“Sustainable agricultural resources. Sustainable forest management indicators, forest landscape zonification, adapted selviculture and new selvicultural models in the circular and green economy framework”

Maria Rosa Mosquera
Universidad de Santiago de Compostela – Profesora USC // EURAF President
Introduction to Sustainable management of agrarian resources

Agroforestry systems and sustainability
  * Plot Scale
  * Farm Scale
  * Landscape Scale

Circular and green economy models
Climate change is a fact that causes:

a) land degradation
   - Soil fertility losses
   - Organic matter losses

b) Land destruction
   - Fires
   - Erosion
   - Floodings
• COP21: Paris agreement Global action plan:

• Limiting global warming below 1.5% above pre-industrial levels

Therefore:

Adequate tools should be developed to
a) mitigate b) adapt c) prevent land degradation

TO PRESERVE LAND
Intergovernmental Panel Climate change assessment:

“Mitigation measures linked to increase food production (e.g., agroforestry or integrated systems) can increase food availability and access especially at the local level”.

Mitigation should be linked to preservation and improvement of soil systems as well as to land preservation.
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Circular and green economy models
<table>
<thead>
<tr>
<th>Agroforestry practice</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silvopasture</td>
<td>Combining woody with forage and animal production. It comprises forest or woodland grazing and pastoral land with hedgerows, isolated/scattered trees or trees in lines or belts</td>
</tr>
<tr>
<td>Homegardens or kitchen gardens</td>
<td>Combining trees/shrubs with vegetable production in urban areas, also known as part of “trees outside the forest”</td>
</tr>
<tr>
<td>Riparian buffer strips</td>
<td>Strips of perennial vegetation (trees/shrubs) natural or planted between croplands/pastures and water sources such as streams, lakes, wetlands, and ponds to protect water quality. They can be combined with arable lands (silvoarable) or grasslands (silvopasture) but are signified by its role in preserving water streams</td>
</tr>
<tr>
<td>Silvoarable</td>
<td>Widely spaced woody vegetation inter-cropped with annual or perennial crops. Also known as alley cropping. Trees/shrubs can be distributed following an alley cropping, isolated/scattered trees, hedges and line belts design</td>
</tr>
<tr>
<td>Forest farming</td>
<td>Forested areas used for production or harvest of natural standing speciality crops for medicinal, ornamental or culinary uses, including those integrating forest and agricultural lands</td>
</tr>
</tbody>
</table>
Cultivo en callejones

Agroforestry practices examples
Agroforestry Practices

Silvopasture
Silvoarable
Homegardens
Fores Farming
Riparian buffer strips
<table>
<thead>
<tr>
<th>Silvopasture</th>
<th>Brief description</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.5 Million ha</td>
<td>Woody + forage and animal production</td>
</tr>
<tr>
<td>10% EU potential area</td>
<td></td>
</tr>
</tbody>
</table>

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Huge Potential!!
<table>
<thead>
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<th>Silvoarable</th>
<th>Brief description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Silvoarable Image" /></td>
<td>Woody + annual or perennial crops</td>
</tr>
<tr>
<td>422,250 hectares</td>
<td><img src="image2.png" alt="Map of Silvoarable Land" /></td>
</tr>
<tr>
<td>0.4% EU Arable land</td>
<td><img src="image2.png" alt="Map of Silvoarable Land" /></td>
</tr>
<tr>
<td>USA: &lt;1%</td>
<td><img src="image2.png" alt="Map of Silvoarable Land" /></td>
</tr>
</tbody>
</table>
AGROFORESTRY

Best tool to

ECOINTENSIFICATE

Aboveground  Belowground
Aboveground

Dupraz and Liagre 2014

40% increase (20-80%)
Nutrient contamination
Belowground level

Carbon
Soil Carbon at Three Distances to Cork Oak to 1 m Depth, Mg ha\(^{-1}\)
Avoiding erosion
Fire risk

Portugal 2017: 64 people died, over 40000 hectares degraded land by fires in 3 days.
Avoiding costs and carbon losses
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Circular and green economy models
Pasture Growth curve

Cold
Temperature Precipitation
Drought

Winter Summer Autumn
Spring
OVERCOMING SHORTAGE PERIODS

Transhumance
Forest grazing

Forage trees:

Leaves and branches (ramón):
   Morus alba
   Robinia pseudoacacia
   Fraxinus excelsior
   Betula alba

Fruit:
   Acorns
   Chestnut
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Circular and green economy models
Ecosystem services delivery at landscape level

- **Road maintenance officers**
  - 125 m³/yr of fuelwood
  - 75 t of grass for each 25 km of road

- **Foresters**
  - 880 m³ of fuelwood for an area of 800 ha

- **River conservationists**
  - 460 m³/yr of fuelwood for each 55 km of river

- **Farmers**
  - 30 m³ of fuelwood/yr/farm
  - (100 ha, of which 20 ha are agroforestry + 5 km of hedges)

Canet and Balaguer, Arbre et Paysage, France
Flooding risk affecting rural and urban areas
OVERCOMING FEED SHORTAGE

TRASHUMANCE
Introduction to Sustainable management of agrarian resources
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Circular and green economy models
 Valuing agroforestry practices
 Result payments
Conecting urban and rural areas
YIELD SAFE: Plot scale
* Allows ecosystem services (including productivity) comparisons at plot scale (i.e. carbon sequestration)
* Allows comparatives of different products (understory and firewood)
* It is not calibrated and validated by all locations, species management and tree species

FARM SAFE: Farm scale
* Linked to yield safe
* Allows farm scale comparisions providing different use models for the farm
* Allows spatial and temporal models for the conversion activities to agroforestry models, by saying when, how and where the farmer has to convert the different plots he has. It considers market and profitability of the farmer.

HIGH SAFE: Landscape scale
* High resolution model
* Only modelled for two species
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Circular and green economy models
  Valuing agroforestry practices
  Result payments
  Conecting urban and and rural areas
Circular Economy
Figura 1. Evolución de los niveles de materia seca, pH, Ca y Mg a lo largo del estudio comenzando en Verano de 2001 y finalizando en Verano 2004
MOUNTAIN AREAS: SOWING AND DOSE
MOUNTAIN AREAS: SOWING AND DOSE

Febrero 1998

**ppm Cu**

- L0
- L26
- L52
- L56Dg

Febrero 1998

**ppm Zn**

- L0
- L26
- L52
- L56Dg
Trees:
  Q. rubra

Five fertilization dose:

Mineralizable N:

  0  40  80  120  160
Pasture production first year

Pasture production second year

Producción de Pasto 2003

Producción de Pasto PRIMAVERA 2004

Tratamientos
Using residues are able to reduce harvest time since planting
Zona Agrícole
Fertile
Low OM content
pH 5,5-6

Zona Monte
Low fertility
High OM content
pH 4,5-5

Metales pesados aparecen tras varios años en suelo. Niveles reducidos.
Desarrollo de fertilizantes a partir de Residuos
Acortar turnos a la vez que obtenemos productos agrícola
Conclusions

* Agroforestry is an excellent tool to combat climate change

• There is a good opportunity to preserve and mitigate climate change and make agricultural systems more resilient through adaptation to climate change
Conclusions

• Using agroforestry practices can contribute to green and circular economy, avoiding soil degradation and soil restoration.

• Adequate design of policies should be delivered in order to take advantage of Agroforestry practices to combat climate change (C increase, storage and stability) to maintain soil fertility and increase food security.
Countries with national associations members of EURAF
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1. EURAF ACTIVITIES
2. REGIONAL AGROFORESTRY NEWS
   2.1 Agroforestry Association in Sweden (Agroforestry Sverige)
   2.2 Pastoralism and Fire Prevention in Spain
3. FEATURED FARM: "Red Tractor Farm", Kea, Greece
4. FOCUS GROUP ON AGROFORESTRY
5. ASPEN AGROFORESTRY
6. EU CONSULTATION ON GREENING
7. MISCELLANEOUS
AGFORWARD
Agroforestry for Rural Development Promotion http://www.agforward.eu/

AFINET
A groforestry Innovation Network http://www.agroforestry.eu/euraf
FRANCE

GREECE