

Foraging behaviour of pigs, Highland cattle and donkeys in woody-encroached silvopastoral systems: a synthesis of three case studies

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Alpine semi-natural pastures

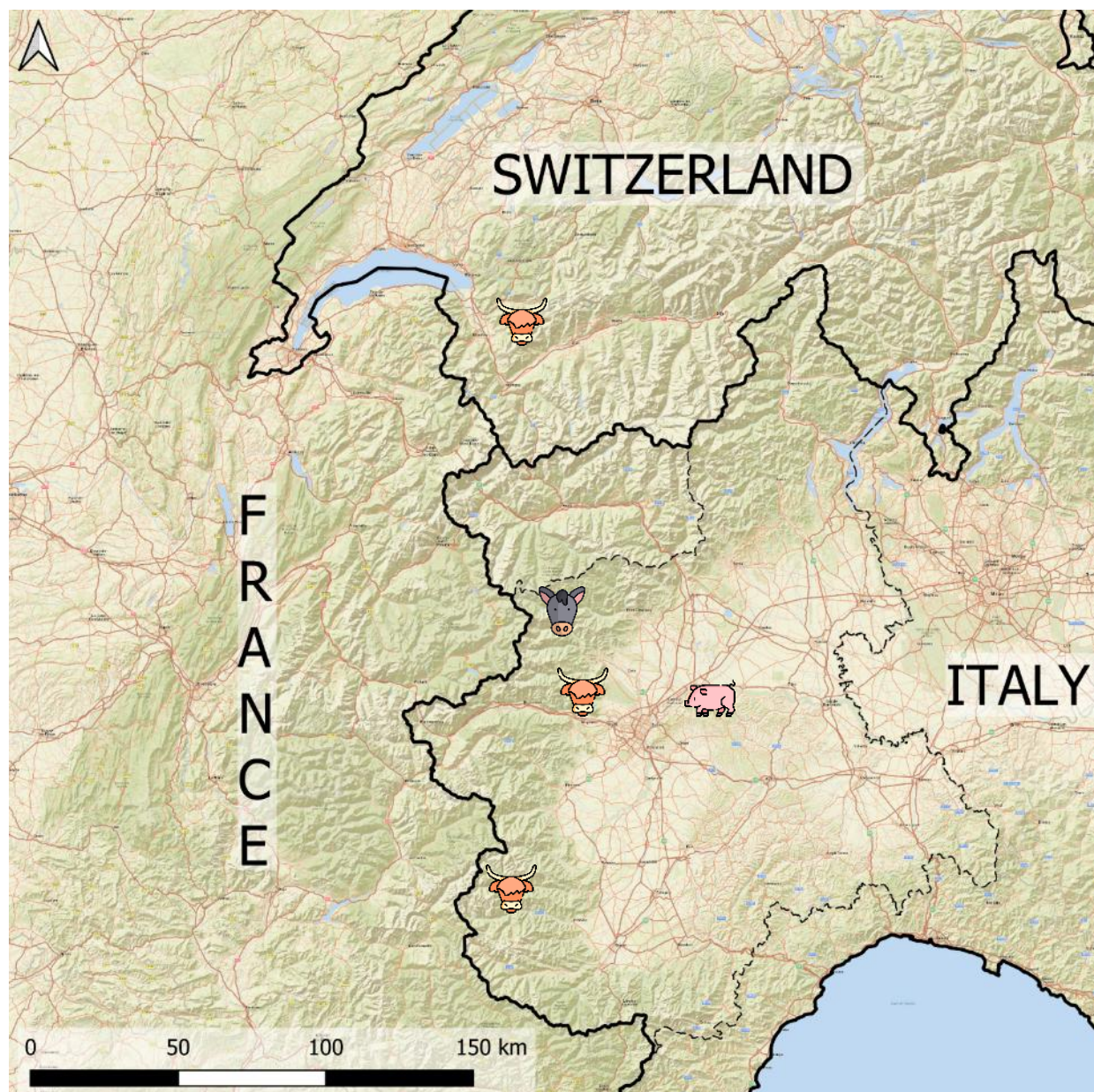
Decline since the 1950s
following the economic boom

Woody tree and shrub
species encroachment

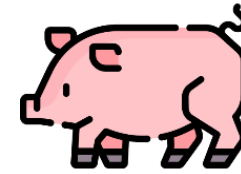
Loss of ecological services



Geographical framework

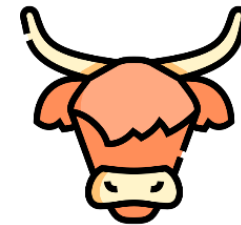


'Nero di Parma' pig: Piedmont hill woodland, Italy (500 m a.s.l.)



- 22 semi-free ranging pigs deployed in a degraded oak (*Quercus robur*) temperate forest undergoing restoration

Highland cattle: western Alps, Italy/Switzerland (480-1745 m a.s.l.)



- Highland cattle herds across highly encroached alpine pasture (woody species cover 50-100%), especially by green alder

Donkeys: Gran Paradiso National Park, Italy (1500-1680 m a.s.l.)



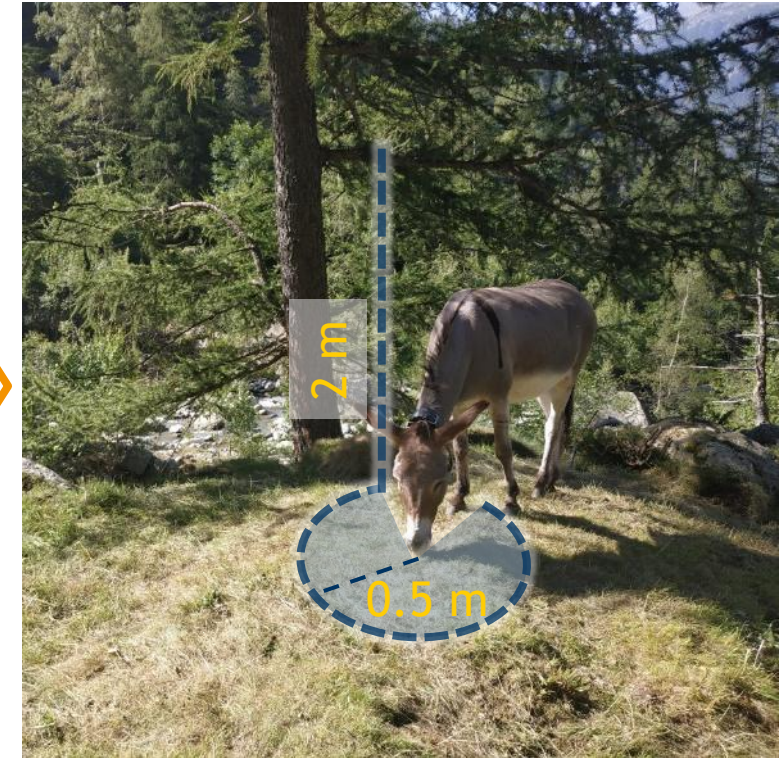
- 18 donkeys monitored in an encroached alpine pasture (woody species cover 31-61%), especially by bramble, birch, and ferns

A common observational framework

Feeding station

The small volume of vegetation immediately available to the animal while foraging without it needing to walk

- Radius: 0.5m around the mouth
- Height limit: animal-dependent (1 m pigs, 1.5 m cattle, 2 m donkeys)

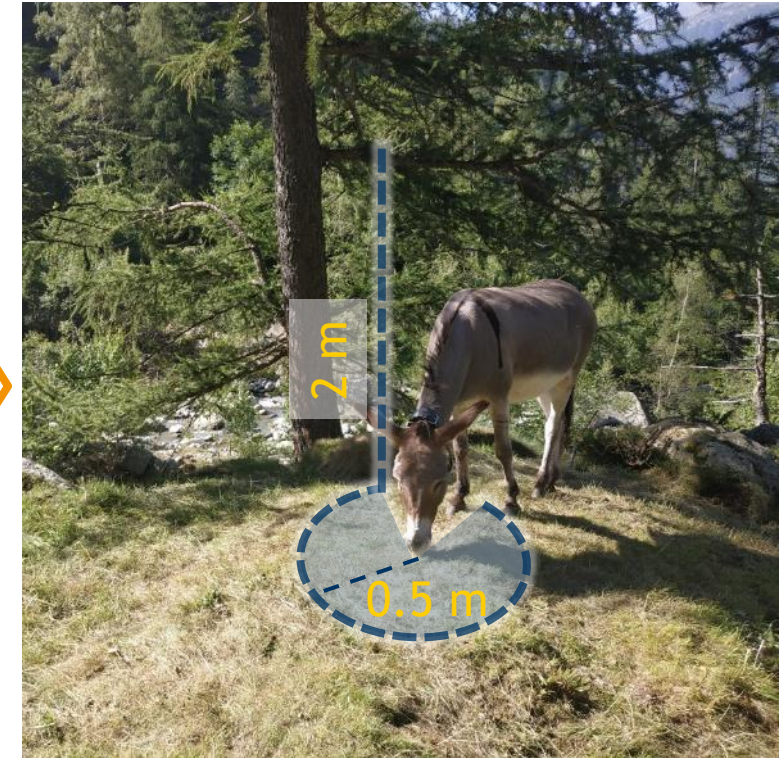


A common observational framework

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Data recorded

1. **Species relative abundance:** % of species available in the feeding station (by volume)
2. **Species relative consumption:** % of species actually eaten (by volume)

(e.g.: **Abundance** 80% species A, 20% species B
Consumed 40% species A, 60% species B)

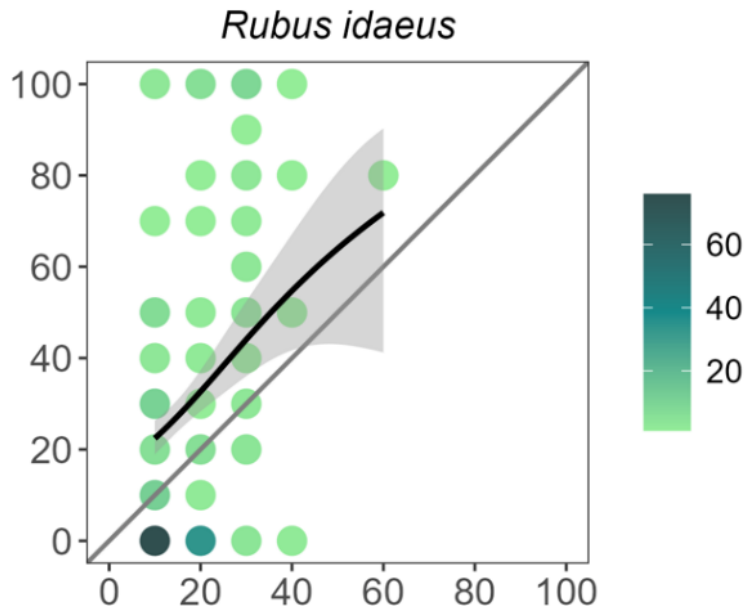
Abundance-consumption relationship

Different relationships between abundance and consumption of the species

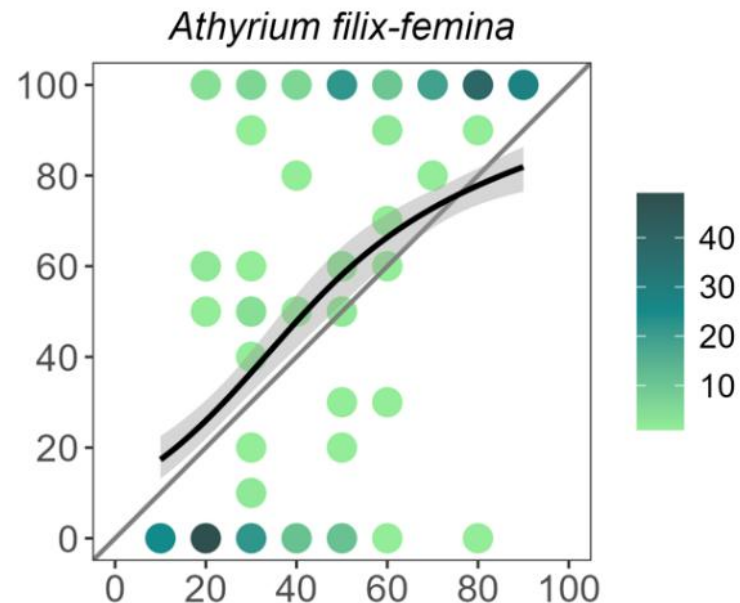
1 More than
proportional selection

2 Proportional
selection

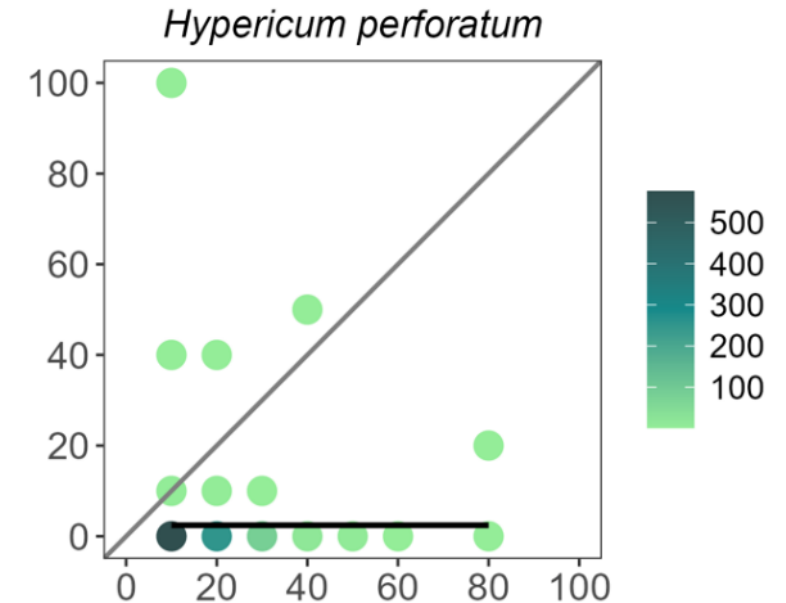
3 Less than
proportional selection



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‘Nero di Parma’ Pigs

Pigs target specific understory species...

- More than proportional consumption of Bramble, black locust, and hazelnut
- Proportional consumption of 9 species (e.g. Chestnuts, *Hedera helix*, and *Clematis vitalba*)
- Less than proportional selection of 18 species (e.g. *Ruscus aculeatus*, *Euonymus europaeus*, and *Lonicera caprifolium*)

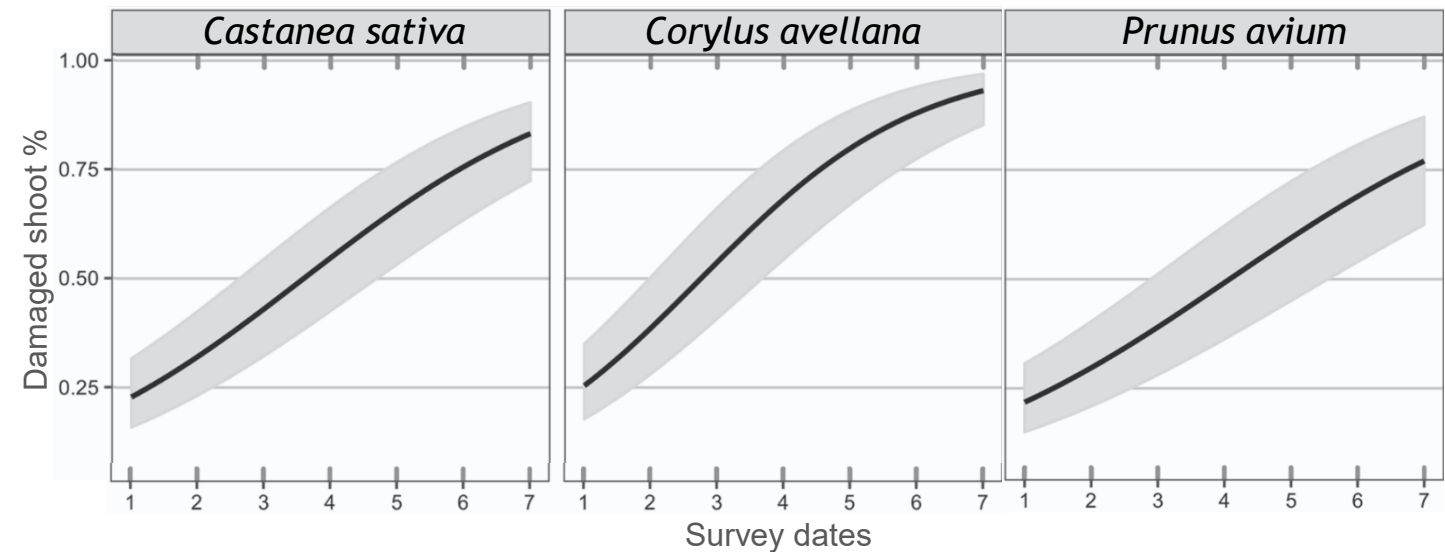


'Nero di Parma' Pigs

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⚠️ ... but can be a threat to silviculture
Following a silvicultural cut, they posed a sever risk to valuable regeneration with high impact on hazelnut, chestnut and wild cherry shoots



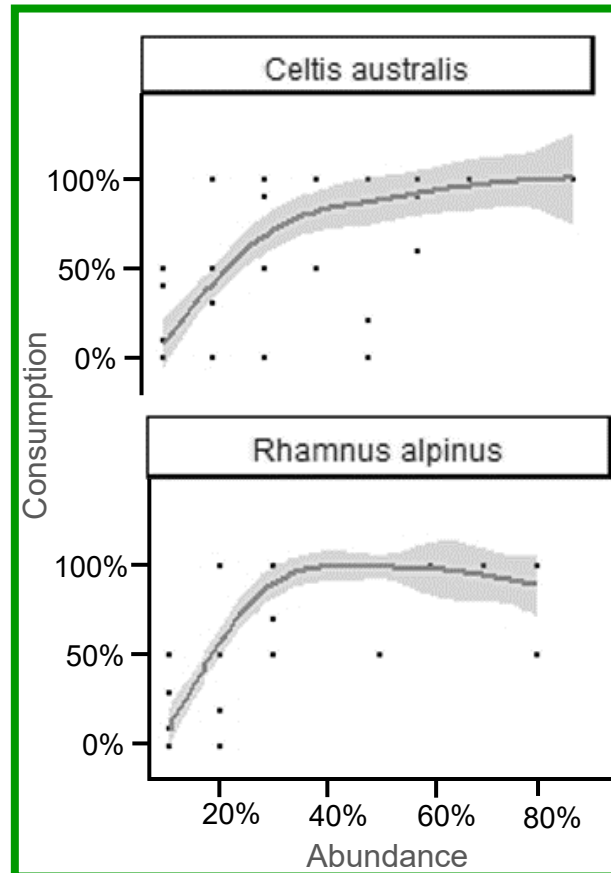
Relationship between the percentage of damaged shoots and time, expressed as survey dates (surveys were conducted every two weeks)



Highland cattle

Highland cattle actively browse trees and shrubs

- They are the most adaptable to highly encroached pasture (15% to 46% of woody species in the diet)
- Species consumption follows the environmental abundance.
- Trampling and mechanical breakage of branches

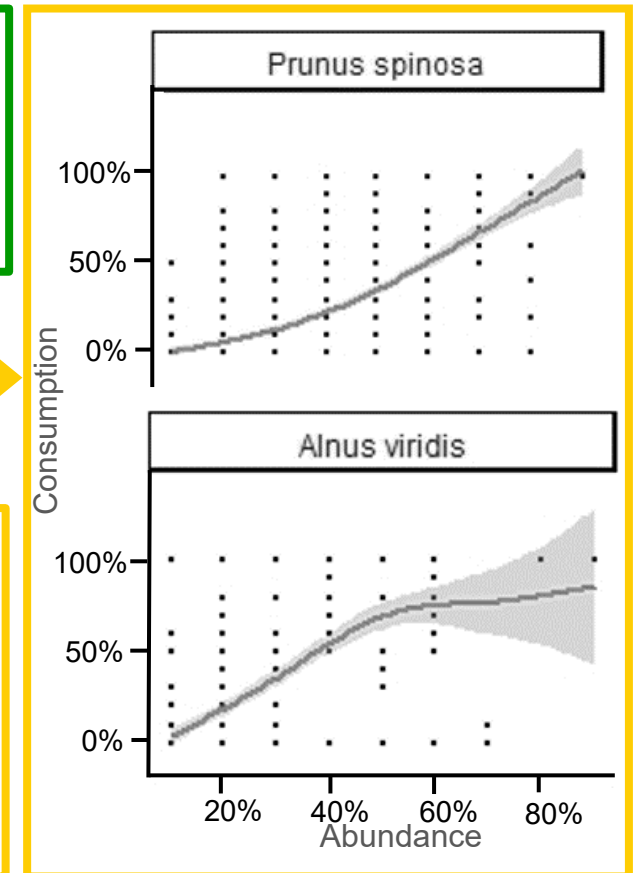


More than proportional consumption

9 woody species: *Celtis australis*, *Fraxinus ornus*,
Quercus rubra, *Rhamnus alpinus*
1 Fern: *Dryopteris dilatata*

Proportional consumption

13 woody species: *Alnus viridis*, *Betula pendula*,
Populus tremula, and *Sambucus nigra*
3 suffruticose: *Prunus spinosa*, *Lonicera xylosteum*,
and *Rosa canina*
1 ferns: *Dryopteris filix-mas*





Domestic Donkeys

Donkeys can maintain grassland through selective browsing

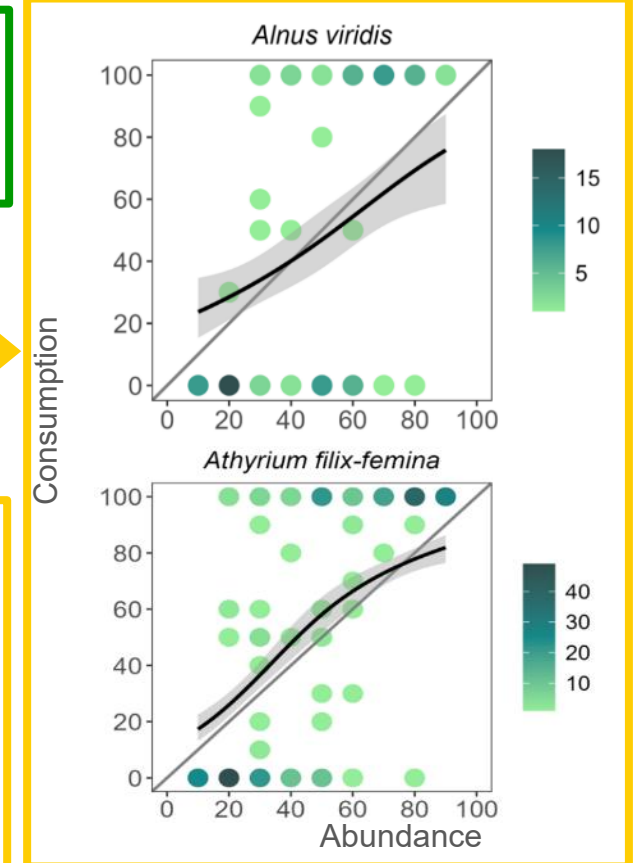
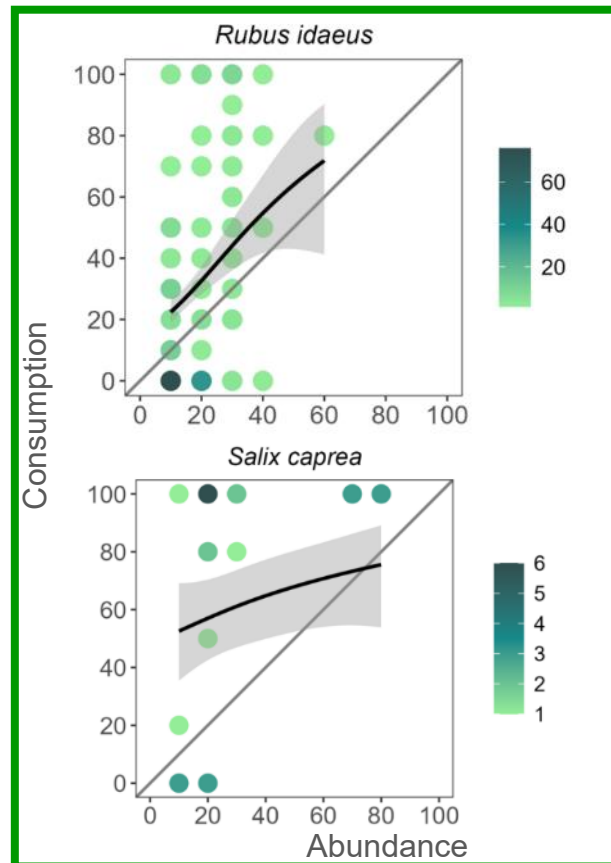
While relying on grass for 89% of their diet, they can adapt to silvopastoral mosaic and exploit alternative forage sources

More than proportional consumption

3 woody species : *Rubus idaeus*, *Salix caprea*, *Sorbus aria*

Proportional consumption

4 woody species: *Alnus viridis*, *Cytisus scoparius*, *Rhododendron ferrugineum*, and *Rosa* spp.
2 ferns: *Athyrium filix-femina* and *Dryopteris filix-mas*
2 suffruticose: *Calluna vulgaris* and *Vaccinium myrtillus*



Target species matrix

Target species	'Nero di Parma' pig	Highland cattle	Domestic donkeys
Bramble	High selection	High selection	High selection
Green alder	/	High selection	Proportional consumption
Black locust	High selection	Proportional consumption	/
Birch	/	Proportional consumption	Avoided
Calluna vulgaris	/	Avoided	Proportional consumption
Chestnuts /Hazelnuts / wild cherry resprouts	Heavy pressure on resprouts	/	/

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Animals should be selected according to the target plant
the same browsing behaviour can be a:

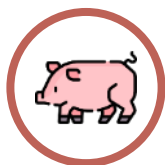
- strong control tool
- valuable support
- lack of control / regeneration risk

Matching the tool to the terrain

Deep deciduous forest

Heavily encroached pasture

Patchy pasture and
encroached pasture edge



- **Aim:** clear heavily encroached understory
- **Precaution:** possible damage to regeneration (e.g. exclude for 3 years after coppice)

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- **Aim:** sustained browsing in highly shrub-encroached mosaics
- **Precaution:** effect depends on species abundance and palatability

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- **Aim:** maintain the herbaceous layer while selectively browsing some woody species and ferns
- **Precaution:** limited impact on some major encroaching species

Thank you for your attention

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Plant species selection and impact on tree resprouts by semi-free ranging pigs in a temperate deciduous forest

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Simone Ravetto Enri  · Marco Pittarello  · Renzo Motta  ·
Luca Maria Battaglini  · Giampiero Lombardi  · Michele Lonati 



Agroforest Syst (2024) 98:491–505
<https://doi.org/10.1007/s10457-023-00926-z>

Foraging behavior of Highland cattle in silvopastoral systems in the Alps

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Simone Ravetto Enri  · Michele Lonati  · Giampiero Lombardi 



Agroforest Syst (2025) 99:187
<https://doi.org/10.1007/s10457-025-01286-6>

Foraging behaviour of donkeys in encroached pastures in Gran Paradiso National Park, Italy

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