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EU CONCERTED ACTION

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FINAL REPORT

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TITLE:

THE EFFECTS OF SHEEP AND GOAT GRAZING, SEPARATELY OR IN COMBINATION, ON THE ECOLOGY OF INDIGENOUS PASTURES WITH DIVERSE FLORA AND AGRICULTURAL SYSTEMS IN LESS FAVOURED AREAS.

GENERAL AND SPECIFIC OBJECTIVES:

General:

To study and gain an understanding of the effects of goat and sheep grazing on indigenous pastures to enable effective land use management and conservation of these ecologically important resources.

Specific:

1. To study the adaptive mechanisms and grazing strategies of goats and sheep, grazing separately and together, on indigenous pastures in the temperate and Mediterranean regions of Europe.
2. To investigate the balance of complementary and competitive grazing between species and the factors which influence this balance.
3. To determine the effects of mixed grazing on the diversity of flora in ecologically important regions.

RESEARCH PLAN

There were two phases to this Concerted Action and each of the five participants had specific roles to play in both phases. The phases were organised as follows:

PHASE ONE

All participants met at SAC Kirkton and Auchtertyre Farms, west Perthshire, Scotland, UK in May 1993. The meeting lasted four days and achieved the following objectives:

1. To provide participants with the opportunity to introduce the work of their institutes and to present up-to-date results of their own current work in the subject area of the project.
2. To establish common ground and initiate joint experiments within a Mediterranean and temperate context.
3. To exchange information on methodology and techniques for experimental research.
4. To initiate the preparation of a document on guidelines for the grazing management of sheep and goats.

5. To set a timetable for phase two of the project.

The report from this meeting was presented to the Commission at the end of 1993.

PHASE TWO

This phase of the Concerted Action lasted from January 1994 to the end of May 1995 and included the following:

1. A joint experiment between AUT and INRA-SAD on 'The effects of grazing management systems for sheep and goats on the utilisation of areas with diverse herbage, including rangelands, in Mediterranean regions.' The work included the study of the effects of animal experience and habitat on spacial and grazing utilisation of pasture and rangelands; the effects of social training of flocks; the effects of allotment of group size; effects of rotational grazing over a grazing season and effects of sequential grazing within daily movement patterns, with particular study of the effects of grazing systems on animal behaviour and utilisation of vegetation.
2. A joint experiment between GhK, USP/ENEA and SAC on 'The effects of goat and sheep grazing, separately or in combination, on the diverse flora of indigenous pastures in temperate regions.' The work included study of the effects on individual plant species; the balance between complementary and competitive grazing and the management and environmental factors which influence adaptive mechanisms and grazing balance.
3. A report on the existing systems in each country, guidelines for sheep and goat grazing and the future potential of systems in assisting the control of landscape ecology and impact on regional socio-economics. This report was submitted to the Commission in April 1995.
4. Exploratory visits between collaborators to view and discuss research facilities, exchange detailed information on methodology and experimental design and ethos. These visits were: I by SAC to INRA-SAD, March 1994; II by GhK to AUT, April 1994; III by GhK to USP/ENEA, April 1994; IV by USP/ENEA to GhK, October 1994.
5. Phase two meeting of all participants to relate experimental results, plan the report document on systems, discuss future collaboration and dissemination plan. This meeting took place in Thessaloniki, Greece in June 1994 and a report of the meeting was presented to the Commission in July 1994.

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**The Management and Protection of
Human Created Landscape with small ruminants
in the Hilly LFA's in Germany**

June 1994

1. Introduction

There are major changes taking place in the agricultural structure in countries of the European Community. Due to the changing economical structure, areas in some countries of the EC are now being taken from use in intensive agricultural production. The areas concerned are field and meadowland from which the yields are so small that high expenditure for production means are not justifiable. These measures are strengthened by increasing jurisdiction in this direction which often impose rigorous limits of use for the farmers. These areas are

however used extensively, mainly as meadowland, and can be used to attain income but in a very reduced way. This extensive use of the land is generally preferable to fallow land.

Europe portrays a **cultural landscape**. Its citizens, especially those in search of areas nearby for their leisure and for tourists, want a varied, in part open countryside. The variety of flora and fauna in such areas is unique. They can often function as a link between areas under protection.

2. The problem of landscape management in Germany

The importance of protection of human created landscape in Germany is necessary for (HEIDENREICH 1993):

1. Nature conservation,
2. Preservation of historical rural culture and
3. Human recreation.

The **characteristic landscapes in Germany** - with their characteristic spectrum of adopted flora and fauna - are a result of human influence (*Kulturlandschaften*), mainly through extensive agriculture, done in the same way over centuries (in the surveyed area *Trockenrasen* and *Feuchtgrünland*-ecosystems are predominant). Now-a-days, many of them are in need of protection. On a idle human created pasture, the composition of the vegetation and the wildlife soon changes. The result is the loss of rare protected species.

The **extensive grazing/browsing on pastures** with adapted and resistant animals on not arable land (woody and hilly land with low fertile soils, often a long distance to market places) over centuries led to the so-called anthropo-zoogen landscapes, which are typical in Germany. This landscapes replaced the original natural woodland (WOIKE/ZIMMERMANN 1992). Goats, sheep, the animals of the poor man, were herded in the forests and marginal hilly areas on common pastures. In addition to the exploiting of the forest for firewood and building material the browsing and the footprints of the livestock deforested the area even in LFA's. Over centuries, this led to open landscapes, e.g. *Hutewälder*, *Heiden*, *Wacholdertriften*, *Feuchtgrünland* or *Trockenrasen* with adopted, specialised plants and wildlife societies (ecosystems).

In the last three decades, **extensive keeping of sheep and especially goats abandon more and more** due to the changes in agricultural structure. The intensivation of animal production led to high-yielding but less resistant and adopted animal types. The low-yielding but resistant and adopted types disappeared and now are in danger of diing out. Concerning the protection of human created landscapes the high-yielding animal-types are not able to be kept extensively.

The protection of the different human created landscapes is an important target of the German society. While in former times the management of the landscapes and (extensive) agriculture were no contradiction, this has changed in the last three decades. Now-a-days, agriculture and the protection of the landscape seems to be a contradiction. In former times the landscape was created and protected through agriculture; today, it has to be protected against (intensive) agriculture.

The protection of the landscape faces the problem: too much (intensive) and too less (no) agriculture has to be prevented. The intensive agricultural production is destroying the human created landscape through intensification/molioration and/or no agriculture. Both leads to changes in the floristic and faunistic composition of the human created habitats. No agriculture is a hard problem in the LFA's of Germany. Without agricultural use (extensive animal keeping or mowing), shrubs soon appear. After 10 years, *Trockenrasen* can be totally covered with them.

Besides the importance of human created landscapes to protect rare plants and wildlife, the preservation of rural culture and recreation areas are important aspects for the protection of the human created landscape. Today, huge areas are out of agricultural production, e.g. the LFA's of hilly areas (*Trockenrasen*) in the surveyed regions. These rural areas with their - over centuries - human created landscapes and cultures disappear. Many villages do not know agriculture, especially extensive animal keeping out of stables. Now-a-days, in these areas many jobs are lost. Concerning these problems, the variety of rural culture is diminishing, not only plants and wildlife. The results are monoton and/or cleared Landscapes without historical rural culture, only few (cultivated) plants and wildlife and - last but not least - of no value for human recreation.

After the targets of the society (environment protection, landscape management, conservation of the rural culture and the creation of recreation areas) became law, the realization was the problem, mainly for the responsible communal institutions. Only an establishment of special areas for the nature did not lead to their protection. The anthropo-zoogen created landscapes need management to protect their character.

The modern farmers with intensive production methods did not do this because it was not lucrative. By this, the communal institutions bought many of the areas which were to be protected. But they were not able to manage the cultivation/protection for lack of finance, technical equipment and experience. The way out of this dilemma were contracts with private persons (farmers, environment units, individual persons), to execute the cultivation/protection with financial compensation. With the contracts/financial compensation, the extinct extensive agriculture became an interesting activity for many animal keepers, especially the keeping of small ruminants. This new task is not production orientated, but civil service for the society. For

the official responsible institutions the contracts are the cheapest way of landscape management (*Kulturlandschaftspflege*).

For the contracts, hobby animal keepers and small farmers are important, since the financial contribution is not sufficient for farmers. The management is intensive in work and can often not be integrated in the farm organisation. The possibilities of mechanisation and rationalisation of the work is limited, many products (e.g. meat of goats) are difficult to market. Against professional farmers, the economic profitability for hobby animal keepers and small farmers is only one aspect of interest. Besides this, they enjoy animal keeping and landscape management, like a special form of recreation.

The **landscape management with extensive animal keeping** is accompanied by problems. The official governmental institutions are responsible for the control of the effects of landscape management with animals to the vegetation and the wildlife. The staff of these institutions have only limited experiences in animal keeping, because they are mainly biologists. They cannot calculate the effects of the grazing/browsing stock. By this, they do not know the necessary density of stock in the special area, which species, the best season of grazing and the costs of this activity for the animal holders to reach the targets in the landscape management. In opposition to this, the animal keepers only know a little about the rare and protected flora and fauna. Even they are in need of information on the effects of landscape management to their animals and/or their farming organisation, despite their knowing a lot about animals and farming.

3. Preliminary Results of Research

While this measure of **landscape protection becomes more important** (see chapter 3.1), there is an obvious **deficiency in empirical research** of the effects of grazing and browsing of the vegetation and animal keeping (see chapter 3.2). Questions are:

- Which landscapes can be managed with small ruminants?
- What are the effects of grazing and browsing?
- What is the impact of landscape management to animal keeping (e.g. profitability, keeping problems)?

For four years, the **Dept. of Animal Husbandry of the University of Kassel** has been working on this topic. From 1991 to 1993, Mrs. C. Schröder carried out an empirical study on the ability of three different goat species for de-forestration on Magerrasen (SCHRÖDER/TAWFIK 1993). From Autumn 1993 to Spring 1994 G. Rahmann evaluated the current importance of goat and sheep keeping for landscape management of two selected rural council areas

(RAHMANN 1994). Some remarkable preliminary results of this two studies are shown in the chapters 3.1 and 3.2.

3.1 The productivity of goats and their influence on the vegetation of Magerrasen

The main questions of the research concerning goat keeping on marginal pastures with high shrub density are:

- Production parameters of goat keeping,
- de-forestration potential to invasive shrub plants and
- behaviour and keeping conditions of goats on marginal pastures.

In the summer seasons 1992 and 1993, three different genotypes of goats (Boer goats, German Alpine goats and Cashmere goats) have been used for de-forestration of a six hectare steep pasture with high shrub density (between 50 and 100 percent). Altogether 136 goats are kept in different densities on several plots. Some of the results have already been presented at the meeting in Glasgow in June 1993, the final report will be finished in summer 1994.

3.1.1 Composition of the vegetation

On the research area 126 different plant species have been identified. The composition of the vegetation and the vegetation cover varies over the area but is homogenous amongst one set of plots. Only the invasion shrub Weißdorn (*crataegus laevigata* and *crataegus monogynata*) cover around 80 percent of the area. In the herbal cover the dominant species are Gemeine Schafgarbe (*Achillea millefolium*), Glatthafer (*Arrhenatherum elatius*), Aufrechte Trespe (*Bromus erectus*) and Rot-Wiesenschwingel (*Festuca rubra*). The majority of the species (109) indicate a preference for light and oligothrope conditions. Following JEDICKE (1993) and ELLENBERG (1976) this pasture shows high succession. The small herbal plants (often protected) lose the competition with the invasion shrub Weißdorn. In some years this shrub will cover the whole area. To protect the rare herbal plants, the Weißdorn bushes have to be pushed back and a grass cover is to be avoided. The feeding behaviour of goats (browsing) is a possibility of de-forestration and to keep the herbal cover low.

3.1.2 Barkstripping of hawthorn and feeding behaviour

As a result of six sets of trials in 1992 the Alpine goats barkstripped most of the shrubs/bushes (58,5%), followed by Cashmere goats (44,1%) and Boer goats (36,8%). The grass cover was kept in all cases low to very low. Because of the low contribution of herbs to the fodder, degradation of the herbal vegetation appears. The **high cover of shrubs** does not seem to be suitable for the feeding requirements of the goats. In literature (MAERTENS/WAHLER/LUTZ 1990) the optimal composition of the feeding plants should be 30%, 30% and 40% shrubs/bushes. In empirical research, differences between the genotypes are obvious (figure 1).

Figure 1: Average time goats spent on different activities (min/h of observation)

Source: SCHRÖDER/TAWFIK 1993

Despite the barkstripping Alpine goats spent more time grazing compared with the other species. Altogether the Alpine goats spent more time feeding than the others. The Boer goats spent most time and also most of the feeding time on browsing (52% of the feeding time),

despite in barkstripping the Alpine Goats are more effective. Boer goats prefer leaves of Weißdorn more than Cashmere or Alpine goats.

Also there were significant differences between the **feeding behaviour in the morning and the evening**. In the morning all groups, except Boer goats, preferred browsing to grazing, where as in the evening all groups spent more time on grazing. The behaviour might be due to wet grass (dew) in the morning.

3.1.3 Production parameters to the goats

The **Boer goats** are selected for meat production. The marginal pastures did not satisfy the feeding needs. While adult goats could only keep their body weight, the growth of the lambs was low for this big species (83 g/day).

The small **Cashmere goats** spent less time for browsing (30% of feeding time) and more time for barkstripping than Boer goats. The weight gain of the lambs was moderate with 43 g/day and the adults kept their body weight.

The high-yielding **German Alpine goat** (milk) shows the best results in gaining weight of the lambs (93 g/day) and the adults could keep the weight but some of the does lost weight.

Finally it can be said that the high-yielding **German Alpine Goat (Milk)** can also be kept under extensive conditions on marginal pastures. Even in barkstripping this indigenous species is more effective than the other two. Problems are wet and cold weather conditions, the lambs especially suffer. **Cashmere goats** are also adapted to extensive keeping conditions on marginal land. The effect on barkstripping is low compared with the others. The South-African originated **Boer goats** are highly productive (meat) but not well adapted to extensive keeping conditions on marginal land in humid climate like the hilly areas of Germany. The production is low and the effect of barkstripping does not satisfy (de-forestration). Furthermore Boer goats suffered badly from *Endotoxaemie*, a disease of *Chlostridium* spp.. Endotoxaemie is a sign of not adapted keeping conditions.

3.2 Maintenance of Magerrasen with small ruminants in practice. The case of Landkreis Göttingen

In practice, **landscape management** with extensive animal keeping is increasing in Germany. Small ruminants especially are used to keep grass cover low and browse on invasive shrubs/bushes on marginal land. Sheep and goats are cheaper than the cleaning and management

of Magerrasen with machines or manually. To show the importance of landscape management with small ruminants, amongst others the performance by the rural council of Landkreis Göttingen was evaluated. This example of this hilly area with many small plots of Magerrasen is typical for the Mittelgebirge in Germany. The case study shows the actual practice, problems and chances of using small ruminants for landscape management. **Following questions are of interest:**

- The importance of small ruminants for landscape management (especially Magerrasen).
- Measures and management pattern and farming systems.
- Problems of keeping small ruminants on marginal land.

The surveyed area of **Landkreis Göttingen** (1,100 km²; 250,000 inhabitants) lies in the middle of Germany in a hilly area (100-700 M. above sea-level) (s. figure 2). Half of the area (53%) is used for agriculture. Crop production is concentrated beside the rivers on fertile land while animal keeping (grassland) dominates the hills. Forest covers 32% of the area¹. The rest of the area is covered by rivers, buildings or roads.

Figure 2: The area of Landkreis Göttingen (Germany)

Source: RAHMANN 1994

1: In Germany the grazing of animals in forest is prohibited. Silvo-pastoral keeping forms are only on orchard pastures (apple-, plum- and cherry-trees) (Streuobstwiesen).

Small protected pastures, especially **Magerrasen**, dominate the landscape of Landkreis Göttingen². Over 169 ha Magerrasen distributed on 249 plots are on the council area (66% of the recorded area). The average plotsize is about 0,6 ha, but with high variation (0,1 to 10 ha). In hectare, Magerrasen dominates with 39% the so-called 28a-biotops. All these biotops are protected by law.

3.2.1 Framework of the Magerrasen-management

Since 1988, Magerrasen has been managed with small ruminants in the Landkreis Göttingen (PREUSCHHOFF 1994). Goats and sheep are used on the basis of contracts with private animal keepers. The initiation came from the Untere Naturschutzbehörde, the responsible office for nature protection in the rural council. 1993 about 52,9 ha Magerrasen are managed by contract with 18 different animal holders. Magerrasen comprises over 34% of all landscapes managed with animals³.

The **contract conditions** are different between the different Kulturlandschaften (Magerrasen/Feuchtgrünland) and even each plot. The rural council pays 250,- DM per hectare and year plus extras (e.g. fences, additional livestock, cleaning) to the goat and sheep keepers for the management of Magerrasen⁴. The period for keeping animals on the pastures (after flowering of protected plants) and the animal density (1,4 AU/ha = 700 kg liveweight) is fixed. While grazing/browsing takes place on the protected pastures, it is not allowed to give extra feed to the animals, to use any fertilizer (eutropie) or pesticide (groundwater). Even shelters for the animals are not allowed (landscape disturbance). This is even valid on privately owned pasture, when it is under protection by law. The majority of biotops are owned privately (50%), 39% by the government, 4% by the church and 7% by the forest departments.

Over 50% of the **expenditures of the rural council** are spent on landscape management with animals (18% for Magerrasen). The other 50% are spent on manual cleaning (de-forestation) or machines (mowing).

2: In the frame of the environmental protection law (1990; §28a NNatG) all biotops have to be cartographed. Actually already 66% of the area is fully recorded (PREUSCHHOF 1994).

3: Over 100 ha of protected wet pastures (Feuchtgrünland) is managed with cattle. Feuchtgrünland is easy to manage and there is no problem to find cattle keepers, while goat and sheep keepers can rarely be found in the area.

4: For Feuchtgrünland 500,- DM/ha and year is payed.

3.2.2 Experiences with the contracts

In Autumn/Winter 1993/94, 26 animal keepers with contracts for landscape management (cattle, horses, goats and sheep) and several organisations/institutions involved in landscape management (e.g. offices, nature protection groups, animal keeping formations) were visited. The selected animal keepers comprises full-time farmers and hobby animal keepers (s. tab. 1).

Table 1: Structure of the evaluated landscape management in the rural council of Göttingen 1993 (n=20)

	Feuchtgrünland		Magerrasen		total	
	ha	animals	ha	animals	ha	animals
goats	0	50	1	35	1	85
sheep	0	35	8,75	219	8,75	254
mixed	5,7	..	14	..	19,7	..
horses	14,5	32	11	42	25,5	74
cattle	29,25	73	0	0	29,25	73
mowing	6,3	..	1,2	..	7,5	..
total	55,75	..	35,95	..	91,7	..

Source: RAHMANN 1994

From the responsible offices' side (Untere Naturschutzbehörde) the majority of the contracts (88%) are fulfilled (KÖNIG 1993). From the animal holders' side there are great differences in the valuation concerning the contract conditions. While the animal holders with contracts to maintain Feuchtgrünland are mainly satisfied, the animal holders with contracts for Magerrasen complain about the conditions. The compensation of 250,- DM/ha and year is not enough in relation to the keeping constraints on this marginal land. The amount does not compensate the low profitability of sheep and goat products and the difficulties of keeping (fencing, low feeding value of the pastures, thorny shrubs and a lot of manual work). The thorny shrubs are not only a problem for nature conservation, but also for goat and sheep keeping. Even the low biomass production is a big problem especially for suckling youngstock. Despite the low compensation the majority of the sheep and goat keepers are hobby animal holders. They do not only orientate their animal keeping for profit, but also for recreation/leisure.

4. The research proposal „Landscape management with animals“

As described, there is an obvious **deficiency in empirical research** of the management of human created landscape with animals. Despite the increasing use of animals to protect human created landscape in LFA's of Germany, these practices have been little researched (MAERTENS/WAHLER/LUTZ 1990). In practice, the management and protection of the landscape is done on the basis of contracts between private animal keepers (farmers and hobby holders) and governmental institutions responsible. While the effects of grazing/browsing of the vegetation is more or less well known, there is a lack of knowledge of the impact of landscape management to the farming situation.

The main **target of the research project** is to analyse the possibilities and limitations of landscape management with goats and sheep in the LFA's of the rural councils of *Landkreis Göttingen* and *Werra-Meißner Kreis*. In the analysis, both - the side of nature and landscape protection from point of view of the governmental institutions and the side of animal keeping in protected landscapes from point of view of the animal keepers (economy, farming systems) - are of interest:

1. Which landscapes can be managed with goats and sheep?
2. Which animal types can be used for the landscape protection?
3. How much experience, working power, material is necessary to manage landscape with small ruminants?
4. What are the economic results of landscape management with small ruminants to the holders and the donors?

4.1 Research methods

The research is carried out in the rural councils of *Landkreis Göttingen* and the adjacent *Werra-Meißner Kreis*. The councils are located in the centre of Germany. The geomorphological and landscape structure is nearly identical: In the dominating hilly area, agriculture is more or less abandoned. The protected anthropo-zoogen created landscapes are

distributed in small plots (0,5 to 10 ha) over the council areas⁵. The survey concentrated on the landscape-types *Trockenrasen*, *Magerrasen* and *Feuchtgrünland*, which are dominant in the councils areas. These landscape-types are result of extensive animal keeping for many centuries. Now, due to the changes in agricultural structure, the farmers leave these landscapes idle. The effect is the Succession (natural re-forestration of *Trockenrasen/Magerrasen* and high grass coverage) of these landscapes. Both, re-forestration and high grass coverage leads to an extinction of rare floristic and faunistic species which are adapted to these landscapes with extensive animal keeping or extensive hay production.

The research will be limited for three years and be carried out on three different levels which overlap in the years of research. Over the research period several meeting and visits of the other counter parts of the EU project are planned to evaluate the possibilities and border of the joined topics.

1. level: Detailed evaluation of the practice of landscape management in the surveyed rural councils and in the federal states of Lower Saxony and Hesse.
2. level: In-deeped analysis of the problematic of landscape management with goats and sheep in the both rural councils.
3. level: Own landscape management with goats.

4.2 Research programme

1. year: Evaluation of the practiced landscape management in the surveyed regions (Landkreis Göttingen and Werra-Meißner Kreis). Analysis of the main problems. Summer to autumn: Landscape management with own goats on selected areas in cooperation with the responsible institutions. Scientific accompany of animal keepers with contracts for landscape management. Control of the effects to the landscape and the impact to the farm economy.
2. year: Evaluation of the landscape management in the both federal states Lower Saxony and Hesse. Summer to autumn: Landscape management with own animals on selected areas. Scientific accompany of animal keepers with

5: Both councils cover around 1,100 ha each, with around 250,000 inhabitants in *Landkreis Göttingen* and 120,000 inhabitants in *Werra-Meißner Kreis*. This includes not the population of the city of *Göttingen* with 130,000 inhabitants and the city of *Kassel* with 300,000 inhabitants. These big cities dominate the economic and social structure of the rural councils.

contracts for landscape management. Control of the effects to the landscape and the impact to the farm economy.

3. year: Analysis of the evaluation concerning landscape management in the both federal states. Summer to autumn: Landscape management with own animals on selected areas. Scientific accompaniment of animal keepers with contracts for landscape management. Control of the effects to the landscape and the impact to the farm economy.

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