World Congress Silvo-Pastoral Systems
27 – 30 September 2016
Evora, Portugal
The silvopastoral landscape: patterns and functions of woody features on the territory crossed by flocks of sheep and goats

Bouerjilat H\(^1\), Castro J\(^2\), Mejjati-Alami M\(^3\), Castro M\(^2,4\)

\(^1\) Graduate engineer, Erasmus + ICM International Credit Mobility, Master of Science in Forest Resources Management, Polytechnic institute of Bragança and Agronomic and Veterinary Institute Hassan II

\(^2\) Dep. of Environment and Natural Resources, Polytechnic institute of Bragança. Campus de Santa Apolónia, Bragança, Portugal

\(^3\) Agronomic and Veterinary Institute Hassan, PO Box 6202 Rabat-Institute 10101, Rabat – Morocco

\(^4\) Mountain Research Centre CIMO-ESA-IPB. Bragança Portugal
Plan

Introduction

Methodology

Results and discussion

Conclusion

Further development
Introduction
• The Mediterranean silvopastoral landscapes hold four major component: Man, Animals, Pastures and Trees.

• In the “Terra Fria” landscapes of Northeastern Portugal
  – The extensive livestock practice and the tree network are slightly connected to the component of the silvopastoral system.
  – The tree network is a pervasive element of Terra fria landscape and it is seen in several forms: scatter trees, fencerows, small woodlots, riparian buffer strips, among others.

• The mobility of the flocks consist into the keystone approach of this study.
<table>
<thead>
<tr>
<th>Introduction</th>
<th>Methodology</th>
<th>Results and discussion</th>
<th>Conclusion</th>
<th>Further development</th>
</tr>
</thead>
</table>

- **Introduction**
- **Methodology**
- **Results and discussion**
- **Conclusion**
- **Further development**
Objectives

• Perceive the influence of the tree network on the grazing itineraries of sheep and goats in Tras-Os-Montes
• Recognize the importance of the tree network on identifying the exploited surface by the flocks
• Discern the relationship between the speeds’ circuit and the ruminant behavior
• Relate the ruminant behavior to the tree network structures through the speeds
Methodology
The approaches conducted

• Woody features (WF) density
  – Define the buffering distance to delimit the exploited area depending on the woody features.
  – Identify the importance of the WF structures.
  – Differentiate the sheep and goats’ behaviors towards the woody structure.

• The flock behavior in function of the woody features
  – Determine a method of classification of speeds.
  – Relate the speeds to the flocks behaviors.
  – Define the interaction between WF and flocks’ behaviors
Construction of the datasets

- Woody features density
  - The Buffer geoprocessing tool (ArcMap 10.1)
  - The Intersect geoprocessing tool (ArcMap 10.1)
  - Statistical analysis (SYSTAT 12)

- The flock behavior in function of the woody features
  - The Near geoprocessing tool (ArcMap 10.1)
  - The speed classification
  - Time accumulation parameter
  - Statistical analysis (SYSTAT 12)
Results and discussion
The woody features among the circuits

• The woody structures density
  - Appearance of the “Dilution effects” on the buffers

• The woody structures and the circuits’ categories
  - Grazing area defined in a range distance of 20 – 50 m
  - Hedgerows: The principal structure on identifying the grazing area and the tracks’ categories.
  - Selective behavior of sheep and seasonal similarities (Winter/Summer and Autumn/Spring)
  - Opportunistic behavior of goats (quantities/HCA)
Speeds: The behavioral indicator

- Natural Breaks of Jenks as a classification method
- Comparison with the classification proposed by E. Schlecht (2009):
  - Speed movements at $v < 0.2\text{m/s}$ were allocated as resting or stagnant grazing on the spot.
  - Speed movements at $0.2 < v < 0.7 \text{m/s}$ were classified as the continuum of short term–grazing and subsequent shifts to a nearby feeding station influenced by grazing or munching.
  - Speeds movements at $v > 0.7 \text{m/s}$ were interpreted as directional walking uninterrupted by feeding.
Interaction of speeds with the woody features

• Ruminants adopt precise behavior across each type of WF structure
• The WF structures are independent in term of speed
• The continuous form of speeds parameter does not allow the classification of behaviors in term of speeds
• The WF are strongly correlated to sheep behaviors
• Goats’ opportunistic behavior constrained the assignment of behaviors to WF
WF: Use among space and time

- Goats’ tracks are closer to the WF structures than the sheep tracks
- The trees: Trifling role on the tracks of both species
- The Near distance parameter confirms the behaviors towards the WF on sheep tracks
- Difference of WF exploitation in term of the grazing journey between goats and sheep
- High recurrence of the hedgerows on goats track
<table>
<thead>
<tr>
<th>Introduction</th>
<th>Methodology</th>
<th>Results and discussion</th>
<th>Conclusion</th>
<th>Further development</th>
</tr>
</thead>
</table>

Conclusion
• More concluding results may be found with a lower resolution of the buffering distances 20 m – 50 m.
• The buffer distance of 50 m maintains a good approximation of this area considering the tree network of the landscape
• The occurrence of the hedgerows on the tracks assisted strongly in order to define the grazed area through the buffers.
• The hedgerows were the only structure which answers favorably to the methods conducted.
• Woods and isolated trees were related to the behavioral aspects.
• The opportunistic behavior of goats didn’t match with the approach conducted.
<table>
<thead>
<tr>
<th>Introduction</th>
<th>Methodology</th>
<th>Results and discussion</th>
<th>Conclusion</th>
<th>Further development</th>
</tr>
</thead>
</table>

Further Development
• Update the tracks with more ruminants’ flocks in consideration.
• Interviews focused on recent trends of WF in landscape with the local shepherds.
• Recognize the main zones (sectors and sections) of the landscape browsed.
• Investigating independently the management of WF structures, particularly the hedgerows.
• Asses an equation estimating buffers from speeds
• Classification of circuits on a seasonal basis. (Using seasonal parameter)
Thank you for your attention.