Multifunctionality of extensive mountain livestock farming and its maintenance in the future

A case-study (Pyrenees National Park area, France)

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Extensive livestock farming in European mountain areas

- a large set of functions
  - conservation of biodiversity hotspots (High Nature Value farmland)
  - delivery at the landscape level of crucial bundles of ecosystem services (ESs) for sustainable rural development

- a sustainability challenge
  - Continuous decline due to intensification and land abandonment
  - Failure of public policies to safeguard them (economic viability)

- a challenge for research
  - Improved understanding of place-specific social-ecological relationships between change in FSs and change in ES bundles to support effective policy and management decision-making

Beaufoy & Poux 2014; Morgan-Davies et al. 2014; Plieninger et al. 2015; Strohbach et al 2015
Farming and landscapes characteristics in the PNP area

- **Small-scale familial agriculture agropastoral system** based on extensive cattle & sheep production

- **Landscape shaped by a long-standing agropastoral tradition**
  private land/ commons individual/collective land management

- **Predominance of semi-natural vegetations** in UAA
  95% grassland and wood-grassland

- **Changes in private land use and agricultural landscape** threatening biodiversity conservation and the delivery of social and cultural ESs of major importance for sustainable rural development

A. Gibon & G. Balent, International Conference on Conservation Agriculture and Sustainable Land Uses, 30-5/2016, pest, Hungary
Study assumptions

• Change in the composition and configuration of mosaic of agroecosystem types and management
  ➢ Currently best proxy of change in ESs bundles delivered at the landscape level (Burgi et al. 2015)

• Traditional management practices of agroecosystems at the parcel level
  ➢ Ecologically intensive in the study area (Balent et al. 2015)
Study design

• A spatially-explicit survey of every farm working the landscape
  5 villages; agricultural landscape: 762 ha; 37 farms
  • family-farm operation in 2010
  • farm territory composition & management (agroecosystems at parcel level)
  • History of family-farm over the 1950-2010 period
  • major events and rationales for changes over time in the system

• Systemic modelling of individual family-farm dynamics
  • family-farm trajectories of change
  • main factors explaining them
    (modular analysis / Q and q data)

➢ Archetypes of families’ farm-development strategies and
their social-ecological rationales

## Archetypes of family farm-development strategies over the 1950-2010 period

<table>
<thead>
<tr>
<th>Main family motivations</th>
<th>Main objectives/farm-holding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entrepreneur</strong></td>
<td>Continuation of livestock farming</td>
</tr>
<tr>
<td><strong>Patrimonial</strong></td>
<td>LT continuation of agropastoral lifestyle</td>
</tr>
<tr>
<td><strong>Conservative</strong></td>
<td>‘passion’ for livestock farming</td>
</tr>
<tr>
<td><strong>Phoenix</strong></td>
<td>land-resource LT maintenance &amp; stewardship /family farm-holding &amp; whole landscape</td>
</tr>
<tr>
<td><strong>Retreat</strong></td>
<td>Rural lifestyle for generation who installed</td>
</tr>
<tr>
<td><strong>Neo-rural</strong></td>
<td>‘hobby’/ commercial livestock farming</td>
</tr>
</tbody>
</table>

Strategies rooted in cultural values in local agropastoral tradition including an integral transfer of farm-holding to a unique successor

Respective contribution of farms to landscape management in 2010 according to strategy types

(wood)-grassland total area

Steep hay meadows*

* Slope $\geq 30\%$
Proxi for contribution to maintenance of agroecosystem types & management practices of importance / landscape social & cultural ESs

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Farm size</th>
<th>Land Use Type</th>
<th>UAA Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrepreneur</td>
<td>3</td>
<td>Agropastoral</td>
<td>Large (average UAA: 52 ha)</td>
</tr>
<tr>
<td>Patrimonial - LS</td>
<td>8</td>
<td>Agropastoral</td>
<td>Large</td>
</tr>
<tr>
<td>Patrimonial - MS</td>
<td>8</td>
<td>Agropastoral</td>
<td>Medium (av. UAA:25 ha)</td>
</tr>
<tr>
<td>Conservative</td>
<td>9</td>
<td>Agropastoral</td>
<td>Small (av. UAA: 10 ha) / medium</td>
</tr>
<tr>
<td>Phoenix</td>
<td>3</td>
<td>Agropast. &amp; addit. livest. prod</td>
<td>Small /medium</td>
</tr>
<tr>
<td>Neo-rural</td>
<td>3</td>
<td>sedentary livestock</td>
<td>Small /medium</td>
</tr>
</tbody>
</table>

# Factors and processes of 1950-2010 change in farm-territory management and size according to strategies

<table>
<thead>
<tr>
<th>Management of elementary agroecosystems (parcel level)</th>
<th>Territory change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patrimonial</td>
<td>Take-over of entire ceasing farms</td>
</tr>
<tr>
<td>LT maintenance &amp; stewardship of agroecosystem types at all the parcels</td>
<td></td>
</tr>
<tr>
<td>Conservative</td>
<td>No change</td>
</tr>
<tr>
<td>Change in AE types &amp; parcel abandonment /consolidation</td>
<td>Selective purchase &amp; hiring of good parcels</td>
</tr>
<tr>
<td>Entrepreneur</td>
<td></td>
</tr>
</tbody>
</table>

- **Main pressure for change**
  \[ agricultural \ W \ economic \ return \ (> 56 \%) \]

- **Main adaptive decisions to maintain the family-farm livelihood**
  **Tradition-based strategies:** ↗on-farm & off-farm workload of family members
  **Entrepreneur strategy:** ↗agricultural \ W \ productivity

NB: complex activity systems of all the farm-families

Prospects for regional change in the landscape mosaic and ES bundle

- Reach of limits in adaptive capacities of tradition-based strategies
  - Patrimonial: ↓ capacity to maintain all agroecosystem types in largest farms (↗ UAA per AWU)
  - Conservative: ↓ prospects for succession (ageing farmers, ↓ LFS gross margin)
  - Retreat: ↓ land-transfer opportunities to a family with a patrimonial strategy

- Pressures of current economic environment
  - farm-size/AWU: main way to maintain/increase farm economic viability under new CAP and environmental policies (Veyssset et al., 2014)

- Future prospects for family-farms according to strategies
  - Tradition-based strategies: collapse or shift towards entrepreneur strategy
  - Entrepreneur strategy: gradual generalisation

- Sustainability prospects / landscape mosaic and ES bundle
  
  *Major short-term risk of farmland abandonment and detrimental change in landscape ESs* (social & cultural ES, natural hazard mitigation)
Conclusions & Perspectives

• Prospective assessment of change in HNV landscape and farming
  • Interest of dynamic case-studies of historical change (Bernues et al. 2011; Burgi et al. 2015)

• Close interlinkages between social and ecological rationales and values in **multilevel management of landscape ESs bundles in extensive livestock farming**
  • Local adaptive strategies / individual family-farms
  • Adaptive governance system of the agropastoral system (Brondizio et al. 2009)

• Improvement of efficiency of European policies / conservation of HVN farmland and associated extensive livestock farming
  • A need to account not only for farming systems at the farm level but also for **local agropastoral systems and their local governance system**
Thank you for your attention
References quoted


Local livestock farming systems in 2010

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>UAA (ha)</th>
<th>Land owned (% UAA)</th>
<th>Livestock (LU)</th>
<th>Cattle share (% LU)</th>
<th>On-farm employment (AWU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large agropastoral farm</td>
<td>10</td>
<td>52.6</td>
<td>40%</td>
<td>85</td>
<td>81%</td>
<td>1.78</td>
</tr>
<tr>
<td>Medium size (MS) agropastoral farm</td>
<td>10</td>
<td>24.8</td>
<td>64%</td>
<td>29.4</td>
<td>77%</td>
<td>1.42</td>
</tr>
<tr>
<td>Small agropastoral farm</td>
<td>8</td>
<td>9.6</td>
<td>88%</td>
<td>8.9</td>
<td>16%</td>
<td>1.26</td>
</tr>
<tr>
<td>End-of-life small agropastoral farm</td>
<td>3</td>
<td>10.1</td>
<td>100%</td>
<td>6</td>
<td>62%</td>
<td>0.75</td>
</tr>
<tr>
<td>MS agropastoral farm additional livestock production</td>
<td>3</td>
<td>27.3</td>
<td>47%</td>
<td>37.5</td>
<td>57%</td>
<td>2.3</td>
</tr>
<tr>
<td>Small to MS farm distinct livestock farming system</td>
<td>3</td>
<td>11.6</td>
<td>91%</td>
<td>8.6</td>
<td>0%</td>
<td>1.2</td>
</tr>
</tbody>
</table>

- activities other than farming at all of the farms
- similar livestock production management in agropastoral farms