



Looking for an eco-sustainable sheep supply chain

Editorial

Matilde Schirru

StS LIFE Communication Manager

Institute of BioEconomy IBE- CNR

After sowing, it is time SheepToShip LIFE to harvest. This second newsletter, six months after the end of the project, condenses in a few pages the ecoinnovations proposed for the ecological transition in the sheep sector in Sardinia. How to cut 20% of greenhouse gas emissions in ten years is suggested by the mitigation techniques presented, from pasture and soil management to flock management and improved farm efficiency, in order to increase milk production per capita and the quality of its products, with a corresponding increase in farm income. Climate change mitigation strategies are presented here by the project partners as a simplified and comprehensible summary of ecoinnovation. The ultimate goal is to communicate without technicalities to the broader public. To communicate not only the project but also the only possible direction for the sheep sector, in Sardinia and elsewhere, for a sustainable present and future.

On the subject of the future, Lukas Bayer, research fellow at CNR's Institute of BioEconomics (IBE), involved the project team in a fruitful vision exercise: a collective reflection on the road travelled so far. What is the "cultural" legacy? What is the "cultural" inheritance, what are the commitments and goals of Sheep-



ToShip LIFE that Sardinian sheep farming will have taken on by 2030? It emerged how SheepToShip LIFE has so far not only promoted ecoinnovation but also stimulated and promoted resilience to climate change of the entire agro-pastoral context, linked to sheep production, to economic values, cultural and social identity and to the protection of the territory of Sardinia. Instead, looking to the future, to what the project will have produced by 2030, the project team imagines a balanced sheep supply chain, in which the more intensive production systems will have improved production and farm efficiency in general, with great results in terms of environmental and animal welfare; and in which the more extensive farms, on the other hand, will see their low-input production efforts recognised and fairly compensated, with respect to the perpetuation and defence of ecosystem services. As we close this Newsletter, the first doses of the SARS-Cov2 vaccine are

being distributed around the world. With the best wishes for renewed confidence in science and its solutions to the challenges that lie ahead, primarily climate change,

Happy new 2021!

Summary

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## Innovation and climate change: on sheep farmer awareness in Sardinia.

**Giovanni Battista Concu,**  
**Uniss—DISEA**  
*gbconcu@uniss.it*

Sheep farming is a sector that has the potential to reduce their greenhouse gas (GHG) emissions through the adoption of a variety of practices, which may also provide individual farmers with significant benefits. As part of the SheepToShip LIFE project, the DISEA group of the University of Sassari has undertaken a investigation on farmers' attitudes towards climate change and innovation. Previous studies have found that belief in climate change is linked to more support for climate change actions. Through a survey of over 120 sheep farmers, the investigations have found that 93% of participants is aware of the necessity of innovating their business to stay on the market and over 63% declared to have adopted a process or product innovation in the last 5 years. On the topic of climate change, over 90% of interviewed farmers believe it is necessary to adapt to climate change while only 36% is willing to adopt innovations to mitigate their emissions. This results are not surprising: as mitigation strategies have a clear and direct cost on farms, their benefits accrue mostly to the community and farmers perceive them as uncertain. The role of research is then to provide mitigation strategies that create direct benefits for farmers -either through efficiency improvements or shielding the farm from the negative effects of climate change- and communicate with farmer by stressing the impact that these innovations have on the business' bottom line.



## L'innovazione incontra i territori: Workshop dimostrativi e di confronto con gli allevatori sardi.

**Domenico Usai,**  
**LAORE**

*DomenicoUsai@agenziaaore.it*

As part of the project, focus group meetings were organised with various operators and stakeholders in the sheep sector. The aim of these meetings was to validate the proposed techniques and identify barriers and possible solutions to the adoption of innovations. The main assumption of this participatory process was both to transfer knowledge from the scientific world to the agricultural world and to develop and share research lines. This type of participatory approach, through the use of specific techniques (Metaplan), made it possible to investigate and highlight the strengths and weaknesses, threats and opportunities of the good environmental practices analysed in the project. In order to make the surveys more representative, it was decided to organise the meetings in different areas of the island. Between June and September 2020, 4 meetings were held in 4 territories: Nurra Marghine, Guilcier Barigadu, Campidano-Marmilla for a total of 41 farmers and professionals who actively interacted with the project staff and discussed the proposed innovative approaches.

The 6 mitigation techniques presented to the participants concerned:

1. increasing the reproductive efficiency of the herd;

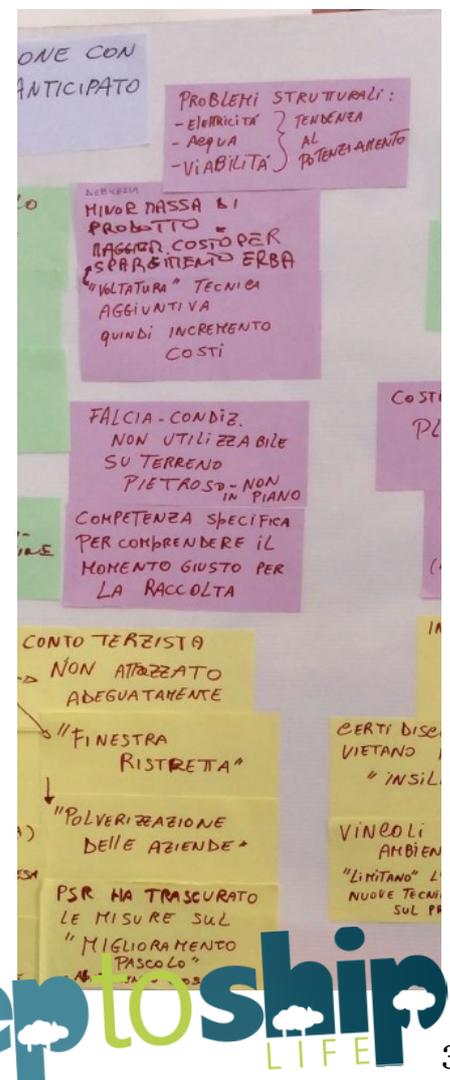
2. efficiency monitoring through the measurement of milk production per animal;

3. haymaking techniques through the use of early cutting but also the production of banded hay-silo;

5. Pasture management and improvement with forage legumes and low-input processing techniques, but also improved, self-seeding and persistent pastures.

The feedback from the participatory meetings revealed the need for greater efficiency in the relationship between farms and external services, both public and private. The essential prerequisite for a generalised innovation process is to give a new impetus to the transfer of innovations through training services. One aspect that the production world has highlighted is that of being able to have new commercial policies and incentives for companies that adopt appropriate measures to combat the pressing environmental emergencies. This can be achieved by also enhancing the function of safeguarding the territory and areas that from an agronomic point of view are less suited to fodder production. Another very important aspect, highlighted by the interlocutors during the Focus Groups, is that of being able to focus on a

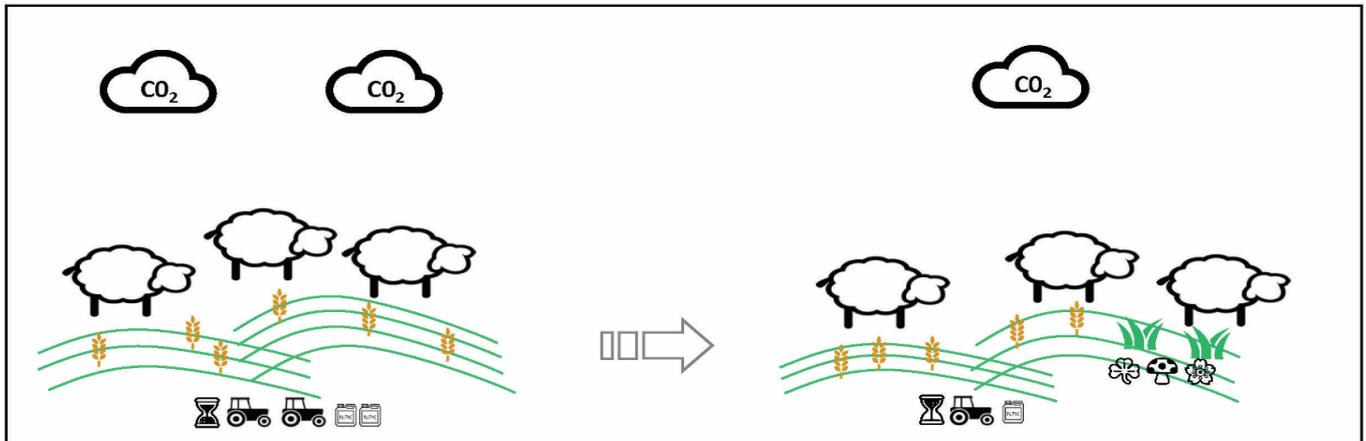
strategy of greater product quality diversification and a corresponding different remuneration for those who really produce quality milk and cheese. In particular, an adjustment of the RDP was requested in order to provide real and effective incentives for quality production and to take into account the different production contexts. The observations collected in the participatory process will be contributed to the construction of the cognitive framework of the sector of the Environmental Action Plan, promoted by the project, as an operational governance tool.



## Pasture improvement in climate change mitigation strategies in Sardinia.

Antonello Franca  
CNR– ISPAAM  
[antonio.franca@cnr.it](mailto:antonio.franca@cnr.it)

Pasquale Arca  
CNR– IBE  
[pasquale.arca@ibe.cnr.it](mailto:pasquale.arca@ibe.cnr.it)



The improvement of natural pastures and the incorporation of semi-natural permanent pasture into the cropping pattern of the model farms are some of the mitigation techniques adopted in the project. Both are based on the use of specific mixtures of self-seeding, perennial annual grasses and legumes that can persist in the soil for several years. The "improved" natural pastures and the semi-natural permanent pastures are created respectively by over-seeding (without any tillage) and sowing (preceded by light soil tillage) of the mixtures, prepared ad hoc in relation to the pedoclimatic conditions of the site and promoting the conservation of the local agrobiodiversity. Management involves rotational grazing, weed control by chopping and interruption of spring grazing in the first year to allow self-seeding of annual species.

The conversion of grassland into permanent semi-natural pasture allows for a reduction in the fre-

quency of annual tillage, resulting in savings in energy, labour and time inputs. From an environmental point of view, greenhouse gas emissions related to tillage are reduced and soil fertility is improved; from a management point of view, this results in reduced production costs, optimised management of farm activities and earlier availability of autumn pasture.

The improvement of natural pastures allows to increase the quality of the forage that can be grazed, leading to economic advantages (lower purchases of off-farm forage and fertilisers), productive advantages (improves the quality and digestibility of self-produced forage, with a consequent increase in production performance) and environmental advantages (reduction in emissions of enteric methane and other greenhouse gases).

## Grazing sheep feeding and greenhouse gas emissions

**Alberto Atzori**  
Uniss Dept. Of Agriculture  
[asatzori@uniss.it](mailto:asatzori@uniss.it)

**Mauro Decandia**  
AGRIS  
[mdecandia@agrisricerca.it](mailto:mdecandia@agrisricerca.it)

Life cycle assessment (LCA) on sheep farms in Sardinia from SheepToShip project, confirmed that animal diet is the crucial element for mitigating methane emissions and carbon footprint of sheep milk. In general animal emissions are reduced ( $\text{CH}_4$  and  $\text{NO}_2$  per animal or per kg of ingested DM) with high digestible diets. Theoretically, in sheep grazing system increase diet digestibility is easy and possible by increasing pasture intake when plants are in vegetative stage.

Digestibility grasses depends on forage species, plant parts, physiological stage, cultivation and/or management techniques. Providing the sheep with grazing for as long as possible in a leaf-rich (vegetative) phase (rapid grazing rotation or part-time access to grazing) leads to a mitigation of emissions. The 'sweeter' grass grazed during the afternoon hours allows the ruminal microbes to better utilize the nitrogen in the grass. Species are rich in water-soluble carbohydrates (WSC) with similar effects and advantages in high nutritive value. Other species (e.g. sulla) contain bioactive com-

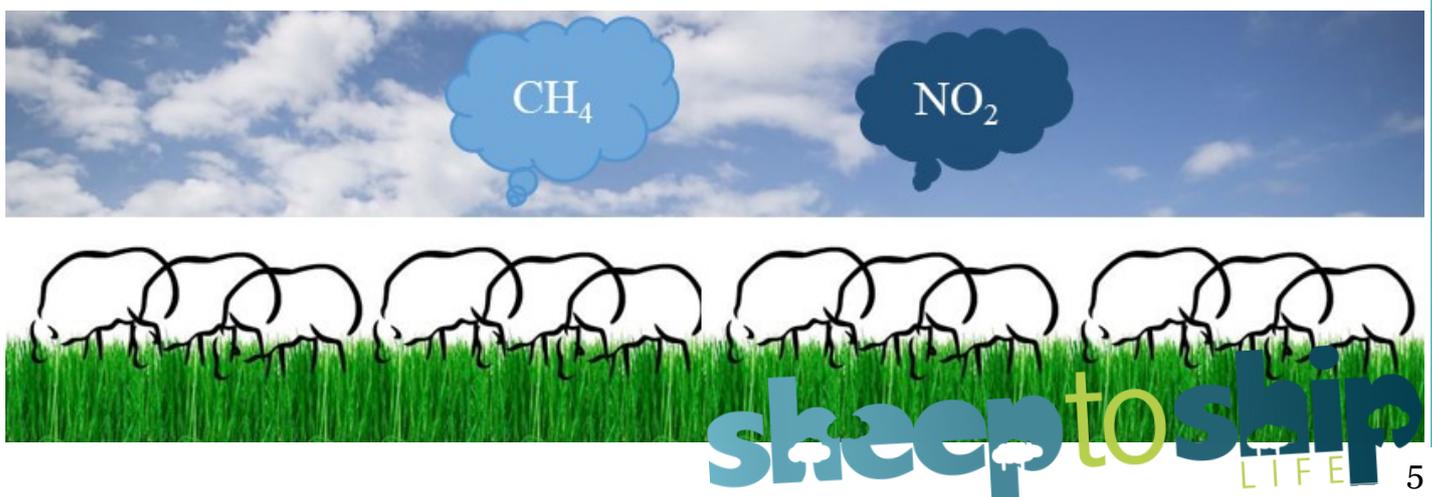
pounds (tannins, saponins) that can reduce  $\text{CH}_4$  and  $\text{NO}_2$  emissions.

The plant maturity stage is also fundamental to produce high digestible hays, silages and haylages. Indeed, digestibility is higher in leaves than in stems and decreases with plant maturity due to the higher concentration of cell wall constituents (NDF, ADF and ADL). Thus high quality hays need to be produced with early cuts to improve feed efficiency and reduce impacts.

The use of cereal concentrates also reduces  $\text{CH}_4$  production and nitrogen excretion allowing synchronizing ruminal fermentations when used as supplement on sheep grazing high protein pastures. Whereas with "fibrous" and poorly pastures (e.g.: cereal stubble or grassland at the earing stage) the use of appropriate additives (e.g. feed blocks based on molasses, nitrates, urea, fatty acids) can increase the digestibility of the diet and reduce emissions.

<sup>1</sup>NDF=neutral detergent fiber; ADF= acid detergent fiber; ADL= acid detergent lignin.

<sup>2</sup>WSC = water soluble carbohydrates



## Animal management by ecoinnovation.

**Mauro Decandia**

**AGRIS**

*mdecandia@agrisricerca.it*

Within the project we identified hot spots related to GHG emissions on dairy sheep farms in Sardinia. Some mitigation strategies have been studied and partly implemented, concerning the following areas of intervention in the production process of sheep farms. Ecoinnovations related to animal management aim to increase their reproductive and production efficiency and thus reduce the farm's carbon footprint (CF, kg CO<sub>2</sub> eq /kg milk). The increase in reproductive efficiency reduces the proportion of non-productive animals that still participate in the farm CF and whose contribution to GHG emissions is amortized on the production of the productive part of the flock. By adopting appropriate protocols on the reproductive management of the flock, the average total fertility of the animals could be increased to 98-99% with an increase in the number of lambing ewes, a better distribution of births and a

consequent increase in milk production on the farm. The increase in production efficiency is equally important, the more individual sheep produce the lower the CF on the farm. The presence of unproductive animals is not only economically but also environmentally convenient. The identification of low-productivity animals and their timely elimination can be carried out either through periodic production controls (using an external service, such as that carried out by the breeders' associations (today AARS)) or by using milking machine equipped with automatic individual milk production meters (flow meters). The latter solution allows more frequent checks on the animals but is likely to be more expensive and requires the farmer to be more familiar with computers.

## Environmental Action Plan of the Autonomous Region of Sardinia

**Federica Romano**

**ENVIRONMENTAL PROTECTION  
COUNCIL FOR AUTONOMOUS  
REGION OF SARDINIA**

*fromano@regione.sardegna.it*

Through the Service for Environmental Sustainability and Informative Services (SASI), the Regional Ministry of Environment Defense of the Autonomous Region of Sardinia participates in the SheepToShip LIFE project as a partner which contributes to the implementation of all project activities and the achievement of expected results with a role of particular importance as coordinator of the project action C.4 relating to the execution of the Environmental Action Plan for the Sardinian sheep sector. The Plan represents the main operational tool that SheepToShip LIFE project develops to achieve the final objective of the project, that is, the reduction of greenhouse gas emissions (CO<sub>2</sub> equivalent) of the sheep sector in Sardinia by at least 20% in 10

years. In consideration of this objective and of outputs as well as intermediate results achieved (milk and cheese LCA studies, good practices manuals for the mitigation of environmental impacts in farms and cheese factories and demonstrative actions), the Action Plan will formulate the mitigation policies for the sector with the involvement of the main stakeholders by promoting a participatory governance approach. More in detail, the Plan will identify ecoinnovation techniques as well as technological improvements for the sheep sector from an environmental point of view, in order to encourage their adoption by final beneficiaries supported by regional planning tools such as the Rural Development Program (PSR of Sardinia).



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### **Project Officer**

Pierpaolo Duce

Pierpaolo.duce@ibe.cnr.it

Tel. +39 079 2841503

### **Project Manager**

Enrico Vagnoni

enrico.vagnoni@ibe.cnr.it

### **Communication Manager**

Matilde Schirru

matilde.schirru@ibe.cnr.it