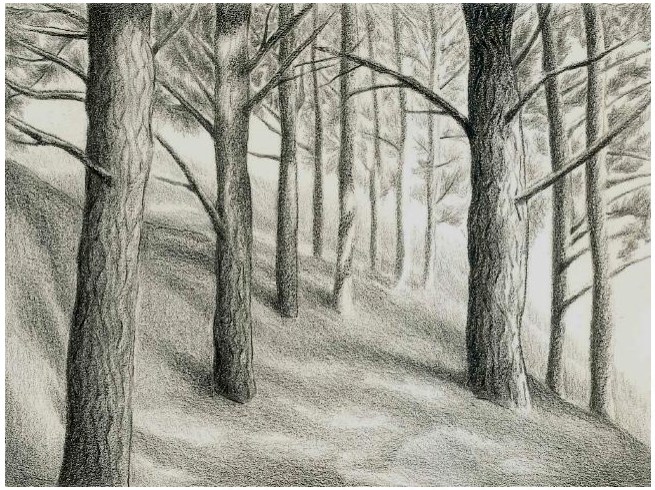
FORRISK

A network for innovation in silviculture and integrated systems for forest risk management



Use of experimental plots to test silvicultural practices adapted to drought risk (use of Biochar and ash from biomass industry)

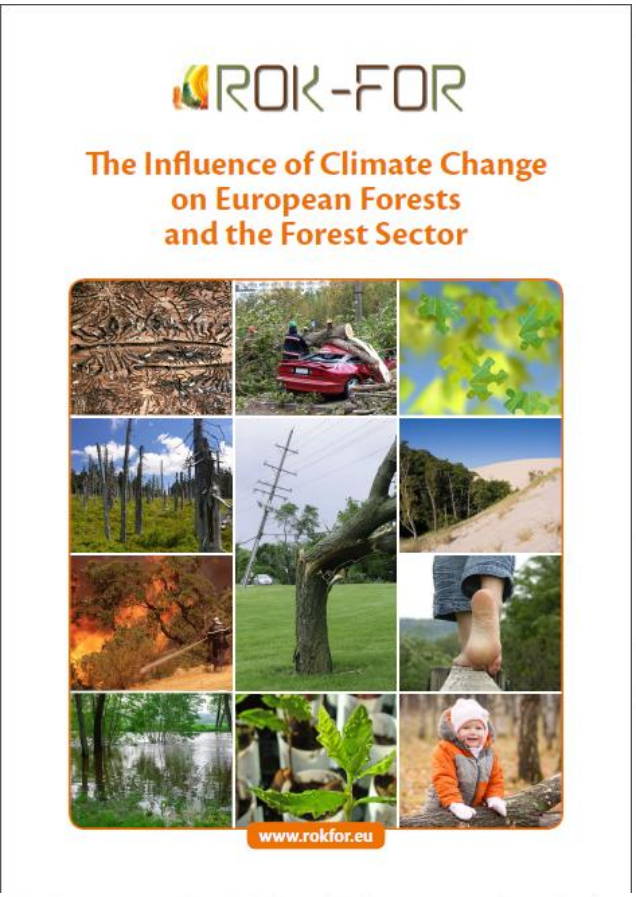
Nahia Gartzia-Bengoetxea
Lur Moragues Saitua
Ander Arias-González

SUDOE Interreg IV B

UE/EU - FEDER/ERDF

neiker tecnalia

How will climate change affect forests?

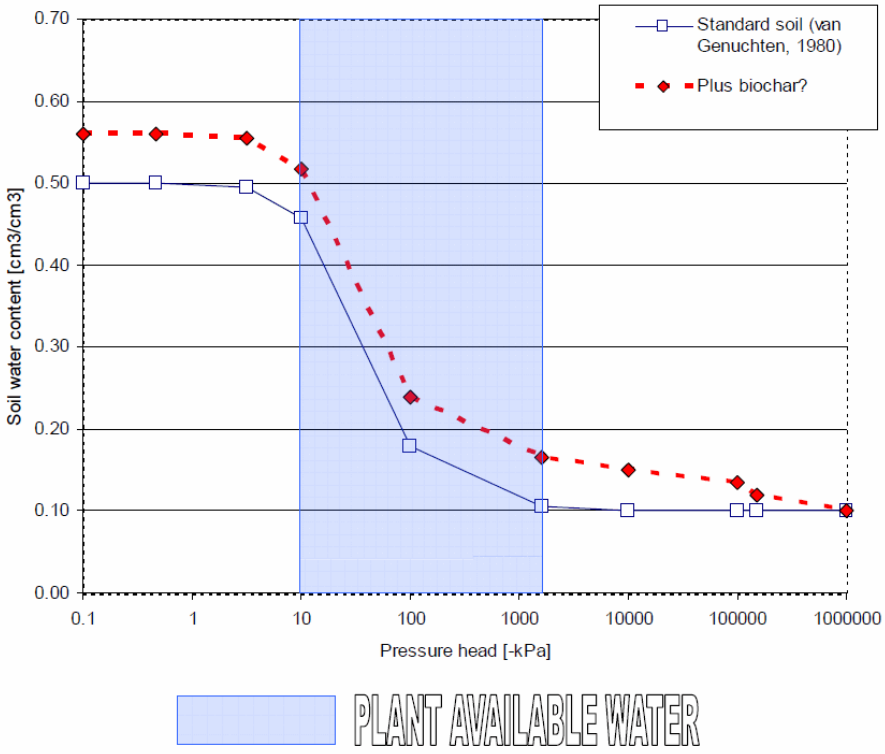


- ✓ Summer droughts are expected to become more frequent and more intense, especially in southern and central Europe, due to the combined effects of rising temperatures and a decrease in summer precipitation.

- ✓ Biotic risk will increase. Forest pests and diseases will benefit from climate change, due to water deficits and higher temperatures in Europe.

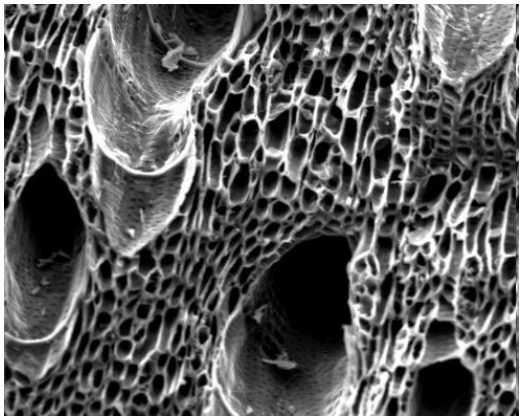
neiker tecnalia

Question: Can foresters improve soil water holding capacity and tree species resilience to biotic diseases?

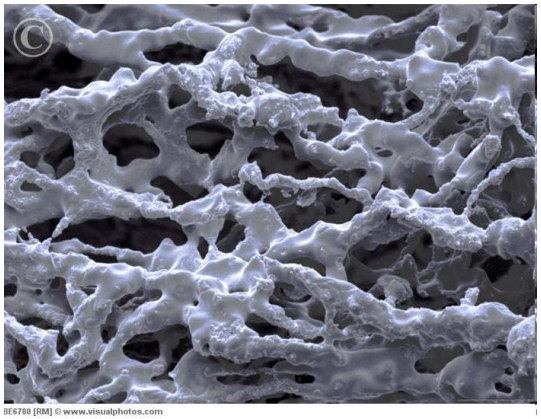


Hypothesis: Addition of biochar or wood ash to soils can improve soil water holding capacity and resilience to biotic diseases.

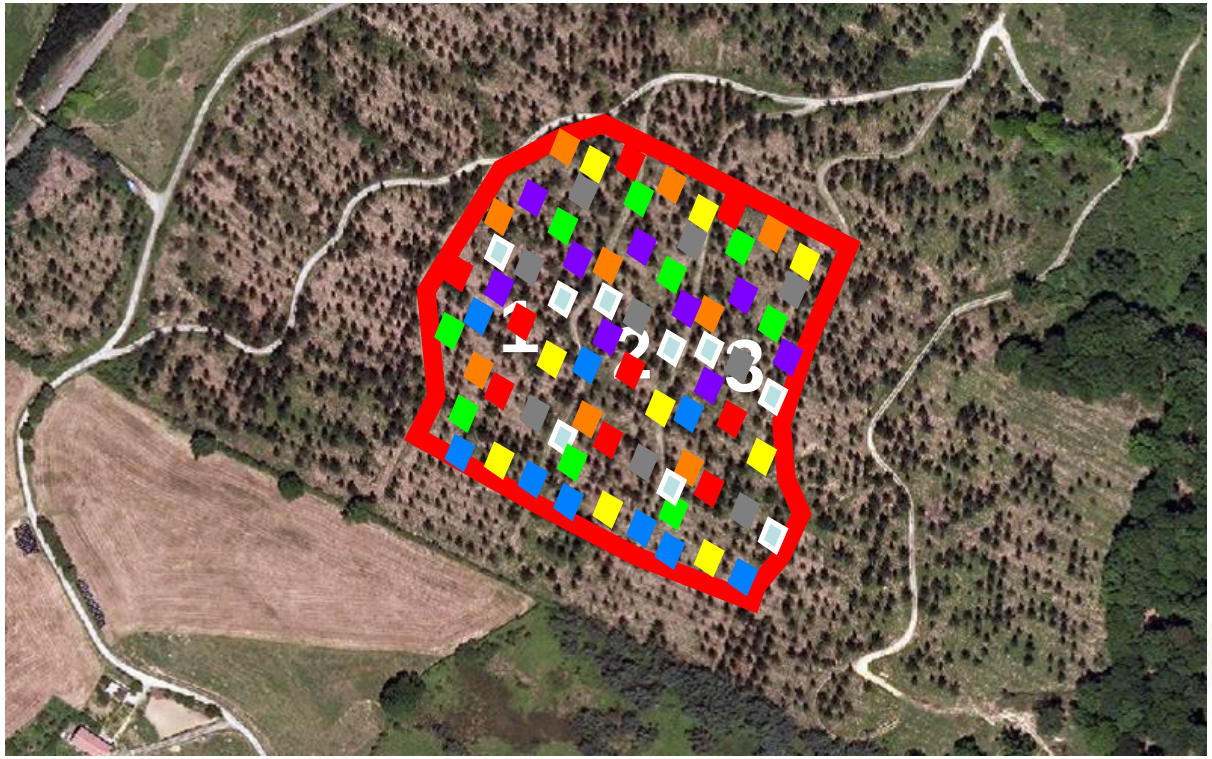
biochar



wood-ash



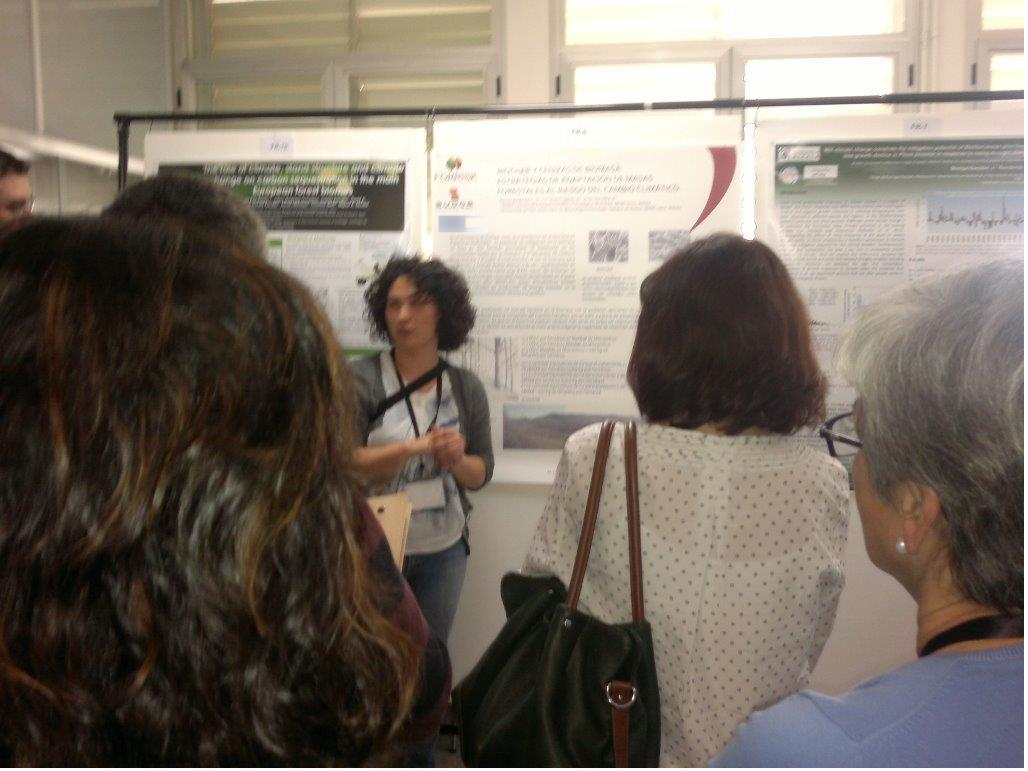
neiker tecnalia



BFA DFB
Bizkaiko Foru Aldundia
Diputación Foral de Bizkaia

REINFORCE

neiker tecnalia



BIOCHAR Y CENIZAS DE BIOMASA.
ESTRATEGIAS DE ADAPTACIÓN DE MASAS FORESTALES AL RIESGO DEL CAMBIO CLIMÁTICO

Gartzia-Bengoetxea, N.[1], Fernández-Ugalde, O.[2], Arias-González, A.[1]
[1] NEIKER-Tecnalia, 812 Parque Científico y Tecnológico de Bizkaia, 48160 Derio, Bizkaia
[2] Universidad del País Vasco, Dpto de Mineralogía y Petrología, Campus de Bizkaia, 48490 Leioa, Bizkaia

En el escenario de Europa 2020, la importancia de la biomasa en España es irrefutable. El potencial de mitigación de la biomasa se basa en dos factores principales: la sustitución de los combustibles fósiles por la biomasa, y el secuestro de carbono en la biomasa y el suelo. A nivel mundial, el uso de biomasa para calefacción y energía podría ahorrar más de 1 gigatoneladas de carbono (GtC) anuales hasta 2030 (FAO, 2010). Sin embargo, se trata de la tecnología renovable menos desarrollada en España en los últimos años (BIOPLAT, 2012). Actualmente existen diferentes métodos de producción de energía basados en la biomasa como la combustión directa o la pirólisis.

BIOCHAR

Se produce mediante pirólisis proporcionando aceite y gas como otros subproductos que pueden ser utilizados como combustibles.

CENIZA

Se produce mediante la combustión directa de biomasa para la generación de calor, en ella se concentran los nutrientes.

Los métodos de producción de energía basados en la biomasa con la posterior aplicación de biochar o las cenizas de madera al suelo parecen prometedoras para la mitigación del Cambio Climático por un lado, y para la de adaptación de las masas forestales frente al riesgo del Cambio Climático, ya que en el futuro se esperan veranos más secos en todas las regiones del arco Atlántico (aún más en las regiones mediterráneas) y la adición de biocarbones al suelo podría mejorar la capacidad de retención de hídrica y mantener la producción primaria, sobre todo en verano.

1) 9 Mg C por hectárea de **biochar** de Miscanthus
2) 3 Mg C por hectárea **biochar** de Miscanthus
3) 9 Mg C **biochar** de Miscanthus + 200 kg de NH_4NO_3 por hectárea
4) La cantidad equivalente de Ca que el tratamiento 1 de **ceniza** por hectárea (4500 kg por hectárea)
5) La cantidad equivalente de Ca del tratamiento 2 de **ceniza** por hectárea (1500 kg por hectárea)
6) La cantidad equivalente de Ca del tratamiento 1 de **ceniza** +200 kg de NH_4NO_3 por hectárea
7) control

3 bloques y 3 repeticiones por tratamiento por bloque.
63 parcelas de $64m^2$

remedia workshop
11-12 de abril de 2013. Zaragoza

Referencias:
FAO, 2010. What woodfuels can do to mitigate climate change. FAO Forestry Paper 162. Food and Agriculture Organization of the United Nations, Rome.
BIOPLAT, 2012. Documento de Líneas Estratégicas de Investigación. Plataforma Tecnológica Española de la Biomasa. Ministerio de Ciencia e Innovación.

Briefly,

The infrastructure and FORRISK project were presented in the scientific network onthe mitigation of greenhouse gas emition in agroforestry (Red REMEDIA).

European Commission

JRC SCIENCE AND POLICY REPORTS

Soil carbon sequestration for climate food security and ecosystem services

Proceedings of the International conference 27-29 May 2013 Reykjavik Iceland

Edited by
Guðmundur Halldórsson
Francesca Bampa
Arna Björk Þorsteinsdóttir
Bjarni D. Sigurdsson
Luca Montanarella
and
Andrés Arnalds

2014

Soil Conservation Service of Iceland

Acknowledgments

The trial setup and prior eco-toxicological assays were financed by the REINFFORCE project, co-funded by the Atlantic Operational Programme through the European Regional Development Fund (ERDF). The first data collection and presentation of results in this conference were financed by the FORRISK project, co-funded by SUDOE Territorial Cooperation Programme through ERDF. Both Projects were co-financed by the Basque Government Department of Economic development and Competitiveness.

Briefly,

The ecotoxicological risk of the aplication of biochar was assessed, and it was concluded that miscantus Biochar cannot be considered a toxic product for the environment.

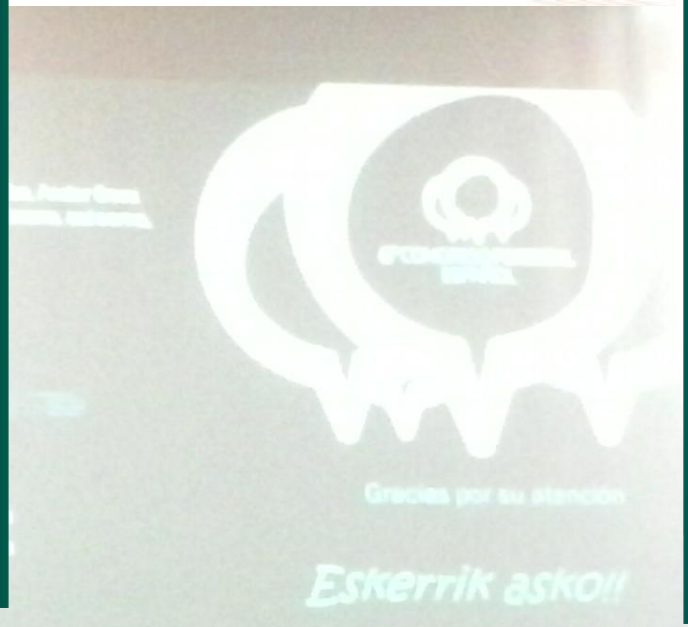
However, when a more novel method to assess toxicology MARA was addressed some toxicity was revealed.

Biochar application to forest soils. A Silviculture trial under the risk of climate change

Nahia Gartzia-Bengoetxea* and Ander Arias-González§§§§§§*

NEIKER-Tecnalia. 812 Bizkaia Science and Technology Park, 48160 Derio, Bizkaia, Spain.

neiker tecnalia



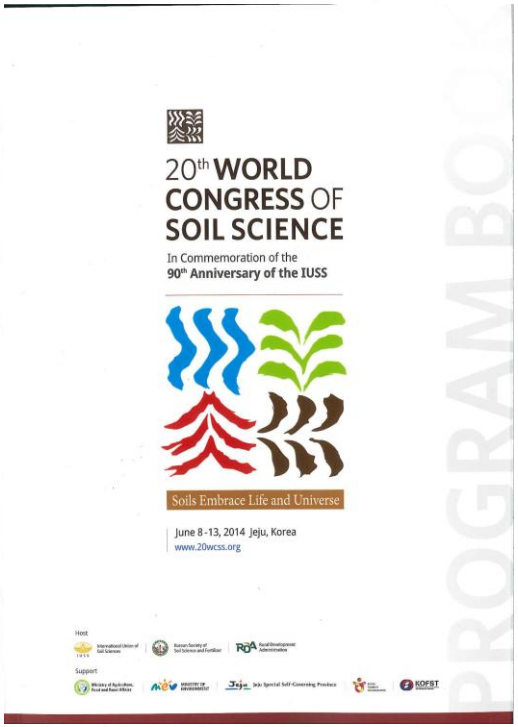
Briefly,

The ecotoxicological risk of the aplication of wood ash was assessed, and it was concluded that wood ash from *Pinus radiata* cannot be considered a toxic product for the environment, but when a more novel method to assess toxicology MARA was addressed some toxicity was revealed.

P2-113

Biochar Stabilization by Organo-Mineral Associations in a Forest Soil Under Pinus Radiata in the Spanish Atlantic Area

Oihane Fernandez-Ugalde[1], Ander Arias-Gonzalez[2], Lur Moragues-Saitua[2], Javier Arostegi[1] and Nahia Gartzia-Bengoetxea[2]
[1]University of the Basque Country, Spain; [2]NEIKER-Tecnalia, Spain



Biochar stabilization by organo-mineral associations in a forest soil under *Pinus radiata* in the Spanish Atlantic area

O. Fernández-Ugalde[1], A. Arias-González[2], L. Moragues-Saitua[2], J. Arostegi[1], N. Gartzia-Bengoetxea[2]

[1]Dpt. Mineralogy and Petrology, Faculty of Science and Technology, University of the Basque Country, P.O. Box. 644, 48080 Bilbao (Spain)

[2]Forestry Unit, NEIKER-Tecnalia, 812 Science and Technology Park, 48160 Derio, Spain

Contact e-mail[1]: ofdez81@gmail.com

INTRODUCTION

The application of **biochar in soils** is being considered **a potential strategy to sequester carbon while improving both soil properties and microbial functions**. The **benefits of biochar for soil** mainly **depend on the properties of adsorption and stability of biochar**. Further, these two properties make biochar an effective technology to tackle major environmental problems.

Many forest soils in the Spanish Atlantic area have low contents of organic carbon, so that the amendments of these soils with biochar might be a key strategy to restore soil quality and to strength the resilience of forest ecosystems to tackle climate change.

OBJECTIVES

✓To study **the stabilization of biochar by organo-mineral interactions in a forest soil in the Spanish Atlantic area**, since the formation of organo-mineral associations is a key mechanisms for the long-term stabilization of organic matter in soil.

(1)To measure the incorporation rate of biochar to organo-mineral associations after one year from the addition of biochar to the soil

(2) To test the role of mineral composition of the soil in the formation of organo-mineral associations

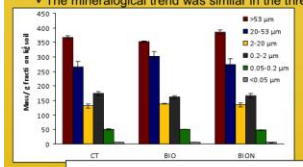
EXPERIMENTAL FIELD

✓A 20-year old plantation of *Pinus radiata* (C3 plant), located in the Basque Country (Spain)
✓Soil: extremely acid (pH = 4.30) with a clayey loam texture, developed in silty sandstones
✓Experimental design: a completely randomized block design with 9 replicated plots per treatment
-Control (CT)
-Biochar (BIO, 9 Mg C of biochar per hectare)
-Biochar + N (BION, 9 Mg C of biochar per hectare activated with 0.8% N)
✓Biochar, produced from *Miscanthus sp.* (C4 plant) by pyrolysis at 450 ºC, was added in May 2012
✓Climate: Humid temperate (mean annual temperature 8.5 ºC and mean annual precipitation 1200 mm)

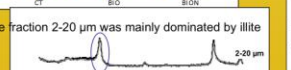
RESULTS from samples collected from 0 to 20-cm depth

1) Particle-size fractionation and clay mineralogy:

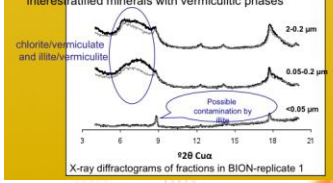
✓We separated organo-mineral associations with contrasted clay mineralogy
✓The mineralogical trend was similar in the three treatments



✓The fraction 2-20 µm was mainly dominated by illite



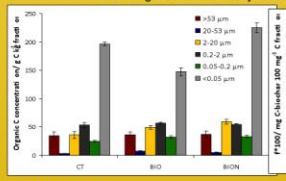
✓Fractions 0.2-2 and 0.05-0.2 µm were dominated by interestratified minerals with vermiculitic phases

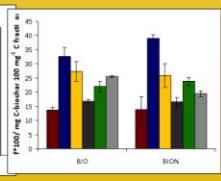


X-ray diffractograms of fractions in BION-replicate 1

2) Organic C and C isotopic composition of particle-size fractions:

✓The <0.05 µm fraction showed the greatest concentration of organic C
✓C_{org} in the <0.05 µm fraction: BION > CONTROL > BIO
✓No clear trend was observed in the distribution of biochar-C among the fraction one year after addition





PERSPECTIVES

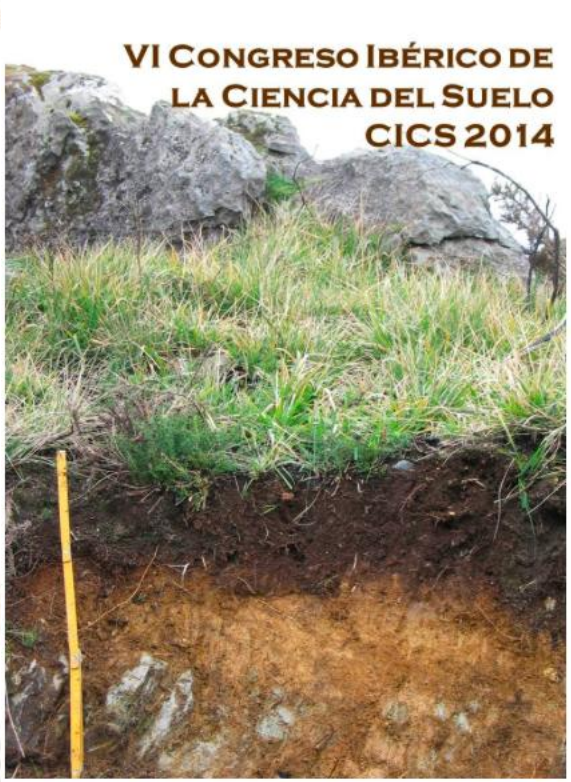
✓The analyses of Fe/Al oxy-hydroxides will complete the mineralogical characterization of the soil, as they also can participate on the stabilization of biochar by the formation of organo-metal associations

✓The performance the particle size fractionation at different times within the next four years (approx. duration of the project), in order to trace the evolution of biochar in the soil and to study the long-term stability of the biochar in soil by organo-mineral associations.

Acknowledgements: Funding was provided by INIA (RTA-2012-00048-00-00) and Interreg SUDOE SOILRISK project. We also acknowledge the post-doctoral fellowship for Dr Fernández-Ugalde funded by the Basque Government.

Briefly,

Biochar stabilization by organo-mineral association can help fighting against Soil Organic Matter decline, maintain forest productivity and improve in forest resistance against pest and diseases.



Briefly,

Biochar plays an active role in the water stable aggregate formation and Biochar can be protected within microaggregates, preventing SOM loss.

Future perspective

- Spanish Ministry of Agriculture granted us with another PhD student.
- We have established another trial in another soil type.
- This autumn we will sample intact soil cores to determine the effect of biochar and wood ash application on soil water retention curves, 2 years after application.
- We are studying the effect of Biochar and wood ash application in soil biodiversity, another risk of soil degradation.

Eskerrik asko!

Thank you for your attention!