Estimating Pastoral Pressure on Arid Rangelands Taking into Account Herd Management Practices

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Introduction One of the main critics formulated against the grazing pressure concept, is that proposed indexes usually do not include elements of livestock management (i.e. forage schedules, temporality of herd movements, supplemental feeding). However, these elements largely modulate the actual level of pressure livestock can exercise on rangeland integrity.

Materials and methods Study area was located in the arid region of Jeffara (South East Tunisia), with mean annual rainfalls of about 170 mm. One hundred parcels of *Rhanterium suaveolens* and *Stipa tenacissima* steppes were surveyed (plant cover measurements, floristic diversity, plant types) in order to characterise range conditions. At the same time, qualitative surveys were performed on each parcel with pastoralists regarding their herd and pastoral management (type of livestock grazing management (transhumant or sedentary), types and temporality of uses, tenure system, livestock feeding system, seasonal and daily grazing patterns, types and levels of complementation, etc.). Collected data were processed by means of Multiple Factorial correspondences analyses, and constituted the basis for the formulation of a Pastoral Use Intensity Index (IIUP), as follow:

$$\mathrm{IIUP}=\frac{\mathrm{NA}\cdot\mathrm{NMU}\cdot\mathrm{TU}\cdot\mathrm{PPA}\cdot\mathrm{PRP}}{\mathrm{SP}\cdot 12}$$

Where: NA: number of small stock (in Ovine Units); NMU: Numbers of months where rangeland is grazed during the year; TU: qualitative variable related to the intensity of use during grazing period (continuous grazing = 1, diffuse grazing on rangeland integrated in larger grazing patterns = 0.5); PPA: proportion of grazed forages in the diet of small stock (0% = 0; 0-20% = 0.1; 20-50% = 0.3; 50-90% = 0.7; > 90% = 1); PRP: eventual period of resting of the parcel during spring (If rangeland is not grazed during spring then PRP = 0.5, if not PRP = 1); SUP: surface of rangeland in hectares; 12 corresponds to the twelve months of the year.

This index was related to the classical calculation of stocking rate and to the range conditions of the 100 studied parcels.

Results and discussion IIUP ranged from 0 to 65, while instantaneous stocking rate varied from 0 to 132. The latter index led to an over-estimated evaluation of grazing pressure because it did not integrate eventual adjustments made by herders in order to balance herd requirements and forage resources of rangelands. We found a clear relationship between IIUP value and range condition. In *R. suaveolens* steppes about 50% of rangelands with a low or moderate IIUP were classified in good condition, while only 26% of them with high IIUP was found in good condition. This relationship was still stronger in *S. tenacissima* steppes. Relationships between stocking rate and IIUP values indicate the magnitude of the risk of overestimating grazing pressure (slopes of the regression curves between 0.35 and 0.45).

Conclusions The IIUP index, potentially, appears to be a useful tool for evaluating livestock management impacts on rangelands, thanks to its capacity to take into account several aspects of herds management practices which fully influence grazing pressure level. However, it needs to be refined in order to simplify it, and be tested within different rangeland situations in order to evaluate its heuristic character.

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