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in

Casasús I. (ed.), Lombardi G. (ed.).
Mountain pastures and livestock farming facing uncertainty: environmental, technical and socio-economic challenges

Zaragoza : CIHEAM

Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 116

2016

pages 337-340

Article available on line / Article disponible en ligne à l'adresse :

<http://om.ciheam.org/article.php?IDPDF=00007471>

To cite this article / Pour citer cet article

Zuliani A., Romanzin A., Bovolenta S. **Animal welfare and ecosystem services in mountain areas.**
In : Casasús I. (ed.), Lombardi G. (ed.). *Mountain pastures and livestock farming facing uncertainty: environmental, technical and socio-economic challenges.* Zaragoza : CIHEAM, 2016. p. 337-340 (Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 116)



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Animal welfare and ecosystem services in mountain areas

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Abstract. The ecosystem services framework describes the benefits that natural environments provide to human populations. Mountain ecosystems are extremely diverse and in fact support about one quarter of terrestrial biodiversity. The provision of ecosystem services in mountain areas depends upon good animal welfare and *vice versa*. Thus, proper assessment methods are needed to measure and ensure good welfare levels in mountain areas. In this study, we have tested five animal-based measures collected in eight mountain dairy farms and compared them to data collected in 124 small-scale dairy farms. Despite obtaining better mean results when looking at selected animal-based indicators in comparison to reference data, great variability was observed between farms similarly to what reported in other studies. Future research should aim at creating a reference database of animal-based measure collected in mountain farms only as well as measuring dairy cow welfare on pasture conditions considering that is a common practice in mountain dairy farms and often involves an abrupt change in husbandry and management systems.

Keywords. Ecosystem services – Dairy cows welfare – Small scale farms – Animal-based measures.

Les services écosystémiques et le bien-être des animaux dans les zones de montagne

Résumé. Le cadre des services écosystémiques décrit les avantages que les environnements naturels fournissent aux populations humaines. Les écosystèmes de montagne sont extrêmement diversifiés et en fait soutiennent environ un quart de la biodiversité terrestre. La fourniture de services écosystémiques dans les zones de montagne dépend du bien-être animal et *vice versa*. Ainsi, des méthodes d'évaluation appropriées sont nécessaires pour mesurer et assurer un bon niveau de protection des animaux dans les zones de montagne. Dans cette étude, nous avons testé cinq mesures recueillies dans huit fermes laitières de montagne et comparés aux données recueillies dans 124 petites exploitations laitières. Malgré l'obtention de meilleurs résultats moyens lorsque l'on regarde les indicateurs basés sur des animaux sélectionnés par rapport aux données de référence, une grande variabilité a été observée entre les exploitations agricoles de façon similaire à ce que rapporté dans d'autres études. Les recherches futures devraient viser à créer une base de données de mesure sur la base d'animaux recueillis dans les fermes de montagne seulement ainsi que la mesure de donné de la vache laitière et les conditions du pâturage considérant que c'est une pratique courante dans les fermes laitières de montagne et implique un changement brusque dans l'élevage et les systèmes de gestion.

Mots-clés. Services écosystémiques – Le bien-être des vaches laitières – Les petites fermes - Méthodes d'évaluation des animaux.

I – Introduction

The ecosystems services (ES) framework was first developed for the United Nations Millennium Development Assessment and was used to estimate the contribution of ecosystems to human well-being (MA, 2005). Mountain ecosystems occupies about one fifth of the terrestrial surface and because of the variety of habitats caused by a steep altitudinal and climatic gradient, they are considered more diverse than lowlands and in fact support about one quarter of terrestrial biodiversity.

The traditional breeding systems in the mountains are largely based on the use of meadows and pastures and deliver a variety of local products and ecosystem services, such as conservation of genetic resources, water flow regulation, pollination, climate regulation, landscape maintenance, recreation and ecotourism (Battaglini *et al.*, 2014).

At present, however, with the exception of some provisioning services (e.g. food), most of the ES are either undervalued or have no market value at all. Being able to measure and quantify in economic terms the value of ES would help inform policymakers and consumers about the real costs and benefits of what is produced and eventually support those systems that contribute the most to the maintenance and provision of ES.

Animal welfare (AW) is a major concern for many European citizens and thus high on the political agenda. However, animal welfare assessment is an ongoing challenge and several methods have been identified to assess it at herd level. The largest research project on animal welfare funded by the European Commission was the Welfare Quality® project (WQ, 2009) which combines animal-based, resource-based and management-based measures in order to determine an overall level of welfare. Few attempts (Comin *et al.*, 2011; Corazzin *et al.*, 2010; Mattiello *et al.*, 2005) have been made to measure welfare on mountain dairy farms and recently the European Food Safety Authority (EFSA) has published an adapted WQ protocol for small-scale dairy farms (EFSA, 2015).

The aim of this paper is to explore the relationship between AW and ES in mountain areas and present the preliminary results of welfare assessment in eight mountain dairy farms in the Province of Udine, Italy with the EFSA adapted protocol for small-scale farms.

II – Material and methods

Eight dairy farms were selected in the mountain areas of the Province of Udine and animal welfare was assessed during wintertime according to the EFSA adapted protocol for small-scale farms (EFSA, 2015). A selection of farm descriptors and animal-based measures describing the response of the animals to resources and management practices to which they were exposed to was used for the study. Five animal-based measures were chosen to describe three welfare principles defined in the Welfare Quality® protocol for dairy cattle (WQ, 2009):

- Body condition score (BCS) for the principle of Good Feeding. The animal were assessed from behind and from the side in the loin and tail head area.
- Lameness, lesions and swellings, high somatic cell count (SCC) for the principle of Good Health. Gait and integument alterations were assessed on the animal. SCC data was retrieved from milk records.
- Avoidance distance (AD) for the principle of Appropriate Behaviour. Good Human-animal relationship was measured by approaching the animals until they move back or the muzzle can be touched.

III – Results and discussion

1. Ecosystem services and animal welfare frameworks in mountain areas

The relationships between ecosystem services and animal welfare were hypothesized following the scheme displayed in Figure 1 in order to understand the role of animal welfare in mountain ecosystems. Animals rely on provisioning and regulating services to achieve good welfare levels. At the same time good animal welfare seems pivotal to ensure provisioning services (e.g. safe food), regulating services (e.g. disease regulation) and cultural services (e.g. humane treatment of animals).

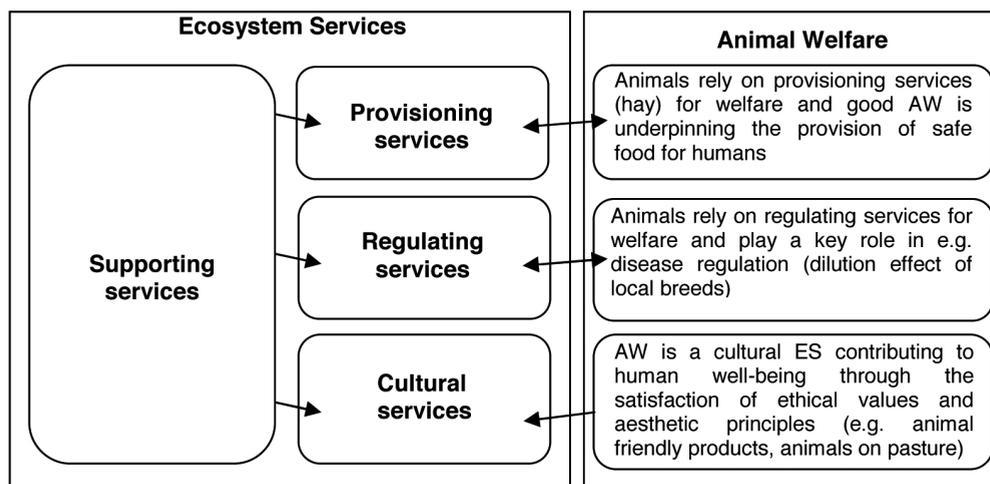


Fig. 1. Relationship and interdependences between the ecosystem services framework and animal welfare.

2. Dairy cow welfare assessment

Farm descriptors (Table 1) and animal-based measures (Table 2) collected on the eight farms considered in this study were compared against data collected on 124 small-scale farms (EFSA, 2015), which were considered as reference values.

Comparable values were obtained in the EFSA study and in our sample when looking at mean herd size (34 vs 24 respectively), mean milk yield (6125 vs 6006 respectively) and mean hours on pasture (2180 vs 2981 respectively).

Table 1. Farm descriptors collected in eight alpine dairy farms

Farm descriptors	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5	Farm 6	Farm 7	Farm 8
Dairy cows (n.)	21	16	15	10	26	20	34	47
Prevalent breed	Simmental	Simmental	Simmental	Alpine Gray	Simmental	Alpine Gray	Brown Swiss	Simmental
Milk yield (kg/cow/year)	7000	6000	4500	5400	5500	4850	7500	7300
Pasture (h/year)	360	3600	2896	2088	4320	4320	2808	3456
Housing (tie stall)	yes	no	yes	no	yes	yes	no	yes

Animal-based measures mean values obtained in our sample were better to those obtained in the EFSA study when looking at cows that could be touched (78 vs 62%), lame cows (8 vs 18%), cows with SCC higher than 400000 cells/ml (6 vs 13%), very lean cows (3 vs 8%), and cows with lesions or swellings (9 vs 16%).

Despite obtaining better mean results when looking at selected animal-based indicators, great variability was observed between farms similarly to what reported in other studies (EFSA, 2015; Fraser, 2014).

Table 2. Animal-based indicators collected in eight alpine dairy farms

Farm descriptors	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5	Farm 6	Farm 7	Farm 8
ADF (%)	86	63	87	60	96	86	50	92
Lameness (%)	9,5	25	0	10	11	0	10	2
SCC >400.000 (% of cows/farm)	9.5	12.5	0	0	3.8	5.0	11.8	6.4
BCS (%)	0	0	13	0	0	5	7	0
Lesions, Swellings (% of cows/farm)	14	25	7	10	8	0	7	2

ADF: avoidance distance test (% animals that can be touched); SCC: somatic cell count; BCS: body condition score (% of very lean animals).

IV – Conclusions

The provision of ecosystem services in mountain areas depends upon good animal welfare and *vice versa*. Thus, proper assessment methods are needed to measure and ensure good welfare levels in mountain areas. In this study, preliminary results on five animal-based measures collected in eight mountain dairy farms were presented and compared against data collected in 124 small-scale dairy farms.

Ongoing research is measuring dairy cow welfare on pasture conditions considering that is a common practice in mountain dairy farms and often involves an abrupt change in husbandry system and management practices. Future research should aim at identifying acceptable levels of welfare that will ensure the provision of ecosystem services in mountain areas.

Acknowledgments

The authors thank the “*Centro di Ricerca e Innovazione Tecnologica in Agricoltura*” (CRITA) for financial support (funds of Friuli Venezia Giulia Region, L.R. n. 26/2005, art. 18).

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