

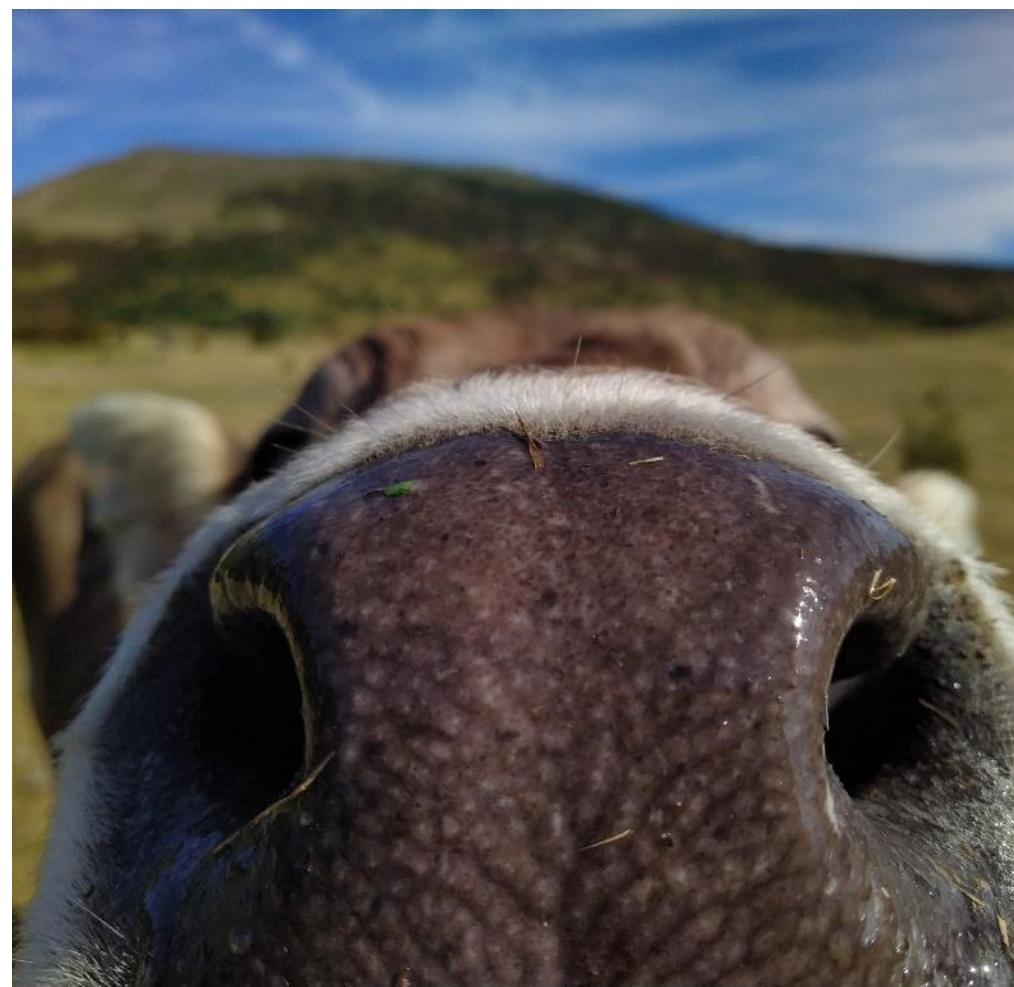


## Best practices for targeted policies to enhance ecosystem services in European livestock agroecosystems

Daniel Martín-Collado, Alicia Tenza-Peral, Alberto Bernués

24<sup>th</sup> Congress of the Animal Science and Production Association. ASPA 2021 PADOVA  
Wednesday, 22<sup>th</sup> September– Session 9. Non-conventional livestock systems





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- **Best management practices to targeted agri-environmental policies in two contrasting European mountain agroecosystems**
- Wrapping up

# Context

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# Challenges of livestock agroecosystems

- Intensification of farming in the most favourable areas



- Abandonment of marginal areas (HNV farmlands)
- Encroachment of shrub and forest vegetation
- Loss of diversified mosaics (landscape heterogeneity)
- Biodiversity loss
- Other negative externalities

- Other observed trends:



- Reduction in the number of farms; enlargement of herd size
- Increasing dependence of farmers on subsidies
- Lack of generational turnover
- Diversification toward non-farming activities, primarily tourism
- Intensification (within HNV and mountains)



# UN Food Systems Summit ... takes place tomorrow in NY

## 7 engagement principles

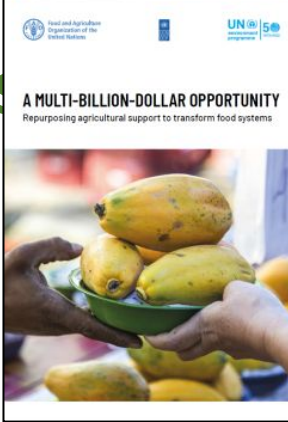
### 4. Recognise complexity

*“Food systems are complex, and are closely connected to, and significantly impact, human, and animal health, land, water, climate, biodiversity, the economy and other systems and their transformation requires a systemic approach”*

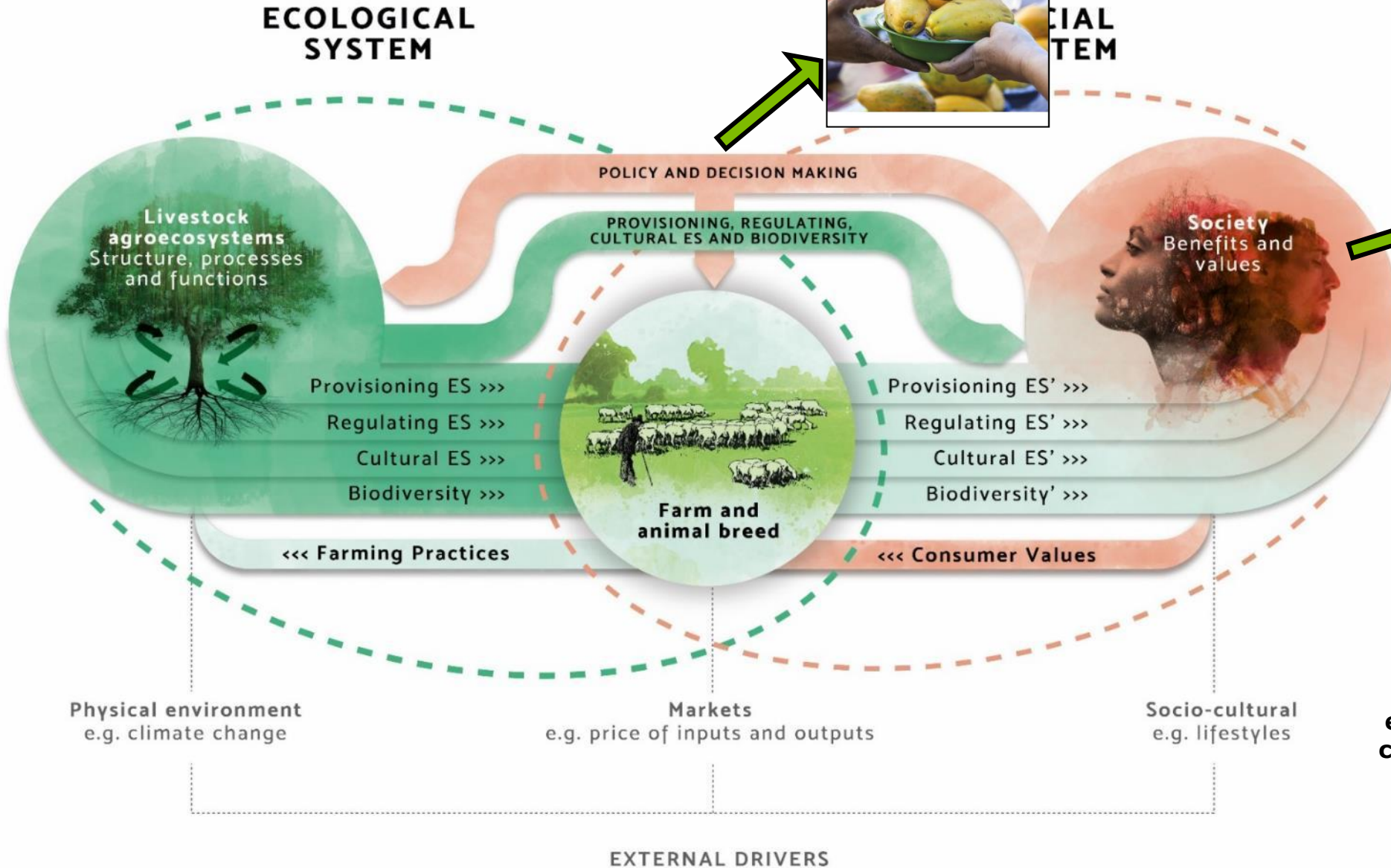
### 6. Embrace multi-stakeholder inclusivity

*“We support inclusive multi-stakeholder processes and approaches (...) that bring diverse perspectives (...) to enable stakeholders to understand and assess potential trade-offs and to design policy options that deliver against multiple public goods across these various systems”*

# Ecosystem services and livestock



Eco-schemes (new CAP)?, F2F (Green Deal)?

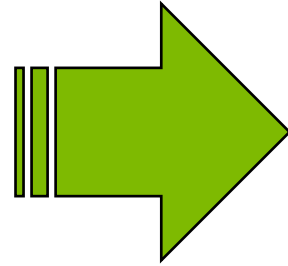


Benefit of ES depends on how actors in society perceive or attach value to them

Martin-Collado et al, 2019. Opinion Paper **Livestock agroecosystems provide ecosystem services but not their components – the case of species and breeds.** Animal 13:10186, 2111-2113.

# Ecosystem Services valuation

- Different functional units
- Different temporal and spatial scales
- Different perceptions by society
- No market price
- **Intangible (cultural ES)**



1. BIOPHYSICAL
2. ECONOMIC
3. **SOCIO-CULTURAL valuation tools**





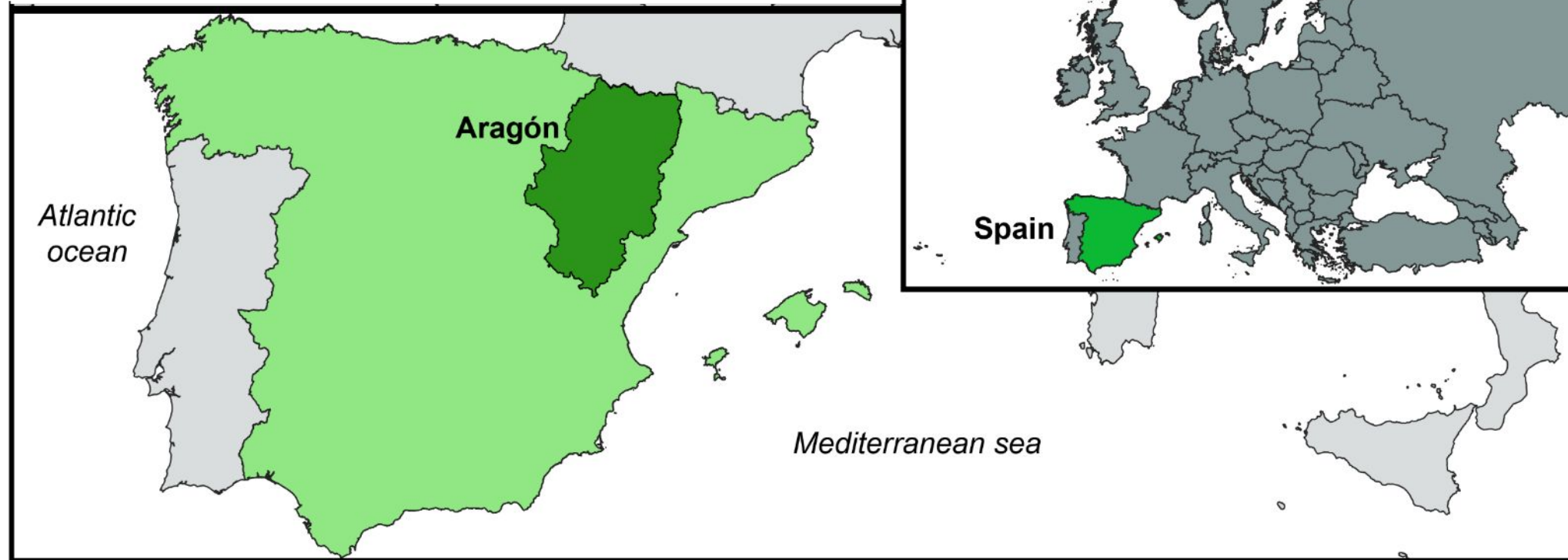
How do different stakeholders value the ecosystem services delivered from mountain agroecosystems?





# **1. Perception of farmers and non-farmers: agricultural practices and ES delivery on Mediterranean mountain agroecosystems**

## Study area



Research conducted in 2012

Reference: Bernués et al. 2016. Agricultural practices, ecosystem services and sustainability in High Nature Value farmland: Unraveling the perceptions of farmers and nonfarmers. *Land Use Policy* 59: 130-142.

# Methods

- Qualitative research: focus groups (FG)

## 2 FG: Farmers

(11 participants)

- Meat-sheep and mixed agriculture-sheep farmers
- Beef cattle farmers with few or no agricultural crops

- Content analysis

- Diagrams □ collective mental constructs

## 3 FG: Non-farmers (*other citizens*)

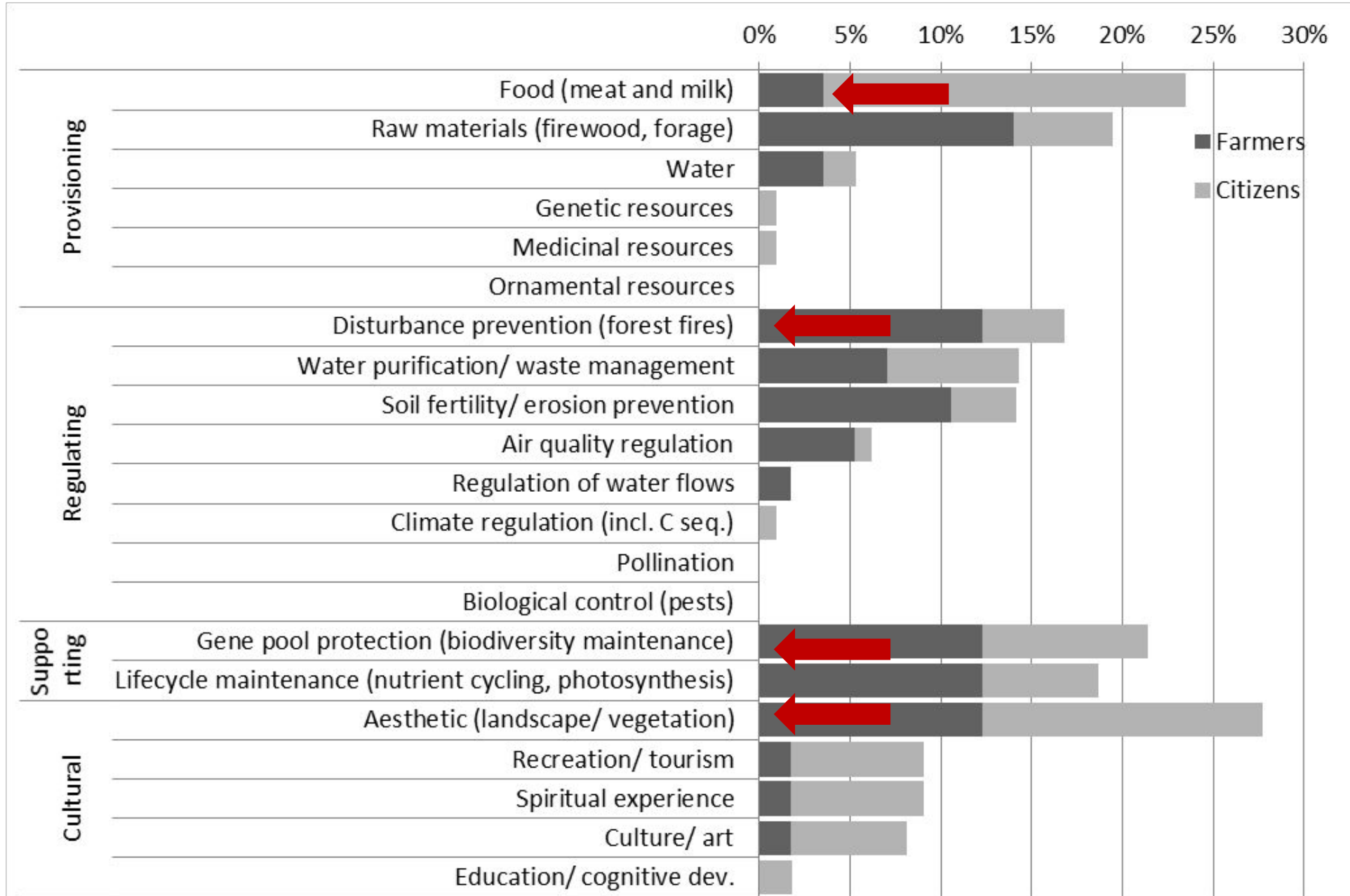
(22 participants)

- Technicians on animal health
- Primary and secondary education teachers
- Members of a consumers' association

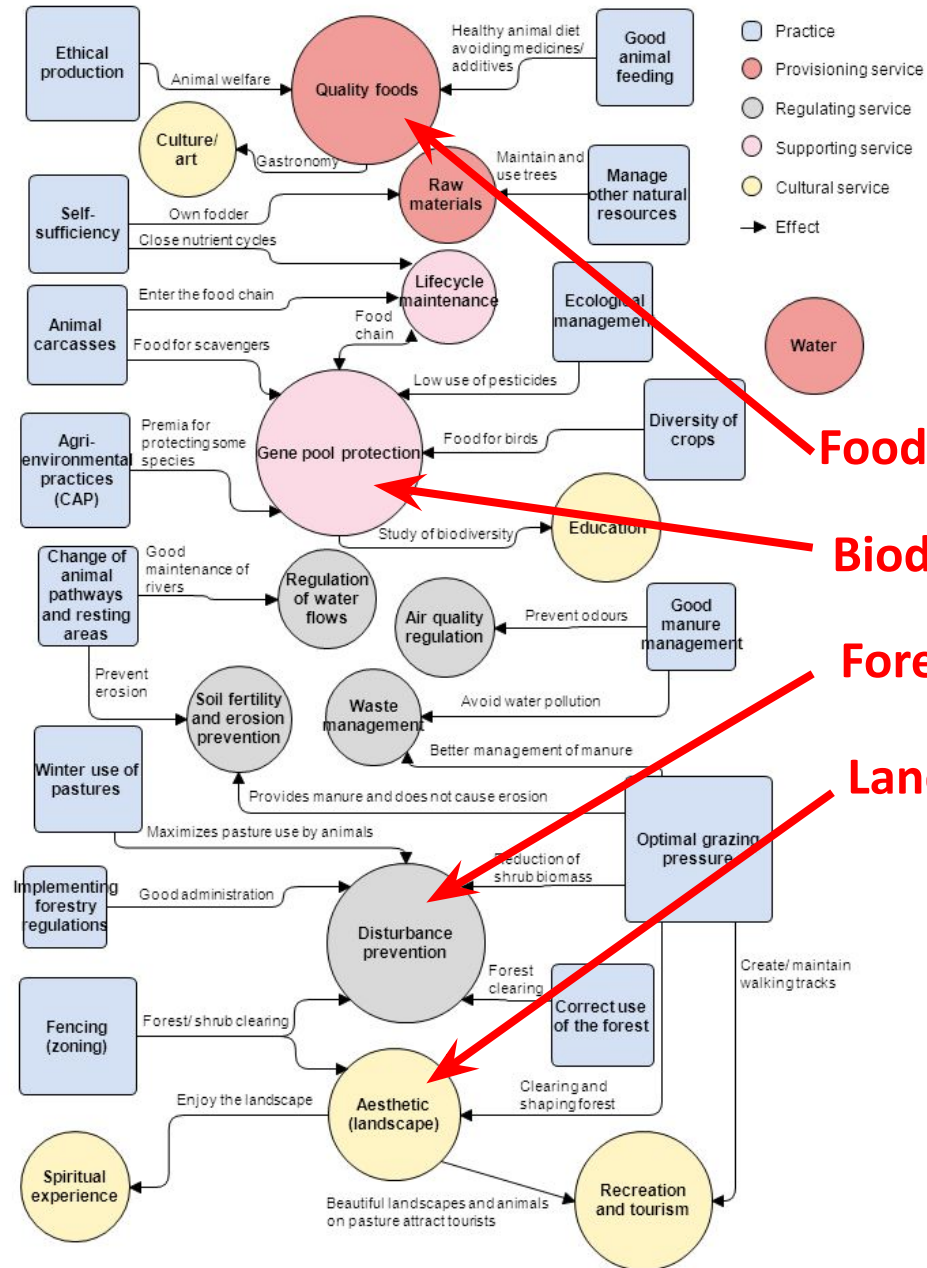


# Main results

# Ecosystem Services valuation: socio-cultural

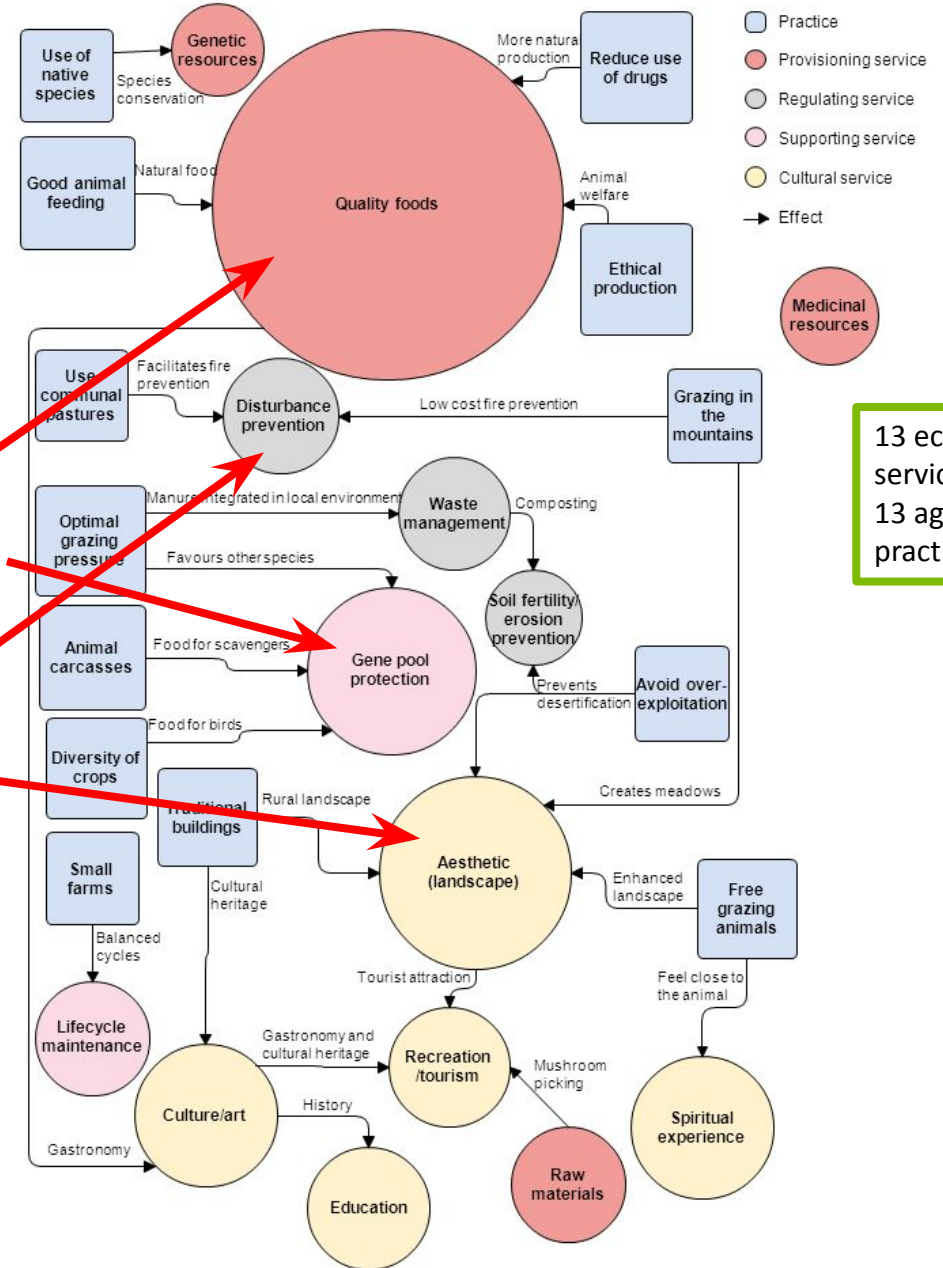


# Farmers



14 ecosystem services  
15 agricultural practices

# Non farmers



13 ecosystem services  
13 agricultural practices

**Food quality**

**Biodiversity**

**Forest fires**

**Landscape**
















## FARMERS

- Great understanding of the influence of agricultural practices on multiple ES.
- Focus on regulating ES (fires prevention, soil fertility, water purification).
- Grazing pressure the most relevant agricultural practice, which influenced key regulating ES.

## NON-FARMERS

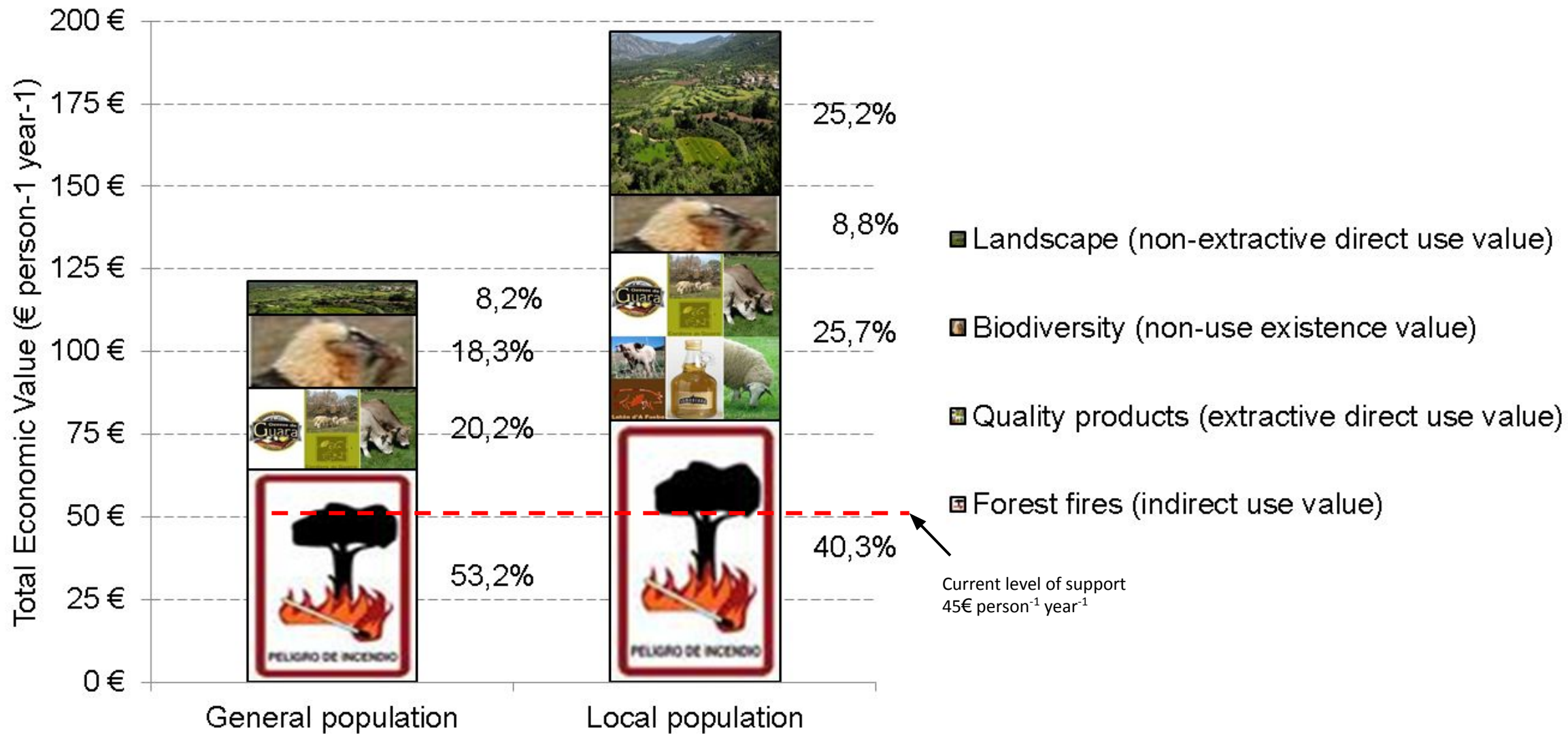
- Less general knowledge about the effect of farming practices on ES.
- Focus on the provision of quality food products and diverse cultural ES.
- Representatives of the consumer association were more concerned about the quality of food products.
- Participants working in education showed greater interest in the cultural ES.

# Ecosystem Services valuation: economic

	<u>Policy A</u>	<u>Policy B</u>	<u>CURRENT policy</u>
<b>Landscape</b>	 strong increment of bushes reduction of meadows and crops	 light decrement of bushes light increment of meadows and crops	 light increment of bushes meadows and crops are maintained
<b>Bearded vulture</b>	 7 pairs	 15 pairs	 11 pairs
<b>Forest fires</b>	 6 forest fires per year	 2 forest fires per year	 4 forest fires per year
<b>Product quality linked to territory</b>	 2 quality products available sheep cheese and lamb meat	 6 quality products available sheep cheese, lamb meat, pasture pork meat and olive oil, pasture beef and organic lamb	 4 quality products available sheep cheese, lamb meat, pasture pork meat and olive oil
<b>Annual cost</b>	 15 €	 75 €	 45 €
<b>CHOICE</b>	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C

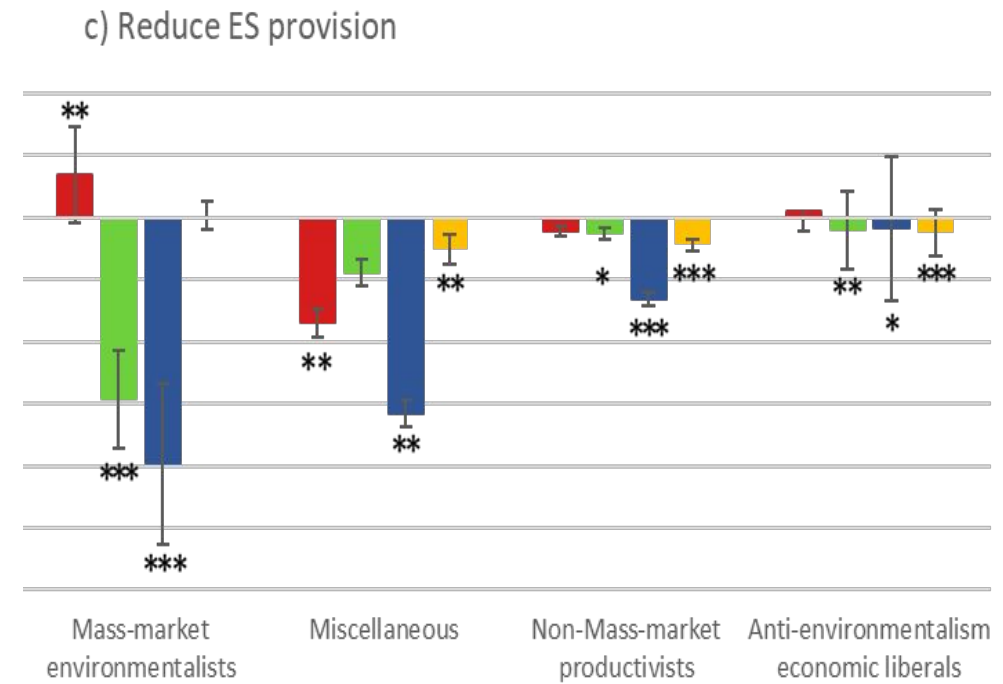
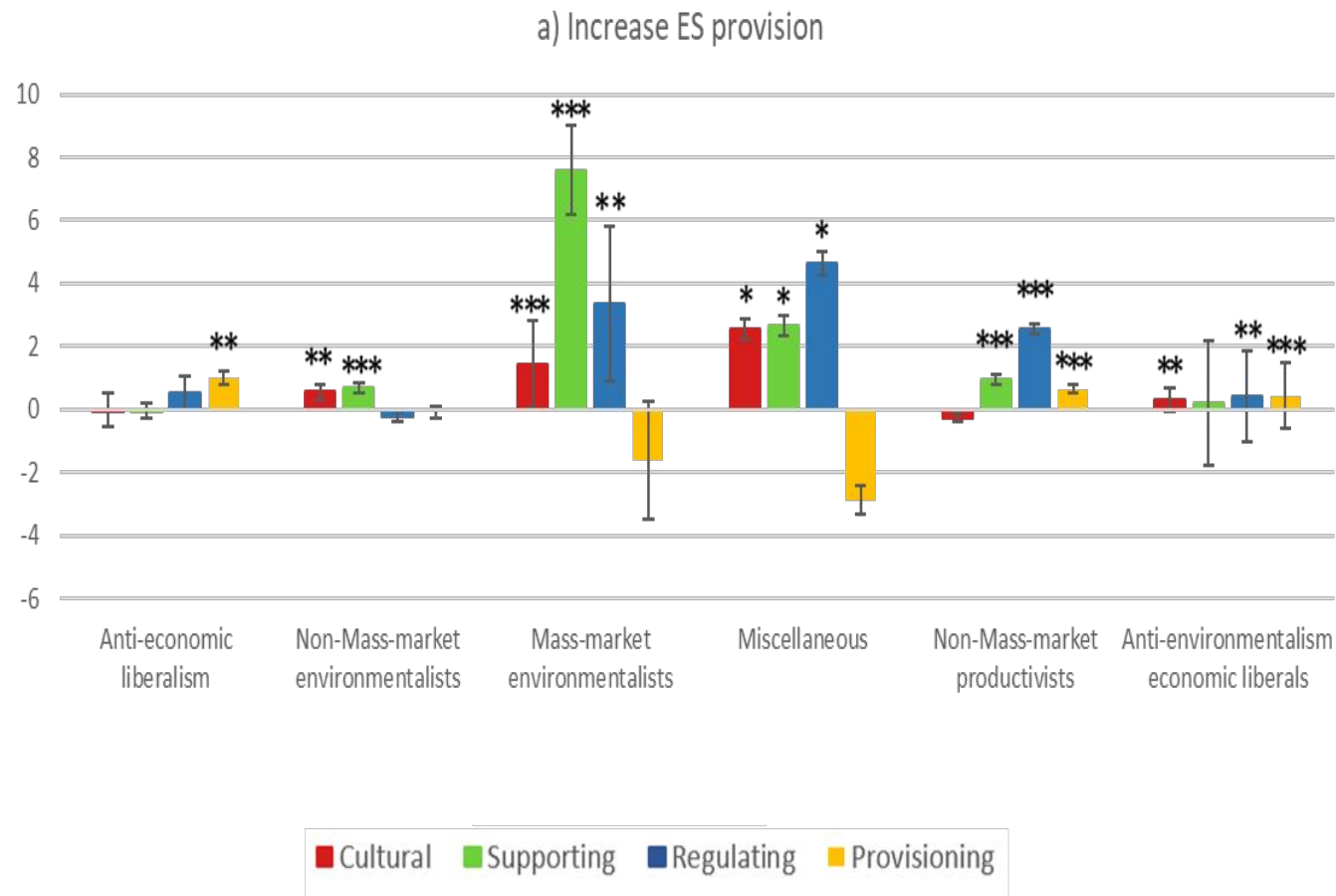
Reference: Bernués A. et al., 2014. Socio-cultural and economic valuation of ecosystem services provided by Mediterranean mountain agroecosystems. PLoS ONE 9(7): e102479.

# Willingness to Pay (WTP) (€ person-1 year-1) and Total Economic Value (TEV)





# Attitudes towards agriculture and food system and ES



Reference: Muñoz-Ulecia et al. Influence of attitudes towards agriculture systems on valuation of ecosystem services of Mediterranean mountain agroecosystems. *Journal of Ecosystem Services (Under Review)*.



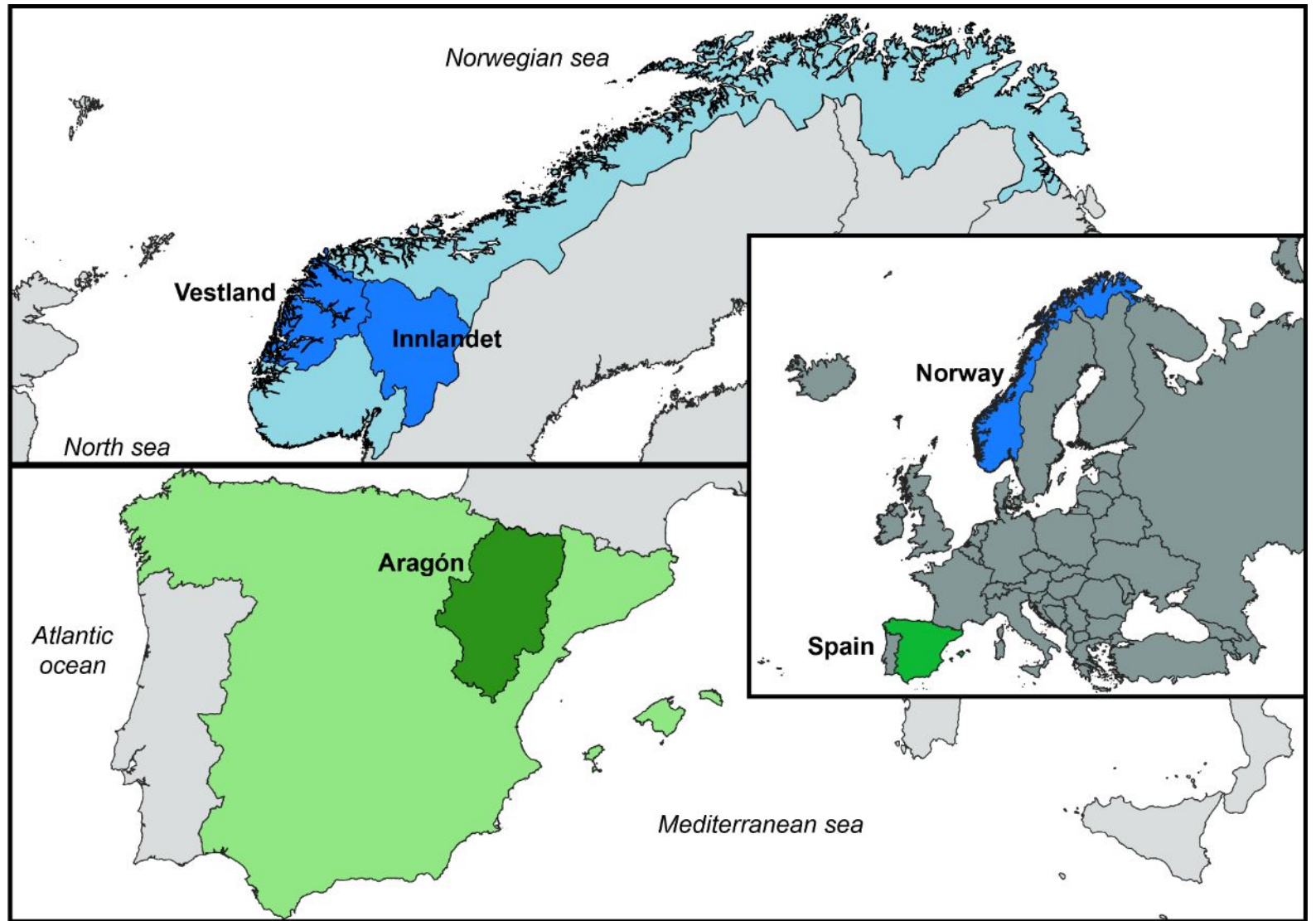
Are all ecosystem services equally important everywhere?

Do agricultural practices have the same effect on all mountain agroecosystems?



**2. Best management practices to targeted agri-environmental policies in two contrasting European mountain agroecosystems**

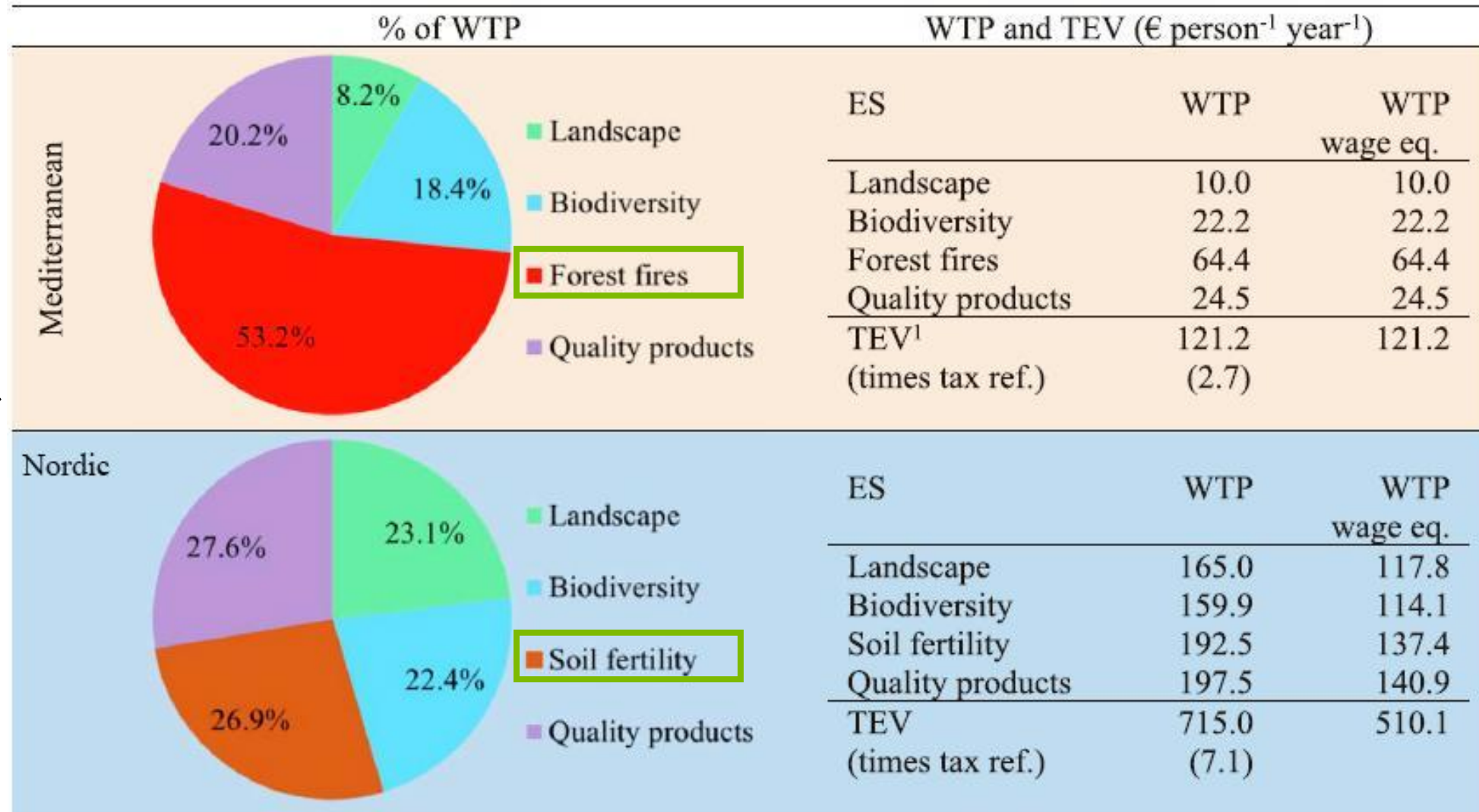
## Study area



Reference: Bernués et al. Targeted agri-environmental policies to enhance ecosystem services in European mountains .  
Journal of Environmental Management (*Under Review*).

# Methods

**Identification:** most important **ecosystem services** provided by the two mountain agroecosystems  
Based on previous research (Bernués et al. 2014, 2016, 2019)



# Methods

**Agricultural practices (AP)** evaluated for each ecosystem services in Nordic (N) and Mediterranean (M) mountains (Rodríguez-Ortega et al. 2018)



**Nordic**

26

agricultural practices

**Mediterranean**

36

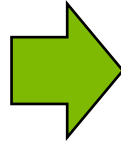
agricultural practices

Group	Agricultural practice	Ecosystem service										
		Landscape		Biodiversity Conservation		Soil fertility	Forest wildfires	Carbon sequestration		Quality products		
Vegetation and elements	1. Maintaining semi-natural vegetation (trees and shrubs) characteristic of each area	N	M	N	M	N	M	N	M	N	M	
	2. Maintaining grasslands	N	M	N	M	N	M	N	M	N	M	
	3. Managing land in small plots	N	M	N	M		M					
	4. Retention of hedges, shrubs and trees among arable fields	N	M	N	M	N	M	N	M			
	5. Retention terraces		M		M				M			
	6. Retention traditional buildings and field boundaries	N	M	N	M							
	7. Retention of water points	N	M	N	M		M					
	8. Retention of drove roads and tracks	N	M	N	M		M					
Crops and species	9. Crop diversification	N	M	N	M	N		N	M			
	10. Growing locally adapted crop varieties and breeds	N	M	N	M	N		N	M	N	M	
	11. Growing crop varieties with lower requirements		M		M				M		M	
	12. Genetic selection for high productivity			N	M					N	M	
	13. Retention of high proportion of semi-natural meadows and pluri-annual crops	N	M	N	M	N		N	M			
	14. Utilizing nectar source crops for pollinators		M		M							
	15. Utilizing cover crops		M		M				M			
	16. Utilizing crop rotations, including legumes		M		M				M		M	
Inputs	17. Maintaining fallows in rotation		M		M		M		M			
	18. Substituting bare fallow for green/seeding fallow		M		M				M			
	19. Reducing use of machinery	N	M	N	M	N	M	N	M			
	20. Reducing ploughing/tilling									M		
	21. Reducing chemical fertilizers			N	M	N		N	M	N	M	
	22. Utilizing manure correctly	N	M	N	M	N		N	M	N	M	
	23. Reducing pesticide use			N	M	N				N	M	
	24. Reducing herbicide use		M									
	25. Reducing animal drugs			N	M	N					N	M
	26. Reducing proportion of animal concentrates			N	M			N	M	N	M	
	27. Reducing off-farm dependency	N	M	N	M	N		N	M	N	M	
	Grazing and silviculture	28. Extend grazing annual period	N	M	N	M	N	M	N	M	N	M
29. Grazing in semi-natural habitats		N	M	N	M	N	M	N	M	N	M	
30. Grazing in remote and abandoned areas		N	M	N	M	N	M	N	M			
31. Grazing with several species		N	M	N	M	N	M	N	M			
32. Moving flocks seasonally		N	M	N	M	N	M	N	M	N	M	
33. Maintaining meadow mowing		N	M	N	M	N	M	N	M			
34. Carcasses left in situ					M							
35. Adapting stocking rate to the carrying capacity of agroecosystem		N	M	N	M	N	M	N	M			
Other	36. Active management of forest (forestry/silviculture)	N	M	N	M	N	M	N	M	N	M	
	37. Optimizing soil drainage (non-organic soils)	N		N		N		N				
	38. Biogas production from animal waste							N				

# Methods

## Expert-based survey and questionnaire

Effect of agricultural practices on ecosystems services at the study areas



### MEDITERRANEAN

- Conducted in November-December 2015
- 61 experts
  - 29 researchers
  - 32 technicians

### NORDIC

- Conducted in March-April 2019
- 32 experts
  - 21 researchers
  - 11 technicians

### Questionnaire:

- Description of **mountain agroecosystems**
- Positive **contribution** of farming practices on **ES**:  
0: none, 1: very low – 5: very high; Don't know



# Main results

Contribution of agricultural practices related to “Vegetation and elements” and “Grazing and silviculture” on ecosystem services in Nordic (blue bars) and Mediterranean mountains (green bars).



\*\*Bars with dark colors refer to statistical differences

Practice type		Landscape	Biodiversity	Soil fertility (Nordic) and Forest fires (Mediterr.)	Carbon sequestration	Quality products
Vegetation and elements	1. Maintaining grasslands	4.4	4.5	3.8	4.0	4.2
		4.4	4.4	4.3	4.2	4.0
	2. Maintaining local semi-natural vegetation (trees and shrubs)	3.9	4.1	3.1	3.7	3.6
		4.5	4.6	3.6	4.3	3.7
	3. Retention of hedges, shrubs and trees among arable fields	3.8	4.0	3.2	3.5	
		4.5	4.4	3.1	4.1	
	4. Retention of water points	3.9	3.8			
		4.4	4.4	4.2		
5. Managing land in small plots	3.8	3.9				
	3.7	3.6	3.5			
6. Retention of drove roads and tracks	3.5	2.9				
	4.2	3.5	4.4			
7. Retention traditional buildings and field boundaries	4.1	3.3				
	4.0	3.3				
8. Retention terraces	4.1					
		3.4		3.1		
Grazing and silviculture	28. Grazing in semi-natural habitats	4.3	4.3	3.3	3.7	4.0
		4.1	4.1	4.5	3.5	4.0
	29. Moving herds seasonally	4.2	3.9	3.2	3.2	4.1
		4.5	4.3	4.4	3.2	4.2
	30. Extend grazing period	3.9	3.9	3.0	3.6	3.9
		3.7	3.6	4.3	3.5	3.7
	31. Active management of forest (forestry/silviculture)	3.4	3.1	2.6	3.7	2.6
		4.2	4.0	4.6	4.1	3.7
	32. Adapting stocking rate to the carrying capacity	3.8	3.8	3.6	3.6	
		4.7	4.6	4.1	4.0	
33. Grazing in remote and abandoned areas	4.3	3.8	3.3	3.6		
	4.2	4.2	4.6	3.5		
34. Grazing with several species	4.0	3.8	3.5	3.2		
	4.1	3.9	4.3	3.1		
35. Maintaining meadow mowing	3.9	3.8	3.2	3.2		
	3.9	3.8	3.9	3.2		
36. Carcasses left in situ	0.0					
	0.0	4.0				

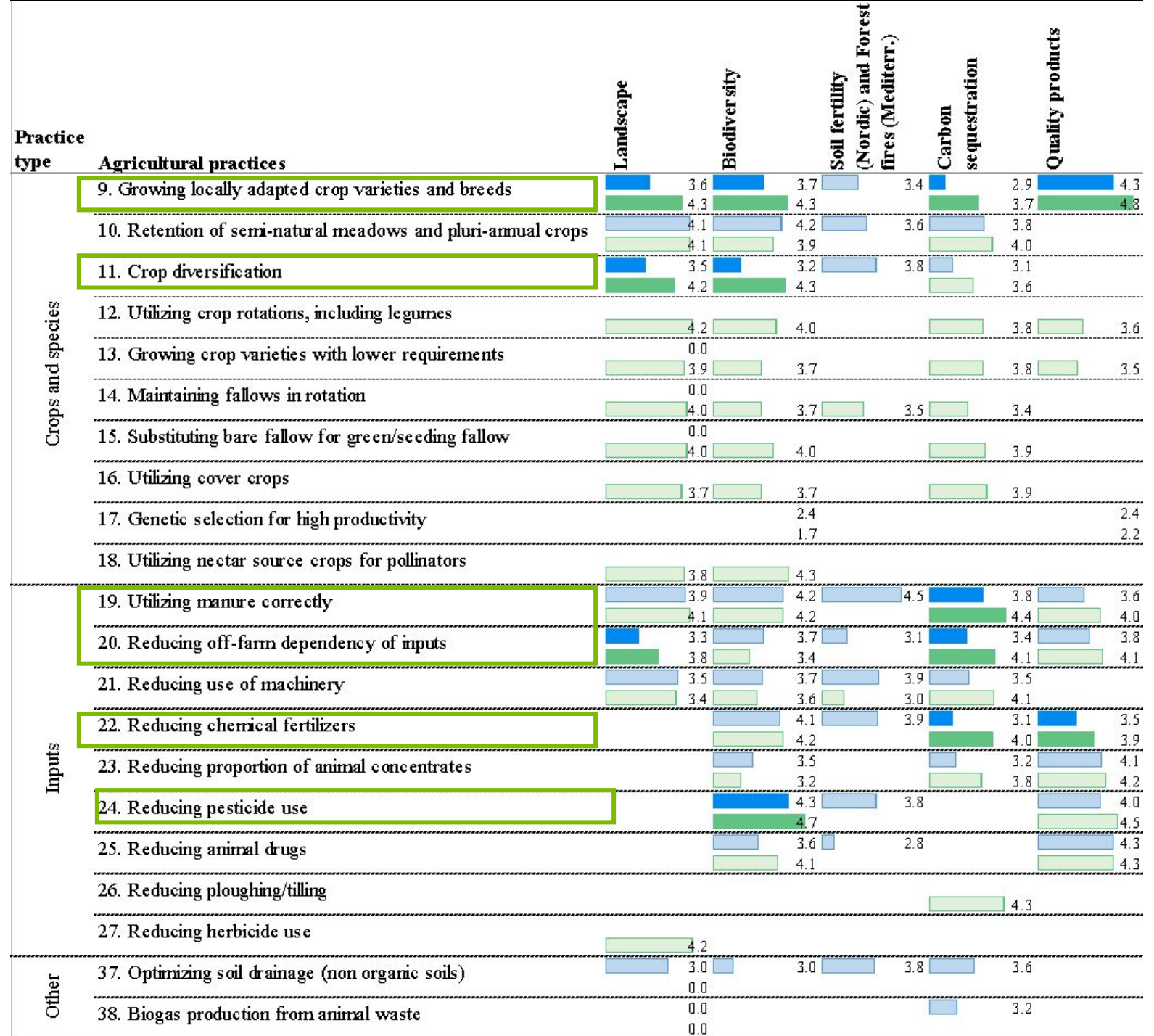


# Main results

Contribution of agricultural practices related to “Crops and species”, “Inputs” and “Other” on ecosystem services.



\*\*Bars with dark colors refer to statistical differences



# Prioritization of agricultural practices for agri-environmental policy scenarios

## 3 policy scenarios:

- *SOCIAL DEMAND.*

\*Based on previous research (Bernués et al. 2014, 2016, 2019)

### **Nordic agroecosystem**

26.6% Landscape; 20.4% biodiversity conservation; **25.5% soil fertility**; 27.6% quality products

### **Mediterranean agroecosystem**

8.2% Landscape; 18.4% biodiversity conservation; **53.2% prevention of wildfires**; 20.2% quality products

- *BIODIVERSITY AND CLIMATE CHANGE MITIGATION.*

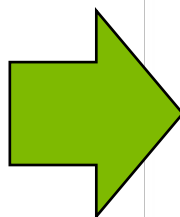
Gives equal importance (50%) to **biodiversity conservation** and **carbon sequestration**

- *BIODIVERSITY CONSERVATION.*

Gives maximum priority (100%) to **biodiversity conservation**

**Contribution (%) of top-twelve agricultural practices to three policy scenarios** (i.e. combination of ecosystem services) in Nordic (blue) and Mediterranean (green) mountains.

Practice type	Agricultural practices	Social demand policy		Biodiversity and climate change mitigation policy		Biodiversity conservation policy	
		Nordic	Mediterranean	Nordic	Mediterranean	Nordic	Mediterranean
Vegetation and elements	1. Maintaining grasslands	9.8	9.4	9.3	8.7	9.0	8.4
	2. Maintaining local semi-natural vegetation (trees and shrubs)	8.7	8.6	8.6	9.0	8.4	8.8
	3. Retention of hedges, shrubs and trees among arable fields			8.3	8.6	8.2	8.4
	4. Retention of water points		7.0	0.0	0.0	0.0	8.3
	5. Managing land in small plots					7.9	
	6. Retention of drove roads and tracks		7.2				
Crops and species	9. Growing locally adapted crop varieties and breeds	9.0			8.0		8.2
	10. Retention of semi-natural meadows and pluri-annual crops			8.7	8.0	8.5	
	18. Utilizing nectar source crops for pollinators						8.1
Inputs	19. Utilizing manure correctly	9.3		8.6	9.2	8.4	8.0
	20. Reducing off-farm dependency of inputs	8.3		7.7			
	21. Reducing use of machinery			7.8	7.7		
	22. Reducing chemical fertilizers	6.7			8.3	8.3	7.9
	24. Reducing pesticide use	7.3				8.7	9.0
	25. Reducing animal drugs	6.7					
Grazing and silviculture	28. Grazing in semi-natural habitats	9.4	9.8	8.7		8.9	
	29. Moving herds seasonally	9.2	10.1	7.7	7.7	8.0	8.2
	30. Extend grazing period	8.7	9.0	8.3		7.9	
	31. Active management of forest (forestry/silviculture)	6.8	9.7		8.3		
	32. Adapting stocking rate to the carrying capacity		7.1	8.1	8.8	7.9	8.7
	33. Grazing in remote and abandoned areas		7.6	8.2	7.8		8.0
	34. Grazing with several species		7.4				
	35. Maintaining meadow mowing		7.0				



- Significant differences in the average contribution of the AP to the provision of ES. **Need for regionalizing the studies** and, therefore, the design **of agri-environmental policies**.
- Several practices consistently relevant for ES delivery **across policy scenarios and agroecosystems**. Especially, **grazing and silviculture practices**.
- Policies are changing from “one-size-fits-all” approaches to results-based schemes. **Provide clear guidance and examples of best practices for policymakers and practitioners** to address context-specific social demands and climate and environmental priorities.



**Final thoughts**

1. Animal agriculture can be multifunctional (delivery of public goods or ecosystem services), but not all farming systems are
2. High variability in the importance given to different ES and to farming practices by rural and urban people and farmer and non-farmers; will likely generate controversies on the focus of public policies
3. There is need to objectively value “non-market” functions of mountain agriculture in agri-environmental policies, which need adaptation to regional conditions
4. Linking agricultural practices to ES delivery is a strategy to follow
5. Some agricultural practices are key to deliver ES in mountain agroecosystems, particularly grazing and silviculture
6. BUT, farmers can perceive these practices as reducing productivity, turning farming more complex and labour intensive, reducing farm competitiveness and/or quality of life
7. It is doubtful that the necessary changes to bringing this paradigm shift to farmers’ communities can be motivated solely by the limited economic premiums established by agri-environmental policies, at least in their current form