

Enhancing Biotic Resource Protection in Nettersheim: Successful Integration of Forestry and Agriculture in Nature Conservation Concerns

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Abstract

Objective of this article is to present degradations and enhancements from a nature conservation point of view achieved during the last two decades within the Nettersheim municipality (Eifel, North Rhine-Westphalia, Germany). For that, a comprehensive biotope evaluation from 1989 summarized in the so-called “Eco-Map” of the municipality has been compared to the map’s second edition from 2009. For each biotope evaluation the Bonner Approach has been used in its current version. In 1989 only around one third of the whole Nettersheim territory shows mean, high or very high importance. In 2009, it is nearly the half of the municipality (46.1%). Only 60 ha degraded from a nature conservation point of view during examination period, while comprehensive enhancements were registered on 1433 ha or 17.5 % of the territory. Area owned by public institutions showed higher percentages of enhancement than overall area. Enhancements are due to the transformation of non-autochthonal coniferous stands in deciduous forests and to the extensification of agricultural use. For latter, the grassland extensification program, the field margin program and the nature conservation by contract programs play a major role because nature conservation measures are directly remunerated. Indirect compensation for nature conservation activities is given by ecological compatible tourism.

Keywords: agricultural extensification, Bonner Approach, ecological points, indirect compensation, natural heritage, nature conservation by contract programs

1. Introduction

Nature protection in Germany can look back to a long tradition (Plachter, 1991), but international attention to the concerns of nature protection was given by the foundation of the famous non-governmental organizations World Wildlife Fund (WWF) in 1961 and Greenpeace in 1971. From that, it lasted some 20 years until the Convention on Biological Diversity has been assigned at the Earth Summit in Rio de Janeiro and the Habitat Directive in the European Union has been adopted. Ultimately, the Rio+20 conference took place, but the destruction of natural ecosystems all over the world for mining, urbanization or agricultural purposes is still going on (Magurran & McGill, 2011). But beside these negative headlines, we have heard from different nature conservation programs, “No net loss” policies and compensation measures following impacts (Peters, Siewert, & Szaramowicz, 2002; Cuperus, Canters, de Haes, & Friedman, 1999; Cuperus, Kalsbeek, de Haes, & Canters, 2002). Although these measures are sometimes scrutinized critically (Jessel, 2003), this raises the question if there are areas that enhanced from a nature conservation point of view during the last decades due to an increasing national or international effort of nature conservation.

The Nettersheim municipality (Eifel, North Rhine-Westphalia, Germany), famous because of its special consciousness for its natural heritage (Mieseler, Ribbert, Jürgens, Schumacher, & Donath, 1984; Schumacher & Außem, 1986), might be such an area where comprehensive enhancements had been carried out. Beside incorporating many areas in the field margin program, the grassland extensification program or the nature

conservation by contract program in order to stimulate agricultural extensification within the municipality (Ministerium für Umwelt, Landwirtschaft und Verbraucherschutz Nordrhein-Westfalen [MUNLV], 2010), the administration funds direct nature conservation measures such as mowing of valuable areas to save populations of rare and endangered species (Perner & Thöne, 2005; personal observations).

Before planning and project development, an “Eco-Map” is consulted to select areas of low value for the conservation of biodiversity (Perner & Thöne, 2005). Dated from 1989, this map illustrates the importance for biotic resource protection of each biotope within the municipality (Biewald et al., 1991, against the international diction we differ between habitat and biotope. The habitat is an area of uniform environmental condition. The German loanword “biotope” comprises the habitat and its specific assemblage of plant and animals as the smallest uniform unity within a landscape). As during the last 20 years many biotopes enhanced or degraded from a nature conservation point of view (i.e. Kühne et al., 2007; Schumacher, 2007), a second edition of this Eco-Map was ordered in spring 2008 and committed to the Nettersheim administration in July 2009.

The aim of this article is to compare both editions of the Eco-Maps to investigate which biotopes from the municipality enhanced or degraded from a nature conservation point of view during the last two decades. Furthermore, underlying activities and measures causing these enhancements or degradations are discussed.

2. Methods

2.1 Study Site

The Nettersheim municipality, situated in the German-Belgian Hohes Venn-Eifel Nature Park, belongs to the district Euskirchen. Covering an area of 94 km² in altitudes between 350 and 590 meters above sea level it includes eleven villages.

Most of the Nettersheim municipality belongs to the geographical entity Limestone Eifel with the Sötenicher and the Blankenheimer Calcareous Basins crossing the territory from South-West to North-East, between them the Nettersheim saddle. These calcareous basins are characterized by Middle Devonian limestone and dolomite, the surrounding Devonian saddles are formed of sandstone, greywacke and slate (Kasig, Bock, Laschet, & Latz, 1988; Meyer, 1994). Only the South-East of the municipality is part of the geographical entity Our Valley and Preliminary Eifel (Kreis Euskirchen, 2004). The Urft drains the western part of the municipality in western direction; the eastern part is drained by the Erft northwards. The small South-Eastern part drains via the Our.

The geological heterogeneity in combination with the landscape's relief result in a mosaic of different soil types: Shallow soils, commonly found on hilltops, are called Rendzina (on limestone bedrocks) or Rankers (above acidic material). The brown forest soil (Cambisols according to the FAO classification (IUSS Working Group WRB, 2007)) dominates even parts of the landscapes or hill slopes, occurring as well above limestone as above non-calcareous material (Außem, 1992). Gleysols are found in most valleys. In the highlands between Nettersheim and Marmagen or between Zingsheim, Engalgau and Tondorf, clayey soil horizons causing waterlogging form surface water gleys and its transitions to brown forest soils (Planosols or Stagnosols in the FAO classification).

Although situated in the rain shadow of the Hohes Venn, the climate of the Nettersheim municipality is still influenced by the Atlantic Ocean characterized by moderate cold winters with regular snow falls and nippy and moist summers. The average annual temperature varies between 7.5 and 8.5°C and the precipitation ranges from 700 to 800 mm (Außem, 1992).

2.2 First Edition of the Eco-Map

The first edition of the Eco-Map from Nettersheim was finished in 1989 based on a phytosociological mapping of the complete territory in the years 1987-1988 (unpublished data). This edition has been kindly placed to our disposal by the Nettersheim administration for digitalization using the software ArcView 3.2 and gvSIG 1.1.

The evaluation framework used to assess the importance of each plot for the protection and conservation of biotic resources has been described by Biewald et al. (1991).

2.3 Second Edition of the Eco-Map

A comprehensive biotope type mapping of the Nettersheim municipality was realized through inspections at a total of 120 days in the growing seasons of 2008 and 2009. Each biotope has been classified according to the slightly modified directives of the German Federal Office of Nature Conservation (Arweiler, Bürger, & Dingler, 2002; Table 1, results of mapping available on request from the corresponding author) and plotted in the official ordinance survey maps (1:5 000) with the software ArcView 3.2 and gvSIG 1.1. Settling areas like villages, industrial areas, streets, forest and field tracks were not evaluated. For biotope's delimitation, high resolution

aerial photographs were used in combination with a Garmin GPS device.

Table 1. Land use of the Nettersheim territory, Eifel, North Rhine-Westphalia, Germany

| Type of land use | Whole | territory | Area from public institutions | |
|---|-------|-----------|-------------------------------|-------|
| | [ha] | [%] | [ha] | [%] |
| Settling areas, villages, transport infrastructure | 1234 | 13.1 | without information | |
| Agricultural area in use | 4185 | 44.1 | 274 | 10.9 |
| From that | | | | |
| Arable fields | 1488 | 15.8 | 20 | 0.7 |
| Meadows and pastures | 2630 | 27.9 | 224 | 8.9 |
| Oligotrophic grasslands and heaths | 49 | 0.5 | 20 | 0.7 |
| Wet and grasslands | 18 | 0.2 | 10 | 0.4 |
| Forests | 3762 | 39.9 | 2150 | 85.5 |
| From that | | | | |
| Autochthonous forests | 1803 | 19.1 | 1050 | 41.7 |
| Coniferous and mixed forests | 1959 | 20.8 | 1100 | 43.8 |
| Copses, single trees, hedges and shrubs | 174 | 1.8 | 46 | 1.8 |
| Continental waters (springs, creeks, surface standing waters) | 63 | 0.7 | 33 | 1.3 |
| Stone quarries | 13 | 0.1 | 11 | 0.4 |
| Fens, bogs and carrs | 4 | < 0.1 | 2 | < 0.1 |
| Others (ruderal areas,...) | < 1 | < 0.1 | < 1 | < 0.1 |
| * * * Total | 9435 | 100 | 2516 | 100 |

Description: Land use of the whole Nettersheim territory and the area owned by public institutions within the Nettersheim municipality, Eifel, North Rhine-Westphalia, Germany.

For each plot a number of relevant data was recorded: Structural diversity, species richness, conservation status, impairments and the occurrence of invasive species. Rare and endangered biotope types or plots with occurrences of rare and endangered plant species have been visited monthly during the study period to ensure their complete census. Common biotope types lacking rare and endangered species have been visited once or twice only.

To calculate the biotic value of the mapped biotopes, the Bonner Approach has been applied. The five criteria naturalness, suitability, rarity and endangerment, intactness as well as importance for the ecosystem structure are evaluated independently by its degrees of performance from zero to five points which are summed up to the biotic value ranging from 0 to 25 points (Gastauer, Trein, MeiraNeto, & Schumacher, 2013). According to its biotic value, each biotope is classified within six categories. This Bonner Approach differs from the evaluation framework presented in Biewald et al. (1991), because of two new categories, A+ on the upper end and E on the lower end of the evaluation scale. Nevertheless, results from both evaluations are comparable (Table 2), because A+ biotopes are lacking in the Nettersheim municipality and category E biotopes (settling areas, streets, forest tracks) were excluded from mapping.

3. Results and Discussion

Excluding 1234 ha of settling areas like villages, industrial areas, rural settlements, streets, field or forest tracks etc., the Nettersheim territory amounts 8201 ha. More than one third of the whole territory except settling areas is owned by public institutions (Table1).

Table 2. Comparability of the actual version of the Bonner Approach to the former version used by the authors of the first edition of the Eco-Map (1991)

| Class | 2011 | 1991 | Examples |
|--|------|------|---|
| Large-scale natural or semi-natural areas of national and international importance for the conservation and protection of biotic resources | A+ | A | Bog complexes such as the High Venn, Wahner Heaths, large-scale natural beech forests like in the Eifel National Park |
| Very high importance for the conservation and protection of biotic resources | A | A | Large-scale complexes of wet meadows; small moorland; natural and near-natural deciduous forests |
| High importance for the conservation and protection of biotic resources | B | B | Extensively managed, species-rich grassland accompanied by hedges or shrubs; indigenous hardwood forests more or less managed by silviculture; semi-dry or dry grasslands |
| Mean importance for the conservation and protection of biotic resources | C | C | Clear coniferous forests with distinct undergrowth and but less than 30 % of autochthonal trees; pesticide-free field margins or fields, semi-extensive managed grassland |
| Low importance for the conservation and protection of biotic resources | D | D | Coniferous forests without undergrowth; intensively managed grasslands; areas used for intensive crop production |
| Very low to no importance for the conservation and protection of biotic resources. | E | D | Sealed or contaminated areas |

In 2009, 46.1% of the whole Nettersheim municipality area and 64.8% of all area owned by public institutions show a mean, high or even very high importance for the biotic resource protection (Figure 1 and Figure 2). As comprehensive evaluations are lacking for other political or natural entities, we are not able to compare these values with other findings.

13% of the areas with high or very high importance are semi-natural biotope types depending extensive agricultural management and cultivation (Table 3) housing rare and endangered species (Schumacher, 2007) indicating the importance of semi-natural biotope types for the conservation of Middle-European diversity (Kahmen, Poschlod, & Schreiber, 2002; Kesting, 2009).

More than the half of the municipality territory and little more than one third of area owned by public institutions is of low importance. Nevertheless, these areas can show importance for the protection of abiotic resources (Schick, 1997).

In 1989, only 31.7% of the whole territory or 47.1% of the area today owned by public institutions showed mean, high or very high importance (Figure 1 and Figure 2). The percentage of area with low importance for the protection and conservation of biotic resources was higher in 1989 than in 2009 (Figure 1). These figures indicate comprehensive enhancements from a nature conservation point of view.

Nevertheless, the biotic value of 60 ha of the investigated area decreased in the last 20 years. These is due to the reforestation with Norway spruce after windfall or clear cutting (28 ha) or intensification of the agricultural management of some plots (17 ha) like the transformation of grassland to arable fields. Others, like the light degradation of the calcareous grasslands in the Schleifbach valley (50°29'N 6°37'E) as well as clear cuttings of autochthonal beech forests or scrub encroachment on some smaller calcareous grasslands, appear only on small scales with subordinate importance. 32 ha of these degradations occurred on land own by public institutions.

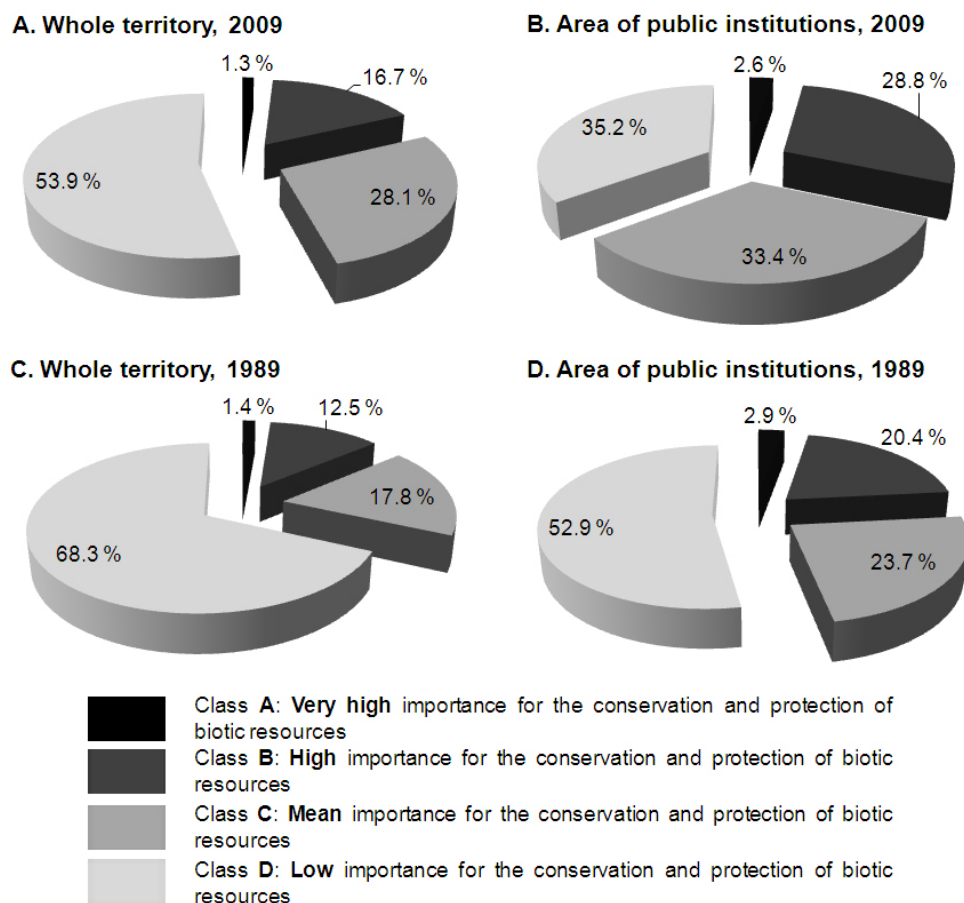


Figure 1. Biotic value of the territory of the Nettersheim municipality

Description: Actual biotic value of the whole territory of the Nettersheim municipality (A) and the area owned by public institutions (B). (C) illustrates the biotic value of the Nettersheim territory in 1989, (D) the area owned by public institution. Data from 1989 kindly placed at our disposal by the Nettersheim administration.

Table 3. Distribution of natural and semi-natural biotope types within biotopes of high and very high importance from the Nettersheim municipality

| Category | Area [ha] | From that: Natural biotope types [ha] | Semi-natural biotope types [ha] | Percentage of semi-natural biotope types |
|----------|-----------|---------------------------------------|---------------------------------|--|
| A | 103 | 71 | 32 | 31 % |
| B | 1 372 | 1209 | 163 | 13 % |
| Total | 1475 | 1280 | 195 | 13 % |

But on the other hand, 1433 ha enhanced from a nature conservation point of view between 1989 and 2009 (Figure 2 and Figure 3). Without settling areas, this corresponds 17.5% of the whole municipality territory. 642 ha of the area enhanced from a nature conservation point of view is property of public institutions. This means that 25.6% of all area owned by public institutions enhanced!

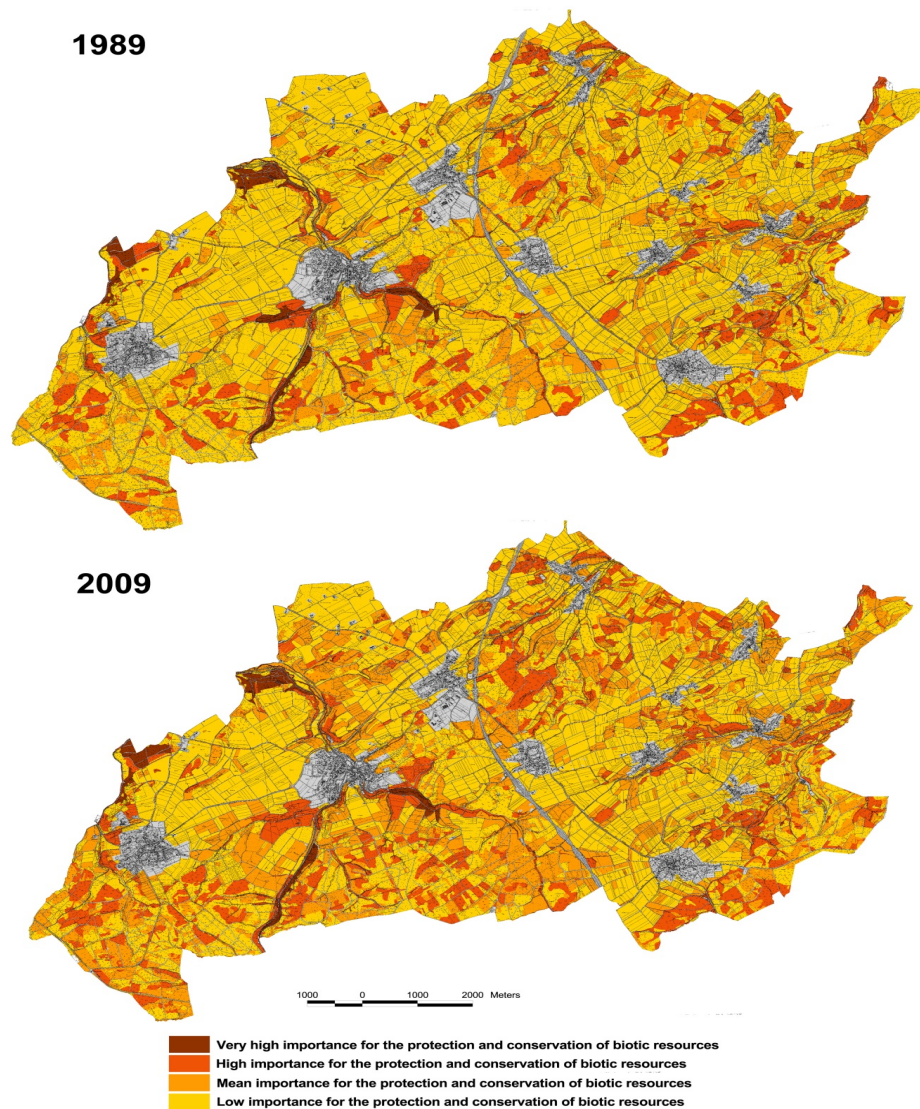


Figure 2. Comprehensive evaluation of the biotopes within Nettersheim from a nature conservation point of view from 1989 and 2009

As shown in Table 4, most of the enhancements are due to forestry activities: Especially the transformation of Norway Spruce stands in pre-forest communities later on followed by pioneer and autochthonal forests enhanced 770 ha of the Nettersheim territory (435 ha of the area owned by public institutions). These activities illustrate a rethinking in forestry: Priority is no more given to fast-growing tree species but to autochthonal, near-natural, ecological and economical sustainable forests (Landesanstalt für Ökologie, Bodenordnung und Forsten Nordrhein-Westfalen [LÖBF], 2004; Thomasius, 2007).

As mentioned above, extensification of agricultural cultivation in the Eifel is supported by three nature conservation programs: In the field margin program, the farmers relinquish the use of herbicides on a part of their arable land. The grassland extensification program requires a reduction of fertilizers and stocking rate, i.e. the number of cattle kept per land unit. The nature conservation by contract program remunerates farmers to use and to care for elements of the landscapes that are threatened by agricultural intensification like oligotrophic calcareous grasslands or mat-grass swards (MUNLV, 2010).

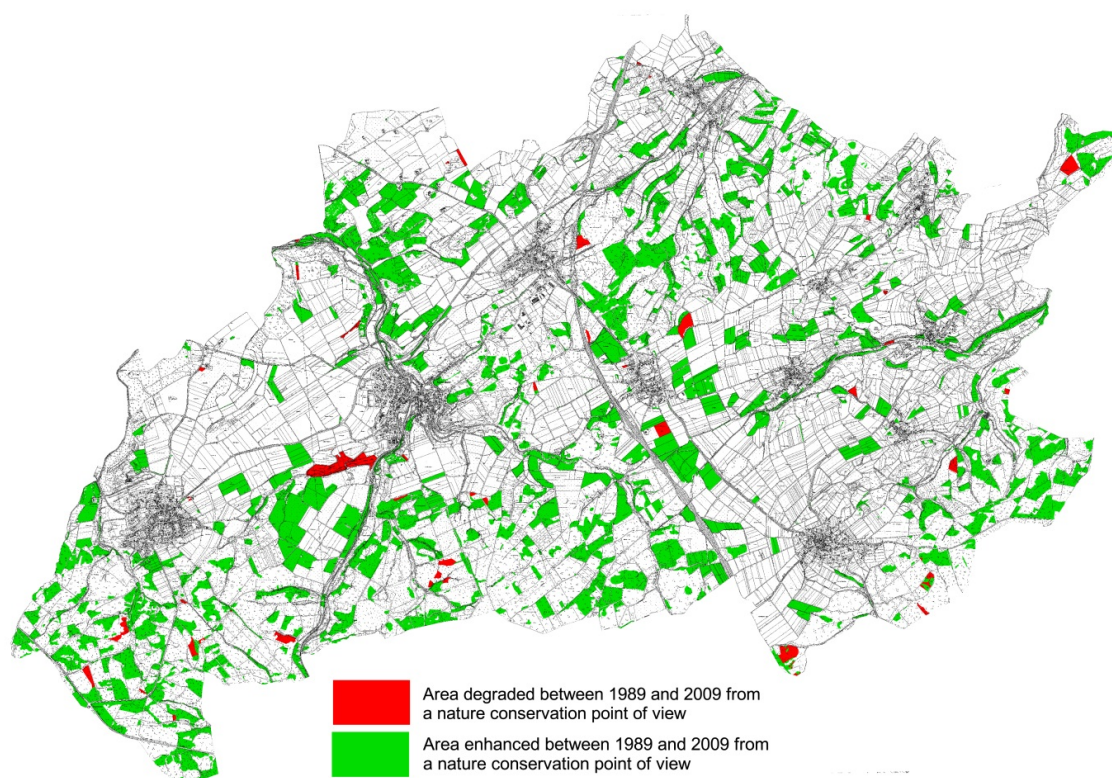


Figure 3. Enhancements and degradations between 1989 and 2009 from a nature conservation point of view within the Nettersheim municipality, Northrhine-Westfalian part of the Eifel, Germany

Table 4. Activities increasing the biotic value of biotopes in the Nettersheim municipalities between 1989 and 2009

| Measure | Whole territory [ha] | Area from public institutions [ha] |
|--|-------------------------|---------------------------------------|
| Extensification or abandonment of agricultural cultivation | 431 | 51 |
| Natural enhancement of deciduous or mixed forests, for example enhancement of pole wood stocks towards autochthonal forests or enhancement of the structural diversity in creek escorting alder swamps | 383 | 231 |
| Transformation of Norway spruce stocks to natural pre-forest communities or pioneer forests after windfall or clear cutting | 387 | 204 |
| Natural enhancement of Norway spruce stocks without understory layer towards stocks with distinct understory layer | 130 | 130 |
| Spontaneous emergence or planting of new single trees, bosks and hedges or enhancement of already existing bosks and hedges | 42 | 7 |
| Success of conservation measures by contract, for example because of spontaneous occurrence of new populations of rare and endangered species | 60 | 19 |

All programs secure the farmer's income and serve the purposes of nature conservation by protecting populations of rare and endangered species or preserve the abiotic resources: Due to the admission of 431 ha in these programs, more than 5% of the whole Nettersheim territory enhanced (Table 4). But not only the admission of new areas guarantees enhancement, long-term enhancements due to the appearance or increase of populations

of rare and endangered species or more structural diversity were detected in biotopes that had been already protected by nature-conservation by contract in 1989 (Table 4).

Indirect compensation for nature conservation activities in the Nettersheim municipality is given by tourism (Perner & Thöne, 2005) because visitors consuming nature spend monetary resources for accommodation and provisions in the region. Attracted by intact nature (Hannemann & Job, 2003) and trophies like the award “Bundeshauptstadt für Natur- und Umweltschutz” (Capital of Nature Conservation), pupils participating the bargain of environmental education services in the “Naturschutz-Zentrum” (Centre of Nature Conservation), patients of the “Eifel-Höhenklinik” (Clinic of rehabilitation) in Marmagen recuperating in the clean air and wanderers or nature watchers relaxing in the intact and beautiful landscape lead to an increase of accommodations (Burgomaster Pracht, personal communication).

4. Conclusion

In twenty years, more than 17% of the territory of the Nettersheim municipality enhanced from a nature conservation point of view. This corresponds to more than one fourth of the area owned by public institutions. These comprehensive enhancements are due to the successful integration of agriculture and forestry in the concerns of nature conservation and - in the analyzed case - are rewarded by increased income from tourism.

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