Technical basis for integrated pasture management: a participative approach

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Use of pastures by cattle in a Pyrenean ski station
Diagnosis and recommendations for improved preservation of natural resources and snow condition

... finding synergies between livestock production and other activities
Synergies

- **Livestock**: forage resources in high mountain ranges used for a large part of the grazing season

- **Ski resort**: pasture consumption avoids residual biomass during the winter and guarantees the stability of the snowpack during the winter


“Long-Term Impact of Cattle Grazing on Subalpine Forest Development and Efficiency of Snow Avalanche Protection”.

Arctic, Antarctic & Alpine Research, 37: 521-526.
vs. Competence

- competence for the use of resources such as land or labour
  (large reductions in animal census, particularly sheep)

Technical basis for integrated pasture management in Panticosa ski station

1. Diagnosis of current livestock farming systems in the surroundings of Aramon-Panticosa ski resort
2. Analysis of pasture productive potential and stocking capacity
3. Study of current patterns of space use by livestock through the grazing season
4. Integration of results and proposals for optimal management
1. Diagnosis of Current Livestock Farming Systems

Aramón-Panticosa ski station

Spanish Pyrenees, 297 ha resort
Herd of 314 adult cows and their offspring
(occasionally also mares and their foals)
Grazing season of 71 d in 2011:
early summer 14/6 to 28/7
+ early autumn (30/9 to 27/10)

1. Diagnosis of Current Livestock Farming Systems

Structured interview to all farmers (10) whose herds used the ski station

- labour
- herd size
- land use
- management
- technical performance
- attitudes and opinions

a) Production system

Similar farm management and performance to other close areas, except for:

- high farmers’ pluriactivity associated with tourism
- increasing importance of winter transhumance out of the valley reduces dependence on purchased feedstuffs
  releases workload (available for other economic activities)
b) Farm dynamics and objectives

**Continuity** ensured on a medium term, maybe low in the long run...

Farms **stable** in terms of size and management
few changes envisaged in the future
technical < economic objectives and family's quality of life

b) Farmers’ opinions and attitudes about tourism-ski

- the valley and their farming activity had benefitted from the ski resort
  - general improvement of socioeconomic conditions and infrastructures
  - alternative for diversification and capitalization of farming activity
- the ski resort profits from the ecosystem services provided by livestock
Livestock as a tool for environmental management

• Adequate and sustainable pasture use
  - vegetation community: intensity / season
  - expected positive outcome for concurring land uses

• Free ranging herds
  - site preferences depend on biotic and abiotic factors
    *amount and quality of available herbage, slope, water, salt, mineral supply, roads, fences, shade, wind exposure*
  - patterns may change during the grazing season

→ Determine pasture productive potential & stocking capacity
→ Study actual pasture use by livestock through the grazing season
→ Suggest correcting measures where needed
2. ANALYSIS OF PASTURE PRODUCTIVE POTENTIAL & STOCKING CAPACITY

a) Pasture types and distribution

- Photographic interpretation [http://sitar.aragon.es](http://sitar.aragon.es)
- Field research - inventories, GPS

227 ha grazable (76% area)

<table>
<thead>
<tr>
<th>Pasture Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bromion erecti</td>
<td>37%</td>
</tr>
<tr>
<td>Festucion eskiae</td>
<td>22%</td>
</tr>
<tr>
<td>Nardion strictae</td>
<td>8%</td>
</tr>
<tr>
<td>Festucion gautieri</td>
<td>3%</td>
</tr>
<tr>
<td>bare rock areas</td>
<td>11%</td>
</tr>
<tr>
<td>roads/ski tracks and buildings</td>
<td>10%</td>
</tr>
<tr>
<td>hygronitrophylous pastures</td>
<td>1%</td>
</tr>
<tr>
<td>dense forest pastures</td>
<td>2%</td>
</tr>
<tr>
<td>open forest pastures</td>
<td>1%</td>
</tr>
</tbody>
</table>

ArcGis 9.3

- Soil use
- Phytosociological classification

Photographic interpretation [http://sitar.aragon.es](http://sitar.aragon.es)

Field research – inventories, GPS
b) Pastoral value and stocking capacity

- **Pastoral value** (0-100)
  - of each community:
  - % of a given species * specific index of each

- **Stocking capacity** (LU/ha)
  - Pasture productivity and Pastoral Value
  - Total area of each pasture type
  - Animal requirements

**Stocking capacity**
1.24 LU/ha during the summer (total: 282 LU)

3. STUDY OF ACTUAL PASTURE USE BY LIVESTOCK THROUGH THE GRAZING SEASON

Weekly observation:
- scan-sampling at 30-min intervals during daylight
- no. heads, activity, position… on-site recorded on a map
- transfer to Geographic Information System (ArcGIS Desktop 9.3)
- biotic & abiotic characteristics of each pasture polygon
Calculations

- For each grazed polygon in the ski station (n=217):
  - stocking rate (LU*month/ha)
  - vegetation type, pastoral value
  - altitude, slope, exposure
  - distance roads, buildings, water, salt
- Same for non-grazed vegetation types / land use polygons (n=73)
- For each pasture type/land use category:
  - Ivlev’s electivity index (+1 to -1)

Comparisons

- Abiotic factors in grazed vs. non-grazed areas
- Correlations among stocking rate and abiotic factors
- Space use in summer vs. autumn

Results

- Livestock used 190 ha (64% of the total area) with a stocking rate of 0.646 LU*month/ha during 2.3 months
- 282 LU/ski station/summer = pasture stocking capacity
  - animal censuses adjusted to pasture offer

Distribution of stocking rate
• Livestock grazed on 189 ha (64% of the total area)

• They rejected 36% of the available area:
  – areas of lower **pastoral value**
  – with higher **slope**
  – at higher **altitude**
  – farther from **salt areas**
  – farther from **infrastructures**
  – not limited by distance from water

<table>
<thead>
<tr>
<th>Grazed</th>
<th>Non-grazed</th>
<th>Sign.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude, m</td>
<td>1695</td>
<td>&lt;</td>
</tr>
<tr>
<td>Slope, %</td>
<td>16</td>
<td>&lt;</td>
</tr>
<tr>
<td>Aspect, ° from N</td>
<td>254 (S)</td>
<td>≠</td>
</tr>
<tr>
<td>Distance to salt, m</td>
<td>461</td>
<td>&lt;</td>
</tr>
<tr>
<td>Distance to water, m</td>
<td>442</td>
<td>&gt;</td>
</tr>
<tr>
<td>Distance to buildings, m</td>
<td>237</td>
<td>&lt;</td>
</tr>
<tr>
<td>Distance to roads, m</td>
<td>63</td>
<td>&lt;</td>
</tr>
<tr>
<td>Pastoral value, points</td>
<td>24.3</td>
<td>&gt;</td>
</tr>
</tbody>
</table>
• **Ivlev’s electivity index**: pasture type / land use category

<table>
<thead>
<tr>
<th>Pasture Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bromion erecti</td>
<td>0.14</td>
</tr>
<tr>
<td>Festucion eskiae</td>
<td>-0.24</td>
</tr>
<tr>
<td>Nardion strictae</td>
<td>0.19</td>
</tr>
<tr>
<td>Primulion intricatae</td>
<td>-0.14</td>
</tr>
<tr>
<td>Festucion gautieri hygronitrophylous pastures</td>
<td>0.23*</td>
</tr>
<tr>
<td>meadows</td>
<td></td>
</tr>
<tr>
<td>open forest pastures</td>
<td>-0.13</td>
</tr>
<tr>
<td>dense forest pastures</td>
<td>-0.03</td>
</tr>
<tr>
<td>bare rock areas</td>
<td>-0.60</td>
</tr>
<tr>
<td>roads/ski tracks and buildings</td>
<td>-0.01</td>
</tr>
</tbody>
</table>

Avoided and preferred pastures and grazing at different stocking rates!

**Preference for different pasture types**

- **positive selection** for meadows, *Mesobromion, Caricion nigrae, Nardion strictae*, and *Festucion gautieri* pastures (and areas close to buildings and infrastructures)
- **negative selection** for rocky areas, forests, *Festucion eskiae* and *Primulion intricatae* pastures

**Avoided**
- *Festucion eskiae*

**Preferred**
- *Bromion erecti*

• different pastures grazed at different stocking rates

• preferences for pastures and topographical aspects changed throughout the grazing season
- Within grazed areas cattle distribution was not homogeneous: stocking rate related to pasture characteristics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Summer</th>
<th>Autumn</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stocking rate, LU*month/ha</td>
<td>0.747</td>
<td>&gt; 0.362</td>
<td>**</td>
</tr>
<tr>
<td>Polygon area, ha</td>
<td>6.0</td>
<td>&lt; 16.8</td>
<td>**</td>
</tr>
<tr>
<td>Distance to salt, m</td>
<td>406</td>
<td>&lt; 615</td>
<td>***</td>
</tr>
<tr>
<td>Distance to water, m</td>
<td>482</td>
<td>&gt; 329</td>
<td>***</td>
</tr>
<tr>
<td>Distance to buildings, m</td>
<td>252</td>
<td>&gt; 195</td>
<td>*</td>
</tr>
<tr>
<td>Distance to roads, m</td>
<td>61</td>
<td>&lt; 149</td>
<td>***</td>
</tr>
<tr>
<td>Aspect, ° from N</td>
<td>270 (S)</td>
<td>&gt; 208 (SW)</td>
<td>***</td>
</tr>
<tr>
<td>Altitude, m</td>
<td>1672</td>
<td>&lt; 1759</td>
<td>**</td>
</tr>
<tr>
<td>Slope, %</td>
<td>16.6</td>
<td>&gt; 14.4</td>
<td>*</td>
</tr>
</tbody>
</table>

Preferences changed throughout the grazing season.

- Different pastures... larger home range in the autumn.
4. PROPOSALS FOR OPTIMAL MANAGEMENT

Comparison of actual use of each pasture type with advised management

livestock performance, resource sustainability, stability of the snowpack

- modifying temporal and spatial management
- providing infrastructures

Adequate:

- *Bromion erecti* pastures grazed according to recommendations at the start & end of grazing season
- *Festucion eskiae* and *Festucion gautieri* pastures naturally avoided as suggested, to prevent from soil erosion

but...

- high quality *Primulion* pastures should be grazed through the summer
- *Nardion* pastures grazed only in early summer: should be grazed more intensely in the autumn

(force use with salt in target areas or fencing access to others)

- *hygronitrophylous pastures* by a leaking water trough in a plain: *place in steep areas + maintenance*
Optimal SR to ensure a proper use of each vegetation type

- modifying temporal and spatial management
- providing infrastructures

Conclusions

a) Farmers have adapted their traditional production systems to allow for pluriactivity related to tourism. They are aware of the mutual benefits between the ski resort and grazing activities and prone to collaborate.

b) Current stocking rates are adjusted to pasture carrying capacity, although use of space is not homogeneous but conditioned by different biotic and abiotic factors.

→ Some pastures are grazed according to recommendations for sustainable management, livestock performance and enhanced preservation of the snowpack.

→ Proposals for a better use of some areas include modifying animal management and providing infrastructures.

Mutual benefit for farmers and the ski resort
Interest of a participative management design
Can livestock be a tool for landscape preservation?

finding synergies...

efficient animal production
+ environmental services

Thanks for your attention