Mammals	66645	Long-nosed Potoroo	VU	4,803,427	48.1	62	0.00%

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Caveats

Pixellation of original shapefiles to facilitate intersections of large datasets and calculation of areas may lead to minor errors in totals of areas shown in tables. We estimate that this error is never more than about +/- 0.05%.

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