

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**





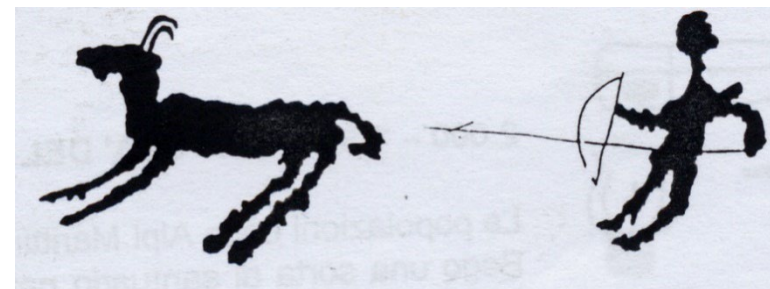
...and alpine pastures





Semi-natural alpine grasslands as cultural landscapes

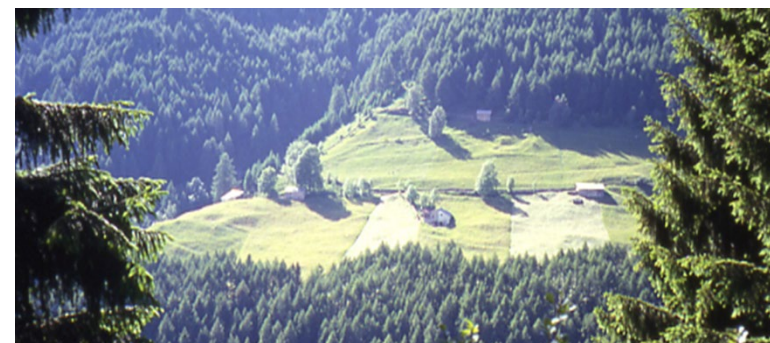
- **15000 BC:** Human alpine settlements at the end of the Ice Age, hunting



- **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**



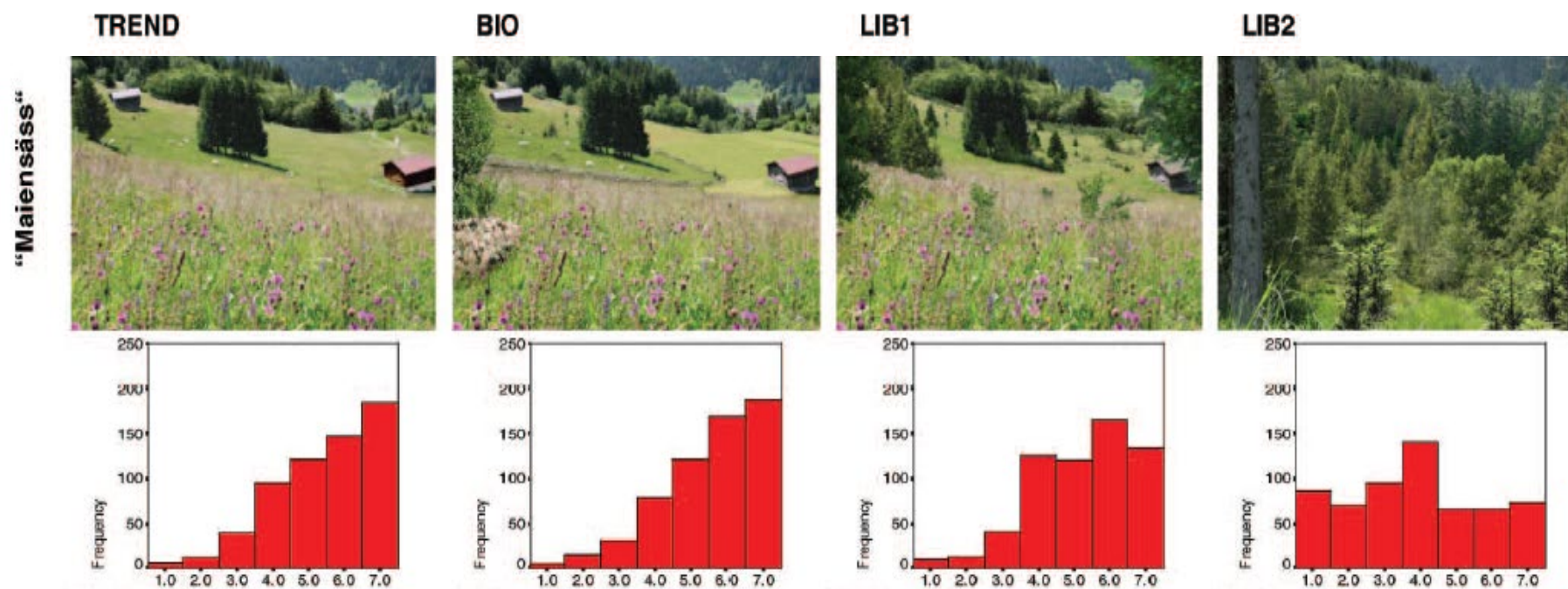


Preferences towards alpine landscapes

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





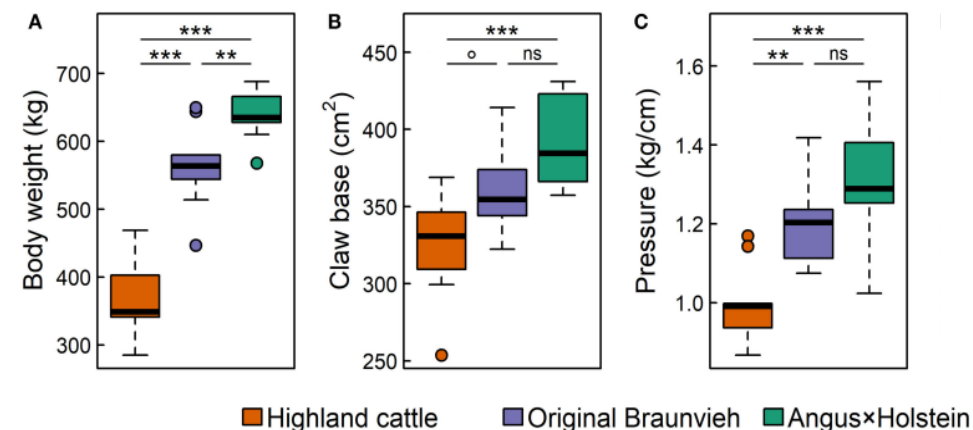
Effects of selective defoliation and trampling on biodiversity

- 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

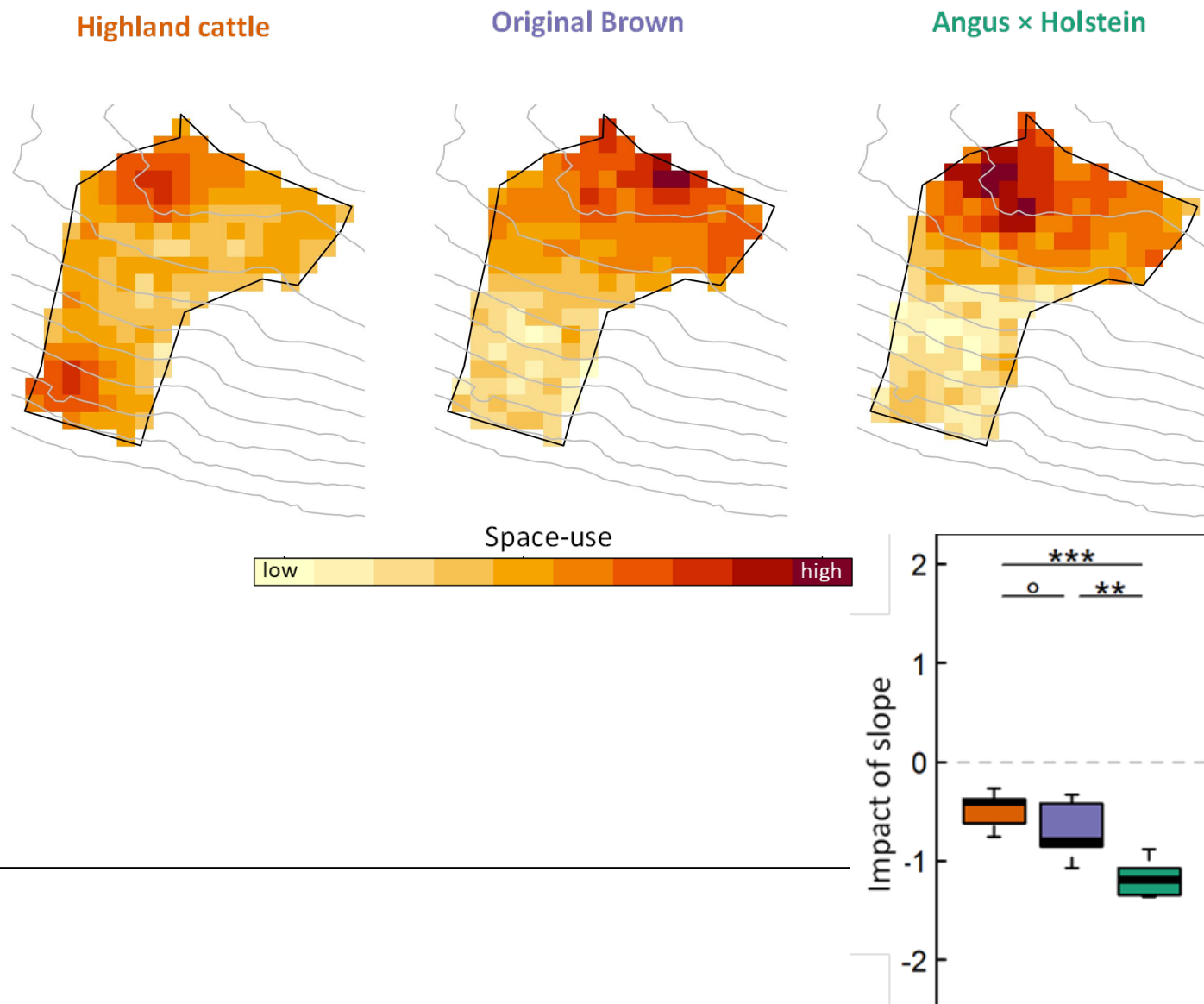
Caren M. Pauler^{1,2,3}, Johannes Isselstein², Joel Berard^{4,5}, Thomas Braunbeck³ and Manuel K. Schneider^{1*}





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**





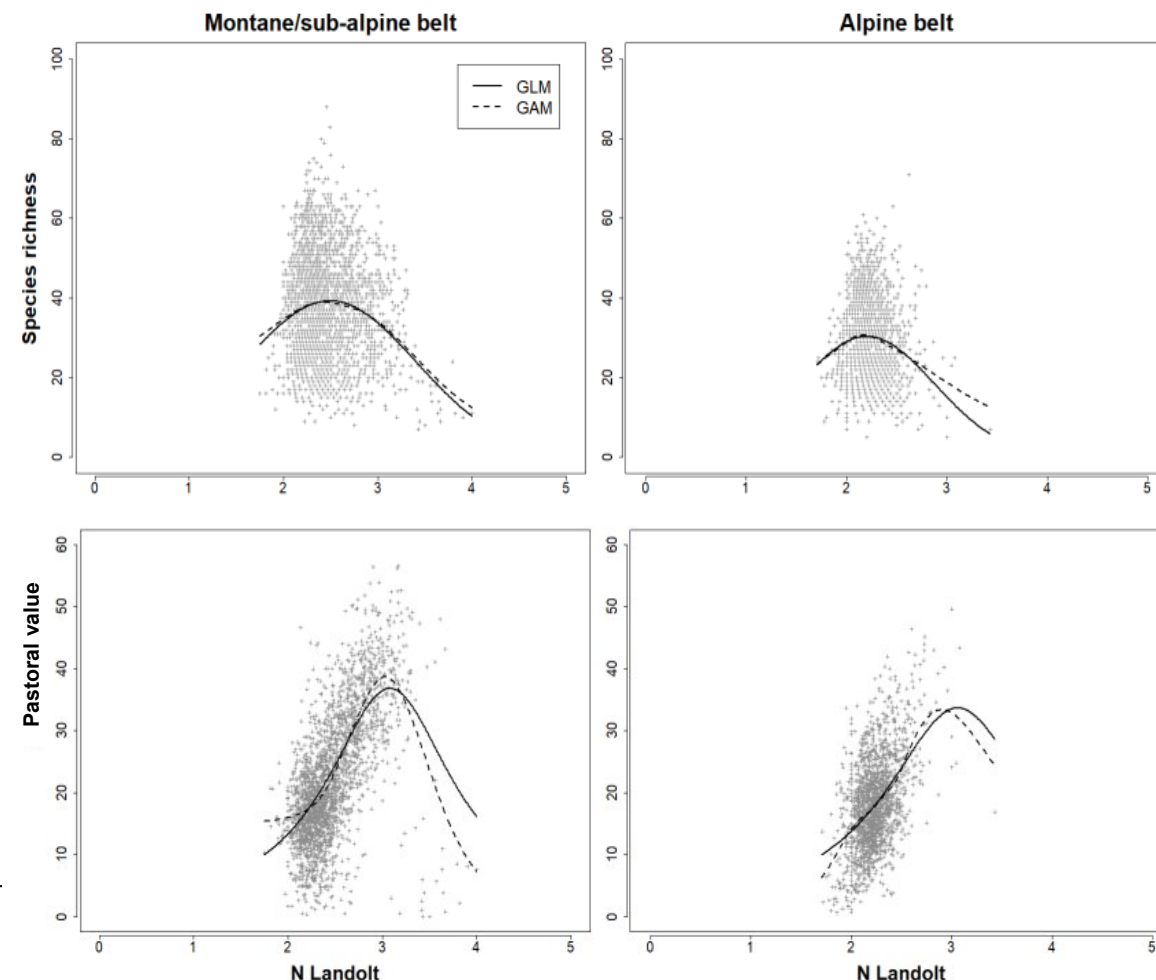
Relationship with soil nutrient content

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**



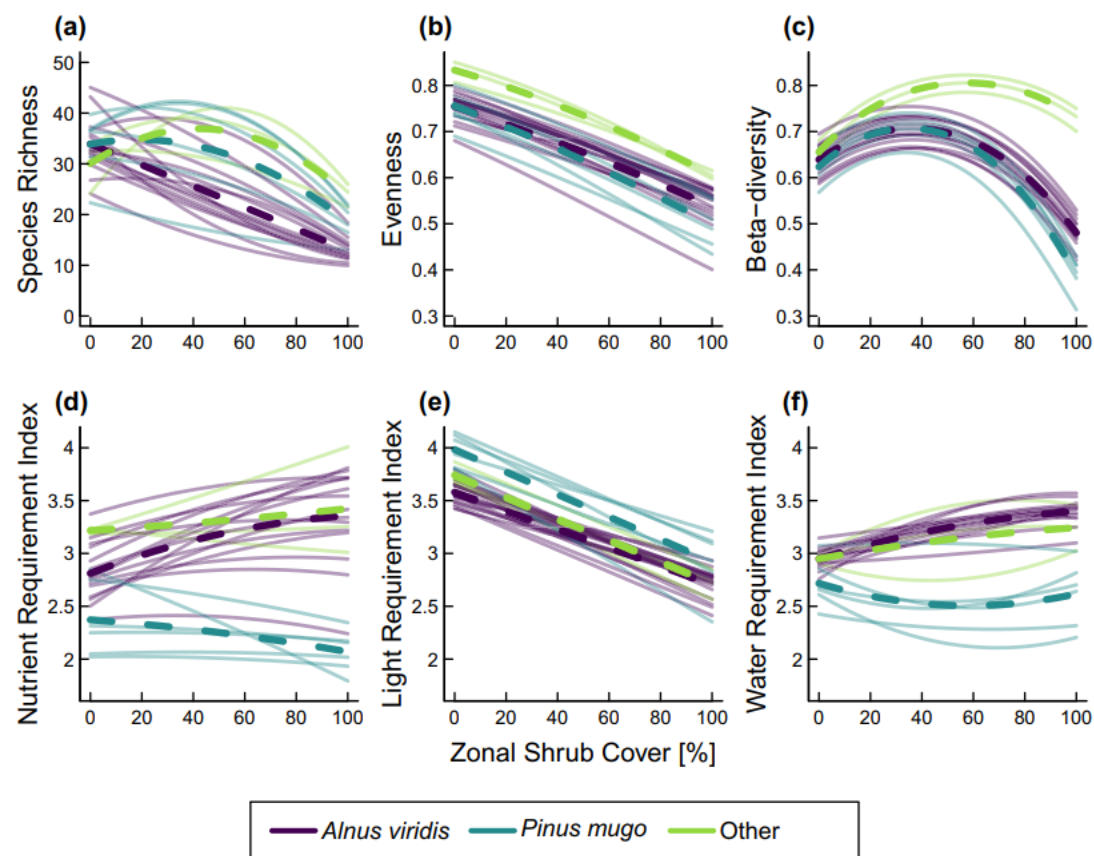
ATF-EAAP Symposium 2024
Massimiliano Probo

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

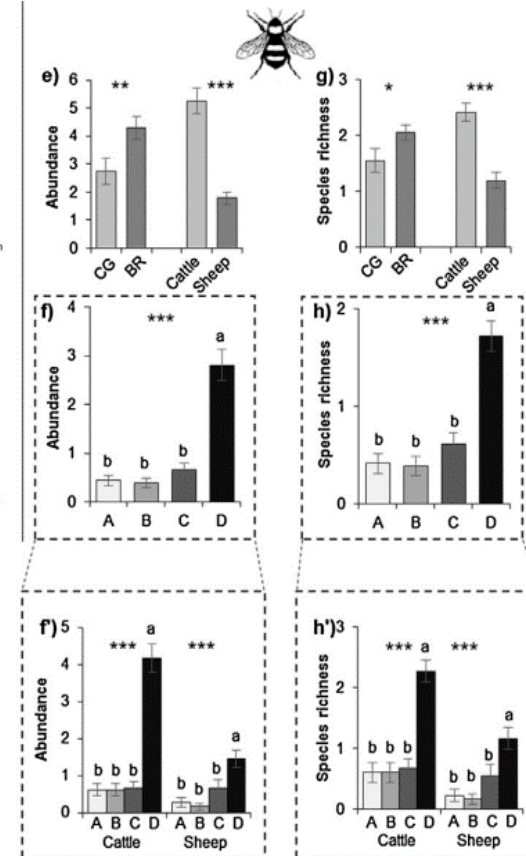
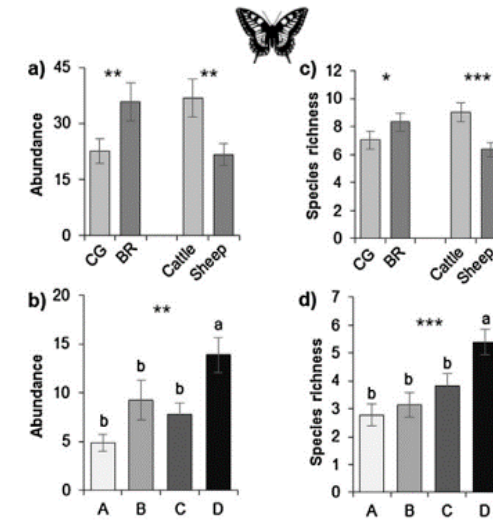
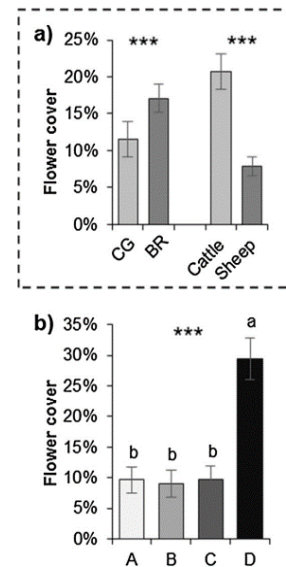
Variables	2011	2016	p-value
	Mean \pm SE	Mean \pm SE	
Sp. richness	28.72 \pm 0.622	36.11 \pm 0.814	***
H' index	3.35 \pm 0.040	3.51 \pm 0.042	***





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

Agriculture, Ecosystems and Environment

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



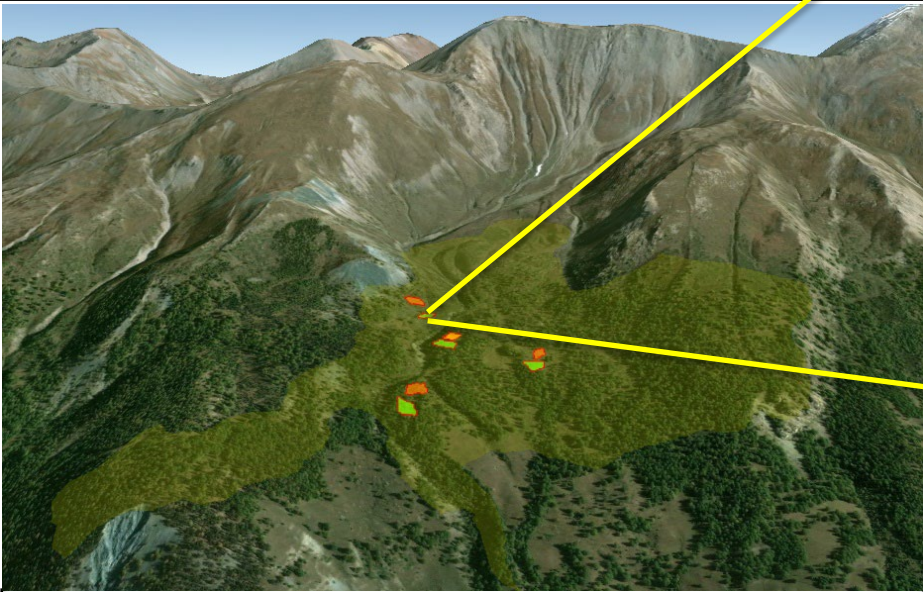
A biodiversity-friendly rotational grazing system enhancing flower-visiting insect assemblages while maintaining animal and grassland productivity

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



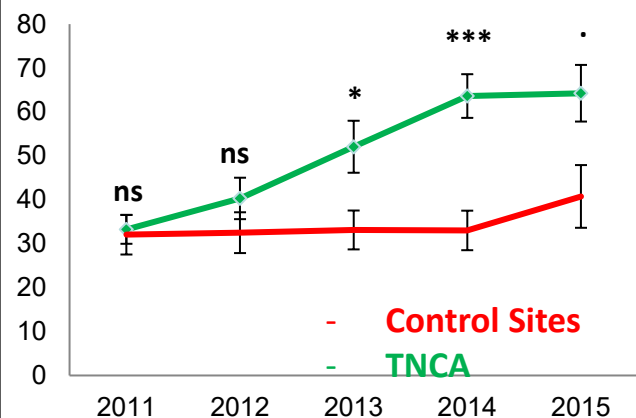
Restoration of sub-alpine shrub-encroached grasslands through pastoral practices: effects on vegetation structure and botanical composition

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

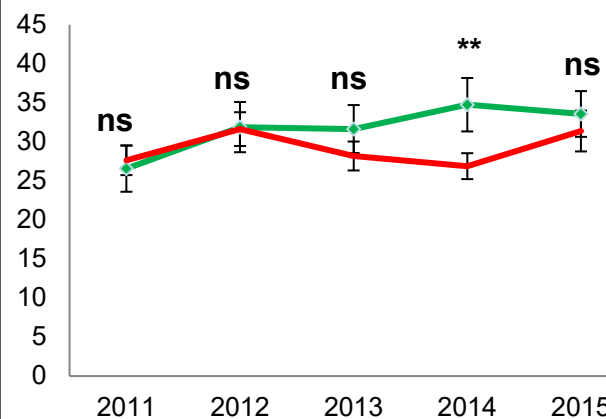
Effects on vegetation

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





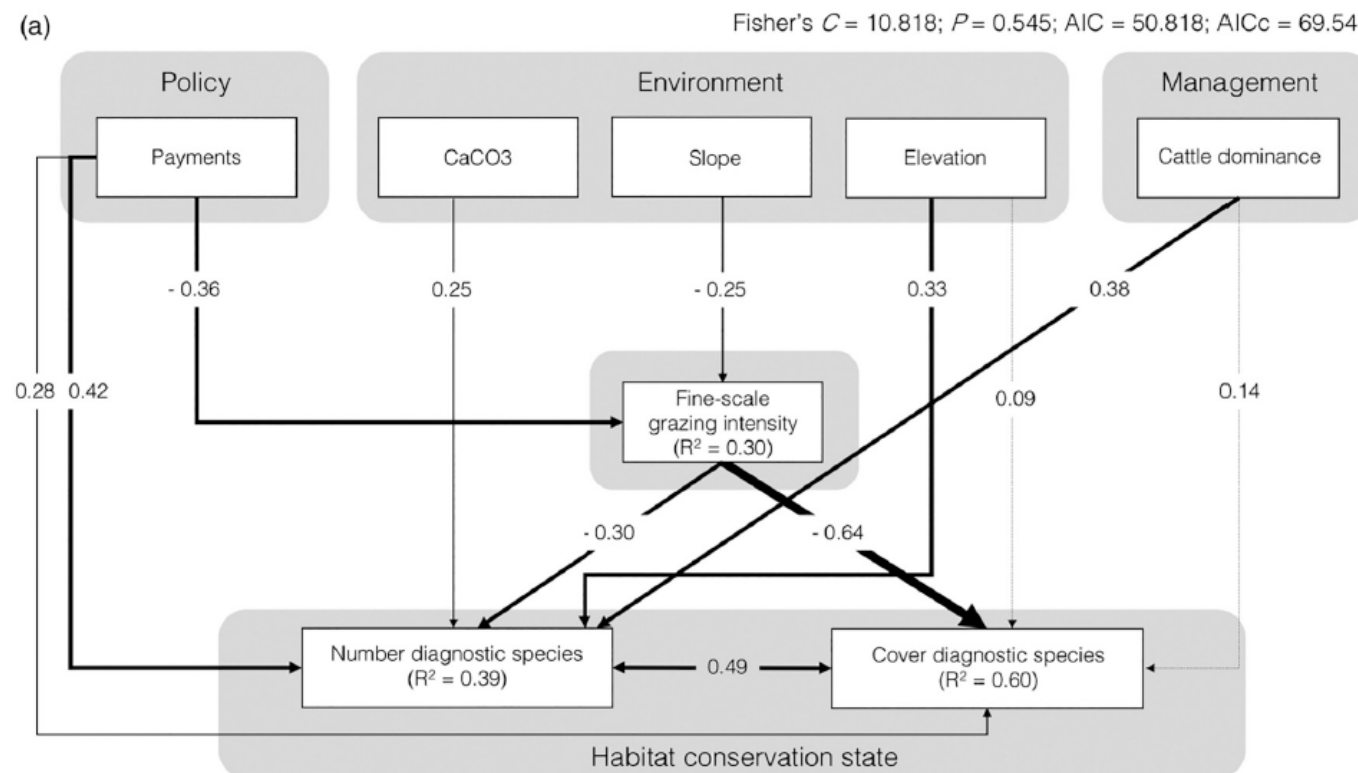
Future perspectives

- **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

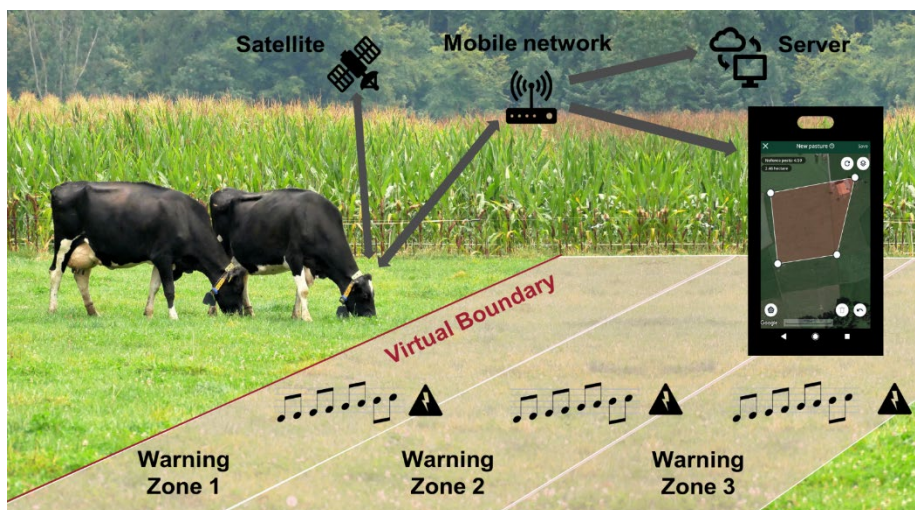


- **Development of sustainable silvopastoral systems:** better adaptation to Climate Change, reduction of wildfire risks and provision of different ES



Future perspectives

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



PIANTE



ROMICE ALPINO



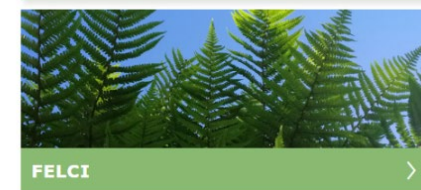
VERATRO BIANCO



GIUNCHI



SENECIONE ALPINO



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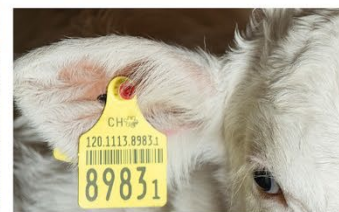
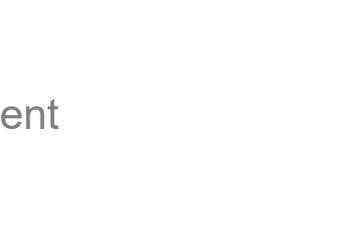
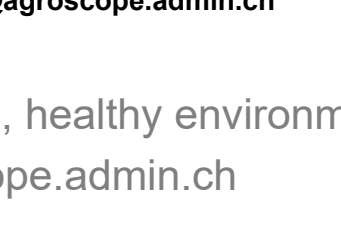
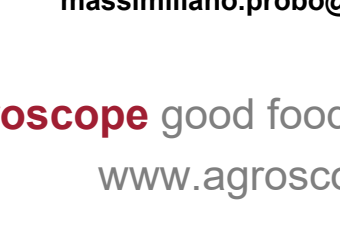
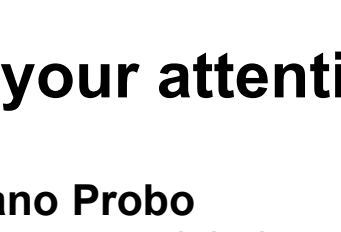
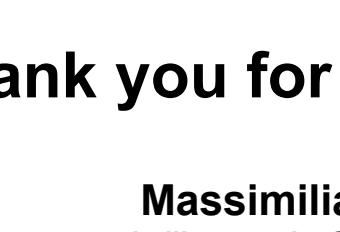
ARBUSTI DI PICCOLA TAGLIA



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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