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BIODIVERSITY IN SEA FOR SPATIAL PLANS — EXPERIENCES FROM THE NETHERLANDS

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This paper provides an overview of the way biodiversity issues are dealt with in strategic environmental assessment (SEA) for spatial plans in the Netherlands. Spatial plans are selected as subject of study because 50 percent of all SEA studies executed in the Netherlands are carried out for spatial plans. Secondly, these plans provide an overarching framework for multiple interventions with potential impacts on biodiversity. It is, therefore, important to pay particular attention to biodiversity at the strategic level of a spatial plan. The evaluation is based on five spatial plans that have been subject to SEA, two national plans, two provincial plans and one local plan. Based on these assessments a number of conclusions are presented on the assessment of biodiversity in SEA for spatial plans in the Netherlands. The evaluation of case studies on which this paper is based was undertaken to produce a submission to the Convention on Biological Diversity for the drafting of international guidelines on biodiversity in SEA.

Keywords: Biodiversity; strategic environmental assessment; SEA; spatial planning.

Introduction

In the Netherlands, there is a continuous need for new urban and industrial areas with considerable impact on biodiversity. Biodiversity conservation reserves and agricultural land used by large populations of meadow birds are evidently affected by new infrastructure (Rijksinstituut voor volksgezondheid en milieu, 2004). However, restoration of natural habitats has been formally recognised as a national

policy (Ministry of Agriculture, Nature Management and Fisheries, 2000) and subsequently also puts a significant claim on the limited available space. Over the last 10 years, approximately 20,000 ha of agricultural land has been transformed into biodiversity conservation areas (Rijksinstituut voor volksgezondheid en milieu, 2004). The day-to-day working experience of the authors in the Netherlands Commission for Impact Assessment has showed that strategic environmental assessment (SEA) for spatial plans is an important and effective tool for balanced and well-informed decision-making with regard to these land use changes. Since 1990, up to the formal introduction of the EU SEA Directive in 2005, more than 100 SEAs for plans and programmes have been executed in the Netherlands, of which 60 were for spatial plans (see Table 1). This paper looks into the way biodiversity has been dealt with in SEA for spatial plans in the Netherlands and draws some lessons from this. It has to be noted that this work is based on practical experiences and non-academic publications, which may not be readily available. All documentation is, however, available at the library of the Netherlands EIA Commission.

To understand the role of SEA in spatial plans, an overview will be presented of spatial planning in the Netherlands in general, and planning of biodiversity conservation areas in particular. In the fourth section the selected plans are briefly described providing some details on the way biodiversity was considered. The findings of the comparative analysis are presented in the fifth section. The sixth section presents conclusions. The review on which this paper is based was carried out within the framework of a project commissioned by the Convention on Biological Diversity (CBD) aimed at drafting international guidelines on the incorporation of biodiversity in SEA. Within this project the conclusions of this review will be further elaborated in an international context.

Table 1. Overview of SEA studies executed in the Netherlands per sector between 1990 and 2003 (and some comparative numbers of EIAs at the local level).

PPPs ($N = 116$)	National	Provincial	Local
Spatial planning	4	22	40
Waste management	5	30	(>150 EIA)
Mining	5	3	(>10 EIA)
Energy	1	3	(>100 EIA)
Water	2	—	(>25 EIA)
Infrastructure	1	—	(>100 EIA)

Source: Annual reports of the Netherlands Commission for Environmental Impact Assessment.

Methodology

SEAs for spatial plans were chosen because biodiversity is more broadly affected by these type of plans than by any other type of plan (e.g., waste management plans). Furthermore, over half of all SEAs focus on spatial plans. The findings in this article are based on an evaluation of five selected SEAs, listed in Table 2. Four of these plans have been approved, providing the opportunity to look back and extract lessons for future application. Two relatively recent national plans were selected providing good examples of SEA at a relatively large, national scale. At the provincial level, two categories of spatial plans subject to SEA are distinguished: 10 year plans, known as regional plan (*streekplan* in Dutch) covering an entire province, and reconstruction plans covering rural areas in a part of a province only. One provincial plan and one reconstruction plan have been selected, considered to be representative for these types of provincial spatial plans. For local plans, a total of 40 SEAs have been carried out; because of strong similarity in the process only one representative SEA was selected. The characteristics of the plans and SEAs are summarised in Table 3.

To evaluate the way biodiversity has been considered in the SEA reports, a list of issues considered has been aggregated from all cases and summarised in Table 4. This list was compared to the CBD objectives and the CBD guidelines on biodiversity in impact assessment (CBD, 2002). The analysis concentrated on how impacts on biodiversity were described. This study did not go into details on the

Table 2. Overview of SEAs for spatial plans and plans selected for evaluation.

	Spatial plans per level	Plans selected for evaluation[a]
National ($n = 4$)	Fourth national plan for physical planning	National spatial plan for the West of the Netherlands — Deltametropolis (1999)
	National structure plan for the green environment	
	National spatial plan for the West of the Netherlands — Deltametropole	Space for rivers (2002–2003)
	Space for Rivers	
• Provincial ($n = 22$)	Spatial plans (eight plans for five provinces)	Spatial plan for province Noord Holland-Zuid (2002)
	Rural reconstruction plans (14 plans divided over three provinces)	Reconstruction plan for Achterhoek and Liemers (2004)
Local	Rural land use plans (40 plans, distributed over the entire country)	Zuidwolde-South (2002)

[a] Year refers to the year in which the SEA report was submitted.

Table 3. Overview of characteristics of the selected spatial plans.

	National		Provincial		Local
	Delta metropolis	Space for rivers	Provincial spatial plan for the South of Noord-Holland	Reconstruction plan for Achterhoek and Liemers	Zuidwolde Zuid rural land use plan
Problem and objectives	Stimulate economic growth. Four cities moulded into one metropolitan area through infrastructure and urban development	Safe discharge of 16,000 m^3 of water via the river Rhine and improvement of landscape quality	Balanced development of urbanised area around Amsterdam with 1.2 million inhabitants	Concentration of pig farming causing pollution and outbreak of diseases. Develop quality of environment, water and nature; improve socio-economic situation for inhabitants, farmers and tourism sector	Improve structure of agricultural sector; develop ecological and tourist infrastructure; improve water management
Main choices	Type and location of new high speed railway system; location of new urban, industrial areas; location of new green, water areas	On type, location and size of the following measures: strengthening of dikes, extraction of clay, land use change, identification of new flood areas	Site selection for 150,000 houses, 1000 ha industrial area; improve water management and nature development	Spatial zoning of concentrations of pigs, including “pig-free” areas; change of natural water/drainage system; develop new and improve quality existing nature areas	Location and size of new nature; development of naturalness of river basin Reest; surface water quality and water availability for agriculture; location of tourism infrastructure; restructuring of agricultural parcels

Table 3. (*Continued*)

	National		Provincial		Local
	Delta metropolis	Space for rivers	Provincial spatial plan for the South of Noord-Holland	Reconstruction plan for Achterhoek and Liemers	Zuidwolde Zuid rural land use plan
Alternatives	*Outer ring model* Cities connected by high-speed train on existing railways; spreading of urban growth *Inner ring model* Magnetic levitation train on new infrastructure in inner circle. Urban growth concentrated near new inner circle	Two-step approach: *Scenario development* at international water basin level *Alternative development* for section in the Netherlands	*Concentration*. Restructuring of existing urban areas *Spreading*. Spreading of urbanisation *Concentration* in Almere a large new satellite town of Amsterdam	Two alternatives are developed differing in level of ambition	Two alternatives are developed differing in level of ambition

Table 4. Overview of biodiversity issues described in five SEAs for spatial plans.

		Case									
		Delta metropolis		Space for rivers		North Holland South		Achterhoek and Liemers		Zuidwolde-Zuid	
	Status: Protected area?	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Ecosystem	Quantity										
	Increase in surface area (ha)	X	X	X		X	X	X		X	
	Quality										
	Restore key ecological processes and ecosystem services			X	X		X	X	X	X	
	Reduce harmful biophysical effects										
	Fragmentation					X		X			
	Water quality and availability through adapted management			X			X	X	X	X	
	Disturbance	X		X			X		X	X	X
	Air emissions	X						X			
Species	Protected species			X	X			X			

procedural aspects of the SEA process, although some discussion is provided on the process as it is generally applied in the Netherlands.

Setting

SEA

Until 2004, SEA for spatial plans at national and provincial levels was not mandatory in the Netherlands. Only for one category of local spatial plans has SEA been mandatory since 1995: rural land re-allotment plans. In total, 40 of these plans have been subject to SEA as shown in Table 1. For other types of spatial plans, voluntary SEAs are executed on behalf of national, provincial or local authorities. The minister of environment decides whether a request for a voluntary SEA will be granted (Ministry of Housing, Spatial Planning and Environment, 2000); so far none has been rejected. Once started, an SEA follows the legal procedure that is also applied for project EIA including public participation, legal advice on scoping and reviewing by the Netherlands Commission for Environmental Impact Assessment and the opportunity for appeal. It is obligatory to elaborate an environmentally most friendly alternative.

Spatial planning

The Netherlands has a long history of spatial planning. The first national plan for spatial planning was submitted in 1960 (Ministerie van volkshuisvesting en bouwnijverheid, 1960). Since then, every decade, the plan was updated and revised. In 2004, the fifth national plan was finalised (Ministry of Housing, Spatial Planning and Environment, 2004). In the national plan, strategic decisions are made on the desired development of urban areas (housing), industrial areas, biodiversity conservation areas, and infrastructure for the country as a whole. This plan provides a general planning framework for a period of 10 years, with a planning horizon of about 25 years. The exact location of the different land use types is not yet determined. The plan provides opportunities and limitations for future developments to be elaborated in more detail at provincial and local levels.

The province is the second administrative level in the Netherlands. The 12 provinces each draft a provincial spatial plan for a period of 10 years. This plan is based on the national plan and addresses land use opportunities and limitations for housing development, industrial areas, agriculture, landscape preservation and biodiversity conservation areas. The level of detail of these plans differs between provinces. The majority of the provinces use the plan to decide on site selection for large-scale housing and large-scale industrial areas. SEA for these plans is not mandatory and is presently executed on a voluntary basis by four provinces only.

At the local level, the authorities take legally binding decisions on land use for each square metre in a rural land use plan, updated every 10 years. This plan is based on the provincial spatial plan.

Spatial planning of biodiversity conservation areas[1]
The approval of the EU bird directive in 1979 (European Commission, 1979) was the occasion that marked the actual start of national planning of biodiversity conservation areas as 50,000 ha of important bird areas had to be demarcated. In 1990, the first edition of the National Nature Policy Plan (Ministry of Agriculture, Nature Management and Fisheries, 1990) launched the concept of establishing a National Ecological Network (NEN).[2] In 2000, a second policy plan followed (Ministry of Agriculture, Nature Management and Fisheries, 2000). The aim of the NEN, being a network of protected areas, is to secure the maintenance of biodiversity in the Netherlands. Measures include (i) the enlargement of existing biodiversity conservation areas by converting 280,000 ha of agricultural lands, (ii) restoring environmental quality and (iii) creating coherence and connectivity through a system of corridors between biodiversity conservation areas. This network has to be realised over a period of 30 years by using the local-level spatial plans. The province implements the network and determines the biodiversity conservation objectives for the areas. This implies the network is elaborated in detail in the Provincial spatial plans. Exact demarcation of the NEN is mainly done in local land re-allotment and rural restructuring plans. After demarcation of the predominantly farmer-owned land, it can be sold on a voluntarily basis to a non-governmental nature management organisation, subsidised by provincial authorities to own and manage these areas.

Biodiversity in The Netherlands[3]

In total, about 6 percent of the land surface of the Netherlands is demarcated as protected area for biodiversity conservation reasons. Until 10 years ago, these conservation areas were extremely small; virtually all movement of species was blocked by dense infrastructure. As a consequence, a large number of populations

[1]The term biodiversity or biological diversity is not commonly used in The Netherlands. Usually people refer to "nature", which in practise has two connotations: (i) that which is governed by natural processes (of which very little is left), and (ii) that which people consider as being nature, usually being highly managed and subject to what is in fashion (for example, in earlier days agricultural landscapes were highly appreciated, but nowadays we prefer so-called wilderness).

[2]This concept has been followed by many countries in the world such as India, Southern Africa and Central America. In 2000, the European Union (EU) launched a plan for establishing a network of conservation areas in the EU, known as Natura 2000.

[3]Refer to footnote 1.

had become threatened. Until the 1970s, the environmental quality continued to deteriorate. Since the 1980s this process has been reversed and an active environmental policy has led to gradual improvements. Despite these positive developments, most of the biodiversity conservation areas remain in bad shape as environmental quality is still too low (Rijksinstituut voor volksgezondheid en milieu, 2004). According to the National Nature Planning Agency (2004), the quality can only be improved when present levels of pollution significantly decrease, existing conservation areas enlarged and connected, and more natural processes are reintroduced in the water system.

Outside the protected areas the agricultural grasslands, mainly used for dairy production, are important habitats for large numbers of protected migratory meadow birds. However, two on-going developments are affecting their habitats. Firstly, habitat quality decreases due to intensification of agriculture, including lowering of ground water levels through drainage, use of high yielding grass species, and more intensive, repeated mowing starting in the middle of the breeding season. Only 2 percent of the agricultural land is used for organic agriculture. Secondly, agricultural lands are being lost to urbanisation and major infrastructural works.

Description of the Selected Spatial Plans Subject to SEA

National spatial plan for the west of the Netherlands

The objective of this spatial plan (Ministry of Housing, Spatial Planning and Environment, 2002a) was to design a plan to further develop the western part of the Netherlands into an internationally competitive urban network, equivalent to London, Paris and Frankfurt. A major element of this plan was the development of a new high-speed public transport system, connecting the four main cities in this part of the country, to "mould" these cities into one new "super city", providing further opportunities for economic growth whilst improving the environmental quality. The plan integrates the following four objectives:

- Improvement of the business climate.
- A new high-speed railway link between the major cities with technology and location alternatives.
- A new urbanisation policy on location of new residential and industrial areas.
- Use of the hydrological characteristics of the area to develop the NEN, recreational areas and areas for water retention (needed as flood prevention measure).

The SEA would provide the environmental, social and part of the economic information, necessary to decide which alternative would best achieve these four objectives. The plan described a limited number of alternatives, portraying the

"extremes" of possible choices. The alternatives provided insight into available options and their consequences, rather than being realistic options for implementation. A layered approach was followed for the development of alternatives. First, a green–blue basis layer was defined, describing the features of the present land and water system. As a second layer, the existing and new infrastructure was projected on the green–blue basis. Finally, the occupational elements, such as residential and industrial areas, were superimposed on the green–blue and infrastructure network layers.

Protected biodiversity conservation areas were not affected. Non-protected areas were lost, mainly agricultural grasslands with relatively large populations of meadow birds (minimum 1170 ha and maximum 1420 ha). The surface of the new biodiversity conservation area that could be realised within the NEN was equal for all studied alternatives. This resulted from the layer approach followed in the development of the alternatives. The blue–green layer contained the areas suitable for nature development. This base layer was used for all alternatives. Except for the small difference in loss of agricultural land, all alternatives scored equally on the impact on biodiversity due to this approach.

Space for rivers (national)

During two winters in the 1990s, the Netherlands faced serious risks of flooding caused by extremely high discharges of the two largest rivers (Rhine and Meuse). In 2001, calculations showed that the risk of flooding was expected to rise in the future, due to more extreme weather conditions in Western Europe (Commissie waterbeheer 21e eeuw, 2000). This was the start of a new plan called "Space for Rivers" (Ministerie van verkeer en waterstaat, 2000) with the following objectives for 2015:

- Safe discharge of 16,000 m^3 through the river Rhine and 3800 m^3 through the river Meuse.
- Improvement of landscape quality.

A two-step approach is being followed (Ministerie van Verkeer en waterstaat, 2002). In 2005, a SEA will become available in which alternatives comprising combinations of measures will be elaborated for both river systems. The following measures have been considered: (i) strengthening or replacing the dikes, (ii) extraction of clay from the river bed, (iii) digging of channels parallel to the main channel, (iv) identifying areas that can be flooded. In the second step, an EIA will be elaborated for each section of the river. Nearly all measures result in positive consequences for the improvement of the quality of riverine habitats. In addition, agricultural activities will be closed down in the majority of these areas due to the fact that these areas

are selected to become part of the NEN. As a consequence, natural habitats will become the primary "land use". The increase of natural dynamics of the river (such as the return of periodic flooding) supports the further development of riverine habitats. Small-scale areas where these measures have been applied in the 1990s have shown a remarkable resilience of these habitats. A number of higher plant species, which completely disappeared from the Netherlands, has returned (Rijksinstituut voor volksgezondheid en milieu, 2004).

Provincial spatial strategy plan for North Holland-South

This strategy plan (Provincie Noord-Holland, 2002) is a first step in the development of a spatial plan for the southern part of the province of North Holland (in the centre of which the Dutch capital of Amsterdam is situated). The area is part of the so-called Delta-metropolis, the area in which the most important economic development of the Netherlands is situated, including Schiphol, the major airport. Two million people live in this area, expected to grow with another 180,000 people in the period 2004–2020 resulting in a demand of 100,000–150,000 new houses. In addition to the growing demand for residential and industrial areas, the region faces problems of traffic congestion. The central objective of the plan is to maintain and strengthen the function of the area as an economic driving force, at the same time respecting the demands for a high-quality living environment, accessibility of the area and water management (both flood safety and quality management).

Since it concerns a plan with economic, social–cultural and environmental objectives, it was decided that the SEA should be integrated covering all these aspects. This assessment was carried out in 4 months on the basis of existing information. In the SEA, five alternative so-called "development models" are examined. Each model consists of a combination of choices of new housing locations, infrastructure development and water management:

- Model 1 tries to find the needed new houses in existing urban areas by making more effective use of these areas.
- Model 2 uses new areas for housing, trying to concentrate new residential areas in a limited number of locations. On these locations houses are built in both high and low densities.
- Model 3 uses new areas, but dispersed over a larger number of new locations compared to model 2. Area occupation is kept to a minimum by high-density buildings.
- Model 4 uses new areas, dispersed over an even larger number of smaller locations in which houses are build in low densities (preferred by most home owners).
- Model 5 is a combination of the above four models (referred to by the competent authority as the "preliminary preferred model").

In models 4 and 5, presently protected areas are selected as new residential locations. The SEA does not describe the feasibility of this option in well-protected locations that cannot be easily converted. Disturbance of protected areas by noise is considered, but it is stated that the impacts are not measurable. The proposed changes in water management have a positive impact on biodiversity in protected areas. These impacts are considered equal for the five alternatives. Non-protected areas are affected but impacts are considered as not significant due to the low biodiversity value (species density) in this metropolitan area.

Regional spatial plan for Achterhoek and Liemers

Achterhoek and Liemers are characterised by extremely high concentrations of livestock, in particular pigs, causing a number of interrelated problems. Environmental restrictions as well as subsequent outbreaks of diseases seriously affect the social and economic conditions for farmers. Biodiversity is seriously affected by ammonium emission from manure deposition, which in turn causes soil acidification and lowers the ground and surface watertables. Inhabitants and tourism are hindered by the smell of ammonium. An outbreak of a swine fever in 2000 with six million pigs being destroyed resulted in the Reconstruction Law (Ministry of Housing, Spatial Planning and Environment, 2002b) The objectives for areas subject to this law are improvement of the environmental conditions and improvement of the socio-economic conditions of farmers.

A voluntary SEA (Provincie Gelderland, 2004) was executed for transparent and balanced decision-making on the required measures. Two alternatives were developed; the environmentally most friendly option being more ambitious. Issues identified for impact assessment included sensitivity for outbreak and distribution of veterinary diseases, water system, water quality, ammonium emission, biodiversity, landscape and cultural history, agriculture and quality of living. In both alternatives, the NEN will be realised and minimum environmental standards are met. In the environmentally most friendly alternative, emission of ammonium will drop significantly. Moreover, the natural water system will be rehabilitated, restoring natural processes such as flooding, erosion and sedimentation. Such developments provide good conditions for considerable biodiversity enhancement in protected areas. Biodiversity outside protected areas would be slightly enhanced due to lower levels of ammonium. From a biodiversity perspective no significant differences were expected between the alternatives.

Local spatial plan for Zuidwolde-Zuid

This spatial plan relates to 2600 ha of land located in the north-east of the Netherlands (Dienst landelijk gebied, 2002). For the drafting of this plan a special land

re-allotment commission had been appointed with representatives of all different land use functions present in this area: agriculture, biodiversity, tourism and water. Dairy farming remains the most important land use although for the past 10 years many farmers have abandoned farming. Part of the available land has been used by the remaining farmers to enlarge their own enterprises. Tourism has become more important but the tourism infrastructure needs to be adapted to present needs. Biodiversity is under pressure due to agriculture-oriented water management. In addition, disturbance of species due to increasing numbers of tourists and fragmentation of protected areas contributed to a decline of biodiversity. The commission drafted a plan to achieve the following objectives:

- *Biodiversity* — development of an ecological network on former agricultural land, restoration of the natural water system in the river Reest watershed, improve conditions for biodiversity enhancement in river and adjacent lands, and decrease of disturbance by zoning of recreational use.
- *Agriculture* — increase accessibility of parcels and improve water availability.
- *Tourism* — increase of locations suitable for cycling and horse riding.
- *Landscape and cultural history* — conservation and restoration of landscape structure.
- *Water* — improve surface water quality, secure water demand of the agricultural sector.

Two alternatives have been elaborated: the preferred alternative and the environmentally most friendly alternative. In both alternatives all objectives will be realised, but the creation of a new biodiversity conservation area differs, respectively, 312 and 400 ha. The water system of the Reest will be rehabilitated providing opportunities for further development of ground water related vegetation types. In the most friendly alternative more measures are taken to decrease disturbance of nature in protected areas. The quality of nature outside the protected areas are not significantly affected by the execution of the alternatives elaborated in the SEA for this plan.

Biodiversity in SEA for Spatial Planning

General

In all the spatial plans that have been evaluated two biodiversity objectives are consistently taken into account. First, the enhancement of existing biodiversity, inside as well as outside protected areas, and secondly the development of new conservation areas. In Table 4, an overview is presented of the different biodiversity issues considered in the SEA reports. In all SEAs a distinction has been made between protected and non-protected areas. This is obvious because, in principle,

new activities with impacts on the quality of the existing protected areas are not allowed. Furthermore, all spatial plans have the objective to realise part of the NEN. Important measures to achieve these objectives are extension of existing biodiversity conservation areas, improvement of availability and quality of water, decreased fragmentation of animal populations by corridors and emission reduction of air pollution.

With respect to the CBD objectives of conservation, sustainable use and equitable sharing, it is obvious that biodiversity conservation is the main biodiversity focus in SEA for spatial planning in the Netherlands. Sustainable use issues are not considered in the cases analysed for this paper. In the Netherlands, inland biodiversity conservation areas are strictly protected and can only be used by tourists for leisure purposes. These areas are not used for collection of products such as timber or non-timber forest products. Disturbance by tourists is controlled by measures such as zoning or temporarily closing of an area (for example, during breeding season). In aquatic biodiversity conservation areas, on the contrary, multiple ecosystem services are exploited, for example, by fisheries, shellfish collection, and sometimes extractive activities (sand, shells, natural gas). These areas are not represented in the cases evaluated in this paper.

One plan specifically aims at restoring the flood storage capacity of the river system in order to protect the hinterland from flooding (space for rivers). This can be described as the restoration of a key natural process (flooding of wetlands) aimed at enhancing flood storage as an ecosystem service, which is valued by society as a flood protection measure. (The naturalness and sustainability of some of the proposed measures, however, is questionable as it concerns intensively managed flood storage basins.)

Methods used in SEA for spatial planning

All SEAs use secondary data already available with the competent authorities and the consultancy firms drafting the SEAs. Data on water and air quality are gathered systematically for the entire country. Distribution of plants and animals is systematically monitored by organised volunteers using internationally accepted and scientifically sound methods of inventory. All available data are accessible through a 1 km^2 grid of the entire country. This information is available at low cost. A geographical information system (GIS) is the tool used for presenting information on expected changes in land use and in quality of biodiversity. Comparison of the environmental impacts of the alternatives is primarily done by expert judgement making use of high-quality GIS maps.

Table 4 shows that SEA for spatial planning regarding biodiversity is predominantly looking at changes at the ecosystem level. Changes in quantity as well

as quality are considered in all SEAs. In the SEA for the Delta metropolis plan, significantly less biodiversity issues were studied than in the SEAs for the other plans. The Delta metropolis was applied at a higher abstraction level than the other plans. The other plans were based upon a detailed topographical map as underground for spatial planning, requiring more information on biodiversity. In only a few cases were, species protected under the national law for flora and fauna considered in the SEA.[4] Genetic diversity is not treated as such, although measures to reduce fragmentation are intended to maintain genetically viable populations of species.

Protected biodiversity conservation areas

In all the evaluated SEAs, a distinction is made between protected areas and non-protected areas. The first category is well protected by national and European legislation. As a consequence, activities that cause significant impacts on these protected areas cannot be executed. If activities causing significant negative impacts have been planned in or adjacent to these areas, the proponent is obliged to consider alternative sites.

Legislation for protected nature areas (Ministry of Agriculture, Nature Management and Fisheries, 2000)

Activities that affect protected nature directly or indirectly must answer the following questions subsequently:

(1) Are significant impacts to be expected?
(2) In case of significant impacts an assessment must be executed by the competent authority taking the following aspects into consideration:
   (a) Are there alternative solutions (including mitigating measures) by which no significant impacts for the protected area will occur?
   (b) Are there reasons of overriding national importance by which the project should be realised?

In case the project has to be executed in or in the vicinity of the protected area and mitigating measures do not remedy the impacts, compensatory measures should be executed to secure the coherence of Natura 2000.

SEA provides the opportunity to make this information available for transparent decision-making.

[4] Species protected under the EU Habitat and Birds directives are associated to geographically defined areas, which are consequently treated as protected areas.

All plans describe one or more measures to improve the quality of the existing protected areas:

- Improve the air, water and soil quality by decreasing the emission of gasses (CO_2, NO_x, NH_4), particularly in SEAs for local and provincial spatial plans.
- Improve the water situation (quality and availability) by applying measures such as reduction of active drainage of rain and seepage water, and reduction of ground water extraction for agricultural and drinking water purposes. Such measures are proposed in all SEAs.
- Decrease disturbance of sensitive species or their habitats. Spatial zoning of disturbing activities and careful planning of physical (and tourist) infrastructure are measures applied in all SEAs. Elaboration in regional and local plans is more detailed.
- In each of the SEAs, alternatives have been developed for the location and configuration of new biodiversity conservation areas and corridors to connect existing protected areas and thus reduce the effects of fragmentation. Although a large number of existing areas have been extended with new areas, the majority of areas are still too small for the survival of a large number of species. For this reason the concept of an NEN has been developed. The location of new ecological infrastructure to some extent is flexible. For example, there may be a number of different routes by which two conservation areas could be connected by the development of new ecological infrastructure that would meet the ecological conditions for the required future quality. Different alternative routes can be assessed in an SEA.

Since the 1990s, more drastic measures have been applied with the aim to restore natural processes in watersheds of smaller as well as the largest rivers in the Netherlands. Human influence on water management will decrease, giving way to the development of a more natural water system. In four out of the five plans, watersheds have been identified where more natural water systems will be established, restoring natural processes such as flooding, natural variations in ground water levels, and erosion and sedimentation. These developments provide great potential for the development of habitats and species that have disappeared decades ago. The multiple ecosystem services provided by these restored systems are increasingly appreciated; leisure activities, flood attenuation and biodiversity conservation can go hand in hand.

Non-protected areas

Apart from protection for biodiversity purposes, large areas in the countryside are protected for other reasons: e.g., cultural history, appreciated landscapes and areas

where ground water is extracted for domestic purposes. For these reasons, approximately 1 precent the national surface area is protected. In most of these areas, land use changes and intensification of agriculture are not allowed or are strictly regulated. As a consequence, existing biodiversity can be sustained. From the CBD perspective, this legal protection can be described as the protection of ecosystem services, and consequently can also be considered to be biodiversity conservation measures.

In the evaluated SEAs, there is far more limited attention on the conservation or enhancement of biodiversity in non-protected areas; see Table 4. The occurrence of habitats and species in these areas is mainly linked to agricultural land use, predominantly intensive livestock raising for dairy production and, on a smaller scale, arable agriculture. The provincial and local decision-makers seem to make a strong distinction between protected areas where nature objectives prevail and non-protected areas where economic activities have been given a free way to develop and where limitations are not accepted. This trend is most likely the consequence of the following developments:

- Demarcation of areas under the EU Bird and Habitat directives has confronted decision-makers with the consequences of these directives. Although the directives allow for economic activities, the proponent has to prove that these activities do not negatively influence nature. The general perception, consequently, is that these areas are strictly protected and activities for economic development severely limited.
- The NEN is strongly supported by the professional non-governmental organisations. They invest their means in the realisation of the NEN and give less priority to other areas.
- In 2002, the law on protection of plants and animals (Ministry of Agriculture, Nature Management and Fisheries, 2002) came into force protecting virtually all vertebrate species. As a consequence, a large number of economic investments were delayed or had to be stopped causing polarisation of decision-makers.

Quality of the SEA process

The SEAs were integrated in the planning process resulting in one report. Representatives of all main interest groups, e.g., the agricultural sector, nature and industries, were involved and agreed on the objectives at the start of an SEA process. By drafting a number of alternatives, it was possible to meet the sometimes conflicting needs of the different interest groups. Based on a comparative assessment of the impacts of the alternatives it was the government authority that decided on the execution of one or a combination of alternatives. In addition, SEA has played an important role

in facilitating the discussion between different interest groups during the process and it contributed to commitment of all parties involved.

Conclusions

A number of conclusions can be drawn from this comparative study on SEA for spatial plans in the Netherlands.

Biodiversity impacts are considered at the ecosystem level. Priority is given to the realisation of the NEN and the improvement of its quality. Biodiversity outside the protected areas is hardly considered in SEAs. Information on protected species is hardly used in SEA.

Ecological network. Realisation of the NEN is one of the main objectives of biodiversity policy in the Netherlands. This network of existing and planned biodiversity conservation areas provides an important framework for the consideration of biodiversity in SEAs for spatial plans in the following manner:

- Verification of whether protected areas are affected. National laws on biodiversity protection and the EU habitats and birds directives, secure the protection of biodiversity conservation areas to a great extent. These areas are hardly affected by new activities and land use changes.
- Demarcation of new conservation areas at the national, provincial and local levels. SEA provides a good tool for this as alternatives provide the opportunity for a comparative assessment of locations for new conservation areas.

From a biodiversity perspective, SEAs for spatial plans address changes in surface areas of biodiversity conservation areas, as far as part of the demarcated NEN. Furthermore, quality enhancement of the NEN is addressed, mainly through rehabilitation of natural water systems. It might become clear that the existence of the NEN provides one of the main conditions to successfully secure and further develop biodiversity conservation areas in the Netherlands.

Restoring key ecological processes. SEAs for spatial plans contribute substantially to decisions on measures to improve the quality of existing biodiversity conservation areas. The most important and effective measure is rehabilitation of natural water systems. As a result of this, natural processes increase, resulting in a significant rise in quality of vegetation types. In terms of required level of detail and information needs the effects of restoration of key ecological processes can be effectively dealt with in an SEA.

Reduction in biophysical changes. Other measures for biodiversity enhancement are based on the reduction of detrimental biophysical changes caused by human activities. Measures include reduction in emission of air pollution, controlling disturbances and small-scale water management measures. However, these measures

are only seriously considered in SEAs for local spatial plans. In SEAs for national and provincial spatial plans these types of measures are not considered because they are too detailed for the scale of assessment.

Recognising ecosystem services — a mechanism for biodiversity protection. Apart from conservation of biodiversity, a number of ecosystem services (or functions) of importance for society have been formally recognised in the Netherlands, and consequently appear in the SEAs. In the Space for Rivers plan, flood storage is a fundamental part of the plan; further protected status is provided to groundwater infiltration areas of importance to public water supply, and areas with high archaeological or landscape quality[5] have a similar legal status. By providing such areas with some form of legal status, important ecosystem services can more easily be taken into account in an SEA study and in final decision-making.

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[5] Another form of protected ecosystem function, not appearing in the presented cases, is the coastal protection performed by natural dunes. These dunes are strictly protected and closed for public.

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