Australian Government

Department of Climate Change and Energy Efficiency

CARBON FARMING INITIATIVE

Draft Methodology for Broadacre Industrial Hemp Planting

This interim template is to be used to submit draft methodologies to the Interim Domestic Offsets Integrity Committee (DOIC) prior to the passage of the CFI legislation. It will be updated following the passage of the CFI legislation.

Disclaimer

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Privacy Contact Officer
Department of Climate Change and Energy Efficiency
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Intellectual Property

Any entity that submits an application for assessment of a draft methodology as part of the CFI warrants that they own or have a licence to use all of the relevant intellectual property rights in the application submitted.

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Interim assessment application template

Instructions for proponents

This template must be completed and used by proponents applying for assessment of a draft methodology by the DOIC. It incorporates:

1) details of a draft methodology, including detailed instructions to project proponents on how to implement and monitor a project for the specified eligible activity; and
2) supporting evidence to enable the DOIC to assess the draft methodology against the offsets integrity standards and other requirements specified in the Interim Guidelines for Submitting a Methodology.

The instructions on project implementation and monitoring will form the basis of the methodology determinations made by the Minister for Climate Change and Energy Efficiency. This information is to be provided in the blue boxes. If the methodology is assessed to meet CFI requirements, the information in the blue boxes would form the published approved methodology. As the published methodology will be used by project proponents to implement and monitor their projects, instructions should be clear and all technical terms should be defined.

Supporting evidence is to be provided in the green boxes. This information would not be contained in the published approved methodology, but will be made publicly available during the public comment period as part of the DOIC's assessment. Methodology proponents may submit a draft project plan as an example.

If a proponent wishes for any information provided as supporting evidence to be exempt from public disclosure, the information must be clearly marked 'CONFIDENTIAL'. An explanation of why this information should not be published during the public comment period should be provided in Section 14 of the template. Where the DOIC requires more information from a proponent on why the information should not be published, it may seek additional information from the proponent.

Draft methodologies that include confidential information in blue sections will not be considered by the DOIC and will be returned to the proponent.

Methodology proponents may wish to include the names and affiliations of technical experts consulted in the development of the methodology. The DOIC would seek permission from the expert to include their names in the draft methodology before it is released for public comment.

A general glossary of terms is provided at the back of the template. A glossary of terms specific to the methodology can be provided in Section 4 of the template. The definitions of terms in the methodology glossary should be consistent with definitions in the CFI legislation and the general glossary provided.

Methodology applications should be submitted to:
DOIC Secretariat
Department of Climate Change and Energy Efficiency
GPO Box 854
CANBERRA ACT 2601

Or DOIC@climatechange.gov.au

Section 1: Applicant details

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Postal address (if different to above):	

Section 2: Expert consultation

Have you consulted technical experts in the development of this methodology? If yes, please provide names and affiliations.		
Name	*Affiliation*	*Does this expert endorse all or part of the draft methodology?*
Gabriel Rau	*UNSW*	*Yes*
Jasmin Herro	*University of Sydney*	*Yes*

NB In addition to consulting technical experts we have made every endeavour to provide scientific support for Industrial Hemp as a Carbon Sink in scientific journals of repute. Where possible references are given. As this is a relatively new crop for Australia most of the references relate to more developed markets in Europe, Asia and North America. Due to differences in available cultivars and climate variations there are differences in available biomass and the quantities of CO2 that can be sequestered.

Section 3: Existing methodologies

3.1 Has a similar methodology already been approved for use under the CFI? If yes, outline how the new methodology proposal is different.
We have no knowledge of a methodology similar to this that has been approved under the CFI. This methodology is similar to other methodologies that have been listed for consultation on the CFI website.

3.2 Is the draft methodology an adaptation of an existing methodology that has been approved under an international offsets scheme or an offsets scheme in another Australian jurisdiction? If yes, provide a reference for the existing methodology and describe any major differences between the draft methodology and the existing methodology.

In view of our research Industrial Hemp farms are eligible for carbon credits under Kyoto where the criteria are that the plant be 2m + and have 20% coverage at the canopy. As such credits can be traded under CDM and JI schemes, as well as on the ETS.

There is no current methodology approved under an Australian scheme. There are however schemes using Industrial Hemp to offer offsets in other markets. The UK, in particular has a group called Hemp Global Solutions (http://hempglobalsolutions.com) that offers offsets to individuals and businesses. Below is information taken from the website:-

HGS and The C-Change Trust Developing Hemp CO2 Offset Scheme

HGS and The C-Change Trust have partnered to develop a system for offsetting and retiring carbon emissions through UK hemp cultivation. The C-Change Trust gives business and individuals the opportunity to acknowledge and offset their carbon emissions through charitable donation. In return they invest 75% of all donations into funding projects that will reduce carbon emissions, educate the young on climate change and create new woodlands right here in the U.K.

The partnership will bring HGS' hemp expertise and research and The C-Change Trusts carbon and UK offset experience to a scheme which offers multiple additional benefits to the environment. The project has the potential to be scaled up to global levels as it is based on agricultural land and offers valuable resources, eliminating costs.

Offsetting for individuals

HGS takes a pragmatic approach to offsetting carbon emissions. Simple products, easy payment options and the knowledge that you are investing in the hemp industry to help create a sustainable future for the global environment and all its inhabitants. We remind you that the first step in emissions reduction is changing behaviour. Click hereto find out how you can reduce your impact on the global environment by reducing your emissions of carbon before you offset. UK residents'**weekly** emissions can compare with the **yearly** output of some of the worlds poorest people. HGS channels funds through our HDF(Hemp Development Fund) into R&D to develop nutrition and fuel solutions for the worlds poorest communities through our 'Food and Fuel' project and Seed The Future campaign.

Offsetting for Business and Organisations

Businesses and organisations who fail to mitigate environmental and social impacts are losing market share and public support. The emerging 'conscience driven' marketplace demands an ethical approach to maintain consumer confidence. Investing in hemp by offsetting with HGS offers numerous advantages:

- Rapid annual CO2 turnaround - this years emissions are returned by the next year.
- Your carbon is converted into sustainable raw materials that don't harm the enviroment and replace high carbon alternatives.
- Your carbon offset automatically helps and empowers local communities in that grow the hemp and then apply it to local uses.
- HGS invests some of your offsetting budget into the Hemp Development Fund HDF offering further downline benefits from your offset spend.

Using hemp for CO2 absorption is more efficient than agro-forestry per land use, with greater overall benefits and more land available to absorb significant quantities of atmospheric CO2 levels. Hemp grows in almost any soil type, altitudes and climate without the need for chemical inputs and improves soil structure while also protecting and binding soils and nutrients. Hemp roots tap into deep subsoil nutrients other plants cannot access, as well as destroying nematodes and other soil pests, resulting in improved yields of follow on crops.

End

Section 4: Methodology glossary

Provide a glossary of terms that are specific to the draft methodology.

Section 5: Methodology (or activity) scope

5.1 Describe the specific abatement activities, technologies or management practices to which the methodology applies. Explain how the abatement activities, technologies or management practices will reduce or avoid emissions or remove and sequester greenhouse gases from the atmosphere.

This methodology applies to the establishment of a broadacre Industrial Hemp Agribusiness in Australia.

Whilst the main objective is to sequester Carbon there are secondary objectives:-

1) To build a sustainable farming and manufacturing industry using Industrial Hemp fibre
2) To offer real employment opportunities to remote communities especially those with significant Indigenous* populations.

*To this end GoodEarth is working closely with Government supportedAIMSC (Australian Indigenous Minority Supplier Council)

We submit that industrial hemp be seriously considered as a crop that can contribute significantly to the Australian Government's aim to reduce global atmospheric Carbon Dioxide.

Industrial hemp has been scientifically proven to absorb more CO2 per hectare than any forest or commercial crop and is therefore the ideal carbon sink. In addition, the CO2 is permanently bonded within the fiber that is used for anything from textiles, to paper and as a building material. It is currently being used by BMW in Germany to replace plastics in car construction. It is therefore additional to what would otherwise be grown or sourced from oil. It can be constantly replanted and as such meets permanence criteria as defined by the Kyoto Protocol.

Industrial hemp is not marijuana. Industrial hemp is the name of the soft fiber from the Cannabis Sativa plant. It is distinguished from the psychoactive varieties by having low (less that 0.05) levels of the chemical THC (Tetrahydrocannabinol). It has been developed to grow long fibers and in dense plantations thereby increasing the biomass. See below:-

Hemp can be grown on a widespread scale throughout Australia, on nutrient poor soils and with very small amounts of water and no fertilisers. Hemp can be grown on existing agricultural land (unlike most forestry projects), and can be included as part of a farm's crop rotation with positive effects on overall yields of follow on crops. It can therefore comply with the Australian Government's plans to increase employment and improve the economic position of remote areas. This is especially relevant to the holders of Aboriginal and Torres Strait Islander land.

A brief history of hemp

Hemp has been in cultivation for thousands of years, most notably for ropes for naval vessels and for paper. In the mid 1930's there was the invention of nylon and the spread of plastics, and a general trend away from all things natural. At the same time use of marijuana as a recreational drug increased and hemp was included in the ban on cultivation of any plant of the Cannabis family. This view spread globally with political pressure from the US and since that time there has been a stigma attached to hemp cultivation.

Governments around the world have realised that this valuable crop is not a threat and have encouraged widespread planting of hemp as a means of absorbing CO2 and have issued carbon credits to farmers growing the crop.

Major producers include Canada, France, and China. In Australia the Department of Primary Industry is encouraging the growth of industrial hemp and is issuing licenses to companies and individuals that meet stringent criteria.

GoodEarth has been through the process and has been awarded a license to grow an industrial hemp crop by the NSW Department of Primary Industries.

The science behind hemp as a carbon sink

One hectare of industrial hemp can absorb 22 tonnes of CO_2 per hectare. It is possible to grow to 2 crops per year so absorption is doubled. Hemp's rapid growth (grows to 4 metres in 100 days) makes it one of the fastest CO_2-to-biomass conversion tools available, more efficient than agro-forestry.

Biomass is produced by the photosynthetic conversion of atmospheric carbon. The carbon uptake of hemp can be accurately validated annually by calculations derived from dry weight yield. This yield is checked at the weighbridge for commercial reasons prior to processing.

Highly accurate figures for total biomass yield and carbon uptake can then be made, giving a level of certainty not available through any other natural carbon absorption process.

The following carbon uptake estimates are calculated by the examining the carbon content of the molecules that make up the fibres of the hemp stem. Industrial hemp stem consists primarily of Cellulose, Hemicellulose and Lignin, whose chemical structure, carbon content, (and therefore absorbed CO_2).

- **Cellulose is** 70% of stem dry weight. Cellulose is a homogeneous linear polymer constructed of repeating glucose units. The carbon content of cellulose accounts for 45% of its molecular mass.
- Hemicellulose is 22% of stem dry weight. Hemicellulose provides a linkage between cellulose & lignin. It has a branched structure consisting of various pentose sugars.
- **Lignin is** 6% of stem dry weight. Lignin is a strengthening material usually located between the cellulose microfibrils. The lignin molecule has a complex structure that is probably always is variable .

To summarise the above, one tonne of harvested stem contains:

- 0.7 tonnes of cellulose (45% Carbon)
- 0.22 tonnes of hemicellulose (48% Carbon
- 0.06 tonnes of lignin (40% Carbon)

It follows that every tonne of industrial hemp stems contains 0.445 tonnes Carbon absorbed from the atmosphere (44.46% of stem dry weight).

Converting Carbon to CO_2 (12T of C equals 44T of CO_2(IPCC)), that represents 1.63 tonnes of CO_2 absorption per tonne of UK Hemp stem harvested. On a land use basis, using Hemcore's yield averages (5.5 to 8 T/ha), this represents 8.9 to 13.4 tonnes of CO_2 absorption per hectare of UK Hemp Cultivation.

For the purposes estimation, we use an average figure of 10T/ha of CO_2 absorption, a figure we hold to be a reasonably conservative estimate. This is used to predict carbon yields, but CO_2 offsets will be based on dry weight yields as measured at the weighbridge.

The roots and leaf mulch (not including the hard to measure fibrous root material) left in situ represented approximately 20% of the mass of the harvested material in HGS' initial field trials. The resulting Carbon content absorbed but remaining in the soil, will therefore be approximately 0.084 tonnes per tonne of harvested material. (42% w/w) (5).

Yield estimates are (5.5 - 8 T/ha) this represents 0.46 to 0.67 tonnes of Carbon per hectare (based on UK statistics) absorbed but left in situ after Hemp cultivation.

That represents 1.67 to 2.46 T/ha of CO2 absorbed but left in situ per hectare of UK Hemp Cultivation. Final figures after allowing 16% moisture (Atmospheric 'dry' weight) are as follows:-

CO2 Absorbed per tonne of hemp stem	1.37t
CO2 Absorbed per hectare (stem) (UK)	7.47 to 11.25t
CO2 Absorbed per hectare (root and leaf) UK)	1.40 to 2.06t

Industrial hemp is a self offsetting crop

According to Defra, UK Farming emits a total CO2 equivalent of 57 millions tonnes in GHG's. UK agricultural land use is 18.5 million hectares. This amounts to an average of around 3.1 tonnes of CO2 per hectare total embodied emissions. As a low fertiliser and zero pesticide/herbicide crop, with little management input, the carbon emissions of hemp cultivation is well below the average. Therefore we can assume the matter remaining in soils roughly offsets the cultivation and management emissions.

References

1. Hon, D.N.S. (1996) A new dimensional creativity in lignocellulosic chemistry. Chemical modification of lignocellulosic materials. Marcel Dekker. Inc. New York.(5)

2. Puls,J., J. Schuseil (1993). Chemistry of hemicelluloses: Relationship between hemicellulose structure and enzymes required for hydrolysis. In: Coughlan M.P., Hazlewood G.P. editors. Hemicellulose and Hemicellulases. Portland Press Research Monograph, 1993. (5)

3. Bjerre, A.B., A.S. Schmidt (1997). Development of chemical and biological processes for production of bioethanol: Optimization of the wet oxidation process and characterization of products, Riso-R-967(EN), Riso National Laboratory, Roskilde, Denmark.

4. Anne Belinda Thomsen, Soren Rasmussen, Vibeke Bohn, Kristina Vad Nielsen and Anders Thygese (2005) Hemp raw materials: The effect of cultivar, growth conditions and pretreatment on the chemical composition of the fibres. Riso National Laboratory Roskilde Denmark March 2005. ISBN 87-550-3419-5.

5. Roger M Gifford (2000) Carbon Content of Woody Roots, Technical Report N.7, Australian Greenhouse Office.

These figures do not include the additional carbon dioxide that is saved by substituting unsustainable raw materials, to end products derived from harvested hemp that effectively locks in

CO2. Such products include, building materials, plastics, cosmetics, composite boards and insulation materials. According to Limetechnology Ltd, Hemcrete locks up around 110kg of CO2 per m3 of wall, compared to the 200kg of CO2 emitted by standard concrete. It also excludes the carbon savings of replacing tree-derived products and leaving trees to continue to absorb CO2

For a crop, hemp is very environmentally friendly, as it is naturally insect resistant, and uses no herbicides. Hemp grows rapidly in Australia and matures in 90 days compared to traditional forestry taking 20 years. It therefore starts absorbing CO2 from almost from the day it is planted.

Industrial hemp needs limited maintenance and regenerates soil

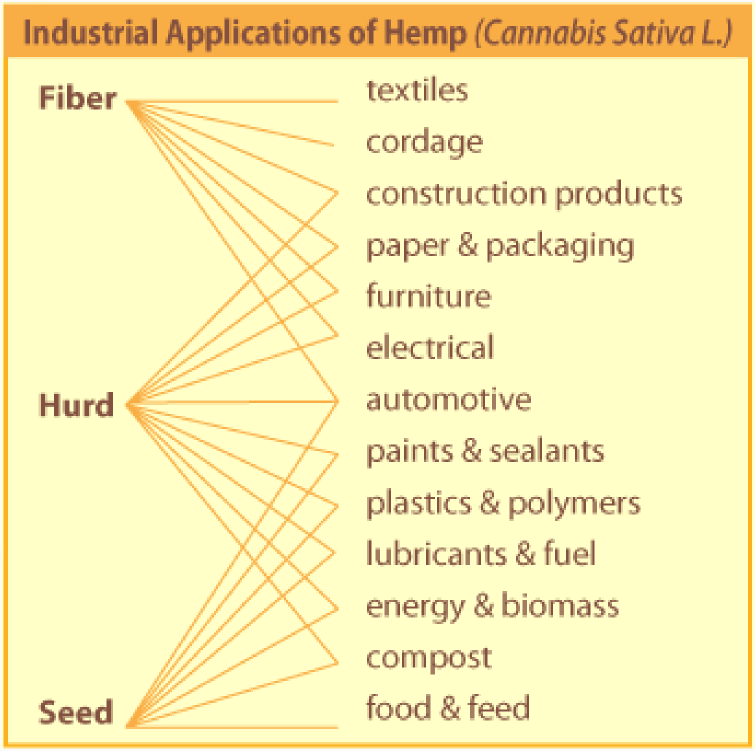
Hemp grows in diverse soil types and conditions without the need for chemical inputs and improves soil structure while also protecting and binding soil. The long roots of the hemp plant help to bind soils and combat erosion. Hemp also is a natural weed suppressant due to the rapid growth of its canopy. Light is blocked out and weeds cannot grow underneath.

Hemp also adds nutrients to soil by tapping into sub-soil nutrients other plants cannot access. It also destroys nematodes and other soil pests, resulting in improved yields of follow on crops. Hemp cleans toxins from the ground by a process called phytoremediation. It was used in Russia to remove radioactive elements following the Chernobyl nuclear disaster. Work undertaken in Germany (noted in Karus and Leson 1994) suggested that hemp could be grown on soils contaminated with heavy metals, while the fiber remained virtually free of the metals. Kozlowski et al. (1995) observed that hemp grew very well on copper-contaminated soil in Poland (although seeds absorbed high levels of copper). Baraniecki (1997) found similar results. Mölleken et al. (1997) studied effects of high concentration of salts of copper, chromium, and zinc on hemp, and demonstrated that some hemp cultivars have potential application to growth in contaminated soils. It is currently being trialled in NSW as a ''mop crop'' to rehabilitate soils that have been contaminated by nearby sewage treatment plants. Where soils have become acidic due to acid rain planting a hemp crop restores the PH balance.

Industrial hemp replaces unsustainable raw materials

The vast quantities of hemp derived products and raw materials created by large scale cultivation could replace many oil-based unsustainable products and materials, particularly in construction, locking in captured CO2 and creating secondary benefits to the global environment. In particular, hemp could be used to replace significant quantities of tree-derived products, allowing reduced use of existing tree populations, thus maintaining their CO2 uptake.

Hemp also produces much higher quantities of stronger and more versatile fibre than cotton, and many other fibre crops, which often have very high chemical residue and water footprints. Extra processing required by hemp is also at least partially offset by its recycling potential. Industrial hemp has thousands of uses with virtually no waste. This proposal focuses on carbon capture, but it is worth emphasising that hemp growers have a crop that is valuable and will be in increasing demand. This is especially true of industrial hemp seed as a food high in protein and Omega 3.



Industrial Hemp as Forestry

There may be a question as to whether Industrial Hemp qualifies as a forest. To qualify as a forest a plant must first qualify as a tree and be composed partly of wood. We have carried out some research into the official and accepted definitions and found that broadacre Industrial Hemp does qualify as a forest as it qualifies as a tree and is composed of wood. The following has been obtained from Australian sources.

Definition

The Australia National Forest Inventory's definition of forest is;

'. . an area, incorporating all living and non-living components, that is dominated by trees having usually a single stem and a mature or potentially mature stand height exceeding 2 metres and with existing or potential crown cover of overstorey strata about equal to or greater than 20 per cent. This definition includes Australia's diverse native forests and plantations, regardless of age. It is also sufficiently broad to encompass areas of trees that are sometimes described as woodlands.'

Throughout this century, Australia has used a number of definitions of forest. It has also developed concepts around the words 'forest' and 'woodland'. The definitions and concepts have never aligned perfectly and now that it is possible to map the whole continent in useful detail in a relatively short space of time, the disjunction's have been exacerbated. The release of the National Forest Policy Statement (NFPS) in 1992, with its clear and comprehensive biological definition of forest, resolved the issue and changed the way we understand and describe forests. This definition is very similar to that used by the United Nations Food and Agriculture Organisation (FAO).

As our techniques for measuring forests have improved, the need for a scientifically, technically and linguistically rigorous definition of forest has arisen. The definition used by the National Forestry Inventory (NFI) is the one set out in the NFPS, but with two technical changes to accommodate implementation.

Crown Cover

The minimum crown cover for forest has been set at 20 per cent. It also marks a boundary that can be mapped reliably from satellite information in most areas.

Although crown cover is well-defined theoretically, the boundaries between areas of different densities can be difficult to determine on the ground. In practice, the usage of wooded lands has not depended upon an strict application of the lower scientific boundary, but has depended on the quality of the potential timber resource.

The standards used now for crown cover are:

- **woodland**: 20-50 per cent crown cover (equivalent to 10-30 per cent projective foliage cover)
- **open forest**: 51-80 per cent crown cover (30-70 per cent projective foliage cover), and
- **closed forest**: 81-100 per cent crown cover (more than 70 per cent projective foliage cover).

Height

There is currently no national standard used for mapping tree height. Mapping compiled for national level reporting had nearly 150 different height classes. Height information has either been collected or reclassified into three categories:

- **low**: 2-10 metres
- **medium**: 11-30 metres
- **tall**: greater than 30 metres.

The terminology used to describe 'forests' in Australia needs reviewing. With the NFPS and FAO definitions both including what has in common usage been called 'forest' and 'woodland', there is ambiguity surrounding the word 'forest'. For the time being, we will use "wooded lands" to refer to the full forest estate as defined by NFPS/NFI. Wooded lands will be divided into closed and open forests, and woodlands.

The common meaning of 'forest' in Australia has tended to be a term describing the use of the wooded land, not its scientifically defined structure and cover. Thus the high forests (>20 m), irrespective of their density were called forests. In many cases these 'forests' are mixtures of open forest, woodland and even open woodland.

Other factors

The NFPS definition refers to 'usually' single stemmed trees, which recognises that tree mallees, Australia's multi-stemmed eucalypts, are to be included. To include mallees in a way that is sensible both biologically and in terms of mapping, a lower height limit of two metres has been adopted, following the definition of forest promulgated by the Australian Forestry Council and recommended by many State agencies that map or work with mallee.

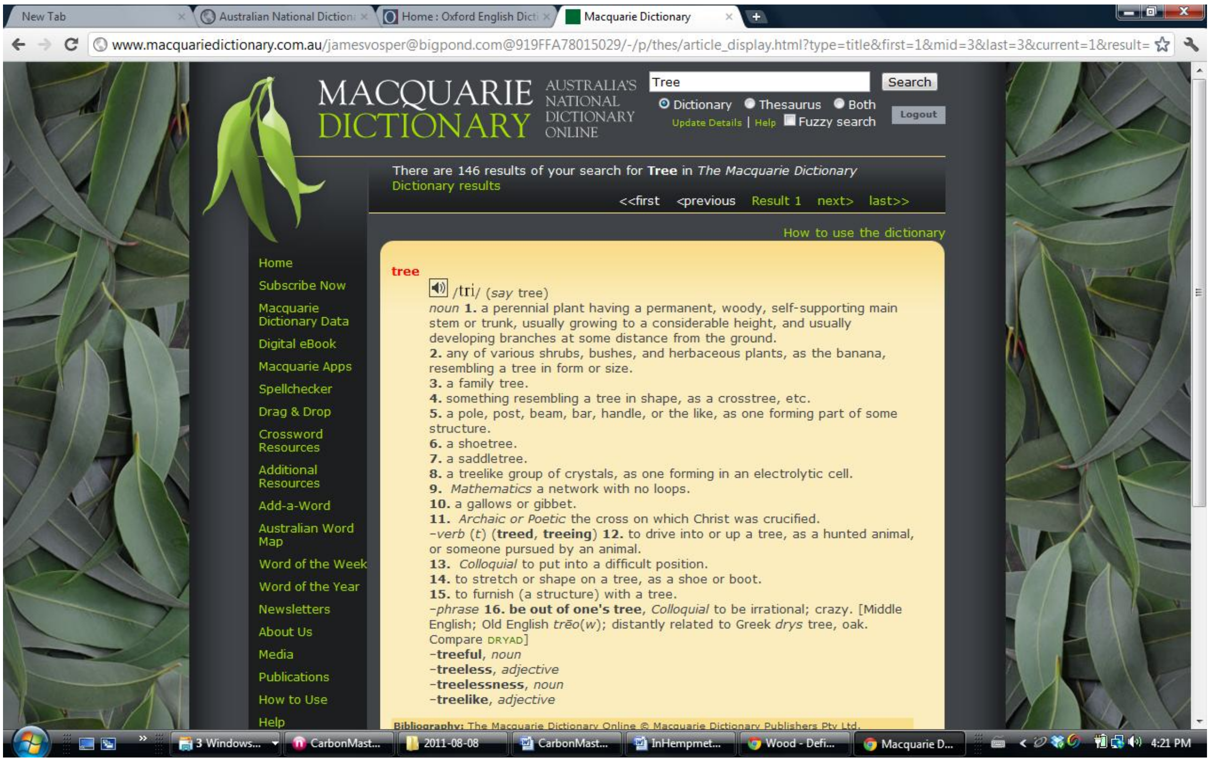
The definition above indicates that Broadacre Industrial Hemp can be classified as Forest. The Macquarie Dictionary confirms that Industrial Hemp can be defined as a

Forrest.

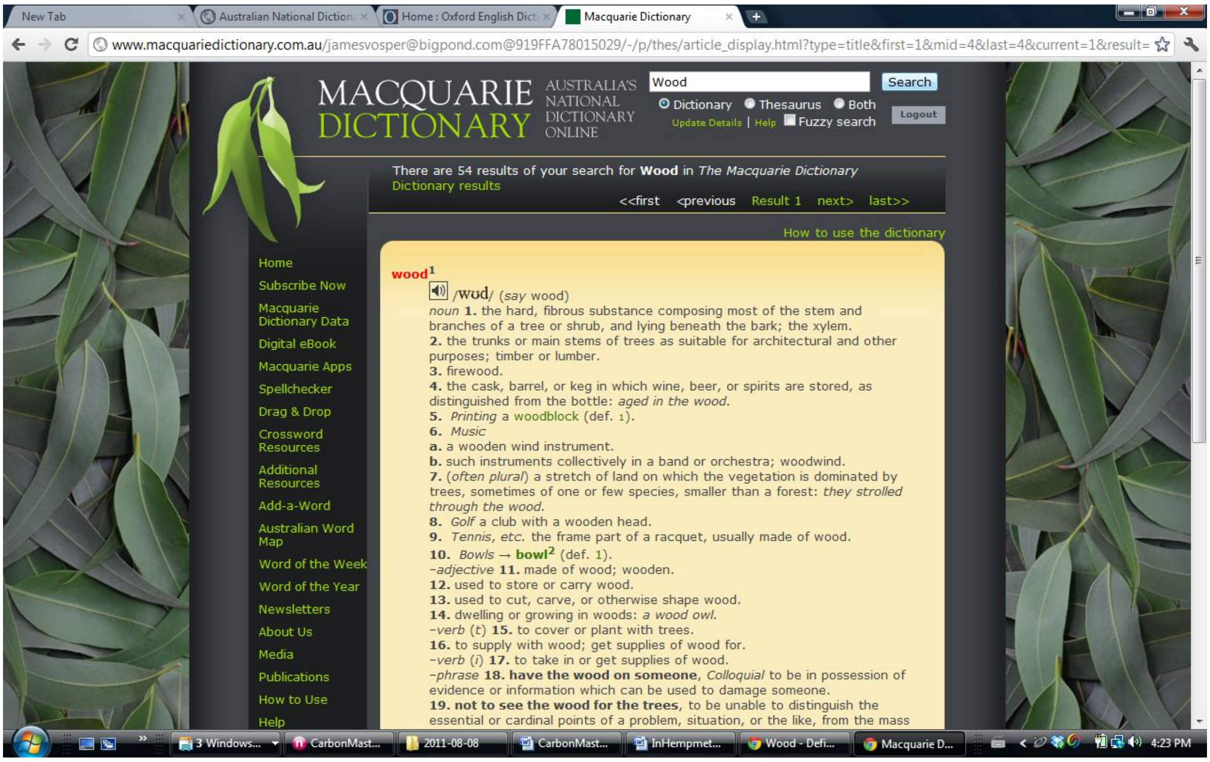
Forest of Industrial Hemp in Temperate Climate

Broadacre Forest of Industrial Hemp in Temperate Climate

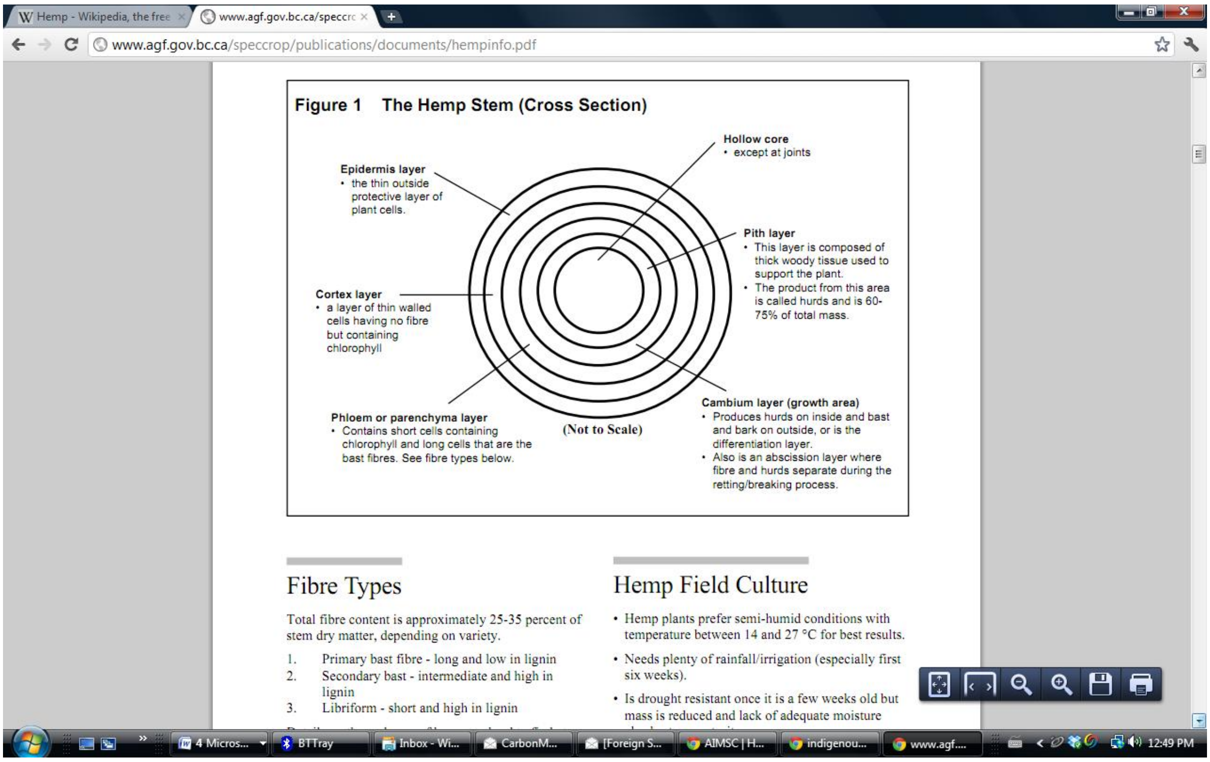
The following definition of "tree" is from Macquarie Dictionary. According to this definition Industrial Hemp qualifies as a tree under definition #2.



The following definition of "wood" is from Macquarie Dictionary. Industrial Hemp qualifies as wood under definition #1.



The diagram below illustrates that woody material composes a significant proportion of the Hemp Stem. Further testament to this is that Hemp is used as a substitute for wood ranging from car door panels in Mercedes Benz cars to electric guiltars.



Conclusion

The cultivation of industrial hemp in Australia is vital in our battle to reduce pollution, conserve precious water resources and to improve soil quality.

Industrial hemp is unmatched as a means of sequestering Carbon Dioxide and binding it permanently in the materials it is manufactured into. The accreditation of industrial hemp as a generator of carbon credits will make its cultivation more attractive.

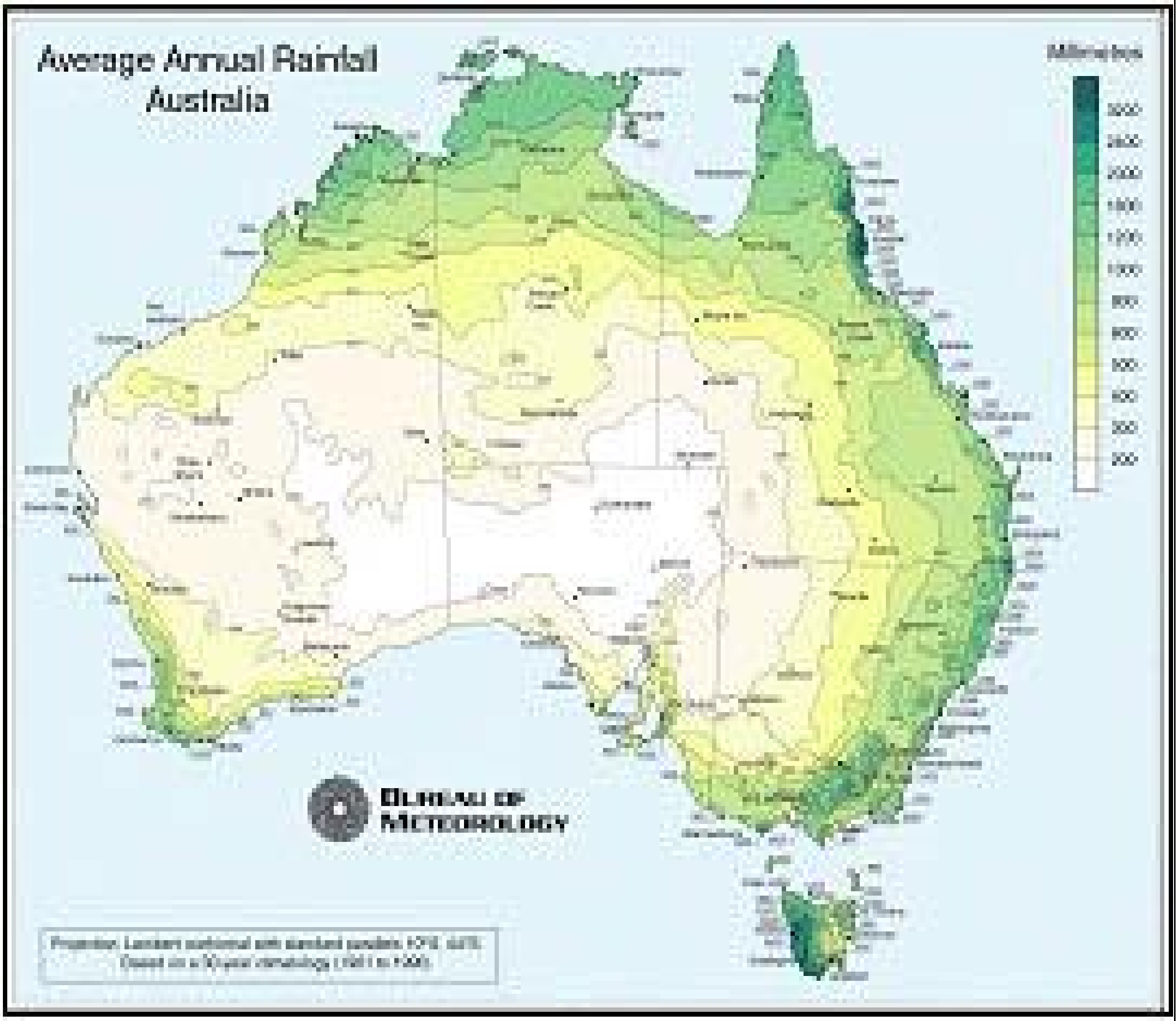
In addition, the fiber is robust and has a large variety of uses as paper, textile and as a biofuel. The seeds are a valuable source of protein for humans and for use in animal feed. This will stimulate a whole new industry and reduce reliance on imported goods.

The widespread cultivation of industrial hemp in Australia will give a much needed economic and sustainable boost to remote country areas and areas suffering high unemployment and hardship.

5.2 List the circumstances or conditions under which the activities, technologies or management practices are to be implemented. If they can be implemented under different circumstances or conditions (for example, climatic conditions, soil types and other regionally specific conditions), specify any differences in implementation for each of the different circumstances or conditions.

The Methodology can be applied anywhere in Australia. Yields will vary due to temperature. Tropical conditions allow the planting of multiple crops per year.

Rainfall is required for growth so the areas in Green/Light Green represent the best potential. The Eastern Seabord has higher summer rainfall and this is advantageous. For broadacre planations significant infrastructure is required and therefore the Eastern Sates of Queensland, NSW and Victoria represent the highest volume and most cost effective options. The prime areas to be considered are those with a significant (i.e higher than 2.5% as defined by AIMSC) indigenous population.



5.3 (Optional) Provide background information about the abatement activities, technologies or management practices. This could include case studies that demonstrate the successful implementation of the abatement activities, technologies or management practices.

This methodology implements two measurement services that will operate concurrently.

The first operates under the Australian Government's National Carbon Accounting System and associated tools such as the CFI Mapping tool and the Reforestation Mapping Tool (RMT)

The second tool is proprietary and has been developed by the Agriplex Group (www.agriplex.com.au) This group has a partnering agreement with Indigenous Communities Alliance, and AIMSC certified organisation. The tool is known as Carbon Master and will act as a subjunct and refinement of the RMT. Details of each service are outlined below. For confidentiality reasons only an outline is provided for Carbon Master. More information can be provided by direct contact with Agribisness:-

David Carter

Director

National Carbon Accounting System

Australia's National Carbon Accounting System (NCAS) provides world-leading accounting for greenhouse gas emissions from land based activities.

Land based emissions (sources) and removals (sinks) of greenhouse gases form a major part of Australia's emissions profile. Around 24 per cent of Australia's human-induced greenhouse gas emissions come from activities such as livestock and crop production, land clearing and forestry.

Land management such as soil preparation, fertiliser use, harvesting and burning all affect emissions of greenhouse gases. A significant proportion of Australia's land based emissions occur as non-carbon dioxide gases, in particular methane from livestock production and nitrous oxide from fertiliser application.

Actively growing forest systems remove carbon dioxide from the atmosphere through photosynthesis. Growing forests act as a long-term carbon sink by storing carbon in the trees, debris and soils. In 2008, removals associated with reforestation activities were estimated to be approximately 23 Mt of carbon dioxide (based on forests planted since 1990), effectively reducing national emissions by almost 4 per cent.

Land activity accounting

Accurate accounting of the emissions and removals of greenhouse gases from the land requires knowledge of the dynamics of carbon (for carbon dioxide and methane emissions) and nitrogen (for nitrous oxide emissions) in the landscape. The growth and life cycles of forests and agricultural crops, climate, soils, land cover change and land management are all important components of a comprehensive emissions accounting system.

The NCAS estimates emissions through a system that combines:

thousands of satellite images to monitor land use and land use change across Australia since 1972 that are updated annually,
monthly maps of climate information, such as rainfall, temperature and humidity,
maps of soil type and soil carbon,
databases containing information on plant species, land management, and changes in land management over time, and
ecosystem modelling - the Full Carbon Accounting Model (FullCAM).

NCAS development

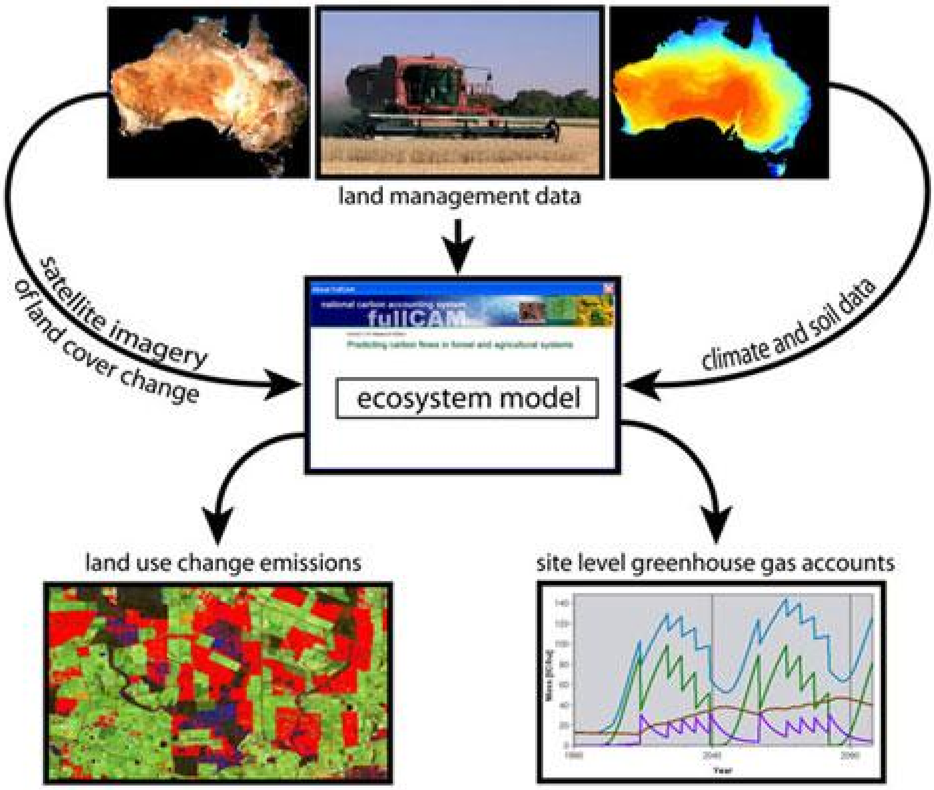
The Australian Government established the NCAS in 1998 to provide a complete accounting and forecasting system for human-induced sources and sinks of greenhouse gas emissions from Australian land-based activities.

The NCAS is continuing to be developed over several phases. These phases are driven by reporting priorities. This reporting capability includes:

land use, land use change and forestry categories for both the United Nations Framework Convention on Climate Change National Greenhouse Gas Inventories and the Kyoto Protocol Greenhouse Gas Inventory, and
projections of future emissions for these same categories.

These reporting categories include changes to emissions and removals of carbon dioxide in the major carbon pools – soil, litter, debris, and both above ground and below ground biomass from agriculture and forest systems.

Derived from the NCAS, the National Carbon Accounting Toolbox (NCAT) is available free of charge and allows users to track emissions and removals of greenhouse gases at specific locations and to input information about their specific management activities.

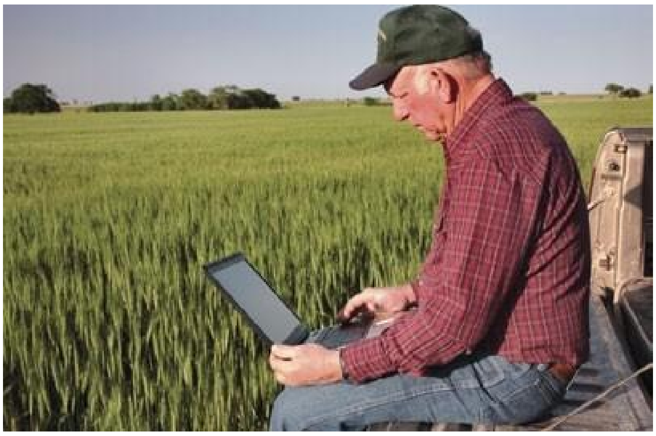


Progress

Ongoing development of the NCAS is focused on improving the estimates of non-carbon dioxide emissions such as methane and nitrous oxide. Enhancing the spatial information in the NCAS is also continuing, with particular focus on reforestation, management of native forests, mapping of sparse woody vegetation and fire extent.

Carbon Master

To accurately manage measure the CO_2 sequestration of proposed Industrial Hemp crops GoodEarth will use the services of Agriplex (http://www.agriplexgroup.com.au). Agriplex have developed a gold standard carbon measurement system called CarbonMaster.



CarbonMaster is a cost-effective method for monitoring and verification of carbon sequestration on a commercial basis. It is designed for all types of land use including forest plantations, managed natural forests and agroforestry. The CarbonMaster system provides reliable results using accepted principles and practices of tree inventory, soil science and ecological surveys. Perhaps most importantly, the system uses real-time field data to help manage commercial-scale tree inventories.

CarbonMaster assesses changes in four main carbon pools: above-ground biomass, below ground biomass, soils and standing under storey brush. It assesses the net change in each pool for project adnoun-project (or pre-project) requirements over a specified time period.

CarbonMaster is a real time software system designed to facilitate management of and strategic decision making for existing and future tree populations, vegetation stands, grassed areas and soil carbon content.

The Features and Benefits of CarbonMaster

- Carbon management software created by industry professionals based on years of industry experience.
- Supported by real software engineers, team of IT engineers and environmental scientists.
- A Comprehensive suite of training and support services to guide clients through the application and implementation.
- Highly accessible user interface that can be accessed from any computer with internet connectivity.

- The safety of confidential data is assured. Only registered users have access to the operating system.

- Detailed reports allow clients to understand and use data in forward planning.

- Work continues on new versions with continued access to updates as they are implemented

Flexibility and scalability ensure future effectiveness e.g.:-

• Real time management data logging (PDA's, GPS etc)

• Visual assessment benefits that can be translated electronically

• Environmental management tools

• Individual or forest classification management strategies

• Existing and future fiscal policy development and implementation

• Urban or large scale commercial tree, vegetation or fairway management tools

• Adaptability to any living environment

• Carbon asset management

• Site/entity mapping

• Asset database

• Extensive asset management reporting

• Real time data assessment

• Real time tree species updates

The system has been developed for a multitude of customers including, small scale individual user's medium scale users (such as local government) and large scale operators (such as plantation managers). The unique features designed within the program allow the user to read and measure carbon capture.

Carbon Master has been successfully implemented by many clients. The following testimony illustrates the seamless integration and the veracity of measured outcomes:-

"CarbonMaster provides an all in one web based software

system that can deliver real outcomes for measuring,

controlling and reducing the carbon footprint of all

major green assets. It's a wonderful achievement ".

Terry Muir - CEO Environmental Business Solutions

Section 6: Identifying the baseline

6.1 Specify the process for identifying the project baseline.
The baseline for all projects using this methodology is zero, based on the assumption that no natural regrowth would occur if grazing, pasture management, cropping, nature conservation, settlements and no use (e.g. of degraded land) were to continue. • Under grazing, pasture management, cropping or settlement, regrowth is assumed to be suppressed. • Under nature conservation or no use, where regrowth has not already occurred, conditions are assumed to prevent natural regrowth. Industrial Hemp has special properties when applied to derelict land (eg mine tailings contaminated by heavy metals) and is therefore a crop that can bring land back into arable status.

6.2 List and justify the assumptions on which the baseline is based.
Ineligible areas in the Project Area can be excluded from abatement calculations: • Areas of land that do not meet the requirements outlined above can be excluded spatially from the Project Area. • Areas of land that were forested prior to 1 July 2010 and are not eligible for crediting can be excluded spatially from the Project Area. • Forests established prior to 1 July 2010 that are eligible for crediting (of abatement since 1 July 2010) can exclude the carbon stock that existed at 1 July 2010 using Equation 1a in Section 9.2. *Note: Clearing forests in order to undertake future reforestation projects will be restricted through the CFI regulations.*

Section 7: Greenhouse gas assessment boundary

7.1 Describe the steps and/or processes involved in undertaking the abatement activity and identify all emissions sources and sinks directly or indirectly affected by the activity. Identify any emissions sources or sinks affected by the activity that will be excluded from the

greenhouse gas assessment boundary. Flowcharts may be used to illustrate typical greenhouse gas assessment boundaries.
The greenhouse gas assessment boundary includes living biomass and debris within a Project Area and the emission of greenhouse gases from managing the project from inception.

7.2 In the table below: List all emissions sources and sinks affected by the project. Indicate whether the source or sink is to be included or excluded from the baseline or greenhouse gas assessment boundary and provide justification for any exclusions. All emissions sources and sinks identified in Section 7.1 should be listed in this table. Expand the table to include additional sources and sinks, as necessary. Additional information justifying the exclusion of emissions sources and sinks can be provided in Section 7.3.				
Source		*Greenhouse gas/carbon pools*	*Included / excluded*	*Justification for exclusion*
Baseline	*Biomass*	CO_2	Excluded	Project is additional and therefore sequesters CO_2.
	Soil	CO_2	Excluded	Soils are an emissions sink under Industrial Hemp.
	Fire	CO_2, CH_4, N_2O	Excluded	Not applicable as fire not used as clearance method.

	Fuel	CH4, N2O,CO2	Excluded	Aim for reduction in fossil fuel use NB. Industrial Hemp makes eco-friendly and efficient bio fuel.
Project Activity	*Above ground biomass*	CO2	Included	Crop is additional and significant biomass.
	Below ground biomass	CO2	Included	Crop has substantial living root system.
	Plant Debris	CO2	Included	Debris used in concrete and represents long time sequestration.
	Soil	CO2	Included	Crop builds carbon stocks in soils.

7.3 (If required) Additional information justifying why a source or sink is excluded.
Due to the uses of industrial Hemp as a fuel and as a building material it is possible for a broadacre plantation to be largely self sufficient.

Section 8: Project Area

If applicable, provide instructions to project proponents on how to determine the Project Area.
Project areas are to be selected on the basis of climate, availability of water and soil composition.

Section 9: Estimating abatement

9.1 Provide instructions to project proponents on how to calculate baseline emissions and removals. Provide formulas and define parameters in each formula, including units. Where parameters are to be derived through data collection, provide instructions on data collection methods in Section 10.
To calculate project emissions and reductions it is advised that proponents use the freely available online tools provided by the Federal Government. These can be downloaded at: http://www.climatechange.gov.au/government/initiatives/national-carbon-accounting.aspx

9.2 Provide instructions to project proponents on how to calculate project emissions and removals. Provide formulas and define parameters in each formula, including units. Where parameters are to be derived through data collection, provide instructions on data collection methods in Section 10.
In order to evaluate the impact of any project the whole lifecycle needs to be considered. **Life cycle assessment (LCA)** Life cycle assessment (LCA) is a tool for the systematic evaluation of the environmental aspects of a product or service system through all stages of its life cycle. The methodology was established in the early 1990s and soon after was adopted and standardised by the International Organisation for Standardisation (ISO). The standards ISO 14040/14044:2006 currently provide a reference with respect to principles, framework and terminology for conducting and reporting LCA studies and are internationally recognised and used.

A typical LCA consists of the four elements: Goal and Scope Definition, Inventory Analysis, Impact Assessment and Interpretation. Goal and Scope Definition describes why and how to use a LCA. During this initial stage decisions are made regarding the definition of the functional unit, system boundaries, allocation procedures, choice of impact categories to be studied and methodology of the impact assessment. The Inventory Analysis quantifies all inputs and outputs of a product system and thus involves data collection and calculation procedures. Impact Assessment translates the inventory data into contributions to environmental impact categories. Interpretation is the final step of LCA.

Here, conclusions are drawn from both the Inventory Analysis and Impact Assessment.

LCA is usually used to compare and improve both products and processes. In this study, product pairs of the same functionality are assessed.

The focus of this study is on the comparison of hemp fibre based products and their fossil-based, non-renewable counterparts.

Product Carbon Footprint

Apart from the assessment of the full life cycle according to the life cycle methodology, much attention during the last few years has been directed to the accounting of one single impact category of greenhouse gas emissions.

Managing greenhouse gas emissions and assigning contribution to climate change is the basis of the currently widely used concept of Carbon Footprint. The term is rooted in the Ecological Footprint method (1994) and in LCA. Although greenhouse gas emissions are accounted for in LCA according to ISO 14040/44 and aggregated in the midpoint impact category of climate change, many methodological problems remain.

Therefore, forces have currently combined to develop a standardised methodology that is scientifically substantiated, transparent and internationally recognised and can be used to assess product and service systems, or whole organisations. Currently the most developed standard of Carbon Footprint is the PAS 2050 'Specification for the assessment of the life cycle greenhouse gas emissions of goods and services' developed by BSI British Standards (PAS 2050 2008).

Furthermore under current development is the 'Product Life Cycle Accounting and Reporting Standard'developed by the World Resource Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) expected to be published by March 2011 (The Greenhouse Gas Protocol Initiative 2009).

Meta-analysis of LCA studies on hemp fibre products

The concept of meta-analysis is adopted for the purpose of this study and is used as the basis for the presented study.

This approach enables the comparison and comprehensive evaluation among life cycle studies. The life cycle studies are selected regarding common characteristics. A meta-analysis of life cycle assessment studies enables the generalisation of conclusions and can reveal strength and weaknesses of the product system analysed. Results are more comprehensive and therefore provide better guidelines for future decisions.

Functional unit

For the analysis of the LCA studies, two functional units were chosen.

• In order to be able to compare two products/applications from two different materials according to certain environmental impacts, one constant has to be fixed. This constant is the desired function of the product and must be identical. Schematically, the comparison of a fossil-based application and a hemp-based alternative per environmental impact category (EI) with the same functionality (f) can be expressed by the following:

$$(EI\ fossil - EI\ hemp) / f = saved\ EI / f.$$

The results of this simple calculation describe the difference in environmental impact and hence the saved environmental impact (saved EI) when a fossil-based application is replaced by its hemp-based alternative. In the case where the hemp-based application shows higher environmental impacts, results are negative. The results of the comparative analysis of each application pair are presented in the section 'Results of the LCA meta-analysis'.

In order to be able to compare pairs of applications that do not have the same functionality, it is possible to define a reference value which serves as the basis of comparison. As all hemp-based applications are as a matter of fact made from renewable resources, it is possible to select a defined area of land [one hectare (ha)] as the means of comparison. The function:

$$\frac{saved\ EI / f}{ha_{hemp} / f} = EI\ savings / ha$$

provides a formula with which it is possible to identify the applications that contribute most to environmental savings and hence to an efficient and sustainable use of land. Through such an analysis it is possible to compare all forest- and agro-based products such as bio-materials, bio-fuels and bio-energy. In the section 'Summary' the results of the analysis are presented.

With regard to the cultivation of hemp, direct and indirect land use changes are currently considered as not relevant. The cultivation of hemp for hemp-based fibre applications is considered to take place in Europe where direct land use changes are assumed to be negligible. The cultivation, production and use of hemp fibres is currently low and is not expected to cause shifts in land use elsewhere in the world.

Impact categories

Energy use and climate change are important characteristic values in describing environmental impacts. Both terms are defined as impact categories in the methodology of LCA. The selection of impact categories has been made according to availability of data, robustness and ranking of importance in the current political debate. Furthermore, fossil energy demand can be used as a screening indicator for environmental performance as it is a driver of several environmental impacts (Huijbregts et al. 2006).

9.3 Provide instructions to project proponents on how to calculate *net greenhouse gas abatement*. This should be the difference between the baseline and project emissions and removals.

Refer 9.2

9.4 For bio-sequestration projects provide instructions on the procedures to be used to account for variations that are likely to occur in the amount of carbon stored as a result of climatic cycles or harvesting over 100 years.

The future climate is difficult to predict as it relies on the actions taken by Governments, Organisations and individuals.

Industrial Hemp is a hardy crop and will survive in warmer or colder climate situations.

Sequential cropping of part of each hectare will assure that there is perennial cover that is sequestering CO2.

9.5 Provide instructions to project proponents on how to calculate net abatement number or net sequestration number for reporting purposes, *if different from the estimate of net greenhouse gas abatement (Section 9.3)*. For bio-sequestration projects, this calculation should take into account any adjustments to the abatement estimate to address variability, and any abatement already reported and credited.
Refer to 9.2

9.6 Indicate whether the estimation methods and emissions factors are from the NGER (Measurement) Determination or Australia's National Greenhouse Accounts. If not, explain why new or different estimation methods are proposed. Note that the methods set out in the NGER (Measurement) Determination must be used to estimate emissions covered by NGERS.
Measurement will comply with NGE. The company will register to have access to OSCAR The Online System for Comprehensive Activity Reporting (OSCAR) is a web–based data tool for business to record energy and emissions data for Government program reporting. OSCAR allows you to gain a clear picture of your organisation's emissions, and can automatically calculate your organisation's greenhouse emissions based on your organisation's energy and emissions data.

9.7 Provide a detailed description of any formulas used and detailed explanations of the parameters included in each formula, along with a description of how each parameter is derived(noting that detailed instructions to proponents on data collection methods for deriving parameters are to be provided in Section 10). Where applicable, provide a citation for the source of equations and/or parameters.

Parameter	Detail Description	Equation	Derived
t	Time in months	general	t
r_p	Month of end of the previous reporting period	general	
r_c	Month of the end of the reporting period	general	
n	Number of Carbon Estimation Areas (CEAs) within a Project Area	general	
m	Number of Project Areas within a project	general	
$IC_{CEA,i}$	Initial Carbon Stock (C) within the Carbon Estimation Area (CEA_s) (i)	Eqn 1a	RMT
$IC_{PA,j}$	Initial carbon stock (C) within a Project Area (j)	Eqn 1a, 2a, 2b	Calculated
$IC_{PA,j}\ (r_p)$	Initial carbon stock (C) within a Project Area (j) as previously reported	Eqn 2b	Calculated
$C_{CEA,i}\ (r_c)$	Carbon Stock (C) within the Carbon Estimation Area (CEA_s) for the reporting period	Eqn 1b	RMT
$C_{PA,j}\ (r_c)$	carbon stock (C) within a Project Area for the reporting period	Eqn 1b, 2a, 2b	Calculated
$C_{PA,j}\ (r_p)$	carbon stock (C) within a Project Area as previously reported	Eqn 2b	Calculated
$\Delta C_P\ (r_c)$	Carbon Stock Change (C) for the reporting period	Eqn 2a, 2b, 3	Calculated
$\Delta C_{CO2}\ (r_c)$	Carbon Stock Change (CO_2-e) for the reporting period	Eqn 4, 11	Calculated
$E_{P,CH4}\ (r_c)$	Emissions of CH_4 (CO_2-e) from biomass burning for the reporting period	Eqn 5, 7	Calculated
$E_{P,N2O}\ (r_c)$	Emissions of N_2O (CO_2-e) from biomass burnings for the reporting period	Eqn 6. 7	Calculated

$M_{tb,ij}$	Tree layer carbon (C) emitted to the atmosphere monthly	Eqn 5, 6	Modelled
$M_{db,ij}$	Debris layer carbon (C) emitted to the atmosphere monthly	Eqn 5, 6	Modelled
$E_F (r_c)$	Total CO_2-e emissions from biomass burning for the reporting period	Eqn 7, 11	Calculated
Q_i	The quantity of fuel type (i) (kilolitres) combusted monthly for: (a) stationary energy purposes; and (b) transport energy purposes;	Eqn 8	Collected
$Q_i (r_c)$	The quantity of fuel type (i) (kilolitres) combusted for the reporting period	Eqn 8, 9	Collected
q	Number of gas types (carbon dioxide, methane or nitrous oxide) combusted from fuel	Eqn 9, 10	CO_2, N_2O, CH_4
p	Number of fuel types	Eqn 8, 9, 10	Collected
EC_i	The energy content factor of fuel type (i) (gigajoules per kilolitre) (If Q_i is measured in gigajoules, then EC_i is 1)	Eqn 9	NGERS
EF_{ijoxec}	The emission factor for each gas type (j) (which includes the effect of an oxidation factor) for fuel type (i) (kilograms CO_2-e per gigajoule)	Eqn 9	NGERS
$E_E (r_c)$	Total project fuel emissions for the reporting period	Eqn 10, 11	Calculated
$A_p (r_c)$	Project abatement within the reporting period (CO_2-e) for the reporting period	Eqn 11	Calculated

Section 10: Data Collection

Provide instructions to project proponents on data collection methods for deriving the parameters used to calculate *baseline emissions and removals* (Section 9.1) and *project emissions and removals* (Section 9.2). Instructions may be provided in the table below.

Reforestation Modelling Tool outputs

	Description	Unit	Measurement Procedure	Measurement Frequency

Section 11: Monitoring and reporting

11.1 Outline the elements of the project that will be monitored and describe how monitoring will be undertaken, including:

- frequency of monitoring;
- the Australian Standards, or other relevant standards, that project proponents will need to comply with to calibrate and maintain measurement equipment; and
- any qualifications that operators will need to operate measurement equipment.

The information provided in this section should not duplicate the information provided in Section 10.

Proponents may use on-ground observation and/or satellite imagery to monitor that the project continues to meet the RMT requirements set out in Section 5.2.

Proponents must monitor Carbon Estimation Areas and report adjustments to these areas if:

- they no longer meet the requirements set out in Section 5.2; or
- changes to the management regime require further stratification.

Proponents must monitor fires and record the timing of the event, the location (CEA), the area affected (proportion of CEAs), and whether trees are killed or survived.

11.2 Specify the data and other information about the project that must be included in project reports and project records, including:

- data required to estimate emissions and removals resulting from the project;
- data required to identify and justify baseline scenarios and to support baseline estimation and resetting; and
- information about project implementation or changes in environmental conditions that are required to determine whether the project remains within the scope of the methodology.

In addition to the reporting requirements set out in the CFI regulations, proponents must report on:

1. forest management
2. Project Areas; and
3. abatement estimates.

The specific reporting requirements are described in **Error! Reference source not found.**.

Proponents must report on all three sections in the first report. For subsequent periods, proponents must report abatement estimates and any changes to the forest management and Project Areas sections.

Note: The CFI legislation also requires proponents to notify the Administrator of certain events.

Section 12: References

Provide a full citation for all reports cited in the draft methodology.

Sources:

Bos, U. 2010. Aktualisierung der CO2-Bilanz des Dämmstoffes THERMO-Hanf mit PES- und PLA-Faser. Fraunhofer Institut für Bauphysik

Bos, U. and S. Deimling. 2010. Development of a Complete Biogenous Insulating Material - LCA Results. LBP University of Stuttgart and PE International, Germany.

Boutin, M.-P., C. Flamin, S. Quinton, and G. Gosse. 2006. Etude des caractéristiques environnementales du chanvre par l'analyse de son cycle de vie. L' Institut National de la Recherche Agronomique (INRA), Lille, France.

Bócsa, I. and Karus, M. 1998.The Cultivation of Hemp: Botany, Varieties, Cultivation and Harvesting. Hemptech. Sebastopol, U.S.

Buschmann, R. 2003. Umweltverträglichkeit von Gebäudedämmstoffen. Katalyse - Institut für angewandte Umweltforschung, Köln, published by: Ministerium für Umwelt, Natur und Forsten des Landes Schleswig-Holstein, Kiel, Germany.

Carus, M., C. Gahle, C. Pendarovski, D. Vogt, S. Ortmann, F. Grotenhermen, T. Breuer, and C. Schmidt. 2008. Studie zur Markt- und Konkurrenzsituation bei Naturfasern und Naturfaser-Werkstoffen (Deutschland und EU). nova-Istitut GmbH, Hürth, Germany.

Carus, M., A. Raschka, S. Piotrowski, D. Schubert, F. Gerlach, L. Scholz, C. Gahle, J. Haufe, B. Hermann, M. Patel, S. Elbe, U. März, S.

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Cherrett, N., J. Barrett, A. Clemett, M. Chadwick, and M. J. Chadwick. 2005. Ecological Footprint and Water Analysis of Cotton, Hemp and Polyester. Stockholm Environment Institute, prepared for and reviewed by BioRegional Development Group and World Wide Fund for Nature (WWF Cymru), Stockholm, Sweden.

EC. 2001. Integrated Pollution Prevention and Control (IPPC) - Reference Document on Best Available Techniques in the Pulp and Paper Industry. European Commision (EC), Joint Research Centre, Institute for Prospective Technological Studies, Seville, Spain.

Ernst & Young. 2005. Evaluation de l'organisation commune de marché dans le secteur du lin et du chanvre. Ernst & Young, September 2005 for the European Commision Agricultural Directorate-General, Brussels, Belgium.

Produced from Crude Oil. North Energy Associates Ltd, prepared for DEFRA project Environmental Assessment Tools for Biomaterials (NF0614), Stocksfield, England.

González-García, S., M. Teresa Moreira, G. Artal, L. Maldonado, and G. Feijoo. 2010. Environmental impact assessment of non-wood based pulp production by soda-anthraquinone pulping process. Journal of Cleaner Production 18:137-145.

Grießhammer, R. and C. Hochfeld. 2009. Product Carbon Footprint Memorandum - Position statement on measurement and communication of the product carbon footprint for international standardization and harmonization purposes. Öko-Institut e.V., Freiburg Office, Germany.

Hischier, R. 2007. Life Cycle Inventories of Packagings and Graphical Papers. ecoinvent-Report No. 11, Swiss Centre for Life Cycle Inventories, Dübendorf, Switzerland.

Magnani, M. 2010. Ford Motor Company's Sustainable Materials. 3rd International Congress on Bio-based Plastics and Composites, 21st of April 2010, Hannover, Germany.

Murphy, R. J. and M. Norton. 2008. Life Cycle Assessments of Natural Fibre Insulation Materials. Imperial College London, prepared for the National Non-Food Crop Center (NNFCC), London, England.

Müssig, J., M. Schmehl, H. B. von Buttlar, U. Schönfeld, and K. Arndt. 2006. Exterior components based on renewable resources produced with SMC technology-Considering a bus component as example. Industrial Crops and Products 24:132-145.Norton, A. J., R.

Murphy, C. A. S. Hill, and G. Newmann. 2009. The Life Cycle Assessments of Natural Fibre Insulation Materials. Proceedings of the 11th International Conference on Non-conventional Materials and Technologies (NOCMAT 2009), 6-9 September 2009, Bath,UK.

PAS 2050. 2008. PAS 2050:2008 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services. British Standards Institution (BSI), London, United Kingdom.

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Pless, P. S. 2001. Technical and Environmental Assessment of Thermal Insulation Materials from Bast Fiber Crops. University of California, Los Angelos, U.S.

Reinhardt, G. A., A. Detzel, S. O. Gärtner, N. Rettenmaier, and M. Krüger. 2007. Nachwachsende Rohstoffe für die chemische Industrie:Optionen und Potenziale für die Zukunft Institut für Energie- und Umweltforschung GmbH (IFEU); Gefördert durch die Fachvereinigung Energie, Klimaschutz und Rohstoffe (FEK) im Verband der Chemischen Industrie e.V. (VCI), Heidelberg, Deutschland.

Rettenmaier, N., G. Reinhardt, S. Gärtner, and J. Münch. 2008. Bioenergie aus Getreide und Zuckerrübe: Energie- und Treibhausgasbilanzen.

Institut für Energie- und Umweltforschung GmbH (IFEU); Im Auftrag des Verbandes Landwirtschaftliche Biokraftstoffe e.V. (LAB), Berlin, Heidelberg, Deutschland.

Schmehl, M., J. Müssig, U. Schönfeld, and H.-B. Von Buttlar. 2007. LCA on a Bus Body Component Based on Biomaterials. Presentation at 3rd International Conference on Life Cycle Management, August 27 to 29, 2007, University of Zurich, Switzerland.

Schmehl, M., J. Müssig, U. Schönfeld, and H. B. Buttlar. 2008. Life cycle assessment on a bus body component based on hemp fiber and

PTP®. Journal of Polymers and the Environment 16:51-60.

Schmidt, W.-P. and H.-M. Beyer. 1998. Life Cycle Study on a Natural Fibre Reinforced Component. SAE Technical Paper Series 982195, presented at Total Life Cycle Conference and Exposition Graz, Austria, December 1-3, 1998.

Section 13: Appendices

Append and list below all relevant documentation necessary for the DOIC to assess the methodology including cited reports.

Appendix A: DPI Papers- Industrial Hemp, a New Crop for NSW

Appendix B:GoodEarth licence to grow Industrial Hemp in NSW

Section 14: Disclosure

Specify documents or parts of documents included as supporting information to the application that are marked CONFIDENTIAL and should not be published and the reasons why.

Acceptable justification would include that the information should not be published if it reveals, or could be capable of revealing:

- trade secrets; or

• any other matter having a commercial value that would be, or could reasonably be expected to be, destroyed or diminished if the information were disclosed.	
Document/Part of document	*Reason for maintaining confidentiality*
None	
None	

Section 15: Declaration

This application must be signed by a duly authorised representative of the proponent. The person signing should read the following declaration and sign below.

Division 137 of the Criminal Code makes it an offence for a person to give information to a Commonwealth entity if the person providing the information knows that the information is false or misleading. The maximum penalty for such an offence is imprisonment up to 12 months.

By signing below, the signatory acknowledges that he or she is an authorised representative of the proponent, and that all of the information contained in this application is true and correct. The signatory also acknowledges that any of the information provided in this application may be copied, recorded, used or disclosed by the Department of Climate Change and Energy Efficiency for any purpose relevant to the CFI. Information will not be publicly disclosed by the Department where it has been identified as confidential by the proponent.

Full name of the person signing as representative of the proponent	James Vosper	*Date*	15/09/2011
Position	CEO		
Signature			