

# COST

Domain Committee "Food and Agriculture"

## COST Action TD1107

Start Date 26.03.2012

*Biochar as option for sustainable resource  
management*

## MONITORING PROGRESS REPORT

**Reporting Period:** from 16.05.2013 to 21.03.2014

This Report is presented to the relevant Domain Committee.  
It contains three parts:

- I. Management Report** prepared by the COST Office/Grant Holder
- II. Scientific Report** prepared by the Chair of the Management Committee of the Action
- III. Previous versions of the Scientific Report;** i.e., part II of past reporting periods

The report is a "cumulative" report, i.e. it is updated annually and covers the entire period of the Action.

Confidentiality: the documents will be made available to the public via the COST Action web page except for chapter II.D. *Self evaluation*.

Based on the monitoring results, the COST Office will decide on the following year's budget allocation.

### **Executive summary (max.250 words):**

This COST Action connects scattered European Biochar research and technology to enable quick implementation of sustainable use of natural resources, to maintain or improve soil quality while efficiently sequestering carbon in the long-term. Innovative Biochar strategies can help the EU mitigating greenhouse gas emissions, while industries and farmers benefit from new markets, opportunities and use of improved soils, e.g. for biofuel production without endangering food supply. However, a risk assessment is necessary to protect food web and human health. Current Biochar research is often fragmented unnecessarily repeated, and new scientific evidence is not connected or implemented, due to the lack of interaction and knowledge exchange. Therefore, this Action aims at coordinating European Biochar research and technology, bringing together researchers, stakeholders and potential users from EU and candidate countries. This will be accomplished by annual Biochar Workshops, Short-Term Scientific Missions, Training Schools, and an internet platform to monitor and streamline Biochar R&D. Four working groups will focus on (i) Biochar production and characterization, (ii) land use implementation, (iii) economic analysis including life cycle assessment, and (iv) environmental impact.



### **I.A. COST Action Fact Sheet**

- **COST Action TD1107** – *Biochar as option of sustainable resource management*
- **Domain** *Food and Agriculture*

- **Action details:**

**CSO Approval:** 01/12/2011

**End date:** 25/03/2016

**Entry into force:** 26/03/2012

**Extension:** -

- **Objectives**

#### **1. Biochar production and characteristics**

- Systematize essential knowledge to optimize Biochar production (“designer Biochars”) with regard to its properties and effects, considering the large range of suitable biomass, energy and mass balances, cost efficiency and Biochar quality.
- Develop an EU road map to produce 140 million tons of Biochar annually by processing 500 million tons of organic residues, offsetting 10% of the European fossil fuel use.
- Systematize and integrate knowledge to identify the most beneficial Biochar use strategies in agriculture across various European regions and climates, identifying the most promising applications.

#### **2. Environmental impact (benefits vs. risks)**

- Identify a comprehensive strategy for the most efficient use of Biochar to maintain and improve C sequestration and soil fertility.
- Evaluate potential threats accompanying the use of Biochar in soils. According to the European Community Regulation on chemicals and their safe use (REACH), safety information on Biochar will deal with toxic compounds (i.e. PAHs, heavy metals) and their effects on plant, animal and human health (e.g. genotoxicity) and effects on GHG emissions (i.e. N<sub>2</sub>O, CH<sub>4</sub>, CO<sub>2</sub>).
- Evaluate potential benefits in detoxification strategies where Biochar is used to adsorb organic pollutants or heavy metals in soils or animal feed,
- Systematize current risks vs. benefits understanding to put forward “best practice” recommendations

#### **3. Knowledge expansion and handling**

- Provide target group-specific recommendations on how to use the knowledge provided about Biochar efficiently,
- Identify common (EU) R&D targets with respect to Biochar aspects,
- Promote public information transfer to enable use of state-of-the art knowledge.

• **Parties:** *list of countries and date of acceptance*

Austria (09/01/2012)	Greece (14/02/2012)	Poland (09/02/2012)
Belgium (29/02/2012)	Hungary (10/04/2012)	Portugal (26/03/2012)
Bulgaria ( <i>in progress</i> )	Iceland (21/02/2012)	Romania (28/03/2012)
Croatia (-)	Ireland (15/03/2012)	Serbia (-)
Cyprus (-)	Israel (27/12/2011)	Slovakia (22/04/2012)
Czech Rep. (12/09/2012)	Italy (21/03/2012)	Slovenia (31/01/2013)
Denmark (30/01/2012)	Latvia (20/01/2012)	Spain (12/12/2011)
Estonia (25/01/2012)	Lithuania (21/04/2012)	Sweden (06/03/2013)
Finland (14/02/2012)	Luxembourg (-)	Switzerland (24/01/2012)
FYR of Macedonia (-)	Malta (-)	Turkey (23/10/2012)
France (27/03/2012)	Netherlands (07/02/2012)	United Kingdom (17/01/2012)
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• **Intentions to accept:** *list of countries and date*

*South Africa, in progress*

*Australia (University of New South Wales), in progress*

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## I.C. Overview activities and expenditure

### (2<sup>nd</sup> year) Budget

Total Action Budget: 182.000

Remaining Action Commitment: 96.229

#### Meetings

Meeting Type	Date	Place							Cost	Total
MC meeting	21- 24/10/2013	Velence, HU							40337.60	<b>45042.90</b>
WG meeting	24 – 25/01/2014	Vienna, AT							1335.47	
WG meeting	13 – 15/02/2014	Ayent, CH							3369.83	
WG Meeting	03 – 04/06/2014	Aveiro, PT							open	

#### STSM

Beneficiary	Date	Place							Cost	Total
Dr Jose Maria De la Rosa	19 – 31/08/2013	Agroscope, CH							1900	<b>6710</b>
Dr Guido Fellet	16/09 – 15/12/2013	UK Biochar Research centre, Edinburgh							2500	
Dr Frank Verheijen	15/01 – 02/02/2014	Volcani Centre Israel							2310	

#### Workshops

Title	Date		Place						Cost	Total
	From	To	From	To						
Goldschmidt Conference	25-08-2013	30-08-2013	ES	IT					1009.68	<b>7758.96</b>
Biochars, Composts and Digestates	17-10-2013	20-10-2013	several	IT					5000.00	
Mediterranean Biochar Conference	16-01-2014	17-01-2014	several	IT					1749.28	
European Geoscience Union	27-04-2014	02-05-2014	several	AT					open	

### General Support Grants

Beneficiary	Date									Cost	Total
											<b>0</b>

### Schools

Title	Date	Place								Cost	Total
Biochar Summer School 2013	02 – 06/09/2014	Ayent, CH								24339.46	<b>24339.46</b>

### Dissemination

Title	Date	Place								Cost	Total
Update Webpage	20/12/2013	Arbaz, CH								1920	<b>1920</b>
Biochar Special Issue in European Journal of Soil Science	open									5000	
Biochar Book Interreg	open									5000	
Biochar Issue in JPNSS	open									5000	

### Others


**Action Total : 85771.32**

## **II. Scientific Report**

### **II.A. Innovative networking**

- **Innovative knowledge resulting from COST networking through the Action. (Specific examples of Results vs. Objectives)**
  - Results of the Biochar Ring Trial currently in evaluation, summary paper publication scheduled for fall 2014 (WG1) ([Annex 1](#))
    - Aim: Consensus methods, method descriptions and comparability for Biochar analysis
    - Analyses of 3 selected Biochar samples produced with the same technology but with different feedstock and from different producers
    - Samples analysed by 23 participating laboratories
    - Individual methods to determine a standard set of parameters
    - 733 data sets received and evaluated with robust statistical methods (HJ Bachmann, Agroscope, Switzerland)
  - Roadmap for a Biochar Archive & Standard Materials; a real-time online database is planned ([Annex 2](#))
  - Results of representativity study / meta-analysis of biochar field trials across Europe presented at COST meeting in Hungary (October 2013) ([Annex 3](#))
    - Identification of most representative environmental factors, land use type, soil type and soil management, main crop type worked well
    - Averages for study duration (1.7 years) and planned life-time (3.8 years), were found to remain too-short and un-representative due to limited funding
    - Interpretation currently very limited due to hesitance of participants to provide absolute data
    - Improved online version of the survey developed and adapted for pot experiments
  - Identification of representativity levels and major constraints of Biochar field trials across Europe via an improved online survey at <http://webform.cost.european-biochar.org/>; results will be written up as a joint COST publication
  - Economic analysis in WG3 concludes that Biochar is only profitable as an added value product with waste management being the most important benefit (as shown in Gerald Dunst's Biochar added value product business case in Austria)
  - 1<sup>st</sup> annual newsletter published (July 2013) ([Annex 4](#))
- **Significant scientific breakthroughs as part of the COST Action. (Specific examples)**
  - Roadmap for an Organization for Scientifically Responsible Biochar (OSRB) will ensure critical evaluation and responsible development ([Annex 5](#))
  - Very successful STSMs, such as Biochar as metal adsorbent for the remediation of wastewater or erosion and leaching behaviour of biochar (STSM report, [Annex 6](#))
  - Report on ecotoxicological risk assessment of Biochars and Biochar applications in preparation ([Annex 7](#))
  - Creation of thematic crosslink groups (based on main soil processes) for specific work in smaller groups; intended outputs:
    - i. Identification of required level of scientific understanding (LOSU) for specific key issues (e.g. ecotoxicity)
    - ii. Roadmap for how to go from the current to the required LOSU
    - iii. Publication of results in opinion papers
  - 1<sup>st</sup> meeting of WG1 focus group for evaluation of Biochar functions held ([Annex 8](#))

- **Tangible medium-term socio-economic impacts achieved or expected (Specific examples)**

**Achieved**

- Networking contacts between scientists and stakeholders enhanced through 1<sup>st</sup> European Biochar Stakeholder Meeting held in October 2013 ([Annex 9](#))
- Intensive discussion on biochar legal issues with key biochar FP7 projects and COST Action together with European Commission ([Annex 10](#), [Annex 11](#) and [Annex 12](#))
- MC members Gerald Dunst (Austria) and Hans-Peter Schmidt (Switzerland) presented under the EU-COST seal at the expert hearing of the E2BEBIS Interreg project meeting on 14 November 2013 in Prague about Biochar Production, Use, Market Legislation
- Hans-Peter Schmidt (Switzerland) presented as EU-COST TD1107 guest speaker on the final Interreg "Biochar – climate saving soils" conference on 10 December 2013 in Groningen about the "Future of Biochar Use and Certification in Europe"

**Expected**

- Expected outcomes of economic analyses in WG3
  - Identification of key economical drivers at each stage of biochar production and biochar application (product acquisition, biochar production, return on investment for biochar appliers)
  - Publication of a collection of auspicious case studies in the form of a folder or leaflet

- **Spin off of new EC RTD Framework Programme proposals/projects. (List)**

- **ACP Science and Technology Programme** Biochar Plus. Energy, health, agricultural and environmental benefits from biochar use: building capacities in ACP Countries”, Coordinator Alessandro Peressotti (IT).
- ESF project Nr. 2013/0020/1DP/1.1.1.2.0./13/APIA/VIAA/066. Interdisciplinary Team of Young Scientists for Assessment and Restoration of Soil Quality and Usage Potential in Latvia. 2013-2015. Coordinator Olga Mutere (LV). <http://www.lu.lv/mbi/laboratories/environmental-microbiology-laboratory/esf/>
- ESF/BMBF project no. BioCharming – win win solution for agriculture. 2014-2015. Coordinator Bruno Glaser (DE). Budget 100 k€.

- **Spin off of new National Programme proposals/projects. (List)**

- Czech Republic, COST LD13068 Development and application of hydrogeochemical models in metal-contaminated soils treated by Biochar. Leader Lukas TRAKAL 03/2013 - 04/2016. Budget: €65k.
- Czech Republic, COST, Biochar soil amendment to prevent leaching of soil nutrients to surface and ground waters and enhance soil fertility. Leader Jan Kopecky and Martina Eiseltova.
- Czech Republic, COST LD14066, Magnetic modification of biochar and activated carbon for xenobiotics removal. Leader Mirka Safarikova and Ivo Safarik.
- Hungary, REG\_KD-O9-2-2009-OO3 (2012-2013) RTD for advanced utilization of animal and agricultural waste streams with biochar integrated composting. Coordinator and key S&T designer Edward Someus. Budget: €175k.
- Switzerland, COST, Reduction of PAHs during biochar production. Leader Thomas Bucheli.
- Switzerland, COST, Processes of Biochar degradation and stabilization under different (temperate) environments, Leader Samuel Abiven.



- Switzerland, COST, Influence of biochar in soil on plant root development, morphology and architecture and its implication to agricultural productivity, Leader Michael Evangelou.
- National Research Programme of Latvia (programme No. 2010.10-4/VPP-5 "Sustainable Use of Local Resources (Mineral Deposits, Forests, Food and Transport) - New Products and Technologies" Leader Olga Muter.
- Germany, COST, Chances and risks of using biochar and other modified biomass for soil improvement or carbon sequestration in soils. Report for the German Federal Environmental Agency, Lead: Michael Haubold-Rosar, Jürgen Reinhold, Jürgen Kern.

## **II.B. Inter-disciplinary networking**

- **Additional knowledge obtained from working with other disciplines within the COST framework. (Specific examples)**
  - Location and experimental setup of biochar field experiment across Europe were made available across COST members in order to facilitate synergism in analysis, data evaluation and publication of results
  - Results presented during WG meetings are summarized in [Annex 13](#)
  - Joint book publication with Interreg concerning practical biochar use in Europe (outline [Annex 14](#))
  - Joint book publication with Johannes Lehmann and Stephen Joseph concerning State of knowledge of Biochar ([Annex 15](#))
  - Preparation of magnetically responsive derivatives of biochar for environmental technology applications (e.g., xenobiotics removal)
  - Social science methodology will be used to analyse required levels of scientific understanding (LOSU) and establish it from current knowledge gaps ([Annex 16](#))
- **Evaluation of whether the level of inter-disciplinarity is sufficient to potentially provide scientific impacts. (Specific examples)**
  - The majority of Biochar COST Action members are scientists of various disciplines. Therefore, the level of inter-disciplinarity is sufficient for provision of scientific impacts
- **Evaluation of whether the level of inter-disciplinarity is sufficient to potentially provide socio-economic impacts. (Specific examples)**
  - We conducted the first biochar stake-holder meeting during which we realized that socio-economic impacts of biochar are still poorly understood. Therefore, it is planned to involve more experts with socio-economic background.

## **II.C. New networking**

- **Additional new members joining the Action during its life**
  - The COST Action comprises now 28 COST countries, Sweden joined in March 2013 and Bulgaria is currently negotiating in joining the Action. In addition, we are in close collaboration with all FP7 projects dealing with Biochar (EuroChar, Fertiplus and REFERTIL) which enlarges our group even more.
  - After the 1<sup>st</sup> European Stakeholder Meeting in Hungary 40 new stakeholders joined the Action
  - New MC Members from Lithuania, Turkey, Slovenia, Sweden, Czech Republic and France joined during year 2 of the Action
  - The student participants of the 2<sup>nd</sup> European Biochar Summer School joined the Action (19 Early Stage Researchers)

- 
- **Total number of individual participants involved in the Action work**
  - Total number of participants 269, 32% female, 43% ESR.
- **Involvement of Early Stage Researchers in the Action, in particular with respect to STSMs, networking activities, and Training Schools. In addition, justification should be provided if less than 4 STSMs were carried out during the year**
  - Tiziana Pirelli (PhD student, University of Udine, Italy) was awarded the annual Biochar prize at the MC meeting in Hungary in October 2013 ([Annex 17](#))
  - 19 ESR participated in 2<sup>nd</sup> European Biochar Summer School (Switzerland)
  - 7 STSMs conducted by ESR
- **Involvement of researchers from outside of COST Countries**
  - Number of participants from non-COST Countries approved by the CSO: 3
  - 100% of these participants from countries with reciprocal agreements
  - **Australia:** The EU and Australia having common environmental and climate protection strategy and integrated efforts to implement Kyoto Protocol II., 2003-2020, including the EU WfD/End of Waste criteria policy. In this context the biochar market based economy is critically important. Farmers are positively interested in C content and soil fertility with short term benefit impacts – but good business comes first. Furthermore, Australia has a long-term documented background in biochar research and technology.
  - **Russia:** Experience with biochar effects on soil physical properties.
- **Advancement and promotion of scientific knowledge through publications and other outreach activities**
  - Number of publications and other outreach activities that resulted from COST networking through the Action (complete publication list see [Annex 18](#)).
- **Activities and projects with COST network colleagues**
  - 2<sup>nd</sup> European Biochar Summer School 2013, organised by Hans-Peter Schmidt in Switzerland (Summary see [Annex 19](#))
  - 1<sup>st</sup> European Biochar Stakeholder Meeting 2013, organised by Jan Mumme and Edward Someus in Hungary (Report [Annex 9](#))
  - Joint Biochar Book Publication Lehmann and Joseph (Table of contents [Annex 15](#))
  - Publication of Biochar Special Issue in European Journal of Soil Science ([Annex 20](#))
  - Publication of Biochar Special Issue in Agronomy ([Annex 21](#))
  - Publication of Biochar Special Issue in Journal of Plant Nutrition and Soil Science ([Annex 22](#))
  - Co-organization of Goldschmidt Conference 2013 (Firenze, Italy)
  - Co-organization of Biochars Composts Digestates Conference 2013 (Bari, Italy)
  - Co-organization of Mediterranean Biochar Seminar 2014 (Palermo, Italy)
  - Organization of a Biochar session at European Geosciences Union General Assembly 2014 (Vienna, Austria)
- **The capacity of the Action members to raise research funds**
  - See section II.A International and national spin-off.

## **II.D. Self evaluation**

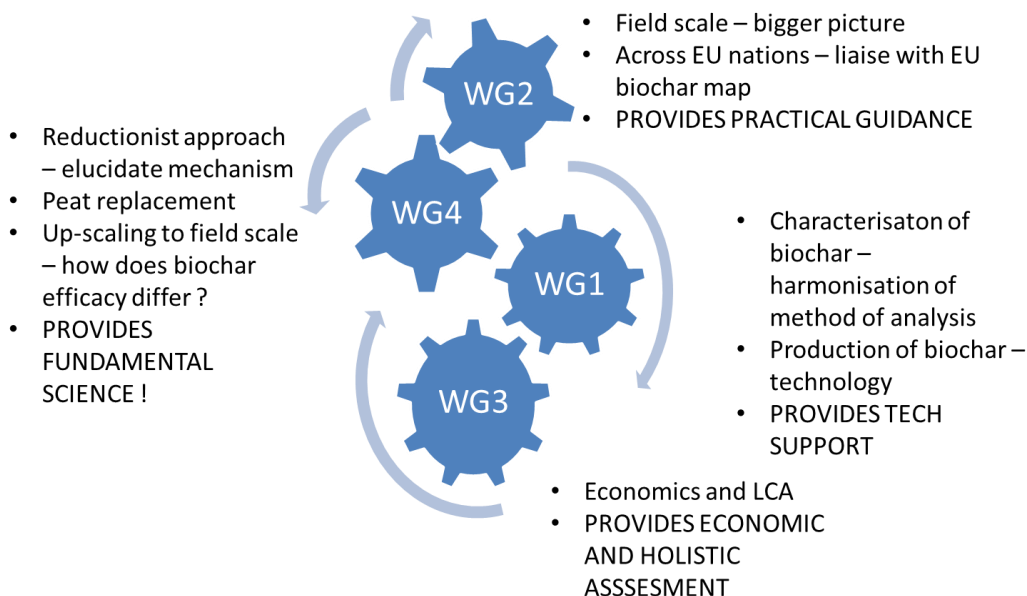
- **Successes:**
  - Platform networking with large number of biochar science colleagues.
  - The structure of the working groups is good, but clearly limitations exist towards working within more than one of them. To improve this in the future, smaller, separate working group meetings at more frequent times will be organized, allowing attendance to more than 1 working group meeting, and a whole action meeting once per year. The availability of funds for small networking events that allow work on publications, conferences etc. should also be highlighted
  - Implementation of STSMs and their output greatly improved. In the meantime STSMs are a well-appreciated tool within the COST Action and among biochar researchers
  
- **Drawbacks and the key difficulties encountered:**
  - Basic science biochar results and considerations might not be valid under scale up, real and market economy based field conditions. In this context the scientific, technical, environmental, legal and economic aspects are equally important already from the beginning of all biochar development works.
  - COST Action output can still be improved. To achieve this, we plan more frequent smaller meeting dedicated to specific objectives such as publication, fund rising etc.
  
- Overall the action, in my opinion, is effective but we should make sure to maximise the potential of the networking opportunities it provides. In addition, to my experience, a proper project-funded project coordinator could boost the project impact and outcome. This task is currently done by two students paid from the grant holder budget.

### III. Previous scientific report

Year 1 report (3/2012 - 5/2013)

#### III.A. Innovative networking

- **Innovative knowledge resulting from COST networking through the Action. (Specific examples of Results vs. Objectives)**



- Biochar ring trial: Three biochar samples were distributed among COST members for analysis of material properties and ecological effects. Results will be evaluated through the second year
  - Establishment of a European map of biochar field trials (public via website)
  - The COST networking and information exchange possibilities wider the REFERTIL biochar EU27 standardization and law harmonization work platform
  - Establishment of a biochar database as basis for a meta-analysis of biochar results across Europe
  - Establishment of a Biochar country report ([Annex 23](#))
- **Significant scientific breakthroughs as part of the COST Action. (Specific examples)**
    - Biochar EU27 standardization and law harmonization that will be reported to the Commission September 30, 2013. Clarification of biochar related specifications, such as:
      - **Biochar material:** Biochar material is a plant and/or animal biomass origin stabile carbon based carboniferous material for Authority permitted open ecological soil enhancement use and eco-safe carbon negative applications. Biochar is not a fine ground charcoal that is made for energetic purpose and not a labile carbon.
      - **Biochar product:** Biochar product is a labelled and full value chain safe product with producers product responsibly guarantees that meets the EU 2008/98/EC “End of Waste” criteria.
      - **Biochar production:** Stabile carbon biochar is produced under 450°C – 650°C reductive thermal processing negative pressure conditions with zero emission or near zero mission environmental performance. Biochar – as chemically modified substance -

industrial production or import above 1 t/year capacity requires comprehensive environmental and industrial safety Authority permits and EU REACH registration by 1 June 2018. All biochar productions and soil applications in industrial scale require accredited MS Government Authority permit in the EU and the temperate climatic zone countries as well.

- **Biochar production input material sustainability criteria:** Biochar production feed material supply may not compete with human food, animal feed and/or plant nutrition production and supply.
  - **Plant based biochar (INORGANIC SOIL IMPROVER):** >90% w/w high carbon content plant origin micro and meso porous (1 nm – 50 nm) carboniferous product, with high water holding and nutrient retention capacity and C sequestration, but no or almost none soil fertilization effects. The stable carbon based biochar is providing high efficient carbon sequestration to avoid global warming caused by climate change. Usual application rate is 2.5 t/ha – 20 t/ha, depending on the case by case scenario and economy.
  - **Animal bone based biochar (ORGANIC FERTILIZER):** <20% w/w low carbon and high calcium phosphate / apatite mineral content macro porous (50 nm – 63,000 nm) NPK-C biochar full value organic fertilizer, with trade name Animal Bone Charcoal “ABC” product. The ABC is made of food grade (category 3) bone meal and the effects are natural slow release fertilization, plant growth promotion, improving soil retention of nutrients and water, improved cation exchange capacity, while decreasing and/or fully substituting the use of chemo-synthetic substances in low input and organic agriculture. ABC is improving soil fertility, enhancing soil microbiological life and biodiversity, restoring soil natural balance in different climatic conditions and at different soil types, especially at degraded soils. The usual and economical ABC application rate is 0.2 t/ha – 1 t/ha.
  - **2008/98/EC End-of-Waste criteria:** The biochar application conditions meets the EU and international “end of waste” criteria policy, including that the biochar is
    - commonly used for specific agricultural and environmental purposes;
    - a market or demand exists for biochar;
    - fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to the EU27;
    - the use of the biochar will not lead to overall adverse environmental or human health impacts and market demand exists.
  - **Biochar low carbon economy:** Biochar can be an important tool to increase food security and cropland diversity in areas with severely depleted soils, scarce organic resources, and inadequate water and eco-friendly fertilizer supplies, whereas important application element is the drought tolerant food crop cultivation system.
- ***Tangible medium term socio-economic impacts achieved or expected (Specific examples)***
    - Development of marked-based and economical biochar production and application systems. The sustainability of the biochar system assessed by means of a multi-criteria analysis. Obviously environmental performance and profitability (economic indicators) are foremost. Besides indicators of resource requirement and of financial soundness, there is a need for “risk” indicators that is [financial] sustainability in view of changing conditions. In this context the technical, environmental and economic criteria for biochar production and use developments are equally important.
    - Luke Beesley hosted a meeting of UK biochar researchers 13<sup>th</sup> August 2012 in Aberdeen. This was designed to develop a list of priority areas we thought the direction of UK biochar research could take. The meeting proved very useful in networking

especially the Northern UK partners and creating a list of areas to explore within COST framework. Short presentations were given by participants. Many fascinating and important questions and issues were raised to take to the WG platforms. For example;

- What biochar application levels are desirable, credible, sensible?
  - Can a predictive model of biochar properties based upon its production conditions be developed, e.g. based on correlation analysis?
  - What is the 'problem' that biochar is aiming to solve and are there other, possibly better, options for addressing such problems?
  - How can a risk assessment for biochar be taken forwards?
  - How can the technological, feedstock and soil constraints / challenges be conceptualised in order to define the possibility space for biochar?
  - What is the role of biochar in phytoremediation?
- **Spin off of new EC RTD Framework Programme proposals/projects. (List)**
    - **EU FP7 REFERTIL (289785)** (2011-2015), Reducing mineral fertilisers and chemicals use in agriculture by recycling treated organic waste as compost and bio-char products. Improvement of comprehensive bio-waste transformation and nutrient recovery treatment processes for production of combined natural products. Biochar EU27 standardization/law harmonization with interlink to the new EU fertilization regulation preparatory works and amendment of WfD/EoW. <http://www.refertil.info> Coordinator and key S&T designer Edward Someus (HU). Budget €4.2M.
    - **EU FP7 C2U (603637) Carbon Capture and Use** from municipal solid waste – One step forward towards carbon neutral society. Coordinator Bruno Glaser (DE). Score 6/10 (Treshold 8/10).
    - **EU FP7 BIOCHAREM (603387)** Thermochemical conversion of urban biodegradable solid waste into biochar: an innovative and sustainable technology for combining positive energy production and soil remediation, Coordinator Alessio Malcevski (IT). Score 5/10 (Treshold 8/10).
  - **Spin off of new National Programme proposals/projects. (List)**
    - Czech Republic, COST LD13068 Development and application of hydrogeochemical models in metal-contaminated soils treated by Biochar. Leader Lukas TRAKAL 03/2013 - 04/2016. Budget: €65k.
    - Czech Republic, COST, Biochar soil amendment to prevent leaching of soil nutrients to surface and ground waters and enhance soil fertility. Leader Jan Kopecky and Martina Eiseltova.
    - Hungary, REG\_KD-O9-2-2009-OO3 (2012-2013) RTD for advanced utilization of animal and agricultural waste streams with biochar integrated composting. Coordinator and key S&T designer Edward Someus. Budget: €175k.
    - Hungary, GOP-1.1.1-08/1-2008-0010 (2009-2012), Innovative biochar processing, bioenergetic and environmental method and prototype development. Coordinator and key S&T designer Edward Someus. Budget: €425k.
    - Switzerland, COST, Reduction of PAHs during biochar production. Leader Thomas Bucheli.
    - Switzerland, COST, Processes of Biochar degradation and stabilization under different (temperate) environments, Leader Samuel Abiven.
    - Switzerland, COST, Influence of biochar in soil on plant root development, morphology and architecture and its implication to agricultural productivity, Leader Michael Evangelou.

### **III.B. Inter-disciplinary networking**

- **Additional knowledge obtained from working with other disciplines within the COST framework. (Specific examples)**
  - Location and experimental setup of biochar field experiment across Europe were made available across COST members in order to facilitate synergism in analysis, data evaluation and publication of results
  - Results presented during WG meetings are summarized in [Annex 24](#) and [Annex 25](#)
  - Joint book publication with Interreg concerning practical biochar use in Europe (outline [Annex 14](#))
- **Evaluation of whether the level of inter-disciplinarity is sufficient to potentially provide scientific impacts. (Specific examples)**
  - In progress
- **Evaluation of whether the level of inter-disciplinarity is sufficient to potentially provide socio-economic impacts. (Specific examples)**
  - Biochar science must be importantly interconnected to the environmental and economic aspects for biochar production and SME enduser farmer oriented applications.

### **III.C. New networking**

- **Additional new members joining the Action during its life**
  - The REFERTIL biochar project is 14 partners from ten EU countries with 65 biochar works related S&T Colleagues. 30% female and 10% Early Stage Researcher participants.
- 
- **Total number of individual participants involved in the Action work**
  - **Total number of participants 177, 30% female, 55% ESR.**
- **Involvement of Early Stage Researchers in the Action, in particular with respect to STSMs, networking activities, and Training Schools. In addition, justification should be provided if less than 4 STSMs were carried out during the year**
  - **Participation of ESR in COST meetings**
  - **20 ESR participated in Biochar Summer School (Potsdam)**
  - **4 STSMs conducted by ESR**
- **Involvement of researchers from outside of COST Countries**
  - Number of participants from non-COST Countries approved by the CSO: 3
  - 100% of these participants from countries with reciprocal agreements
  - **AUSTRALIA:** The EU and Australia having common environmental and climate protection strategy and integrated efforts to implement Kyoto Protocol II., 2003-2020, including the EU WfD/End of Waste criteria policy. In this context the biochar market based economy is critically important. Farmers are positively interested in C content and soil fertility with short term benefit impacts – but good business comes first. Furthermore, Australia has a long-term documented background in biochar research and technology.
  - **Russia:** Experience with biochar effects on soil physical properties.

- **Advancement and promotion of scientific knowledge through publications and other outreach activities**

- Number of publications and other outreach activities that resulted from COST networking through the Action (Complete publication list see [Annex 18](#)).

- **Activities and projects with COST network colleagues**

- *Joint PhD program "Measuring the stability of biochar in soil and developing biochar characterisation techniques", promoters: F. Ronsse (Ugent), O. Masek (UoE), 3-year, approx. 120,000 €*
- 2<sup>nd</sup> Nordic Biochar Seminar (14 – 15 February 2013 in Helsinki, Finland).
- North East European Biomass Agenda 2020 (1.5.2012 – 30.4.2013). Establishment of an innovative R&D network with partners from the Baltic countries. Workshops in Riga and St. Petersburg were focused on new added value chains of biomass (fibres and biochar)
- EUROSOIL 4th International Congress, Italy (July 2012).

- **The capacity of the Action members to raise research funds**

See section II.A International and national spin-off.



#### **IV. Annexes**

1. [Biochar Ring Trial results](#)
2. [Roadmap for a Biochar Archive & Standard Materials](#)
3. [Results of representativity study / meta-analysis of biochar field trials across Europe presented at COST meeting in Hungary \(October 2013\)](#)
4. [1<sup>st</sup> annual newsletter](#)
5. [Roadmap for an Organization for Scientifically Responsible Biochar \(OSRB\)](#)
6. [STSM report](#)
7. [Report on ecotoxicological risk assessment of Biochars and Biochar applications in preparation](#)
8. [1<sup>st</sup> meeting of WG1 focus group for evaluation of Biochar functions](#)
9. [1<sup>st</sup> European Biochar Stakeholder Meeting](#)
10. [REFERTIL Biochar Policy Abstract 2014](#)
11. [Public position and comment by members of this COST Action, EBC, IBI and BBF on the REFERTIL policy abstract](#)
12. [REFERTIL response to public position paper on Biochar policy abstract 2014](#)
13. [Hungary WG1-4 meeting report](#)
14. [Joint book publication with Interreg concerning practical biochar use in Europe](#)
15. [Joint book publication with Johannes Lehmann and Stephen Joseph concerning State of knowledge of Biochar](#)
16. [Social science methodology will be used to analyse required levels of scientific understanding \(LOSU\) and establish it from current knowledge gaps](#)
17. [1<sup>st</sup> Biochar Award](#)
18. [Publication list](#)
19. [2<sup>nd</sup> European Biochar Summer School 2013](#)
20. [Publication of Biochar Special Issue in European Journal of Soil Science](#)
21. [Publication of Biochar Special Issue in Agronomy](#)
22. [Publication of Biochar Special Issue in Journal of Plant Nutrition and Soil Science](#)
23. [Country report Version 7](#)
24. [Crete workshop report \(WG1-4\)](#)
25. [London WG1-4 workshop report](#)