Multiple Use of Alpine Grassland in Austria and the Implications for Agricultural Policy

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Mehrfachnutzung des alpinen Grünlandes in Österreich und deren Implikationen für die Agrarpolitik

1. Introduction

Grassland is a key component of alpine environments, landscapes and agriculture (see HOVORKA, 1998). Although pastures and meadows still serve as a fodder resource for ruminant livestock husbandry, they are increasingly expected to fulfil a range of additional non-agricultural functions in the context of, for example, tourism or landscape and environmental protection. Given that society now places greater demands on grassland in terms of the variety of functions it is expected to fulfil, there is a need to re-evaluate the procedures used to reward farmers for the management of this resource. Accordingly, European agricultural policy (as seen in, for example, the Agenda 2000 drafts) is favouring a move toward more direct payments as a means of internalising the positive external effects of land management. Two preconditions must, however, be satisfied if externalities arising from grassland management are to be properly linked to land units and/or farmer activities;

- we must have an understanding of the function profile of pastures and meadows that also accounts for spatial variation (the relative importance of different functions can vary considerably between different sites),
- farmers must recognise and accept the non-agricultural demands placed on grassland (thus producing management regimes which are better suited to addressing these additional requirements).

Accordingly, the aim of this paper is to present a record of the multifunctionality of parcels of grassland at a local level – as seen from the subjective perspective of the farmer responsible for their management – based on the results of model research in a selected mountain region. This record is then itself used as a basis for exploring the influence of agricultural management practices on non-agricultural grassland functions, thereby allowing the identification of potential conflicts of use. Such an approach can provide a

Zusammenfassung

Grünland hat zusehends außeragrarischen Ansprüchen zu genügen. Zur Erfassung der Multifunktionalität des Grünlandes wird ein Scoringmodell entwickelt. Es berücksichtigt Beanspruchungen durch die Wasser-, Freitzeit- und Tourismuswirtschaft, durch Umwelt- und Naturschutz sowie durch Abfallwirtschaft und Jagd. Das Meßkonzept, das die Intensität der auf einzelnen Grünlandparzellen geübten Nutzungen widerspiegeln soll, stützt sich auf einen komplexen Variablensatz. Er umfaßt Bewirtschaftungsmaßnahmen, die Häufigkeit von Sekundärnutzungen (Sport, Biomasserecycling etc.), das Vorkommen seltener Tier- und Pflanzenarten sowie Natur- und Wasserschutzauflagen.
Empirisch angewendet wurde das Modell bei 377 Grünlandparzellen im Mittleren Ennstal (Steiermark). Als Basis dienten Daten einer im Herbst 1997 durchgeführten Befragung von 125 Landwirten. Ihnen zufolge standen ästhetische und jagdliche Nutzungen im Vordergrund. Ferner war Grünland häufig von Wanderern und Skifahrern beansprucht. Zudem erwies sich bei bestimmten Nutzungen (Umwelt- und Naturschutz, ästhetische), daß sie an eine geringe agrarische Bewirtschaftungsintensität gekoppelt waren.
Die Erfassung der Multifunktionalität des Grünlandes empfiehlt sich als Schlüssel zur Zumessung von Direktzahlungen. Die verortete Registrierung außeragrarischer Grünlandnutzungen könnte somit als wertvolles Instrument im Dienste einer zukunftsweisenden Agrarpolitik fungieren und für eine faire Verteilung und argumentative Absicherung der Honorierung „überwirtschaftlicher" Leistungen der Landwirtschaft sorgen.

Schlagworte: Multifunktionalität, Grünlandnutzung, Agrarpolitik.

Summary

Grassland is increasingly expected to deliver non-agricultural products and services. This paper evaluates grassland multifunctionality by using a scoring model with index points. The (multiple) uses to which grassland may be put include agriculture; water resource management; leisure, recreation and amenity; waste disposal; environmental protection; hunting and shooting; and military purposes. A set of variables (agricultural land management activities, the frequency of various secondary uses (sport, disposal of sewage sludge etc.), prevalence of rare plants and animals, and the existence of legislative restrictions relating to environmental protection, water resource management etc.) is used as measure to represent the sum of all demands (at various levels) placed on a particular grassland area.

The model is tested empirically on 377 grassland parcels in the central Ennstal (Styria), using data collected in a survey of 125 farmers in autumn 1997. According to farmers, the most prominent non-agricultural uses are "aesthetic uses" and hunting/shooting. Grassland is also frequently used for hiking, cross-country skiing. Certain uses (e.g. environmental protection, hiking and aesthetics) were associated with grassland managed at low intensity.

The assessment of grassland multifunctionality on a parcel-by-parcel basis suggests itself as a mechanism for determining direct payments. This kind of localised evaluation of non-agricultural uses of meadows and pastures is unavoidable if compensation payments are to be fair and if these payments are to receive long-term public approval.

Keywords: Multifunctionality of grassland, land use, agricultural policy.

promising basis for the integrative evaluation of the services performed through grassland management in mountain areas, and for the allocation of direct payments in a way that is both economically sustainable and best able to secure the long-term futures of grassland areas.

2. A model of grassland multifunctionality

The concept of multifunctionality begins with the phenomenon of multiple use (of agricultural land). This means that a theoretical model of multifunctionality assumes that a single unit of agricultural land can help satisfy a range of different human and societal needs, and may therefore have a number of important characteristics, each of relevance to one or more different potential uses for that land. Accordingly, the term function (or use) also includes "contributions to societal objectives", which may be expressed in terms of production or services (PEVETZ, 1998, p. 11).

In order to give grassland multifunctionality some kind of formalised structure in a modelling environment, we need to closely examine the various demands placed on pastures and meadows. Relevant analyses of political and societal objectives have already been carried out in Austria, drawing

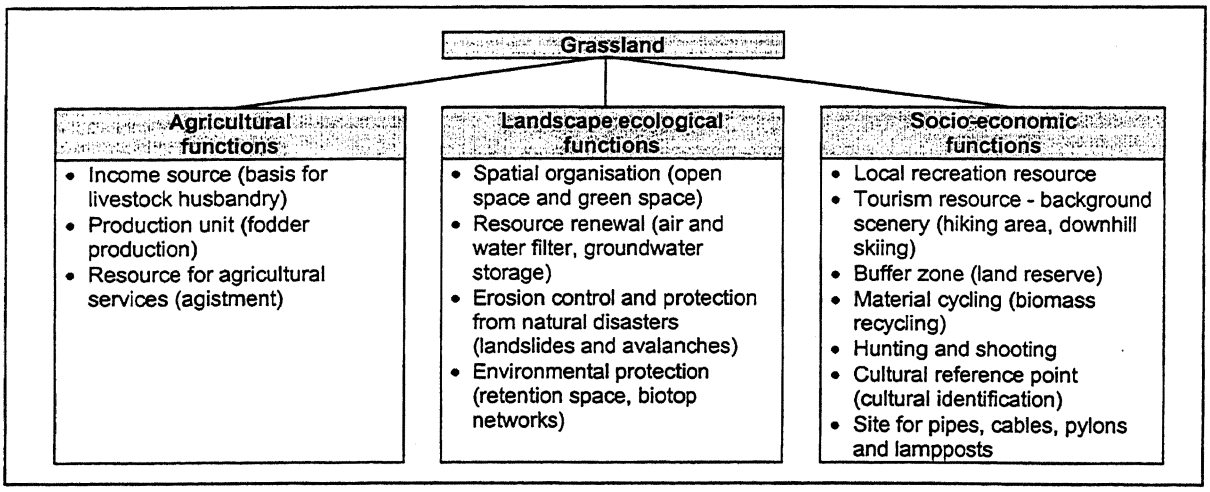

Figure 1: The main functions performed by grassland in mountain areas
Abbildung 1: Hauptfunktionen des Grünlands im Berggebiet

on legislation, framework policies for rural planning and tourism, political proclamations, environmental protection programmes and other planning documents. The results of such theoretical (and somewhat abstract) research have been used to draw out three key areas of focus regarding the functions of grassland (see Figure 1).

As a component of the *agricultural sector*, grassland plays the classic role of production unit (for livestock husbandry using home-produced feed) and is, therefore, an income source (for the farming population). More recently, grassland has also provided a basic resource for diversification into special services, such as agistment (WYTRZENS, 1995, p. 90ff; BRIEMLE and ELSÄSSER, 1997, p. 273ff). Grassland has a *socio-economic* importance which goes beyond the confines of the agricultural sector and covers tourism and recreation; grassland areas provide the terrain or aesthetic background required for various holiday and leisure activities. Grassland also plays a key role in material cycles and is used for recycling organic substances (particularly from organic waste and/or sewage sludge), although the desirability of this is sometimes a matter of intense debate. Grassland also serves as a kind of buffer zone or land reserve for future rural development – as an "open" area, grassland can be relatively easily put to a new use. Last, but not least, grassland has a cultural value and serves as a kind of identification or reference point for the local population (WYTRZENS, 1995, p. 90f). Within the context of *landscape ecology*, grassland has a number of roles related to resource renewal, including air filtration, oxygen production (photosynthesis), groundwater storage and water filtration (all-year-round vegetation cover means that less nutrients leach out into groundwater). Grassland also provides balance and structure in zones where a mixture of uses can be found. The capacity of grassland to protect against natural disasters (wind and water erosion, landslides, mudflows and avalanches) is of particular importance in mountain areas (ELSÄSSER and BRIEMLE, 1996, p. 5; GREEN, 1996, p. 223). Grassland also fulfils a number of other environmental functions, as a connective element in biotop networks, as a source of species-rich plant communities, and as a habitat and food source for a diverse community of animals (SCHWAHN and BORSTEL, 1997, p. 268). In summary, we can say that there are a wide range of functions which grassland can or should fulfil.

3. The research approach to the local assessment of grassland multifunctionality

If agricultural policy is to properly account for this multifunctionality, then we need to find methods which allow us to make specific statements about what demands are being placed on which areas and at what intensity. Such a method has been developed for, and tested in, a small regional case-study of the central Ennstal (Styria).

The so-called "multidimensional intensity of use" is used as a measure of the actual degree of multifunctionality. This measure seeks to represent the sum of all demands (at various levels) placed on a particular grassland area, whereby "intensity of use" is taken to be "the usage load per unit area of land within a particular time period" (SPITZER, 1971, p. 36). Figure 2 shows how "multidimensional intensity of use" is made up of a combination of agricul-

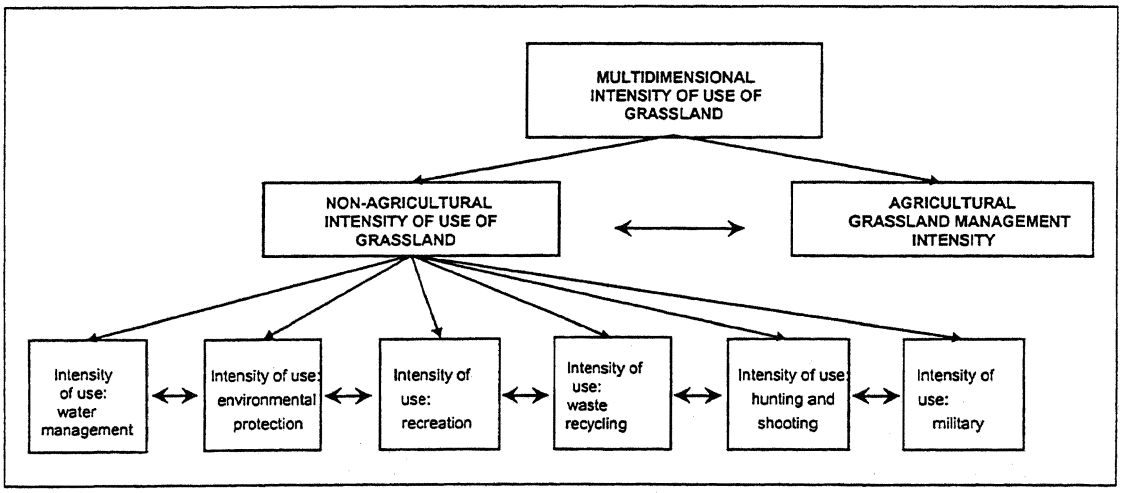

Figure 2: Multidimensional intensity of use as a measure of grassland multifunctionality
Abbildung 2: Multidimensionale Nutzungsintensität als Maß der Grünlandmultifunktionalität

tural management intensity and the intensity of non-agricultural uses.

The total non-agricultural intensity of use is determined from both the number and intensity of individual non-agricultural uses; this means that at least the main such uses need to be properly identified. Uses covered in this work took account of the local situation in the project area, and included:

- water management;
- environmental protection;
- recreation;
- material cycling (recycling of organic waste);
- hunting and shooting
- military uses

Each different type of use was classified according to its intensity (0 to 3). This classification is based on the relevant degree of expression of defined intensity indicators (see Table 1 for a list), all of which can be recorded using surveys and rating scales and are intrinsically non-metric in nature. Indicators expressed through a yes/no response were given a score of 3 and 0 respectively. Indicators where multiple levels of intensity are possible were scored as 0, 1, 2 or 3. The indicator values for each individual use were then combined with the help of the matrix illustrated in Figure 3.

The classification of intensity within this matrix is based on considerations of plausibility and the methodology used by FLECK (1985, p. 156). The matrix is designed such that the intensity level (category) recorded for a particular use because of a high rating for some intensity indicator is not reduced by a lower value obtained for another intensity indicator relevant to that use.

Once the net intensities of use for each of the six possible non-agricultural uses has been calculated for any one parcel of land, then these values are added together to give the total intensity of non-agricultural use for that unit of land. This total intensity of non-agricultural use can therefore have a theoretical value between 0 (no non-agricultural use at all) and 18 (all non-agricultural uses are found on the land at their highest intensities). The higher values are more or less

Table 1: Intensity indicators used to measure the non-agriculture uses of grassland
Tabelle 1: Indikatoren zur Messung der außeragrarischen Grünlandnutzungsintensitäten

Type of use	*Intensity indicators*	*Answer category* never/rarely/sometimes/often [0] / [1] / [2] / [3]	no/yes [0] / [3]	none/very few/some/many [0] / [1] / [2] / [3]
environmental protection	• Management subject to environmental controls		x	
	• Landscape protection area		x	
	• National park		x	
	• Prevalence of rare plant species			x
	• Prevalence of rare animal species			x
water management	• Important for water supply		x	
	• Sensitive hydrological area		x	
	• Water protection area		x	
recreation use	• Frequency of use for hiking	x		
	• Frequency of use for alpine skiing	x		
	• Frequency of use for cross-country skiing	x		
	• Frequency of use for paragliding	x		
	• Frequency of use for horse riding	x		
	• Frequency of use as a panoramic viewing area	x		
	• Frequency of flower-picking activities	x		
	• Aesthetic value - "admired as a beautiful meadow/pasture"	x		
recycling of organic material	• Frequency of application of (composted) sewage sludge	x		
	• Frequency of application of composted organic waste	x		
hunting and shooting	• Frequency of use for hunting or shooting	x		
military use	• Frequency of use for military purposes	x		

Intensity level		Rating value for indicator y			
		0	I	II	III
Rating value for indicator x	0	0	I	II	III
	I	I	I	II	III
	II	II	II	II	III
	III	III	III	III	III

Figure 3: Intensity matrix
Abbildung 3: Intensitätsmatrix
Source: Fleck, 1985

impossible, since some of the non-agricultural uses, such as intensive recreational use and intensive environmental protection, are incompatible (FLECK, 1985, p. 207).

Of all the various possible uses of grassland, it is agricultural management that is predominantely responsible for the existence of the grassland in the first place. Special attention is therefore given to the measure used to represent the intensity of this agricultural use, namely "management intensity". The determination of this intensity draws on classic production economics, where intensity is described as the ratio between production factors used in the context of some production process (STOYKE, 1995, p. 24). "Land" is used as the reference factor to which the other two production factors ("labour" and "capital") are related, thus allowing the results to be differentiated according to location.

It is almost impossible to measure the exact use of labour and capital on any one individual pasture or meadow unit, because of valuation and allocation problems. This method was therefore rejected in favour of another, where the following "intensity parameters" were used to make quantitative statements about the management intensity on the 377 grassland units investigated in the case study[1]:

- frequency of agricultural use (n), calculated according to the following formula[2]:
  n = number of cuts + number of grazings * 0,67 + follow-up grazing * 0,335;
- amount of nitrogen applied each year (d);
- number of mechanical treatments (p);
- pesticide use (l);
- oversowing (yes/no) (u) and
- grassland improvement (yes/no) (g).

In order to allow a comprehensive evaluation of management intensity, these parameters were used to calculate a "single grassland unit management intensity factor" (bi):

$$bi = 2 * \nu + 2 * \delta + 2*\pi + \lambda + \upsilon + \gamma$$

This intensity factor is the sum of the standardised numeric expressions (hence the Greek letters) of each of the intensity parameters listed above. "Frequency of agricultural use" and "amount of nitrogen applied each year" were weighted with a factor of 2 because they are particularly important in determining the quality and quantity of the yield. The "number of mechanical treatments" was given a similar weighting. This is because this variable covers a wide range of potential treatments (rolling, mechanical weed control etc.); the weighting compensates for the fact that pesticide use, oversowing and grassland improvement are treated separately and are, by implication, given a higher weighting than any of the other individual mechanical treatments covered under parameter p.

4. Selected results

Empirical data was obtained from a series of interviews carried out with 125 farmers in autumn 1997 in the Styrian districts of Oppenberg, Aigen, Stainach, Pürgg-Trautenfels and Tauplitz (see WYTRZENS and MAYER, 1998). A comprehensive and standardised questionnaire was used to obtain characteristic values for various aspects of farm enterprise structure, and to gather detailed information on the management regime and non-agricultural uses of 377 selected grassland units (these units were chosen systematically based on botanical, yield and socio-economic considerations).

The respondents manage a total of 2,386 ha of on-farm grassland, consisting mostly of multi-cut meadows (74 %), followed by rough grazing (14 %) and improved pasture (8 %). Single-cut (3 %) and litter (1 %) meadows are relatively rare.

4.1 General characterisation of the grassland units included in the research

The 377 meadows and pastures analysed in the study make up a total 710 ha. Average unit size is 1.88 ha, though the variation about the mean is high (minimum unit size is 0.03 ha, maximum unit size 12.69 ha and median unit size 1.32 ha).

Notwithstanding the limitations of the data collection process, an attempt was made to measure particular natural site parameters for each of the grassland units (see Table 2), given that many types of grassland use are closely dependent on existing natural conditions.

Table 2: Site parameters for the grassland units incorporated in the 1997 central Ennstal pilot study
Tabelle 2: Lageparameter der in der Pilotstudie „Mittleres Ennstal" 1997 erfaßten Grünlandparzellen

Elevation		[m]	
	Average:	845	
	Std. Dev.:	192	
	Median:	830	
	Minimum:	550	
	Maximum:	1400	
Slope	Maximum slop	Number of units	%
	≤ 18 %	192	51
	> 18 % and ≤ 25 %	51	13
	> 25 % and ≤ 345 %	70	19
	> 35 % and ≤ 50 %	49	13
	> 50 %	15	4
	Σ	377	100
Hydrology	Hydrological class	Number of units	%
	dry	113	30
	fresh	130	34
	moist	66	18
	transition site	68	18

4.2 Non-agricultural uses of the grassland units included in the research

Table 3 details the extent to which the grassland units serve non-agricultural purposes (as seen from the perspective of the farmer respondents).

From the viewpoint of the farmers, hunting and shooting and "aesthetic uses" are the most prominent non-agricultural uses made of grassland. Two- and three-cut meadows and pastures in particular tend to serve aesthetic purposes, while hunting and shooting is carried out equally across all grassland management regimes. The grassland units are rarely used for horse riding and paragliding, but more frequently for hiking, cross-country skiing and, to some extent, alpine skiing. Water supply as a use tends to be found on units where cutting or grazing frequencies are low, while waste recycling almost never takes place. The relatively intensive military use of the grassland in this study is something of a local anomaly and is explained by the presence of a military airfield.

Table 3: Non-agricultural uses of the grassland units incorporated in the 1997 central Ennstal pilot study
Tabelle 3: Außeragrarische Nutzungen der in der Pilotstudie „Mittleres Ennstal" 1997 erfaßten Grünlandparzellen

Non-agricultural use	non-agricultural use applies to unit in question						
	yes		of which			no/never/none	
			rarely (few)	sometimes (some)	often (many)		
	#	%	#	#	#	#	%
Water-related uses							
Water supply	37	10				340	90
Sensitive hydrological area	15	4				362	96
Water protection area	14	4				363	96
Environmental and landscape protection							
Area subject to environmental controls	14	4				363	96
Landscape protection area	59	16				318	84
Prevalence of rare plant species	112	30	40	63	9	265	70
Prevalence of rare animal species	72	20	48	21	3	305	81
Hunting and shooting							
Hunting and shooting takes place	209	55	50	145	14	168	45
Military use							
Used for military purposes	36	10	11	11	14	341	90
Recreation							
Used for hiking	97	26	32	45	20	280	74
Admired as a beautiful meadow	223	59	63	143	17	154	41
Flowers picked	184	49	73	94	17	193	51
Used for horse riding	24	6	14	10	0	353	94
Launch pad / landing site for paragliders	21	6	16	2	3	356	94
Used for alpine skiing	29	8	13	6	10	348	92
Used for cross-country skiing	70	19	8	16	46	307	81
Used as a panoramic viewing area	91	24	26	47	18	286	76
Waste utilisation							
Organic waste compost applied to site	0	0	0	0	0	377	100
Sewage sludge applied to site	2	1	1	1	0	375	9

Figure 4 gives the distribution of the grassland units across the range of intensities for each indicator of non-agricultural use, as defined in the scoring model. The relative importance of uses related to hunting and shooting, environmental protection and recreation are clear, as is the relatively wide variation in the non-agricultural uses found on different grassland areas.

As mentioned before, agricultural management has a special place among the potential uses of grassland; it is often a prerequisite for the existence of the grassland in the first place and is, therefore, a precondition for any non-agricultural uses. Accordingly, the next section is devoted to a more detailed look at the agricultural management of the meadows and pastures covered in the research.

4.3 Agricultural management of the grassland units included in the study

Table 4 details the distribution of the grassland units across the various agricultural management categories.

The average level of nitrogen application across all units is 60.3 kg per ha per year (PISTRICH, 1999), although just over one fifth of the units receive no fertiliser at all. Pesticide application hardly ever leads to conflicts with non-agricultural grassland functions (particularly environmental and water protection) since just 67 units (17 % of the total) receive pesticide treatment, and then almost always in the form of point applications (1 to 5 applications a year). Treatments associated with grassland regeneration could also potentially conflict with the demands of environmental protection, but (as with pesticides) such treatments are relatively rare.

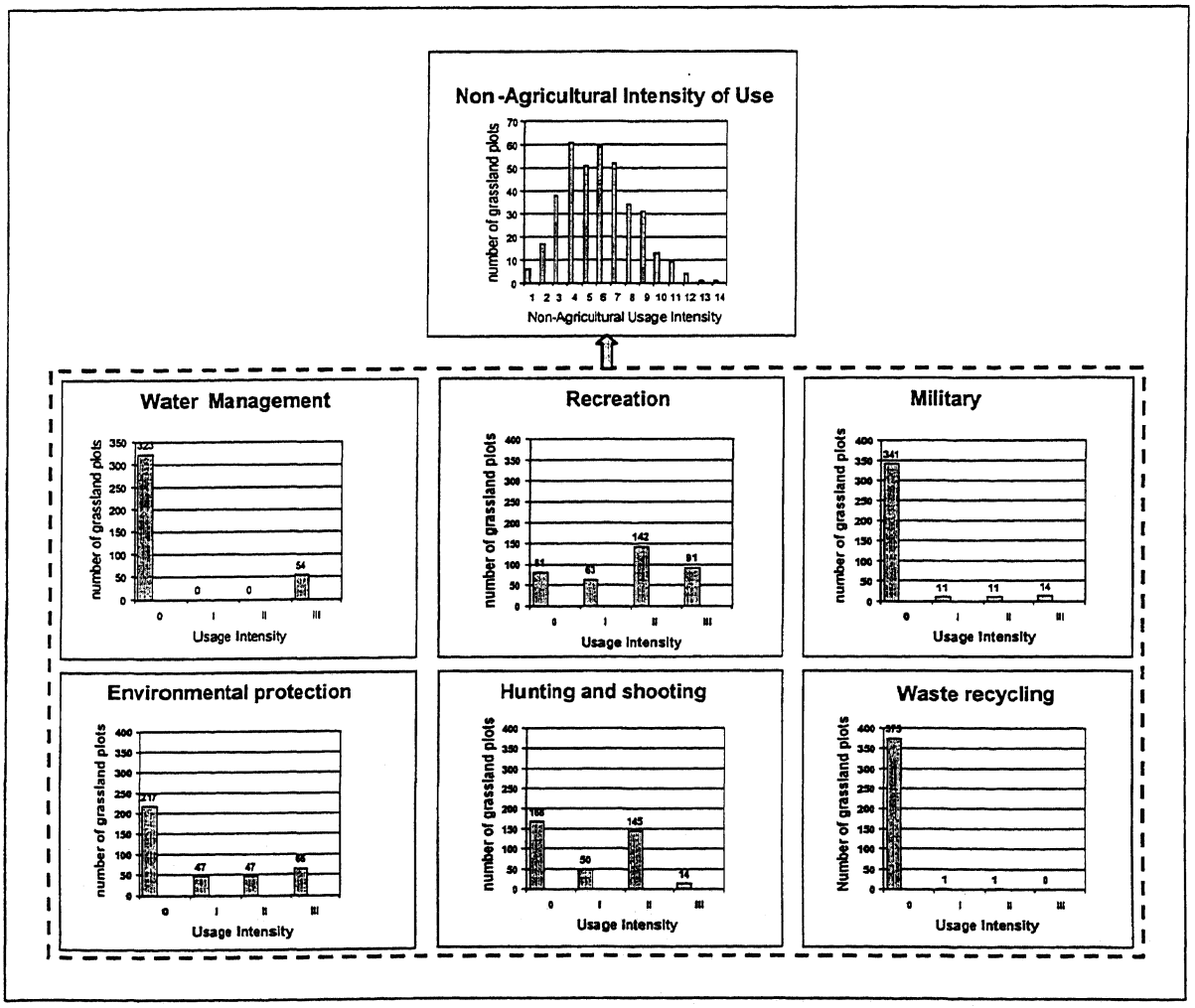

Figure 4: Non-agricultural usage intensity of the grassland units incorporated in the 1997 Central Ennstal study
Abbildung 4: Außeragrarische Nutzungsintensitäten der in der Pilotstudie „Mittleres Ennstal" 1997 erfaßten Grünlandparzellen

Table 4: Management of the grassland units incorporated in the 1997 central Ennstal study
Tabelle 4: Bewirtschaftung der in der Pilotstudie „Mittleres Ennstal" 1997 erfaßten Grünlandparzellen

Management category	Category	Number of units	%
	4-cut meadow	13	3
	3-cut meadow	96	25
	2-cut meadow	84	22
	1-cut meadow	33	9
	Litter meadow	13	3
	Temorary pasture	46	12
	Improved pasture	31	8
	Rough grazing	61	16
Fertiliser application	Fertiliser class	Number of units	%
	No fertiliser	84	22
	Manure only	182	48
	Artifical fertiliser only	26	7
	Manure and artifical fertilier	85	23
	Total nitrogen application	kg/ha/year	
	Average	60.31	
	Std. Dev.	55.7	
	Median	50.4	
Other management treatment	Category	Number of units	%
	Pesticide application	64	17
	Harrowing	232	62
	Pasture maintenance	139	37
	Mechanical weed control	74	20
	Rolling	12	3
	Oversowing	25	7
	Grassland improvement	14	4

An average "management intensity factor" (see Section 3) of 0.01 (minimum: -9.53, maximum: 19.80, median: -0.22, data for 3 units is missing) was calculated for the meadows and pastures included in the central Ennstal study (see also Figure 5).

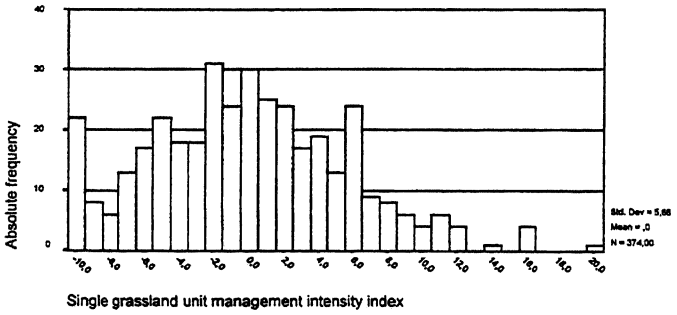

Figure 5: Distribution of the pastures and meadows incorporated in the 1997 central Ennstal study across management intensity factors
Abbildung 5: Verteilung der in der Pilotstudie „Mittleres Ennstal" 1997 erfaßten Wiesen und Weiden nach dem Bewirtschaftungsintensitätsindex

4.4 Relationships between non-agricultural uses and management intensity

There is no evidence of a linear relationship between the management intensity factor and the non-agricultural usage intensity factor (in the sense that non-agricultural usage intensity might sink with increasing management intensity). However, individual analyses show that particular non-agricultural uses are directly dependent on relatively low management intensity, or are at least predominately found on those grassland types which are managed less intensively (see Table 5).

One such example is the use of grassland areas for environmental protection, itself closely related to the prevalence of rare animal and plant species. Similarly, the use of grassland for hiking or more aesthetic purposes is negatively correlated with management intensity.

Nevertheless, a number of grassland uses are not significantly correlated with the management intensity factor, including hunting and shooting, paragliding (where grassland is used as a launch pad or landing site), use as a panoramic viewing area, alpine skiing and military uses. Care must be taken with the interpretation of this result however; although the intensity of agricultural management (and by implication a relatively high level of management intensity) has no direct impact on these uses, the latter are dependent on at least a minimum level of grassland management in order to ensure the landscape remains open. No significant relationship could be found between management intensity factor and uses relating to water supply or the incorporation of the unit in some kind of landscape, water or hydrological protection area. A degree of caution is again needed when considering this result, however, as the allocation (or not) of a grassland unit to a protection area was based on the farmers' own statements, which were often very uncertain.

Table 6 shows that the respondent farmers perceive secondary uses (or neighbouring land use) as a constraint to management, albeit to a limited degree.

The most commonly cited constraint is that of a bordering road or railway line. The latter are associated with problems arising from loose chippings, dust and gravel, rubbish (bottles, soft drink cans) and cars which leave the road. Pylons and lampposts are the second most common problem. Problems associated with water or environmental protection were spontaneously cited by farmers as management constraints in only four cases. According to these results,

Table 5: Uses showing a significant correlation with the management intensity of the grassland units incorporated in the 1997 central Ennstal study
Tabelle 5: Nutzungsarten mit signifikanter Korrelation zur Bewirtschaftungsintensität der in der Pilotstudie „Mittleres Ennstal" 1997 erfaßten Grünlandparzellen

Hiking				**Aesthetic value (admired as a beautiful meadow)**			
Usage frequency	N[1]	ϕ bi[2]	Std. Deviation	Usage frequency	N	ϕ bi	Std. Deviation
never	277	0.28	5.51	never	154	0.44	5.78
rarely	32	0.60	6.23	rarely	61	0.34	5.33
sometimes	45	-0.15	5.66	sometimes	142	-0.18	5.47
often	20	-4.45	5.61	often	17	-3.60	6.77
TOTAL	374[3]	-0.01	5.68	TOTAL	374	-0.01	5.68
ANOVA: F = 4.582; Sig. 0.004				ANOVA: F = 2.75; Sig. 0.042			
Flower picking				**Env. protection area (area subject to env. controls)**			
Usage frequency	N	ϕ bi	Std. Deviation	Usage frequency	N	ϕ bi	Std. Deviation
never	191	0.33	5.47	yes	14	1.36	0.84
rarely	72	0.73	5.88	no	360	2.58	1.08
sometimes	94	0.04	5.56	Independent Samples T-Test: t = 4.193; Sig. 0.000			
often	17	-6.90	2.90				
TOTAL	374	-0.01	5.68				
ANOVA: F = 9.61; Sig. 0.000							
Prevalence of rare plant species				**Prevalence of rare animal species**			
Usage frequency	N	ϕ bi	Std. Deviation	Usage frequency	N	ϕ bi	Std. Deviation
none	262	1.24	5.16	none	302	0.35	5.27
few	40	-1.24	-1.24	few	48	-0.88	6.68
some	63	-3.38	-3.38	some	21	-1.83	7.78
many	9	-6.83	-6.83	many	3	-7.97	2.70
TOTAL	374	-0.01	5.68	TOTAL	374	-0.01	5.68
ANOVA: F = 19.03; Sig. 0.000				ANOVA: F = 3.539; Sig. 0.015			
Cross-country skiing trail							
Usage frequency	N	ϕ bi	Std. Deviation				
never	306	-0.40	5.62				
rarely	8	5.19	4.51				
sometimes	16	1.85	5.77				
often	44	1.25	5.64				
TOTAL	374	-0.01	5.68				
ANOVA: F = 4.119; Sig. 0.007							

[1] Number of units
[2] Average management intensity factor
[3] Only 374 units are included in the analysis as the management intensity factor could not be calculated for 3 of the 377 units investigated due to errors in the data

Table 6: Management constraints arising due to secondary grassland uses or neighbouring land use, as cited by respondent farmers in the 1997 central Ennstal study
Tabelle 6: Von Mehrfach- und Nachbarnutzungen bedingte Bewirtschaftungshindernisse gemäß Aussagen der Landwirte im Mittleren Ennstal 1997

Management constraint	Number of units affected
Through neighbouring uses	
– bordering on a road or railway line	15
– bordering on woodland	5
– bordering on a footbal pitch or pub	3
Through secondary uses	
– Pylons and lampposts	13
– Uncultivated field margins	9
– Military use	6
– Winter tourism	5
– Pressures brought about by water / environmental protection	4
– Hunting and shooting	2
– Rights of way crossing the unit	2
– Water basin	2
– Tourists	1

the fact that tourists often provide farmers with an alternative or complementary income (through farmhouse holidays, part-time work in the tourism industry, direct marketing etc.).

5. Discussion and conclusions

With regard to the design of the research, it has already been made clear that there are limitations regarding the suitability of a questionnaire survey of farm managers as a tool for recording the intensities of non-agricultural uses of grassland. Although the method has the advantage of practicability (it is relatively easy to get hold of local data on non-agricultural grassland use), the data so obtained is likely to be somewhat subjective and unspecific. Nevertheless, the results are able to give us a reasonable picture of the diverse demands placed on grassland in mountain areas. Further research will need to include discussions with relevant

experts (environmental authorities, tourist offices etc.) and separate surveys.

The results show that there is considerable variation in the intensity of both on- and off-farm use of grassland units in central Ennstal. If farmers in mountain areas are to be properly compensated for the positive external effects of grassland management, then the services they perform on behalf of society need to be more precisely registered and categorised at a local level. The survey also revealed that the non-agricultural demands placed on meadows and pastures do not always seem to be properly articulated; some owners or managers of grassland areas do not know if their land is included in some kind of water or landscape protection area. Given this deficiency, and with a view to providing compensation for the non-agricultural services provided by grassland, it might be worth considering the production of a clear, multidimensional planning-based profile of the functions and task required of grassland by society, where possible at a local level.

Notes

[1] BOCKHOLT, FUHRMANN and BRIEMLE (1996) also give some guidelines for estimating different levels of grassland management intensity.

[2] a correction factor for grazing is needed because the frequency of agricultural use of comparable grassland units is higher if the grassland is used exclusively for grazing, rather than mowing. The grazing factor is calculated here by comparing two grassland units which were located very close to each other in the surveyed area; one gave three cuts and a follow-up grazing (Nachweide), the other was a grazing ley giving two cuts and two grazings. The equation is therefore: 3 cuts + 1 follow-up grazing = 2 grazings + 2 cuts. Assuming that a follow-up grazing is equivalent to half a normal grazing, then the correction factors become: 1 grazing = 0,67 cuts; 1 follow-up grazing = 0,335 cuts.

References

BOCKHOLT, R., U. FUHRMANN und G. BRIEMLE (1996): Anleitung zur korrekten Einschätzung von Intensitätsstufen der Grünlandnutzung. Natur und Landschaft, 71 (6), 249–251.

BRIEMLE, G. and M. ELSÄSSER (1997): Die Funktionen des Grünlandes. In: Berichte über die Landwirtschaft. Volume 75, 272–289.

ELSÄSSER, M. and G. BRIEMLE (1996): Zur Funktion der Grasnarbe. In: BUNDESANSTALT FÜR ALPENLÄNDISCHE LANDWIRTSCHAFT GUMPENSTEIN (Ed.): Alpenländisches Expertenforum "Erhaltung und Förderung der Grasnarbe". BAL Gumpenstein 5–6 September 1996, BAL Gumpenstein, Irdning, 1–10.

FLECK, P. (1985): Zur Bewertung der Mehrfachnutzung des Landes. Diss., Justus-Liebig-Universität, Gießen.

GREEN, B. (1996): Countryside conservation: landscape ecology, planning and management – 3rd ed. Spon. London [u. a.].

HOVORKA, G. (1998): Die Kulturlandschaft im Berggebiet in Österreich. Politiken zur Sicherung von Umwelt- und Kulturleistungen und ländliche Entwicklung. OECD-Fallstudie. Forschungsbericht der Bundesanstalt für Agrarwirtschaft Nr. 43. Wien.

PEVETZ, W. (1998): Die Multifunktionalität der österreichischen Land- und Forstwirtschaft. Schriftenreihe der Bundesanstalt für Agarwirtschaft Nr. 82. Bundesanstalt für Agrarwirtschaft, Wien.

PISTRICH, K. H. (1999): Einzelflächenbezogene Intensitätsunterschiede der Grünlandnutzung und -bewirtschaftung. Diplomarbeit, Universität für Bodenkultur, Wien.

SCHWAHN, CH. and U. BORSTEL (1997): Möglichkeiten des Zusammenwirkens von Naturschutz und Landwirtschaft bei der Erhaltung montanen Grünlands. Ergebnisse eines interdisziplinären Gutachtens im Oberharz. In: Natur- und Landschaft. 72 (6), 267–274.

SPITZER, H. (1971): Die Landnutzung in der Massenkonsumgesellschaft. zitiert nach FLECK, P. (1985): Zur Bewertung der Mehrfachnutzung des Landes. Diss., Justus-Liebig-Universität, Gießen.

STOYKE, C. (1995): Die Ökonomik einzelbetrieblicher Anpassungsmaßnahmen an Extensivierungsauflagen in der Pflanzenproduktion. Landwirtschaft und Umwelt. Schriften zur Umweltökonomik. Vol. 11. Wissenschaftsverlag Vauk, Kiel.

WYTRZENS, H. K. and MAYER, CH. (1998): Unterschiedliche Nutzungs- und Bewirtschaftungsintensitäten im Grünland des Mittleren Ennstales und ihr sozioökonomischer Hintergrund. Regionalplanungs-Forschungsberichte Band 3, Wien.

WYTRZENS, H. K. (1995): Grünland als Element der Agrarraumgestaltung. In: VERBAND DEUTSCHER LANDWIRT-

SCHAFTLICHER UNTERSUCHUNGS- UND FORSCHUNGSANSTALTEN (VDLUFA) (Ed.): Grünland als Produktionsstandort und Landschaftselement. Kongreßband 1995 Garmisch-Partenkirchen. Vorträge zum Generalthema des 107. VDLUFA-Kongresses vom 18.–23. 9. 1994 in Garmisch-Partenkirchen. VDLUFA-Verlag, Darmstadt, 83–94.

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