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PRESERVING AND MANAGING FOREST HABITATS IN THE MEDITERRANEAN AREA

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NATURA 2000

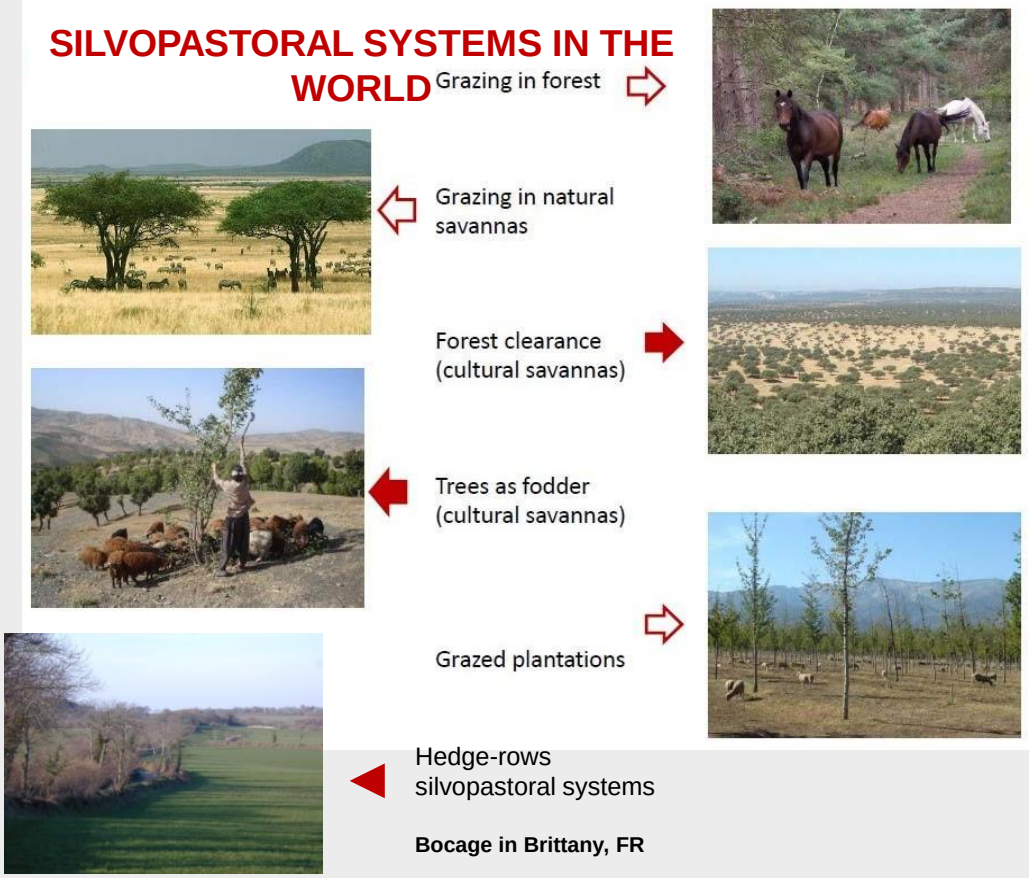
Grazing in the forest: critical issues and solutions

GIOVANNA SEDDAIU

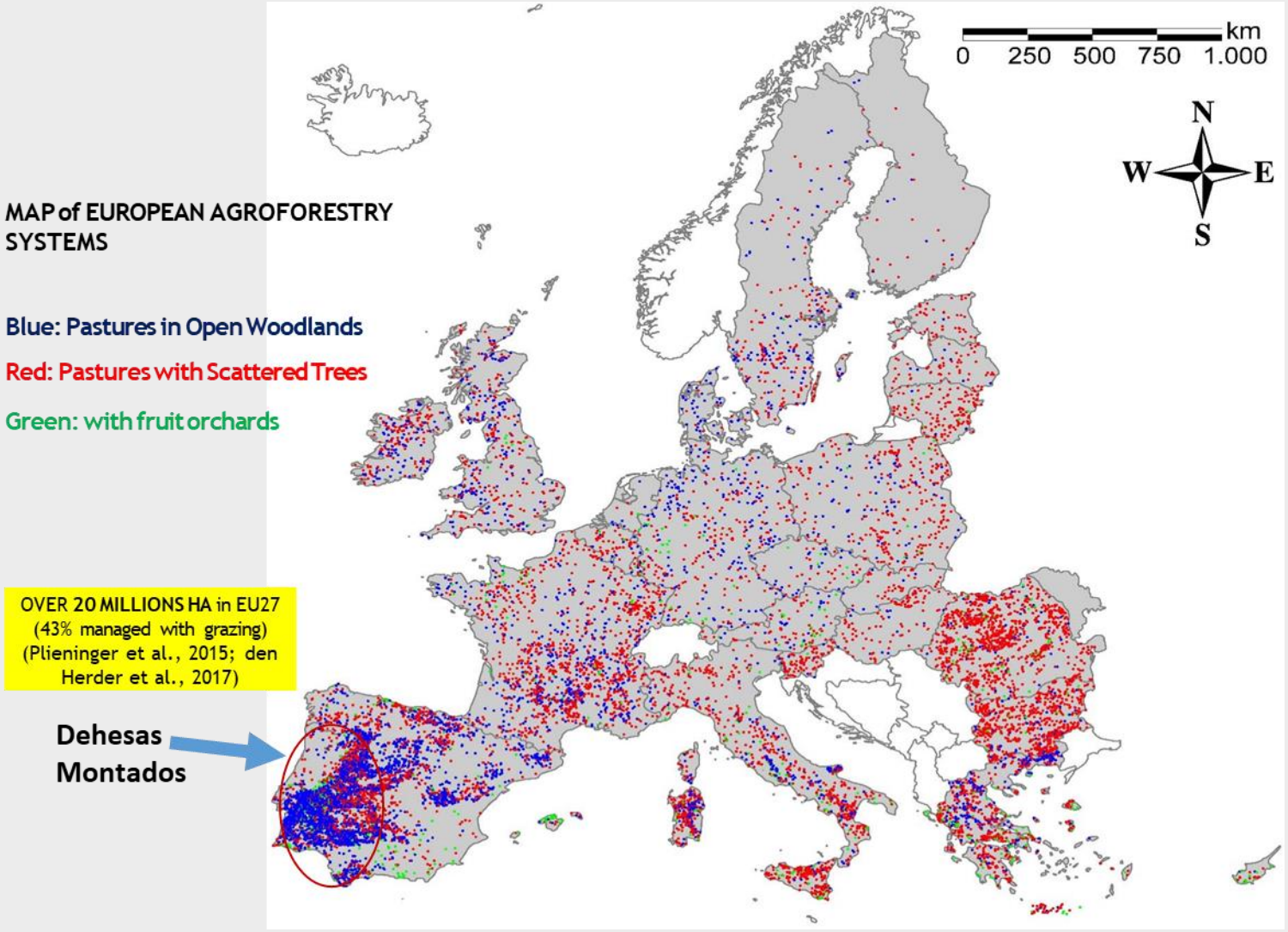
DIP. AGRARIA E NUCLEO RICERCA DESERTIFICAZIONE – UNIVERSITA' DI SASSARI)

Grazed forests
An example of silvopastoral systems

(Intentional) combination of forest production with herbaceous and livestock production present simultaneously or sequentially in the same unit of area. They include grazed forests, wooded pastures, open grazed woodlands, but also fodder and cereal crops combined with trees and grazing.



Grazed forests
An example of silvopastoral systems



Grazing in forest
An example of silvopastoral systems

Situation in Italy

Table 1 Extent and distribution of agroforestry in Italy based on LUCAS data categorized according to two systems and relative to the utilised agricultural area (UAA) and total extent. (from den Herder et al. 2017)

Agroforestry type	Primary land cover			Total ('000 ha)	Proportion of UAA (%)	Ranking in EU-27 in terms of total area
	Permanent crops ('000 ha)	Woodland ('000 ha)	Shrubland and grassland with sparse trees ('000 ha)			
Agroforestry with livestock	116.2	622.4	565.0	1303.6	10.1	4th
Arable agroforestry	90.3	15.8	0.0	106.1	0.8	2nd
Total	202.2	638.2	565.0	1403.9	10.9	4th
Utilised agricultural area (UAA)				12,856.0		

Paris *et al*., 2019. Agroforestry Systems, 93, 2243–2256

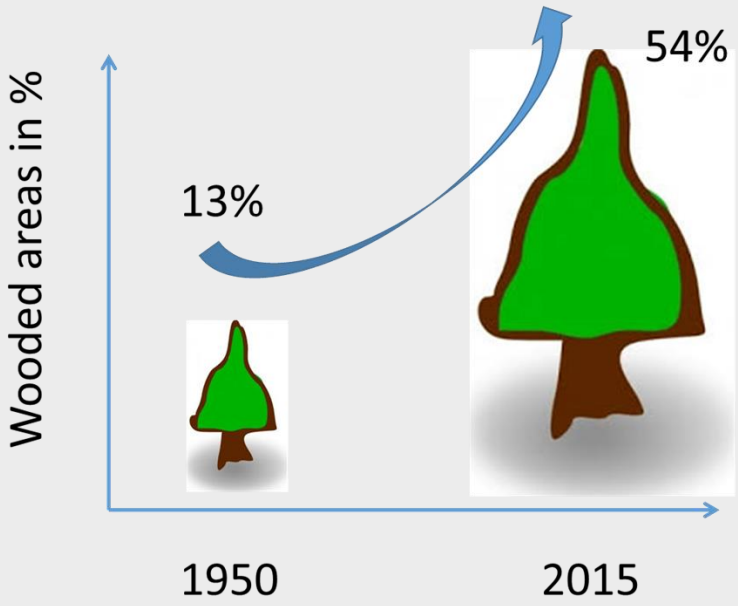
Grazing in forest
An example of silvopastoral systems

Situation in Sardinia, Italy

Forests: ~600,000 ha

Other wooded areas: ~600,000 ha

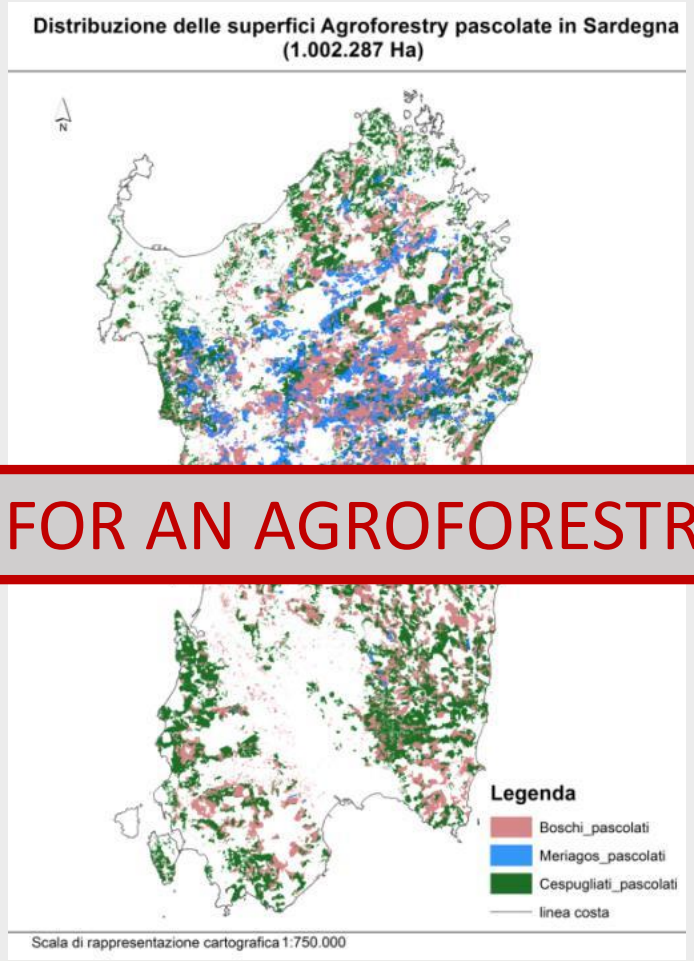
(INFC - ⇒ http://www.sian.it/inventarioforestale/)



From Pulina, 2016

Grazing in forest
An example of silvopastoral systems

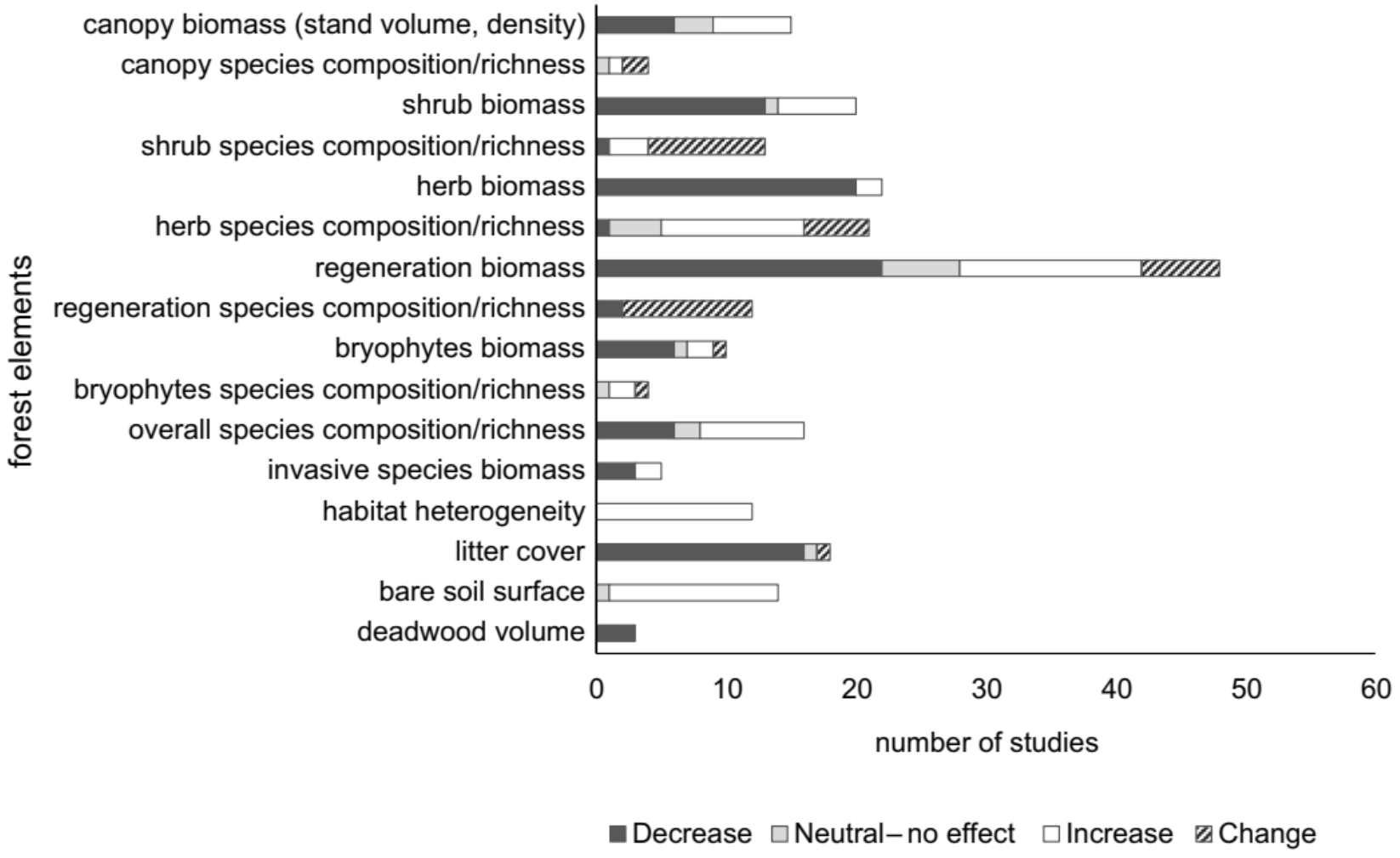
Situation in Sardinia, Italy



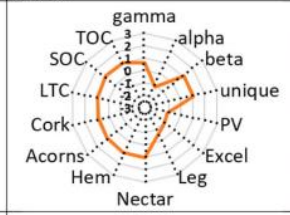
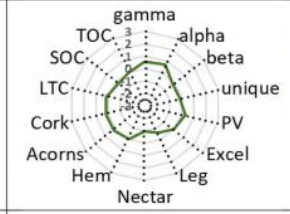
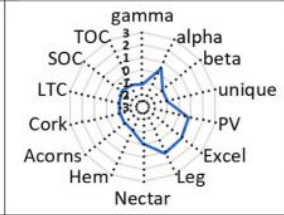
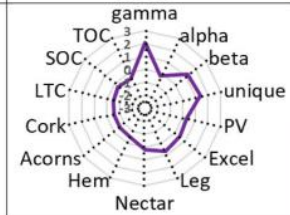
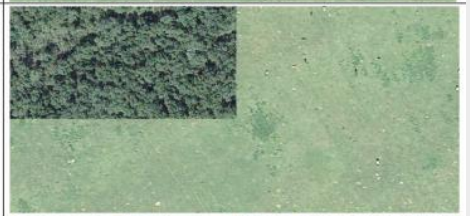
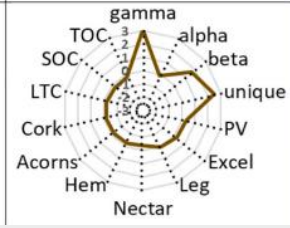
NEED FOR AN AGROFORESTRY AND SILVOPASTORAL MAP

Around 1 million ha of agroforestry areas with grazing animals

Grazing in forest
Trade-offs between constraints and benefits



Grazing in forest
Trade-offs between different ecosystem services

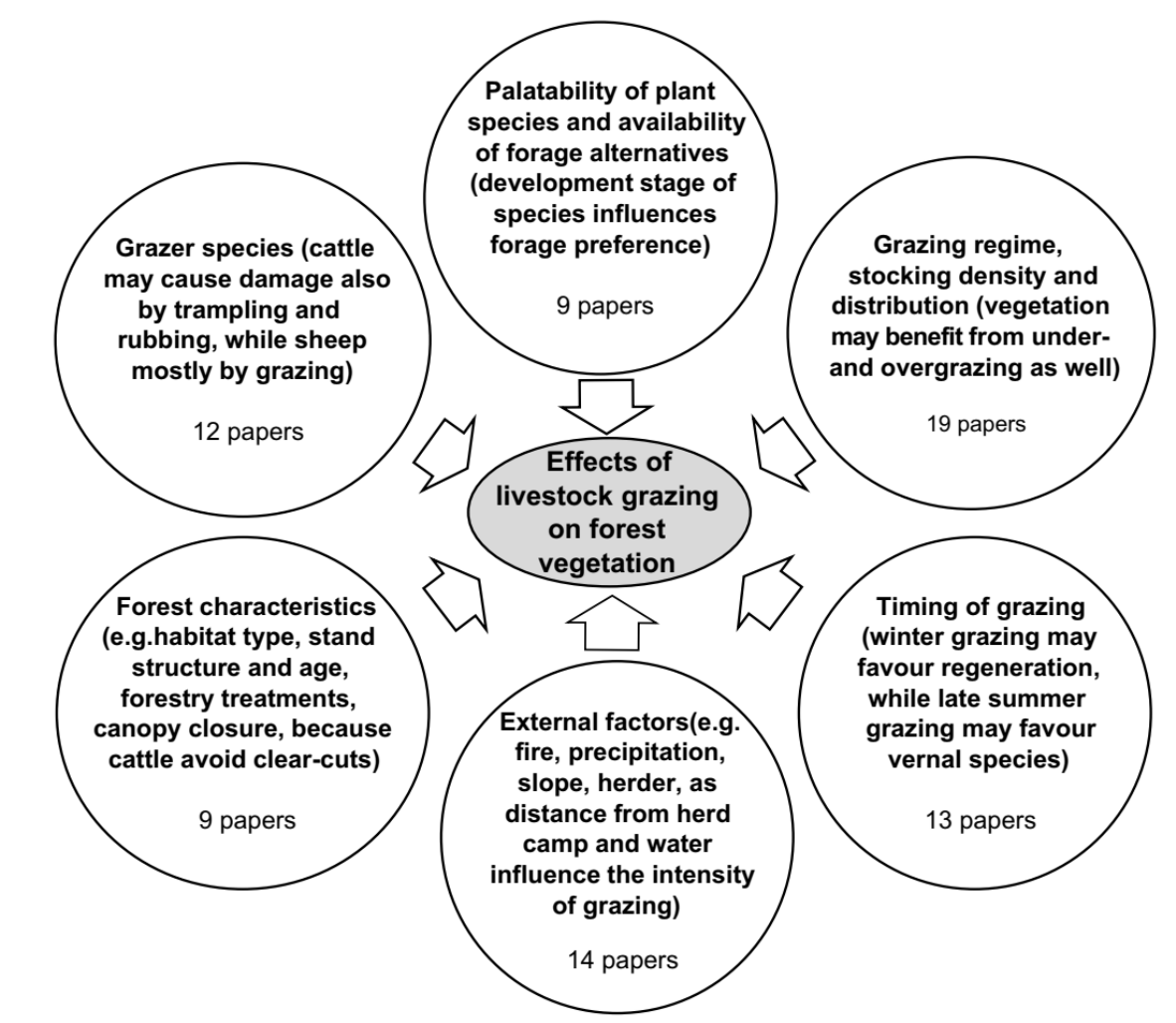
Land uses	Standardized diversity and ES indices	Sample illustration
WL		
WG Dehesa type		
OG		
Specialized		
Patchy		

The “Specialized” and “Patchy” scenarios were characterized by higher plant diversity and similar or better ecosystems services than the “Dehesa” scenario and the “Woodland” scenario.

Bagella et al., 2020. Agricultural Systems, 185, 102945.

Grazing in forest

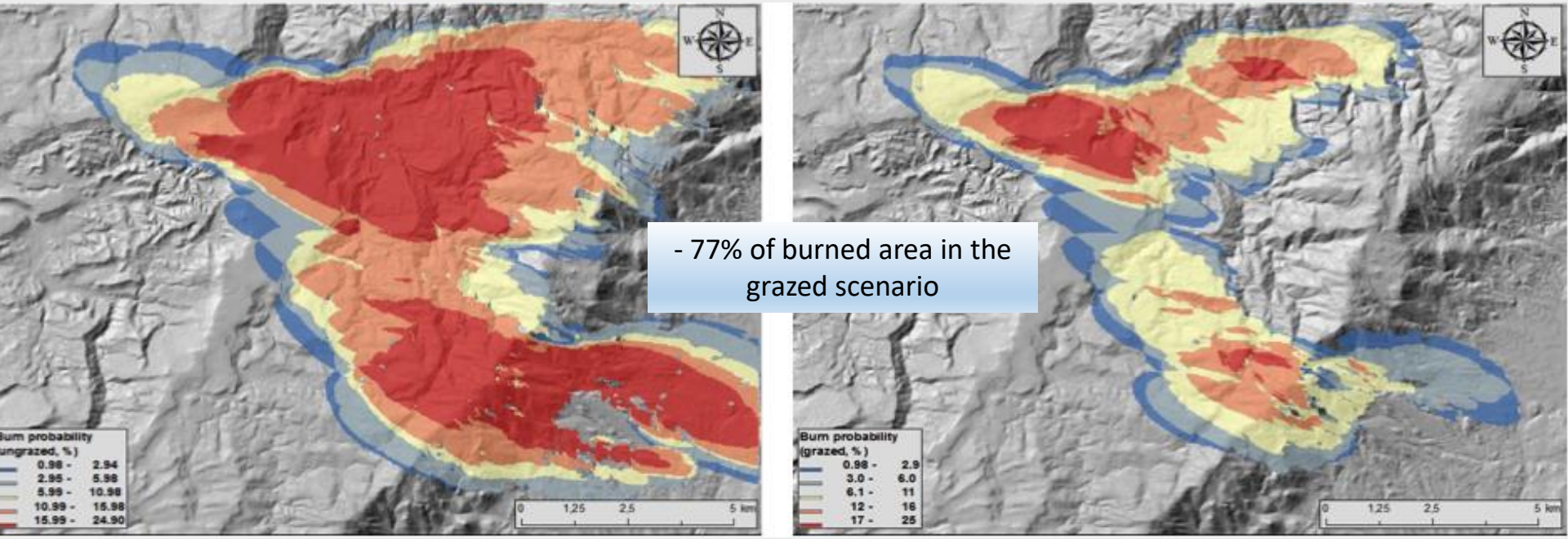
Main biotic and abiotic factors that influence the effects of forest grazing



Grazing in forest: Potential benefits

- to control or encourage the spread of forest to create landscape-scale vegetation mosaics which have been shown to have high cultural and biodiversity values
- to favour desired vegetation structures and compositions for conservation and forestry reasons
- silvicultural tool for suppressing competitive herbaceous and woody species in plantations and in controlling invasive woody species
- role in fire mitigation, reducing the flammability of forests through reducing the combustible load of the forest understorey, representing a potential management tool in the context of increasing incidence of extreme forest fires as an outcome of climate change.
- to generate income for farmers through the sale of animals or meat, thus helping to support local livelihoods and communities

Grazing in forest: Wildfire risk mitigation



Propagation probability on ungrazed (left) and grazed (right) scenario estimated by FARSITE simulator

Franca et al., 2012. Effects of grazing on the traits of a potential fire in a Sardinian wooded pasture. Options Méditerranéennes, A, no. 102, 2012 – New approaches for grassland research in a context of climate and socio-economic changes.

Grazing in forest: Wildfire risk mitigation

sustainability

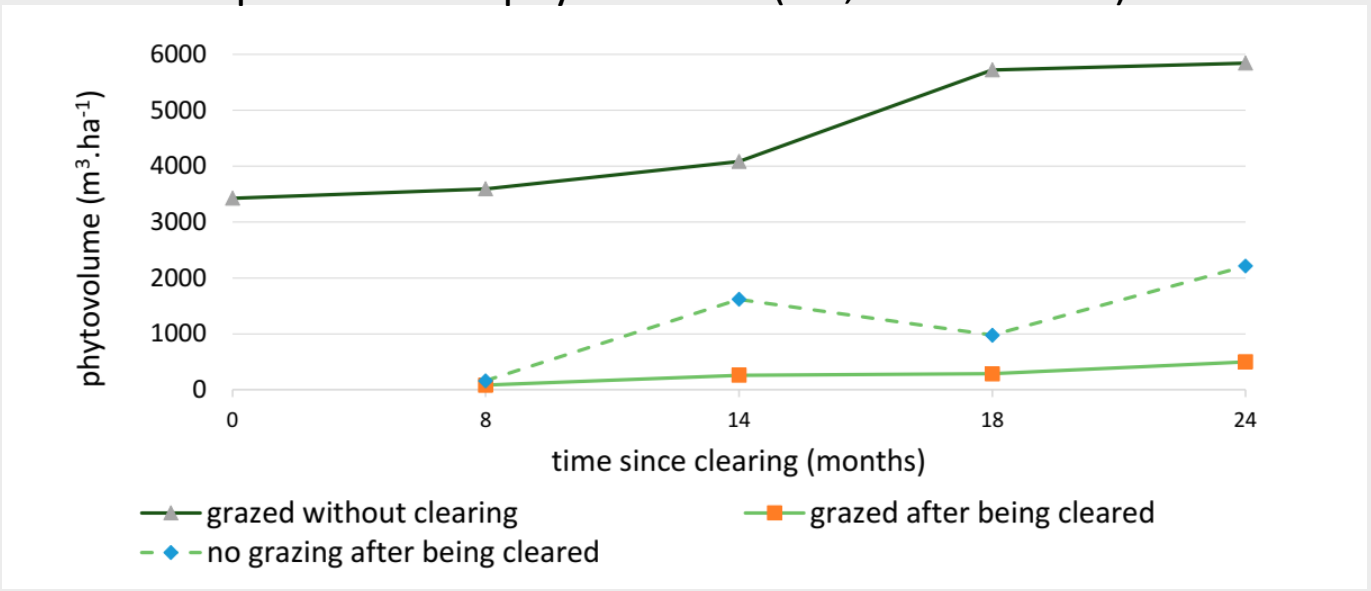
MDPI

Article

Understory Clearing in Open Grazed Mediterranean Oak Forests: Assessing the Impact on Vegetation

Marina Castro [1,*], João Paulo Castro [1] and José Castro [2]

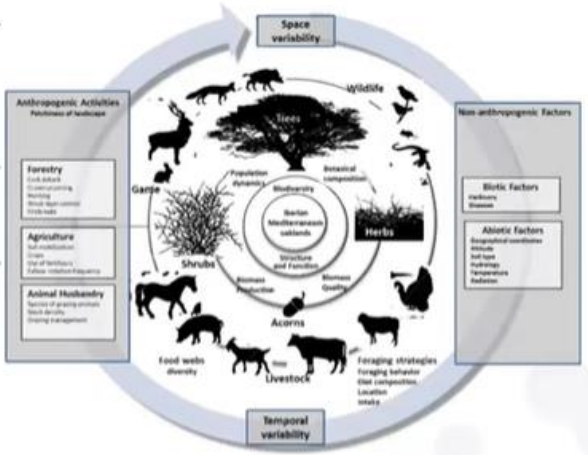
Development of the phytovolume (i.e., fuel biomass) since clearing



Grazing in forest: Potential benefits

The benefits of silvo-pastoral systems for **mitigation** and **adaptation** to climate change

Climate change activity	Major climate change functions	Agroforestry functions that support climate change mitigation and adaptation
Mitigation	Sequester carbon	Accumulate C in woody biomass
		Accumulate C in soil
	Reduce GHG emissions	Reduce fossil fuel consumption in equipment
		Reduce CO_2 emissions from farmstead structures
		Reduce N_2O emissions by greater nutrient uptake and reduced N fertilizers
		Reduce CH_4 by enhancing forage quality
Adaptation	Enhance resilience	Maintain quality and quantity of products
		Increase habitat diversity
		Increase structural and functional diversity
		Foster diversified production opportunities
	Reduce threats	Reduce impacts of extreme weather events
		Reduce stress in flora and fauna
		Provide travel corridors for fauna migration



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Hernández-Morcillo, M., Burgess, P., Mirck, J., Pantera, A., & Plieninger, T. (2018). Scanning agroforestry-based solutions for climate change mitigation and adaptation in Europe. Environmental Science & Policy, 80, 44-52.

Perceived constraints of silvopastoral systems in Italy

- Farm labour complexity
- Difficult grazing animal control
- High management costs
- Competition by wild animals
- Difficult mechanization

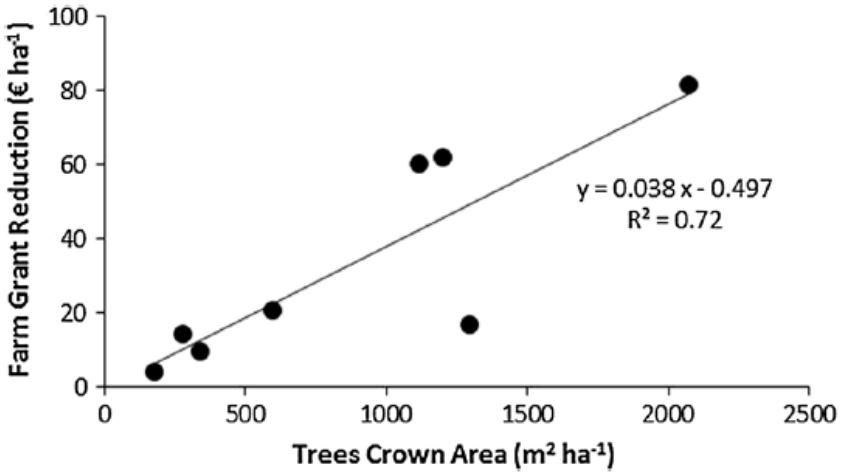


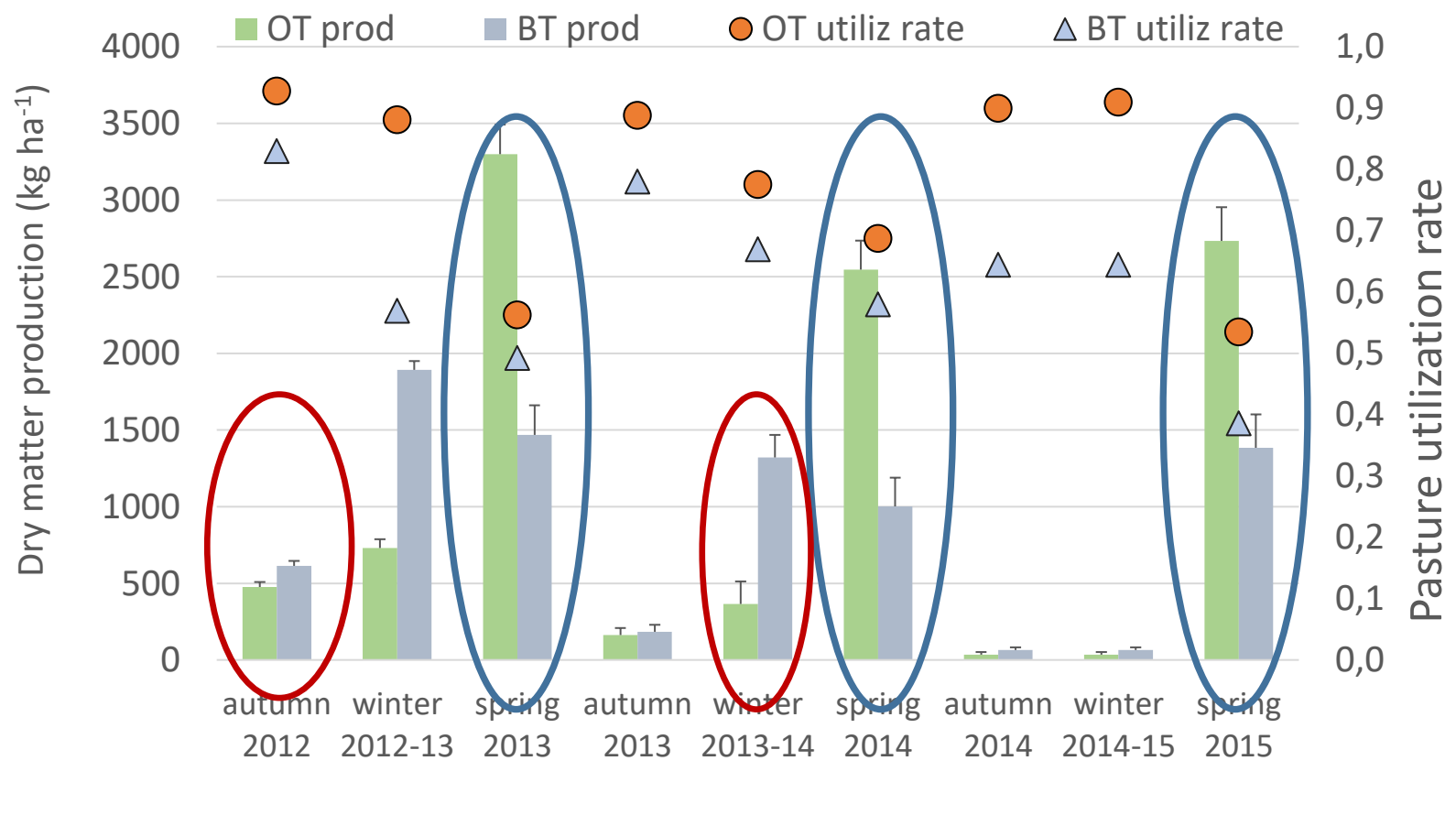
Fig. 1 Reduction in Pillar 1 EU single farm payments in relation to the area occupied by trees in agricultural areas, based on crown projection in Italy. (Perali 2011/2012)

AGFORWARD
Agroforestry for Europe

Paris et al., 2019. Agroforestry Systems, 93, 2243-2256

Role of trees in forage availability in Med silvopastoral systems

Seasonal dry matter production in relation to the positions below (BT) and outside (OT) of the tree canopy in the wooded grasslands



Seddaiu et al., 2018. Agroforestry Systems, 92 (4), 893–908

Grazing in forest: Which innovations?

Pasture productivity and quality:

a) Selection and multiplication of species suitable for different silvopastoral conditions, with focus on **site-specific mixtures**, identified on the basis of pedo-climatic conditions and grazing characteristics

b) Introduction of Innovative techniques for grazing management, as tools for improve **sustainability** (Virtual fences, GPS collars, adaptive grazing, etc.)

Evaluation of multiple ecosystem services: C sequestration, water quality control, biodiversity conservation, fire prevention etc. in different environmental and management contexts. Agro-environmental payments and/or Payments for ecosystem services

Green accounting: Economic evaluation of silvopastoral systems must include the provisioning of environmental goods and services

Improving pasture productivity and quality in Med silvopastoral systems

Dry matter yield (DMY)

LEGUME BASED SWARD	DMY kg ha^{-1}				
	PS		FS		LI
L100MIX	1641.6	a	2920.2	a	*
L80GMIX	1945.6	a	4270.4	b	***
100BCLO	1660.3	a	3566.4	ab	**
L60SNPA	1331.3	a	3210.1	ab	**

L100MIX = Fertiprado commercial mixture, L80GMIX = CNR ISPAAM mixture, 100BCLO = *Trifolium spumosum* L., pure sward, L60SNPA = Unsown semi natural pasture.

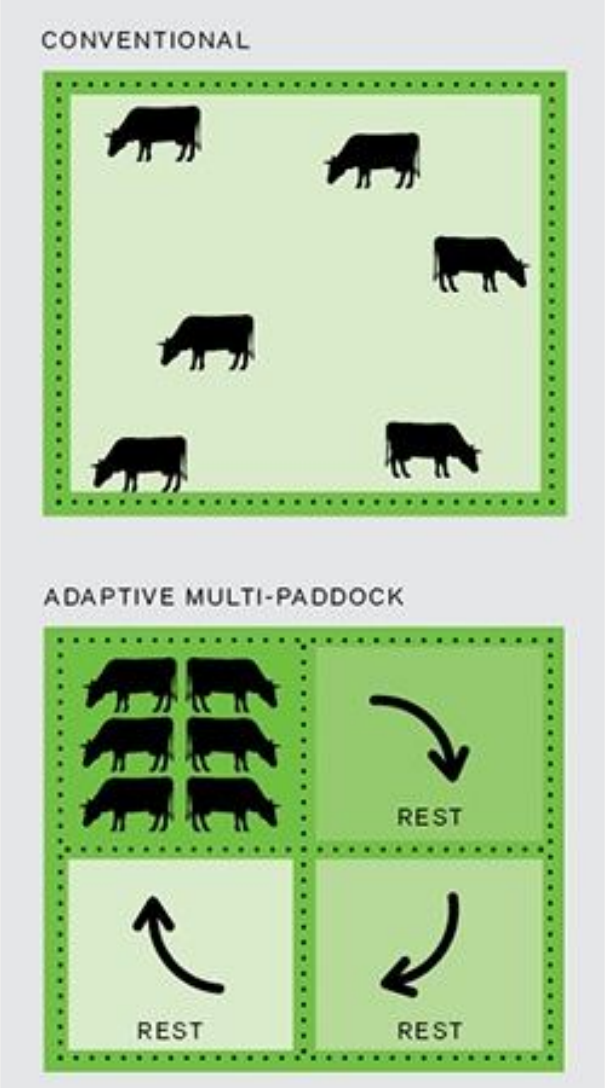
Crude proteins (CP)

Legume based sward	CP		
	%		
	PS	FS	LI
L100MIX	18.5^{c}	12.4^{bc}	**
L80GMIX	14.9^{b}	9.5^{ab}	**
100BCLO	17.9^{bc}	14.1^{c}	*
L60SNPA	9.5^{a}	8.6^{a}	NS

- Light intensity markedly affected DMY of legume-based swards that were halved
- beneath cork oak cover, at 15–30% of the effective light radiation.
- Crude protein content of forage significantly increased in partial shade
- If expressed on a hectare basis, in some mixtures differences of crude protein yields between PS and FS were less relevant.

Sanna et al., 2019. Agroforest Syst (2019) 93:2151–2161

Improving grazing systems in Med silvopastoral systems:
Adaptive multi-paddock grazing (AMP)



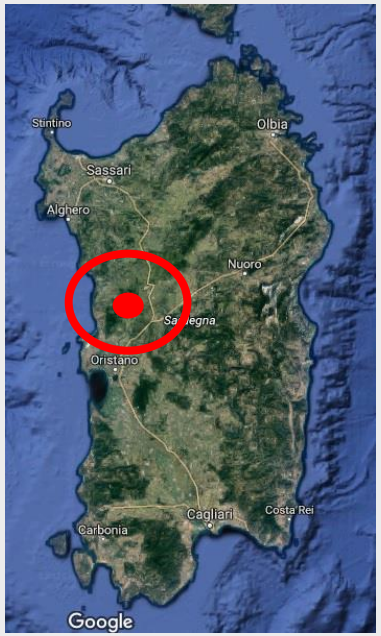
What is the AMP grazing?

- very high instantaneous stocking rates
- very short grazing events
- long restoring periods….
- within a rotational scheme of “adaptive” paddocks in terms of surface, grazing animals, and management decision making

Improving grazing systems in Med silvopastoral systems:
Adaptive multi-paddock grazing

Research question

Can the AMP grazing be more effective than continuous grazing systems in supporting the **biodiversity** and the **provision of ecosystem services** in Mediterranean *Quercus*-based silvopastoral systems?

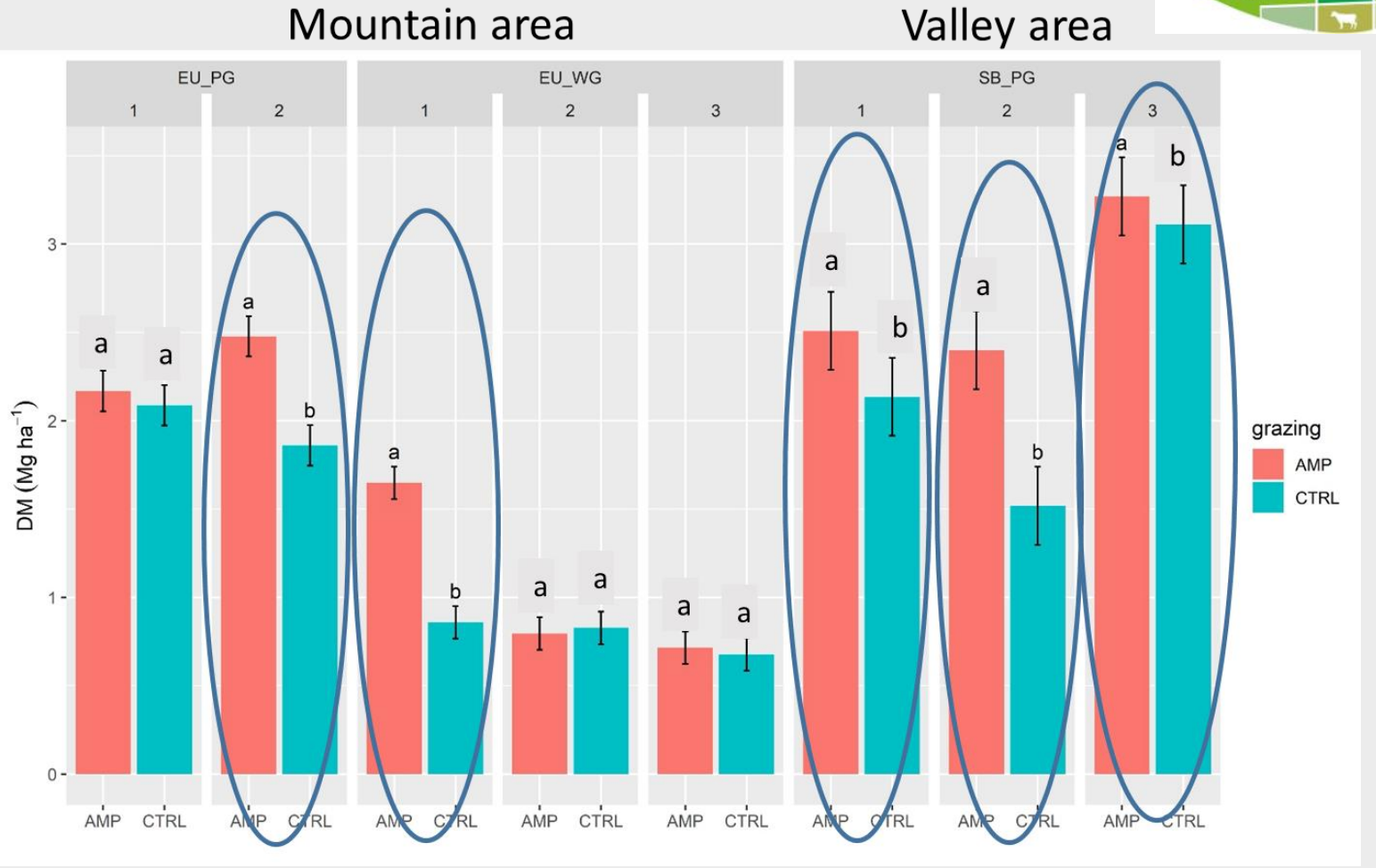


"Elighes Uttiosos" farm case study

- 800 m a.s.l. - 62 ha
- Land use
  - Grazed holm oak woodlands 30 ha
  - Wooded pastures 20 ha
  - Annual forage crops 12 ha
- Livestock
  - 70 cattle Sardo-modicana bred
  - 140 "Saanen" goats
  - Horses, pigs and poultry (agri-tourism)

Improving grazing systems in Med silvopastoral systems:
Adaptive multi-paddock grazing (AMP)

Herbage availability (DMY Mg ha^{-1})

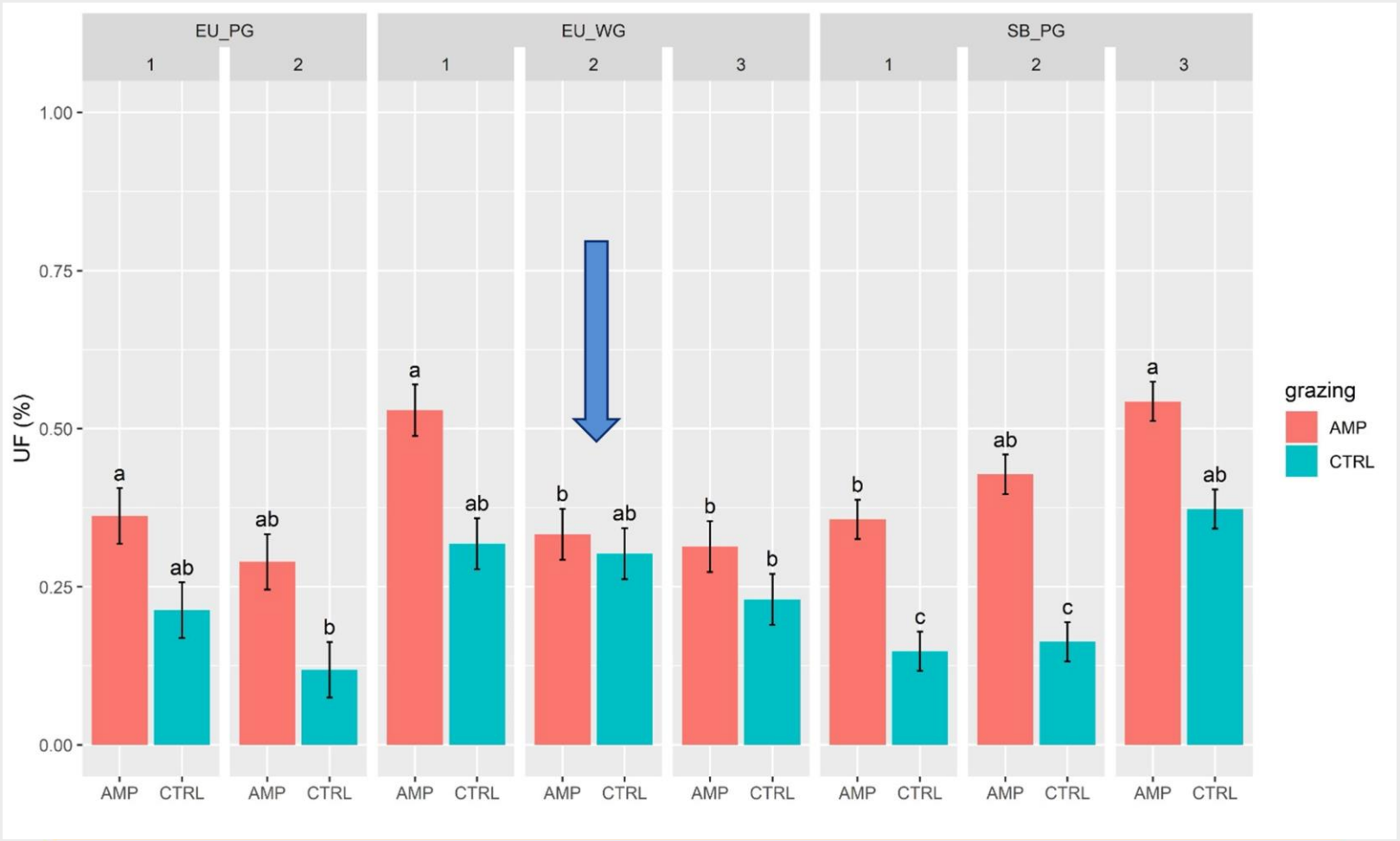


Improving grazing systems in Med silvopastoral systems:
Adaptive multi-paddock grazing (AMP)

Herbage utilization efficiency (UF %)

Mountain area

Valley area



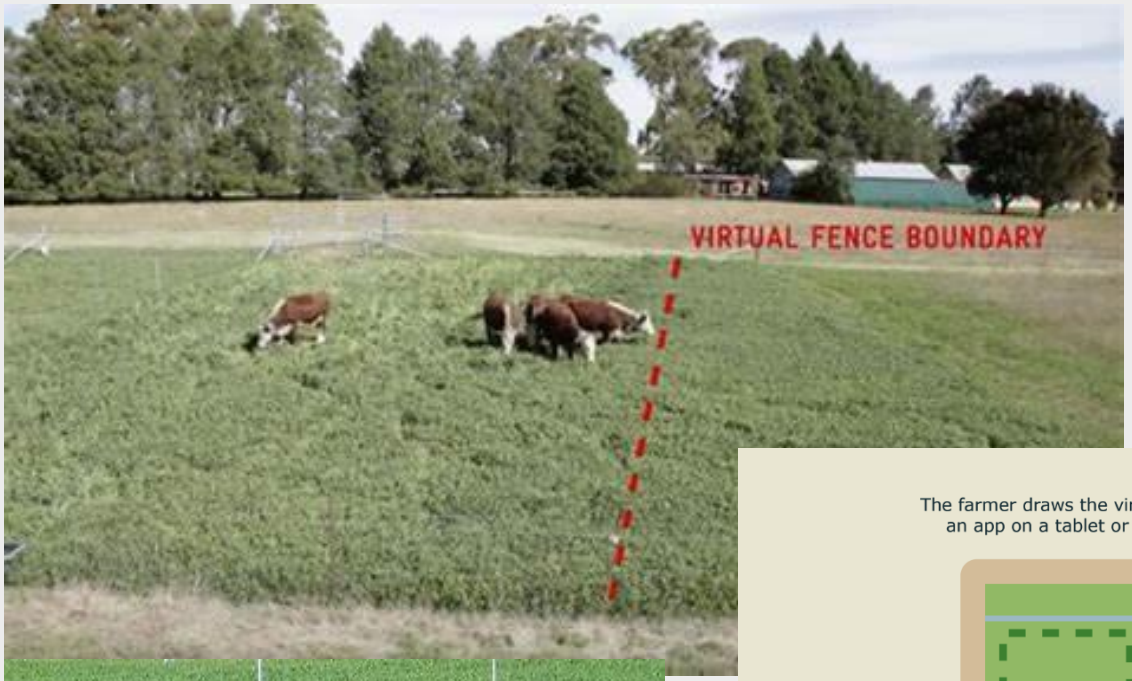
Improving grazing systems in Med silvopastoral systems:
Adaptive multi-paddock grazing (AMP)

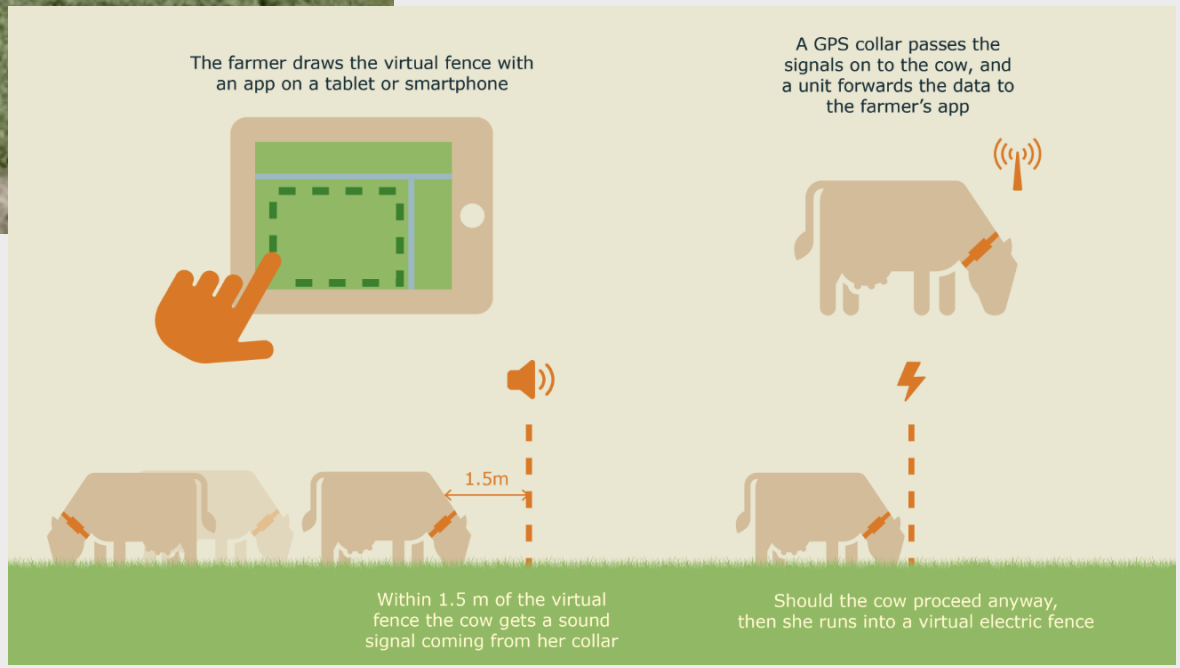
Effects on tree damages

Mean Values ± CI [%]	*Grazing System*	
	AMP	C
Debarked Individuals **	62.50 ± 11.66	81.88 ± 9.16
Debarked Circumference	40.73 ± 05.12	42.27 ± 4.92

Mean Values ± CI [%]	***Grazing System***	
	AMP	***C***
Foliage transparency **	26.87 ± 3.09	39.97 ± 4.32
Defoliation*	31.72 ± 2.96	40.75 ± 4.22

Improving grazing systems in Med silvopastoral systems:
Grazing management with Virtual fencing





Improving grazing systems in Med silvopastoral systems:
Grazing management with Virtual fencing

Rangeland Ecology & Management 89 (2023) 87–93

Contents lists available at ScienceDirect

Rangeland Ecology & Management

journal homepage: www.elsevier.com/locate/rama

Using Virtual Fencing to Create Fuel Breaks in the Sagebrush Steppe ☆

Chad S. Boyd [1,*], Rory C. O'Connor [1], Juliana Ranches [2], David W. Bohnert [2], Jon D. Bates [1], Dustin D. Johnson [2], Kirk W. Davies [1], Todd Parker [3], Kevin E. Doherty [4]

Virtual fencing can be a highly effective method of concentrating grazing to reduce herbaceous fuel biomass within linear fuel breaks

Improving grazing systems in Med silvopastoral systems:
Grazing management

Sustainability **2015**, *7*, 7232-7244; doi:10.3390/su7067232

OPEN ACCESS

sustainability

ISSN 2071-1050

www.mdpi.com/journal/sustainability

Article

Fitting the Stocking Rate with Pastoral Resources to Manage and Preserve Mediterranean Forestlands: A Case Study

Elisa Bianchetto [1], Ivan Buscemi [2], Piermaria Corona [3], Giovanni Giardina [2], Tommaso La Mantia [2,*] and Salvatore Pasta [4]

Objective: applying measures in order to improve the grazing value of grasslands and ecotonal patches and lower the grazing impact on native woodlands

Improving grazing systems in Med silvopastoral systems:
Grazing management using molasses-based and salt blocks



Photo credit: Marco Pittarello, UNITO

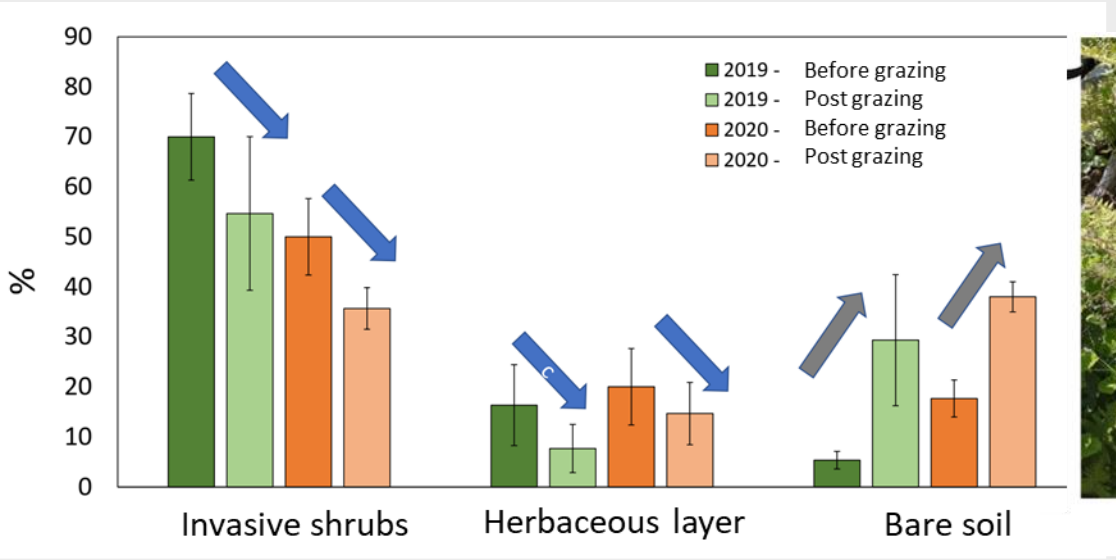


Photo credit: Marco Pittarello, UNITO

Some references

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- Seddaiu et al., 2018. Mediterranean cork oak wooded grasslands: synergies and trade-offs between plant diversity, pasture production and soil carbon. Agroforestry Systems, 92 (4), 893–908.