Can we quantify pasture in these landscapes?

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19th Meeting of the FAO-CIHEAM Mountain Pastures sub-network. 14-16 June, 2016. Zaragoza, Spain
- Area of permanent pastures is the main currency for CAP payments to livestock farmers.

- It is based on the current CAP definition of PP (Reg. 1307/2013):

land used to grow grasses or other herbaceous forage naturally (self-seeded) or through cultivation (sown) and that has not been included in the crop rotation of the holding for five years or more; it may include other species such as shrubs and/or trees which can be grazed provided that the grasses and other herbaceous forage remain predominant;
as well as, where Member States so decide, land which can be grazed and which forms part of established local practices where grasses and other herbaceous forage are traditionally not predominant in grazing areas.

- To calculate a parcel’s pasture eligible area (i.e. to subtract what is not pasture), MS can choose from 2 options:
  - Subtract each ineligible feature
  - Apply a pro-rata reduction

- Spain chose pro-rata-reduction: Coefficient of Pasture Eligibility (CPE). In 2011 Spain starts an “Action Plan” to calculate CPE in all parcels of SIGPAC (Spanish LPIS) based on the use of remote sensing techniques. The result: CPEauto (2015).
- **Pasture** is grazed/mown but also browsed/(pruned): the vegetation *used as feed for livestock herbivores*, especially in extensive systems, easily spans all Raunkjaer biological forms: from herbaceous therophytes and hemicryptophytes to woody chamaephytes and phanerophytes.

- But not all plants are **pasture**. And this is highly flexible and site specific: it depends on the herbivores (species, breed, culture), their grazing pressure, the abundance and structure of the plant species and of other accompanying plant species, etc.

- A gradient of **greys from white to black**: it is easy to recognise certain vegetation types as pastures (*whites*: e.g. well managed grasslands) and discard clearly others (*blacks*: e.g. beech forests or dense bramble thickets); but many situations in between (*greys*) are difficult to judge.

- Many of the **greys** are very valuable: high biodiversity and strategic livestock resources (medicinal, feed for times of scarcity or of refuge).

- Mountain areas have many greys.
The Spanish National CPE\textit{auto} methodology explained with a real example of a \textit{failed} wood pasture (PA).

- Green factor: $f(NDVI) = 88.9$
- Vegetation factor: $f(\text{LiDAR}) = 0.11$
- Slope factor: $CPE=10.6$

Further rounding: $CPE<20\% \rightarrow 0\%$
As part of the National CPE Action Plan, Regional Governments had to perform a “quality check” of the \textit{CPEauto}. Cantabria. Environmental stratified sample of potentially pastoral vegetation (classes PS (17)-PR (257)-PA (15)-FO (54) of LPIS). 343 transects in 38 different locations.

Transects were homogeneous in:
- Vegetation
- Green factor (1)
- Vegetation factor (0 or 1)
MAIN VARIABLES MEASURED IN EACH TRANSECT
- Vegetation composition: volumetric cover of plant species/types at livestock reach (VVC)
- Evidence of livestock tracks (LT): inexistent/weak/evident
- Ease of walking out of tracks (WE): easy/medium/hard/impossible
- Signs of burning, defoliation and livestock dungs

INTEGRATION OF MEASUREMENTS INTO A TRANSECT GRAZABILITY INDEX (GI)
\[
GI = \sum_{p=1}^{t} (PGA_p \times VVC_p) \times Transitability
\]
- \( PGA_p \) (Plant Grazing Adaptation): probability of a plant (species or type) to survive when grazed at a rate similar to the most productive neighbouring grassland (0-1)
- \( Transitability \) = non-linear combination of \( LT \) and \( WE \) (0-1).

STATISTICAL ANALYSIS
- In each analysis all transects were grouped in 10 equal segments according to their GI values (0-0.1 .... 0.9-1.0)
- Linear regressions were performed for the mean \( GI - CPEauto \) values of the transects in each of the 10 segments. The sample was bootstrapped to avoid overfitting.
FIELD VALIDATION OF AN AUTOMATIC COEFFICIENT OF PASTURE
ELIGIBILITY IN MOUNTAIN AREAS

INTRODUCTION

MATERIALS & METHODS

RESULTS & DISCUSSION

CONCLUSIONS
Good relationship ($R^2=0.81;\ RSE=0.12$) but overestimation of CPEauto at low GI values

Correction of $CPE_{auto}$ by a new slope factor ($1-0.003 \times \text{Slope}$) improved the relationship ($R^2=0.83;\ RSE=0.11$) and lowered biases
- **Shrubs** was the vegetation responsible for the good overall relationship, as well as the compensation of the completely different behaviour of **Woods** and **Grasslands**. Shrub height seems to be a good grazability surrogate, irrespective of shrub species.

- **Woods** were in many cases underscored as pasture. The *CPEauto* method, based on nadir remote sensing observations, neglects the possible grazability of the trees understory.

- **Grasslands** are not always good pasture land. Rough grasslands on steep slopes dominated by large grasses (*Molinia caerulea* or *Brachypodium pinnatum* or *Pseudarrhenatherum longifolium*) denote grazing abandonment and management mainly through fire.
Can we quantify pasture?

- **In the field.** It is possible, even in complex vegetation communities and landscapes (in the grey zone), and using fast sampling procedures.

  - This may be useful for the CAP compulsory on-site controls performed annually,
  - To check automatic methods (as in this work),
  - But is unfeasible for assigning eligibility to all problematic LPIS parcels

- **Automatically.** Supported by remote sensing, such as CPEauto, shows promising results, although important drawbacks are still detected. These may be solved in the future if we improve the predictability on:

  - classify vegetation types and
  - transitability and forage quality below tree canopies

- But never forget the importance of **interacting with farmers and their livestock**!