Submission No 236

SUSTAINABILITY OF ENERGY SUPPLY AND RESOURCES IN NSW

Organisation: Australian Forests and Climate Alliance

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AFCA

Australian Forests & Climate Alliance inc.

Submission: Inquiry into the sustainability of energy supply and resources in NSW

Thank you for the opportunity to provide information that will help promote genuine sustainability of energy supply and resources in NSW.

Introduction

AFCA's submission addresses Terms of Reference Numbers 2, 4 and 5 and focuses on the impact of Federal and NSW state legislation that deems energy from burning wood, and in particular wood biomass from native forests, a carbon neutral 'renewable'. We provide an overview of the impact and implications of legislation currently enabling subsidisation of native forest bioenergy and fuels.

Assertions made in this submission are based on pertinent peer reviewed science compiled in Appendix 1, demonstrating that:

- Emissions from forest biomass combustion exceed those from coal per unit of energy produced; it is not carbon neutral.

- The opportunity cost of logging forests is the immediate release to atmosphere of otherwise safely stored carbon and the destruction of those forests full capacity to sequester carbon from the atmosphere for decades and up to centuries, which sequestration is referred to in climate science as CDR, carbon dioxide removal. As forest bioenergy is increasingly driving native forest logging this form of energy is dangerous in a climate crisis.

- Forest biomass for energy is the second greatest driver of forest degradation globally.

- Nature Based Solutions are the preferred climate change mitigation pathway as opposed to B.E.C.C.S (bioenergy with carbon capture and storage, i.e. replacing fossil fuels with forest biomass feedstock). Nature Based Solutions involves protecting and enhancing the biological integrity of natural systems so that they can withstand climate change impact and continue capturing and storing carbon (CDR). The IPCC now warns that CDR must accompany emission reduction, thereby rendering attempts to lower emissions through sustainable energy, alone, futile without forest protection and restoration.

- Forest biomass energy/fuel emission accounting is flawed

Please refer to Appendix 1 (and relevant Endnotes) **for evidence of our claims throughout this submission.**

Problems with Forest Bioenergy Legislation

Both Federal and state legislation allows for and promotes combustion of native forest biomass (hereafter referred to as NF biomass), and other wood biomass, as a renewable form of energy or fuel thereby permitting it to compete for subsidy with genuinely renewable forms of energy and thereby potentially undermine the maximum uptake of genuine renewables. Ironically wood combustion as a fossil fuel substitute presents a severe threat to human and environmental health (and survival).

Combustion of wood biomass is more emissive of CO^2 per unit of power generated, and a source of multiple other noxious gases. Its use exacerbates the present climate crisis. (See Appendix 1)

The false regard of NF biomass as a carbon neutral renewable also provides economic incentive for prolongation of unsustainable (and otherwise uneconomic) native forest logging, an activity the IPCC now warns against given that natural systems must immediately be protected and restored to enhance their resilience to climate change impact (already impacting forests), in order that forests can continue atmospheric carbon dioxide removal (CDR).

Even before IPCC acknowledgement of the critical C storage and sequestration role of natural forests for limiting warming to 1.5^0, scientists were warning against ongoing native forest logging owing to impacts on water catchments, biodiversity – in short the ecosystem functions of native forests on which the health of the environment in general, depends. This should have been reason alone to stop doing it.

Although forest 'bio'energy is largely discredited by the IPCC as a climate mitigation pathway, its use is entrenched in claiming renewable energy transition because flawed carbon emission accounting methodology has not been rectified. This emission accounting flaw is a massive obstacle to international, national and state/regional governments which can continue to claim credit for conversion to renewables by forest bioenergy/fuel uptake when in fact its use is raising global emissions. (Appendix 1 covers this in detail)

It has been economic, not environmental considerations that have driven the adoption of this flawed methodology in Australia also. The continuation of the false claim that forest biomass is carbon neutral provides economic gain for particular sectors. We provide an overview of the evolution of Federal and state legislation in Australia that 'enables' NF biomass to be burnt, processed and/or exported under the guise of renewable energy/fuel feedstock.

Overview of legislative change promoting forest bioenergy

In response to intense lobbying by the logging industry, the Abbott government in its 2015 review of the RET, reversed a former ban on the use of NF biomass.

This 2015 Federal legislation 'reversal' allowed NF biomass combustion to be eligible for subsidy in the form of large scale renewable energy certificates, placing combustion of native forests in competition with unequivocally renewable forms of energy such as wind, solar, tidal, geothermal.

In 2012 the logging industry, championed by the National Party, had attempted to prevent the Gillard government banning subsidisation of NF biomass in 2012, which it was able to do with the advice and approval of Australian scientists.[i]

Unsuccessful at Federal level in 2012, the National Party (on behalf of the logging industry) lobbied the NSW O'Farrell government to introduce discussion papers and propose changes to the PEOB that would embrace NF biomass as a 'renewable' energy (XX). This draft legislation eventually materialised under the Berijiklian government allowing biomass from any native forest in NSW to be burnt or turned into fuel and called 'renewable' as long as it did not involve the use of the highest quality saw logs.[ii] Though the rhetoric of the legislation described it as facilitating the combustion of NF biomass 'residue' for combustion and subsidisation per unit of power created, the fine print of the legislation reveals that the NF biomass in question would include any product from an operation undertaken under a Regional Forest Agreement (with the exception of the highest quality saw log), i.e. whole logs. Please see Appendix 1, an analysis of sections of a NSW DPI 'Residues' Study the thesis of which is that there is a million tonnes of native forest biomass available for combustion for energy, this million tonnes comprising immature native forest trees, which, being immature, are regarded as 'pulp' and therefore not sawlogs but 'pulp' trees. This endnote also analyses the definitions of NSW DPI of 'residue'. [iii]

This history is relevant because this it is the initial NSW draft state legislation that paved the way for the current Federal legislation which defines NF biomass 'residue' to be any NF biomass that derives from a Regional Forest Agreement operation (barring only the highest quality sawlogs). Regional Forest Agreements are the Federal/state legislation that legitimises native forest logging. This exposes native forests to exploitation to supply a domestic and export 'bio'energy/fuel trade.

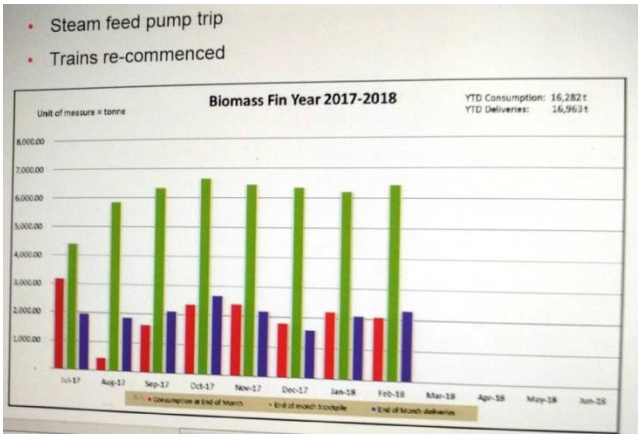
In NSW the legislation is quite specific in regard to entire native forest trees to be regarded as 'residue'. This is clear from a 2017 NSW DPI report proposing that there is 1 million tonnes of forest 'residue' available for combustion, and specifying that the preferred 'residue' for forest 'bio'energy facilities are 'pulp logs' (whole trees) and not tree crowns and branches left on forest floors after logging (removal of which would pose serious problems for soil fertility and ongoing biological processes in forests but not a consideration of proponents of forest 'bio'energy). Please see the extract from the NSW DPI report which sets out logging industry preferences to utilise whole logs due to the uses of logging forest floor debris being prohibitive.

Impact of legislation deeming forest bioenergy eligible for subsidy as a 'renewable'

Native forests in NSW are being clear felled to supply multinational BORAL, exporter to China of woodchip and now of whole logs, and ANWE, exporter of woodchip to Japan for Nippon Paper. There is a strong push to market their export for combustion in overseas furnaces and for processing into wood pellets to supply the international forest bioenergy trade.

They are also being chipped and trucked for combustion in NSW at four locations that we are aware of and in interstate power stations (both coal fired and for co-generation with other substances).

These images illustrate stockpiled NF biomass (in the form of woodchip) and records of combustion from Vales Point Power Station, still subsidised to substitute NF biomass for coal (per unit energy forest biomass energy produced), thereby prolonging the life of this coal power station.



Vales Point Power Station, in conjunction with regional industry partners has been in receipt of taxpayer funds for native forest feedstock experimentation for over a decade. A scientist with Pac Pyro admitted that the company had been living off R & D 'renewable' energy grants for decades, and was at that time experimenting with running native forest biomass into forms palatable for co-combustion with coal. Shortly after the 'enabling' legislation for subsidy of NF biomass in amendments to the RET in 2015, Vales Point consumed about 15,000 tonnes of NF biomass a year, since when consumption has increased. The source is primarily threatened species habitat in native forests of the NSW Mid North Coast. Hence for over 5 years Vales Point Coal Fired Power Station has been propped up with subsidies from large scale renewable energy certificates under the pretext of providing a low emission or carbon neutral form of energy.[iv] Thus, a highly emitting form of energy has been subsidised at the expense of genuinely renewable wind or solar. Likewise the significant R&D subsidies to the Vales Point Power Station owner's partners, experimenting with drying out NF Biomass prior to combustion should have instead have been issued to genuinely renewable developing technologies. Effectively the ongoing Vales Point 'experiment' has been the subsidising prolongation of the coal industry at the expense of genuine renewable energy forms.

Not well known is that the uptake of forest bioenergy globally (as a renewable) accompanies a rise in global GHG emissions. Australia's contribution to this rise might not be significant yet, but what is significant is that since combustion of wood became regarded as a *renewable* replacement for coal, now more than 40% of so-called renewables in OECD countries are from the combustion of forest biomass. The decade which has seen wood as a so-called renewable subsidised as a carbon neutral renewable coincided with a doubling in global emissions [v] due to forest degradation (i.e. from industrial logging, not clearing for agriculture). This issue is so dire that since this enquiry was announced another new scientific paper has been published on the disjunct between science and policy in relation to forest bioenergy: "Serious mismatches continue between science and policy in forest bioenergy" Global Change Biology.[vi]

Scientific warnings against the use of forest biomass as a renewable energy or fuel are published on a weekly, almost daily basis, internationally.

The science clearly outlines why forest biomass used for energy is not carbon neutral and should not be classified as renewable. It demonstrates that use of forest biomass is having the opposite effect than intended, increasing rather than decreasing atmospheric carbon. It points out that the Paris Agreement requires efforts to constrain global warming to 1.5^0 C but that this will not be possible without immediate and full protection and restoration of native forests. It calls for revision of the UNFCCC accounting system including the classification of biomass as zero in the energy sector. It explains that the problem is not confined to Europe but spreading, especially to Japan and South Korea, and addresses the impacts on forests elsewhere, such as the southern states of the USA and the large boreal forests on northern Europe, being clear felled to supply forest biomass.

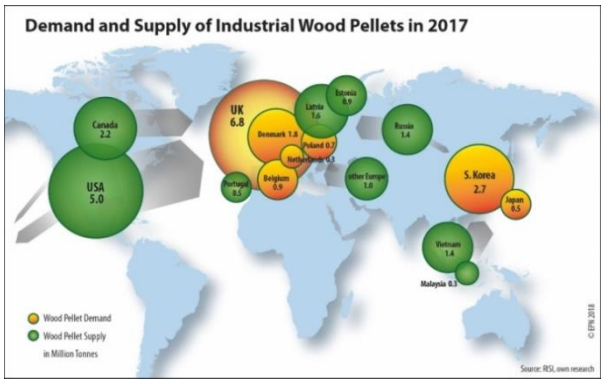
Terms of Reference Point 2: Emerging trends in energy supply and exports, including investment and other financial arrangements

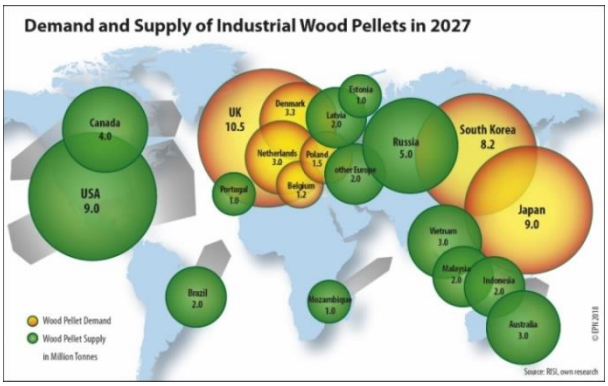
Without an immediate change in legislation Australia's extant native forests will remain vulnerable to clear fell and export to supply the burgeoning international wood pellet trade. Our native forest carbon stocks will be sent to atmosphere and the sequestration of our extant native forest estate will be severely diminished. This is the current situation that urgently needs rectification.

With the failure of the international community to close carbon emission accounting loopholes at climate talks in Katowice Poland in late 2018, enabling forest bioenergy protocols remain in place. This provides minimal incentive (beyond survival) for countries currently or planning to replace coal with wood to refrain from investment in this highly emissive form of energy. After all, it allows them to claim that they are meeting emission targets by adoption of 'renewable' energy, whether the emission reduction is real or proxy.

Asia is following the European dictum that forest bioenergy can replace coal and has already commenced this process with over 3,000 projects approved for subsidy in Japan. China is championing the wood pellet industry and will supply Asia with pellets processed from imported wood, (much of which will be from Australia), (despite the fact that as of 2020 not one native tree in China will be permitted to be cut down).

Projected expansion of the wood pellet trade 2017-2027 threatens survival of Australian native forests under current policy. Unless the consensus of world scientists that B.E.C.C.S (Bioenergy With Carbon Capture And Storage) is not a credible pathway to climate change mitigation, 3 million tonnes of forest biomass are likely to be exported per annum from Australia by 2027.





This will make it impossible to prevent loss to atmosphere of the current carbon stocks held in our living forests which will be released by industrial logging. The following extract from a timber industry press release about a recent trade delegation to China illustrates the determination of the industry and Coalition Ministers to sacrifice Australian native forests to the dangerously flawed 'renewable' energy trade, thereby contributing to, not alleviating climate emergency.

Australia-Japan forest products trade strengthened, 20 December 2018
Led by AFPA, Responsible Wood, and Federal Member for Barker and Co-Convenor of the Australian Parliamentary Friends of Forestry and Forest Products group, Mr Tony Pasin MP, and made up of senior representatives of various Australian forestry companies the delegation briefed Japanese trade partners on exciting innovations and emerging opportunities in Australia's sustainable forest industries.

It met with Japanese Government officials, Japanese industry leaders including bioenergy and paper companies, and Tokyo-based Australian officials…..

"Japan's appetite for our Aussie woodchips and manufactured bio-pellets has driven the country's move into bio-energy. This means increased demand for our product and the South East sits in prime position to benefit from this burgeoning market. The Japan-Australia Economic Partnership Agreement (JAEPA) is assisting our export growth and is already having huge positive effect our local industry.

Terms of Reference Point 4: Effects on regional communities, water security, the environment and public health

There is a plethora of information on the direct and indirect impacts of forest biomass facilities on human health compiled in Appendix 2. A fairly recent study, "Burning biomass: the impact on European health" summarises some of these.[vii] Suffice to say this is not a technology that should be unleashed on the public or the environment.

In relation to water security we draw to the attention of the inquiry the overlooked issue of the relationship between forests and rainfall. The current NSW drought is not only a result of general global warming. There are direct relationships between forest cover and drought. Forests Corporation's intensive logging of the native forests of NSW has destroyed forest canopies. This is dangerous as people living in regional NSW understand. Here is a brief summary of the inter-relationship between intact native forests and regional rainfall. A forest bioenergy industry threatens our regional rainfall patterns. Given the stress we are already under from global warming one can only ask: *What sort of governance is it that would permit this threat to continue?*

Forests: Essential for Regional Rainfall Precipitation and Cooling

Loss or degradation of native forests reduces rainfall, increases temperatures and intensifies droughts.

Overwhelming evidence from around the world shows land-clearing has directly caused a significant reduction in regional rainfalls and an increase in land temperatures.

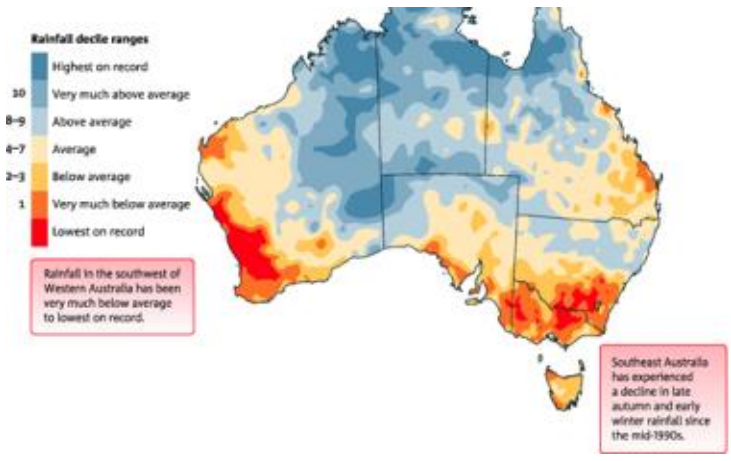
Native forests generate rainfall by:

- Recycling water from the soil back into the atmosphere through transpiration
- Creating updrafts that facilitate condensation as the warm air rises and cools; creates pressure gradients that draw moist air in from afar
- Releasing atmospheric particles which are the nuclei around which raindrops form.

Native forests lower temperatures by

- evaporative cooling whereby the surface heat is transferred to the atmosphere in water vapour
- resultant clouds also help shade and cool the surface.

Since European settlement, land-clearing and logging in eastern Australia has caused significant summer rainfall decline surface warming of around 0.4-2^{0} C



Terms of Reference Point 5: Opportunities to support sustainable economic development in communities affected by changing energy and resource markets, including the role of government policies.

We would like to draw to your attention the potential for regional economic renewal in shifting primary production from unsustainable native forest logging to more sustainable resource production. Previously one such alternative, Industrial Hemp, was hampered by prohibition at both Federal and state level of both production and seed importation (not for biosecurity concerns). These legislative barriers have now been removed and Appendix 3 describes these developments and the status and potential of this industry from the perspective of primary production of a genuinely sustainable resource.

Please note also that we attach a spreadsheet developed by the CSIRO (Appendix 4) on crop areas now under cultivation in Australia, derived from data from each state's licencing body for the Australian figures.

World data is from the European Hemp Alliance. The US signed the farm bill last year legislating the production of Industrial Hemp and there are now vast areas under cultivation. Kentucky has 70,000 acres growing.

Summary:

Use of native forests for energy and fuels is fundamentally flawed given the situation we are in. For NSW to achieve a legislative and policy platform conducive to a sustainable energy future, existing legislation and policies that promote the opposite outcome must be removed.

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[i] 2012 Scientist Letter

[ii] NSW Environment Protection Authority: Amendments to the burning of native forest biomaterials: questions and answers, http://www.epa.nsw.gov.au/licensing-and-regulation/licensing/environment-protection-licences/burning-of-biomaterial/amendments-to-the-burning-of-native-forest-biomaterials-q-and-a (2017).

[iii] **Carbon neutral residue rhetoric promulgated by state forest agencies:**

Within the same document Department of Primary Industry researchers advise their studies focused on quantities of forest biomass available from whole trees (due to the inefficiencies of transporting actual logging residue) yet counter criticism of using forestry residues for energy generation by arguing that:

"The greenhouse gas balance carried out here clearly shows that, from a climate perspective, using biomass that would have otherwise been left in the forest to burn and/or decay for bioenergy generation results in positive outcomes, especially if biomass is used to produce electricity displacing the use of coal. This is true even when the carbon dioxide emissions from burning the biomass to generate energy are included in the calculations. In practice, the CO2 released will be reabsorbed by the growing trees in a sustainable harvest system, eventually negating the impact of such emissions, p.3.

Later, (on p.6), forest residues again become whole logs: 1.2 Forest harvest residues: 1.2.1 Native forests – Public:

> "For native forests, residue estimations were conservative, as we only considered logs that met the specifications for pulpwood as available for extraction (typically 10 cm small end diameter overbark, and a minimum of 2.5 m in length – no species restrictions – and the crown was typically left in the forest). This was partly due to the fact that the local industry already has experience harvesting and transporting pulpwood from the forest." North Coast Residues: A project undertaken as part of the 2023 North Coast Forestry Project

Published by the NSW Department of Primary Industries, November 2017. Authors: Fabiano Ximenes, Rebecca Coburn, Michael McLean, John Samuel, Nick Cameron, Brad Law, Caragh Threllfall, Kate Wright and Shane Macintosh

[iv] Vales Point Power Station receiving native forest woodchip via Mid North Coast NSW as Delta Power 2013-4 40.9 KT (forest biomass delivered), 31.5 KT consumed, 2015-6 14.7 KT (delivered), 16.5 KT consumed (presumably carry over stock)

[v] From an average of 0.4 Gt CO2 yr-1 in the period 1991–2000 to an average of 1.0 Gt CO2 yr-1 for 2011–2015Ibid, http://www.fao.org/docrep/009/j9345e/j9345e07.htm. Note, this is unrelated to deforestation for agriculture.

[vi] https://onlinelibrary.wiley.com/doi/10.1111/gcbb.12643

[vii] Fern. Burning biomass: the impact on European health, https://www.fern.org/fileadmin/uploads/fern/Documents/briefingnote%20burning%20biomass.pdf (2018)

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APPENDIX 1:

Introduction to the evidence: The Paris Climate Agreement that seeks to restrict global warming to less than 1.5^{O} C is not sufficient.[1] Warming of 1^{O} has already occurred and it is too dangerous.[2]

Some of the 'tipping points'[3] that compound global warming (summer sea-ice-free Arctic conditions, loss of West Antarctic glaciers and multi-metre sea-level rise) are likely to be reached at less than 1^{O}.[4]

Current emission rates could activate other elements, compounding the rate and scale of temperature rise.[5]

The global carbon debt [6] is such that the aim must be for zero greenhouse gas emissions across all sectors within the next decade.[7] Simultaneously, as much CO_2 as possible must be removed from the atmosphere, referred to as Carbon Dioxide Removal (CDR). [8]

Natural systems are the most effective for CDR, but if they suffer further undue climate change impact these systems could themselves break down, preventing them from removing CO2 from the atmosphere. For this reason natural systems must immediately be fully protected, and, as far as is possible, ecologically restored so that they can withstand climate change impact.[9]

Emission reduction strategies focused on the energy, and more recently, transport sectors, claim wood combustion is a carbon neutral fossil fuel substitute 'because trees regrow'. [10] This ignores the need for immediate emission reduction as well as the fact that wood combustion is more emissive than coal. Decades, indeed centuries, would need to pass before the emissions released by logging and combustion of natural forest ecosystems are reabsorbed from the atmosphere. Further logging could jeopardise the ability of some forests to regain their full CDR potential given climate change impacts e.g. prolonged drought, bushfire, other ecosystem damage.

Forest biomass combustion is an emission generating activity, not an emission reduction strategy.[11] Trees logged for biomass combustion, which immediately releases huge quantities of carbon to the atmosphere, would have continued to capture and store carbon in increasing volumes had they not been logged and left to mature, for the rate of tree carbon accumulation increases continuously with tree size.[12]

Forests won't begin to recover from industrial logging until it stops. Unless fully protected, and where possible, restored, forests impacted by global warming might not recover to perform what is now an absolute necessity for the survival of all, i.e. their CDR efficiency potential.[13]

Produced by Frances Pike

Scientific warning of forest bioenergy danger has been unheard, or unheeded. [14] **A six point summary below explains reasons for immediate protection of native forest and woodland**

1. Emissions from forest biomass combustion **exceed coal emissions per unit of energy produced; it is not carbon neutral**.[15]

2. The opportunity cost of logging forests for bioenergy or fuel **is immediate release to atmosphere of their stored carbon and destruction of their future capacity to sequester carbon from the atmosphere, known as CDR,** carbon dioxide removal. Maturing trees capture and store more carbon.[16] Ongoing industrial logging degrades forests till they emit more carbon than is captured.[17] Global forest carbon stores are estimated to be at least 862 GtC, [18] which represents significant avoided emission potential. If converted to CO2 by logging, clearing, or other factors, the risk of exceeding 1.5^{O} warming increases and escalates to a likelihood of 2^{O}, or above.[19]

So even if GHG emissions cease, the logging of forest carbon stores diminishes opportunity to stabilise at 1^{O}.

3. Forest biomass for energy is the second greatest driver of forest degradation.[20]

Forest bioenergy requires an ongoing supply of large volumes of wood. It is driving deforestation and forest degradation in North America, Europe and Russia. [21],[22] Europe is burning 21.7 million tonnes of wood pellets annually, of which 5 million tonnes is exported from the USA.[23] In 2017 global demand for industrial wood pellets exceeded 14 million tonnes and is predicted to increase by more than 250 % over the next decade, having already doubled in the last ten years.[24]

Current Australian government policy is to export more forest biomass for combustion.[25]

4. Nature Based Solutions: Protecting and enhancing the biological integrity of natural systems so they can withstand climate change impact and continue capturing and storing carbon (CDR).

Even with emission reduction across all industrial sectors we will have an 'emission gap' [26] in the 'carbon budget'.[27] This must be closed within a decade to prevent warming beyond an already dangerous 1.5^{O}. Nature Based Solutions, effective without incurring risk, are now considered by the IPCC to be preferable to geo-engineering and/or Bioenergy with Carbon Capture and Storage. (BECCS), within the timeframe we have in which to act. For example, protection and targeted reforestation of tropical forests would reduce total emissions by as much as 5 billion tonnes of carbon each year, i.e. a *reduced source* of 1 billion tonnes and an *increased sink* of 4 billion tonnes a year.[28] Yet, *Australia has some of the most carbon dense forests in the world* capable of storing more carbon per hectare than tropical forests.[29] To enable CDR to continue from natural systems their full protection is now regarded as essential.[30]

5. Flawed emission accounting creates a convention that forest bioenergy is a legitimate renewable, thereby attracting misinformed social acceptance (social licence) and financial benefits.

Emissions from forest biomass combustion are not accounted for in the energy sector. Relegated to the Land Use and Land Use Change and Forestry (LULUCF) sector, it is assumed that there they will be accounted for in quantification of emissions from deforestation and/or forest degradation. However biomass combustion emissions are not adequately accounted for in the LULUCF

sector, where emission accounting loopholes and reporting gaps exist.[31]

6. Alienation of scarce land resources to log and/or grow forest biomass feedstock.

Forest derived bioenergy is placing additional and significant pressure on the global forest resource. There is a push to establish large scale genetically engineered plantations of native species for BECCS as a modelled climate change strategy. This would impact habitat critical for the retention of terrestrial biodiversity (especially forests) and land required for food production.[32]

Further explication of the six points

Forest biomass energy:

1. Emits more CO2 than coal per unit of energy produced: "owing to biomass having lower energy density and conversion efficiency".[33] Forest biomass plants can emit 65 % more CO2 per MWH than modern coal plants, and approximately 285 percent more than natural gas combined cycle plants.[34]

Is not carbon neutral: Using forests for bioenergy (as wood pellets or chips) by logging live forest biomass is not carbon neutral.[35] That assumption regrowing trees re-captures carbon emitted upon combustion ignores:

- The nature and scale of carbon sequestration and storage capacity loss: it is not just a question of the time taken for trees to regrow. Much carbon is lost from roots of big old trees and the soil ecosystems disturbed during logging.[38]

2. Is subject to flawed 'residue' arguments:

The definition of forest biomass as a carbon neutral energy and fuel feedstock extends beyond logging and mill residue to entire trees. Referred to as 'pulp' logs, native forest tree species that have not been allowed to grow to maturity are re-defined by (Australian) state forest agencies as residues, to attract subsidisation as renewable energy biomass feedstock.[39]

A presumed regulatory safeguard to ensure forest wood biomass destined for combustion doesn't add to the carbon debt, is the requirement that the biomass be sourced from forests 'sustainably' logged. Inadequate as a definition, this descriptor omits to reference principles of ecologically sustainable forest management (ESFM). ESFM is supposed to underpin Australian native forest logging as of 1995.[40] The principles of ESFM are not adequately addressed by any agreed international logging certification standard. As industrial native forest logging undermines biodiversity and CDR [41] capacity, such a standard is not possible. Efforts toward certification of logging conducted in accordance with ESFM principles should be confined to the establishment of biodiverse woodlots and/or plantations.

- Critical timeframes by which emissions must be reduced and massive draw down commenced to avoid irreversible warming.[36] In the case of regrowth forests, multiple decades are required to restore carbon stocks to pre-industrially logged levels, if indeed the forests regrow at all (increasingly uncertain as extreme weather events increase with associated droughts and fires). For primary, (unmodified) forests, the timeframe is many centuries. The IPCC states that combustion of forests for energy emits more CO2 than fossil fuel, the re-capturing of which will require decades or centuries.[37]

When the more stringent restriction is considered, that logging or mill residue, only, provide feedstock for bioenergy, the argument is made that if such residues were not burnt, they would otherwise decompose adding to the global CO2 burden. Rates of decay, biological processes that convert forest floor humus to soil, and the environmental benefits of natural carbon recycling within the forest ecosystems are ignored.[42] The residue argument assumes native forest logging is inevitable, whereas the opposite should be the case at this point in earth's bio-geophysical history.

3. Ignores the 'opportunity cost' of burning; using forests for energy/fuel

The carbon stock for intact South Eastern Australian eucalypt forests has been found to be about 640 tonnes per hectare.[43] In some of those forests the carbon stock is very high with a total biomass density of 1,867 tonnes of carbon per hectare,[44] exceeding that of equatorial rainforests.

It is worse than negligent to allow any further industrial logging of native forests.

Heavy machinery logs and then transports dense forest biomass long distances. The logging depletes native forest carbon stored in trees and soil by up to 70%, not recaptured within current logging cycles.[45] Industrial logging rotation cycles degrade forests to the extent that they can become sources, not sinks, of carbon.[46] To protect and not log the native forests and woodlands of Australia is the pathway to the greatest climate change mitigation possible from terrestrial systems.[47]

4. Is not residue based and is driving global forest degradation. By 2011 'The Economist' was reporting 'Environmental Lunacy in Europe: European firms are scouring the earth for wood.'[48] Companies operating under the aegis that 'forest bioenergy is carbon neutral' profit from the subsidies it attracts as supposed renewable energy. This being the case in multiple jurisdictions, companies can combine to exert immense pressure to sanction forest bioenergy expansion at the highest levels. Hence advice from the European Scientific Union of Scientists can be ignored. IPCC panel member and a series of other scientific statements from hundreds of international scientists at any one time, continue to be ignored by policy makers. Meanwhile global forest carbon stores are being felled to supply an expanding wood pellet trade, predicted to escalate globally from 14 to 36 million tonnes per annum as Europe, Japan and South Korea increase wood combustion.[49]

In Australia, industry sectors and government insist forest biomass will not drive more native forest logging. The residue argument continues to be invoked.[50] At least three pieces of legislation have been passed to facilitate the use of native forest biomass as subsidised energy: NSW drafted the Protection of the Environment Operations (General) Amendment (Native Forest Bio material) Regulation 2013.[51] At a Federal level there was an amendment to the Renewable Energy Target 2015, and in 2018 in NSW the renewed NSW Regional Forest Agreement amended the definition of 'other wood products' to include forest biomass material. Analysis of 2015 legislation passed by the Abbott government reveals fine print that permits whole trees of native forests to be subsidised as renewable energy when burnt.[52] From the mid 2000's the NSW Department of Primary Industries (DPI) has advocated large scale power generation from native forest wood.[53] In 2017 the NSW DPI reported a million tonnes of residue available for the bioenergy/fuel trade, the definition of which includes whole trees without species restrictions and which includes forest

compartments housing Australian wildlife threatened with extinction.

Contemporaneous publications by the same department define whole trees as the preferred and feasible residue, not branches or leaves left over from logging operations.[54] As large-scale renewable energy credits (subsidies) augment profit of Australian coal-fired power stations substituting (some) native forest biomass for coal, the fossil fuel industry benefits, and can be prolonged.[55] Where native forest biomass feedstock is co-generated with other substances that is also subsidised.[56]

Export of wood biomass and pellets plays out via The National Forest Industries Plan 2018 [57] which restates the logging industry agenda successfully played out this decade.[58] Hence the Australian government is marketing forests for export for combustion in Asia. In December 2018 Australian government representatives met Japanese government officials and Japanese industry leaders, including bioenergy and paper companies. The Federal Member for Barker and Co-Convenor of the Australian Parliamentary Friends of Forestry and forest Products group, Mr. Tony Pasin MP, announced:

Japan's appetite for our Aussie woodchips and manufactured bio-pellets has driven the country's move into bio-energy" and, with the release of the Federal Government's National Forest Industries Plan, "it's the perfect time to ensure the Japanese government understands the opportunities that will open for the forestry sector in Australia and what this means for increased trade".[59]

Japan's wood pellet demand is estimated to increase from 500,000 tonnes in 2017 to 9.5 million tonnes in 2025. Total biomass demand in Japan is expected to increase from 7.6 million tonnes in 2017 to 23 million tonnes in 2025.[60]
Japan's need is not so great that its own forests will be logged. It is similar with China, which, while importing most Australian wood, will, as of 2020, cease logging its own native forests.

5. Native Based Solutions: as native forests and woodlands are critical to sequester carbon they must be protected. Where practical, ecological restoration must occur to enhance forest resilience to climate change, in order that CDR from terrestrial systems can continue.
CDR by terrestrial systems – forests – is preferred to geo-engineering.[61] The most ecologically sound, economical, and scalable ways to accomplish (increasing carbon uptake on land) are by protecting and enhancing natural climate sinks." [62] Protection of natural (native) forests from logging induced degradation will promote resilience to climate change impact.[63] Where practical, resilience should be enhanced by ecological restoration.[64] Natural Solutions [65] for CDR is on the agenda of the UN Secretary General Summit meeting September 2019 as the best strategy to draw down atmospheric carbon.[66]

As a first priority of CDR, native forests should be protected immediately with re-afforestation initiatives being in addition to, not instead of, native forest protection, because:

- The mitigation value of forest lies in the accumulated stock of ecosystem carbon, not in the short term rate of forest photosynthesis.

- The biodiversity of natural forests provides forest ecosystems with resilience and adaptive capacity, resulting in more stable carbon stocks.[67]

Produced by Frances Pike

6. Forest biomass energy/fuel emission accounting is flawed: If accounted for in the energy sector, bioenergy emissions could be quantified. Relegated instead to the land use and land use change sector, (LULUCF) for quantification of emissions arising from deforestation or forest degradation, which latter is driven by provision of biomass feedstock, the real emission impact is obscured, minimised or hidden.[68] Protocol and practice for reporting deforestation and forest degradation is not adequate and reporting not universal or consistent.[69]

Exposition of forest bioenergy carbon accounting flaws has not resulted in rectification.[70] Legislated loopholes continue. The European Parliament's 2018 renewal of its Renewable Energy Directive (RED 11) will have worse impacts on forests and climate.[71] With the planned expansion of 'renewables' from 27-35 per cent came a LULUCF accounting rule change. "Under these revisions, land-use change requirements would apply only to agriculture (Art. 26.2-26.4) **and no longer to forestry**. Instead, new 'sustainable' forestry management rules with few biodiversity safeguards have been added, meaning that bioenergy produced from biomass harvested in primary forests, in high-biodiversity, non-primary forests, and in forests on peatlands, could now be sold legally as sustainable bioenergy in Europe."[72] **This is occurring despite the fact that as large-scale bioenergy has increased in Europe, global forest degradation emissions have roughly doubled.[73]**

7. The impact of large-scale forest derived bioenergy on land resources.

Despite combustion emissions, forest biomass as 'renewable' energy in Europe has expanded rapidly this century to provide approximately half Europe's 'renewable' energy with most of the forest biomass from U.S. forests.[74] In 15 years U.S. wood pellet exports increased from nil to 4.6 million tonnes. The 2017 European directive to double European (forest biomass derived) energy by 2030 would see Europe consuming a forest biomass quantity greater than the combined 2017 European harvest. Resulting (real) emissions would see a proposed 6 per cent emission decrease become a 6 per cent emission increase by 2050. To supply only 3 per cent more global energy, the world would have to double its commercial wood harvests.[75] Land habitat for biodiversity would be severely impacted, at a time when that area requires expansion and protection. Huge areas of land already required for global food supply would be alienated. A media release promoting forest bioenergy as a climate change solution issued May 2019 suggests a third of UK will need to be converted to plantations for biomass crops, ignoring the fact that burning them will immediately emit CO2 to atmosphere.[76] The IPCC has also acknowledged the difficulties of a bioenergy CDR agenda.[77]

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[1] The Paris Agreement emphasises "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C". Experience of global warming impacts has led to categories of danger: "dangerous" (1-2°C band) and "extremely dangerous" (above 2°C). Spratt, David and Dunlop, Ian, What Lies Beneath: The Understatement of Existential Climate Risk, 2018, Melbourne, Australia

[2] "An expert panel recently concluded that warming would need to be limited to 1.2°C to save the Great Barrier Reef.132 That is probably too optimistic, but with a current warming trend of about 1.1°C and 2016 global average warming above 1.2°C, it also demonstrates that climate change is already

dangerous". Ibid, referring to Hannam, P 2017, 'Warming limit of 1.2 degrees needed to save Great Barrier Reef: expert panel', The Age, 2 August 2017.

Also: "Global temperatures have risen 1°C in the era following mass industrialisation and this has directly affected Australians". Climate Council Joint Statement: Australia Needs New Policy Effort To Get On Track To Meet Its 2030 Target, 4th March, 2019

[3] https://www.researchgate.net/publication/326876618_Trajectories_of_the_Earth_System_in_the_Anthropocene

[4] Spratt, David and Dunlop, Ian, What Lies Beneath: The Understatement of Existential Climate Risk, 2018

[5] Evidence is accumulating that at the current level of warming other elements could be disrupted with compounding impacts on global warming, i.e. the slowing of the Thermohaline Circulation (the Atlantic conveyor); accelerating ice-mass loss from Greenland and Antarctica; declining carbon efficiency of the Amazon forests and other sinks; and the vulnerability of Arctic permafrost stores. Spratt, David and Dunlop, Ian, What Lies Beneath: The Understatement of Existential Climate Risk, 2018

[6] A carbon budget is an estimate of greenhouse gas emissions, in tons of carbon consistent with limiting global warming to a specified figure. We have exceeded the budget for limiting warming to 2 degrees, creating a 'carbon debt'. To close the 'emissions gap', maximum draw down of atmospheric carbon is 'non-negotiable'.

[7] 2019 climate modelling indicates 2018 IPCC limits understate urgency: https://www.nature.com/articles/s41558-019-0426-8 but IPCC recommendations that 'Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems … and imply deep emissions reductions in all sectors. https://www.ipcc.c/summary-for-policy-makers/ is still true.

[8] More CDR is needed to restrain temperature increase. All pathways that limit global warming to 1.5°C with limited or no overshoot project the use of carbon dioxide removal (CDR) on the order of 100–1000 GtCO2 over the 21st century. https://www.ipcc.c/summary-for-policy-makers/

[9] Forest restoration will be practical where the CDR outcome exceeds emission intensity expended in undertaking the restoration action, e.g. degraded areas difficult to access; areas where restoration timeframe and therefore CDR outcome cannot payback in proportion to resources, energy expended.

[10] "bioenergy systems have often been assessed (e. g., in LCA studies, integrated models, policy directives, etc.) under the assumption that the CO2 emitted from biomass combustion is climate neutral14 because the carbon that was previously sequestered from the atmosphere will be re-sequestered if the bioenergy system is managed sustainably (Chum et al., 2011; Creutzig et al., 2012a; b). The shortcomings of this assumption have been extensively discussed in environmental impact studies and emission accounting mechanisms (Searchinger et al., 2009; Searchinger, 2010; Cherubini et al., 2011; Haberl, 2013)." This is extracted from Smith, et al., (2014). Agriculture, Forestry, and Other Land Use (AFOLU). Intergovernmental Panel on Climate Change(IPCC). Accessed: https://archive.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter11.pdf

[11] 'For example, in the specific case of existing forests that may continue to grow if not used for bioenergy, some studies employing counterfactual baselines show that forest bioenergy systems can temporarily have higher cumulative CO2 emissions than a fossil reference system (for a time period ranging from a few decades up to several centuries; (Repo et al., 2011; Mitchell et al., 2012; Pingoud et al., 2012; Bernier and Paré, 2013; Guest et al., 2013; Helin et al., 2013; Holtsmark, 2013)', this extracted from Smith, et al., (2014). Agriculture, Forestry, and Other Land Use (AFOLU). Intergovernmental Panel on Climate Change(IPCC). Accessed: https://archive.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter11.pdf

[12] N. L. Stephenson, A. J. Das, R. Condit, S. E. Russo, P. J. Baker, N. G. Beckman, D. A. Coomes, E. R. Lines, W. K. Morris, N. Rüger, E. Álvarez, C. Blundo, S. Bunyavejchewin, G. Chuyong, S. J. Davies, Á. Duque, C. N. Ewango, O. Flores, J. F. Franklin, H. R. Grau, Z. Hao, M. E. Harmon, S. P. Hubbell, D. Kenfack, Y. Lin, J.-R. Makana, A. Malizia, L. R. Malizia, R. J. Pabst, N. Pongpattananurak, S.-H. Su, I-F. Sun, S. Tan, D. Thomas, P.

J. van Mantgem, X. Wang, S. K. Wiser[…]M. A. Zavala, Rate of tree carbon accumulation increases continuously with tree size Nature volume 507, pages 90–93 (06 March 2014), https://doi.org/10.1038/nature12914

[13] Given logged forests' vulnerability to climate change impact, impacts of ongoing logging cycles, and land use change (conversion of a forest to other uses) that is often the consequence of severe forest degradation.

[14] A small sample only of the many reports and letters from scientists (and economists) to policy makers against legitimising forest derived biomass energy and fuel. Australian scientists have also written to Australian policy makers and politicians urging them not to adopt forest derived biomass as feedstock for energy and fuel.

[15] Wood that reaches a power plant can displace fossil emissions but per kWh of electricity typically emits 1.5x the CO2 of coal and 3x the CO2 of natural gas because of wood's carbon bonds, water content (Table 2.2 of ref. 17) and lower burning temperature (and pelletizing wood provides no net advantages) (Supplementary Note 1) 6,16 (extracted from) Europe's renewable energy directive poised to harm global forests, Timothy D. Searchinger, Tim Beringer, Bjart Holtsmark, Daniel M. Kammen, Eric F. Lambin, Wolfgang Lucht, Peter Raven and Jean-Pascal van Ypersele, and also see: http://ase.tufts.edu/gdae/Pubs/climate/ClimatePolicyBrief7.pdf, http://www.ase.tufts.edu/gdae/Pubs/climate/ClimatePolicyBrief8.pdf

[16] Stephenson, N.L. et al. Rate of tree carbon accumulation increases continuously with tree size. Nature 507, 90–93 (06 March 2014) doi:10.1038/nature12914

[17] Popkin, G. Tropical forests may be carbon sources, not sinks. Nature. doi:10.1038/nature.2017.22692. (2017).

[18] Fact Sheet No 4. Primary Forests and Carbon, Intact, International Action for Primary Forests

[19] Presentation for Land use and Forests in the Paris Agreement, real world implications of negative emissions and Bioenergy CCS (BECCS),May 12th & 13th2016, Brussels by Professor Brendan Mackey, Director, Griffith Climate Change Response Program

[20] Expanding human population being the first

[21] https://www.birdlife.org/europe-and-central-asia/black-book

[22] http://www.ase.tufts.edu/gdae/Pubs/climate/ClimatePolicyBrief8.pdf

[23] Kuhlmann, Wolfgang and Putt, Peg Are Forests the New Coal – a Global Threat Map of Biomass Energy Development. Environmental Paper Network. November 2018

[24] http://environmentalpaper.org/wp-content/uploads/2018/11/Threat-Map-Briefing-Are-Forests-the-New-Coal-01.pdf

[25] Australian Forests & Timber News, Australia-Japan forest products trade strengthened, 20 December 2018

[26] i.e. an excess of atmospheric carbon that would make possible limiting global warming to the already 'risky' 1.5 degrees mandatory to avoid climate change catastrophe)

[27] A carbon budget is an estimate of the total future human-caused greenhouse gas emissions, in tons of carbon, CO_2 or CO_2 equivalent, that would be consistent with limiting warming to a specified figure, such as 1.5°C or 2°C, with a given risk of exceeding the target, such as a 50, 33 or 10 per cent chance. The carbon budget for limiting global warming to 2 degrees has already been exceeded. To close the 'emissions gap' maximum removal of atmospheric carbon is now 'non-negotiable'.

'The most ecologically sound, economical, and scalable ways to accomplish [increasing carbon uptake on land] are by protecting and enhancing natural climate sinks.' John M. DeCiccoa, and William H. Schlesinger, "Reconsidering bioenergy given the urgency of climate protection", 9642–9645 | PNAS | September 25, 2018 | vol. 115 | no. 39, www.pnas.org/cgi/doi/10.1073/pnas.1814120115

[28] Presentation for Land use and Forests in the Paris Agreement, real world implications of negative emissions and Bioenergy CCS (BECCS),May 12th & 13th2016, Brussels by Professor Brendan Mackey, Director, Griffith Climate Change Response Program

[29] From analysis of published global site biomass data (n _ 136) from primary forests, we discovered (i) the world's highest known total biomass carbon density (living plus dead) of 1,867 tonnes carbon per ha (average value from 13 sites) occurs in Australian temperate moist Eucalyptus regnans forests, and (ii) average values of the global site biomass data were higher for sampled temperate moist forests (n

_44) than for sampled tropical (n _ 36) and boreal (n _ 52) forests (n is number of sites per forest biome). Heather Keith, Brendan G. Mackey, and David B. Lindenmayer, Re-evaluation of forest biomass carbon stocks

[30] Since global deforestation has resulted in about a third of total anthropogenic CO_2 emissions since 1850 it is obvious that stopping this process will be fundamental to emission reduction and CDR. Bagley, J.E. (2011) Impacts of land cover change: energy regulation, breadbasket production, and precipitation. Phd., Atmospheric and Oceanic Sciences, University of Winconsin-Madison.

[31] 'few countries provide annual figures for their land use-related emissions', The LULUCF Sector: Ever-Difficult Estimations, Climate Chance (2018) Sector-Based Action, Book 1 of The Annual Report Of The Global Observatory On Non-State Climate Action

[32] Modelled 2 °C pathways assume a level of bioenergy production by 2050 that would require doubling the current harvest of all global biomass for all uses (food, feed and fibre) (Dooley et al., 2018; Searchinger et al., 2015). A recent UK report suggests sacrificing up to a third of UK farmland for biomass crops: https://www.thetimes.co.uk/article/britain-must-plant-billions-of-trees-says-committee-on-climate-change-786mpclfr

Field and Mach (2017,p.707) highlight the issues at stake, suggesting that converting land scale required for bioenergy in many modelled climate change mitigation scenarios would "pit climate change responses against food security and biodiversity protection". Extracted from "The role of the land sector in ambitious climate action: Missing Pathways to 1.5°C, CLARA, Climate ambition that safeguards land rights, biodiversity and food sovereignty

Climate Land Ambition and Rights Alliance. Lead authors: Kate Dooley, Doreen Stabinsky. Contributing authors: Kelly Stone, Shefali Sharma, Teresa Anderson, Doug Gurian-Sherman, Peter Riggs. Also see: van Vuuren DP, van Vliet J, Stehfest E (2009) Future bio-energy potential under various natural constraints. Energy Policy 37:4220–4230.

[33] John D. Sterman, Lori Siegel, and Juliette N. Rooney-Varga, "Does Replacing Coal with Wood Lower CO 2 Emissions? Dynamic Lifecycle Analysis of Wood Bioenergy," Environmental Research Letters 13, no. 1 (2018): 015007, https://doi.org/10.1088/1748-9326/aaa512

[34] William R. Moomaw, EU bioenergy policies will increase carbon dioxide concentrations, Climate Policy Brief No. 7: Tufts University 2018, http://ase.tufts.edu/gdae/Pubs/climate/ClimatePolicyBrief7.pdf and Booth, Mary, Biomass Amendments in Recent Federal Legislation, Presentation, Partnership for Policy Integrity, 2016.

[35] (DeCicco and Schlesinger, 2018; Searchinger et al., 2017; Smyth et al., 2014; Sterman et al., 2018) and https://www.chathamhouse.org/publication/woody-biomass-power-and-heat-impacts-global-climate, https://www.chathamhouse.org/publication/impacts-demand-woody-biomass-power-and-heat-climate-and-forests

[36] Increased atmospheric concentrations from burning bioenergy will worsen irreversible impacts of climate change before forests eventually grow back to compensate (Booth, 2018; Courvoisier et al., 2017 Schlesinger, 2018).

[37] Smith, et al., (2014). Agriculture, Forestry, and Other Land Use (AFOLU). Intergovernmental Panel on Climate Change(IPCC). Accessed: https://archive.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter11.pdf

[38]Christopher Dean, James B. Kirkpatrick, Andrew J. Friedland, Conventional intensive logging promotes loss of organic carbon from the mineral soil, 2016,https://doi.org/10.1111/gcb.13387

[39]Carbon neutral residue rhetoric promulgated by state forest agencies:

Within the same document Department of Primary Industry researchers advise their studies focused on quantities of forest biomass available from whole trees (due to the inefficiencies of transporting actual logging residue) yet counter criticism of using forestry residues for energy generation by arguing that:

"The greenhouse gas balance carried out here clearly shows that, from a climate perspective, using biomass that would have otherwise been left in the forest to burn and/or decay for bioenergy generation results in positive outcomes, especially if biomass is used to produce electricity displacing the use of coal. This is true even when the carbon dioxide emissions from burning the biomass to

generate energy are included in the calculations. In practice, the CO2 released will be reabsorbed by the growing trees in a sustainable harvest system, eventually negating the impact of such emissions, p.3. Later, (on p.6), forest residues again become whole logs: 1.2 Forest harvest residues: 1.2.1 Native forests – Public:

> "For native forests, residue estimations were conservative, as we only considered logs that met the specifications for pulpwood as available for extraction (typically 10 cm small end diameter overbark, and a minimum of 2.5 m in length – no species restrictions – and the crown was typically left in the forest). This was partly due to the fact that the local industry already has experience harvesting and transporting pulpwood from the forest." North Coast Residues: A project undertaken as part of the 2023 North Coast Forestry Project

Published by the NSW Department of Primary Industries, November 2017. Authors: Fabiano Ximenes, Rebecca Coburn, Michael McLean, John Samuel, Nick Cameron, Brad Law, Caragh Threllfall, Kate Wright and Shane Macintosh

[40] Australian National Forest Policy Statement, Commonwealth of Australia 1992, 1995

[41] Under ESFM principles, Australian forest management should:

1. *Maintain the ecological processes within forests (the formation of soil, energy flows and the carbon, nutrient and water cycles);*
2. *Maintain the biological diversity of forests; and*
3. *Optimize the environmental, economic and social benefits to the community within ecological constraints.*

[42] Ignored also is the fact that net emissions from forestry residues burned as fuel are also significant over the mid-term (20-40 years). Partnership for Policy Integrity.

[43] Brendan G. Mackey, Heather Keith, Sandra L. Berry and David B. Lindenmayer, Green Carbon: The role of natural forests in carbon storage: Part 1. A green carbon account of Australia's south-eastern Eucalypt forests, and policy implications, The Fenner School of Environment & Society, The Australian National University, 2008

[44] From analysis of published global site biomass data (n _ 136) from primary forests, we discovered (i) the world's highest known total biomass carbon density (living plus dead) of 1,867 tonnes carbon per ha (average value from 13 sites) occurs in Australian temperate moist Eucalyptus regnans forests, and (ii) average values of the global site biomass data were higher for sampled temperate moist forests (n _44) than for sampled tropical (n _ 36) and boreal (n _ 52) forests (n is number of sites per forest biome). Heather Keith, Brendan G. Mackey, and David B. Lindenmayer, Re-evaluation of forest biomass carbon stocks

[45] Bowd, E.J., Banks, C.S., Strong, C.L. and Lindenmayer, D.B. (2018). Long-term impacts of wildfire and logging on forest soils. Nature geoscience www.nature.com/naturegeoscience

[46] Logging rotations in NSW are now routinely less than 20 years. This is a global phenomenon. https://www.carbonbrief.org/tropical-forests-no-longer-carbon-sinks-because-human-activity.

Baccini et al. (2017) Tropical forests are a net carbon source based on aboveground measurements of gain and loss. Science. http://science.sciencemag.org/content/early/2017/09/27/science.aam5962

Raupach et al. (2014). Biogeosciences, 11, 3453–3475. https://www.biogeosciences.net/11/3453/2014/bg-11-3453-2014.pdf

[47] Keith H, Lindenmayer D, Macintosh A, Mackey B (2015) Under What Circumstances Do Wood Products from Native Forests Benefit Climate Change Mitigation? PLoS ONE 10(10): e0139640. doi:10.1371/journal.pone.0139640

[48] https://www.economist.com/business/2013/04/06/the-fuel-of-the-future

[49] http://environmentalpaper.org/wp-content/uploads/2018/11/Threat-Map-Briefing-Are-Forests-the-New-Coal-01.pdf

[50] Debating the exclusion from the national Renewable Energy Target of native forest biomass in 2012, and then its inclusion in 2015, the arguments were that the legislation and regulatory mechanisms would ensure that residue based operations only would be eligible for subsidy as 'renewable'.

[51] whereby "material resulting from forestry operations carried out on land to which an Integrated Forestry Operations Approval (IFOA) applies under Part 5B of the Forestry Act 2012" is eligible for subsidy when burnt. That's most material from most public forests in NSW logged under a Commonwealth State Regional Forest Agreement, (which is most logging mass from public forests in NSW)

[52] The RET regulation states:

1. Biomass from a native forest must be:

a. harvested primarily for a purpose other than biomass for energy production; and

b. either:

i. (i) byproduct or waste product of a harvesting operation, approved under relevant Commonwealth, State or Territory planning and approval processes, for which a highvalue process is the primary purpose of the harvesting;

However, when a sawmill processes a sawlog, less than a third ends up as sawn timber, a high value product. What looks like a safeguard is a legal ambiguity: (3) For subparagraph (2) (b) (i), the primary purpose of a harvesting operation is taken to be a highvalue process only if the total financial value of the products of the high value process is higher than the financial value of other products of the harvesting operation.

[53] DPI 'forest' scientist Fabiano Ximenes argues NSW is well positioned to lead the nation in the adoption of bioenergy as a cost-effective and climate friendly energy solution. "Biomass from forestry residues has great potential for large-scale electricity generation, industrial heat, biofuels and valuable natural chemicals, all within NSW regional communities." https://www.dpi.nsw.gov.au/about-us/media-centre/releases/2017/north-coast-forests-offer-untapped-bioenergy-opportunity

[54] From North Coast Residues: A project undertaken as part of the 2023 North Coast Forestry Project,

1.2 Forest harvest residues: 1.2.1 Native forests - Public

"For native forests, residue estimations were conservative, as we only considered logs that met the specifications for pulpwood as available for extraction (typically 10 cm small end diameter overbark, and a minimum of 2.5 m in length – no species restrictions – and the crown was typically left in the forest). This was partly due to the fact that the local industry already has experience harvesting and transporting pulpwood from the forest."

Though it is made clear that whole trees are defined as residue, in the same document claims are made that using "biomass that would have otherwise been left in the forest to burn and/or decay" demonstrates the GHG benefits of this technology. A 'carbon neutral/ residue' argument is promulgated by state forest agencies to draw attention away from the intention to use whole trees to supply the bioenergy market.

"Although many studies demonstrate the GHG benefits of using forestry residues for energy generation, others argue that this practice does not result in GHG benefits, with some claiming worse outcomes than the use of coal for electricity generation. The greenhouse gas balance carried out here clearly shows that, from a climate perspective, using biomass that would have otherwise been left in the forest to burn and/or decay for bioenergy generation results in positive outcomes, especially if biomass is used to produce electricity displacing the use of coal. This is true even when the carbon dioxide emissions from burning the biomass to generate energy are included in the calculations. In practice, the CO2 released will be reabsorbed by the growing of trees in a sustainable harvest system, eventually negating the impact of such emissions". p.3, North Coast Residues: A project undertaken as part of the 2023 North Coast Forestry Project, Published by the NSW Department of Primary Industries, November 2017. Authors: Fabiano Ximenes, Rebecca Coburn, Michael McLean, John Samuel, Nick Cameron, Brad Law, Caragh Threllfall, Kate Wright and Shane Macintosh

[55] Vales Point Power Station receiving native forest woodchip via Mid North Coast NSW as Delta Power 2013-4 40.9 KT (forest biomass delivered), 31.5 KT consumed, 2015-6 14.7 KT (delivered), 16.5 KT consumed (presumably carry over stock)

[56] A grant based culture is enjoyed by the logging industry entering the renewable energy and fuel markets. BORAL received a .5 million dollar grant from the Australian Renewable Energy Agency in 2018 to explore a 'bio-bitumen' and 'bio-diesel' facility to power its truck fleet. North Coast NSW sugar mills at Condong and Broadwater which traditionally burnt bagasse (cane residue) for refining processes now enjoy subsidies for combusting logs from both plantations and private native forest logging operations; wood biomass input is increasing.

[57] Department of Agriculture and Water Resources 2018, Growing a better Australia – A billion trees for jobs and growth is the current national forest plan that re-states a series of industry/ government documents which culminated in a 'new' national forest policy: Transforming Australia's forest products industry, Recommendations from the Forest Industry Advisory Council, 2016, (FIAC). The public are largely unaware that the national forest policy has changed, having been developed and written by FIAC, an industry dominated legislated departmental partner of Australian Primary Industries, with industry co-chairing the council with the Federal Minister since at least 2016.

[58] http://www.agriculture.gov.au/forestry/industries/fiac/transforming-australias-forest-industry

[59] Australian Forests & Timber News, Australia-Japan forest products trade strengthened, 20 December 2018

[60] Japan changes biomass subsidies in response to rapid demand growth, FutureMetrics, January 25, 2018 https://www.canadianbiomassmagazine.ca/pellets/japan-changes-biomass-subsidies-in-response-to-rapid-demand-growth-6691

[61] 'Geo-engineering is a catch-all term, better broken down into two main categories, carbon dioxide removal (CDR) and solar radiation modification (SRM) (IPCC 2018, 544, 558). The latter, such as seeding the atmosphere with fine particles to reduce temperatures, has been largely eschewed by the international community, as it does not do anything to actively remove emissions, with UNEP and the Convention on Biological Diversity (CBD) recommending a precautionary principle approach (CBD 2016). CDR has some policy traction primarily through the concept of bio-energy, carbon capture and storage (BECCS). The solution promotes the burning of forest biomass whilst capturing emissions through various sequestration technologies.' From Paris to Poland: A Postmortem of The Climate Change Negotiations, Tim Cadman, Research Fellow, Griffith University, Klaus Radunsky, Austria Federal Environment Agency, Andrea Simonelli, Assistant Professor, Virginia Commonwealth University, Tek Maraseni, Associate Professor, University of Southern Queensland

[62] John M. DeCiccoa, and William H. Schlesinger, Reconsidering bioenergy given the urgency of climate protection, 9642–9645 | PNAS | September 25, 2018 | vol. 115 | no. 39, www.pnas.org/cgi/doi/10.1073/pnas.1814120115

[63] Half the world's terrestrial vegetation cover has been lost over the past 200 years (Erb et al., 2017), precipitating a global crisis of biodiversity loss (IPBES, 2018). Feedback loops between biodiversity and climate change flow both ways— the more ecosystems are degraded the more carbon is released into the atmosphere, and the harder it will be to mitigate climate change (CBD, 2014).

[64] Thompson, I.; Mackey, B.; McNulty, S.; Mosseler, A. 2009. Forest Resilience, Biodiversity, and Climate Change: a synthesis of the biodiversity/resilience/stability relationship in forest ecosystems. Secretariat of the Convention on Biological Diversity, Montreal. Technical Series no. 43. 1-67.

[65] https://www.nature.com/articles/d41586-019-01026-8

[66] P19, Section C.3.2 of the IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.

[67] http://www.upi.com/Science_New s/2017/02/28/Diverse-forests- tend-to-be-healthier-more- resilient-Study/3151488295356/ ?utm_source=sec&utm_campaign= sl&utm_medium=12

[68] The flaw in current bioenergy emission accounting originates from a misapplication of guidance provided for the national-level carbon accounting under UNFCCC. In the land use sector forest clearing is not adequately accounted for, because when forests are replaced by some other form of vegetation it is no longer considered 'deforestation' and is regarded as 'carbon neutral'. Thus, in the case of industrial logging of native forests neither biodiversity nor the vast range of environmental goods and services provided by native forests are taken into account. The immense carbon storing capacity lost when forest ground ecosystems are disrupted by industrial logging is completely ignored.

[69]'few countries provide annual figures for their land use-related emissions', The LULUCF Sector: Ever-Difficult Estimations, Climate Chance (2018) Sector-Based Action, Book 1 of The Annual Report Of The Global Observatory On Non-State Climate Action

[70] Timothy D. Searchinger,* Steven P. Hamburg,* Jerry Melillo, William Chameides, Peter Havlik, Daniel M. Kammen, Gene E. Likens, Ruben N. Lubowski, Michael Obersteiner, Michael Oppenheimer, G. Philip Robertson, William H. Schlesinger, G. David Tilman, Fixing a Critical Climate Accounting Error, 2009

[71] "In response to this latest EU decision, 796 lead scientists from around the world, including two Nobel Laureates, wrote detailed letters to the EU Parliament condemning the recent decision regarding forest biomass." Moomaw, W. (2018) EU Bioenergy Policies Will Increase Carbon Dioxide Concentrations. GDAE Climate Policy Brief #7 http://www.ase.tufts.edu/gdae/Pubs/climate/ClimatePolicyBrief7.pdf

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[73] From an average of 0.4 Gt CO2 yr^{-1} in the period 1991–2000 to an average of 1.0 Gt CO2 yr^{-1} for 2011–2015Ibid, http://www.fao.org/docrep/009/j9345e/j9345e07.htm. Note, this is unrelated to deforestation for agriculture.

[74] https://www.statista.com/statistics/748707/wood-pellet-exports-in-us/

[75] Modelled 2 °C pathways assume a level of bioenergy production by 2050 that would require doubling the current harvest of all global biomass for all uses (food, feed and fibre) (Dooley et al., 2018; Searchinger etal., 2015).

Field and Mach (2017,p.707) highlight the issues at stake, suggesting that converting land scale required for bioenergy in many modelled climate change mitigation scenarios would "pit climate change responses against food security and biodiversity protection". Extracted from "The role of the land sector in ambitious climate action: Missing Pathways to 1.5°C, CLARA, Climate ambition that safeguards land rights, biodiversity and food sovereignty, Climate Land Ambition and Rights Alliance. Lead authors: Kate Dooley, Doreen Stabinsky. Contributing authors: Kelly Stone, Shefali Sharma, Teresa Anderson, Doug Gurian-Sherman, Peter Riggs. Also see: van Vuuren DP, van Vliet J, Stehfest E (2009) Future bio-energy potential under various natural constraints. Energy Policy 37:4220–4230.

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[77] C.3.4 Most current and potential CDR measures could have significant impacts on land, energy, water or nutrients if deployed at large scale (high confidence). Afforestation and bioenergy may compete with other land uses and may have significant impacts on agricultural and food systems, biodiversity, and other ecosystem functions and services (high confidence). Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp. https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/

APPENDIX 2

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AFCA
Australian Forests & Climate Alliance inc.

APPENDIX 3

Primary production that can contribute to sustainable energy and resources in NSW

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THE STANDARD

Hemp is a "wonder fibre" which can be used to create everything from socks to roof tiles, rather than a drug, a swag of Victorian politicians say. **The Andrews Labor government is hoping to ramp up the state's hemp industry**, with a new cross-party task force to investigate where it has potential and whether regulations should be changed to support its growth. It will also tackle the public image of hemp as a drug, which prevents some farmers from growing the plant and others from buying products made from it, Agriculture Minister Jaclyn Symes says. "There's definitely public perception work that we need to do...hemp is not a drug, hemp is a wonder fibre that can be used for a range of materials," she told reporters on Thursday.

Currently, 45 businesses have a licence to grow the industrial plant in the state, signed off by Agriculture Victoria. "It's important to have restrictions and regulations around the industry, but we want to make sure that the barriers are as low as possible for people to enter," Ms Symes said. Independent MP for Mildura Ali Cupper - who is also on the task force - said growing hemp so far hasn't been part of the state's agricultural "DNA". But **more farmers have been approaching her about the water-efficient crop as dry condition have taken hold. Fellow task force member and Reason Party Leader Fiona Patten said the recent easing of hemp regulations in the US makes their work important. "This will change the international market and Victoria is now on the front foot to ex**ploit that."

Australian Associated Press

https://nnimgt-a.akamaihd.net/transform/v1/crop/frm/silverstone-feed-data/16225f64-c439-4ce5-ba18-430fbd22b07e.jpg/r0_74_800_526_w1200_h678_fmax.jpg

August 29 2019 - 12:12PM

Victoria eager for a bigger hemp industry, Marnie Banger**,** National

Victoria wants to further develop its industrial hemp industry to capitalise on its many uses.

Hemp is a "wonder fibre" which can be used to create everything from socks to roof tiles, rather than a drug, a swag of Victorian politicians say.

The Andrews Labor government is hoping to ramp up the state's hemp industry, with a new cross-party task force to investigate where it has potential and whether regulations should be changed to support its growth.

It will also tackle the public image of hemp as a drug, which prevents some farmers from growing the plant and others from buying products made from it, Agriculture Minister Jaclyn Symes says.

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But more farmers have been approaching her about the water-efficient crop as dry condition have taken hold.

Fellow task force member and Reason Party Leader Fiona Patten said the recent easing of hemp regulations in the US makes their work important.

"This will change the international market and Victoria is now on the front foot to exploit that."

https://www.newcastleherald.com.au/story/4649330/hemp-hope-for-farmers/?cs=12

The Fifth Estate 15/8/2019

Five ways hemp can help save the planet, Willow Aliento, 15 August 2019

Last week, the Northern Territory became the final Australian jurisdiction to legalise the cultivation and sale of industrial hemp with low levels of tetrahydrocannabinol (THC), the mind-altering chemical compound found at high levels in marijuana.

The plant's qualities and multiple benefits have encouraged a swathe of new industries to take root across sectors such as consumer goods, construction, food, and fuel, and in the area of environmental rehabilitation.

Low carbon and green

Forget happy hippy shacks made of hemp bale; hemp masonry is a high-quality building material that has been scoring awards for high-end homes.

One home in O'Connor in the ACT, constructed by David Fogg from ProStyle Builders and designed by Angela Knock from Plan It Green, used products from the Australian Hemp Masonry Company (AHMC). The home won the HIA 2018 Australian GreenSmart Award and the 2018 ACT Master Builders People's Choice Award.

AHMC managing director Klara Marosszeky tells The Fifth Estate demand for hemp masonry has been growing rapidly over the past 12 months as more builders and buyers see examples of completed projects around the country.

She says the feedback from buyers is that the homes perform exceptionally well in terms of their thermal comfort and acoustic insulation and general wellbeing for inhabitants, including anecdotal reports from asthmatic sufferers that their symptoms lessened after they moved into a hemp home.

As a biomass for building construction, hemp absorbs more carbon per kilo than timber during its growth phase. That carbon is then stored permanently in the building products. Hemp delivers a breathable wall product, which reduces condensation and improves air quality, and is light, and durable.

The next step for the industry is to establish local processing and manufacturing in every state to reduce the carbon footprint from freight. Some states, such as Tasmania, don't have processing for the fibre used to make building materials.

Marosszeky says the goal is not to have hemp products replace everything else but for it to be used in conjunction with other materials to introduce biomass into building products across the materials spectrum and reduce the quantity of higher-emissions material.

Hemp helps increase biomass while also storing carbon.

"It's a carbon bank, and at the same time we can create homes and workplaces where people have a better life and a healthy life," Marosszeky says.

AHMC has just completed its first project in the commercial building space, an Innovation Centre at Cape Byron Steiner School.

Another advantage of hemp masonry is that building owners can become involved in the building process, leading to significant cost-savings.

Marosszeky sees enormous potential for the material in the affordable housing space, including remote Indigenous communities.

She was one of the earliest innovators in the space, gaining a special license from the NSW Government to grow a trial hemp crop in the Hunter Valley in 1999 and undertaking research into applications for hemp at the University of NSW, Sydney from 2000 to 2006.

Her involvement with Landcare, Greening Australia and the Nature Conservation Council and her realisation that to protect crucial forest corridors we need an alternative to the continued harvesting of native forests for timber, prompted her to get involved with hemp.

Using hemp as a product for food, fibre, fuels and construction is not entirely new; historically, many cultures have used hemp for a variety of purposes.

“There is a really quite deep cultural knowledge [about hemp] in many of our migrant communities, and we have an opportunity to innovate using that knowledge.”

In addition to the traditional uses, new applications for hemp are emerging, such as hemp-based superconductors.

Replacing plastics

Car manufacturers, including Mercedes Benz and Porsche, are using hemp fibre composites in new luxury car models but Henry Ford built an entire car from hemp composite as early as 1941.

There’s a hotbed of innovation happening in the bioplastics space too, as materials manufacturers look for low-carbon, renewable materials.

Australian company Zeoform is using hemp to manufacture a range of products, including surfboards made of hemp instead of fibreglass, extruded bioplastic furniture, and rapidly biodegrading plastic substitutes for throw-away consumer items.

In Europe, Kanesis, a company based in Sicily, is manufacturing 3D printer filament from hemp waste.

Not a thirsty crop

Per hectare, hemp uses about a third of the water used by cotton, and whatever cotton can do, hemp can do, too. The earliest Levis jeans manufactured for California gold miners in the 1800s were made from hemp, and Levis has now come full circle, with a new range of “cottonised” hemp garments.

Hemp clothing is also gaining traction in the ethical, organic and Fair Trade clothing space.

Given the water savings, it’s easy to imagine the positive benefits it could have for the Murray-Darling River system and other regions where water supplies are at crisis point, if thirsty industrial cotton crops were swapped for hemp.

Hemp needs extra water beyond natural rainfall in most regions only in the first six weeks of its growth cycle, and in many parts of Australia, hemp can yield two crops a year.

Sucking up chemicals

In 2004, Southern Cross University researcher Dr Keith Bolton, in conjunction with Ecofibre Industries Ltd (EIL) and Byron Shire Council, demonstrated that hemp can be used to “mop up” sewerage plant effluent.

Other research has shown hemp can be grown on land contaminated by heavy metals, while still producing a safe material. It can also be grown with fewer pesticides than cotton. Bugs just don’t dig hemp.

Every part of the crop can be used

Hemp is the posterchild for multipurpose cropping – the stems can be used for fibre and biomass; the seeds produce high-quality food for humans and animals as well as high-quality oil for both human consumption and conversion to biodiesel; and while it is currently not legal in Australia to feed animals the leafy parts (although it is in Europe], the leaf material left after harvest can be ploughed back in to boost soil carbon and mulch for the next crop.

Hemp can also be direct seeded without needing to plough deep into the soil, protecting soil structure and soil moisture.

The use of low-THC seed for human consumption in Australia was legalised by the Australia and New Zealand Ministerial Forum on Food Regulation in 2017, following extensive research and consultation. Demand quickly soared.

Farm Weekly reported last month that Australian Primary Hemp, which offers customers an end-to-end hemp service, is preparing to list on the Australian Stock Exchange. The company’s products include cold pressed hemp oil, protein powders for human consumption and stock feeds using hemp grown in Victoria and Tasmania by contract growers.

Research shows stock feed products made from hulls left over from processing for human food products improve dairy animal gut health and general condition.

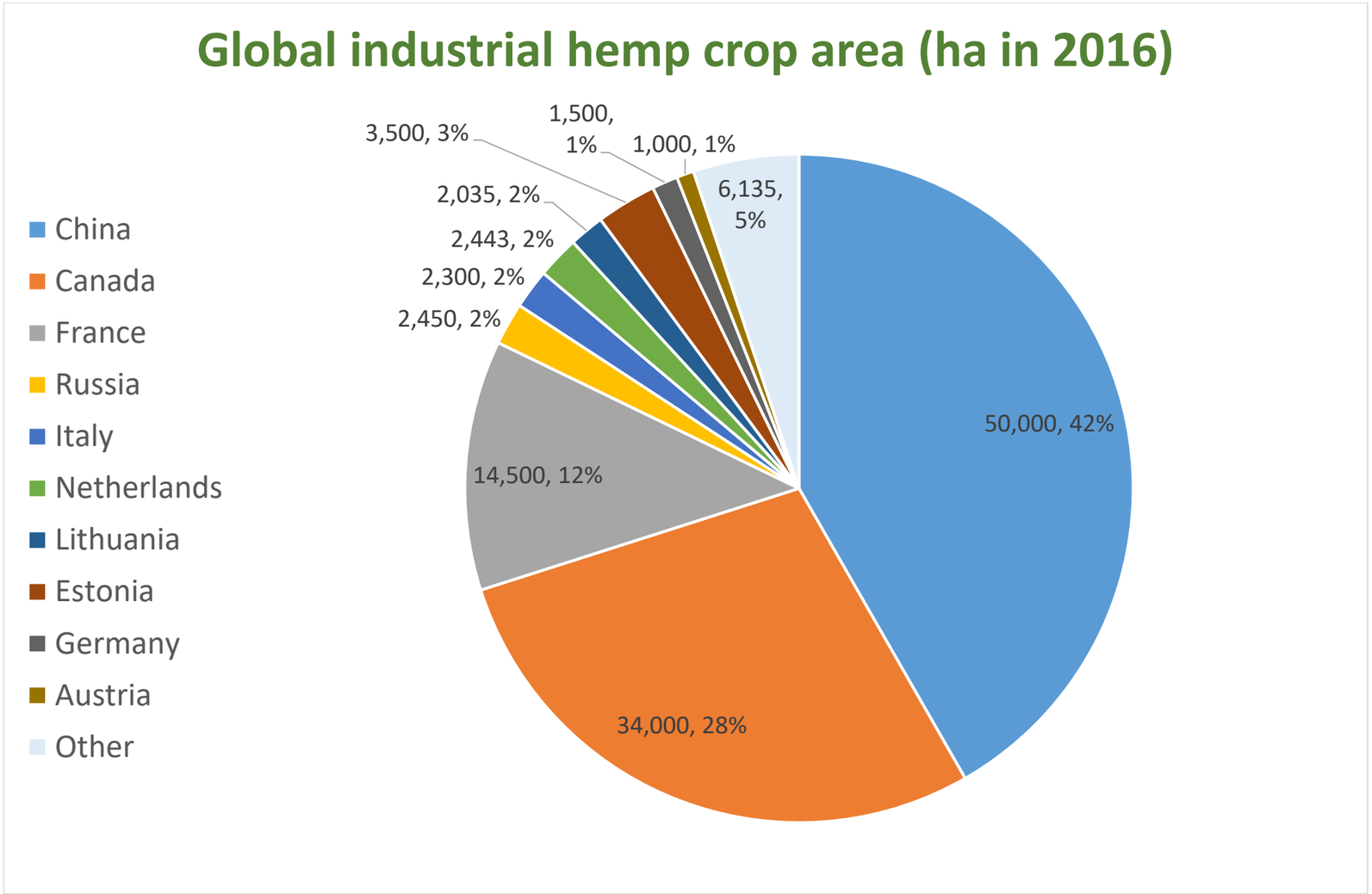
Hemp seed oil is also a promising product as a vegan substitute for fish oils as a source of Omega 3 oils as well as Omega 6 and Omega 9 oils. It is also appearing in a wide range of cosmetic and personal care products.

The protein powder derived from the seeds has the full amino acid complement required for human nutrition, a quality shared by few other Australian-grown, plant-based proteins. Soy, for example, does not have the full amino acid complement.

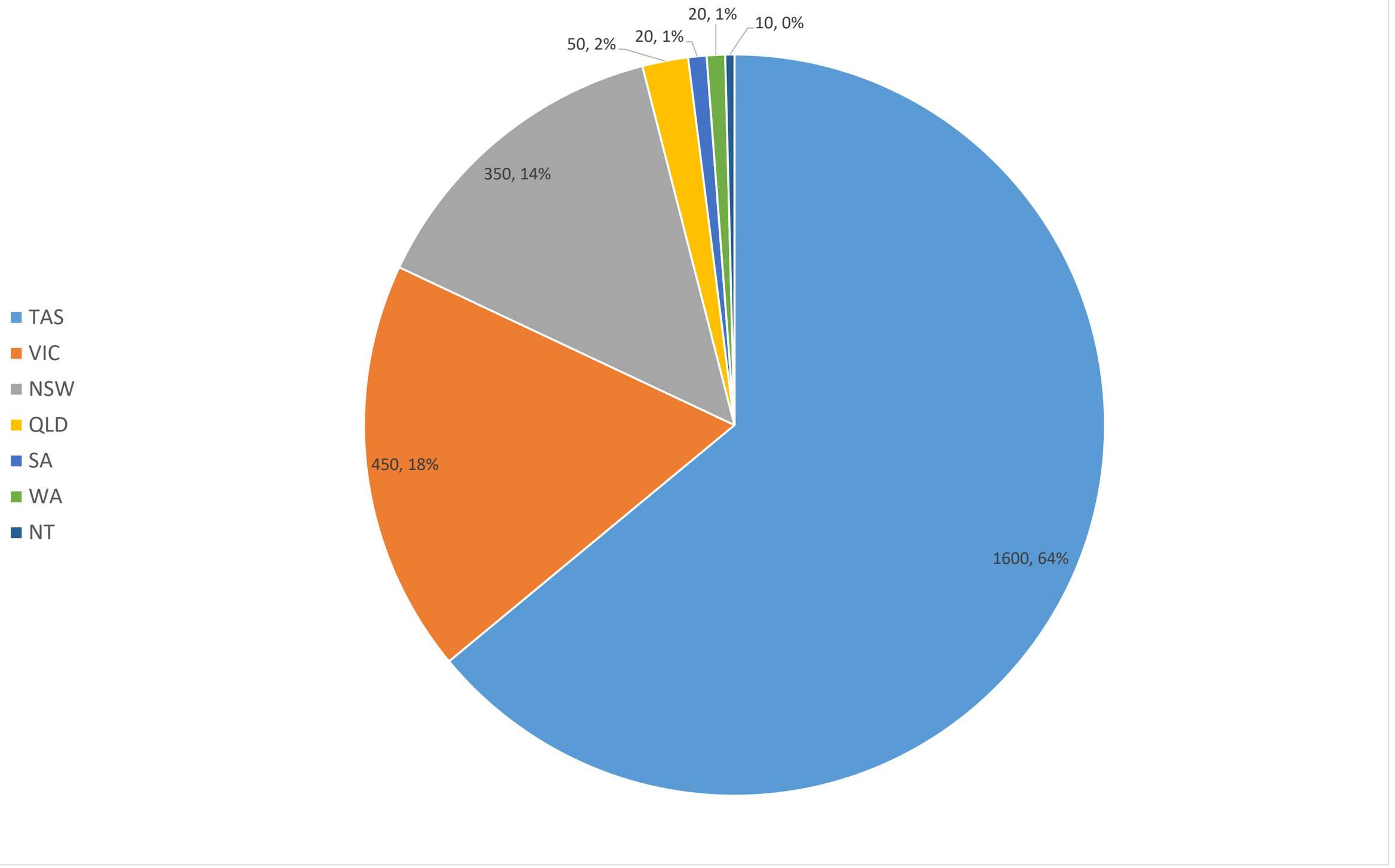
Since legalisation, the number of Australian food manufacturers jumping on board with hemp seed containing foods has skyrocketed.

Given its environmental credentials, if we are looking for a recipe to help save the planet hemp seed and hemp oil would be excellent ingredients.

Tags: buildings materials, built environment, hemp, hempcrete, sustainability


Global industrial hemp crop area (ha in 2016)
China
Canada
France
Russia
Italy
Netherlands
Lithuania
Estonia
Germany
Austria
Other
50,000, 42%
34,000, 28%
14,500, 12%
2,450, 2%
2,300, 2%
2,443, 2%
2,035, 2%
3,500, 3%
1,500, 1%
1,000, 1%
6,135, 5%

Australian industrial crop area (ha in 2017/18)



Country	ha
China	50,000
Canada	34,000
France	14,500
Russia	2,450
Italy	2,300
Netherland	2,443
Lithuania	2,035
Estonia	3,500
Germany	1,500
Austria	1,000
Other	6,135

USA > 70,000

State	ha
TAS	1600
VIC	450
NSW	350
QLD	50
SA	20
WA	20
NT	10
	2500