Newsletter 2 (January 2013)

BIOCHAR climate saving soils

The project *Biochar: climate saving soils* is a project which is funded by the Interreg IVB North Sea Region Programme.

The partners from 7 countries share their biochar knowledge about standards, production, use and environmental impact.

January is the month to look ahead and come up with new ideas and new visions about the tasks and opportunities that lay ahead. We have asked a number of prominent members of the European Biochar community to share their thoughts and ideas on the future of Biochar research and on the need to support and organize the European research community. They present their ideas in this newsletter.

Let 2013 be a good Biochar year...

F. Debets
project leader
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About the newsletter

This newsletter is a product of the Interreg IVB project Biochar: climate saving soils.

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Upcoming Events

February 14th and 15th 2013
2nd Nordic Biochar Seminar (Helsinki)

March 12th and 13th 2013
Biochar: climate saving soils project meeting (London)

March 14th and 15th 2013
Biochar COST action meeting (London)

Written by

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Hans-Peter Schmidt (*1972) is director of the Delinat-Institut for Ecology and Climate Framing in Valais (Switzerland). With his institute he develops concepts for the remediation of agronomic ecosystems and carbon sequestration through agronomic methods. He works on the integration of renewable energy production into landscape design and on strategies to foster the biodiversity in cityscapes. His Delinat-Institut is one of the leading research centers for the post production treatment and use of biochar. He is coordinating the European working group on biochar characterisation and is the main author of the European Biochar Certificate. The Delinat-Institut is consultant to more than 100 European vineyards that follow its ecological guidelines and certification scheme.
Hans-Peter Schmidt co-chairs the Biochar Science Network Switzerland. He is editor of the Ithaka Journal on Climate Farming and is lecturer in Urban Design at the Liechtenstein University.

In the article ***Biochar - a key technology for the planet***, previously published in the Ithaka magazine, he shares his ideas about the tasks that we face and the questions that need to be answered in Biochar research.

The Interreg IVB North Sea Region Programme

European Union
European Regional Development Fund

Partners:

Biochar – a key technology for the planet

by Hans Peter Schmidt

The current imbalance in the world's carbon and nitrogen cycle is not just the main cause of climate change, but also a direct threat to ecosystems through eutrophication, desertification and a decline in biodiversity. Re-balancing through regularly recycling organic material with its carbon, nitrogen and phosphor content is needed. Biochar has the potential to play a key role, as it not only converts the carbon found in a wide range of biomasses into a stable form, but also binds volatile nutrients from biomass residues, thereby recycling them for agricultural use. Though still "early days" for biochar, the prospects for its use are good, whether in crop or livestock farming or in industry.

Carbon as a raw material and as a limiting factor for sustainable economic development

Both industry and the ecosystem have a huge appetite for carbon. Yet while industry gains its carbon through plundering the earth's fossil resources built up over millions of years, only to burn it or convert it into plastic, all living things rely on the natural carbon cycle to provide them with valuable energy and cell-building material.

Put simply, the carbon cycle involves plants, algae and certain specialised types of bacteria adsorbing CO_2 from the atmosphere and using the sun's energy to synthesise it into the carbon molecules used in cell growth. Once this has been done, the complex organic carbon molecules become food for microorganisms and animals. Their digestion processes in turn split up the complex molecules, releasing the solar energy stored in them for their own use. This process ends with the carbon molecules being broken down into their smallest stable units and returned to the atmosphere in the form of CO_2 or CH_4, thereby restarting the cycle.

The natural role of carbon is thus to supply energy and nutrients. It is also a battery for storing solar energy, a framework for all natural substances, a mobile storage device for nutrients and a hard drive for genetic information. Carbon is the key element in all life processes!

In nature the carbon cycle described above is basically intact. Just think: each carbon molecule in our bodies has at some stage in the Earth's history been CO_2 in the atmosphere, sugar or an amino-acid in a plant, protein in meat and humus in the soil.

Restoring the carbon cycle

To achieve truly sustainable economic development in tune with nature, industry needs to become an integral part of the carbon cycle described above. The target must be for industry to only use carbon taken from the natural carbon cycle and to return it there after use. If on the other hand we go on burning fossil coal, oil and gas, all of it extracted millions of years ago from the biosphere; the natural carbon cycle will stay imbalanced, causing climate change and the destruction of natural habitats.

The key to restoring the carbon cycle is using and recycling biomass. Biomass must be recognised as the most important raw material for our civilisation and a new economy.

Biomass: the one and only renewable raw material

Subject to permanent natural recycling, biomass is the one and only truly renewable raw material. Throughout the world, biomass assimilates some 120 gigatonnes of carbon from the atmosphere each year. The same amount is returned to the atmosphere through respiration, decay and natural fire. On top of this, some 9 gigatonnes of carbon are entered into the cycle from fossil sources through human activity. To re-balance the cycle, these 9 gigatonnes need to be taken from renewable sources.

If just 7.5% of the carbon stored each year in biomass were to be taken away from natural respiration and decay and given over to industrial use in the form of stable carbon, the natural carbon cycle could be re-balanced and the 9 gigatonnes of fossil carbon replaced. The amount of carbon gained from biomass each year would have to be the absolute maximum used by industry.

Replacing fossil carbon through biomass recycling

Mankind's hope for the future is dependent on fossil carbon being replaced by biomass carbon. The use of wood as a building material is one of the oldest examples of removing the carbon found in biomass from the carbon cycle for a few hundred years and then returning it to the cycle through burning it or letting it rot. Up to now, building wood and compost were the only ways of stabilising the carbon found in biomass for interim use, removing it from the carbon cycle for a certain period of time. The development of new technologies and their combination are now making this possible for all forms of biomass.

Biomass can be fermented to produce methane gas, whereby the solid residue, rich in lignin, can be used to produce plastic for use in such things as computers or car components (see for example www.tecnaro.de). Liquid residue can be used as a fertiliser. Instead of just letting biomass rot, it should be used as a source of energy and as a raw material. Fuel produced through biomass fermentation has no adverse effect on the climate, and the organic building materials act as a medium-term carbon sink until they are composted at the end of their product life.

A further exceedingly promising technology for the intelligent use of the natural carbon cycle is pyrolysis. Through heating any form of biomass in the near absence of oxygen, high caloric gas and recalcitrant biochar are produced. Using pyrolysis, some 65% of the carbon originally contained in the biomass can be concentrated and stabilised in the form of biochar. Dependent on the type of biomass used, biochar is made up of 50 – 90% carbon. Hardly degradable by microbial action, it can be removed from the carbon cycle for several centuries and be used as a soil additive or a building material.

Biochar in agriculture

Used for thousands of years for producing organic soil substrates, feed supplements and for the conservation of organic fertilisers, biochar (in its charcoal form) disappeared from the scene with the onset of industrial agriculture. The old techniques were forgotten. It is only in the last ten years that the possibilities offered by biochar have been rediscovered. A whole new research sector has developed over the last few years, dedicated to the production, characterisation and application of biochar. At the same time, a new industrial sector is emerging, focused on transforming biochar into new high-value industrial products. Though still "early days", the sector has already come up with an impressive range of products, enabling the carbon found in biomass to be used more efficiently.

The cascading use of biochar

As in the natural carbon cycle, biochar in agriculture is mainly used as a carrier and groundmass for making more efficient use of natural nutrient cycles. This can be impressively seen in the cascading use of biochar in livestock farming and fertiliser management, in both of which particular use is made of biochar's high adsorption capacity.

1. Mixing biochar at 1% by volume to silage prevents the formation of mycotoxins, binds pesticides and suppresses the formation of butyric acid, meaning that fermentation can take place in a perfectly clean manner, thereby improving feed quality.

2. Via the silage, the biochar finds its way into animal feed, improving animal digestion, increasing roughage and reducing GHG production.

3. Mixing biochar at 10% by volume into litter is a way of binding liquid nutrients and reducing ammonia emissions. It helps prevent putrefaction, thus improving hygiene in the stables. Just two days after applying biochar, a noticeable change in how the stables smell can be registered.

4. Regularly mixed into slurry at 1 – 5% by volume, biochar binds volatile nutrients and improves the microbial environment. This leads to less nutrients being lost, thereby improving the slurry's fertilising effect and reducing phyto-toxicity and GHG emissions.

5. After filtering out the liquids, the slurry's solids are composted together with the stable litter, ultimately yielding valuable black earth due to the high biochar content.

6. Through working the biochar-rich black earth and the stabilised liquid slurry into the soil, the soil's propensity to retain water is heightened and infiltration and aeration improved, resulting in increased microbial activity and thus higher yields. Soil acidification is prevented, and fertilisers and pesticides leach into groundwater at a much lower rate.

7. Enriched with organic nutrients, the biochar thus finds its way into farmland soil, where it is hardly degraded by microbes and thus constitutes a valuable carbon sink. This is even more effective when biochar acts as a groundmass for organic molecules, thereby promoting the creation of humus.

For more information on the use of biochar in livestock farming, see the Ithaka articles: Treating liquid manure with biochar and Biochar in Poultry Farming.

Treating slurry with biochar on the Holderstock farm. (Photo: Wilhelmine and Bruno Koller)

Marketable biochar-based agricultural products

Beside the cascading use of biochar described above, there are further interesting uses for biochar in agriculture that have already been taken up by the market:

- as a compost supplement for greater nutrient efficiency and lower GHG emissions
- as a binder for use in dry toilets (local production of "terra preta")
- as a carbon fertiliser in association with mineral or organic plant nutrients to reduce fertiliser leaching and to improve nutrient efficiency
- as a long-term fertiliser in association with such organic residues as wool, bristles, feathers, helping to activate nutrients in hitherto unused biomasses
- as carbon feed, improving digestion
- in fish breeding for improving water quality.

What has now turned out to be counterproductive (contrary to previous recommendations) is the application of large quantities of untreated and non-loaded biochar to the soil. The main use of biochar is as a carrier and binder for organic nutrients. As such it needs to be specifically applied. Its successful use in agriculture is dependent on it being strategically integrated into organic material cycles. On its own, biochar is nothing but a skeleton without flesh.

The use of biochar in industry

There are also promising uses of biochar in areas other than agriculture. For instance, biochar can be used for insulating homes, as a reducing agent in metallurgy, as a storage medium in batteries, as a raw material for carbon fibers and plastics, or as a water or air filter. The first industrial applications are already in use, with one of the main fields being home insulation open to diffusion.

Technology for producing biochar

The greatest bottleneck preventing the large-scale use of the different forms of biochar is the production technology. The optimistic forecasts made two years ago that within two years there would be over 50 plants operating in Germany and Switzerland have unfortunately not materialised. Due to the heterogeneity of the biomasses used and the sustained very high temperatures needed in the reactors, the various manufacturers are still fighting teething problems. Despite these setbacks the technology has nevertheless made great progress over the last two years. The company Pyreg is now operating 5 plants in Switzerland, Germany and Austria, each with an annual biochar output of 300 tonnes. Carbon Terra is using its own technology to produce 1000 tonnes of biochar a year. Looking just at Europe, the two German companies, Rewenergy and BioMaCon, and the Danish BlackCarbon have each developed their own pyrolysis plants and will soon be bringing them to market. There is reason to hope that 2013 will become the year in which pyrolysis technology achieves its breakthrough.

Pyreg was the first company to develop certified biochar production plants. These are the only plants currently operating at independent producers.

Quality control – biochar certification

On account of the wide range of biochar applications and the different forms of production technology, quality control is of crucial importance, whether with regard to product quality or the environmental impact of its production. This is the reason why the European Biochar Foundation has developed the European Biochar Certificate (EBC). Biochar producers throughout Europe can now have their products certified by an independent QA agency. In Switzerland, the EBC is used by the Federal Agricultural Agency as the basis for the provisional approval of biochar. The Agency is also expected to decide on full approval for the use of biochar as a soil additive and as a recycling fertilizer in the beginning of 2013. Biochar already has official approval for use as a feed supplement, both in Switzerland and in Europe.

Manufacturers of industrial pyrolysis equipment

Pyreg GmbH: Pyrolysis plants with an annual biochar production capacity of 300 tonnes (www.pyreg.de)
Carbon Terra GmbH: Pyrolysis plants with an annual biochar production capacity of 1.000 tonnes (www.carbon-terra.de)
Regenis GmbH: Pyrolysis plants with an annual biochar production capacity of 500 tonnes (www.rewenergy.de)
Biomacon GmbH: Various pyrolysis plants, with production capacities ranging from 140 to 2.000 tonnes (www.biomacon.com)
BlackCarbon: Pyrolysis plants with combined electricity production and annual biochar production capacity of 300 tonnes (www.blackcarbon.dk)

Companies selling biochar

Germany: EM-Chiemgau, CarbonTerra, BioMaCon,
Switzerland: Swiss Biochar (EBC-certified)
Austria: Sonnenerde (EBC-certified)

Achim Loewen is Professor for Energy Technology and Environmental Management at HAWK University of Applied Science and Arts in Göttingen. He is leading a research team that focuses on bioenergy and waste treatment. Projects include technology development and optimization as well as technology assessments and eco balances. He is member of the Executive Board of the project *Biochar: climate saving soils.*

In **A Short Perspective on Current and Future Biochar Research** he distinguishes six major areas that need to be covered by research.

A Short Perspective on Current and Future Biochar Research

By Achim Loewen

The greenhouse effect and sufficient global food supply are two of the most urgent problems of mankind. Biochar produced by pyrolysis processes can fix carbon long-term and might increase yields when applied to agricultural soils. Other uses are possible in industry or for energy generation. For these reasons, currently several suppliers produce biochar which is already being applied, mainly in agriculture. However, there are still a lot of questions to be answered with respect to improved biochar production technologies, the combination with other approaches such as anaerobic digestion or the behavior of biochar in soils. Technology assessments and eco-balances have to take the whole process chain into consideration in order to evaluate positive and negative impacts and to provide information that helps to choose the best available options for specific applications.

Pyrolysis converts biomass under absence of oxygen into three different fractions – solids (biochar), liquids and a gaseous phase. The amount and properties of each fraction depend on production technology, operational parameters and feedstock. Various utilization paths are possible for the products; they can for instance substitute other (fossil) fuels in energy generation units, the solid product can be used as animal feed additive or serve as soil enhancer etc. Benefits can increase if biochar is used in cascades as described in the previous article by Hans-Peter Schmidt. The following list gives a brief overview of research topics currently being performed or discussed in order to better understand and improve biochar production processes and biochar application.

1. Feedstock

As there is only a limited amount of agricultural land and of biomass available for food and feed production, for energy generation and for other uses, more efforts have to be taken to use waste material that ensures sufficient biochar properties and that does not prevent the application of the produced biochar in agriculture.

2. Production technologies

Several companies are able to provide pyrolysis units and produce biochar, but production capacities are still limited. Processes could be improved with respect to feedstock handling, susceptance to failure, energy supply and use of by-products for energy generation (also for external consumers), consistent biochar quality, overall efficiency and economics. As process parameters have a large influence on amount and properties of the different fractions produced, still a lot of research can be performed to evaluate optimal conditions for the production of long term stable biochar with properties custom tailored to its respective application and for an optimal use of the by-products.

3. Combination of technologies

In order to make the most of available biomass and to achieve optimal results with respect to ecological and energy balances as well as economics, different technologies could be combined. For instance, specific components can be extracted from plants to produce pharmaceuticals, plastics or other materials, digestible components can be used for biogas production, remaining material with high moisture content can be used for hydro-thermal carbonization and remaining ligno-cellulosic material for biochar production. Biochar added to substrate in digestion processes might have positive effects on gas yield and at the same time could improve fermentation residue properties with respect to agricultural application. Gaseous and liquid by-products can directly be used for energy generation or upgraded for use in chemical industry or as fuels.

4. Effects of biochar in soil

In the past, pot trials as well as field trials have shown different results of biochar application to soil. Depending on soil type, water supply, fertilization etc. positive and negative effects on plant yield have been achieved. Long term effects can differ from short term effects. Besides carbon sequestration, also eutrophication and acidification potentials are important in the agricultural sector. Issues to be investigated in more detail include dependencies between carbon stability, N_2O- and CH_4-emissions or nutrient balances and regional parameters such as soil type, rainfall etc. There is still a lot of research needed to better understand the effects of biochar in different types of soil and its impacts on plant growth, fertilizer and irrigation demand. Latest research has shown that biochar should be activated before applied to fields, e.g. by mixing with compost, manure or fermentation residues. It is also important to evaluate more in detail if and how biochar serves as a contaminant source or sink, depending on feedstock properties and operational parameters.

5. Use of biochar for other applications

Biochar can also be used for energy generation or for different applications in industry (e.g. as filter material). Therefore, biochar properties can be influenced, e.g. by activation with steam. In the past mainly agricultural application has been discussed, other uses are being investigated more in detail just recently.

6. Eco balances and life cycle analyses

Within the project "*Biochar – climate saving soils*" life cycle analyses are being performed

including feedstock supply, different pyrolysis processes, and application in agriculture and for energy generation. In order to make optimal use of available biomass, to improve biochar processes and applications and to achieve optimal results with respect to environmental and economic impacts, different process chains have to be evaluated and compared. Based on these results, best available concepts and technologies can be promoted.
After biochar application has been rediscovered, significant research and development has just been performed within the last few years. Therefore, still a lot more know-how generation and improvement can be expected in the areas described above. Only if all effects are being investigated objectively and results are being used for implementing the right strategies, potential benefits of biochar can be maximized and potential risks minimized. This is especially important as available biomass is limited and, thus, should be used in the most efficient ways.

Simon Shackley is Lecturer in Carbon Policy, University of Edinburgh. He is a biologist turned social scientist working in the broad field of 'integrated assessment' of climate change and sustainable energy. His main areas of research are socio-economic, agronomic and regulatory evaluation of biochar-systems and public acceptability and engagement with low-carbon technologies, including CO2 capture and storage.
He is a member of the Executive Board of the project *Biochar: climate saving soils.*

In his article **A Perspective on the Role of the European Society for Biochar Science** he reflects on the role of science in the biochar story.

A Perspective on the Role of the European Society for Biochar Science

By Simon Shackley

Biochar is one of the most intriguing ideas to have emerged in the maelstrom of thinking and dialogue surrounding climate change and carbon reduction in the past two decades. It also happens to be one of the most complex – a heady and often confusing brew of soil science, bio-resources, agronomy, carbon markets, bio-energy and regulations! In this short essay, I present a perspective on the role of a European Society for Biochar Science (what may also come to be called the European Biochar Foundation).

I want to start by asking a quite fundamental question – namely, what is the role of science in the biochar story? The conventional answer to this question is that science has some privileged position from which to view reality – a superior vantage point compared to other ways of knowing the world. Sociologist Robert Merton articulated a view of science in the 1970's which aimed to capture the distinctive character of science as a community in terms of its 'disinterestedness, organised scepticism, communalism and universalism'. Yet, other sociologist and historians such as (most famously) Thomas Kuhn, pointed out that science *in practice* doesn't operate according to these lofty principles. Indeed, in many cases, scientists act surprisingly similarly to any other professional community – as anyone who works in research knows, micro-politics abound, competition is rife, there are biases, prejudices, proclivities, preferences, values and beliefs, and to neatly cleave these from scientific outputs and findings is not generally straight forwards. To imagine that science as an institution and individual scientists do not have their own agenda, or rather agendas, is somewhat naïve in a world where scientists have to convince funders to provide them with research grants, where they struggle for attention by funders, industry, government and the media, and which frequently necessitates the heightening of expectations and sometimes hype.

Scientists often throw their hands up in horror at such accounts of their profession and they do indeed have a good point that many social scientists have gone too far in portraying scientific communities as no different at all from non-scientific ones. Science does have some special (if not unique) self-corrective mechanisms and does encourage collective and individual (self) critique to an extent that is not readily found to the same extent in other parts of professional and commercial life. There is an ethic of robust argumentation and critical analysis of our own

and of each other's work that is just not as accepted or acceptable in business, government and consultancy – we should treasure and protect that.
To make more sense of where biochar 'fits' into this nexus of science, technology, business, climate and carbon policy and regulation, a very useful distinction is that made by Jerome Ravetz and Silvio Funtowicz between 'normal' and 'post-normal' science. Their simple schematic (Figure 1) distinguishes between normal and applied science, where uncertainties are controlled through experimental set-ups and the decision stakes are confined to highly specialised and small scholarly communities.

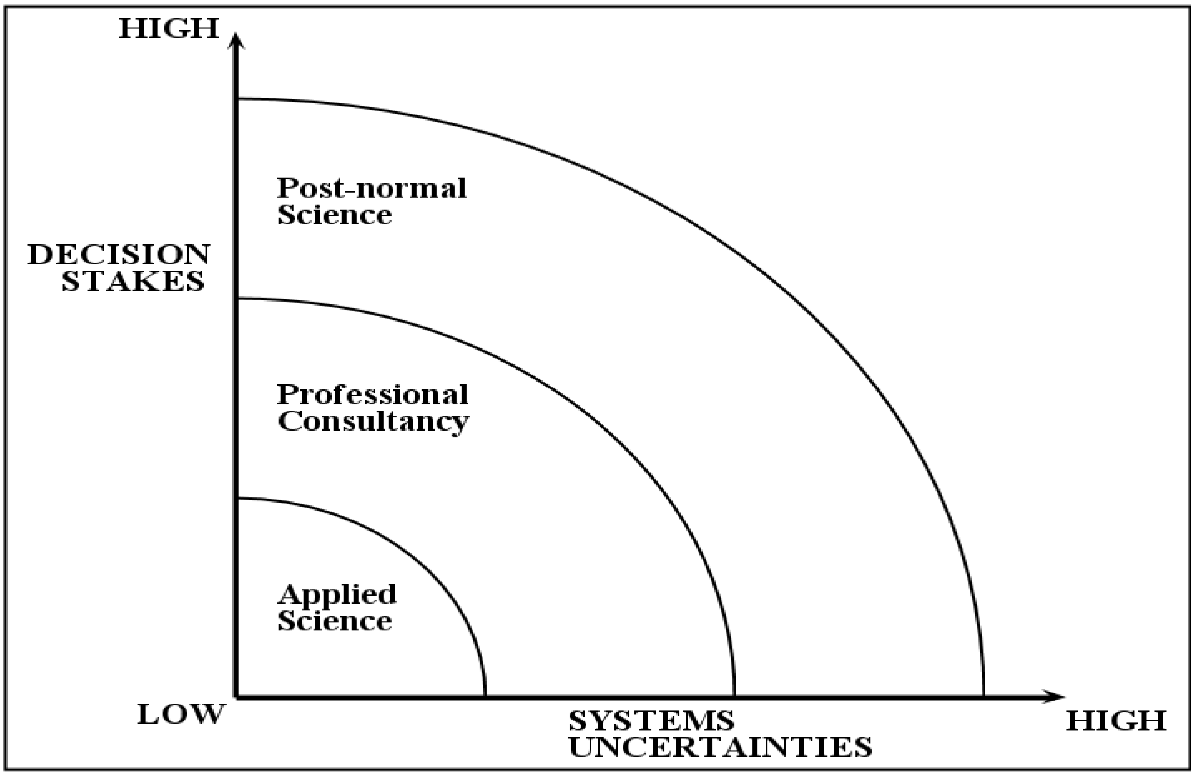

Figure 1: Post-Normal Science (source: Funtowicz & Ravetz)

As research, development and demonstration (RD&D) moves out of the laboratory into the 'field', pilot stage and closer to real-world application, the uncertainties tend to escalate and the decision-stakes rapidly rise. If the design of a large-scale technology demo turns out to seriously wrong, for example, then the 'error-costs' can be frightening high. When we arrive at an issue like climate change and the accompanying need for profound reductions in carbon emissions (and ultimately in atmospheric CO_2 concentrations), we are truly into the world of post-normal science. The stakes couldn't be much higher – whether for the planet, for the economy, for ecosystems, for big business, for the sustainability of the on-going juggernaut of late capitalist globalisation, for politicians and local communities alike! Prime Ministers and senior ministers have lost their jobs over climate change and carbon policy and both business entrepreneurs and environmentalists liken the challenge to an impending 'war' – as in Virgin's 'Carbon War Room'. Nor could uncertainties be much larger – the whole premise rests upon highly complex computer model simulations and data assimilations which are ultimately unverifiable. The whole caboodle rests upon 'conditional' knowledge, a foundation that is always going to seem flaky to some, not simply or only because of a commercial or ideological interest in not accepting the anthropogenic climate change premise.

Biochar straddles this spectrum of possibilities shown in Figure 1. For some, it is normal or applied science – firmly in the domain of controlled laboratory experiments, with tentative steps into the field situation. For others, biochar is already established as the ultimate 'win-win-win' game-changer (sustainable carbon abatement, economic development, energy production). We saw in the build-up to COP-15 in Copenhagen (December 2009) a big push by the International Biochar Initiative (IBI) to get biochar included in the negotiations and as a legitimate option under the 'flexibility mechanisms' such as the Clean Development Mechanism (CDM). Statements were circulating in the public domain to the effect that biochar had already been endorsed as a credible and important option by the Intergovernmental Panel on Climate Change (IPCC). Digging around, I found that the IPCC had not endorsed biochar; rather one IPCC panel meeting had had a discussion about biochar but had not come to any formal evaluation or position on the topic.

Probably in a direct response to this rather strong 'push' by the IBI and other biochar advocates, Biofuel Watch, an NGO, launched a remarkably effective campaign against the idea of biochar, raising many questions about its sustainability. 150 or so NGOs from all around the world signed a petition coordinated by BioFuel Watch to oppose the inclusion of biochar in the climate negotiations and in the CDM. This wave of criticism culminated in the UK with a withering critique of the biochar concept in an article in 2009 in *The Guardian* newspaper by the doyen of left-leaning environmentalists, George Monbiot, entitled: "Woodchips with everything. It's the Atkins plan of the low-carbon world: The latest miracle mass fuel cure, biochar, does not stand up; yet many who should know better have been suckered into it"

A few years on, both sides in this post-normal science debate have gone through a learning process and the expectations of biochar promoters have been lowered and made more realistic. For example, no longer do biochar advocates talk about using energy crops or plantation biomass for producing biochar. The feedstocks now being talked about are waste wood and other biodegradable organic waste materials, as well as agri-residues such as rice husks and arable straws that would otherwise be wasted or used inefficiently. The benefits to the small farmer and to the community of biochar have also come more to the foreground. The agronomic benefits of biochar in producing more sustainable food from more sustainable and climate-friendly soils has now become centre stage, more so that the much vaunted recalcitrant carbon storage benefits of biochar of the earlier 2006-2010 era. This has also led to a newly invigorated role for the 'normal' and 'applied' scientists, since there are a plethora of fascinating and important research questions which need to be addressed to made biochar work in agronomic and agricultural settings (e.g. the concept of specified or bespoke biochar, where biochar is designed to have particular properties, hence benefits in very specific farm contexts), taking also into account environmental impacts.

Alongside the applied and consultancy research, the post-normal science entrepreneurs are busy engaging in a two-way transfer of knowledge and experience from users and researchers / scientists. This approach is not confined to Europe and other industrialised regions, but is also very much found in emerging and developing economies, where agricultural R&D on biochar is becoming a sort of market-place between different kinds of experts - scientists and agronomists, technologists, local firms and entrepreneurs and the farmers, resource owners and managers themselves.

Meanwhile, we shouldn't forget the increasingly powerful role of business and industrial RD&D attached to big corporations with marketing departments! If biochar does indeed make agronomic sense (and there is increasingly good evidence that it will in particular agricultural settings) then the commercial sector will be quick to grasp the opportunities. Already, we see Non-Disclosure Agreements proliferating between R&D groups and companies and IP positions being articulated. This is not so encouraging if we want to cultivate a dynamic and innovative market-place where ideas and concepts can be shared and exchanged – without a big price-tag attached.

So where does this leave the European Society for Biochar Science? Our strength lies in our independence from vested interests, either in business (large or small), NGOs and lobby groups or from scientific institutions themselves. The Cochrane collaboration in the pharmaceuticals sector is a good analogue and potential model for us to adopt. As in Cochrane, there can be regional and national level organisation, but along common principles of operation and strict rules about private-sector funding. And there can be scientific reviews on particular topics, drawing upon a pool of experts who would work in a self-organising process of writing and then internal / external review.

Ellen Graber works at the Agricultural Research Organization (ARO) in Bet Dagan in Israel. In 2009 she initiated an interdisciplinary research effort into biochar in Israel, and established a network of researchers involved in biochar research in Israel. Her major current research activities are directed towards biochar use in agriculture, and involve understanding the mechanisms responsible for plant growth promotion and improved plant resistance to disease under biochar addition.

Frank Verheijen is a research scientist (fellow) at CESAM - Centre for Environmental and Marine Studies - of the University of Aveiro, Portugal. His fellowship was awarded by the national Science and Technology Foundation (FCT) and focuses on soil hydrology and plant physiology after biochar application to soils.
His primary research interest is the interaction between vegetation and its abiotic environment, particularly vegetation - soil organic matter (SOM) - soil hydrology dynamics.

In their article they share some thoughts about an organization that can assess the biochar research and the biochar functions as revealed in publications.

How to fill the gap for unbiased assessment and evaluation of biochar-environment interactions

By Ellen Graber and Frank Verheijen

In a long series of conversations and discussions amongst us (Hans-Peter Schmidt, Claudia Kammann, Simon Shackley, Frank Verheijen, and Ellen Graber) about possibly resurrecting, or reforming, the defunct European Biochar Foundation, we focused on two major organizational structures: (i) an organization primarily involved in promoting and advocating sustainable biochar use, and (ii) an organization involved principally in assessing and evaluating biochar function as revealed in scientific literature, without bias either towards or against the pyrolysis/biochar platform. [Experiential learning is purposely excluded here, because while the scientific method is sometimes poorly applied, in the main, it is still superior to observations or deductions made without regard to scientific principles of reproducibility and repeatability, avoidance of artifacts (unintended effects), and inherent bias].

In our opinion, the world does not need a new organization that promotes the sustainable use of biochar. This role is filled very well by the IBI, and any differences between the European world view and the world view as represented by the IBI can be easily bridged by a European IBI branch.

What is missing today is an organization that fills the large (and growing) gap for unbiased assessment and evaluation of biochar-environment interactions, and one that will also be perceived to be unbiased by the outside world (policy makers, anti-biochar lobby, etc.). Such an organization would have as its goals: **unbiased assessments, scientific rigor, neutrality and transparency**. This type of organization cannot be readily combined with a promotional / advocacy role because, by definition, advocacy takes a prior stand and cannot be neutral or unbiased. When an organization is dedicated to the 'sustainable use' of biochar, there is an implicit expectation that biochar 'is good' and will be used widely in the future. The purpose then becomes to make sure it happens in the most sustainable way. This is not the role of the needed organization, nor is it the role that should be filled by the scientist.

Ideally, scientists strive to describe the natural world and explain how it works. Of course, this is only an ideal and is rarely achieved, but it should be our motivation. Many people are involved in biochar research because they have an underlying motivation to do something about climate change, and see the pyrolysis/biochar platform as one way to do this. We think that to be the most honest scientist possible, it is essential to do away with such motivations. When science moves into the realm of promotion of an idea, a technology, or a platform, it necessarily moves out of the purview of science and into the realms of engineering, business, consulting, marketing, sales, regulation, and so on. These are not bad things, in and of themselves. But they don't have a place in an organization dedicated to evaluation and assessment of the pyrolysis/biochar platform in all its ramifications and forms.

Therefore, we propose the new organization take up the currently vacant role of 'assessing without bias'; this should be its clearly stated aim, and this aim should be reflected throughout the organization, including its selection of deliverables, its processes, procedures, funding policy, and more. One type of deliverable may be the contextualization of specific emerging developments in the literature, in an attempt to prevent mis(over)representation of different findings.