

GRAZING RESEARCH FOR NATURE MANAGEMENT PURPOSES

IN THE NETHERLANDS

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A grazing research program for Nature management purposes started in the Netherlands in '71 and has runned for more than 10 years now. I'll give you a survey of objectives, methods used and I'll summarize the general results up to now.

As to objectives

The landscape in the Netherlands has developed under the influence of human activities during many centuries. Old farming practises have increased the ecological variety of this landscape. Modern farming practises of this century are levelling this variety again.

It is the interest of nature conservation to preserve parts of the man-made landscape in the former way.

Within the framework of reallocation programs a part of the agricultural ~~landscape~~ area was given other destinations. Where those old fields could be integrated in existing nature-reserves some kind of management is requested to avoid monotonous rough vegetations poor in species. Grazing management of those fields together with parts of the nature area aims to start restoration of the area by gradually fading away the straight cultural lines.

The general objective of the research can be summarized as preserving qualities (in terms of diversity) of existing naturereserves and increasing qualities again on already spoiled places and on a few quite new places in recently dyked areas.

Biological diversity of spontaneous origin is the main criterion for valuating management results. Economic profit is not. However the first preliminary analyses of costs of management have shown that what we call 'a nature technical grazing management' is farout the cheapest method compared with others such as cutting and burning, all of course with regard to the results in terms of diversity.

A practical objective which has to be kept in mind was to come up with results for application in the practise of management and not only with those of the highest scientific interests.

As to methods

From 1970 onwards grazing management started again on several places over a wide range of vegetation formations: salt marshes, heath- and moorland, marshes, former agricultural areas on sand and peat on surfaces of a few ha's to several 100 of ha's, using domestic animals as cattle, horses, sheep and goats, preferably one kind at one place, but varying in methods such as permanent grazing all over the year and seasonal grazing. So there were some variables to look at.

The general procedure of the research was as follows: Each area, about 20 in succesion, was described by inventories and mapping. In all areas vegetation data were gathered in some way (not always the most efficient way as later became apparent). In about half of the areas more aspects were covered as soil properties and fauna inventories and in a couple of areas we tried to cover as many aspects as possible including yearly monitoring programs of soilchemistry, floristic composition, rabbits, mice, breeding birds, dungbeetles, moles, earthworms together with the monitoring programs of the 2nd fase of the research involving yearly mapping of direct effects of the grazing animals such as dung dispersal, pathdevelopment etc.

The 2nd fase, involving husbandry behaviour and dispersal, including diet studies, started after a new management had come into force always with a control area with another- or no-management.

In the 3rd phase of the research the programs of the first phase were repeated, general inventories and mapping usually after a five-year period of management. Those effects due to the grazing can become clear by comparing changes in the grazed- and the control area.

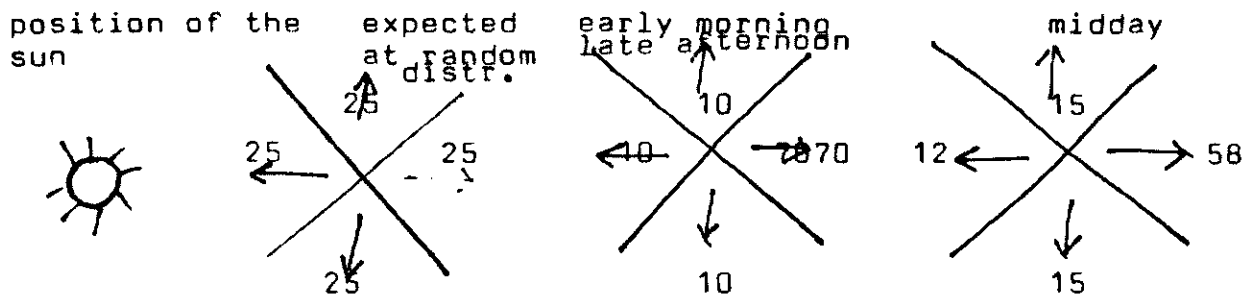
The 4th phase of the program finally was a closer research into the ecology of those species, which appeared to have indicatory value for the management practice in order to refine standards and into those effects of grazing management on the vegetation which come about in interaction with other animals, especially those living in and on the soil.

And of course there is a 5th phase in which all those aspects should be written down together preferably in close relations and that is my main problem at present.

As to results

I start with the 2nd phase of the research - domestic animal behaviour and dispersal - which was followed the year round in about 10 areas. It has become clear in all areas that husbandry when left alone for a season or the whole year develops a very constant behaviour pattern with slight seasonal differences. Some parts of the area are heavily used, some moderately, some lightly and if the stocking rate is low there will be always parts with no influence at all; as the places of heavy to no-influence are yearly constant impact gradients will arise with a varied vegetation structure and -composition. A linear connection is found of animal-time spent in a certain part of the area and the number of droppings to be found there. In cases of cattledroppings you even can see how the area was used. All bigger areas (over 100 of ha's) grazed with cattle or horses showed a daily clockwise pattern of herd movement. These animals seem to prefer to graze with the sun on their back. Cows have a somewhat higher correlation in this respect than horses. This general pattern can deviate due to natural barriers in the area and specific sites of interest such as only one drinking place or only one tree for shadow. This general grazing movement pattern can be checked on every place in the countryside by plotting grazing directions in relation to the position of the sun at that moment or by plotting of animal presence in relation to the part of the area at certain times; during midday for instance most animals can be found in the northern part of the area. In the southern hemisphere a anti-clockwise pattern seems to occur.

Fig 1 Number of animals grazing in a certain direction in %
n = 440



Corelation of grazing movement in directions opposite to the sun increases according as the grazed area is bigger.

The distribution percentage of heavy, moderately and lightly used parts of the area has something to do with stocking rates. The terms high, moderate and low with regard to stocking rate are however never defined in literature otherwise than relatively. For practical reasons of expected advices from our side to managers we were in need of some absolute classification and related to the historical landuse in the Netherlands the following was chosen.

Fig. 2 STOCKING RATE (animals / ha)

	cattle/horses	sheep/goats	actual use of year veg.prod.
HIGH	> 1	> 3	> 30%
MODERATE	0.3-1	1-3	10-30%
LOW	0.1-0.3	0.3-1	5-10%
VERY LOW	< 0.1	< 0.3	< 5%

Figures on actual use of the years vegetation production, that is to say that part which passes through the grazing animals guts, are difficult to obtain. The figures presented here are rough estimations. We should appreciate very much to hear if any of you can give us references on actual use at certain stocking rates for refining modelling work on grazing relations.

Fig. 3 AREA USE AT LOW-STOCKING RATE in %

		heavy	moderately	lightly	very lightly-no
CATTLE	(300 ha)	6	12	57	25
HORSES	(100 ha)	3	10	60	27
SHEEP	(230 ha)	3	12	50	35
SHEEP	(15 ha)	29	24	37	20
SHEEP	(3 ha)	6	34	40	20

Figures on the intensity of area use appear to be rather constant for all quite different areas tested. When areas become smaller the area-use intensifies even at the same stocking rate. The figures on area use can be used for modelling purposes in forecasting grazing effects in relation to vegetation pattern distribution.

Fig. 4 AREA USE AT ALL STOCKING RATES in %
(hypothetically for high and moderate)

stocking rate	heavy	moderately	lightly	very lightly-no
HIGH	85	15	-	-
MODERATE	25	60	10	5
LOW	5	15	55	25
VERY LOW	3	5	17	75

If a rough classification of vegetation pattern (structure) is used which can be recognized on air photographs and the effects of area use on vegetation pattern are analysed we come to following:

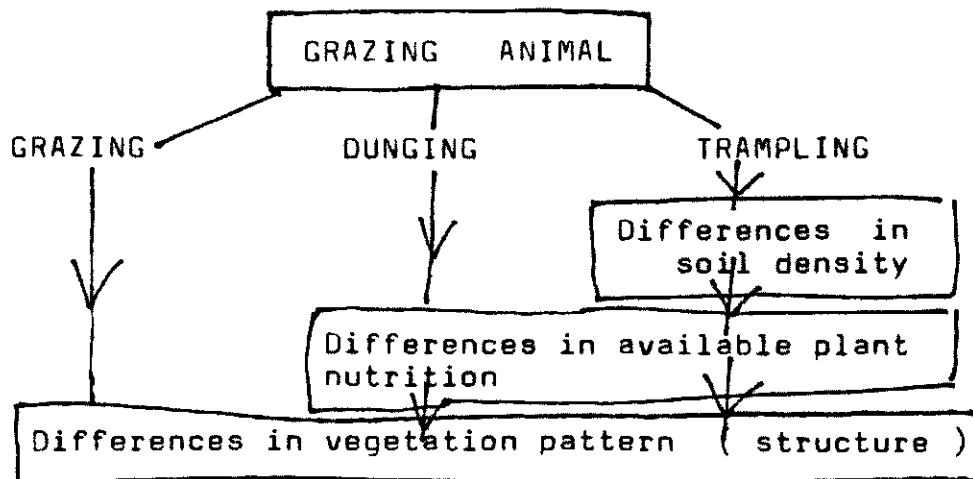
Fig. 5 LONG TERM SIGNIFICANCE OF AREA USE FOR THE VEGETATION +)

Area use	short-grazed < 25 cm	rough stands > 25 cm	bushes woody pl. < 2.5 m	wood > 2.5 m
HEAVY	100 %			
MODERATELY	80 %	20 %		
LIGHTLY	10 %	50 %	30 %	10 %
VERY LIGHTLY	< 5 %	10 %	20 %	> 50 %

+) Example: A moderate use of the area means that you get 80% short grazed- and 20% rough vegetation as a result; at moderate stocking rates 60 % of the area is moderately used..

All effects of grazing on vegetation, in terms of floristic changes, come through after structural diversification of that vegetation by animal activities.

Fig. 6 EFFECTS OF GRAZING ANIMALS ON VEGETATION PATTERN DIVERSIFICATION



There is some indication that diversification along the trampling line brings about the highest diversity in floristic composition.

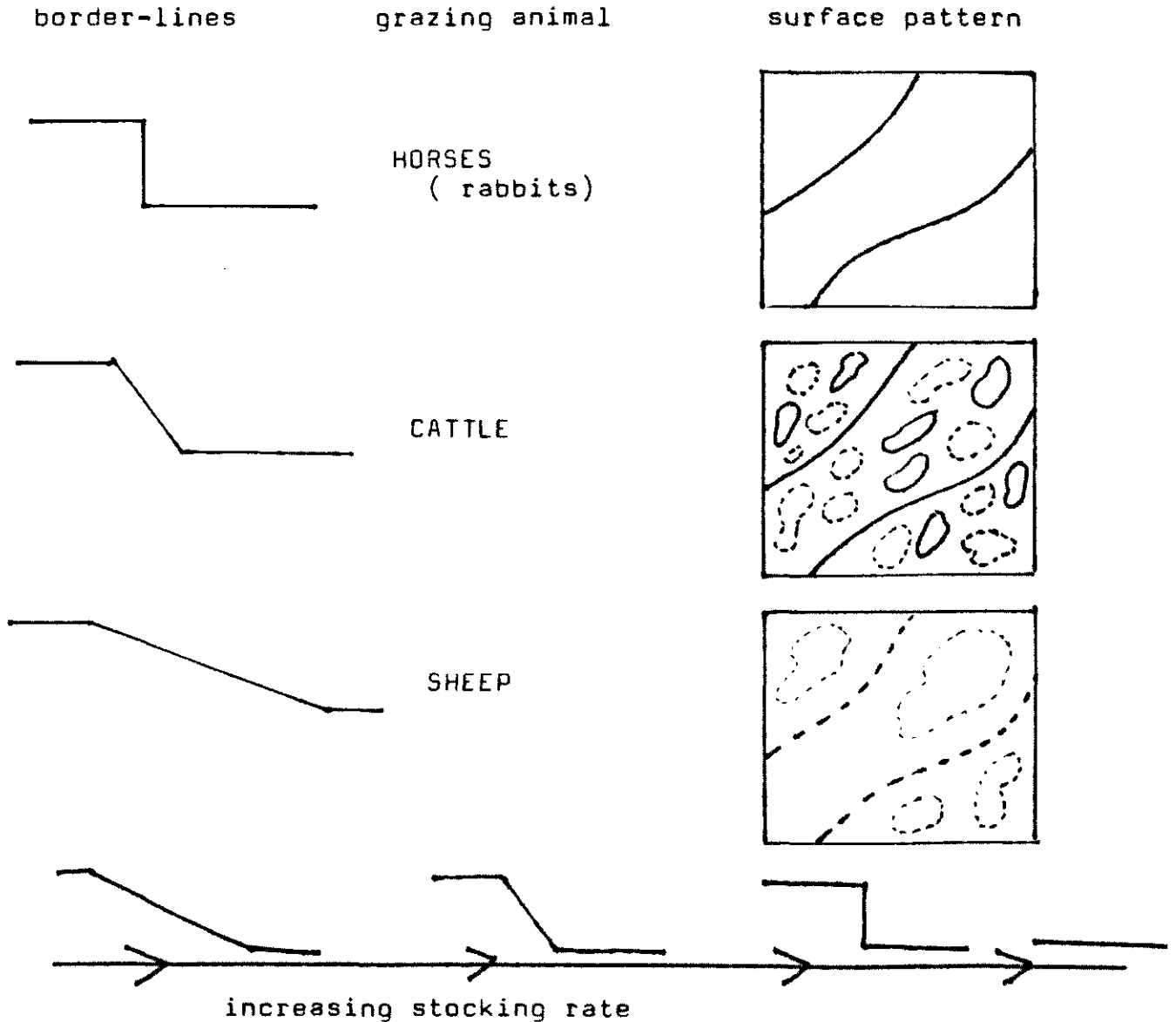
If there is brought about pattern diversification in vegetations alot of very interesting processes can have a start from abiotic as well as from biotic origin. Vegetation litter for instance is blown away on the short grazed plots but on the contrary concentrated in the rough stands, thus creating more difference between both; on periodically flooded areas every different vegetation pattern gets its

own composition of sediment with the same result.

Though specific evidence is scarce it is generally thought that structural differences in the vegetation at short distances is of utmost importance for entomofauna diversity. Compared to other management practises grazing shows for instance the development of ant hills (*Lasius flavus*) ; in moderately moist and gently sloping meadows it takes about 10 years to develop such anthills under the conditions of low stocking rate grazing management.

All grazing animals create their own specific pattern in vegetations.

Fig. 7 GRAZING PATTERNS AT LOW TO MODERATELY STOCKING RATES



At moderate to high stocking rates patterns created by one kind of animal are consumed by another kind when they are grazing together in one field.

Diet studies of grazing animals in terms of which plant species are eaten give a lot of information but only for the area where it is done. Generally can be said that during all seasons plants are eaten for lack of better ones in terms of quality for the animal involved.

In all areas grazed plots showed higher diversities than comparable plots with another or no-management. At the same time became clear that the vegetation of grazed places got higher stability; changes due to climatic causes as for instance extremely dry summers were far less dramatic on the grazed plots.

In an area where the numbers of rabbits per ha were monitored the decrease in numbers stood in direct relation to the decrease of available short grazed vegetation; on places which had a more intensive use of domestic animals rabbits were able to maintain higher numbers than on comparable lightly used plots. Within 8 years it has become clear that vegetation properties are determining rabbit numbers. This aspect seems to be of significance for grazing animals in general and relations between vegetations and grazing animals should be looked upon as prey and praedators in which the prey is regulating the number of praedators.



Numerous references can be found on studies on the effects of grazing animals on vegetation, in the opposite direction however hardly any. The time-factor of course is the main cause as most studies have to be finished in relatively short terms of a few years. Especially for domestic animals mans activities in facilitating vegetations for his grazing animals by cutting and burning is a difficult factor to quantify. Still I'm convinced that effects of vegetation on grazing animals are more important ecologically simply due to the fact that you can have vegetations without grazing animals, but no grazing animals without vegetation.