Leading | Protecting | Enhancing

Rodrigo Olave & Jim McAdam

19th June 2024 Farm Woodland Forum, Cranfield University, England, UK.

afbini.gov.uk

Greenhouse gas emission reduction using agroforestry solutions in the UK and Ireland



What is Agroforestry?

Farming system that combines trees with agricultural crops or livestock



Agroforestry plot 10th April 2010

Agroforestry plot 26th April 2022

Grassland plot 4th September 2023

Source or Sink for GHG emissions ?



Internationally : Expectations on all sectors to further reduce emissions and hold global temperature rise below 1.5°C.

Europe : the Climate and Energy Package 2030 sets out an EU obligation to reduce total emissions by 40% by 2030.

UK : Climate Change Act 2008, requires an 80% reduction in emissions across all sectors by 2050.



Environmental Benefits of Agroforestry Systems

- Improved nutrient cycling
- Moderation of drainage
- Reduced soil erosion
- Enhanced animal welfare
- Carbon sequestration
- Offsetting of gaseous emissions
- Buffering for aquatic pollutants
- Shelter from wind and rain
- Shade from sun
- Enhanced biodiversity





Greenhouse gas calculations

To quantify GHG emissions, activity data from grassland, woodland and silvopasture experimental plots at AFBI have assessed using *cradle to farm gate* methodology.

Emissions from land-use, livestock and energy are assumed from IPCC methodology. Livestock emissions are also compared with Greenfeed measured emissions from individual animals

Emission sources at the plot scale are summarized for the GHG - CO2 CH4 and N20.

Emissions sinks from trees and soil are also summarized. Total emissions are expressed per unit of output, per hectare and per livestock unit equivalent to allow comparisons to be made between experimental plots.



Examples of GHG emission measurements at the AFBI agroforestry site



Greenfeed to measure fluxes from sheep



Static flux chambers to measure gases from soil

Preliminary results : GHG emissions from grassland plots





Sheep emissions by gas (%)

Sheep emissions by source



- Total CO₂ from energy use
- Total CO₂ from methane
- Total CO₂ from nitrous oxide





Preliminary results: GHG emissions from agroforestry plots

Whole plot emissions by gas (%)



Whole plot emissions by source (%)





• Sheep emissions by gas (%)

Sheep emissions by source









Preliminary Results: Experimental Plots

Results are on a per plot basis

Total emissions (kg CO2e)	
Emissions from grassland plots	8,471
Emissions from agroforestry plots	8,881
Sequestration by agroforestry	3,681
Sequestration by woodland	10,890
Sequestration by soil	0*
*Sward is over 20 years old and therefore according to IPCC is at C equilibrium	
Net emissions (kg CO2e)	
Grassland	8,471
Agroforestry	5,200
Woodland	-10890



Conclusions

- Grassland has higher emissions than net Agroforestry emissions, due to the offsetting of emissions by trees.
- However, saleable products (meat and wool) are similar from both systems suggesting that measures in both systems can be identified to improve efficiency and reduce greenhouse gas emissions.
- Animal performance data shows no discernable weight gain benefit from grazing in agroforestry by ewes or lambs, although other metrics including animal health and welfare are being assessed.
- More data (past and current) from field trials will be used to generate and refine specific emissions data from these systems – both animal activity and performance and emissions from soil.



DAERA for funding the project (**22/1/05): AGROFORESTRY:** Responding to climate change – Adaptation and mitigation





www.daera-ni.gov.uk