

## HABITAT

### A Spatial Analysis Tool for Ecological Assessments



#### More than just a tool

Habitat analyses are important for studies of ecological impacts on local, regional and (inter-)inational environments. Proper understanding of the functioning of these environments and the species therein is essential, especially now that awareness of the negative human impacts on the natural environment has increased over the last three decades. Predictions of impact of human interventions in the natural environment on the development of the ecosystem are required for appropriate management responses. Also, the effects of rehabilitation, mitigation or conservation strategies need to be quantified in a clear and understandable way, to be of use in spatial planning and ecosystem management.

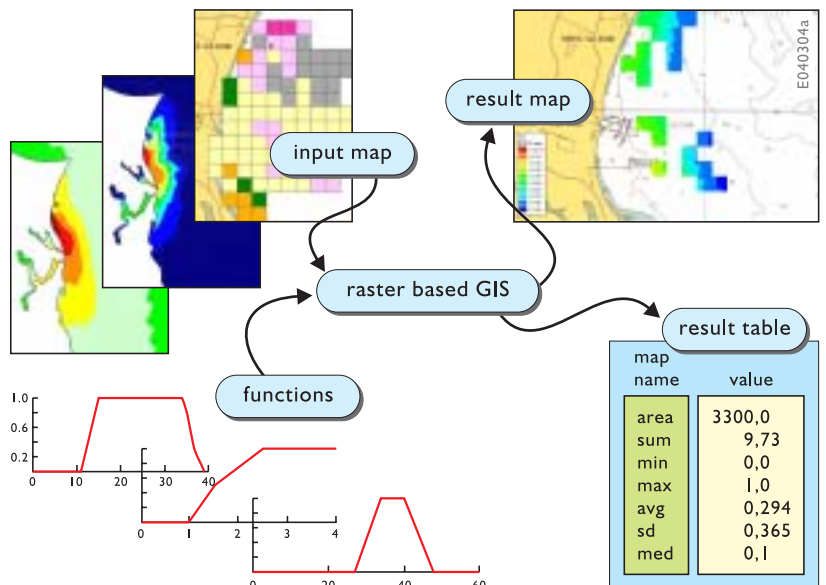
HABITAT is a GIS-based framework application that allows for the analysis of ecological functioning of study areas in an integrated and flexible way. GIS maps and environmental information, for example resulting from models (Delft3D, SOBEK) or field observations, are combined to generate spatial (maps) and quantitative (tables) results. HABITAT can be applied to analyze the availability and quality of habitats for individual species. Moreover, it can be used to map spatial ecological units (e.g. ecotopes) and predict spatial changes in habitat suitability for example due to human interventions. Users can use predefined habitat evaluation modules for individual species, or can define new modules to suit their needs for specific applications. Therefore, HABITAT is a flexible tool and strong predictive instrument which can be of great advantage in the case of specific long term planning projects and decision support systems.

#### A flexible system

HABITAT has been developed in the range of Delft tools and conforms to the same input and output format. It can therefore be linked to other modelling software such as SOBEK and Delft3D. Its structure is based on a user-friendly graphically oriented interface. HABITAT further offers a case management tool, the set-up of an ecological model library, a quick visualization of maps and the possibility of reporting meta-information with projects, cases and models. HABITAT offers the possibility to design user-defined area specific models for a wide application area.

HABITAT is being developed by WL | Delft Hydraulics and three research institutes within the Ministry of Public Works, Transport and Water Management: RIZA, RIKZ and DWV.

Schematic representation of an application of HABITAT in an outfall study. Input maps are combined using knowledge rules within a GIS. The results are presented in maps and quantitative tables



keywords:  
 HABITAT, instrument,  
 Delft Tools, Habitat Evaluation  
 Procedure, ecotope classification

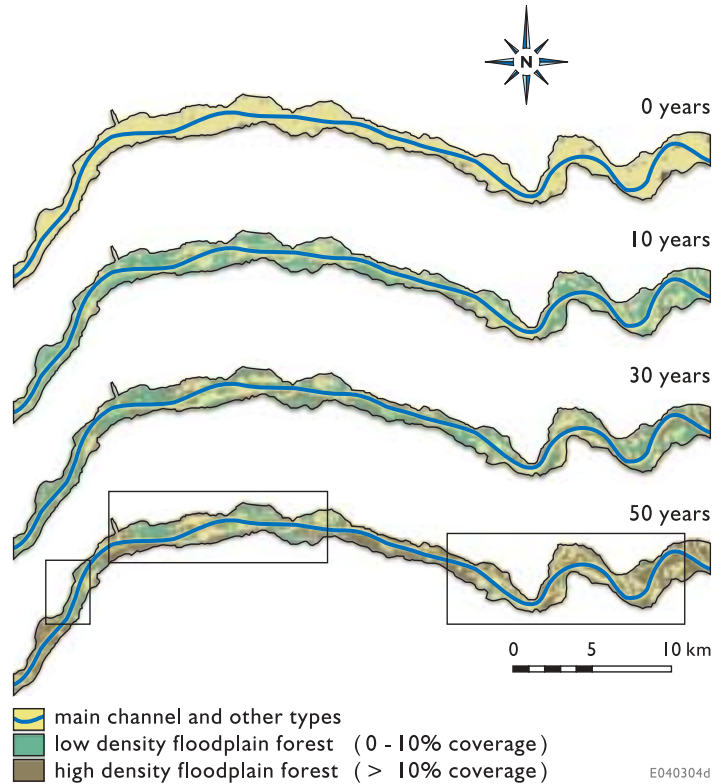
## Application fields

### Habitat Evaluation Procedures (HEP)

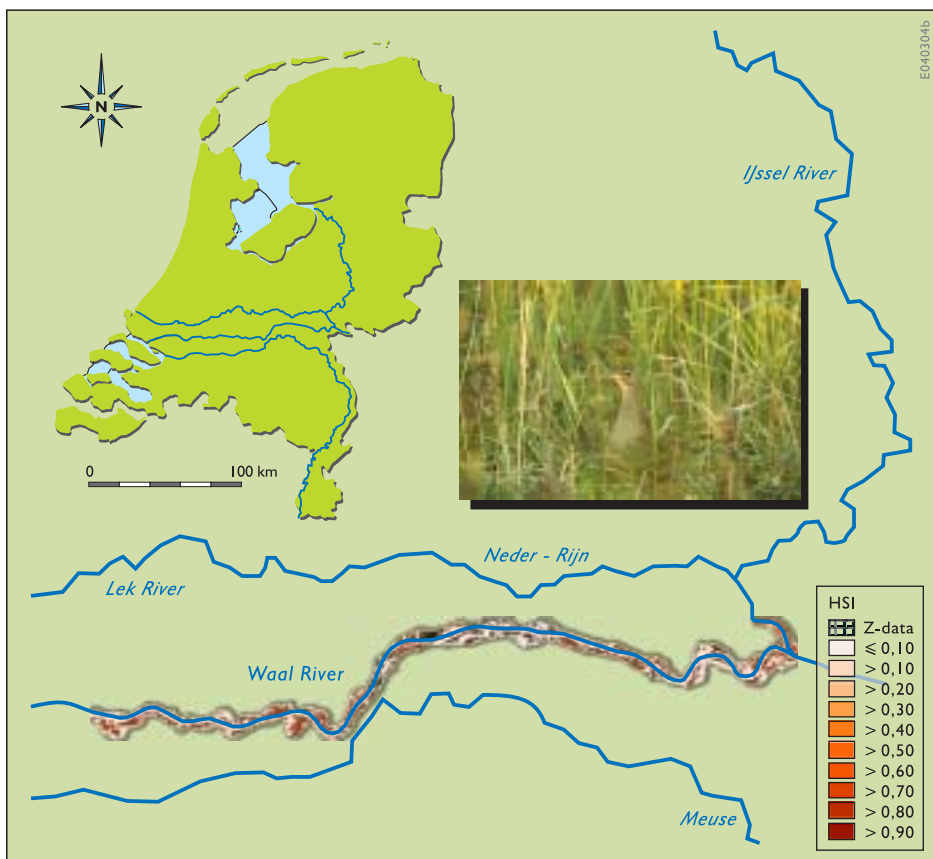
Habitat evaluation procedures are used to predict changes in the suitability of the faunal and floral habitats in response to changes in environmental factors. These can be factors such as stream flow, water depth, substrate type and location, inundation frequency or duration, vegetation cover, salinity, water temperature and water quality. Suitability can be translated to the potential carrying capacity of a system. Habitat requirements are derived from life history studies, field observations, literature surveys and frequency analyses of environmental factors characterising habitats used by fauna and flora.

The habitat evaluation procedure is often a component of an Environmental Impact Assessment (EIA). Typically, in an EIA, the present situation (including habitats) is evaluated and the effects of planned measures, such as power plants, river construction measures or drilling on the surrounding environment are quantified.

Habitat suitability for Corncrake (*Crex crex*) in the floodplains along the Waal river, according to vegetation structure and inundation time, 10 years after flood risk reduction measures.



Increase in floodplain forests along the river Waal over a period of 50 years. The sections indicated with square boxes are areas where floodplain forest had to be removed to remain within the safety standards for flooding. Vegetation types are predicted with HABITAT and can be used as input for habitat evaluation procedures.



### Ecotope classification

Based on biotic and abiotic criteria, ecosystems are often subdivided into ecological units such as ecotopes. HABITAT can be used for ecotope classification and the prediction of changes in ecotopes due to human interventions or climate change.

### Water Framework Directive

HABITAT is designed for the evaluation of criteria for water quality and ecological quality as for instance defined in the European Water Framework Directive. The present situation can be evaluated and the effects of autonomic developments and rehabilitation measures can be assessed. With this information, HABITAT can provide maps showing the ecological and chemical status of water bodies.

### Environmental Flows

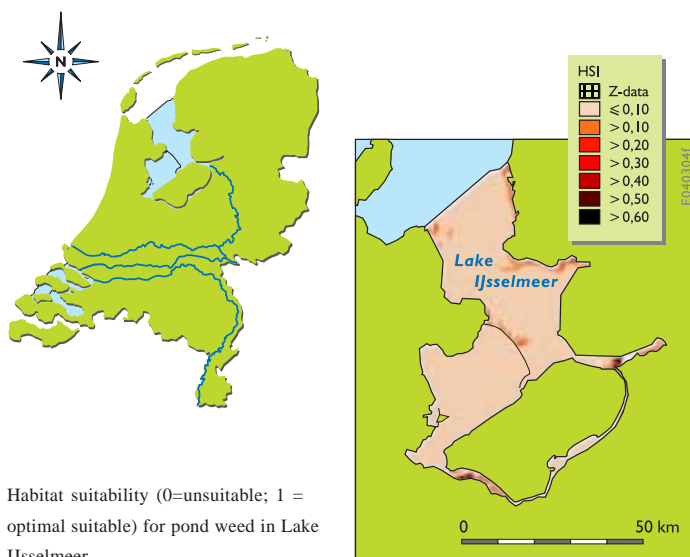
The hydrological flow regime has a large impact on aquatic and riparian ecosystem processes. The natural range of streamflow variation should be preserved with river alteration projects designed for the improvement of economic functions. With HABITAT, Environmental Flow Requirements can be defined and evaluated, together with requirements for other functions of rivers.

### Multi-criteria analyses

Nowadays, areas often have multiple functions, some of which can be conflicting (such as ecology and economic development) Measures to improve one function may often also affect other functions. To evaluate the effect of measures on different functions, a multi-criteria analysis can be defined in HABILAT.

### Risk assessment

HABILAT can be used to generate risk maps of coastal areas for disasters such as oil spills. The risk is a function of probability of a spill (based on information on shipping routes) and impact (based on sensitivity maps of the area).



Habitat suitability (0=unsuitable; 1 = optimal suitable) for pond weed in Lake IJsselmeer.

## Case Management Tool

The Case Management Tool manages four databases:

- Projects
- Ecological Models (HSI models)
- Ecotope Classifications
- Maps

The projects, which comprise one or more cases each, are defined and results are stored in the project database. Within each case, ecological models or classifications are combined with maps, which can be stored and retrieved from the corresponding databases. Output maps can be exported to the map database for application in other projects.



## Computational Core

The GIS computation core implemented in HABILAT is PCRaster (PCRaster Environmental Software/ Faculty of Geographical Sciences, Utrecht University). PCRaster offers an extensive list of arithmetic operators i.e. natural logarithms, minimum and maximum functions, which can be used by HABILAT with great flexibility. PCRaster is available through [www.pcraster.nl](http://www.pcraster.nl).

## Visualisation

The Delft Tools visualisation module is used for the visualisation of input and output maps. These maps can be combined with GIS information. Rules are visualized with graphs to enable a visual check on the correctness of the defined functions.

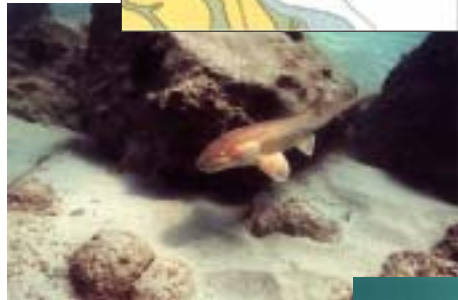
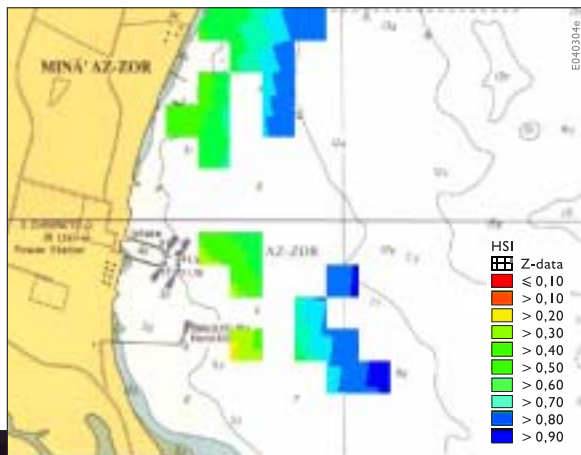


## Input and output formats

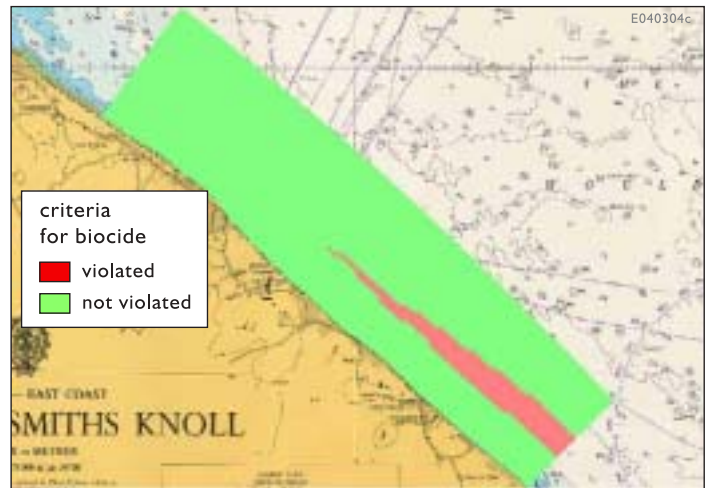
HABILAT uses binary grid maps of the industrial BIL format. HABILAT has a stand alone conversion module for a quick conversion of maps of other formats, sizes and resolution. HABILAT also produces output tables with a (statistical) summary of map data.

## Extensions

HABITAT will continuously be expanded in cooperation with its end-users. Expected extensions include a functionality dealing with temporal and spatial variations in habitat requirements of individual species and an uncertainty analysis module.



Predicted effect of a power & desalination plant cooling- and wastewater effluent on habitat suitability for existing coral reefs at Az-Zour (Kuwait).



Predicted distribution of the violation of the criteria for biocide concentration near Bacton (United Kingdom) after discharge of hydrotest water from a gas pipeline between Balgzand (The Netherlands) and Bacton (United Kingdom)

## System requirements

HABITAT runs on stand-alone computers as well as in a network system. HABITAT is designed to run on all currently available MS WINDOWS platforms. For common analyses, only a few seconds of calculation time on a modern PC are needed.

## Availability

As of April 2004, HABITAT is being used as a developer's tool, but it will be commercially available before the end of 2004.

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