Council of Europe
Conseil de l'Europe

Strasbourg, 8 December 1995
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PE-S-ZP (96) 42

Group of Specialists on Protected Areas (PE-S-ZP)

Strasbourg, 6 - 8 March 1996

Hautes-Fagnes Nature Reserve (Belgium)

Category A

Renewal

on-the-spot appraisal by:
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1. INTRODUCTION

The Hautes Fagnes Nature Reserve was established in 1957. It was the first one to be awarded the European Diploma for the Conservation of Nature (category A), together with the Camargue Nature Reserve (France) and the Peak District National Park (UK), in 1966. The Diploma is awarded for a period of five years. It is successively renewed in 1971, 1976, 1981, 1986 and 1991.
In view of the renewal of the Diploma in 1991, I was invited by the General Secretariat of the Council of Europe to carry out a new on-the-spot appraisal. For its successive renewal in 1996, I was reinvited to do so. The objective of these appraisals is to describe the state and development of the reserve since the previous renewal of the Diploma. This should take into account the recommendations attached to the previous renewal, and recommend, if possible and necessary, measurements for the coming period.

The following recommendations were attached to the last renewal:
1. To persevere with the implementation of the management plan, having resource to impact studies and developing a monitoring system.
2. To reinforce the Reserve's protection status.
2.1 Cross-country skiing should be prohibited in ecologically sensitive areas and in the wintering areas of the black grouse (Lyrurus tetrix).
2.2 A socio-economic study of recreational and tourist activities, including their environmental repercussions, should facilitate application of certain selective protection measures.
2.3 In general, information for visitors, and particularly for local inhabitants, should have top priority as a means of improving understanding of the need to conserve these landscapes.
2.4 To redraw the Reserve's boundaries so as to include sites which are of obvious ecological interest or which might help rationalize the layout of the Reserve. Particular attention should be paid to the upper reaches of the Schwalm and its tributaries.

Following a short introductory breefing late June 6, 1995, the Hautes Fagnes Nature Reserve was officially visited June 7 and 8; on the spot it was decided to accept a cordial offer to extend the visit to the morning of June 9. The Belgian hosts representing the Direction Général des Resources Naturelle et de l'Environnement of the Ministère de la Région Wallone were ir. Letocart, ir. Dahmen, ir. Colleau, and ir. Schlembach, accompanied by their colleagues and assistants. The Consultative Management Commision was represented by dr. R. Schumacker (Université de Liége/Station Scientifique des Hautes Fagnes, Mont Rigi).

2. GENERAL SITUATION

2.1 The Hautes Fagnes

The Hautes Fagnes are a plateau area. The area constitutes the northern part of the geologically very ancient Ardennes, i.e. roughly the area over 450 m a.s.l. It forms the highest part of Belgium. The climate is montane.
The original climax vegetation is deciduous forest, in part also peatland, i.c. the edaphic climax of raised bog. Natural processes and human exploitation changed it early in history into heathland and peatland. The toponym 'Fagnes' refers to the general aspect of peatland and wet heathland. 5000 years ago, the active raised bog area in the Hautes Fagnes

should have covered over 1000 hectares. Two centuries ago, the total fagne area covered appr. 15,000 hectares.

The fagnes were traditionally exploited by grazing, mowing and gathering peatmoss (Sphagnum) for litter, shifting cultivation (superficial drainage, followed by burning and a few years of exploitation enabled by the fertilizing effect of the ashes, and then abandonment), and peat cutting. This exploitation concentrated on the margins of the fagnes. It petered out around 1900.

In the middle of the 19th century, reafforestation started. It concentrated on coniferous forest, mainly Picea, on the dryer heathland. The process continued far into the 20th century. This changed the historical nature and landscape drastically.

The traditional exploitation had a local, limited and temporary impact on the fagnes. Human influence was greatly intensified, when in the first half of the 20th century large scale drainage works were carried out in a methodical attempt to cultivate the wetter heathland and peatland for agriculture and furhter afforestation. These attempts failed, but the ditches remained. Drainage continued and even increased due to erosion of these ditches, and to rising water loss by invasion of purple moor-grass (Molinia caerulea) and the growing forest.

The area is geomorphologically interesting because of the presence of remains of periglacial phenomena, i.e. palsa ruins. It is rich in historical and cultural assets, including old roads and paths like the Via Mansuerisca, and memoral crosses. In local folklore the past is still vividly alive.

The scenery is impressive scenery. It offers ample attraction to recreational visits and activities throughout the year. These became very much extended in the recent past.

2.2 The Hautes Fagnes Nature Reserve

The first attempts to create a nature reserve were instigated by a.o. Léon Fredericq and Jean Massart already around 1910, resulting in the assurance by the Minister of Agriculture late 1911 that appr. 600 ha of the Hautes Fagnes near la Baraque-Michel would be maintained in the original state. However, other events postponed the proclamation until 1956.

The present Hautes Fagnes Nature Reserve consists **not** of **one** single area, but of a **patchwork** of variably-sized islands and islets within the Belgian part of the Belgo-German Hautes Fagnes - Nordeifel Nature Park. The larger part of the Reserve is concentrated in the centre of the Belgian part of the Park, in the Botrange - Baraque Michel area, and in the northeast of the plateau. This archipelago is more strictly regulated than the rest of the Nature Park.

The Nature Reserve embraces the scattered moister remnants of the formerly vast expanse of open and marginally exploited, but nowadays largely afforestated plateau of the Hautes Fagnes, as well as some brook valleys. All together, the Reserve covers around 4500 hectares. This is largely owned by the State, in part also by local municipalities.

Prominent among the represented ecosystems are:
- peatland, i.e. ombrotrophic raised bogs and transitional mires;
- heathland, in less wet sites, including inactive raised bogs;
- moist montane brook valley grassland;
- cryptogam-rich ravines.

The natural values of these systems are regulated by their specific, but vulnerable hydrology, as regards cryptogam-rich ravines also by the microclimate and the litter of indigeneous deciduous trees. The hydrology is vital, both in quantitative and in qualitative respect (level, flow, oligotrophy, mineral load, acidity).

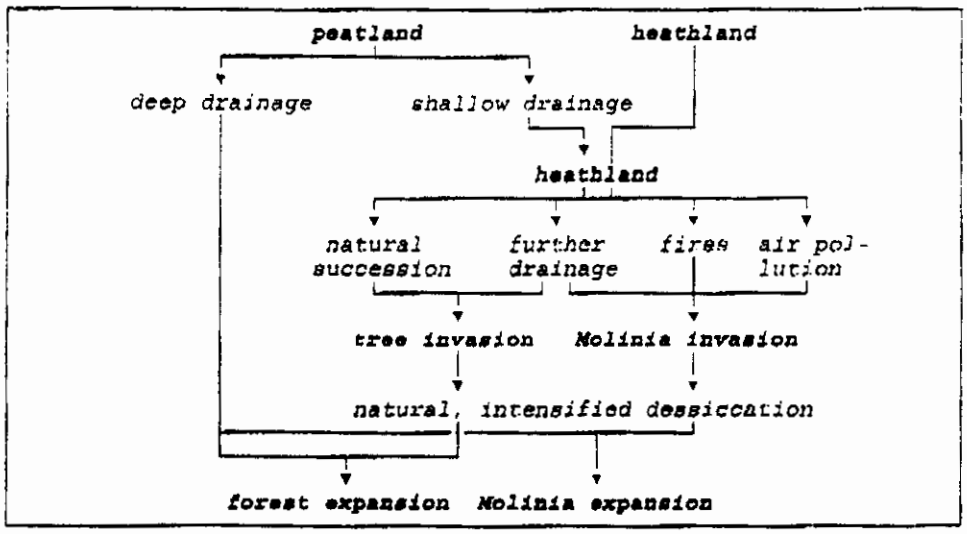
2.3. Organisation of the management of the Nature Reserve

The management of the Reserve is, along the lines of the local cantons, distributed over five forestries each headed by a chief forester ('Oberforstmeister'). These officials resort under the office of the Division de la Nature et des Forêts, Direction Général des Resources Naturelle et de l'Environnement, at Malmédy.

3. THREATS

The major threats to the characteristic organisms and communities, c.q. biodiversity and ecosystems of the Nature Reserve are drainage, forest expansion, air pollution, fires and disturbance by recreation. These phenomena also affect the scenery. Large scale methocical drainage and forest expansion are the oldest threats. Already 85 years ago, prominent scientists like Leon Fredericq and Jean Massart warned for a total destruction of the fagnes if these activities were not halted.

The simplified outline of the effects of drainage, air pollution, fires and natural succession on peatland and heathland is sketched below.



3.1 Drainage and dessiccation

The dessiccation of the peatland and moist heathland results from vain attempts for drainage in the past, afforestation, spontaneous forest expansion, and local peat cutting.

Dessiccation started when large scale drainage was undertaken early in the 20th century. The objective to cultivate the peatland and wetter heathland failed, but the system of

ditches remained and the drainage continued. In many places these ditches show a natural tendency to widen and to deepen by erosion, owing to concentration of the discharge and to increasing peak discharges. This erosion increases the drainage. Besides, dessiccation reinforces may itself to some extent by giving rise to cracks in the plant cover and the subjacent peat, which intensifies drainage. The effect of peat cutting is more localized.

Dessiccation of soils changes the water - air balance in the (top)soil. In addition to the direct impact, this increases the mineralization rate of the organic material in that (top)soil. The result is eutrophication, which has a detrimental impact on the characteristic oligotrophic peatland and moist heathland ecosystems. Peatland and moist heathland communities become replaced by very species-poor Molinia grassland, or by forest. These phenomena endanger the natural values of the Nature Reserve by affecting the fundamentals of the ecosystems and by replacing characteristic habitats. Moreover, eutrophication threatens the very rare and endangered European freshwater pearl mussel (M. margeritifera) in the Schwalm.

Invasion of Molinia and trees increase dessiccation due to increasing interception of precipitation as well as to increasing evapotranspiration. The dessiccation by forest intensifies with the growing of the trees. Dense, evergreen conifers like spruce intercept and evapotranspirate considerably more water than deciduous foliage-trees and open conifers like pine.

Forest expansion also affects the hydrology, habitat and scenery of brook valley grassland and old, moist montane grassland. However, spontaneous forest expansion in hydrologically undisturbed wet brook valley grassland is comparatively slow.

It should be noted that dessiccation and its aftermath not only results from drainage resulting in a general lowering of the ground water table, but also from drainage bringing about increasing fluctuations in the ground water table which may go without a pronounced lowering of the average annual ground water table.

3.2 Air pollution

Air polution has three main lines of impact:
- eutrophication (by nitrogen compounds, especialy NH_3);
- acidification (especially SO_2 and NH_3);
- contamination by heavy metals (directly from precipitation, and indirectly due to acidification).

The impact of these phenomena on terrestrial and aquatic ecosystems is first of all also a decline in biodiversity.

Actual data on precipitation of air pollution and its impact in the Hautes Fagnes seem to fail. It is considered to be at least as serious as elsewhere in Belgium, where e.g. the average annual N-deposition is reported to be over 20 kg per hectare. So far, possible effects seem to be limited to some surface waters as indicated by their high acidity, the virtual absence of macrophytes and the dominance of the diatom Eunotia exigua.

Probably, the slow regeneration of peatmoss (Sphagnum) after deep sod cutting might also be attributed to acidification and related changes in ion ratios. The possible impact of eutrophication and acidification on heath and bog is comparable to the effect of dessiccation, but seems to be overshadowed by the effect of dessiccation.

The level of immission of heavy metals and their possible toxic impact are reported to be unknown.

3.3 Fires

The direct impact of fires on organisms, communities and scenery is initially disastrous, and leaves scars that heal but slowly. The effect on local populations may be fatal. Indirectly, fires increase mineralization and may thus, in particular in less permanently wet soils, cause eutrophication.

The occurrence of uncontrolled fires is a consequence of the natural conditions, in combination with enhanced vulnerability due to dessiccation of the peatland and wet heathland, and with the accessibility of the area to visitors. The last fire occurred in 1994. It was caused by a car which cought fire, and affected appr. 40 ha of fagne near le Baraque-Michel.

3.4 Recreation

Intensive recreational use has a negative impact on e.g. bog, heath, valley grassland and montane grassland by

- soil compaction, affecting the air-water balance and redox conditions in the soil; in turn, this affects the nutrient cycling in the plant - soil system, soil acidity, soil temperature regime, etc.;
- initiating erosion, resulting in drainage and subsequent dessiccation and eutrophication;
- trampling of plants (peatmoss carpets, etc.);
- disturbance of the characteristic fauna (e.g. black grouse);
- trampling of animals (e.g. egg-laying sand lizzards, and their eggs);
- risk of (accidental) fires.

Recreation has grown enormously. The number of visitors is still increasing, especialy in early autumn (in the weekend, in the season, up to 15,000 persons per day). The surveillance of these masses puts a heavy task on the shoulders of the Reserve's wardens and their helpers.

4. CONSERVATION

4.1 Communities

The main groups of communities represented in the Reserve are

- fagnes: peatland and heathland;
- montane grasslands in wide river valleys;
- woods in narrow river valleys/ravines.

4.1.1 Peatland and heathland

a. Description

The international importance of the remains of peatland and ecologically related more or less moist heathland ecosystems is well recognized, but their ongoing decline and vanishing is difficult and very expensive to halt. Both peatland and heathland are gradually degrading into coarse grassland by the invasion of purple moorgrass (Molinia caerulea) from the margins, and likewise into forest by the invasion of trees like Betula, Salix, Picea and Pinus.

The peatland in the Reserve represents active, ombrotrophic raised bogs, locally also somewhat richer, more minerotrophic c.q. rheotrophic blanket bogs bordering on brook valleys. Since about a century, these are steadily diverging from typical turf forming bog. Once covering over 1000 hectares, today only three bogs (la Fagne Wallonne, le Misten and la Fagne de Clefay) share a mere 125 hectares of more or less active raised bog. Most of the present peatland must be classified as inactive, superficially dessiccated bog invaded by heather, or as more seriously degraded bog invaded by Molinia and trees.

The heathland is found in originally less permanently wet sites and in more or less dessiccated, inactive raised bogs. The total fagne area dwindeled from appr. 15,000 hectares two centuries ago, to a mere 5,000 hectares around 1962. Much of the present heathland must be classified as Molinia 'heath'.

The essential hydrology of these systems is characterized by a specific, delicate balance between the input by precipitation and the output by interception, discharge and evapotranspiration. Conservation thus primarily focusses on restoration of the natural balance by elimination of increased drainage by damming of ditches, removal of trees, mowing, and experimental sod cutting. The first general effects indicate a slowing down of the up to a few years ago progressively aggravating dessiccation.

b. Conclusion

The state of the characteristic bog and moist heath communities in the Reserve remains critical. The present vegetation continues to diverge from typical turf forming vegetation, but as it seems in a decreasing speed. The situation is in my opinion progressively promising, thanks to the energetic efforts of the managers. Considering the results so far, the expectations for halting dessiccation and eutrophication by various measures, and the prospects for subsequent restoration are hopeful and in some places materializing.

4.1.2 Montane grasslands

a. Description

The main type of montane grassland found in the Nature Reserve is moist to wet rough grassland in the brook valleys (e.g. Meum grasslands, Narcissus grassland). Moist rough pasture grasslands in the periphery of bogs are virtually lost, and dry thermofilous grasslands do not occur in the Reserve any more at all.

West to moist montane valley bottom grassland

The wet to moist montane rough grasslands in the brook valleys are very characteristic and of high international importance.

Their recent decline in the Hautes Fagnes is limited and mainly due to block-wise afforestation by spruce, and - less abruptly - to agricultural abandonment and agricultural amelioration (local drainage, fertilizing, high stocking, etc.). Apart from the effects on the ecological conditions, the afforestation has an enormous, negative impact on the scenery.

The valley bottom grassland area of the Reserve is enlarged by including the Schwalm Valley in late 1990 (see 6). Further enlargement is pursued by purchase, exchange, and management agreements with municipalities, and concentrates on the valleys of the Grande Rur, the Petite Rur, the Rur itself and of the Olefsbach. After acquisition, coniferous plantations are step-wise carefyily removed for reasons of ecology and scenery. Their hydrology being rather robust, their perspectives on regeneration, especially by deforestation, are good and rapidly materializing. In the future, part of the valleys will be mowed while the other rest will be left to spontaneous development.

Moist montane grassland in the transiton bog - valley

Moist, montane grasslands in the periphery of bogs (i.e. in the gradient bog - transitional mires / transitional moist grassland - valley bottom) are very characteristic and of high international importance. These very rich grasslands represent a very fragile system, depending on vital hydrological conditions of lateral ground water inflow from adjacent bog and output by surface run-off of precipitation, ground water discharge, and interception and evaporation. Once rather common, these pastures are nowadays virtually lost due to agricultural abandonment followed by spontaneous forest expansion, afforestation especialy since about 1970, and agricultural amelioration, etc. Elsewhere, but different and also severely endangered, such grassland is still found also in Scotland, Wales, and the Vosges.

Restoration of such grassland primarily depends on the restoration of adjacent active bog, and is thus still far away. However, the ongoing removal of conifers from slopes of wet brook valleys gives in various places rise to restoration of the hydrology and spreading of peatmos (Sphagnum), suggesting a trend towards the development of gradient-rich, intermediary blanket bog somewhat grading into this type of grassland (e.g. la Fagne de Schwarzes Venn, la Fagne de Herzogen Venn). The Sphagnum-growth concentrates around felled logs which were - in spite of adverse advices - experimentally left behind.

In 1993, a large area of grassland of the former peatland farms adjacent to the west of la Grande Fagne were acquired. Plans to afforestate the larger part of these grasiands are pending. A minor part, where there is a arena of black grouse, is mowed.

Dry thermophilous montane grassland.

Dry thermophilous montane grasslands do not occur in the Reserve and its direct surroundings anymore. Former sites are found along the southern periphery of the plateau, where the perspectives for acquisition and restoration are limited due to their use and location near the villages. The major exception is presented by the area between the confluence of the Grande Rur and the Petite Rur. Otherwise, remnants of these grasiands are reported to be still present on the military training grounds of Elsenborn.

b. Conclusion

The state of the moist to wet rough pastures in the brook valleys is promising. The policy regarding acquisition and management of montane wet brook valley deserves respect and support.

Future recovery of moist rough pasture grasslands in the periphery of bogs depends on the degree and scale of recovery of active bog; fragmentary development may be starting in the successfull trend towards development/restoration of local intermediary blanket bog.

The recently acquired pastures of the former 'fermes en Fagne' offer potentials for development of related moist montane peatland grassland, but pending plans are aimed at afforestation of the greater part of them.

Dry thermophilous grasslands might come into existence again in the Reserve if suitable sites, i.c. in the area between the confluence of the Grande Rur and the Petite Rur, could be acquired and/or adequately managed. This would contribute also to landscape, layout of the Reserve, and prevention of ecologically undesirable developments.

4.1.3 Narrow river valleys/ravines.

a. Description

The narrow, woodclad valleys of in particular the Warche and the Hoëgne are of special interest, in view of their geology, geomorphology, hydrology, botany and fauna as well. Botanically, the moss flora greatly attributes to the high biodiversity of these ravines. Thus, e.g. at least 139 species of bryophytes are reported from the Hoëgne valley. The moss flora is especially rich in rare and menaced species. The main threat to these valleys is visitors (very vulnerable: slopes, wet seepage and exfiltration sites); other threats are plantation of exotic trees, water pollution by e.g. car-washing and litter.

In 1988 and 1989, the Station scientifique des Hautes Fagnes of the Université de Liège proposed to put the most important valleys on the list of required extensions of the Natural Reserve. As a whole, these comprise the Warche valley, including the lower valley of the Bayehon, from the Barrage de Robertville to close to the route N28, and the Hoëgne valley between Hockay/le pont due Centenaire and Sart/Passerelle de Belleheid. At present, the Reserve comprises a substantial part of the most valuable stretches of these ravine-valleys, which are reported to be to be kept well.

b. Conclusion

The natural values of the parts of the ravines of the Warche valley and the Hoëgne valley included in the Reserve are well maintained, but the Reserve does not (yet) fully comprise the most important stretches of these valleys.

4.2 Species

a. Description

The flora and fauna characteristic of conditions as prevailing in the Reserve are poor in species and frequently also in numbers. A relatively large number of the species is characteristic of edaphic-hydrologic, microclimatic and vegetational gradients in peatland and heathland, and especially of such gradients in transitional zones from peatland to adjacent heathland, as well as from peatland to rough grassland, to brook valley marshes, and forest.

a.1 Peatland and heathland

Highly characteristic of, and indicative for the quality of the Reserve is the black grouse Tetrao tetrix). Although the lowland heath population of this bird species shows since tens of years a steady and alarming decline all over western Europe, the population in the Reserve seemed to hold until 1995. Since about 1980 it fluctuated around a total number of appr. 40 cocks, but this year the number dropped dramatically (preliminary information suggests a decrease of over one-third at least). The population is the more vulnerable, as it is devided over a number of local populations. It should be noted that the occurrence of black grouse here is probably the only one in western Europe which concerns its original, natural habitat.

The causes of the decline are not well known. It is geberally atrributed to
- deterioration of the environmental quality (e.g. acidicifation),
- decreasing habitat quality (vegetational composition, structure and pattern; forest expansion, decline of deciduous trees in the bog margins, maturing of adjacent coniferous forest, etc.),
- natural weather fluctuations,
- predation (in the Hautes Fagnes probably mainly by fox), and
- increasing risk of disturbance by the public (not in the Reserve).

The main strongholds of the black grouse are la Fagne Wallonne and la Fagne de Steinley. Disturbance by visitors is minimalized by severe restrictions on visits. (Since 1991, these areas - among others - are fully closed to the public from 1 April to 1 July; otherwise, they are only accessible in the company of an official guide, along a restrcted number of routes; *nota bene*: cross-country skiing in the Reserve is prohibited since 1975, cross-country biking is meanwhile prohibited as well)

a.2 Moist montane grassland.

These semi-natural ecosystems represent very different vegetation types as regards flora, and vegetational structure and pattern, and harbour a rich and characteristic flora and entomofauna. Some of these grasslands types may count over 35 species per four square meters.

They harbour a rich and characteristic entomofauna as well. This includes for instance several Macrolepidoptera from the list of theatened species in Europe. These are good indicators for the quality of moist montane rough grassland.

Of these butterflies, Lycaena helle, Proclossiana eunomia and P. bistorta are characteristic of oligotrophic upper brook valeys with superficial ground water flow, where the hostplant Polygonum bistorta is found. Their present strongholds are the upper course of the Helle and the Hoegne near Hockai. Boloria aquilaris is found also along the upper Helle, in relatively peripheral and mineralogically somewhat richer (rheotrophic) bog conditions somewhat richer in species and vegetational structure. In the Olefbach Valley, Erebia ligea is still present.

The very rare Colias palaeno became extinct in the Hautes Fagnes around 1940. Two reintroduction attempts failed, as the specific spatial pattern in flora and vegetation is long since gone: its lives as a larva on the bog plant Vaccinium uliginosum, as an imago on flowers in adjacent herb rich rough grassland (i.e. pasture).

a.3 Brooks and small rivers.

The hydrology of the waters coming from the Hautes Fagnes should tend to reflect the ongoing dessiccation, eutrophication and acidification on the plateau. However, there is little evidence of expression of this in the characteristic aquatic flora and fauna. The carefull management of the European fresh water pearl mussel shows traces of first success.

b. Conclusion

Since 1990, the state of the characteristic species of the Reserve is in my opinion well preserved, with the exception of the black grouse. The cause of the sudden decline of the black grouse is unknown and calls for ever closer attention and research in cooperation with study programs on this bird elsewhere in western Europe.

4.3 Landscape

a. Description

An important feature of the Reserve is the characteristic beautiful scenery of the vast stretches of more or less undulating open peatland and heathland with their ever changing, subtile nuances of pastel colours, contrasting with the surrounding forests. The brook valleys winding through the forests offer with the regenerated, herb-rich wet grassland on their slopes and bottoms a very attractive scenery as well. This is along the Rur enhanced by the newly created open views towards stretches adjacent peatland in the background. The clearance of the palsas in the Northeastern part of the Reserve (the fagne de Brackvenn), combined with a number of carefully laid out footpaths, is especially motivated by scenic considerations. The management of the Reserve thus deliberately attributes also greatly to the quality of the landscape. The management retains a carefully exercised equilibrium between offering the view to the public and safeguarding nature from excessive recreation pressure.

b. Conclusion

Since 1990, the landscape quality of the Reserve is further increased, while possible negative consequences of the attraction of visitors to vulnerable site is kept well in control.

5. MANAGEMENT

5.1 General

A Consultative Commission for the Management of the Hautes Fagnes Nature Re-serve is established, in which the responsible authorities (Eaux et Forets), scientists and associations of volunteers are represented. The authorities enjoy the support of a large private association, 'Les Amis de la Fagne'.

5.2 Management plan

a. Description

In 1990 the 'Station scientifique des Hautes Fagnes' of the University of Liege at Mont Rigi completed the management plan for the Nature Reserve. Its main objectives are, in short:

1. to check the regression of the active raised bogs, and to restore these and the more degraded ones;
2. to restore, maintain and enlarge moist and dry heathland;
3. to limit forest expansion, in particular in potential raised bog sites;
4. to canalize the visiting public, and to pay attention to adequate information and surveillance;
5. to provide the different parts of the Reserve with a buffer zone;
6. to eliminate non-indigenous tree species from the Reserve.

The management plan is based on extensive inventories and other documentation, and worked out in a series of plans for the different parts of the Reserve. These plans specify the measures necessary to realize the objectives, including e.g. procedures for implementation. The management plan also covers historical, cultural and scenic aspects, as well as research activities.

b. Conclusion

In my previous on-the-spot appraisal I considered the objectives of the management plan as being most appropriate and the plan itself of a professionally high standard and adequate. I maintain this opinion. I emphize the absolute necessity of monitoring, including feedback and evaluation of the results of recent research.

c. Recommendation

My conclusion implies a carrying on of the first recommendation attached to the last renewal, i.e.:

- To persevere with the implementation of the management plan, having resource to impact studies and developing a monitoring system.

5.3 Execution

a. Description

a.1 General

The plan was positively received. The concept is clear and evidently effective; actually, part of the proposed measures were already gradually taken into execution before the plan was officially completed and accepted. The execution is presently in full progress.

In view of specific organisms and communities, the restoration and maintainance of ecosystems requires:

- fundamental hydrological measures;
- adequate management of vegetation and the stock of large wild herbivores;

- limitation and elimination of forest expansion and of invading Molinia; also: elimination of non-indigenous tree species, in particular coniferous ones.
- establishment of buffer zones forming, as regards vegetational structure, gradual transitions from open field to forest.

The implementation of the concept of the establishment of buffer zones around the Reserve's parts is considered to call for careful working out in closer studies.

a.2 Peatland and heathland

The objective to check the regression of the active raised bogs, and to restore these and the more degraded ones, is implemented by measures to restore and maintain the original hydrology. The required suppression of drainage includes
- damming of ditches;
- establishment of buffer zones; especially by removal forest on peaty soil adjacent to present peatland, in particular to peatland with nuclei of active raised bogs.
- limitation and elimination of forest expansion in general.

The objective to restore, maintain and enlarge moist and dry heathland is implemented likewise.

Measures to reduce the drainage by damming the existing and eroding ditches are in progress (e.g. la Fagne des Deux Series, de Clefay, Misten). This halts erosion, but the effect on the drainage appears to be less effective than expected. The second experience is attributed to the intensity of superficial drainage and the increased evapotranspiration by Molinia which roots far deeper than the heather plants (Calluna, Erica, etc.).

The removal of spontaneous forest expansions on the fagnes is well under way, in as is the creation of said buffer zones. This is done very carefully. Large scale deforestation concentrates on the peaty soils adjacent e.g. to the Fagne de Clefay. The removal of trees is in various places remarkably quickly rewarded by regeneration of peatmos growth (e.g. in the linking up of the Fagne de Schwarzes Venn and la Fagne de Herzogen Venn to the Rur Valley).

The deterioration of moist heathland, including heathland on inactive bog, into Molinia grassland is in addition counteracted by local mowing and small scale experimental sod cutting; grazing is not applied. Experimental mowing is concentrated on sites of special importance for flora and fauna, including arenas of black grouse. The mowing of somewhat tussocky Molinia bog in la Fagne Wallonne appears to increase the wetness of the site. This phenomenon is accompanied by suppression of Molinia and the return of characteristic peatland plants.

The experimental small-scale, deep sod cutting started thus recently, that results may yet hardly be expected (la Fagne de Clefay, la Fagne des Deux Series). Anyhow, the re-establishment of peatmos seems to be laboursome, even when Sphagnum cuspidatum is given a hand by transplantation.

Since 1991-1992, the more sensitive fagnes are closed to the public. They may only be visited in the company of a guide over but a very few fixed routes, during a certain period of the day outside the breeding season (see also 5.4).

a.3 Montane grassland

The management of montane grassland is of course limited to the existing and restored wet to moist montane rough pastures in the brook valleys. This refers mainly to the more or less moist types (the wet one hardly calls for [intensive, annual] management, see: 4.1.2). is rather successful. In but a few years time, regular mowing and more experimental mulching followed by regular mowing of such valley grassland abandonned since decades shows a rapid recovery of biodiversity and vegetation. In terms of higher plants, a doubling to trebling of the number of species is observed in but a few years (from over 10 species per four square meters to over 25, even 36 species in the Schwalm Valley so far). These two management regimes greatly differ in costs, but differences in their effect on the flora are in my opinion only initial and mostly concern less characteristic species.

b. Conclusion

The recommendation to persevere with the implementation of the management plan is consciously realized. The management deserves much appreciation. It applies traditional measures carefully and ingeniously, often starting with experiments. In addition, controlled grazing by cattle might be given attention in view of recent results abroad (UK, Netherlands).

c. Recommendations

In view of the preceeding, I recommend the folowing:

- To extent dams in drainage ditches to limit lateral bypass of superficial water discharge.
- To carry out experimental sod cutting in inactive bog with heathland vegetation, where the substratum not so deeply affected by dessiccation and its aftermath as in inactive bog overgrown by Molinia.
- To continu mowing and to extend the mowed area in wet to moist peatland invaded by Molinia, where the grass has not (yet) completely taken over, affected the hydrology fundamentally, and formed too high tussocks.
- To continu and intensify monitoring hydrology, flora (phanerogams, mosses) and specific fauna groups in representative sites.
- To carry out an impact study on the immission of air pollution and its possible impact, and to develop a monitoring system to register and evaluate the impact.

5.4 Recreation and socio-economic aspects

a. Description

The regulation of the heavy pressure from visitors puts a heavy burden on the management, in spite of assistance to the Reserve's wardens by forest wardens and volonteers from the private association 'Les Amis de la Fagne'.

In the previous on-the-spot appraisal is was recommended to carry out a socio-economic study of recreational and tourist activities, including their environmental repercussions, which should facilitate application of selective protection measures. This recommendation is followed and resulted in two reports. However, a great deal of pressure is being evoked by locally elected representatives and inhabitants, who demand that the economic impact of the park should be developed to the maximum; both more or less ad hoc as well as by

projects such as carried out by the Groupe de Project pour la Promotion du Tourisme Hautes Fagnes - Eifel. It is therefore vital that it be made more generally recognized that also for the sake of tourism the environmentally sensitive areas be firmly and strictly protected.

In consequence, the previous on-the-spot appraisal recommended to give top priority to information for visitors, and particularly for local inhabitants, as a means of improving understanding of the need to conserve these landscapes.

In 1993, an information centre was already established at the initiative of the Nature Park. It is located near Botrange and gives general information for visitors to the Park.

Meanwhile, the Division de la Nature et des Forêts, Direction Général des Resources Naturelle et de l'Environnement opened an information centre at Botrange specifically for the Reserve. It provides hand-outs, maps and booklets, is the starting point for organized, guided visits to the Reserve, and constitutes the base for the the regular and auxiliary surveillance. The authorities recently published most very informative and most attractive guidebooks for some of the nearby fagnes, which are offered at the centre at a very friendly price.

In 1991, à large part of the Reserve areas is declared zone C. This concerns vulnerable areas where the public is not allowed to visit without the company of a licensed guide, in groupes larger than 30 persons, and between 18.00 and 9.00 hr. Moreover, areas in zone C remain closed to the public during periods of risk of fire (only la Fagne de la Poleur en le Neur Lower remain accessible) and in the nesting period, that is from 15 April to 30 June.

In 1992, these rules were modified to the extent that the public is admitted free access to certain traditional footpaths.

The temporary closure of the Reserve in view of risk of fire is continued. Cross-country skiing in the Reserve is prohibited since 1975. In the recent past, the local authorities were not well aware of this (re: recommendation 2.1). Cross-country biking is prohibited since 1991.

c. Conclusion

The heavy pressure from visitors on the Reserve is carefully handled and canalized. The recommendations regarding top priority to information is adapted and carried out. So is the one concerning a socio-economic study of recreational and tourist activities, but a closer and better (mutuel) understanding with the policy-making of the Park authorities calls for extra effort in the Park and in the Reserve.

d. Recommendation

Refering to the socio-economic studies, I recommend:

- To intensify efforts to reach a better understanding and cooperation with the Park authorities and locally elected representatives and inhabitants on the value and proper management of the Reserve in view of recreational and tourist activities.

6. THE AREA OF THE NATURE RESERVE

a. General

The Nature Reserve embraces the spread areas in the Hautes Fagnes which escaped afforestation and cultivation, and were at the time of its establishment recognized as vanishing waste lands of great importance for nature conservation. However, in view of more recent knowledge the limits were not fully ecologically founded. Ecologically important transitional zones, sites of additional characteristic high value, less obviously threatened areas, and sites which might help rationalize the layout of the Reserve were not included. In consequence, a revision of the delimination of the Reserve was stressed in the recommendations resulting from the previous on-the-spot appraisals in 1985 and in 1990.

A guideline for an ecological and practical revision is presented in the second edition of the synthetic report on the Management Plan. Meanwhile, the Schwalm Valley has been designated a State Nature Reserve in 1990 (112 hectares). In 1993, the Reserve was further enlarged by the addition of the grassland of the former 'fermes en Fagne' (200 hectares). Further enlargements concern various parts of the Reserve, i.e. purchase of peatland at Vennberg (80 ha), and minor acquisitions such as in the Rur Valley (3 ha), la Fagne Devant Troupe (17 ha), 'Sources de la petite Rur' (3 ha), Herzogenvenn (3 ha).

b. Conclusion

An ecological and practical revision of the area of the Reserve is in progress, as circumstances permit.

c. Recommendations

Calling to mind and emphasizing the previous recommendations in question, I recommend

- To persevere with the action to redraw the Reserve's boundaries so as to include sites which are of obvious - actual or potential - ecological interest, or which might help rationalize the layout of the Reserve;
- To pay special attention to ecological considerations by
  * rounding off of catchment areas, including buffer zones and incorporating transitional zones as such (bog-heath-grassland-forest);
  * creating corridors between isolated elements in the archipelago of the Reserve, changing the patchwork of the Reserve into a whole by a network or ecological infrastructure to deminish the risk of local extinction of populations due to unforeseen events and to benefit biodiversity of the biotopes.
- To reconsider pending plans for afforestation of the pastures of the former 'fermes en Fagne' and to investigate the possibilities for (re)development of moist transitional grassland and peatland. Restoration and further management will require carefull management planning and monitoring.
- To include the area between the confluence of the Grande Rur and the Petite Rur into the Reserve, by acquisition or management agreement, for the restoration of dry thermophilous grasslands. This is recommended not only in view of its natural potentials, but also for reasons of landscape, layout of the Reserve, and prevention of ecologically undesirable developments.

- To include the Warche valley, including the lower valley of the Bayehon, from the Barrage de Robertville to close to the route N28, and the Hoëgne valley between Hockay/le pont due Centenaire and Sart/Passerelle de Belleheid fully into the Reserve.

7. SCIENTIFIC RESEARCH

Scientific research in the Hautes Fagnes Nature Reserve is of importance for the advancement of knowledge and for the interest of nature protection and management in general, and for the objectives of the Reserve itself in particular.

Research is concentrated in the 'Station Scientifique des Hautes Fagnes' of the university of Liege, at Mont Rigi, which was rebuilt in 1975. This station contributes considerably to the management of the Reserve. The value of the station is recognized both by the researchers as well as by the Reserve's officials and managers, which leads to growing mutuel understanding, involvement and cooperation. This is among others reflected by particiation of researchers in the Consultative Commission for the Management of the Hautes Fagnes Nature Reserve and the responsibility of the Station for making the Management Plan.

Research is focussed on dessiccation and regeneration of peatland and bog, and on individual species. Impact studies and monitoring are carried out in good cooperation between the responsible authorities/managers, the Station scientifique des Hautes Fagnes of the Université de Liège, and the Consultative Commission for the Management of the Hautes Fagnes, and concern in particular

- detailed hydrological research: in more or less active heathclad bog and inactive Molinia bog;
- hydrological and vegetation monitoring: along some transects in more or less active heathcovered and inactive Molinia bog;
- management experiments, including selective monitoring of flora and fauna: deep sod cutting and mowing (see previous paragraphs).
- birdlife (especially black grouse) and the area of active raised bog.

The preliminary results of the first months of the detailed hydrological research look very promising as regards the perspectives for restoration of more or less dessicated, inactive bog invaded either by heath or by Molinia. Air pollution and its possible impact are not studied or monitored.

b. Conclusion

The current impact studies and monitoring call for appreciation. Management experiments, accompanied by monitoring, and monitoring of regular management measures deserve more emphasis and a more systematic ecological approach. Especially the detailed hydrological research should be intensified and extended. The respons to the recommendations concerning impact studies and developing a monitoring system are so far somewhat limited. This is recognized by the managers, but means and staff are limited.

c. Recommendations

My recommendations are the folowing:
- To persevere and reinforce the scientific cooperation with the Station scientifique des Hautes Fagnes of the Université de Liège;
- To extend and intensify the hydrological research aimed at restoration perspectives of various stages of deterioration of raised bog;
- To extend scientific research on management experiments, especially as regards mowing and sod cutting in slightly dessiccated raised bog;
- To start a program on the black grouse.

8. CONCLUSIONS

My conclusion is that:
- the importance of the Reserve maintains a high international status;
- the condition of the Reserve is satisfying and in several respects ameliorating;
- the management of the Reserve is of a high professional level;
- the staff and authorities are well aware of the threats and problems, keen to develop countermeasures, and show great personal concern and devotion.

In consequence, I propose to renew the European Diploma (category A) for the Nature Reserve of the Hautes Fagnes.

9. RECOMMENDATIONS

In conclusion to my findings and proposals I summarize my recommendations as follows.

1. To persevere with the implementation of the management plan, having resource to impact studies and developing a systematic monitoring system.
2. To reinforce the Reserve's protection status.

2.1 Information for visitors, and particularly for local inhabitants, locally elected representatievs and the Park authorities, should have top priority as a means of improving understanding of the need to conserve these landscapes also in view of their socio-economic value for recreational and tourist activities.

2.2 To redraw the Reserve's boundaries so as to include sites which are of obvious ecological interest or which might help rationalize the layout of the Reserve Particular attention should be paid to
  * rounding off of catchment areas, including buffer zones and transitional zones;
  * creating corridors between isolated elements in the archipelago of the Reserve;
  * the area of the former 'fermes en fagne';
  * the valleys of the Warche and the Hoëgne;
  * the area between the confluence of the Grande Rur and the Petite Rur;

2.3 To persevere and reinforce the scientific cooperation with the Station scientifique des Hautes Fagnes of the Université de Liège;
  * To continu and extend research on and monitoring of the peatland hydrology;
  * To carry out an impact study on the immission of air pollution and its possible impact, and to develop a monitoring and evaluation system;
  * To extend practical research on management experiments, especially concerning mowing and sod cutting in slightly dessiccated raised bog;
  * To start a program on the black grouse.

ANNEXE I

RESOLUTION (91)9

concerning the renewal of the European Diploma awarded to the Hautes-Fagnes Nature Reserve (Belgium)

(adopted by the Committee of Ministers on 17 June 1991 at the 460th meeting of the Ministers' Deputies)

The Committee of Ministers, under the terms of Article 15 (a) of the Statute of the Council of Europe,

Having regard to Resolution (65) 6 establishing the European Diploma,

Having regard to Resolution (66) 22 awarding the European Diploma to the Hautes-Fagnes Nature Reserve,

Having regard to the proposals of the Steering Committee for Conservation and Management of the Environment and Natural Habitats (CDPE),

Renews until 28 March 1996 the European Diploma awarded in category A to the Hautes-Fagnes Nature Reserve;

Addresses the following recommendations to the authorities responsible for the management of the Reserve:

1. To persevere with the implementation of the management plan, having recourse to impact studies and developing a monitoring system;

2. To reinforce the Reserve's protection status;

3. A socio-economic study of recreational and tourist activities, including their environmental repercussions, should facilitate application of certain selective protection measures;

4. In general, information for visitors, and particularly for local inhabitants, should have top priority as a means of improving understanding of the need to conserve these landscapes;

5. To redraw the Nature Reserve's boundaries so as to include sites which are of obvious ecological interest or which might help rationalise the layout of the Reserve;

6. Prohibition of cross-country skiing in the Reserve should be extended to ecologically sensitive areas and in the wintering areas of the black grouse (*Lyrurus tetrix*).

APPENDIX II

Draft Resolution (96)...

concerning the renewal of the European Diploma awarded to the Hautes Fagnes Nature Reserve (Belgium)

The Committee of Ministers, under the terms of Article 15 (a) of the Statute of the Council of Europe,

Having regard to Resolution (65) 6 establishing the European Diploma,

Having regard to Resolution (66) 22 awarding the European Diploma to the Hautes-Fagnes Nature Reserve,

Having regard to the proposals of the Steering Committee for Conservation and Management of the Environment and Natural Habitats (CDPE),

Renews until 28 March 2001 the European Diploma awarded in category A to the Hautes-Fagnes Nature Reserve;

Attaches the following recommendations to the renewal:

1. To persevere with the implementation of the management plan, having recourse to impact studies and developing a systematic monitoring system;

2. To reinforce the Reserve's protection status:

2.1 Information for visitors and particularly for local inhabitants, locally elected representatives and the Park authorities, should have top priority as a means of improving understanding of the need to conserve these landscapes also in view of their socio-economic value for recreational and tourist activities;

2.2 To redraw the Reserve's boundaries so as to include sites which are of obvious ecological interest or which might help rationalize the layout of the Reserve.

Particular attention should be paid to:
* rounding off to catchment areas, including buffer zones and transitional zones;
* creating corridors between isolated elements in the archipelago of the Reserve;
* the area of the former "fermes de fagne";
* the valleys of the Warche and the Hoëgne;
* the area between the confluence of the Grande Rur and the Petite Rur;

2.3 To persevere and reinforce the scientific cooperation with the "Station scientifique des Hautes Fagnes" of the "Université de Liège":
* to continue and extend research on and monitoring of the peatland hydrology;
* to carry out an impact study on the emission of air pollution and its possible impact, and to develop a monitoring and evaluation system;

* to extend practical research on management experiments, especially concerning mowing and sod cutting in slightly desiccated raised bog;
* to start a program on the black grouse.