

## **A STUDY ON THE REGENERATION OF NATURE IN THE KITAKYUSHU AND EMSCHER INDUSTRIAL AREA**

*Bart Dewancker*<sup>1</sup>

### **Abstract**

The urban area of the pre-Industrial Revolution had a rich natural environment. Due to industrial developments in the city, the expansion of the residential and industrial area has caused severe destruction of this natural environment. Some biotopes are still left in the urban area. The preservation of these biotopes has become an important matter in urban ecological planning. In this research, the change of land use in two industrial areas has been investigated, the Emscher Industrial Belt in Germany and the Kurotaki Area in the Kitakyushu Industrial Belt in Japan. Furthermore, a proposal has been made for the development of an urban biotope network in the Kurotaki Area.

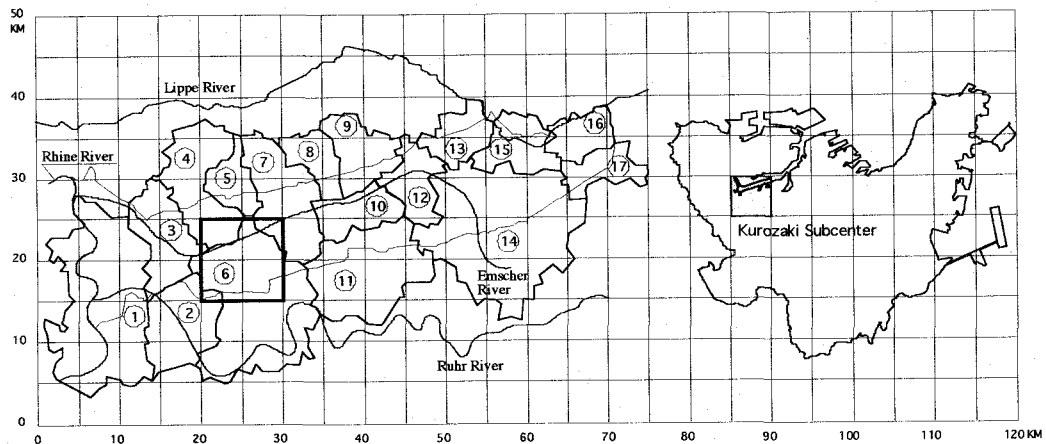
**Keywords:** change of land use, restoration of nature, biotope network

### **1. Introduction and purpose of this research**

In Europe as well as in Japan, the pre-industrial city was characterized by an abundant natural green landscape. Since the Industrial Revolution, this mostly scarcely inhabited agrarian landscape has been changed into a densely built urban industrial landscape. Industrial developments in the city required factories, energy plants and other industrial buildings, as well as infrastructure, such as railways, canals, roads, harbors, etc. Large natural areas in the city have been contaminated, reduced or even completely been destroyed due to the expansion of the infrastructure, the industrial area and the residential area. The destruction of these natural areas has resulted in the loss of many urban eco-systems. The destruction of urban natural areas, the so-called urban biotopes did not yet come to an end. Some biotopes are still left in the urban area, however the risk is high that even these left over urban biotopes are going to disappear in the 21<sup>st</sup> century. The preservation of these biotopes has become an important matter in urban ecological planning. Not only the protection is important, but also the recovering of them, and there is an urgent necessity for the creation of an urban biotope network. The basis for the creation of such an urban biotope network will be a historical study of the change of land use in the city. In this research, the change of land use in two industrial areas has been investigated, the Emscher Industrial Area in Germany and the Kitakyushu Industrial Area in Japan.

---

Associate Professor, The University of Kitakyushu, Faculty of Environmental Engineering,  
Hibikino 1-1, Wakamatsu-ku, Kitakyushu City, 808-0135 Japan, Tel: 093-695-3245, Fax: 093-695-3345,  
e-mail: bart@env.kitakyu-u.ac.jp



The 17 Cities of the Emscher Industrial Belt: 1 Duisburg, 2 Mulheim, 3 Oberhausen, 4 Bottrop, 5 Gladbeck, 6 Essen, 7 Gelsenkirchen, 8 Herten, 9 Recklinghausen, 10 Heme, 11 Bochum, 12 Castrop-Rauxel, 13 Waltrop, 14 Dortmund, 15 Lünen, 16 Bergkamen, 17 Kamen

Figure 1 The investigated areas (left Emscher Industrial Belt – right Kitakyushu City)

Furthermore, a proposal has been made for the development of an urban biotope network in the Kurosaki area in Kitakyushu. Figure 1 shows both investigated areas. Both industrial areas have been selected because much green area has been destroyed in the 20<sup>th</sup> century. The Emscher Industrial Area with population of about 2 million people is the central part of the Ruhr region and covers an area of about 800km<sup>2</sup>. The Kitakyushu Industrial Area is situated in the north of Kyushu, with a population of 1 million people and covers an area of about 480km<sup>2</sup>.

## 2. Change of Land use in the Emscher Industrial Area and the Emscher Urban Biotope Network

In this chapter, the change of land use and the role of the urban biotope network in the Emscher Industrial Area have been investigated. The Emscher Industrial Area, one of the most densely populated areas in Germany, is an urban conglomeration of 17 cities. In this study, the city of Essen has been selected. The change of the city area, industrial area and green area of 100km<sup>2</sup> (10x10km) has been investigated for the years 1950, 1970 and 1990. Figure 2 shows this change of land use in the city of Essen. The used mesh was 50x50m. It was found that the city area expanded from about 31% in 1950 until 44% in 1990. The industrial area doubled from 9% in 1950 until 18% in 1990. The city and industrial area together has expanded from 40% in 1950 until 62% in 1990. This has resulted in the decrease of the green area from 60% in 1950 until 38% in 1990. The industrial area has expanded along a south-north axis. The city area has been formed around this industrial area. Green areas have been destroyed especially in the central zone. The more larger green areas have been left over in the west and north zone.

The federal government of the state of North-Rhine Westphalia, to whom the Emscher Industrial Area belongs to, has set up a strategy plan to protect and expand the left over green areas, this to avoid a further destruction of the left over large green areas in the city.

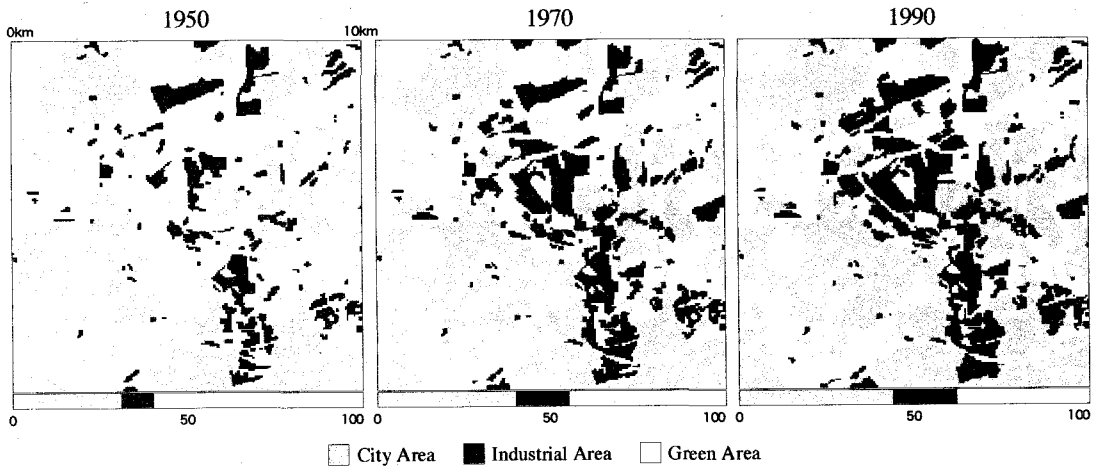


Figure 2 Change of land use in the City of Essen (1950-1990)

The basic framework of this new green infrastructure network, named the Emscher Landscape Park, is made up of some 300km<sup>2</sup> lands running from west to east through the Emscher Industrial Area. This west-east belt has been intersected by 7 green corridors, which are running along a north-south axis. These north-south corridors are formed by the connection of the remaining green areas between the cities. The idea of these large ecological corridors, does not only consists out of the connection of the still existing green areas, but also of the creation of completely new urban biotopes. For example, abandon industrial areas have been regenerated into large natural parks. Figure 3 shows this biotope network plan. There is one large east-west corridor of about 65 km long, and there are 7 north-south corridors. A database of all the existing biotopes has been set up based on land use maps and aerial photographs. This plan is an instrument for urban ecological planning. The function of these west-east and north-south axes is to connect isolated open spaces, and to restore the landscape, as well as to upgrade the ecological quality of the region. Furthermore, this urban biotope network plan protects and avoids a further destruction of large green areas. New urban development projects can only be carried out, if these natural areas are not endangered.

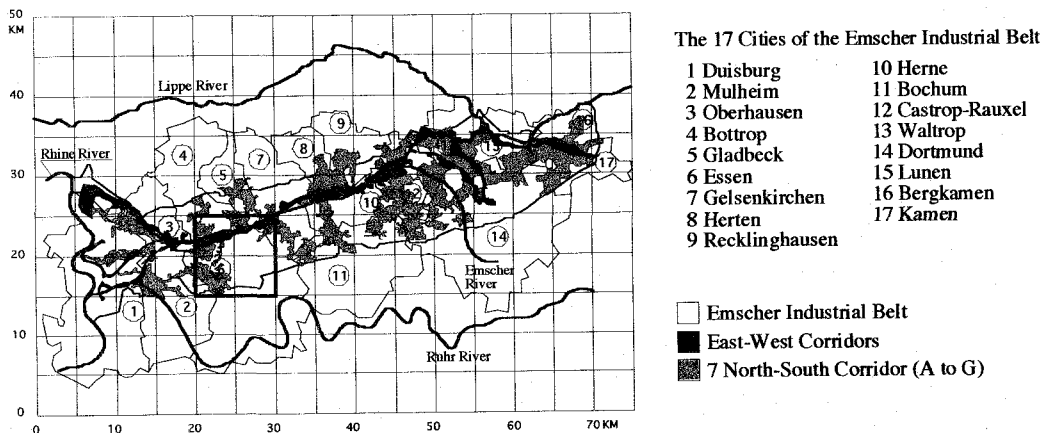


Figure 3 Emscher Urban Biotope Network

### 3. Change of Land use in the Dokaiwan Zone and proposal of a Biotope Network in the Kurosaki Area

In chapter three, the change of land use in the Kitakyushu Industrial Area has been investigated for the years 1900, 1950 and 2000. Similar as in chapter two, an area of 100km<sup>2</sup> (10x10km) has been selected as is shown in figure 4. The selected area is situated around the Dokaiwan Bay, and has been called Dokaiwan Zone. The used mesh was 20x20m. It was found that the city area increased from 3.2% in 1900, 11.7% in 1950 until 25.6% in 2000. The industrial area increased from 0.5% in 1900, 7.0% in 1950 until 13% in 2000. The landfills increased from 0.6% in 1900, 3.8% in 1950 until 9.3% in 2000. Due to these industrial developments, the water area decreased from 38.4% in 1900, 31.6% in 1950 until 21.7% in 2000 and the green area decreased from 57.4% in 1900, 31.6% in 1950 until 21.7% in 2000.

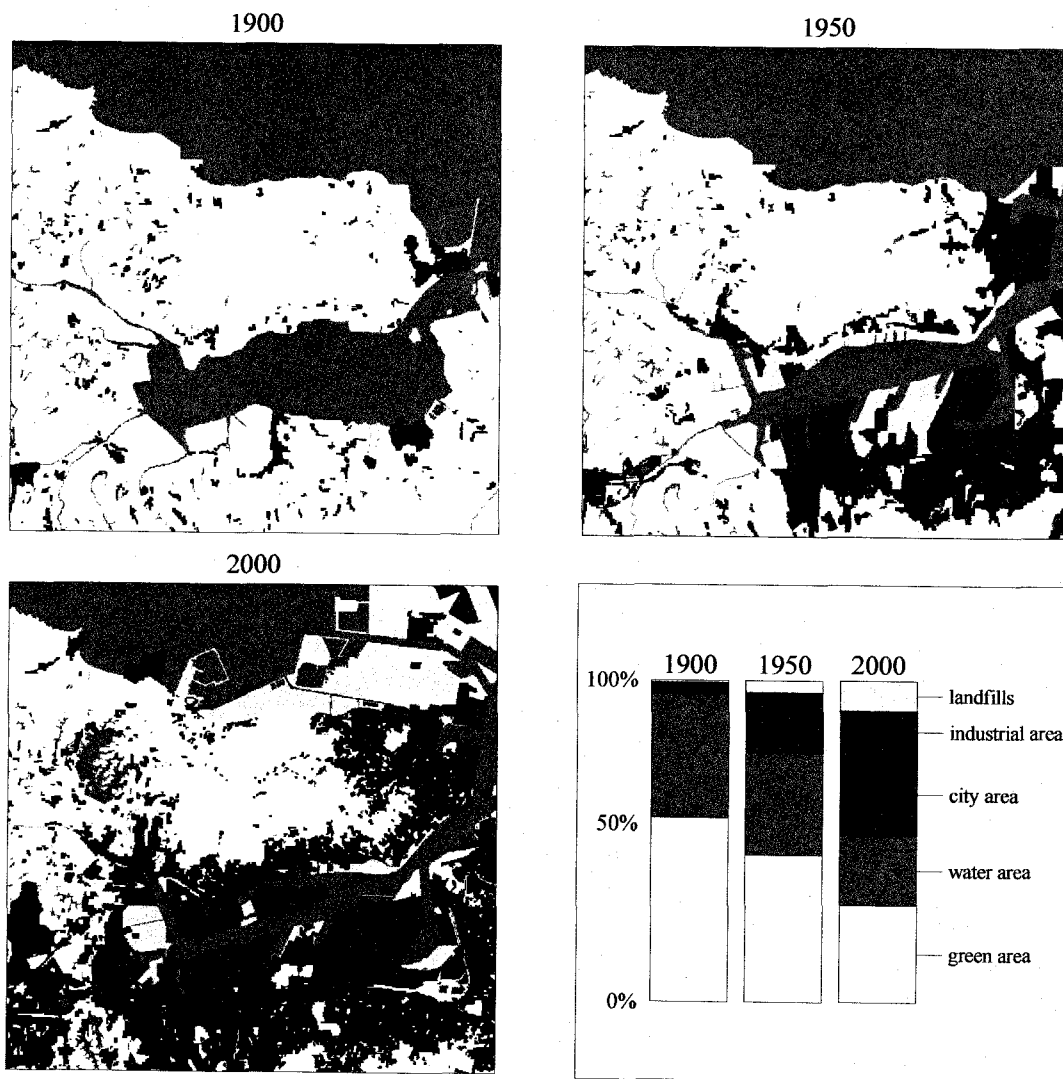


Figure 4 Change of land use in the Dokaiwan Zone (1900-2000)

in 1900, 45.9% in 1950 until 30.3% in 2000. The formation of large industrial zones in especially the south area of the Dokaiwan has resulted in drastic changes of the natural areas.

Within the Dokaiwan Zone, the change of land use in the Kurosaki Area, which is the sub center of Kitakyushu, has been investigated. Natural areas are still endangered by urban developments in the Kitakyushu Industrial Area. To avoid a further decrease of green areas in this zone, an urban biotope network has been proposed. The investigated Kurosaki Area is a zone of 16km<sup>2</sup> (4x4km) as is shown in figure 5. The years 1900, 1925, 1950, 1975 and 2000 have been investigated. It was found that the city area and industrial area together have increased from 2.6% in 1900 until 51.2% in 2000. The water area decreased from 32.9% in 1900 until 14% in 2000 and the green area decreased from 64.5% in 1900 until 34.8% in 2000. At present, more than half of the Kurosaki area consists out of industrial and city area. For the period 2000-2100, an urban biotope network based on a simulation of the change of land use in the 21-century has been proposed.

To create an urban biotope network, it is necessary that as much as possible the urban biotopes be physically connected. However, in urban areas this not always possible, and even it is not always necessary that they are physically connected. Urban biotopes are the habitats where animals could live in the city. It can be said that, the bigger in area these biotopes are, the higher the natural values of the urban biotopes will be. The general concept is to connect as much as possible the existing water and green areas. In the first phase, a green belt has been proposed in the zones along the Dokaiwan and existing rivers. The urban biotope network consists of a southern and northern part. The southern part corresponds with the zone of the existing residential and commercial area. In the most southern part, large green areas are left around the foot of the mountains. A new green infrastructure network has been introduced in the northern part, where the industrial area is located.

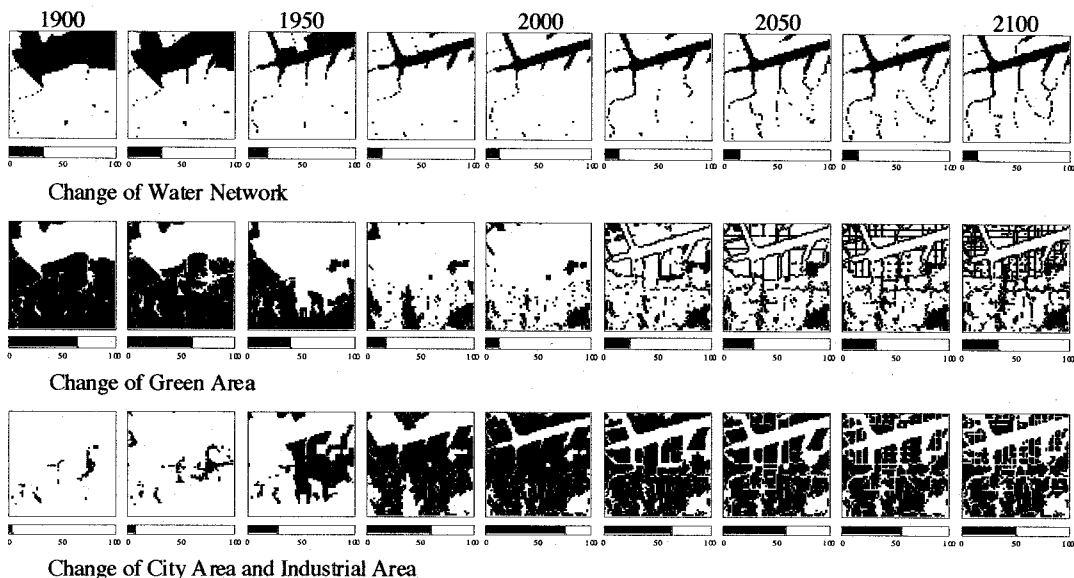


Figure 5 Change of land use (1900-2000) and proposal of an urban biotope network in the Kurosaki Area

In this part, a further changing of the industrial structure in the Kitakyushu Industrial Area has been supposed. So, a new industrial structure could be imagined with new and higher buildings, or even this zone could become in the future residential area as well. For the northern part, the use of a grid has been introduced. The basic chosen grid was 1x1km for the year 2025, 500x500m for the year 2050, 250x250m for the year 2075 and 125x125m for the year 2100. The space in between the high buildings has been used to bring a part of the water of the bay more close to the residential area in the south. The left over space in between the buildings has been filled up with greenery zones. From an ecological point of view, the restoration of the ecotone has been emphasized (an ecotone is the border area between two different ecosystems, in this case, the Dokaiwan and the industrial area). Figure 7 shows an image of what the urban biotope network in the Kurosaki Area could be.

Furthermore, the location of the building function for the year 1995 has been investigated and we find that mainly all the industrial buildings are located in the north, around the Dokaiwan Bay as is shown in figure 6. In the south are the housing, commercial and office buildings located. There is no physical relation between the housing and commercial area in the south, and the Bay in the north.

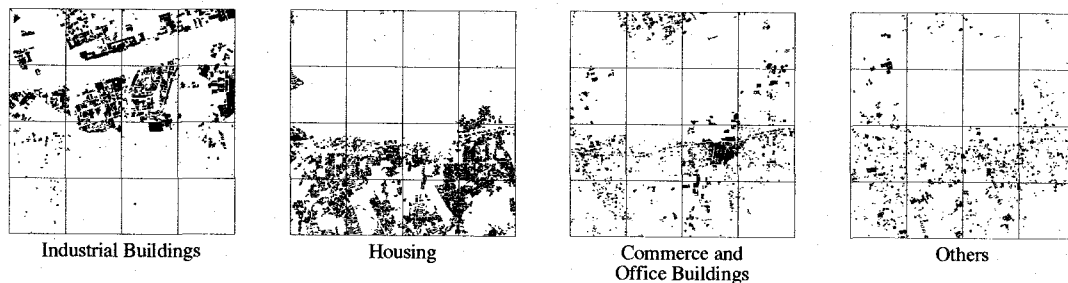


Figure 6 Building function in the Kurosaki Area (1995)

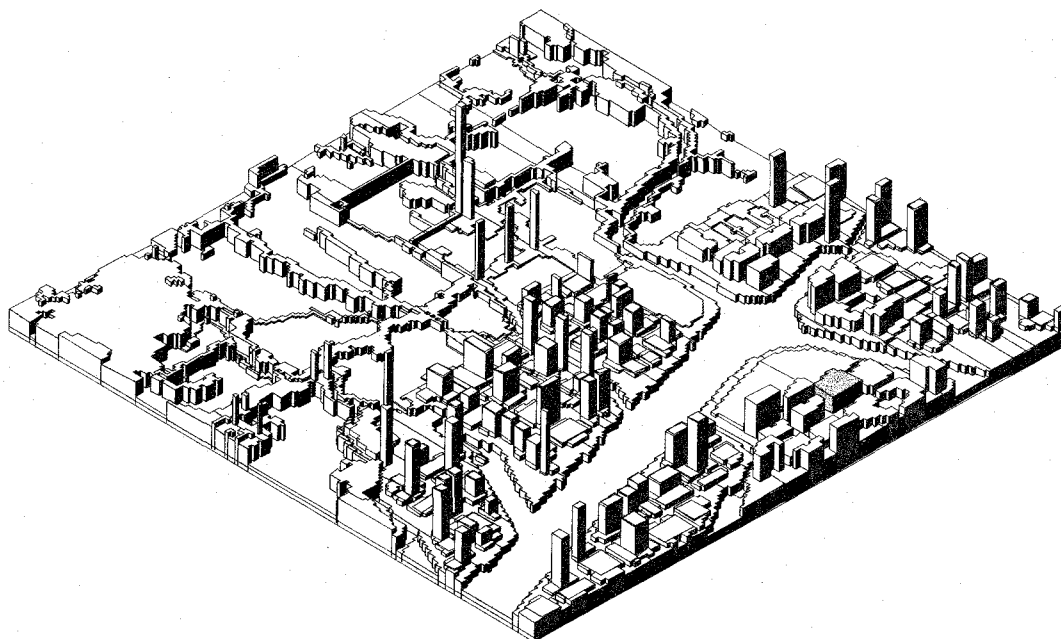


Figure 7 Proposal of an urban biotope network in the Kurosaki Area

To realize an urban biotope network in the city of Kitakyushu and especially in the more urbanized areas, such as the Kurosaki Area, and this based on the experiences of the creation of such a network in the Emscher Park in Germany, following steps must be undertaken. First of all, there must be an understanding of the necessity of an urban biotope network. Following, the city office must make a guideline and a long term plan to realize this biotope network. The plan must have certain flexibility and the citizens could be involved at all the different levels of the planning. Besides of that, existing natural areas must be protected as much as possible and new developed projects must regenerate as much as possible already destroyed green zones. At the moment several activities are undertaken by a group of researchers, named the Kitakyushu Biotope Network Research Team. This research team works in close relation to citizens and city office, mainly concentrates on the diffusion of the concept urban biotope network.

#### **4. Conclusion and prospects for the future**

This research has investigated the change of land use in the Emscher Area in Germany and the Kitakyushu Industrial Area in Japan. It was found that in both industrial areas the city area and industrial area has expanded enormously. This expansion has resulted in the destruction of large natural areas. Furthermore, an urban biotope network has been proposed for the Kurosaki Area, similar as the urban biotope network in the Emscher Area. By way of linking existing and increasing new green zones in the urban area into green belts on a regional scale, the approach of this Emscher urban biotope network can be seen as a solution for the regeneration of old industrial regions into ecological qualitative landscapes, and could serve as a possible solution for the ecological regeneration towards sustainable development of many ravaged industrial landscapes in Japan as well.

In urban ecology, the concept of an integrated nature conservation strategy has become important. Germany has a long tradition of scientifically thorough mapping activities, with the ultimate goal of increasing the ecological value of the urban greenery. Around 200 towns and cities in Germany have carried out urban biotope mapping. In Japan however, nearly no cities have conducted urban biotope mapping. Biotope mapping has become necessary in dense populated urban areas and must be carried out by an interdisciplinary group of geographers, biologists and environmental planners, among others. This research has shown the increasing necessity of urban biotope mapping as an instrument to avoid a further decrease of natural area in the city. In my following research, the investigation of the possibility of biotope mapping in the Kitakyushu Industrial Area will be undertaken.

#### **Acknowledgement**

The "Research on the Regeneration of Nature in the Kitakyushu and Ruhr Industrial Area" has been supported by a "grant-in-aid for Scientific Research of the Japan Society for the Promotion of Science" and the by "Sumitomo Foundation", the "Research of biotope mapping in the Kitakyushu Industrial Belt" has been supported by a grant-in-aid of the "Kajima Foundation" to whom I wish to express my sincere and deep gratitude.