Vegetation change in a lichen-rich inland drift sand area in the Netherlands

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with 3 figures and 4 tables

Abstract: In this paper we compare the cryptogam vegetation in the Spergulo-Corynephoretum and Genisto-Callunetum in an inland drift-sand area in three periods (1968, 1993 and 2004). In the early period the lichen diversity in these plant communities appeared to be very high. The aspect was formed by Corynebicus canescens and Polytrichum piliferum. The highest numbers of lichen species are found in the S.-C. cladonietosum, irrespective of the period. In all years, variants of this subassociation are found, with many lichen species. In time pH decreases and organic matter, % total N and % total P increase by humus production. Cover sands having relatively high content of cations form a suitable substrate for lichens. Since the 1970s the neophytic moss Campylopus introflexus, a species adapted to acidic, nutrient-poor sand, has invaded the sand dunes. These changes have been attributed to the high aerial deposition of N in this central part of the Netherlands. In the more recent periods the actual lichen diversity did not really diminish, but the cover of lichen-rich plant communities was clearly reduced when encroaching mosses outgrew the lichens in all succession stages. However, when C. introflexus is less vital because of ageing, desiccation or burial under wind-blown sand, common humicol, aero-hygrophytic and even pioneer lichen species may locally establish on or between the moss cushions. The former succession series starting with P. piliferum and ending with lichen-rich Calluna heath (1968) has been partly replaced by one including C. introflexus (1993 and 2004). Process management is necessary to keep the sand blowing and hereby reduce the colonization by C. introflexus. Habitat restoration by small-scale management consisting of cutting down self-sown trees and removing the top soil has positively influenced lichen diversity and needs to be continued.

Keywords: acidification, biodiversity, Campylopus introflexus, Cladonia, Genisto-Callunetum, invasive species, management, Spergulo-Corynephoretum, terricolous lichens.

Introduction

In the central part of the Netherlands, the Veluwe, Pleistocene sands have been deposited and blown into inland sand dunes, resulting from overexploitation of the former vegetation by men. Here large areas of acidic and nutrient-poor drift sand existed until the end of the 19th century when they were afforested for the greater part with Scots pine trees (Pinus sylvestris), see Riske et al. (2006).

Without management, through succession, the pioneer communities on the drift sand change into grassland, followed by heath and finally by forest consisting of self-sown Scots pine or deciduous trees. If left unchecked, ultimately only a small area of the open drift-sand ecotope will survive. This process has been taking place on drift-sand areas all over the Netherlands since the 1970s, and biodiversity has declined alarmingly as result of high aerial deposition (Quené-Boterbrood 1988; de Smidt 1995).

In 1959 the first vegetation survey on inland sand dunes and heath of the Veluwe was published (Stoutjesdijk 1959). It paid much attention to the relation between landscape structure, vegetation, soil and microclimate. Until well into the 1970s mats of reindeer lichens locally covered the transition area between the sand dune ecotope and heath, especially in blown-out depressions near the edges of the planted pine wood.

Since the 1960s, interest in the botany of the inland and coastal heath and sand dunes has grown; there have been vegetation surveys by de Smidt (1977) and detailed descriptions of the cryptogam richness of these ecotopes, a.o. by Pos (1968) and Daniëls et al. (1987).

In the Spergulo-Corynephoretum, the characteristic pioneer community of the inland sand dunes, the decrease of species from dry oligotrophic biotopes was accompanied by an increase in the size and abundance of graminoids, also species of such biotopes. Moss encroachment, with the alien moss species Campylopus introflexus forming a large biomass, had a direct impact on succession. Since the 1970s, this alien moss species from the southern hemisphere, has been gradually increasing in coastal and inland sand dunes of Western Europe (Van der Meulen et al. 1987). Its rapid dispersal and its high humus production are likely the main threats to the inland sand dune ecosystem (Hasse 2007).

Research objectives

The objective of the present study is to compare the vegetation composition of an inland sand dune area in three periods (1968, 1993 and 2004). Our purpose is to gain insight in the composition of the cryptogam vegetation before the 1970s and to study the changes