



*Image © Jamie Trew, Chaining advanced regrowth Ironbark Cracow, Queensland, February 2000*

## **Consequences for Australian emissions of land clearing in Queensland**

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## *Executive summary*

Since 1990, declining greenhouse gas emissions from clearing of native vegetation have balanced Australia's ever-increasing emissions from energy and industry. They have kept Australia within striking distance of International targets under the Kyoto and Paris agreements.

Emissions from clearing are reported in the National Greenhouse Gas Inventory under the banner of land use, land use change and forestry (LULUCF). LULUCF emissions have been markedly reduced in every State and Territory since 1990, but changes to clearing in Queensland are particularly important because Queensland contributes the majority of Australia's LULUCF emissions. Most States are now net sinks in the LULUCF sector, so that their landscape management is reducing atmospheric CO<sub>2</sub> concentrations, while Queensland's emissions from LULUCF are about 4% of Australia's total net emissions.

Land clearing in Queensland, and the resultant emissions, has proven sensitive to regulation. Tightening of controls on clearing through the first decade of this century resulted in historically low clearing, and setup a trend of declining emissions from clearing. Similarly, relaxations to clearing laws saw increases in clearing rates and emissions.

This paper presents an analysis of data on LULUCF emissions trends reported through Australia's National Greenhouse Gas Inventory, and estimates the consequences for greenhouse gas emissions under four future clearing scenarios for Queensland, representing a range of plausible future regulatory regimes.

The results highlight the importance of clearing in Queensland for Australia's ability to meet its international commitments to reduce greenhouse gas emissions. **If clearing of mature native vegetation is effectively controlled by regulation, Queensland's landscape can become a modest carbon sink, while a return to relaxed regulation and compliance could increase national emissions by more than 10% and blow-out our opportunity to meet international commitments.**

The consequences of an emissions blowout in Queensland from more relaxed laws would go beyond international treaties. They would also undercut the credibility of incentive schemes like the Emissions Reduction Fund, through which Australians are purchasing greenhouse gas abatement from farmers willing to go above and beyond regulatory baselines. A blowout would also cut against National Agricultural industry objectives, such as Australia's red meat industry's ambition to be carbon neutral by 2030, which industry sees as maintaining access to premium markets for our agricultural products.

Reducing emissions through new technologies is a vital National priority, but the importance of maintaining the hard-won gains achieved through regulation of native vegetation clearing must not be overlooked, especially in Queensland.

## Land use, land use change and forestry and Australia's National Greenhouse Gas Inventory

Australia's greenhouse gas emissions are reported annually through the National Greenhouse Gas Inventory (NGGI), in accordance with international reporting guidance provided by the United Nations Framework Convention on Climate Change (UNFCCC). This analysis was developed using data to 2018, and the data from the inventory is provided back to 1990. More recent data to 2019, which was released early in 2021, does not change the overall picture. In the NGGI, emissions from land management are reported within the sector of land use, land use change and forestry, abbreviated as LULUCF.

Reductions in LULUCF emissions are the primary change that has kept Australia's greenhouse gas emissions from increasing substantially relative to baseline years for the Kyoto and Paris agreements (1990 and 2005). Waste and agriculture have achieved reductions, but without LULUCF they would not be sufficient to offset an ongoing upward trend in emissions from energy production (Figure 1).

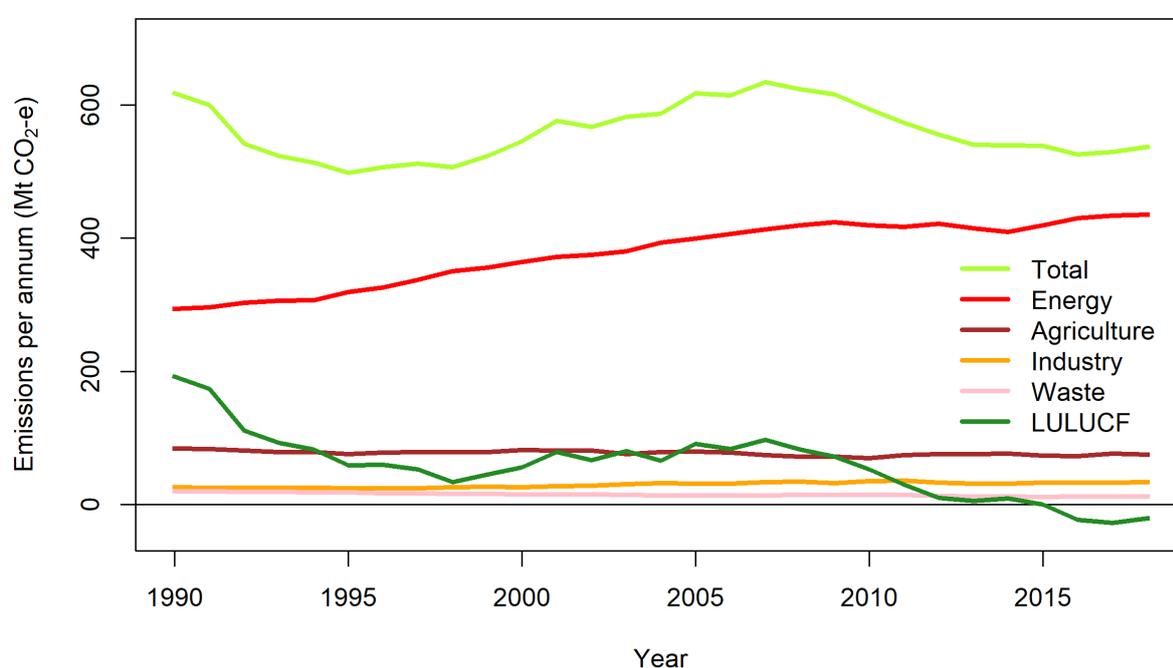


Figure 1. Australian emissions according to individual sectors. Declining LULUCF emissions (dark green line) have largely offset the effect of increasing emissions from energy (red line) on Australia's national emissions (light green line). Source "State & Territory Inventories 2018 - Emission Data Tables" <https://ageis.climatechange.gov.au/QueryAppendixTable.aspx> (accessed 12 September 2020)

Activities in Queensland have a significant effect on national LULUCF emissions, because Queensland is the largest source of LULUCF emissions. All states and territories have achieved substantial declines in LULUCF since 1990, and most are now net sinks for greenhouse gases in LULUCF (i.e. States with bars below the zero line in Figure 2).

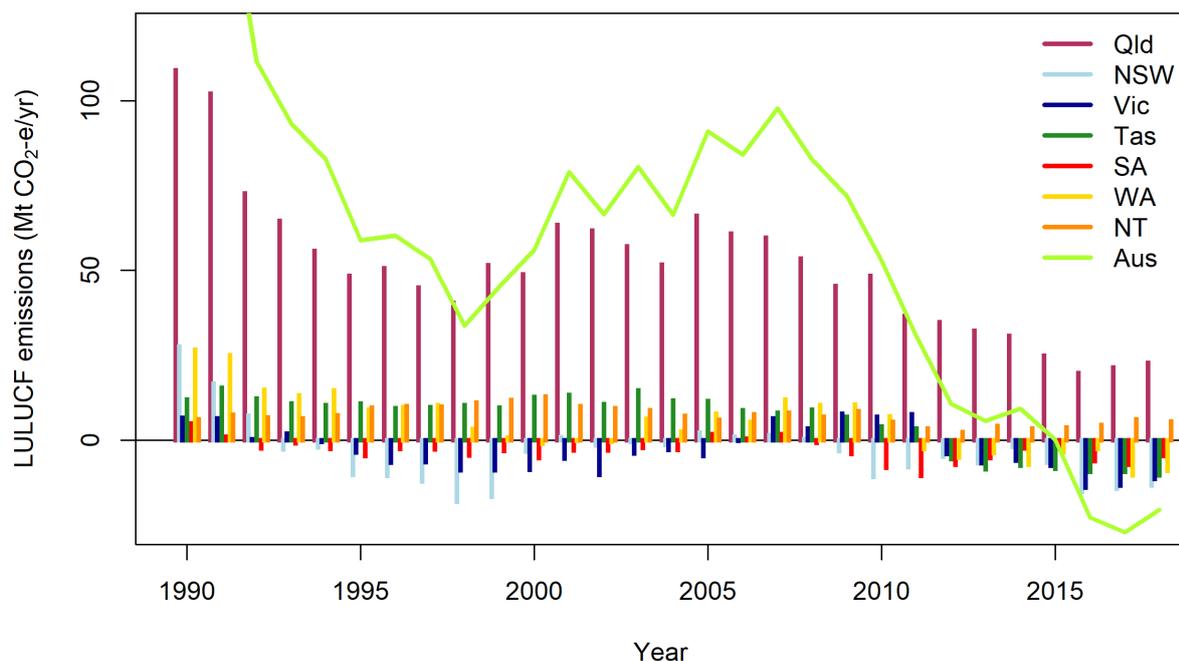


Figure 2. LULUCF emissions from 1990 to 2018 for Australia (line) and its States and Territories (bars). Source “State & Territory Inventories 2018 - Emission Data Tables” <https://ageis.climatechange.gov.au/QueryAppendixTable.aspx> (accessed 12 September 2020)

LULUCF is reported under several segments based on predominant land use and vegetation structure. The “grassland” segment predominates Queensland’s LULUCF account (yellow line in Figure 3), because converting forested land to grassland is the dominant source of Queensland’s LULUCF emissions. For the purposes of the emissions account a forest is defined as vegetation with trees >2m tall and at least 20% crown cover over more than 0.2 ha.

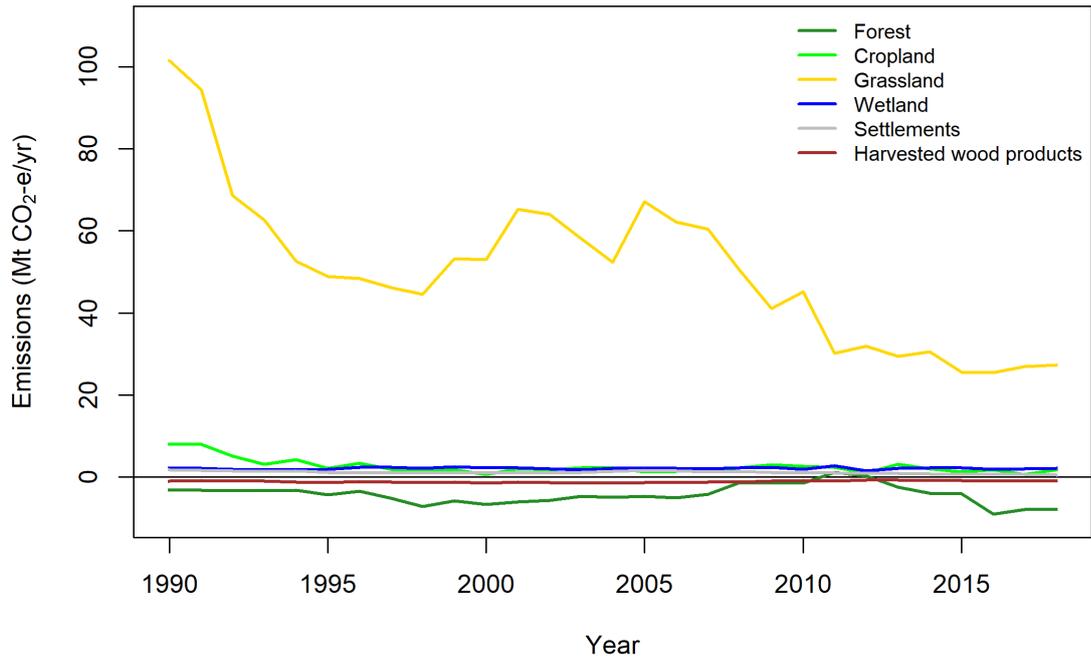


Figure 3. Components of Queensland’s LULUCF greenhouse gas emissions account. Forest converted to grassland (yellow/orange line), includes emissions from forest clearance and re-clearing of regrowth to establish and maintain grasslands, which is done mostly for pastoralism.

The trends through time in Queensland’s LULUCF emissions are strongly related to the rate of forest clearance (Figure 4, compare bars showing clearance with green line showing LULUCF emissions).

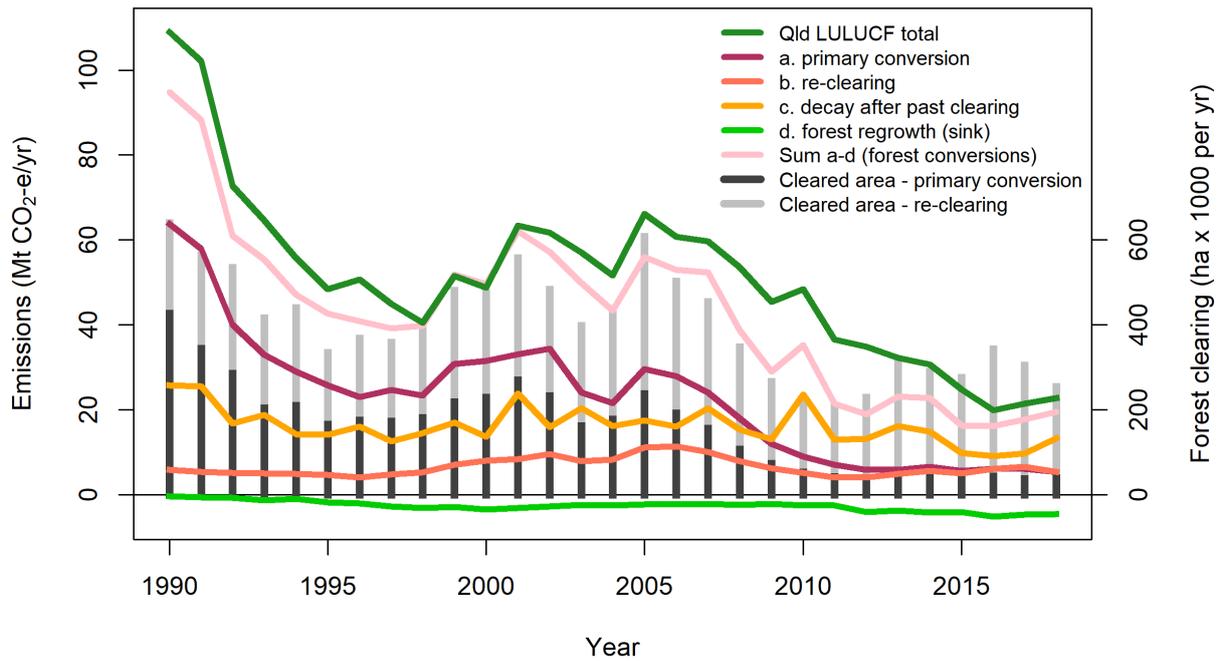


Figure 4. Components of Queensland's LULUCF account (lines) and forest clearance activity (bars).  
 Source "Activity Table 1990-2018 - LULUCF"  
<https://ageis.climatechange.gov.au/QueryAppendixTable.aspx> (accessed 12 September 2020)

The activity tables published for the NGGI provide a breakdown of the individual components of the inventory. Activity data for LULUCF includes details on primary forest conversion (i.e. clearing mature native vegetation), re-clearing of regrowth vegetation on land that was previously cleared of forest, plus direct and delayed emissions from clearing and regrowth. The NGGI data indicate that direct emissions per hectare for primary conversion and re-clearing (Figure 5) have consistently been close to their average values of 147.9 and 26.9 t/ha respectively between 1990 and 2018 (with standard errors of 2.8 and 1 t/ha). Regrowth has consistently represented an average sink of -2.1 t/ha/yr (standard error 0.1 t/ha).

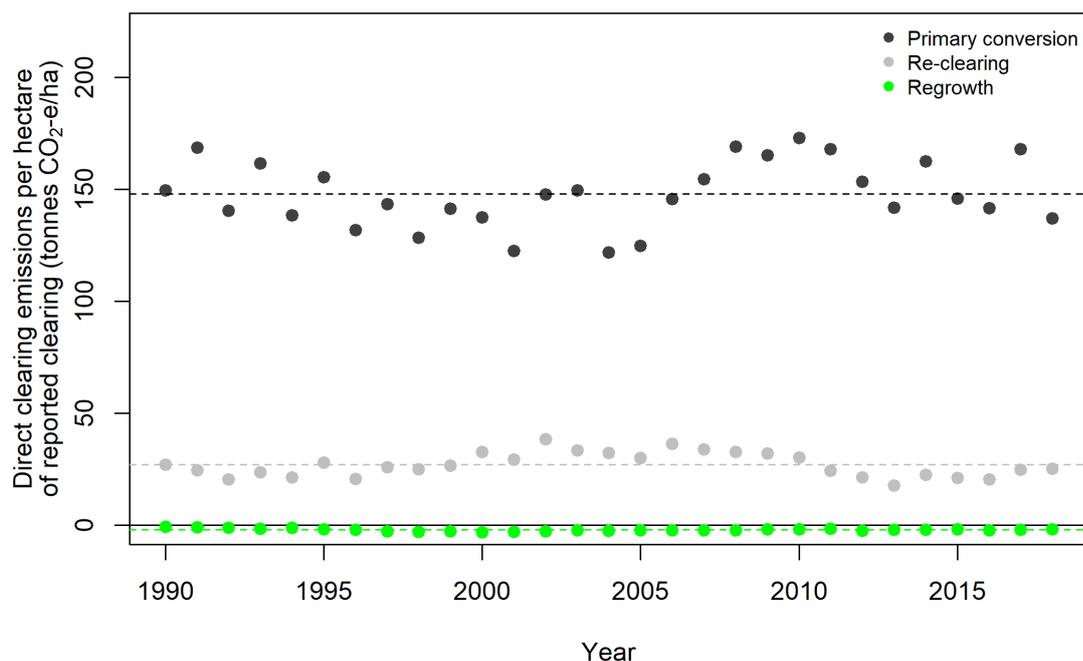


Figure 5. Emissions intensity per hectare of clearing activity in Queensland’s LULUCF account. Average values, used to estimate emissions for future scenarios, are represented by dashed lines. Source “Activity Table 1990-2018 – LULUCF” and “State & Territory Inventories 2018 – Emission Data Tables” <https://ageis.climatechange.gov.au/QueryAppendixTable.aspx> (accessed 12 September 2020)

The four components of forest conversion emissions plotted in Figure 4 (i.e. a-d) explain 97% of the variation in Queensland’s LULUCF emissions from 1990 to 2018. They are used below as the basis of scenarios to assess implications of potential future changes to emissions resulting from clearing regulation in Queensland.

#### *Sensitivity of Queensland’s clearing rates and emissions to regulation, a case study in policy efficacy*

Queensland’s LULUCF emissions have steadily declined since 2005 (Figure 6), this downward trend is a direct response to clearing regulation implemented since the turn of the century. According to the NGGI, regrowth forest on previously cleared land has been accruing a growing stock of carbon as clearing rates have declined over time, with a net sink of nearly 5 Mt CO<sub>2</sub>-e reported for 2018. This regrowth sink is significantly offsetting an increase in direct emissions from increases in forest re-clearing observed since 2012, an example of the many time lags involved in emissions responses to regulation in the land sector. Emissions due to decay from past clearing, which also lag behind practice change, have declined by about 5 Mt CO<sub>2</sub>-e over the last decade (16.4 Mt average 2005-2009 vs 11.3 2004-2018). The trend to lower decay presumably reflects the diminishing lag effects of higher clearing rates before 2010. Lag effects include declines in soil carbon and woody debris following clearing. The key point is that lower clearing rates can both reduce emissions from clearing activities and also increase carbon storage in regrowing forest provided it is not subsequently cleared.

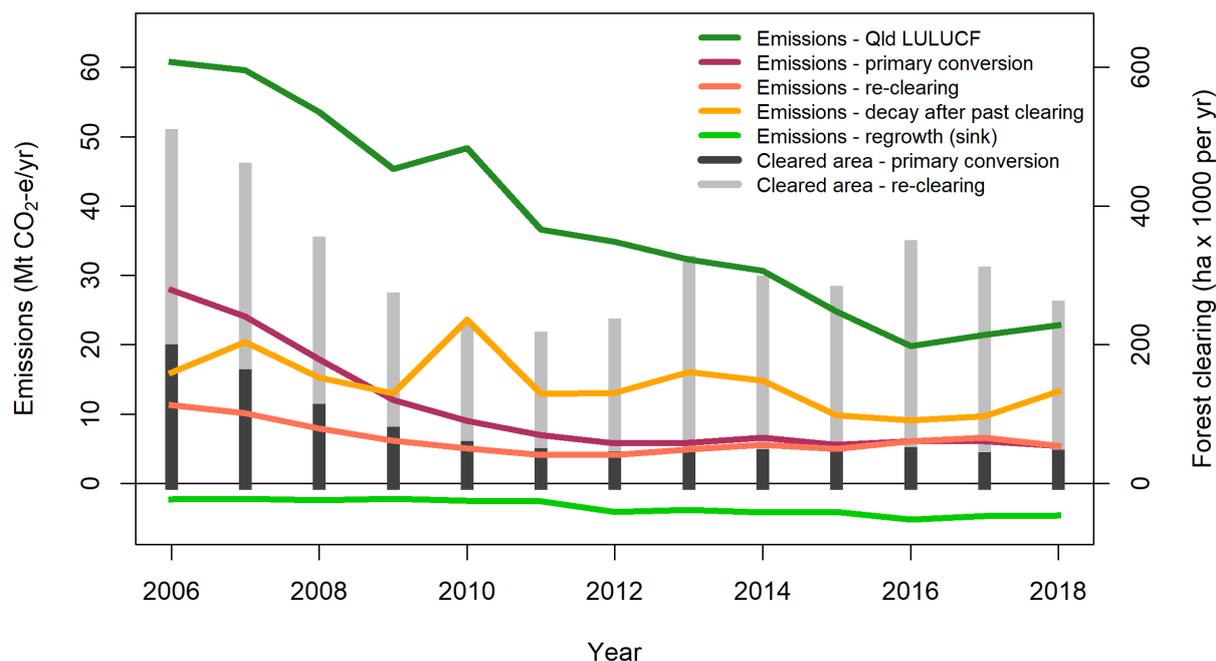


Figure 6. Components of Queensland's LULUCF account (lines) and forest clearance activity (bars) since 2006 (i.e. detail of Figure 4) since 2006 (i.e. detail of Figure 4) since 2006 (i.e. detail of Figure 4). Source "Activity Table 1990-2018 - LULUCF" <https://ageis.climatechange.gov.au/QueryAppendixTable.aspx> (accessed 12 September 2020)

Data from Queensland's Statewide Land and Trees Study (SLATS) confirm the significant decline in clearing after 2006 and the increase in clearing since 2012 reported in the NGGI, but SLATS also suggest a higher impact on mature native vegetation than the NGGI indicates (Figure 7). SLATS and NGGI use different methods to report on slightly different aspects of clearing. SLATS report on annualised rates for clearing of all woody vegetation, which is a broader concept than the 'forest' lands that are the focus of this report. The higher density of carbon in forests, broadly defined as vegetation with trees >2m tall and at least 20% crown cover over more than 0.2 ha, and especially in mature native forests, means that prediction of future LULUCF emissions can focus on forest clearing.

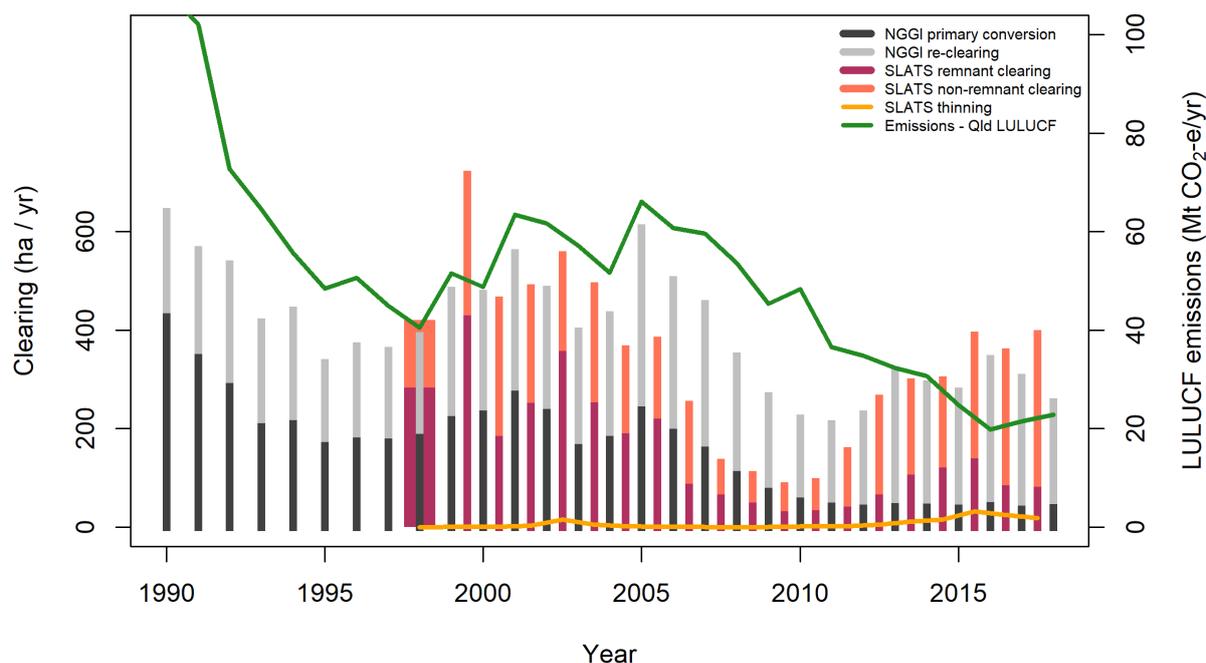


Figure 7. Comparison of NGGI forest conversion activity and LULUCF emissions data for Queensland, with the State's Statewide Land and Trees Study data for woody clearing rates. Source "Activity Table 1990-2018 - LULUCF" <https://ageis.climatechange.gov.au/QueryAppendixTable.aspx> (accessed 12 September 2020), SLATS "Data summaries 1988-2018" [https://data.des.qld.gov.au/data/assets/excel\\_doc/0026/83825/slats-data-summaries-1988-2018.xlsx](https://data.des.qld.gov.au/data/assets/excel_doc/0026/83825/slats-data-summaries-1988-2018.xlsx)

Despite their differences in method and application, SLATS and the NGGI both clearly document reducing rates of mature vegetation clearing through the decade to 2010 (i.e. remnant clearing in SLATS or primary forest clearing in NGGI), followed by increasing clearing, particularly of regrowth, since 2012.

Another noteworthy point from the SLATS data is rising rates of clearing reported as 'thinning', particularly since 2012. Thinning accounted for 5% of the total woody vegetation clearing rate reported by SLATS for 2017-18 (18 531 ha/yr), but this does not distinguish thinning of mature native vegetation from thinning of regrowth vegetation. The rise of thinning since 2012 also points to the important influence of State vegetation management regulation on Queensland's clearing rates, as explained below.

The rates of vegetation clearance in Queensland reflect the strength of regulation (Figure 8), which began to apply from the mid-1990s. Prior to the 1990s government policy tended to support clearing to advance agricultural development. Regulation was initially introduced through increasing assessment of intended clearing of mature native vegetation on leasehold land (which is most of Queensland) from 1997. Restrictions on clearing of threatened ecosystems were extended to freehold land, effective from the end of 2000, following establishment of the *Vegetation Management Act 1999* (VMA). In 2004 a ballot was held to issue the last permits for broadscale clearing of mature native vegetation for most agricultural purposes, and a \$150M structural adjustment package was provided to assist severely impacted landholders. Clearing under the permits issued in 2004 had to be

completed by the end of 2006, making that year the natural marker for the end of the initial period of regulatory tightening on Queensland's clearing (phase marked "a. tightening" in Figure 8).

Clearing rates dropped dramatically following the end of broadscale clearing for agriculture in 2006 (phase marked "b. tight" in Figure 8). This period of tight regulation and compliance, beginning in 2007 and ending in 2012/13, still allowed clearing of many tens of thousands of hectares per year. Queensland still accounted for the vast majority of Australian clearing during these years, despite the lowest clearing rates since the second world war (Fensham and Fairfax, 2003). Regulation was strongly focussed on clearing of mature native vegetation, which was still allowed for various routine land management activities such as constructing or maintaining fencelines or roads, or managing weeds. Allowances for harvesting of fodder to feed stock, particularly in south-west Queensland, were also retained. Clearing of regrowth was unrestricted until 2009, when some controls on clearing older regrowth were introduced. This is largely why 2006 also marked the transition from a period when the majority of clearing was of mature native vegetation before 2006, to a period where most clearing has been of regrowth, since 2006.

A State election in 2012 saw a rapid change in policy regarding clearing. The new government began with a review and negative statements about compliance in 2012, including promises to "take the axe to Queensland's clearing laws" from the Minister for Natural Resources (phase marked "c. loosening" in Figure 8). These rhetorical signals were followed by amendments to the VMA in 2013 to enable more clearing. The VMA was not removed entirely, and the broad framework for regulating clearance of mature native vegetation was retained largely intact, but protections for high-value regrowth were removed. New opportunities for broad-scale clearing of mature native vegetation were enabled, primarily for development of 'high-value agriculture'. Some high-value agriculture permits were extremely large, including 58,000 hectares on a single property in the Gulf of Carpentaria<sup>1</sup>. Moves were also made to broaden the scope of activities that could be conducted without permits, through the institution of self-assessable codes for clearing, which included widely applicable allowances for thinning of mature native vegetation.

The government that made these changes lost power in 2015, but its successor failed in its first attempt at passing legislation to reinstate tighter restrictions on clearing in 2016. They had to wait until 2018 to bring about legal change. Many internal policies changed in 2015, including reactivation of compliance and presumably the weight given to environmental outcomes during assessments of development applications, but the laws only changed in 2018. 2018 is also the most recent year for which the NGGI has published data. So although Figure 8 shows a phase marked "d. tightening" beginning in 2015, the changes in this period were initially softer changes, involving policy and compliance, rather than a rapid shift in the firmer aspects of regulation.

The regulatory changes that were made in 2018 included removal of high value agriculture clearing as an allowable clearing purpose, as well as new protections for some areas of older regrowth, and some parts of reef watercourses. The coverage of regrowth regulation is significantly restricted by the widespread coverage of a statutory instrument known as a "property map of assessable vegetation" (PMAV). PMAV's allow landholder to 'lock-in' exemption from the controls on clearing under the VMA for previously cleared areas of land. PMAVs were introduced in 2004 to provide landholder certainty, and now cover more than two thirds of the previously cleared land on which regrowth clearing could be regulated. The new controls introduced in 2018 could only protect high-value regrowth and reef water courses where PMAVs do not provide an ongoing exemption from the VMA.

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<sup>1</sup> <https://www.abc.net.au/news/2015-11-22/land-clearing-investigated-for-legal-breaches-environment-damage/6961108>

It is apparent that there is a lag between changes to policy and regulation, and land clearing activity. Even promises to axe tree clearing laws take time to produce higher clearing rates. Similarly, there was a three-year lag between the tight regulation of broadscale clearing in 2006 and the low clearing rates in 2009 and 2010. It may be some time before we see emissions decline to reflect the 2018 law change.

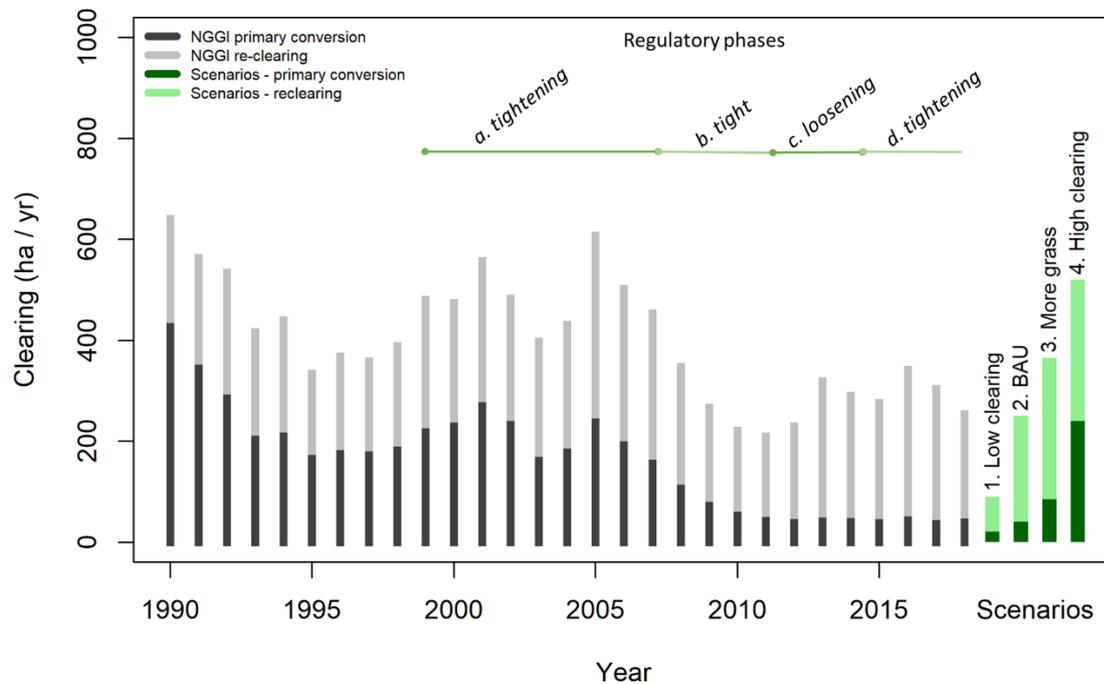


Figure 8. Regulatory trends and rates of clearing in Queensland. ‘a tightening’ – introduction of regulations including the VMA, resulting in end to broadscale mature native vegetation clearing in 2006. ‘b. tight’ – period of tight regulation with interest in compliance. ‘c, loosening’ – disinterest in compliance and new mechanisms to allow clearing instituted. ‘d – tightening’ change of government in 2015 reinstates interest in compliance but legal changes not passed until 2018. Scenarios defined in terms of clearing rates, and modelled for emissions, are represented as green bars to the right of the figure.

#### What next? Four scenarios for Queensland’s clearing future and their impact on Australia’s greenhouse gas accounts

Given the clear relationship between regulation and clearing rates outlined above, and the consistent average emissions intensity revealed by the NGGI, it is reasonable to project emissions from potential future regulatory options. The question is, what is the future for the VMA?

Four potential future scenarios are developed as detailed in Table 1 and illustrated in the right side of Figure 8. The first scenario, labelled “**low clearing**”, reflects a relatively rigorous regulatory regime slightly stronger than that in place from 2006 to 2013 and largely re-established in 2018, with tightly constrained primary forest conversion (mature native vegetation clearing) plus controls on regrowth clearing. Under this low clearing scenario, mature native vegetation clearing would continue at a rate of 20,000 ha per annum, partly in relation to activities outside the jurisdiction of the VMA, including mining activities and urban expansion, but also for ongoing fodder harvesting in the south-west of

Queensland. Similarly re-clearing would continue, but at 70 000 hectares per annum, which is low by Queensland standards, to help conserve older regrowth and regrowth in priority locations such as along reef watercourses.

The second scenario, labelled “**business as usual**” is pitched to reflect the regime as it was from 2015 to 2018, with some attention to compliance but also with self-assessable codes, including a code for thinning. Clearing rates under this scenario are below the average since 2006.

The final two scenarios are informed by the clearing rates observed between 2001 and 2008, and 2013 to 2015, when regulation of regrowth clearing was minimal, and clearing of mature native vegetation was also permissible for many purposes. Scenario 3, “**more grass**”, models this type of regime without opportunities for significant clearing to develop high value agriculture, but with widespread opportunities to thin mature native vegetation, as were instituted in 2012. This is consistent with current suggestions for a change to the ‘balance’ between trees and grass in Queensland’s rangelands. Scenario 4, “**high clearing**”, models weakened regrowth protections plus significant mature native vegetation clearing for agricultural intensification, as would be expected from a push for northern development such as regularly coincides with drought-periods in southern Australia, and also a lax compliance regime facilitating illegal clearing at a high rate (Appendix).

Table 1. Four future scenarios of native vegetate clearing in Queensland in relation to area of clearing, component emissions and a brief rationale. Further rationale is provided in the text and in the Appendix.

Scenario #	Land clearing ('000s hectares p.a.)	Regrowth sink	Decay from past clearing	Rationale	
<ul style="list-style-type: none"> <li>• Total clearing p.a.</li> <li>• Carbon emissions p.a.</li> </ul>	First time clearing <sup>2</sup>	Re-clearing (regrowth)			
<b>Scenario 1. Low clearing</b> Total clearing: <b>90,000 ha/yr</b> Emissions: <b>-0.1 Mt/yr</b>	20 3	70 1.9	Increases to 4M ha representing a sink of 10 Mt/yr	Declines to ~5Mt/yr and would continue to fall while clearing constrained.	First-time clearing approximately half of the average reported rates since 2010. Low re-clearing, around half of rates reported 2009-2013 under policies restricting regrowth clearing, which were relaxed in 2013.
<b>Scenario 2. Business As Usual</b> Total clearing: <b>250,000 ha/yr</b> Emissions: <b>14.5 Mt/yr</b>	40 5.9	210 5.6	Maintained at ~2.5 Mha, sink is 5Mt/yr	Declines to 8 Mt/yr	First time clearing and re-clearing approximately half of the average of rates reported 2006-2018. Re-clearing comparable to average rate reported between 2006-2018.
<b>Scenario 3. More Grass</b> Total clearing: <b>365,000 ha/yr</b> Emissions: <b>32.8 Mt/yr</b>	85 <sup>3</sup> 13.3	280 7.5	Reduced to 3 Mt/yr over time	Increases to 15 Mt/yr	Both first-time clearing and re-clearing at higher end of range reported under relatively permissive regrowth regulation policies. Comparable to reinstatement of regulatory relaxations implemented in 2013 without expansive clearing for high value agriculture.
<b>Scenario 4. High Clearing</b> Total clearing: <b>520,000 ha/yr</b> Emissions: <b>60 Mt/yr</b>	240 35.5	280 7.5	Reduced to 3 Mt/yr over time	Increases to 20 Mt/yr	Both first-time clearing and re-clearing at higher end of range reported under relatively permissive regrowth regulation policies. Not an extreme scenario. Most likely scenario if policy relaxations implemented in 2013 are reinstated and include extensive clearing for new agricultural development.

<sup>2</sup> First time clearing refers to bulldozing mature forest and woodland.

<sup>3</sup> Scenario 3 note: 40,000 hectares of first time clearing annually (mature forest/woodland), releasing 5.9 Mt/yr, plus an additional 150,000 hectares thinned which would remove ~30% of biomass, which is equivalent to clearing 45,000 hectares that would release 7.4 Mt/yr.

The emissions consequences of the four scenarios highlights the importance of Queensland’s clearing regulation for Australia’s national greenhouse gas inventory. Under the low clearing scenario the increasing sink in regrowing forests offsets emissions from permitted clearing. The sum of the four components of forest conversion is slightly negative. Of course, total LULUCF includes more than just the forest conversion components modelled here (see difference between the dark green line and pink lines in Figure 9, which averages 7.5 Mt CO<sub>2</sub>-e annually). The difference between low clearing and high clearing is more than 60 million tonnes of CO<sub>2</sub>-e annually. This is more than ten percent of Australia’s National emissions, which in 2018 were 537 Mt CO<sub>2</sub>-e. To offset emissions of the magnitude of 60 Mt CO<sub>2</sub>-e, at the average price of \$15.74 per tonne from the latest Emissions Reduction Fund auction, would cost \$944M every year into the future.

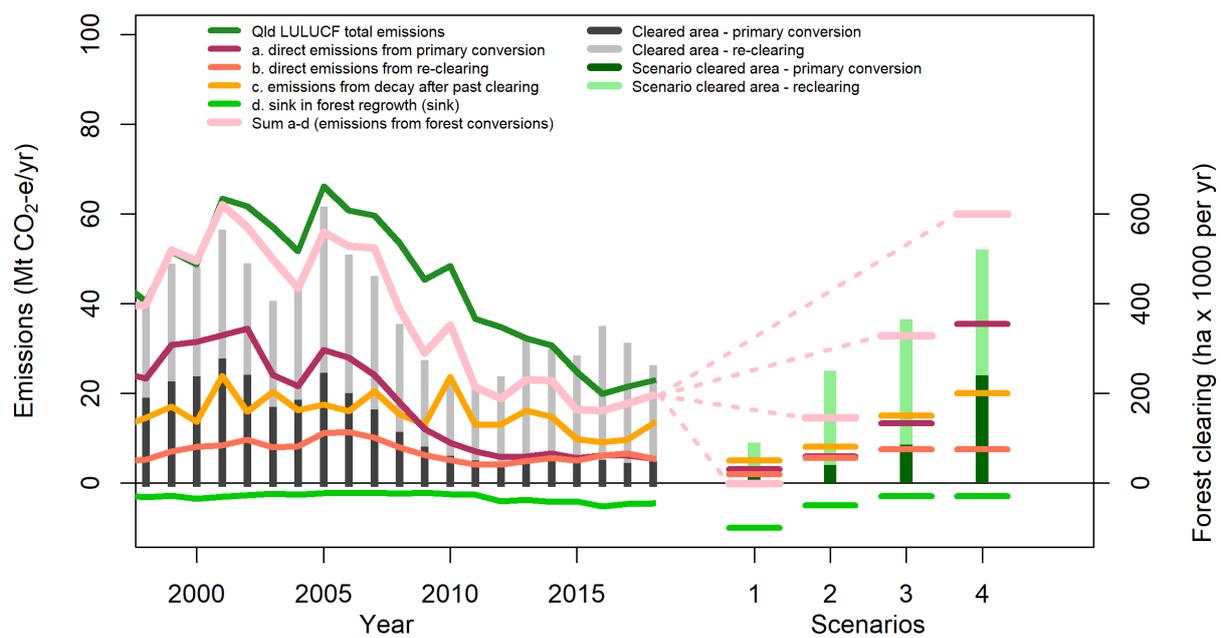


Figure 9. Emissions outcomes from the four scenarios, in the context of Queensland’s historical clearing and emissions data. The scenarios are represented by stacked bars on the right of the figure, depicting clearing rates, with coloured lines for each scenario to indicate the estimated average emissions from the four components of forest clearing emissions.

### Conclusions

The clearing of native vegetation in Queensland has major consequences for Australia’s national greenhouse gas account. When clearing in Queensland is not effectively regulated it represents more than one tenth of the national account and when is constrained it can be more than offset by regrowth after previous clearing and the LULUCF sector becomes a greenhouse gas sink. Native vegetation clearance is directly related to the regulatory framework although there is a delay between policy and the response in terms of emission due to longer term effects of clearing (time lags). Most native vegetation clearing occurs in Queensland although there is significant proportion in NSW. In both states the issue has been a political football (Maron et al., 2015) swaying between tighter regulation and the relaxation of laws under alternative governments. The activity is not only a response to a legislative framework, because the legislation also reflects a national environmental standard, which is gradually adopted as a cultural standard by the protagonists of the practice. Land clearing regulation was developed in South Australia during the 1980s amidst great controversy (Harris, 1996). After a

few decades properties with mature native vegetation in many areas were worth more than properties that had been over-cleared, and public investment was being expended on tree planting (Marano, 1999). Investment in recovery and repair only makes sense once clearing is effectively regulated.

Land development through clearing has yielded substantial productive benefit, particularly through the conversion of forests with low productivity for grazing into highly productive pasture, such as occurred with the development of brigalow vegetation in sub-coastal Queensland. However, there are few who dispute that the small areas of these land types that remain should be preserved. The best country has already been cleared, but as a nation we can choose to keep clearing the bush until all that remains is in National Parks or on rugged terrain — or we can stop it. The potential gains from doing the latter are immense. Not only would this provide a major contribution to the balance sheet for our national greenhouse gas account, but could be used to market green produce from a clean country that no longer destroys habitat, threatens species and is not contributing to the ongoing loss of the Great Barrier Reef.

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### *Acknowledgements*

Thanks to Stuart Blanch and Megan Evans for support and advice.

## **Appendix. Information relating to support of Scenarios 3 and 4**

Summary of legal changes 2012-2015

<https://eprints.qut.edu.au/105605/8/105605.pdf>

### **March 2012**

Promise to retain current [2013] level of statutory vegetation protection from Queensland Liberal National party

Source: Letter to CEO WWF-Australia 14 March 2012

### **April 2013**

Agforce recommendations for changes to VMA

<https://www.parliament.qld.gov.au/documents/committees/SDIIC/2013/10-VegetationMgmtFramewk/submissions/046.pdf>

### **2013**

Amendments to VMA

Explanatory notes for the 2013 Amendment Bill

<https://statements.qld.gov.au/?Search=True&Text=vegetation&FromDate=&ToDate=&t=8&m=154>

### **2012-2014**

Media statements of Minister Cripps

<https://statements.qld.gov.au/?Search=True&Text=vegetation&FromDate=&ToDate=&t=8&m=154>

### **2012-2105**

*Clearing during and immediately after Newman Government 2012-2015*

Mature native vegetation clearing 2015-2016: 138,000 ha/y

Non mature native vegetation clearing 2015-2016: 257,000 ha/y

Source: (Queensland Department of Science, 2017)

### **2012-2016**

#### **Estimate of illegal clearing**

Exempt (Mining, Forestry, Linear?? (Roadworks?)) 6%; Permitted 8%; Unexplained 12%; Exempt Cat X 74%

From above: Proportion of mature native vegetation unexplained =  $12/6+8+12 = 46\%$  x 138,000 = 63,700 ha

Source: (Queensland Department of Science, 2015)

## 2020

- 1) Commitment to 'review and reform Labor's laws
- 2) Restoring sensible property rights to landholder
- 3) Opportunities for considered and economically significant agricultural development

Source: Media Release 20 August 2020 LNP to deliver fair and balanced landscape laws

## 2020

Agforce policy includes

- 1) Repeal and replacement of the *Vegetation Management Act 1990* and the *Nature Conservation Act 1992*
- 2) Replacing punitive legislation with Natural Capital Policy

Source: [https://agforceqld.org.au/2019-20#Landscape and vegetation management:](https://agforceqld.org.au/2019-20#Landscape and vegetation management)