

LIVESTOCK ARE MORE THAN FOOD



4th one-day symposium of the Animal Task Force & the EAAP Commission on Livestock Farming Systems: *Livestock are more than food*

**“Influence of pastoral management on
the conservation of the cultural
landscapes and biodiversity of mountain
pastures”**

Massimiliano Probo

Caren Pauler



Contents

- **Origin of mountain grasslands**
- **Ecosystem services and biodiversity**
- **Livestock and biodiversity**
- **Site-adapted pastoral management**
- **Trends, challenges and perspectives**





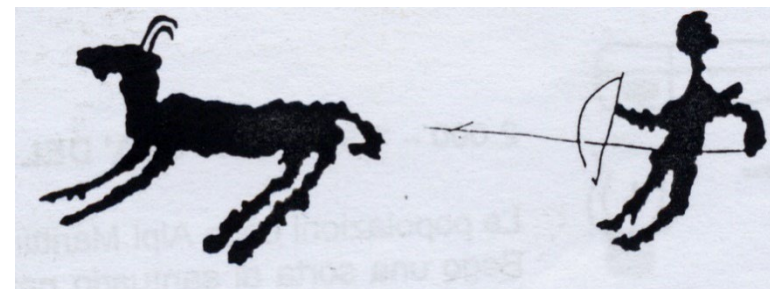
...and alpine pastures





Semi-natural alpine grasslands as cultural landscapes

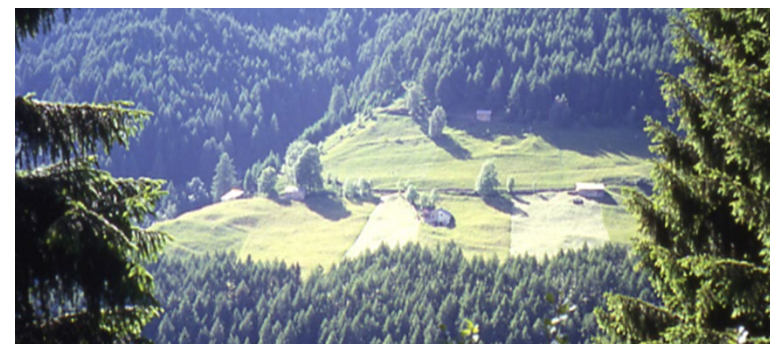
- **15000 BC:** Human alpine settlements at the end of the Ice Age, hunting



- **From 5500 to 4000 BC:** Livestock rearing, vertical transhumance and alpine agriculture



- **From 4000 BC to 0 (Celts):** **“Alps” from “Aulp” = pasture -> “the mountains of pastures”**
- **Roman period:** trade in Alpine livestock products
- **Middle Age:** internal migrations, development of middle elevation meadows





Alpine grasslands: ecosystem services

- **Biodiversity**
- **Food production**
- **Aesthetic value and touristic attractiveness**
- **Cultural heritage** (Swiss Alpine pasture season: UNESCO Intangible Cultural Heritage of Humanity)
- **Carbon sequestration and nutrient cycling**
- **Wildfire, erosion and flood control**
- **Pollination**
- **Water purification**



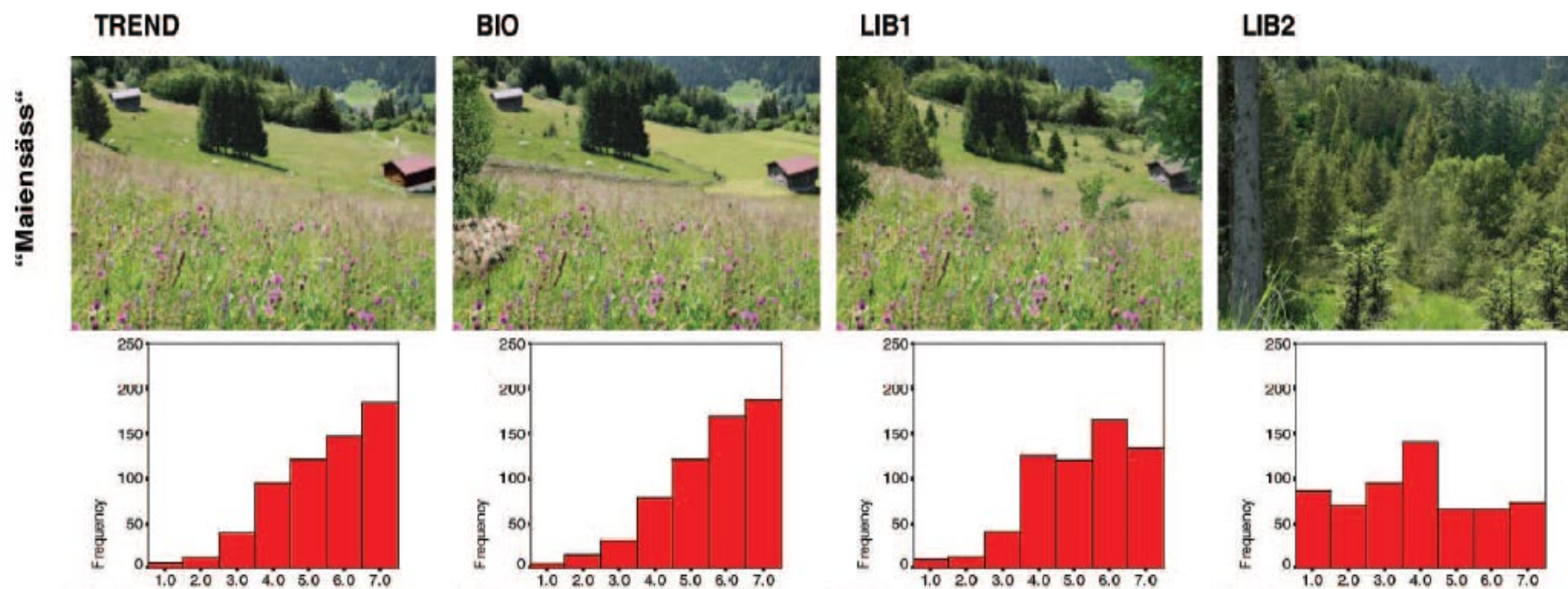


Preferences towards alpine landscapes

Differences in preferences towards potential future landscapes in the Swiss Alps (Soliva et al., 2010):

3 scenarios of land-use and landscape change based on conservation and agricultural policy drivers:

- 1) **Continuation of current trends**
- 2) **Liberalization** (agricultural markets are liberalized and agri-environmental regulations abolished)
- 3) **Biodiversity enhancement** (less conventional farms, more land managed by NGOs)





Biodiversity of mountain grasslands

- One of the most biodiverse habitats in the world (Dengler et al., 2014)
- Within limited spatial extents, vascular plant diversity may exceed even that of tropical rainforests
- **World records:** 89 plant species within 1m² in Central Argentina; 105 and 131 species within 16 to 49 m² in the Carpathians
- More than 75% of the 4485 plant species recorded in the Alps are linked to grassland habitats





Biodiversity of mountain grasslands

Several ecological factors determine this high biodiversity:

1. **'island nature' of mountains** (endemisms)
2. **high topographic variability** (altitude, slope, aspect, roughness): influence on micro-climate (solar radiation, temperature, snow cover duration, etc.) and soil (soil types, moisture, nutrient content, etc.)
3. coexistence of **natural grasslands** above the treeline and **semi-natural grasslands** below (traditional agricultural practices)





Impact of livestock on plant diversity

Grazing livestock influences the environment directly and indirectly by :

1. **Selective defoliation**
2. **Trampling**
3. **Nutrient redistribution**
4. **Seed transport**

Thereby, grazers alter the competition for light and nutrients among species within the plant community, thus shaping its botanical composition





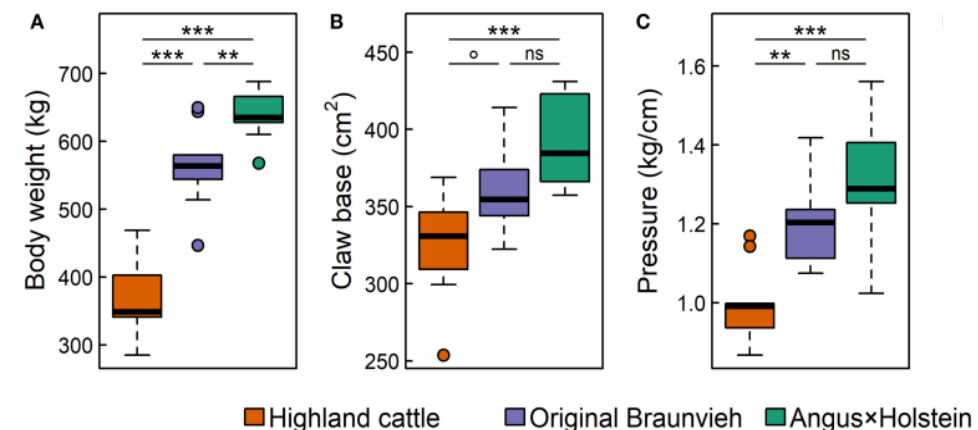
Effects of selective defoliation and trampling on biodiversity

- Moderate and patchy defoliation and trampling increases biodiversity
- Intensively grazed areas have lower diversity: a few rosette, stoloniferous, spiny and toxic species
- Feeding preferences of livestock: grazers vs browsers
- Modern breeding with negative effects on biodiversity: livestock with higher productivity, weight, pressure per cm², nutrient demand, selectivity, and higher use of the flattest areas



Grazing Allometry: Anatomy, Movement, and Foraging Behavior of Three Cattle Breeds of Different Productivity

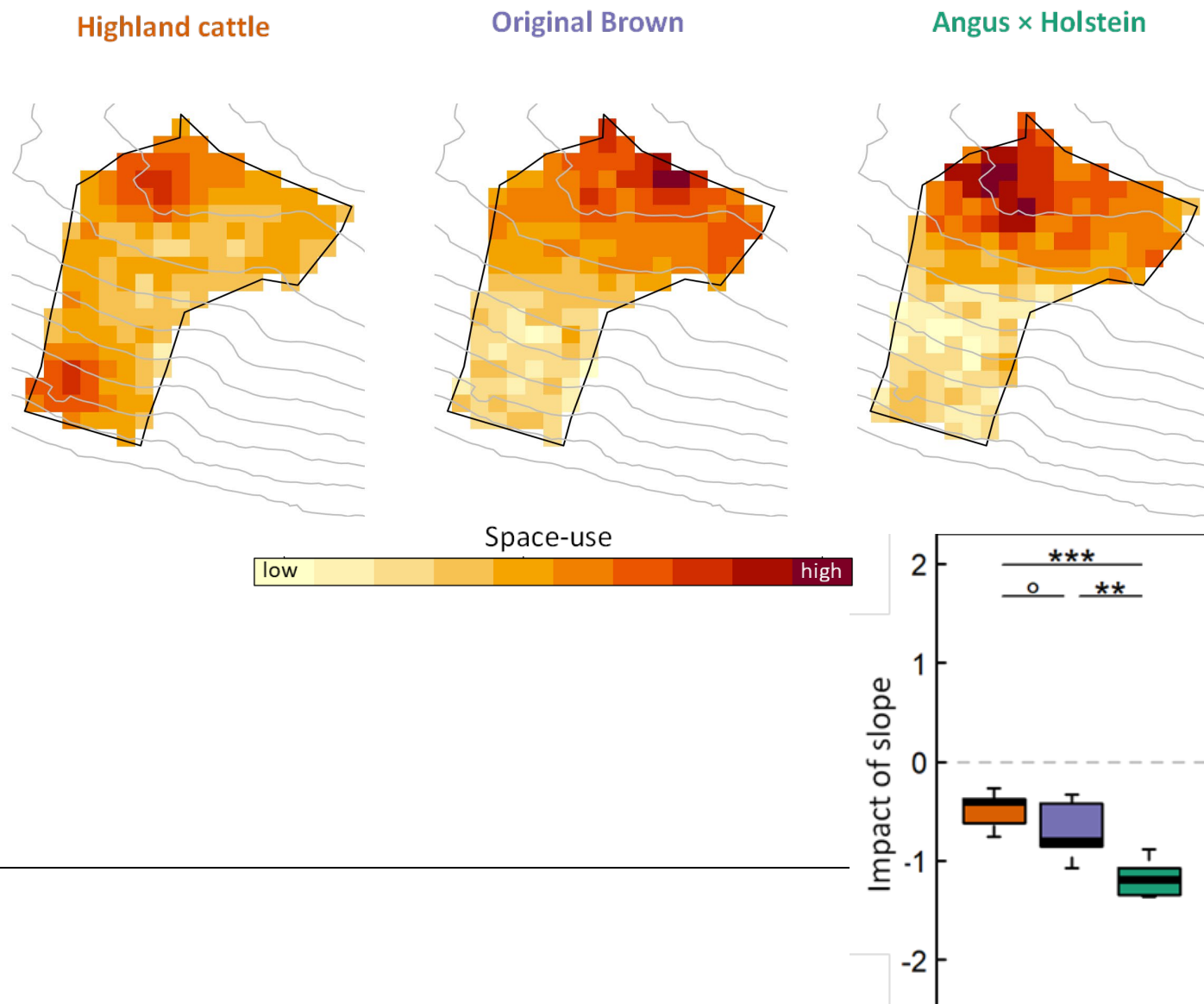
Caren M. Pauler^{1,2,3}, Johannes Isselstein², Joel Berard^{4,5}, Thomas Braunbeck³ and Manuel K. Schneider^{1*}





Effects of nutrient and seed redistribution on biodiversity

- **Uneven use of pastures:** higher use of the flattest areas
- Nutrients transported through animal excretions, seeds by **endozoochory and epizoochory**
- Uneven spatial distribution of dung pats and urine: excretions are mainly deposited in localized flat resting areas, while steeper areas are nutrient depleted
- Increase of pasture heterogeneity and biodiversity at the landscape level: **gradient from nutrient-poor to nutrient-rich vegetation communities**





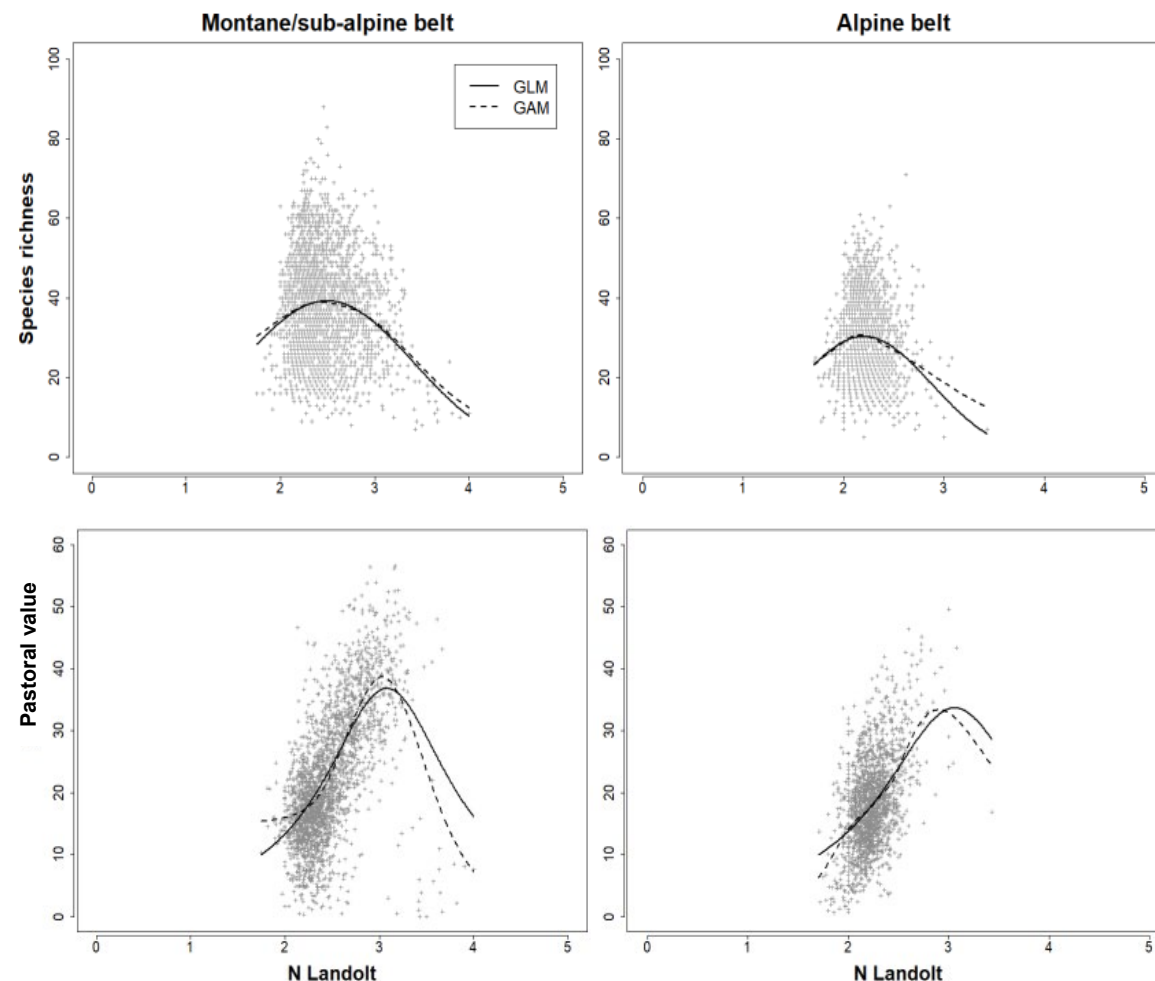
Relationship with soil nutrient content

Research paper

Plant diversity and pastoral value in alpine pastures are maximized at different nutrient indicator values

Marco Pittarello, Michele Lonati, Alessandra Gorlier, Elisa Perotti, Massimiliano Probo, Giampiero Lombardi

- Low and high amounts of soil nutrients = lowest diversity and forage quality
- Lower plant diversity at higher elevations
- **Trade-off between plant diversity and pasture productivity:** plant diversity peaked at intermediate N values, while pastoral value peaked at higher N values
- Importance of having different grassland types at the landscape scale



Current trends: extensification and intensification of alpine pastures

- Intensification of the most productive areas
- Extensification and abandonment of the most marginal ones: woody encroachment
- Both trends: **decrease of plant diversity**



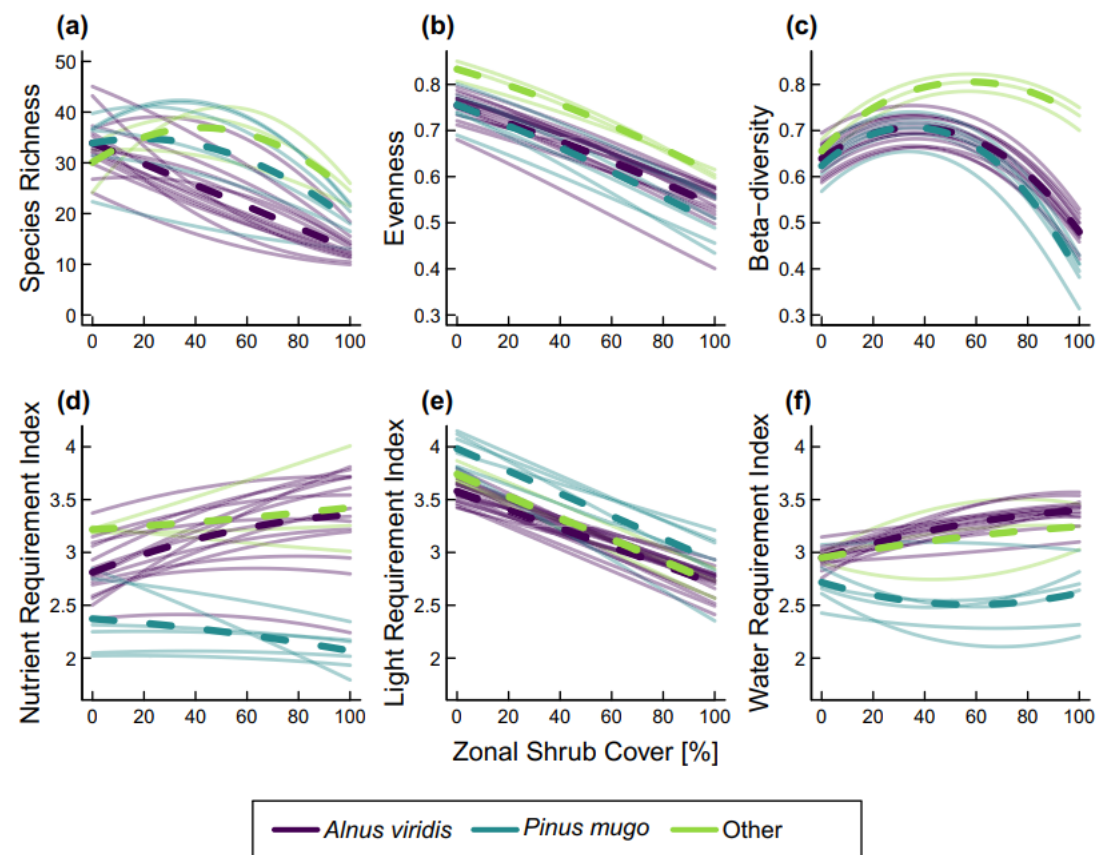
ATF-EAAP Symposium 2024
Massimiliano Probo

Alpine Botany (2020) 130:141–156
<https://doi.org/10.1007/s00035-020-00241-8>

ORIGINAL ARTICLE

Dominant shrub species are a strong predictor of plant species diversity along subalpine pasture-shrub transects

Tobias Zehnder^{1,2} · Andreas Lüscher¹ · Carmen Ritzmann¹ · Caren M. Pauler¹ · Joel Berard^{3,4} · Michael Kreuzer² · Manuel K. Schneider¹





Necessity to define a site-adapted pastoral management

To define a site-adapted pastoral management it is essential to define the:

1. Livestock category
2. **Grazing system**
3. Animal stocking rate
4. **Grazing frequency**
5. Grazing length
6. **Specific agro-pastoral practices**



Pastoral management: effects of grazing systems on biodiversity

- Historically: a large number of small family herds and **herding-based grazing systems**
- Recent decades: lower number of farms and workers per farm, higher average number of animals per herd
- **Free-roaming livestock**: more selective and spatially heterogeneous grazing (over- and under-grazing), negative effects on biodiversity
- Solution: **rotational grazing systems** -> reduction of livestock selectivity. Beneficial effects on biodiversity, increased connectivity among plant communities

RESEARCH ARTICLE

Applied Vegetation Science 

A 5-year rotational grazing changes the botanical composition of sub-alpine and alpine grasslands

Elisa Perotti¹  | Massimiliano Probo²  | Marco Pittarello³ | Michele Lonati¹ | Giampiero Lombardi¹

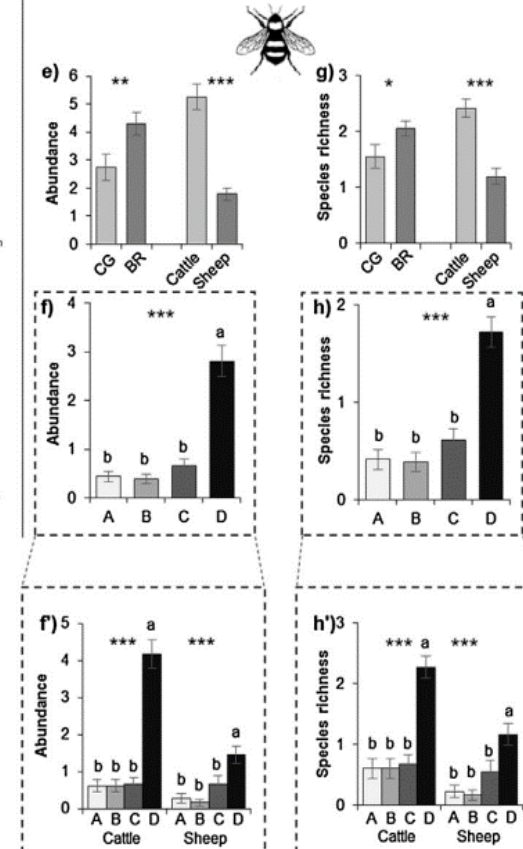
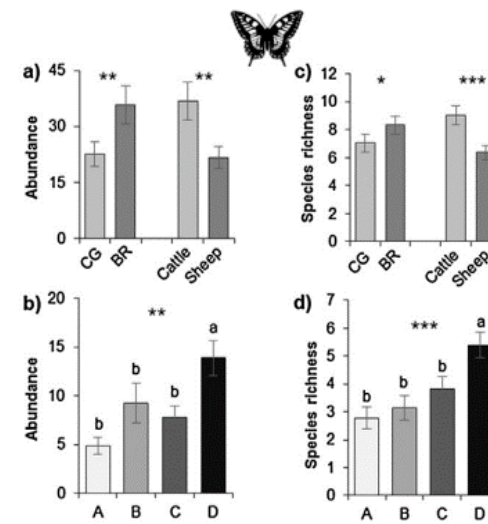
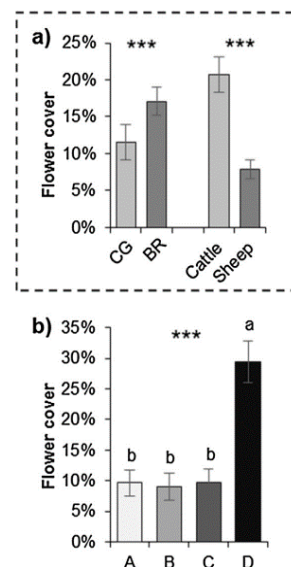
Variables	2011	2016	p-value
	Mean ± SE	Mean ± SE	
Sp. richness	28.72 ± 0.622	36.11 ± 0.814	***
H' index	3.35 ± 0.040	3.51 ± 0.042	***





Pastoral management: effects of grazing frequency on biodiversity

- Multiple grazing events during the vegetative season: necessity of enough time for grass regrowth
- Frequent grazing: presence of species with high resistance to defoliation
- **Early grazing** beneficial to control shrub and coarse plant development
- **Longer resting time** (at the peak of forb flowering season): beneficial effects on biodiversity, but long-term trade-offs



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Agriculture, Ecosystems and Environment

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



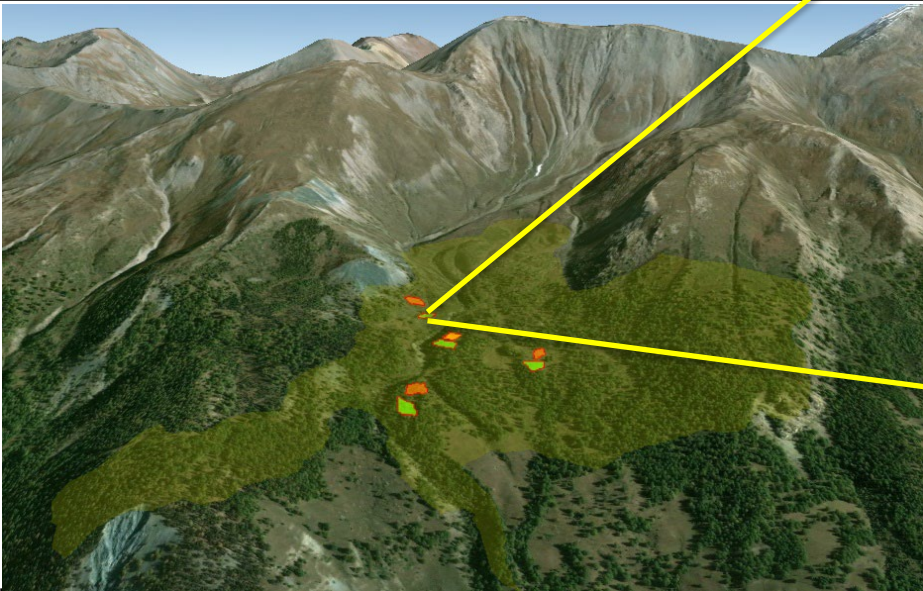
A biodiversity-friendly rotational grazing system enhancing flower-visiting insect assemblages while maintaining animal and grassland productivity

Simone Ravetto Enri^a, Massimiliano Probo^a, Anne Farruggia^{b,*}, Laurent Lanore^b, André Blanchetete^c, Bertrand Dumont^b

Grazing management: effects of one pastoral practice on biodiversity

Temporary night camp areas (TNCA) for cattle on steep and shrub-encroached locations

STUDY AREA: 75 ha, 160 beef cows (135 LU)
grazing for **22 d** in July 2011



4 TNCA + 4 paired CONTROL TNCA



- **Cattle for 2 consecutive nights** within each area, delimited with electric fences
- Mean **extent** of TNCA: **1107 m²**
- **Stocking density:** **0.12 LU m⁻²**

High grazing pressure, trampling, deposition of urine and dung, and seed transportation



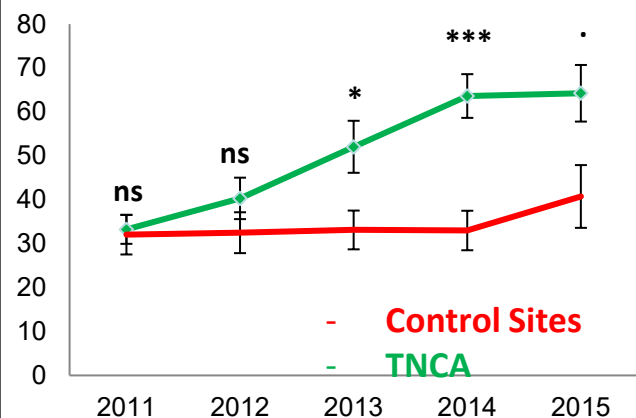
Restoration of sub-alpine shrub-encroached grasslands through pastoral practices: effects on vegetation structure and botanical composition

Marco Pittarello ✉ Massimiliano Probo ✉ Michele Lonati ✉ Giampiero Lombardi ✉

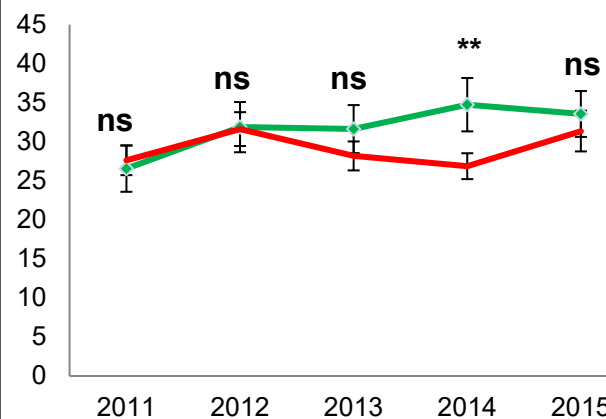
Effects on vegetation

2015

Herbaceous cover (%)



Species richness





Current challenges for the conservation of pasture biodiversity

- **Lower income and direct payment policies**, which are ruled-focused -> minimum stocking rates, grazing dates, specific pasture management actions (e.g. shrub-clearing) -> ineffective results
- **Increased pressure of large predators** -> expensive and time-consuming protective measures, reduction of small ruminants
- **Climate change** -> impact on water availability (increasing drought periods, reduction of water from glaciers) and on forage yield, quality and botanical composition





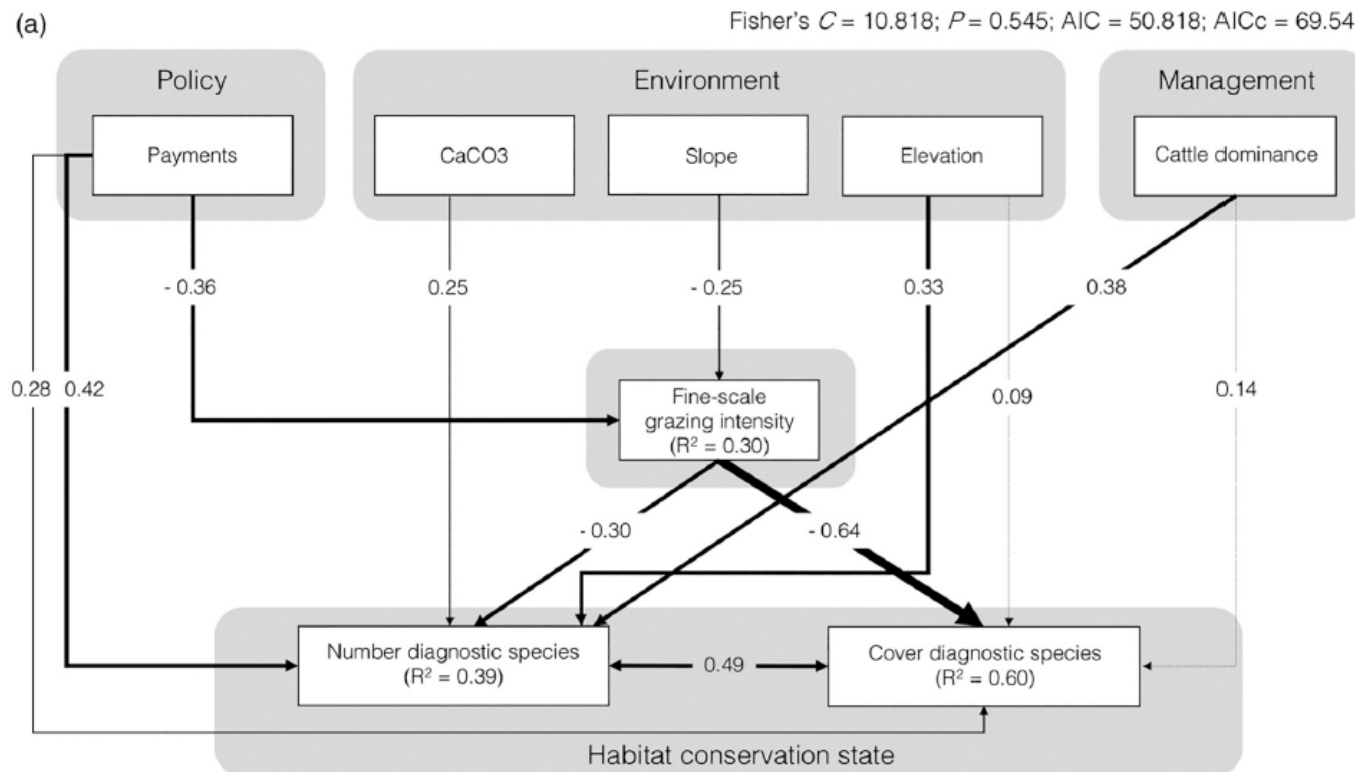
Future perspectives

- **Results-based policies** to promote new site-adapted management strategies. Swiss system: farm-level grazing contracts and periodic field monitoring



Agri-environmental payments drive the conservation and forage value of semi-natural grasslands by modifying fine-scale grazing intensity

Francesca Napoleone^{a,*}, Massimiliano Probo^b, Pierre Mariotte^b, Simone Ravetto Enri^c, Michele Lonati^c, Giovanni Argenti^d, Sabina Burrascano^a

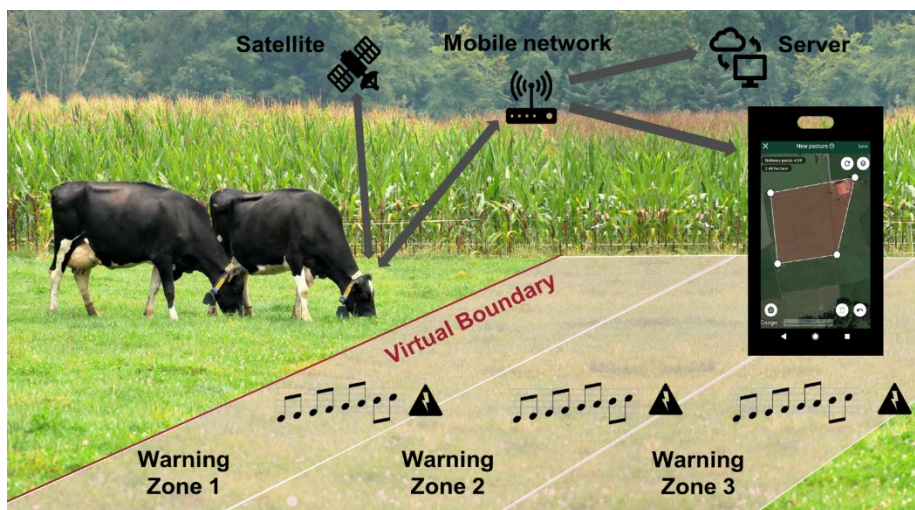


- **Development of sustainable silvopastoral systems:** better adaptation to Climate Change, reduction of wildfire risks and provision of different ES



Future perspectives

- **Improved knowledge transfer:** www.paturalpina.ch
- **New technologies:** airborne sensor systems, GPS-tracking systems, virtual fencing



PIANTE



ROMICE ALPINO



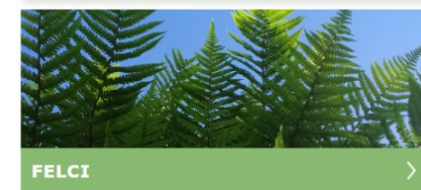
VERATRO BIANCO



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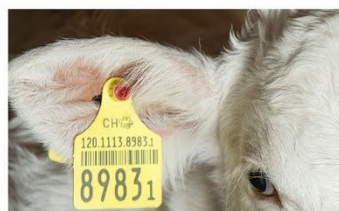
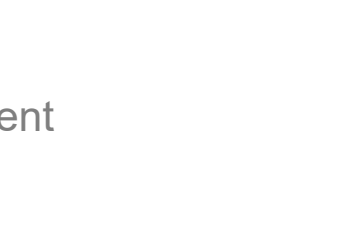
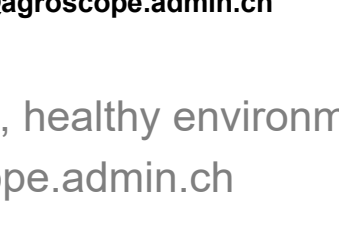
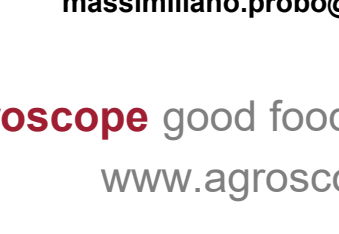
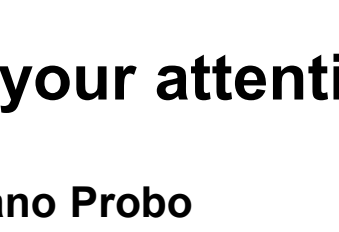
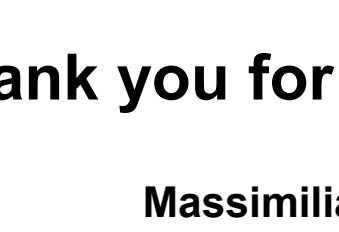
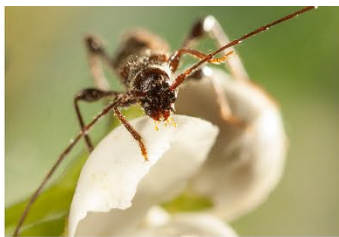
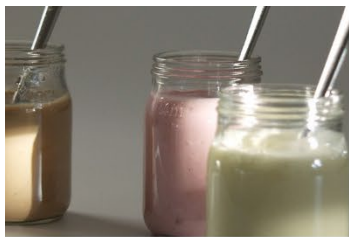
ARBUSTI DI PICCOLA TAGLIA



Take-aways

- **Heritage and environmental importance**
- **How to achieve a site-adapted pastoral management**
- **Importance of targeted political measures**





Thank you for your attention

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