HOOFDSTUK 14 SUMMARY – THE BIODIVERSITY OF THE NETHERLANDS

This book provides an up-to-date survey of the biodiversity of the Netherlands. The treatment of all taxonomic groups which occur in the Netherlands forms the core (chapter 5). Around 100 specialists contributed to this unique survey. The other chapters highlight many aspects of the Dutch biodiversity: natural history (chapter 2), research (chapter 3), classification (chapter 4), patterns (chapter 7), trends (chapter 8), government policy (chapter 10) and nature management (chapter 11). In this summary we focus on the taxonomic treatments. They show that even a small and geologically relatively young country such as the Netherlands, harbours an immense diversity in life forms.

Most people associate biodiversity with flowering plants, birds, mammals, and maybe butterflies or fishes. In the Netherlands these groups are limited to a mere 2000 species, just a fraction of the 47,800 settled species. It is a pity that other groups are not better known, because they contain many fascinating, frightening and freaky species. Think about gall mites flying hand-in-hand, mushrooms parasitising mushrooms, stampeding barklice, slave-keeping ants, clams hooked up to fish and viviparous coccids. Each of these species is unique and has its own role in our ecosystems. For many species we know almost nothing apart from their name, so there is ample space for new discoveries. Take, for example, the Cycliophora, a small phylum discovered as recently as 1995. These minute animals live on the hairs of the mouthparts of lobsters and were not yet known from Dutch waters. Inspired by the work for this book, some research on lobsters in the collection of the National Museum of Natural History in Leiden yielded the first specimens of this remarkable group for the Netherlands. But who will search for the similarly obscure Mesozoa, the many as yet unrecorded cyanobacteria or parasitic wasps? Many challenges remain.

Biodiversity by numbers

Table 1 in chapter 6 shows that 47,800 settled species occur in the Netherlands. Settled means that a species has lived here for a period of at least ten years consecutively, without direct aid of man, irrespective whether their origin is indigenous or alien. For the unicellular species these numbers are not very precise, but the counts of multicellular species are usually based on actual species lists, provided with literature sources. These lists are maintained in the webbased database Dutch Species Catalogue (www.nederlandsesoorten.nl).

Table 1 in chapter 6 also shows total world numbers for each taxonomic groups, now approaching two million. The distribution of the numbers of species over the major groups are not very different globally and in the Netherlands, with relatively few plants, with 3894 species (ca. 10%, globally ca. 16%), Fungi contain 10,300 species (ca. 22%, globally ca. 5%) and most species in our country are animals (27,758, ca. 58%, globally ca. 76%). Within the animals the insects are – as everywhere – the dominant group, with 19,684 species (71% of the animals, globally ca. 68%). One must however bear in mind that the percentage of described species varies much per taxonomic group. The numbers given here might change drastically if for example more species are described in relatively unknown groups such as mites, molluscs, nematodes and especially bacteria.

These numbers include 1100 exotic (or alien) species, whose arrival was aided by man. Plants are, not surprisingly, relatively numerous among the aliens, since gardens and nurseries are important sources for escapees. Exotic species which have lived less than ten years in the Netherlands are excluded from the statistics. These include many insects which are occasionally imported, or garden plants which escape but cannot naturally survive our winters.

Evolution and classification

The tree of life has seen dramatic changes in the last decades due to modern DNA research. For this book we have placed all the taxonomic groups in the evolutionary or phylogenetic relationships, by showing phylogenetic trees, summarising these modern scientific results. Since the classification used follows these trees, remarkable changes can be observed compared with former handbooks and the like. Biota are no longer divided into plants and animals, but into the domains Eubacteria, Archaea and Eukarya. The latter again is divided into four supergroups: Plantae, Chromalveolata, Excavata and Unikonta. The Unikonta comprise some amoeboid organisms and the fungi and animals. The classification follows the principles of the cladistic school, avoiding so called paraphyletic groups, meaning that, for example, birds (as dinosaurs!) are now part of the Reptilia.

Form and function

About 15% of the Dutch species have a basic form which does not concur with the normal picture of animals or plants: they are unicellular. These are the bacteria, many algae and what used to be called 'protists'. Recent research has shown that the latter form not a natural group, since all multicellular organisms (plants, brown algae, fungi, animals) have their closest relatives amongst the unicellular groups. The unicellular species show a remarkable variety in form and life style, which remains hidden for those who don't have access to a microscope. Some species are primary producers and contain chlorophyll. These are preyed upon by herbivores, which in turn are eaten by predators. Many unicellular organisms can be considered detritivores and quite a few have a parasitic life style.

Multicellular species show an even larger diversity, because groups of cells are specialised for different tasks. This is clear in flowering plants, where the cells responsible for anchorage, uptake of water and food are called the root. Cells meant for stability and vertical transport form the stem and those responsible for transforming solar energy in sugars are

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called the leaf. The group of cells which have a reproductive function form the flower. In the Fungi the morphological diversity is somewhat less, but in animals evolution has been most inventive. The simplest sponges to the megadiverse insects show intriguing specialisations. Even the seemingly uniform 'worms' (about 8% of the Dutch species) show an interesting variety of body plans and life histories.

Dutch species range from microscopic (e.g. unicellular organisms, Cycliophora) to gigantic (trees, mammals, birds). Less obvious large organisms include some fungi with extensive underground mycelia and ribbon worms. The longest animal of the Netherlands is the aptly named *Lineus longissimus,* a ribbon worm (phylum Nemertea) with a maximum length of 30 m. Although large species are most conspicuous, small species also have ways to stick out. Fireflies and the marine dinoflagellate *Noctiluca scintillans* shine in the dark and cyanobacteria, copepods and chironomid midges occur in huge aggregations.

Distribution

The flora and fauna of the Netherlands are among the best studied in the world. Databases with millions of distribution data are available for many species groups. Diversity maps from these databases are presented here for several groups. These maps show the number of recorded species per 5 km grid square. For some well-investigated groups, such as birds (p. 299) and dragonflies (p. 204), the maps show real diversity patterns, but for many others the maps mostly reflect the recording effort (see the woodlice on p. 191 and Pterophoridae on p. 250). In chapter 7 these maps have been combined for terrestrial and aquatic groups (fig. 17 and 18 on p. 329 and 332). The higher sandy soils in the south and north-east of the country show the highest biodiversity. Two typical Dutch landscapes, the marine clay area and the eutrophic fen area in the western part of the country, are relatively species poor.

Dutch biodiversity is not static, but changes continuously. For several groups the rate of local extinction is well documented: 16 of 27 stonefly species (ca. 60%), 24 of 78 butterflies (ca. 31%) and 30 of 350 bees (ca. 9%) have disappeared. Many other species are reportedly in decline due to changes in the Dutch landscape. On the other hand, many species extended their range, some after a period of decline or absence. Remarkable examples are several birds of prey which have profited from the decreasing hunting pressure and the dragonfly *Gomphus flavipes* which has recolonized the now cleaner large rivers. Several species have reached the Netherlands in recent times. Many exotic species were imported by man and southern species have been able to establish populations as a result of the more favourable climatic circumstances. The number of groups for which these changes are documented are rather limited, but similar patterns can be assumed for other groups. It is expected that new species will continue to arrive in the coming decades. This will include colourful birds such as bee-eaters, but also less pleasant company such as termites and scorpions.

Biodiversity and man

Man *Homo sapiens* is one of the common Dutch species, but a special one at that. No other species has such an enormous impact on biodiversity. Humans have changed all habitats, soil, air, water and climate. This has affected many species which live in the natural landscapes negatively. But man has also shaped many new habitats: agricultural land, cities and roadside verges. The human body forms a special habitat for many species, such as fleas, midges, ticks, worms and bacteria. All these influences have provided a whole range of species the possibility to live in the Netherlands. It could well be that these new species outnumber those which have been driven to local extinction. We could say that the net result is thus positive, and policy makers like to do so. The problem is that the disappearing species are mostly rare and characteristic of stable old habitats, and new species are widespread and living in disturbed sites and wastelands. At a European scale rare and/or characteristic species become extinct and common and/or eurytopic species become even more common. This leads to homogenization of the European and global biodiversity.

Biodiversity provides us with many so-called ecosystem services. We eat many species and make use of natural products such as wood. Many drugs are derived from plants or animals, plants help cleaning the air and produce oxygen, prevent erosion and are used in helophyte filters. In agriculture many arthropods are used for controlling pest organisms. Bees and hoverflies play a crucial role in pollination of crops.

On the other hand, many species are considered a nuisance or even dangerous, such as mosquitoes, horseflies and ticks. Colorado beetles devour our potato plants, bacteria let wooden piles collapse and biting midges transmit the blue tongue virus. The Dutch bulb fields are infested with larvae of the narcissus bulb fly, mole crickets and larvae of leaf beetles. In many cases man himself is the very cause for these problems, by providing the preferred habitat for these species in unnatural expanses.

All in all it seems sensible to preserve biodiversity as good as possible. Biodiversity provides us with means of life that we can not do without, and who knows which species can be of use in the future? We could also consider protection to be an obligation towards the species which were mostly already present before we arrived. And finally, the Netherlands would become quite boring without the possibility to stand eye to eye with a roe deer in the forest or to meet groups of geese in the meadows, hear the songbirds in spring and the stridulating bushcrickets during warm summer evenings, and observe hunting jumping spiders on the wall of our garden shed. Biodiversity means life.

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