Annette Prochnow and Ralf Schlauderer, Potsdam-Bornim

Land use systems encouraging open vegetation on former army exercise areas

Army exercise areas feature large-scale and valuable biotopes, the care of which requires special systems to keep vegetation open including actions such as grazing by domestic or wild animals, mowing and removing or mulching cuttings, clearing the ground with soil cultivation implements or scrapers, controlled burning and scrub clearance. Questioning of the authorities, accompanying recording of methods and information from the literature help with the design of systems and their economic evaluation.

PD Dr. Annette Prochnow and Dr. Ralf Schlauderer are members of the scientific staff at the Institute for Agricultural Engineering Bornim e.V. (scientific director: Prof. Dr.-Ing. J. Zaske), Max-Eyth-Allee 100, 14469 Potsdam, e-mail: *aprochnow@atb-potsdam.de*

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Literature

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Army exercise areas feature extraordinarily important landscape-ecological substances of high quality and worth [7]. Open landscape biotopes of especial value on such areas open sandy heaths, dry grassland, dwarf bush heaths, wastelands and „hute“ heaths. Once military operations are over, these biotopes undergo rapid change and require large-scale measures for keeping the landscape open. Amongst methods used currently for this are grazing with domestic or wild animals, mowing and clearing or mulching, scrub clearance, working the ground with agricultural cultivation implements or through scraping as well as controlled burning.

With all these vegetation opening methods there remain, to different extents, deficits in knowledge regarding suitable nature conservation measures with respect to design of system and its application.

Targets and tasks

Within the framework of interdisciplinary research cooperation project the aim was to process management concepts for helping with the conservation and development of valuable open landscapes of special nature conservation importance on army exercise areas in northeast Germany [5]. The task for Agricultural Engineering within this cooperation was the preparation of knowledge in system design, economic evaluation of open landscape management on different levels and in the componential and methodic cooperation within a total evaluation.

Material and methods

On six army exercise areas in Brandenburg and Saxony ecological, economical and sociological investigations on open landscape management were carried out as part of the cooperation project. For agri-technological investigations, the authorities were question and accompanying procedural recording carried out during the execution of actions. The recorded data when applied in association with literature information formed the basis for solutions regarding system design, for own cost calculations and for the evaluation of in- and outputs on the system level.

Grazing with sheep

The investigated army exercise areas of dwarf scrub heaths, ruderal and „landreitgras“ areas were mainly grazed with sheep. The average stocking rate was limited at 1.0 to 1.5 MuS/ha (MuS= ewe with lambs and flock followers).

Keeping sheep on these areas led to high animal-linked total costs of 176 to 247 /MuS. The reason here was mostly the high building and machinery costs as well as considerable expenses for bought-in winter feed. Market income of sheep keeping on this area was only 9 to 15 /MuS, in that possible stocking density, the reproduction rates and the dlwg of the extensive breeds were all low. For this reason financially supported nature conservation agreements were indispensable for securing viability.

Items	Sum [€/ha]
Costs	
Labour (grazing management, visitor services)	113
Fixed (fencing, machinery, visitor infrastructure)	34
Variable (vet., supp. feed, other materials)	30
Shared (fees, administration. publicity)	52
Incomes	
Visitors (entrance money, guides, tours, donations)	101
Contract nature conservancy (care of 20 ha wet grasslands)	16
System costs of wild animal grazing	104
System incomes from wild animal grazing	0
Total costs (incl. shared costs and visitor enterprise)	230
Incomes in total (incl. common costs and visitor enterprise)	117

Table 1: Costs and performance in paddock Glauer Tal in year 2001

Table 2: Costs and performance of procedures for maintaining open landscape

Factors	Unit	Amount
Technical data		
Tractor engine power	[kW]	27
Working width of flail mower	[m]	1,60
Loader wagon volume	[m^3]	16
Results		
Realised working width	[m]	1,34
Working speed	[km/h]	1,73
Area performance		
In total working time	[ha/h_{GAZ}]	0,10
Required working time	[h_{GAZ}/ha]	10
System costs	[€/ha]	300

GAZ Total working time [h_{GAZ}]

Grazing with wild animals

Grazing with wild animals offers a dynamic concept for keeping open the vegetation. On 164 ha of the fomer army exercise area Glau 136 red and fallow deer, wild sheep and Iceland ponies had free run of the whole area.

System costs of 104 /ha meant a considerable reduction on those for domestic animal grazing (*table 1*). After building up animal numbers, enterprise income of around 25 /ha should be achievable through marketing of meat. In association of the leisure use of the area, the grazing enterprise could in the end clear costs if the number of paying visitors increased continually [9].

Mowing and clearing

Mowing and clearing as a regular action to keep the landscape open was practiced mostly with the Calluna heaths. The regrowth of pure Calluna proved suitable for the production of biofilters. It was carted off as fresh cuttings with mowing taking place in five to seven year rotations from October to March.

The working width and speeds involved here were low, with high downtime and timeloss proportions and thus poor area performance (*table 2*). This gave high enterprise costs. The sale of the cuttings enabled costs to be covered.

Mulching

Mulching to keep landscape open from dwarf scrub heaths and for suppressing „landreitgras“ areas was carried out to a very small extent on the army exercise areas. In both cases, mulching should take place up to the beginning of August. With marked ground unevenness, innumerable obstacles and parcel sizes of under 1 ha enterprise costs in the literature were given as up to 175 /ha [8].

Ground working

For biotopes with limited ground cover such as open sand flats and sandy dry pastures keeping landscape open could be possible with farm cultivation implements. The only experience in this aspect featured the use of spring tine harrows on a sand dune. Area performance of 1.5 ha/hGAZ and enterprise costs of 27 /ha meant performance was similar to that on farmland.

Scraping

Scraping represented a special action with the Calluna heath with raw humus layers and upper layer of mixed ground to a depth of 10 cm being shaved off. Recommended is a small area treatment in a rotation of 20 to 50 years for this measure. Scraping includes bulldozing, shovelling or lifting with special machinery. The cleared vegetation is then composted. Enterprise costs vary from 1700 to 5000 /ha [1, 4, 10]. On the other hand, using ploughing or rotovating mixes the vegetation and upper ground only so that costs are decreased to 500 to 1500 /ha [1, 6].

Controlled burning

This method is carried out in individual and small area exercises. In the regions investigated, controlled burning took place every two to ten years on small areas of 0.5 to 10 ha [2]. Because of the weather only a few days are available for this action between January and March. At first, protection strips are created around the area to be burned. These are usually formed by burning too. Mostly three of a staff are required for the subsequent main burning with the leader operating a gas burner for starting the fires and the others guarding against spread of flames into surrounding areas.

Enterprise costs for controlled burning are from 40 to 142 /ha and these decrease with the size of area to be burned and the reducing width of protection strips.

Scrub clearing

Clearing of bush scrub can be necessary with advanced overgrowth succession. Increasing density and thickness of the growth leads to enterprise costs rising up to 10000 /ha [8] and, with this, reaching many times the costs of other landscape opening systems.

System costs and incomes

The systems for open landscape management offer substantial differences in cost, incomes and support requirement (*table 3*). Under favourable conditions grazing with wild animals and mowing and removal can give returns making them economically viable. Enterprises with low financial support requirement, are mulching, harrowing the ground and controlled burning. Regular actions for keeping landscapes open are better than bush clearing carried out at longer intervals.

Outlook

The results presented here are part of a total evaluation of open landscape management. These were determined utilising interdisciplinary research cooperation involved specialist nature conservation, economic and sociological criteria.

Table 3: Costs and performance of procedures for maintaining open landscape

System	Interval	Costs	Income	
			Market	Support
	[year]	[€/(ha • a)]	[€/(ha • a)]	[€/(ha • a)]
Sheep grazing	1	175 - 385	13 - 18	160 - 260
Wild animal grazing	1	105 - 235	83 - 115	0
Mowing and clearing	1 - 3	60 - 350	0 - 212	50 - 350
Mulching	1 - 3	8 - 175	0	≤ 175
Scrub clearing	2 - 20	140 - 500	0	≤ 500
Ground working	≥ 1	≤ 25 - 65	0	≤ 65
Scraping	20 - 40	13 - 250	0	≤ 250
Controlled burning	2 - 10	4 - 71	0	0