April 24th 2008

Carbon Cycles and Sinks

(Land Use and Land Use Changes: LULUC)

Proposal for a Policy Development, Advocacy and Dissemination

EENGOCF

A vision

Contrary to the priority given so far by the policy community to emissions reductions through 'domestic action' in the energy sector, the contention here is that a strategy that focuses on managing the whole carbon cycle through sustainable land use improvement on a worldwide basis should, *ex ante*, have equal priority in policy-making. *Ex post*, consideration of beneficial environmental and socio-economic developmental externalities, and of concerns regarding potential abrupt climate change, suggests that the technology types involved should have priority over deploying zero-emissions technologies.

> **P. Read and A. Parshotam, *Holistic greenhouse gas management: mitigating the threat of abrupt climate change in the next few decades*.** Victoria University of Wellington, Institute of Policy Studies Working Paper 07/01

Context

On January 23, 2008, following the historic agreement of national leaders at the Spring European Council of 2007, the European Commission published a comprehensive body of proposals designed to tackle the global challenge of climate change at which very ambitious Co2 target cuts were set.

Country	Target (% of 2005)	GDP 2005 of EU Ave %	Emissions per capita 2005 (tonnes CO2-eq)
EU27	-10	100	10.5
Ireland	-20	139	17

Figure 1: Ireland's target, GDP and Co2 per head compared to EU average [1]

Article 6 of the Proposal outlines the provisions for the division of a higher 30% target, should other developed countries: "*commit themselves to comparable emissions reductions*". In the event of an international agreement on emissions reductions, 50% of any additional emission reduction effort can be met through the use of Kyoto credits. It is further proposed that the scheme be widened to include other greenhouse gasses. The inclusion of nitrous oxide from fertilisers and perfluorocarbons from aluminium is included so as to offer new and more cost-effective abatement opportunities.

Renewables Burden Sharing

Country	Target from 2020%	Penetration (2005%)	Distance from target (2005)%	Biofuels
EU	20	8.5	11.5	10
Ireland	16	3.1	+12.9	10

Figure 2: Ireland's renewables target, current status and distance to target compared to EU average [2]

In an attempt to allay mounting fears on the effectiveness of biofuels in reducing emissions and to counter the unintended consequences of the target on, for example, food production and food prices, the proposal establishes several environmental criteria. The greenhouse gas emissions savings accruing from use of biofuels must be 35% or more (measured against the product they displace) and must not be sourced from areas designated for nature protection, bio-diverse grasslands, wetlands or forests. It is hoped that with these criteria for first generation biofuels would ensure environmentally positive outcomes. In the medium to long-term, it is expected that second generation biofuels would play an increasingly important role.

These are very difficult targets to meet and it is to the Irish government's credit that they have not wasted too much time in resisting them at the EU level, but have given full attention to addressing huge task– as demonstrated by Renewable Energy Forum 6th March.

Ireland's tradable or ETS covered sector is 34% of the economy as opposed to 41% for the EU. The question thus becomes how would Ireland deal with the target for the non ETS sector of

[1] Institute of International and European Affairs: *Energy and Climate Change Policy Brief February 2008*

[2] Institute of International and European Affairs: *Energy and Climate Change Policy Brief February 2008*

between -20 and -30% on 2005 levels by 2020. The sectors in question are transport, residential & construction and agriculture. This question becomes pressing as half of the emissions in the domestic sector arises from agriculture, so it is difficult to see where the emission reduction measures will come from without a major restructuring of the Irish economy. The emissions for agricultural activities break down as follows:

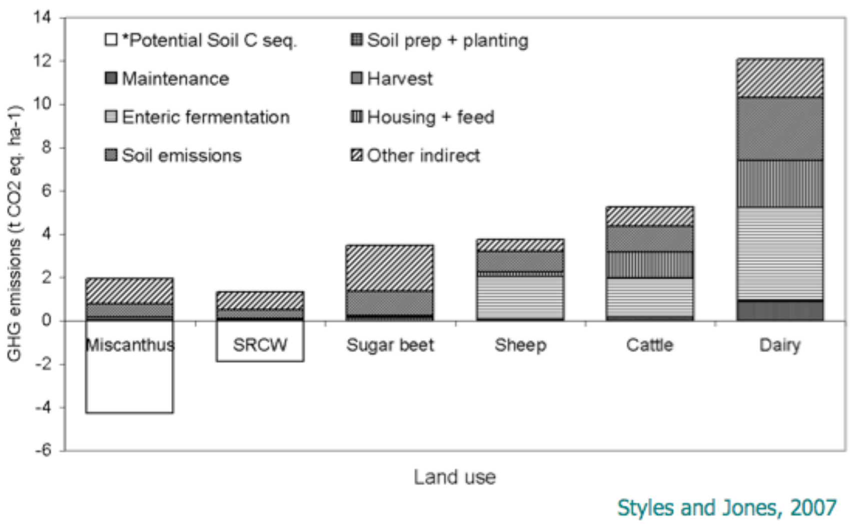

Figure 3:Life cycle analysis: GHG Emissions for different land-use types [3]

This, on the face of it, suggests that dairying is a very climate endangering activity. But this crude analysis leaves out the other, often forgotten, side of the carbon equation. As suggested by Peter Read at the start of this paper, the non-fossil fuel or natural GHGs fluxes and sinks - the most important of which land/soil and related land uses - must also be considered. Few know that Ireland's record of absorbing and retaining carbon in the soil is remarkably good, probably unique in Europe – at least until the year 2000 as the following figures show.

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[3] Mike Jones et al; *EPA Environmental Research Conference Dublin,* ***Towards Reducing Greenhouse Gas Emissions from Agriculture*** *7th February 2008.* School of Natural Sciences, Department of Botany, Trinity College Dublin, Ireland School of Biology and Environmental Science, University College Dublin, Ireland And Teagasc Crop Research Centre, Oakpark, Carlow

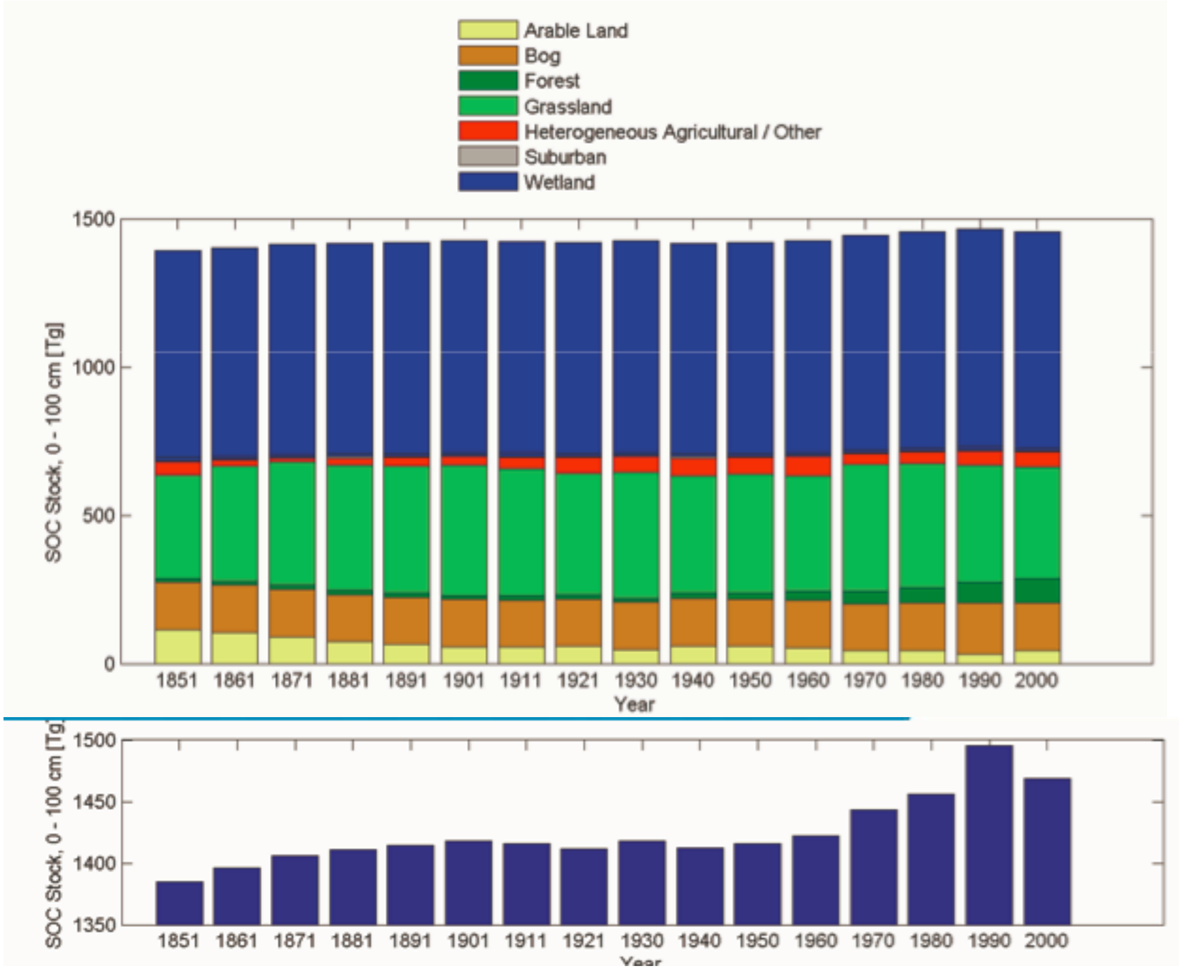
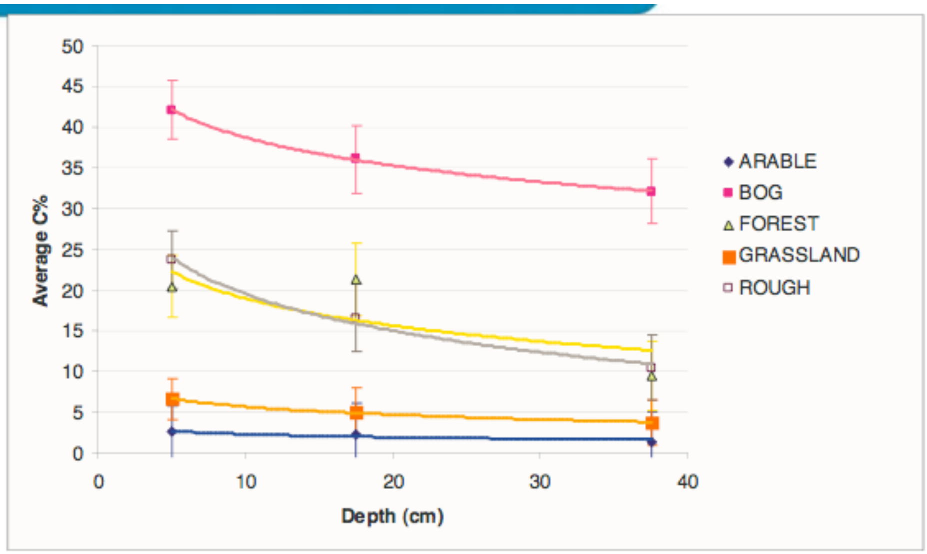


Figure 4: **SOC (soil organic carbon) stock in Ireland to 1 m, 1851-2000**[4]

This indicates that the gain in soil carbon was probably the result of the switch from tillage to grassland after the famine and in later years, to forestry.



[4] Paul Leahy et el, University College Cork, ***Soil Carbon Stocks and Stock Changes in Irish Soils*** *EPA Environmental Research Conference Dublin, 6th -7th of February 2008*

Figure 5: **SOC (soil organic carbon) concentration profiles by land cover family** [5]

Figure 5 confirms the higher performance of forest and grassland over arable as carbon stores; a reason to caution switching from grassland to tillage to grow first generation biofuels such as rape seed. But what caused the drop in soil carbon since 1990? The answer is suggested in the top line of the graph, the high concentration of carbon contained in Irish bogs.

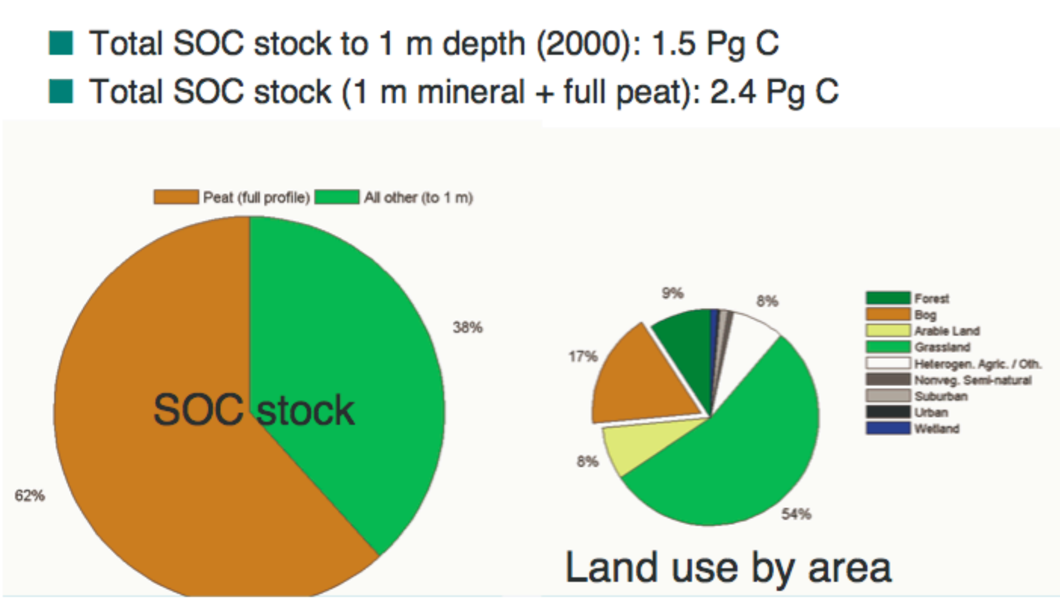


Figure 6: **SOC(soil organic carbon) stock calculations based on existing data** [6]

Fig 6 shows that although bog of all types accounts for only 17% of land use by area, it accounts for nearly two thirds of soil organic carbon stores in Ireland. We now know from recent EPA research that carbon gases are taken in by intact bogs but are released by cutover or degraded bogs and this flux is greater even than emissions from peat power stations; .97 Mt as compared to .9Mt ; nearly twice as much as emissions from domestic turf heating at .5 Mt.

[5] ibid

[6] ibid

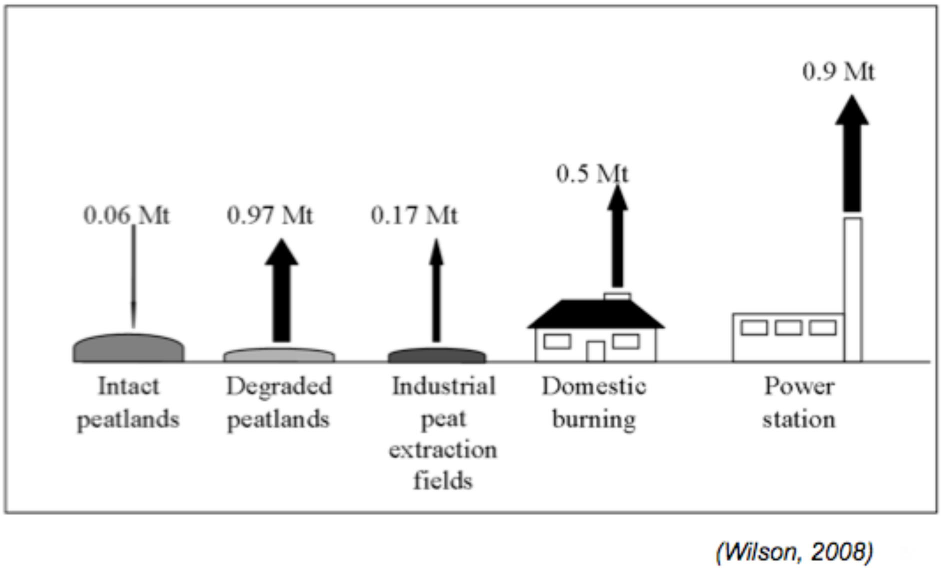


Figure 7: Estimated annual peatland carbon gas fluxes in Ireland. [7]

If we set our priorities by this information, we should be prioritizing our effort in restoring or capping the carbon loss from bogland; whereas all focus so far is on cutting herd numbers, growing rape for first generation biofuels and planting forests for second generation biofuels. Instead of vigorous bogland protection and restoration in Ireland, we discovered from Dr Florence Renou-Wilson's work, that although active peatlands (with the capacity to form peat) are protected under the Habitats Directive since 1997, turf-cutting is on-going at a number of bogs that have been designated for nature conservation. Traditional turf cutting has been undergoing a revival; it appears that 544,000ha of bogs have been destroyed by owners of turbary rights, stimulated to some degree by the very measures that were supposed to protect the bogs.

We also understand that Coillte and other forestry promoters continue to plant or replant conifers in peaty soils ignoring that the balance of the carbon equation is very likely, in the red.[8] But probably the most alarming suggestions for the use of peatlands in connection with climate change and meeting energy targets has come from the Finnish company Vapo. In the context of second generation liquid transport fuels, Vapo suggests that gasification and Fischer–Tropsch synthesis of biofuels can also be used to turn peat into liquid fuels that can be used on their own or mixed with liquid fossil fuels without any need to modify engines. In Finland, the viability of

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[7] Dr Florence Renou-Wilson, **Peatlands: Here Today, Gone Tomorrow? EPA Presentation 6th February 2008.** School of Biology and Environmental Science University College Dublin

[8] ibid

the method is being studied in the VTT-Tekes second-generation liquid fuels development project. They claim that the energy efficiency of Fischer–Tropsch synthesis with peat would be 55 per cent; if the heat produced by the process is used, its energy efficiency would rise to almost 90 per cent. Generation in plants of 150-300 MW would be viable. The first step has been taken in this direction: Stora Enso and Neste Oil have announced a joint project to build a 14 MW demonstration plant in Varkaus, eastern Finland.

The European Union is currently preparing a Directive setting out the criteria for liquid transport biofuels that would allow them to gain approval as liquid biofuels. The criteria are currently expected to be released in December. "*According to advance information, this Directive considers peat a good raw material for liquid biofuels. And indeed many factors speak in favour of using peat to produce liquid transport fuels; we have significant peat resources, peat cannot be used for food, it is a good raw material technically speaking and its impact on the climate is also acceptable if the peat is taken from land that is already ditched*", Kari Mutka of Vapo explains. In Finland two per cent is all it takes. According to Vapo producing liquid transport biofuels does not pose a threat to Finland's peat reserves. To give an idea of their size, Finland's technically feasible peat reserves are equivalent to the known oil reserves in the North Sea; two per cent of Finland's peatland area would be enough to satisfy half of Finland's liquid transport fuel requirements for 50 years..[9]

The reasoning set out above ignores the carbon stores contained in peatland and their potential to be restored to absorb Co2. Were the Directive to allow the utilization of 'ditched' peatlands for biofuels, it might thereby create an incentive to drain them, or at least not to restore bogland where authorised or unauthorized extraction has occurred.

Peter Read suggests that the most effective strategy to tackle climate change is two pronged; reduce fossil fuels emissions as fast as possible as current Kyoto policy attempts, but also stimulate the natural carbon cycle in and above the soil by land use changes, by adopting new agricultural practices and new technologies. He is critical of the Kyoto protocol approach not least for the sheer cost associated with addressing only the fossil energy sector.

> This focus on domestic action in the highly capital-intensive energy sectors of industrialised countries is trebly cost enhancing, through the great difficulty of rapid

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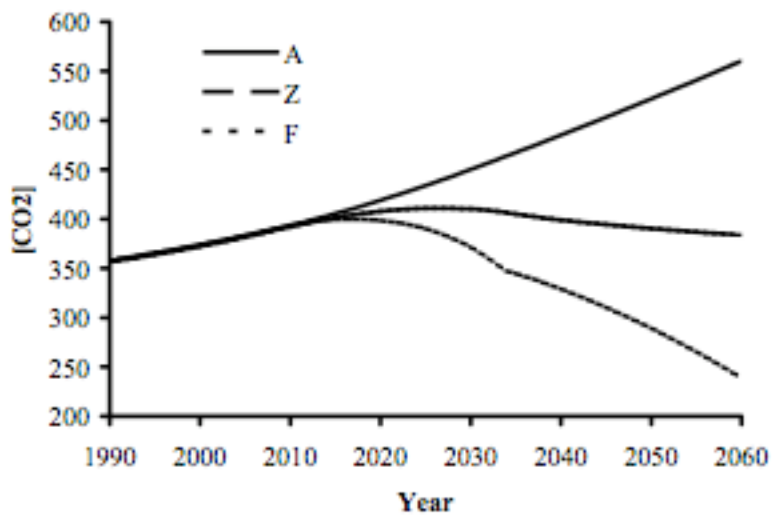
[9] Juhani Rahkonen, Vapo View nhttp://www.vapoviesti.fi/vapoview/index.php?id=1379&type=9

change in a sector with very long lived assets, through its neglect of ~95 per cent of CO2 flows into and out of the atmosphere, and through its focus on the small proportion of the global land surface occupied by those countries. Furthermore, the Protocol overlooks the potential for environmental and socio-economic benefit that may come from well-conceived investment in under-capitalised, and in many places degraded, land. Accordingly, it fails to capture the need to link climate change mitigation with sustainable development that emerged in the Millennium Development Goals[10] (Page 4)

In this scenario, addressing the full spectrum of carbon cycles and directing investment to where the biggest climate protecting gains can be won, places land use, agriculture and forestry at centre stage. For Ireland, this reframes the problem of reducing carbon gases from one of great difficulty, into one of immense opportunity.



Comparison of zero emission systems and negative emissions systems in mitigating the level of CO_2 (in ppm) in the atmosphere

Legend

A SRES-A2

Z SRES-A2 with a transition to zero emissions technologies between 2011 and 2035

F SRES-A2 with a transition to negative emissions technologies over the same period (for details see discussion of Figure 2)

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[10] Peter Read and A. Parshotam***, Holistic greenhouse gas management: mitigating the threat of abrupt climate change in the next few decades,*** Victoria University of Wellington, Institute of Policy Studies Working Paper 07/01

Figure 8[11]

Fig. 8 shows how zero and negative emission systems can act together to rapidly reduce levels of CO2 far earlier of the most optimistic zero-only measures can; fast enough to address a slide into a new hostile climate equilibrium as we reach tipping points. This is very good news at a time when all recent climate data is confirming worst case scenarios.

Apart from conserving existing carbon sinks in peatland and old growth forest, Read describes three main technologies, each of which yields economically valuable outputs in addition to carbon benefits:

A Co-production of timber and bio-energy (fermentation of cellulosic fractions of woody wastes plus power generation from ligneous residues or pyrolysis to bio-diesel with bio-char co-product) from new plantations on mostly non-arable land in temperate and tropical regions, leaving bio-diverse natural forest less disturbed by timber extraction

B Co-production of animal feed and bio-energy from grass (extraction of protein, fermentation of cellulosic fractions plus power generation from ligneous residues) on existing or potential arable land in temperate regions

C Co-production of sugar and biomass for bio-energy (fermentation of cane sugar syrup plus power generation from bagasse residues) on potential arable land in tropical regions

Fermentation and pyrolysis of woody biomass describes second generation bioenergy technologies. There is a mistaken belief that these technologies are not yet at commercialisation stage that must be challenged. Daniel Hayes of the University of Limerick has published and presented papers to Irish and EU policymakers that so far, have not been fully assimilated into targets and RTD considerations. While there are no commercial biorefineries in full-scale operation, there are several pilot plants operational and many more companies promoting plans for large-scale lignocellulosic fuel production. [12]

Daniel Hayes also researched the contribution that biorefineries can make in the Republic of Ireland to the mandated 10% biofuel quotient for 2020 by considering eight different technologies and the practical quantities of waste suitable for them. He concluded that between 3.5 and 5.7%

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[11] ibid

[12] Daniel John Hayes, ***State of Play in The Biorefining Industry***, University of Limerick, http://www.carbolea.ul.ie/downloads.html

of the 2008 demand for biofuels can be met from the utilisation of wastes and residues in near - term biorefining technologies and that up to 5% of the 2020 petrol and diesel demand can be met via processing a similar quantity of waste in an advanced enzymatic hydrolysis technology. The remaining biofuel requirements can be met by processing energy crops in either this or an advanced thermochemical facility. Between 1.8 and 13.7% of the agricultural area of Ireland would be required for the production of these crops, depending on the particular feedstock. [13]

The pyrolysis process offers not only bio-diesel, hydrogen and many other products that are currently made from fossil fuels, it can also produce an important product for climate change mitigation - biochar. Biochar is charcoal, typically produced from low temperature steam pryrolysis, that is not maximized for energy production or charcoal but to mimic natural forest fire temperatures and pressures. This produces char that benefits soil and soil microbes, and critically, can sequesters carbon for long periods in the soil as demonstrated by the highly fertile 'terra preta' anthropogenic soils of the Amazon basin, some over a thousand years old. The leading researcher in this emerging field is Johannes Lehmann of Cornell University US.

> '"The application of bio-char (charcoal or biomass-derived black carbon (C)) to soil is pro-posed as a novel approach to establish a significant, long-term, sink for atmospheric carbon dioxide in terrestrial ecosystems. Apart from positive effects in both reducing emissions and increasing the sequestration of greenhouse gases, the production of bio-char and its application to soil will deliver immediate benefits through improved soil fertility and increased crop production.[14]

Figure 9 illustrates the schematics for biomass or bio-char remaining after charring and decomposition in soil. The most important opportunities to incorporate a biochar soil management technique are in (i) shifting cultivation; (ii) charcoal production; (iii) recycling of agricultural wastes; (iv) energy production using renewable fuels (bio-fuels); and (v) cropping for bio-char using fast-growing trees. In all five systems, bio-char can be produced

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[13] Daniel John Hayes, ***The Role that Lignocellulosic Feedstocks and Various Biorefining Technologies Can Play in Meeting Ireland's Biofuel Targets**,* University of Limerick 2008

[14] Johannes Lehmann, John Gaunt and Marco Rondon, **Bio*-char Sequestration in Terrestrial Eco-systems – A Review**,* in Mitigation and Adaptation Strategies for Global Change (2006) 11: 403–427 C Springer 2006, DOI: 10.1007/s11027-005-9006-5, Department of Crop and Soil Sciences, College of Agriculture and Life Sciences, Cornell University

and applied to soil.

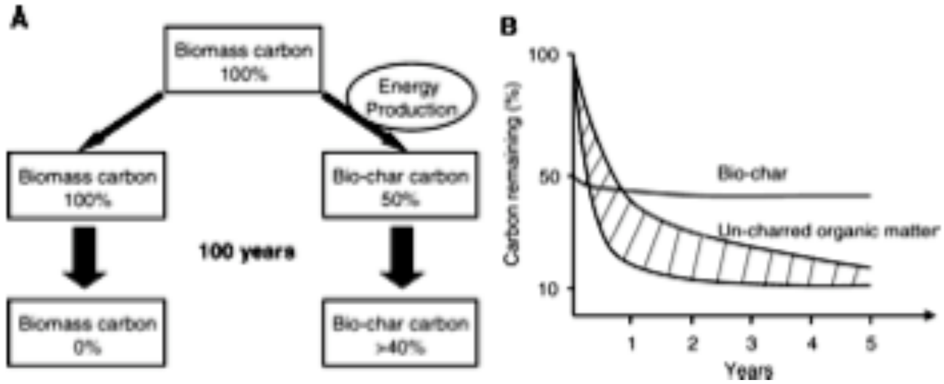

Figure 9[15]

The soil carbon pool is made up of different types of carbon with different turnover times. Labile carbon, as occurs in the microbial biomass, has a turnover time of about 1–5 years, humic carbon may turn over in decades, and inert organic matter such as charcoal may decay over thousands of years. Biochar or black carbon increases soil fertility through at least two mechanisms.

- The first improves cation exchange capacity, which in effect means that plants can take up nutrients more easily.
- In the second mechanism, nutrients bind to the carbon in such a way that rainfall washes less of them from the soil. Together with the first mechanism, this effectively increases the productivity of fertiliser. It incidentally reduces leaching of nitrogen into the water table, a serious problem of intensive agriculture.
- There may also be a third mechanism in which black carbon provides an environment for the proliferation of soil micro-organisms. By this mechanism, it is believed that terra preta may perpetuate and even regenerate itself.

In addition black carbon improves the water retention capability of a soil, neutralises acid soil, significantly reduces the release of CH4 and N2O (nitrous oxide, another almost equally important global warming gas) from natural decay processes in the soil.[16]

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[15] ibid

[16] Malcolm Fowles, ***Black carbon sequestration as an alternative to bioenergy***, Biomass and Bioenergy 31 (2007) 426–432, Department of Technology Management, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK, Available online 6 March 2007

Humic substances contain both carbon and nitrogen, so that soils acting as net sinks for carbon are also acting as sinks for nitrogen. Every tonne of carbon lost from soils adds 3.67 tonnes of carbon dioxide to the atmosphere. Soils losing carbon are also losing nitrogen, including nitrous oxide and other forms. Humus improves soil structure, moisture retention, and microbial activity. As soils approach nitrogen saturation, and plants are unable to take it up, the risk of nitrates and nitrates leaching into waterways increases.[17]

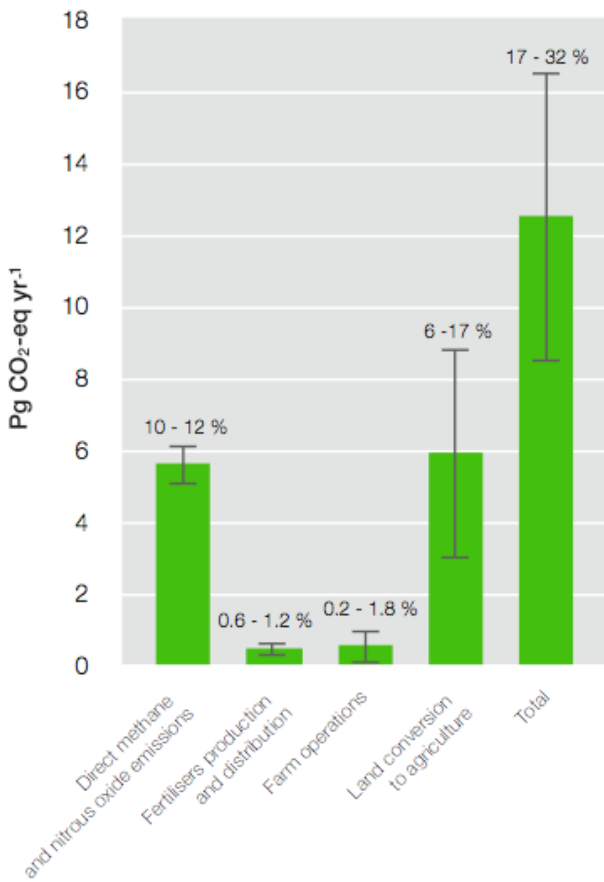

Figure 10: Global contribution of agriculture to greenhouse gas emissions[18]

Figure 10 shows the very significant contribution methane and nitrous oxides make to emissions. (percentages are relative to global greenhouse gas emissions). Biochar helps soil retain nutrients and fertilizers. Apart from the beneficial effects of drawing CO2 from the atmosphere, bio-char applications to soil are also able to reduce the emissions of other greenhouse gases.

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[17] Peter Winsley, ***Biochar and bioenergy production for climate change mitigation,*** Ministry of Agriculture and Forestry, P O Box 2526, Wellington

[18] Jessica Bellarby, Bente Foereid, Astley Hastings and Pete Smith, ***Campaigning for Sustainable Agriculture, Greenpeace,*** January 2008, School of Biological Sciences, University of Aberdeen,

Studies in Columbia found a virtually complete suppression of methane emissions at bio-char additions of 20 g kg−1 soil. Nitrous oxide emissions were reduced by up to 50% when bio-char was applied to soybean and by 80% in grass stands. These low emissions may be explained by better aeration (less frequent occurrence of anaerobic conditions) and possibly by greater stabilization of C. The lower nitrous oxide evolution may also be an effect of slower N cycling (possibly due to a higher C/N ratio).[19]Biochar has also been shown to be an excellent support material for *Rhizobium* inoculants and there is interest in New Zealand in experimenting with application of sufficient volumes of biochar to reduce nitrous oxide emissions and nitrate leaching from soils.[20] There may also be potential to reduce run off to watercourses by constructing deep trenches filled with biochar along field ditch boundaries.

But caution is required; the benefits of biochar addition to soils already high in carbon in cool temperate climates have to be tested and proven on a systematic basis but there is sufficient archeological evidence of 'black soils' in the Northern hemisphere to give grounds for optimism. There is already evidence that biochar applied to arable land significantly reduces nitrous oxide emissions. These results are very exciting as existing agricultural techniques to reduce nitrous oxides are limited to optimizing the reduction of artificial fertilizers relative to maximising tillage yields. But if proved biochar application has important immediate economic advantages for Irish targets and farmers as nitrous oxides can be counted under the EU ETS and Kyoto so their reduction in Irish agriculture can be made cost effective.

The revised ETS gives particular importance to carbon capture and storage (CCS). The European Council accepts that the target of halving 1990 global GHG emissions by 2050 will never be met unless the energy potential of coal can be exploited without ballooning emissions. It backed early action to make CCS the technology of choice for new power plants, including the setting up of up to 12 demonstration plants by 2015 and identified a need for investment in the order of tens of billions of euros. Since there is no possibility of significant funding from the EU budget, the only possible sources for this investment are public-private partnerships fed predominantly by national

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[19] Johannes Lehmann, John Gaunt and Marco Rondon, **Bio-*char Sequestration in Terrestrial Eco-systems – A Review*,** in Mitigation and Adaptation Strategies for Global Change (2006) 11: 403–427 C Springer 2006, DOI: 10.1007/s11027-005-9006-5, Department of Crop and Soil Sciences, College of Agriculture and Life Sciences, Cornell University

[20] Peter Winsley***, Biochar and bioenergy production for climate change mitigation,*** Ministry of Agriculture and Forestry, P O Box 2526, Wellington

budgets and private sector investment. For governments, the income stream provided by the auctioning of ETS allowances is an obvious source of revenue for this purpose. It sees a real commercial benefit to power generators prepared to move early into this market but reserves the threat of compulsory application of CCS technology if sufficient progress in not made on a voluntary basis.[21]

It is not clear if the definition of CCS can include the new cellulosic and pyrolysis technologies discussed above. These technologies produce char from biomass representing 25-50% by dry weight of the Co2 taken up the feedstock and if land-filled or in the case of biochar, incorporated in the soil could be classed as sequestration should certified research confirm their longevity in the soil. There are also claims that biochar combined with ammonia, can be used to scrub Co2 up to 60% of the Co2 and other GHGs such as NOxs from the exhaust gases of fossil energy plants for electricity generation, cement manufacturing or similar heavy industry. The resultant amalgam of biochar and ammonia bicarbonate acts as a fertilizer when added to the soil.[22]

These are important questions to resolve. Peter Read fears that any continuation of coal burning will make climate change prevention impossible. The attention to CCS technology with coal ignores the reality that it may not be technically feasible for all coal plants because of their location, nor that will it may not be commercially viable for at least 15 years – the danger period for tipping points. The high value for carbon emissions that would enable CCs would also make airborne Co2 a reality – using agricultural waste, forestry thinnings, and biomass and pyrolysis-biochar technology as described. As Peter Read asserts

> *"A 50 ppm drawdown via agricultural and forestry practices seems plausible. But if most of the CO_2 in coal is put into the air, no such "natural" drawdown of CO_2 to 350 ppm is feasible."*

Need for New Policies

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[21] Communication form the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions, 20 20 by 2020, ***Europe's climate Change Opportunity,*** 23/01/2008

[22] Danny Day, Robert J. Evans, James W. Lee, Don Reicosky, ***The Utilization of CO2 for the |Creation of a Valuable and Stable Carbon Co-product from Fossil Fuel Exhaust Scrubbing*** **www.eprida.com**

The preceding chapter set out the conflicting targets and perspectives of policy makers at national and EU level coupled with rapid the emergence of new data, new research conclusions, and new technologies concerning CO2 and other GHGs cycles and sinks and their implications for land use and land use changes.

The environmental NGO sector in Ireland, through its member groups, has campaigned vigorously for protection of natural forests, peat bogs and for environmentally friendly farming and forestry practices for many years - mainly for biodiversity, health and cultural reasons. We knew that these resources were relevant as carbon sinks but the overwhelming importance and power of land uses linked to new technologies to actively prevent catastrophic climate change is relatively new for us – as it is for the Irish government.

There is an urgency to this discussion as the pressure for secure energy alternatives to fossil fuels is also driving the agenda of policy makers. While the objectives of addressing climate change and of addressing energy security are often aligned, they are not so in every case as we have seen from the competing demands and proposals for peatlands.

Environmental NGOs need resources and capacity building to contribute to the decision-making process around land use and land-use change issues. While really excellent research, commissioned and funded by the EPA, is now publicly available to inform stakeholders, it does not appear to be impacting on policy or practice in any significant way. Environmental NGOs are willing to take on the role of addressing this gap; to link research institutions, renewable energy associations, technology developers, foresters, biomass growers, renewable energy investors/operators and educational and farming organisations in order to develop a shared understanding from which to derive strategies for the future.

This core network of NGOs, and others where agreement is possible, will then be in a position to develop evidenced-based policy options that can meet National targets under the new 2020 Directives in a cost efficient and revenue maximising way; and also to significantly contribute addressing global climate change by better informing our negotiators at the highest level. The Network will promote support these policies through engagement with the social partners, through the media and through workshops and training courses held by its Member Groups.

Finally, the Network's work will help identify and promote promising technologies in the environmental services sector that have the potential to deliver jobs in Ireland and exports abroad.

Specifically, policies could be developed which would enable the Irish land mass to become a carbon sink rather than a source while at the same time remaining productive, attractive and rich in native species. The tasks the Network could undertake might be:

1. The collation of information about the best management practices to increase the carbon content of forests, hedgerows, scrub and arable and pasture land. (The arable section would include biochar). An analysis of the economic, environmental and social consequences of adopting those practices.
2. The collation of information about the best management practices and technologies to reduce or eliminate the release of greenhouse gases from damaged peat bogs. An analysis of the economic, environmental and social consequences of adopting those practices.
3. The collation of information about the best management practices and technologies to reduce nitrous oxide emissions from fertilizer use. An analysis of the economic, environmental and social consequences of adopting those practices. Preparation of suitable policies.
4. Study GHG impact of slurry storage i.e. methane emissions 20 times than Co2 from equivalent field composting of animal waste. Technologies such as AD to capture methane for energy and organic fertilizer with or without addition to biochar.
5. The collation of information about the best ways of measuring soil carbon, establishing a base line for later comparison with various agricultural practices or additions of amendments such as compost, biochar and/or microbial inoculations.

Indicative Policies

6. Development of policy to substantially reduce nitrous oxides and other gases from tillage land used for food and biofuel crops and measures to reward farmers for these new practices.
7. Development of policy to incentivise the effective protection of intact bogland; the restoration cutover bogs to functioning bogland where possible, and if not possible, to

investigate ways and means to retain their organic carbon while producing genuine renewable energy and/or food crops.

8. Development of policy to on the treatment of standing crops, including trees, in the measurement of the carbon content of a tract of land. (When are the trees in a wood not a crop?)
9. The development of a system which would reward those increasing the carbon content of the land and penalize those whose land was losing carbon.
10. An analysis of the economic, environmental and social consequences of adopting this system, particularly in relation to Ireland's international emissions obligations.

<u>Methodology</u>

1. <u>Developing strategies</u>

   - Consolidate the network of member groups interested and already involved in inputting to national policy-making in the field of land-use such as agricultural, forestry and peatland practices.
   - Formation of the steering committee of member group NGOs for the network to guide the shaping of policy inputs. Hire policy coordinator. Invite relevant 3rd level research and advisory organisations to join the network.
   - Collect and collate member groups' historic contributions to national policy-making in the agricultural, forestry and peatland practices. Collect and collate key research reports and technological information. Analyse and summarise both.
   - Introduction of the project: it is proposed to hold a meeting to enable face-to-face contact for those able to attend, and for those unable to attend, the project will also be introduced online.
   - Dissemination of relevant departmental drafts and key research documents around agricultural, forestry and peatland practices.
   - Identification of gaps and/or conflicts in non technical information and the commissioning of research to address them (i.e. socio economic impacts of various strategies and policies).
   - Solicitation of feedback and discussion of the above
   - Collation and summary of responses
   - Circulation of a proposed synthesis

- Meetings with network groups
- Revisions to synthesis and production of final drafts of reports and policies.
- Circulation of final reports and policies to EENGOCF member groups and directors

2. Engagement with potential allies

The second step of the process, namely engagement with other relevant branches of national and local government, social partners, interested parties and civil society organisations as well as with the media, is a vital one. Having established the common ground, and moulded its presentation, the ENGO sector will approach and join potential allies in rural development, renewable energy, and farming sector as the brief context study showed considerable potential mutual benefit to be gained from a common approach. It is currently also a challenge for ENGOs to respond adequately to correcting inaccurate media reports, an important area on which to concentrate efforts when it comes to engaging with the public.

3. Drafting Policy Change

An important role of the transport network is to impact policy in government. That means identifying those aspects of current legislation and/or the remit or powers of responsible bodies that impede the delivery of sustainable land use policies relating to climate change. This is quite different to our usual responses to consultation calls; it requires a different set of skills and a legal / technical in approach. Some capacity building within member groups will be necessary so that they can contribute fully to the development of legislative change emerging from new policy strategies. Also the services of a professional parliamentary draftsperson may be required.

Network Members

The network would initially comprise members of the EENGOCF with a particular interest in climate change, forests, environmental friendly farming and forestry systems, peatlands, biodiversity, natural resources, and general sustainable development issues. CELT and Feasta have cooperated to write this proposal with the knowledge and support of the EENGOCF.

Other Potential Network Members

Eprida Ireland - a company promoting Eprida technology and vision in Ireland (see www.eprida.com)

Carbolea - University of Limerick research network (see http://www.carbolea.ul.ie/) managed by Daniel Hayes a PHD researcher.

Ir bea - (Irish Bioenergy Association

GEGA (Green Energy Growers Assoc)

Teagasc

A general outline of some of the ongoing costs that will be associated with this project is given below.

Item	**Cost (€) per annum**
Salary and PRSI of coordinator	40,000
Travel: Conferences, meetings, etc.	5,000
Management: Steering committee expenses	8,000
Research commissioning	25,000
Meeting facilitation	8,000
Overheads and materials: Light, heat, insurance, phone, computer, stationary, etc.	9,000
Rent	5,000
Total	100,000