



# Anthropogenic Transformations of the Bagno Chlebowo Peat-bog (Wielkopolska Province)

ZBIGNIEW CELKA & PIOTR SZKUDLARZ

*Department of Plant Taxonomy, Adam Mickiewicz University, Niepodległości 14,  
61-713 Poznań*

**ABSTRACT:** The study reports human-imposed changes that have affected over the past two centuries the flora and the vegetation of Wielkopolska's largest peat-bog complex, known as the Bagna ('Swamps'), situated near Chlebowo, ca. 35 km north of Poznań. The transformations to be discussed involve the disappearance, persistence and encroachment of various plant species and communities.

**KEY WORDS:** peat-bog, Poland, Wielkopolska, plant cover, anthropopressure, *Aronia x prunifolia*.

## 1. Introduction

Peat-bogs are systems affected by violent and far-reaching changes in recent times. The changes have for the most part been imposed by direct or indirect human activity. A large number of such complexes have been significantly transformed, partly as a result of their economic utilisation (Jasnowska 1995).

Wielkopolska is an area with moderately abundant peatlands, most of which, however, are low peat-bogs. The scarcer raised peat-bogs include the Bagna ('Swamps') complex near Chlebowo (Jasnowski 1975). Covering an area of approximately 500 ha, it is the largest system of its kind in Wielkopolska. It is situated ca. 35 km north of Poznań and 11 km north of Oborniki (cf. Fig. 1), within the Toruń–Eberswalde Proglacial Valley and the eastern reaches of the Nadnotecka Forest, in the valley of the river Warta (Kondracki 1998). The complex occupies an enclosed depression with a gentle westward slope, flanked by dunes along its northern, western and southern margins. Meadow complexes and transitional peat-bogs have developed at its peripheries, while the central part is an already





Fig. 1. The Bagny Chlebowo peat-bog: a) in 1890; b) in 1976



extinct raised peat-bog. The Bagno Chlebowo peatland is listed as one of the Polish nature refugia (Dyduch-Falniowska *et al.* 1999).

The aim of the present study is to characterise the processes that have affected the vegetation of the peat-bog complex over the past two centuries as a result of land drainage and the exploitation of peat deposits.

## 2. Materials and methods

The analysis of anthropogenic changes in the Bagno Chlebowo peat-bog is based on various types of data. Cartographic information is provided by topographic maps to a scale of 1:25 000 – a German map of 1890 (a sheet representing Polajewo, Kreis Obornik, Reg. Bez. Posen; Königl. Preuss. Landes-Aufnahme 1890, published 1892) and a Polish map of 1982 (the Boruczyn sheet, published by Geokart) – cf. Fig. 1. The literature of the subject includes a small number of published sources (e.g. Czubiński & Świtalska 1937; Wodziczko *et al.* 1938; Ilnicki 1996). Field observations at the Chlebowo complex have been conducted by the authors since the late 1980s, and particularly intensive research work was done in the years 1997–1999.

## 3. Anthropogenic changes in the flora and the vegetation of the peat-bog complex

The Bagno peat-bog near Chlebowo has been strongly affected by human activity since the nineteenth century. The changes have been connected with land drainage by means of the Ludomicki Canal and a system of ditches. The lowering of the water table made peat exploitation possible; on the other hand, it has resulted in the extinction of the peat-bog (Schulz 1916). Exploitation progressed in stages. Depending on the method of excavation, two phases can be clearly distinguished. The first lasted until the end of World War II, the second extends over the post-war period. Initially, peat was extracted in peripheral areas of the peat-bog, particularly in its northern and western parts. It was obtained chiefly with hand tools. During the second phase, exploitation reached the central part of the complex; it has been carried out till now with the use of mechanical shovels that can extract peat from a considerable depth. The use of mechanical equipment has necessitated the construction of several hard-surface roads that intersect the area at present. This method of peat extraction has also produced a large number of water-filled post-excavation pits.

Before World War II, when peat was obtained from shallow deposits, the ecological succession typically resulted in thickets or climax communities of *Betula pubescens* and *Pinus sylvestris*. The process is particularly well exemplified in the northeastern part of the complex. Places where peat was extracted are now faintly marked in the landscape as shallow depressions with vegetation consisting mostly of sphagnum moss, as well as *Betula pubescens*, *Pinus sylvestris*, *Frangula alnus*, *Molinia caerulea*, *Eriophorum angustifolium*, *E. vaginatum*, *Vaccinium myrtillus* and *Oxycoccus palustris*. On dykes separating the depressions one encounters old specimens of



*Pinus sylvestris*, and the locally rare species *Vaccinium uliginosum* and *Dryopteris cristata*.

The central part of the bog, where peat has been excavated with mechanical shovels, is now punctuated by numerous water-filled pits of considerable dimensions; the largest of them have areas measuring several hectares and may be several metres deep. The recovery of peat-bog plant communities is taking place very slowly. Spontaneous renaturalisation in that area has been studied in detail by Ilnicki (1996). His research was conducted in the central part of the Chlebowo complex, within an area of 64.4 ha. Ilnicki (1996) finds that post-excavation pits cover 65.4% of the area, and 25.9% is occupied by thickets and tree communities. Within the pit ponds, the open-water zone accounts for 85.3% of the area, emergent and surface vegetation occupying the remaining 14.7%. In ponds different scenarios and phases of ecological succession are represented. Most typically, succession begins at the edge of the water as the encroachment of emergent-phase communities including *Phragmites australis*, *Typha latifolia* and *Eleocharis palustris*, or the expansion onto the water surface of a sphagnum carpet, accompanied by *Oxycoccus palustris*, *Drosera rotundifolia* and *Eriophorum vaginatum*, as well as other species. The moss layer is then encroached upon by *Betula pubescens* and *Pinus sylvestris*. These processes are most evident in the southeastern part of the complex, and are parallel to those presented by Podbielkowski (1960). In larger ponds, surface undulation hinders the encroachment of the plant carpet. Natural succession is also slowed down by human activity affecting many of the peat ponds, which are rented by individual users who stock them with fish fry and clean the water surface of plants, such as the genera *Potamogeton* and *Utricularia*. At several locations peat extraction is still being carried out, the peat ponds in question being systematically enlarged.

Drainage works in the area have led to the subsidence of the water table by approximately 0.6 m, which in turn has caused the desiccation of the upper peat layer and drastic changes in the flora. Numerous species characteristic of peat-bog communities, e.g. *Saxifraga hirculus* and *Scheuchzeria palustris*, which used to occur in the area were no longer found there in the 1930s (Czubiński & Świtalska 1937). The retreat of this type of species is accelerated by droughts that occur at several years' intervals. In the early 1980s *Drosera intermedia*, *Carex limosa* and *Rhynchospora alba* could still be encountered in the best-preserved peat-bog in the western part of the complex Celka & Szkudlarz (1999). Research carried out in the years 1997–1998 did not reveal the presence of these species. Desiccation has resulted in the disappearance of the local micro-biotopes of such taxa, which can be considered extinct in this area. Certain species recorded as abundant before World War II, e.g. *Dryopteris cristata* or *Gentiana pneumonanthe*, have since regressed. In recent years also *Andromeda polifolia* and *Ledum palustre* have suffered decline in terms of condition and abundance.

Despite the radical changes that have affected the Bagno Chlebowo complex, its vascular flora still includes more than 300 species. This number includes 13 taxa from the red list of endangered peat bog species (Jasnowska & Jasnowski 1977). Water reservoirs created during as a result of peat exploitation have enabled a



group of water species to survive. Those species include *Wolffia arrhiza* and species of the genus *Utricularia* (Fig. 2). Another noteworthy survival reported from the western (as well as southeastern) part of the complex is *Potentilla anglica* (Krawiec 1935). An *Empetrum nigrum* site, isolated from the continuous range of the species, has also been found within the complex (Celka & Szkudlarz 1999). The plant occurs at a single locality, occupying a compact patch of several square metres. Despite the ongoing environmental changes the site remains in good condition. The only threat to its survival is the deterioration of sunlight conditions caused by the fast growth of pine-trees in its vicinity – a consequence of drainage.

The partial removal of natural vegetation from the peat-bog complex has created favourable conditions for the encroachment and proliferation of species that are not characteristic of peat-bog habitats. One can observe the encroachment of colonising species from several directions. It may proceed from the human settlements to the north and southeast of the complex. For example, *Artemisia vulgaris*

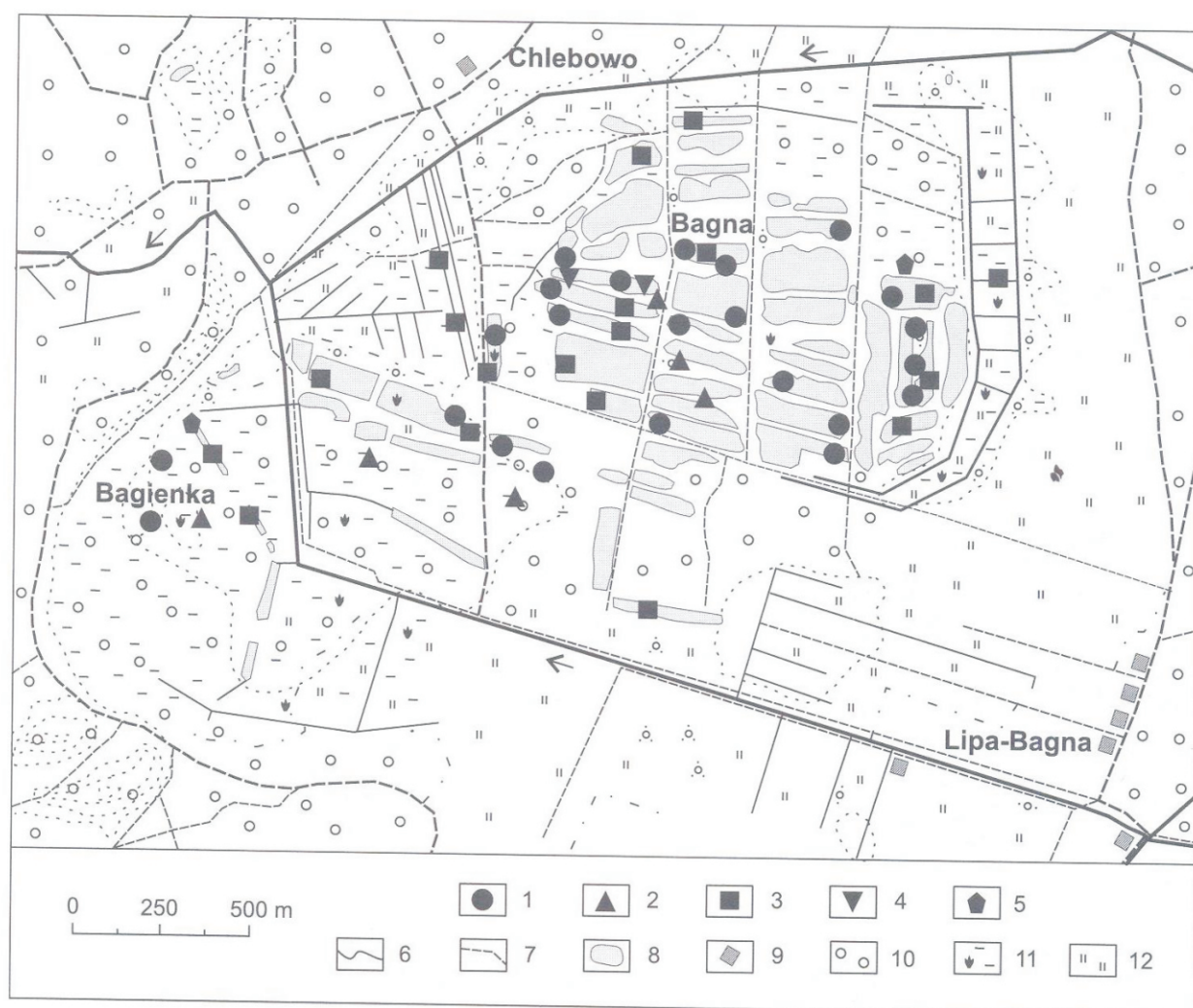


Fig. 2. Distribution of selected non-synanthropic spontaneophytes in the area of the Bagno Chlebowo peat-bog

- 1 – *Drosera rotundifolia*, 2 – *Andromeda polifolia*, 3 – *Utricularia vulgaris*, 4 – *Wolffia arrhiza*, 5 – *Dryopteris cristata*, 6 – watercourses, 7 – roads, 8 – post-extraction pits, 9 – buildings, 10 – woods, 11 – marshes, 12 – meadows



and *Sonchus asper* encroach in this manner (Fig. 3). Numerous species enter along transport routes. The road providing access to the currently exploited areas plays a significant role. Along that road, which is used by heavy equipment, one can often encounter, among others, *Galinsoga parviflora*, *Lactuca serriola*, *Ballota nigra*, *Artemisia vulgaris*, and *Melandrium album*, whereas *Juncus tenuis* abounds along the less frequently used road in the eastern part of the complex. Also in the vicinity of hunting lookouts in the western part of the complex, in the area of the so called 'Little Swamps', one can observe the encroachment of species, e.g. *Rumex obtusifolius*, *Urtica dioica*, *Agropyron repens* and *Polygonum persicaria*. *Bidens frondosa* can also be seen among the plants colonising the edges of post-extraction ponds. A separate and interesting issue is the persistence and proliferation of *Aronia x prunifolia*. This species is cultivated and utilised in Poland, but it can sometimes occur as an escapee plant. In the area under research *Aronia x prunifolia* is found in considerable numbers at places such as sunny dikes separating peat ponds (Fig. 3).

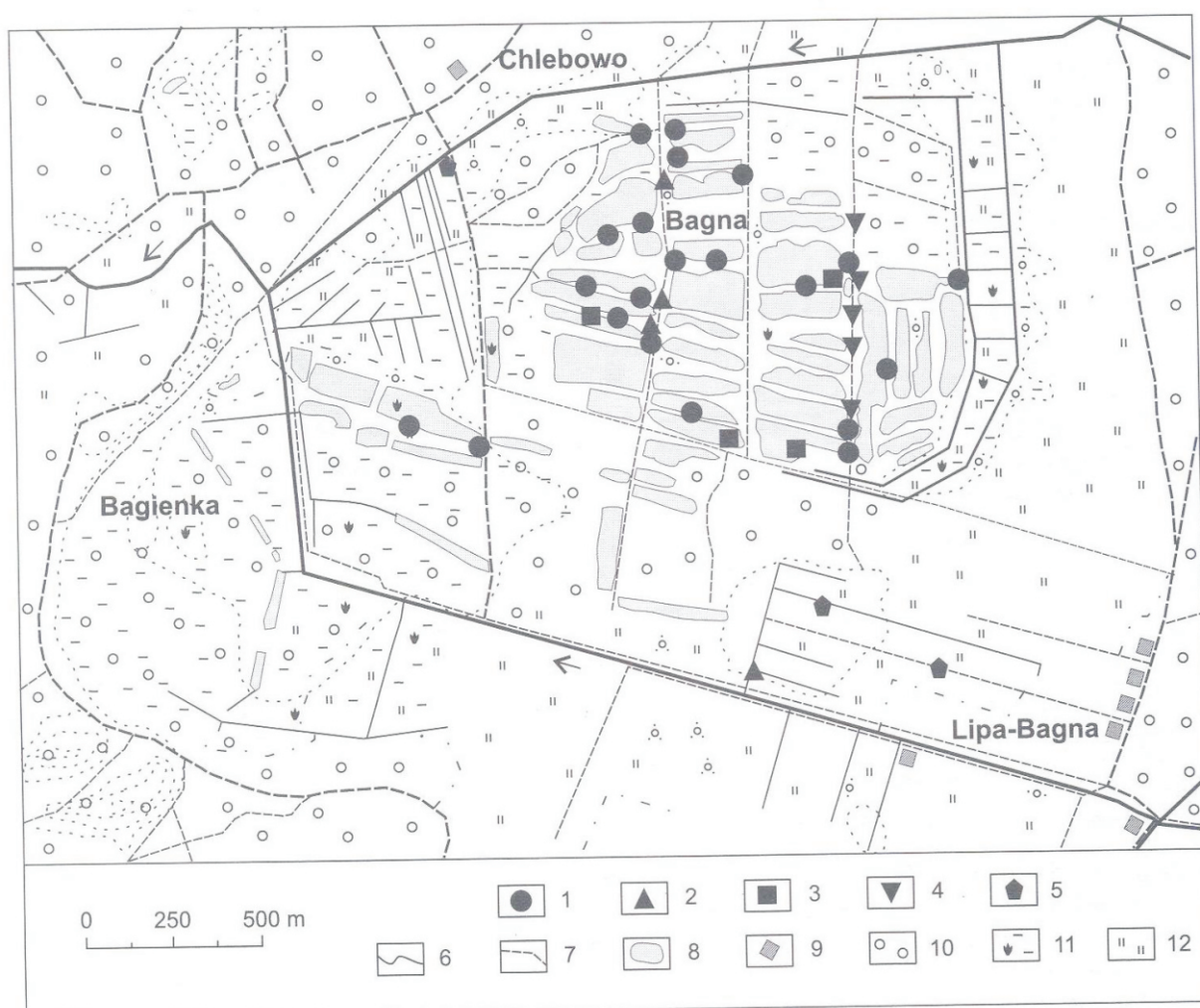


Fig. 3. Distribution of selected anthropophytes and apophytes in the area of the Bagno Chlebowo peat-bog

1 – *Aronia x prunifolia*, 2 – *Artemisia vulgaris*, 3 – *Bidens frondosa*, 4 – *Juncus tenuis*, 5 – *Sonchus asper*, 6 – watercourses, 7 – roads, 8 – post-extraction pits, 9 – buildings, 10 – woods, 11 – marshes, 12 – meadows



## 4. Conclusions

Land drainage and peat exploitation have caused drastic changes both in the flora and in the vegetation of the peat-bog. Thanks to earlier observations it is possible to distinguish a group of particularly sensitive species that disappeared from the area probably as soon as drainage had begun. These undoubtedly include *Saxifraga hirculus* and *Scheuchzeria palustris*. Other sensitive species are *Drosera intermedia*, *Carex limosa* and *Rhynchospora alba*, which persisted longer but eventually succumbed to environmental changes that have increased in recent years. Less sensitive species include, among others, *Dryopteris cristata*, *Vaccinium uliginosum* or *Gentiana pneumonanthe*. They still remain in the flora of the peat-bog complex, though numerically depleted and facing a threat of extinction on a local scale. As observations indicate, spontaneous renaturalisation does not guarantee the restoration of the original diversity of the flora. In none of the patches of restored vegetation does one find species from groups particularly sensitive to changes in water conditions.

Major as the changes are, the peat-bog complex is not vulnerable to the encroachment of alien species. Desiccation leads, first of all, to the reduction of diversity and to the predominance of one or several members of the ecological complex, e.g. *Pinus sylvestris*, *Betula pubescens* or *Frangula alnus*. Species alien to the peat-bog flora, e.g. *Plantago major*, *Galinsoga parviflora* and *Ballota nigra*, encroach and persist in the most altered habitats, such as roads surfaced with material of non-local origin. *Aronia x prunifolia*, which thrives on sunny dikes separating peat ponds, is an exception.

## References

- CELKA Z. & SZKUDLARZ P. 1999. Nowe informacje o występowaniu *Empetrum nigrum* L. w Wielkopolsce [New Data on the occurrence of *Empetrum nigrum* L. in Wielkopolska]. Bad. Fizjogr. Pol. Zach., seria B – Botanika 48: 159–166.
- CZUBIŃSKI Z. & ŚWITALSKA H. 1937. Torfowiska mszarne Wielkopolski i ich ochrona [Sphagnum-bogs of Wielkopolska and their preservation]. Wyd. Okr. Kom. Ochr. Przyr. na Wielkopolskę i Pomorze 7: 38–57.
- DYDUCH-FALNIEWSKA A., KAŹMIERCZAKOWA R., MAKOMASKA-JUCHIEWICZ M., PERZANOWSKA-SUCHARSKA J. & ZAJĄC K. 1999. Ostoje przyrody w Polsce [Nature refugia in Poland]. 244 pp. Instytut Ochrony Przyrody. PAN, Kraków.
- ILNICKI P. 1996. Spontaniczna renaturalizacja wyeksploatowanych torfowisk wysokich [Spontaneous renaturalisation of vegetation on worked-out raised bogs]. Przegląd Przyr. 7 (3–4): 113–127.
- JASNOWSKA J. 1995. Konsekwencje melioracji wodnych w świetle badań geobotanicznych [Impact of drainage in the light of geobotanical studies]. In: Tomiałojć L. (Ed.). Ekologiczne aspekty melioracji wodnych [Ecological aspects of land drainage]. Pp. 27–35. Instytut Ochrony Przyrody PAN, Kraków.
- JASNOWSKA J. & JASNOWSKI M. 1977. Zagrożone gatunki flory torfowisk [Endangered plant species of the peat-bog flora]. Chrońmy Przyr. Ojcz. 33 (4): 5–14.
- JASNOWSKI M. 1972. Rozmiary i kierunki przekształceń szaty roślinnej torfowisk [Extent and directions of plant-cover transformation in peat-bogs]. In: Faliński J. B. (Ed.).



- Synantropizacja szaty roślinnej [Synanthropisation of the plant cover]. III. Podstawy teoretyczne i metodyczne badań nad synantropizacją szaty roślinnej [Theoretical and methodological basis of research on the synanthropisation of the plant cover]. *Phytocoenosis* 1 (3): 193–209.
- JASNOWSKI M. 1975. Torfowiska i tereny bagienne w Polsce [Peat-bogs and swampy areas in Poland]. In: N. J. Kac. *Bagna kuli ziemskiej* [The Earth's Swamps]. Pp. 356–390. PWN, Warszawa.
- KONDRACKI J. 1998. *Geografia regionalna Polski* [Regional Geography of Poland]. 441 pp. Wyd. Nauk. PWN.
- KRAWIEC F. 1935. Rezultaty wycieczek florystycznych po Wielkopolsce [Results of floristic excursions in Wielkopolska]. *Wyd. Okr. Kom. Ochr. Przyr. na Wielkopolskę i Pomorze* 5: 100–108.
- PODBIELKOWSKI Z. 1960. Zarastanie dołów potorfowych [The development of vegetation in post-extraction peat pits]. *Monogr. Bot.* 10 (1): 1–144.
- SCHULZ C. 1916. Moorkultur und Naturdenkmalspflege. *Zeitsch. Natruwiss. Abteil.* 23 (1): 3–8.
- WODZICZKO A, KRAWIEC F. & URBĄŃSKI J. 1938. Pomniki i zabytki przyrody Wielkopolski [The natural monuments of Wielkopolska]. *Wyd. Okr. Kom. Ochr. Przyr. na Wielkopolskę i Pomorze* 8: 1–472.