i. **Title/Heading.:** **Agroforestry a nature based solution for sustainability**

ii. Context and rationale.

Climate change is generating uncertainties in agrofood systems framework due to the speed of the change but also the increased appearance of extreme events which is caused by the increase of Green House Gases (GHG) in the atmosphere. Relevant international bodies such as the Global Research alliance, the FAO who establishes the concept of Climate smart agriculture as well as the IPCC (Intergovernmental panel on climate change) in the 1.5 Report indentifies agroforestry as a negative emission technology that should be expanded to reduce GHG in the atmosphere. Agroforestry is also able to improve farm resilience due to the increased farm diversification, self-sufficiency and reduced production costs. They can also improve community resilience and enhance mitigation through e.g. carbon sequestration and reduced mineral fertilizer needs as recommends the National adaptation strategies (NAS) and plans (NAP).

iii. An overview of the contribution.

The contribution will evaluate the five types of agroforestry practices: silvopasture, silvoarable, homegardens, riparian buffer strips and forest farming in the different types of land use across the world (table 1) as a tool to mitigate climate change with also links to how these sustainable land use systems are able to increase resilience of farm systems at plot, farm and landscape scale.

Land use and agroforestry practice		Common name	Brief description
AGRICULTURE	Silvopasture	Wood pasture and parkland	Typically areas of widely-spaced trees that are also used for forage and animal production.
		Meadow orchards	This practice includes fruit orchards, shrubs which are grazed or sown with pastures, but also olive groves and vineyards
	Silvoarable	Hedgerows and windbreak systems	Here the woody components are planted to provide shelter, shade, or parcel demarcation to a crop and/or livestock production system
		Alley-cropping systems	Widely spaced woody perennials inter-cropped with annual or perennial crops. It comprises alley cropping, scattered trees and orchards and line belts within the plots. These practices are sometimes found only during the first few years of the plantation
	Riparian buffer strips	Riparian buffer strips	Areas of tree and shrubs allowed to establish croplands/pastures and water sources such as streams, lakes, wetlands, and ponds to protect water quality, can be identified as silvoarable or silvopasture.
FOREST	Silvopasture	Forest grazing	Although the land cover is described as forest, the understory is grazed
	Forest farming	Forest farming	Forested areas used for production or harvest of naturally standing speciality crops for medicinal, ornamental or culinary uses
URBAN AND PERIURBAN	Homegardens	Homegardens	Combining trees/shrubs with vegetable production usually associated with peri-urban or urban areas

Table 1. Agroforestry practices associated to policy land use: agriculture, forestry and urban and periurban areas.

Mitigacion options declared by the European Union includes (i) the reduction of the GHG emissions through a more effective use of resources and technological development (e.g. by better land/waste management better land/waste management through the better use of the resources promoted by agroforestry and (ii) the removal of GHG from the atmosphere (e.g. by trees in farms), while maintaining production and decreasing input needs. The soil plays an important role in counteracting the GHG emissions into the atmosphere because it contains the 85% of the carbon in terrestrial ecosystems. The main sources of soil carbon are the roots being them increased when woody perennials are present as highlights the Decision 529/2013/EU of the trees. The introduction of trees in arable lands increases the soil capacity to store carbon at deeper soil layers than tree less systems, which can be also associated to long term carbon stocks because the probability of C release to the atmosphere is reduced with the depth of the soil. The initiative 4 per thousand established by the COP of Paris establishes that an annual growth rate of 0.4% in the soil carbon stocks, or 4‰ per year, would halt the increase in the CO2 concentration in the atmosphere related to human activities. Moreover. silvopasture implementation has demonstrated to increase carbon store in the soil in pinus radiate, birch and cherry stands due to the dinamization of nutrients that animals with their faeces and urine cause. The degree of mitigation of climate change in agroforestry systems depends on the tree species and for example broadleaves are associated to store carbon in soils linked to small soil particles which store carbon for a longer period of time than coarse particeles. Better design of farming systems including agroforestry at farm, landscape and value chain level is essential to reach the 1.5ºC while increasing competitiveness, sustainability and resilience of farming systems in Europe to fulfill food demand as shown by the FAO.

iv. **How the contribution leverages living natural systems as a solution to avert climate change?**

The contribution will leverages living natural systems by the integration of existing knowledge (i.e. see AFINET project: www.eurafagroforestry.eu/afinet) in the different types of land use (forest, agriculture and urban and periurban areas) with regard of the better combinations of woody perennials (the most promising carbon soil sequesters component) and other species.

v. **How might the contribution support both climate, mitigation and adaptation as well as other important co-benefits and social, economic and environmental outcomes in coming years including:**

a. Reduction in carbon emission and carbon capture (GTonnes)

The introduction of trees in arable lands increases the soil capacity to store carbon at deeper soil layers than tree less systems, which can be also associated to long term carbon stocks because the probability of C release to the atmosphere is reduced with the depth of the soil. The initiative 4 per thousand established by the COP of Paris establishes that an annual growth rate of 0.4% in the soil carbon stocks, or 4‰ per year, would halt the increase in the CO2 concentration in the atmosphere related to human activities. The degree of mitigation of climate change in agroforestry systems depends on the tree species and for example broadleaves are associated to store carbon in soils linked to small soil particles which store carbon for a longer period of time than coarse particles. Agroforesty is also able to reduce fire risk, so avoiding greenhouse gases emissions from forest lands.

b. Increasing climate resilience

Adaptation is mainly related to droughts, extreme temperatures, flooding, sea level rise, storms and water scarcity. Main adaptation options recognised by the United Nations Framework Convention on Climate Change (UNFCCC) are related to water control (e.g. increase water retention, recycling and irrigation efficiency) and thermic regulation (e.g. shading and sheltering for livestock), that can be improved through AF systems. Water retention is improved by the woody perennials as they increase

porosity reducing therefore water run-off, but also due to the water soil extraction reduces the flooding risk, acting as barrier against unpredictable flooding. Water recycling is fostered because some tree species such as the ash i sable to uptake water from deep soil layers and make it available in more superficial soil layers, permitting enough humidity to allow pasture to grow. Water efficiency can be improved if woody perennials are placed in such a way that wind desiccation negative impact on crops is reduced. The presence of trees in grasslands is key to provide shelter livestock. Some agroforestry actions help also to improve farm resilience such as the extension of the grazing season thanks to the reduction of the impact of droughts in herbaceous vegetation when growing under trees that allows animal to have a forage bank for this shortage periods, but also the leaves pruned by the trees used as forage in those specially difficult years when both drought or frost reduce forage availability. Moreover, the shade is able to avoid big losses of arable crops associated to extreme heats. Finally, understory grazing in forest stands reduces fuel and therefore fires risk, increasing the resilience in high risk periods associated to specific weather conditions.

c. Social impact (job increase; poverty reduction, etc.)

The high number of products produced per unit of land due to the ecointensification processes increases the number of jobs per unit of land. In Portugal, it has been found that an agroforestry farm has 10 times more workers that a conventional farming system.

d. Net economic impact (total in US$; how was it achieved?)

The estimation of the economic benefits of agroforestry with respect to agricultural lands have shown an economic return increase over 25% in France, UK and Spain

e. Impact on realization of the 2030 Agenda for Sustainable Development (in particular SDGs 1,2,6,12,13,14,15,16)

Because agroforestry is able to deliver multiple products from the same unit of land based on the fact that optimize the use of the resources and therefore reducing external inputs in the system both poverty and zero Hunger SDG are fulfilled. The capacity of the deep roots of the trees of uptake the excess of nutrients applied into the crop greatly contributes to enhance the water quality as highlights the SDG number 6. There are good regional examples of this. The fact that agroforestry can be used in any type of land all over the world makes this technology easy to be used under the concept of the SDG 12 of responsible production but also to responsible consumption as local markets should be promoted to better get the benefits from agroforestry. Agroforestry is one of the best tool recognized by the FAO to fight against climate change therefore fulfilling SDG 1. The fact that agroforestry is a sustainable intensification system able to improve the use of the resources and therefore improving nutrient recycling and increasing soil organic matter justifies the fulfilment of SDG 14 (life below water) and 15 (life on land). SDG number 16 dealing with peace, justice and strong institutions support is needed to help agroforestry to provide all benefits that it can provide to the society.

f. Just transition

Transition should be fostered considering local knowledge and integration, for this AFINET (Agroforestry Innovation Network) has been creating aiming at integrating practical, local knowledge and latest research knowledge in documents to be integrated in an attractive and multi-lingual knowledge reservoir that may enhance the needed just transition towards sustainable land use system

g. Food security

Agroforestry is usually associated to the use of the resources. The fact that is a multi-specific farming systems use to reduce the need of pesticides, herbicides associated to conventional farming systems, for this food security is usually better associated to agroforestry practices. Good examples of high quality products coming from agroforestry systems such as the dehesa reaches better price for their quality and security. The fact that agroforestry increases the outputs per unit of land thanks to

the better use of the resources also increases food availability and therefore food security.

vi. **Which countries and organisations are involved in the contribution?**
All national European agroforestry associations and Brasil together with the agroforestry temperate association (Canada, United States, México) and research institutions among others, can be included as we already work together. ICRAF can also be included.

vii. **How have stakeholders (for example indigenous peoples, local communities, and youth) been consulted in developing the contribution?**
AFINET is a thematic network on agroforestry where already over 500 stakeholders and farmer are integrated from 9 countries, they are happy to contribute to the development of a contribution.

viii. **Where the contribution can be put into action?**
The multi-lingual knowledge cloud can be put into action all over the world. The KC is already created (see the webpage of AFÏNET)

ix. **How the contribution will be delivered? How will different stakeholders be engaged in its implementation? What are the potential transformational impacts?**
The contribution will be associated to the already existing web page of AFINET and to the GRA, the engagement will be by sharing the information either for searching either for uploading. The potential of transformational impacts is huge because the relevance of agroforestry in mitigating and adapting farming systems to climate change but also because it could be used in any type of land such as agriculture, forestry and urban and periurban areas.

x. **Is this initiative contributing to other Climate Action Summit workstream (industry transition; energy transition; climate finance and carbon pricing; infrastructure, cities and local action; resilience and adaptation; youth and citizen mobilization; social and political drivers; mitigation strategy)?**
Farmers in AFINET have been asked about the main challenges to overcome in order to enhance the transition from conventional farming systems to agroforestry. The adoption of AF and MF systems in both conventional and organic farming systems needs to be cost-effective and overcome several **challenges** as previously described by over 400 stakeholders in the project AFINET: (i) **technical** (best combinations and organization), (ii) **economic** (value chain and business plan development), (iii) **education and communication** to the relevant stakeholders, including consumers and (iv) **policy** (CAP, IPCC, SDG, National Determined Contributions (NDC) to fulfil the Paris Agreement, the National adaptation strategies (NAS) and plans (NAP), and initiatives such as 4 per thousand (Paris Agreement). So, yes the whole value chain should be integrated to foster agroforestry all over the world

xi. **Examples of experiences to date: how does this contribution build upon this experience? How does the contribution link with different ongoing initiatives?**
The AFINET project and its knowledge cloud is the main initiative that allows farmers to include information to be shared all over the world.

xii. **Mechanisms for funding (with specific emphasis on potential for partnerships).**
We already asked for a project to expand the AFINET concept to Eastern European projects, but other initiatives like World bank can be evaluated

xiii. **Means of stewardship, metrics for monitoring.**
By the number of documents uploaded in the knowledge cloud and by the number of farmers involved.

xiv. **Communication strategy.**
The communication strategy will follow the one already working in AFINET with the reinforcement/establishment of the web page, newsletter production already existing in the GRA, news in the newspapers…

xv. **Contact details of proponents (indicating the degree of commitment among the countries and organizations that are named).**

Maria Rosa Mosquera Losada: mrosa.mosquera.losada@usc.es