

Botanical field trip

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Synanthropization of flora and vegetation: phenomena and processes observed in the Warta and Noteć Rivers Interfluve (Toruń-Eberswald Proglacial Stream Valley)

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Objective

The aim of the field trip of botanists participating in the 11th International Scientific Conference “Synanthropization of Flora and Vegetation” is to discuss a number of aspects associated with anthropogenic transformations of the plant cover concerning different levels of nature organisation: from landscape to population. The route of the trip leads through the Toruń-Eberswald Proglacial Stream Valley, an area important for the post-glacial natural history of Central Europe and interesting from the point of view of contemporary plant cover changes.

Key issues

- Decline of *Potentillo albae-Quercetum* – the process of regeneration of vegetation resulting from indirect human pressure or other forms of anthropogenic influence? Is there any chance to stop this process?
- Transformations of the swampy complex following long-term peat exploitation; regression of native species and expansion of alien species.
- River valleys as historical and contemporary plant migratory routes; native and alien species accompanying the Warta and Noteć Rivers.

- Natural and anthropogenic characteristics of the Noteć Forest.

Physiographic outline of the Toruń-Eberswald Proglacial Stream Valley

The Toruń-Eberswald Proglacial Stream Valley (TEPSV) is an extensive geomorphological form expanding parallelly from Płock-Toruń in the east, through Eberswald, to the place called Fehrbellin (Ostprignitz-Ruppin district in the Brandenburg region), approximately 60 km north-west of Berlin (Fig. 1). In this area, it joins with the Warsaw-Berlin Proglacial Stream Valley.

The main elements of the TEPSV surface features and geological structure were formed in the course of the deglaciation of the Pomeranian phase of the Baltic glaciation (Kondracki 2011). River waters from the south and waters from the melting ice-wall from the north flowed into this extensive terrain basin and were then flowing westwards. Sandy terraces and outwash fields were formed from the fluvoglacial material in this extensive terrain basin. In the region of the Warta and Noteć Rivers Interfluve, the greatest accumulation of inland dunes occurs, with their relative height reaching 20 m. During the Holocene period, on the

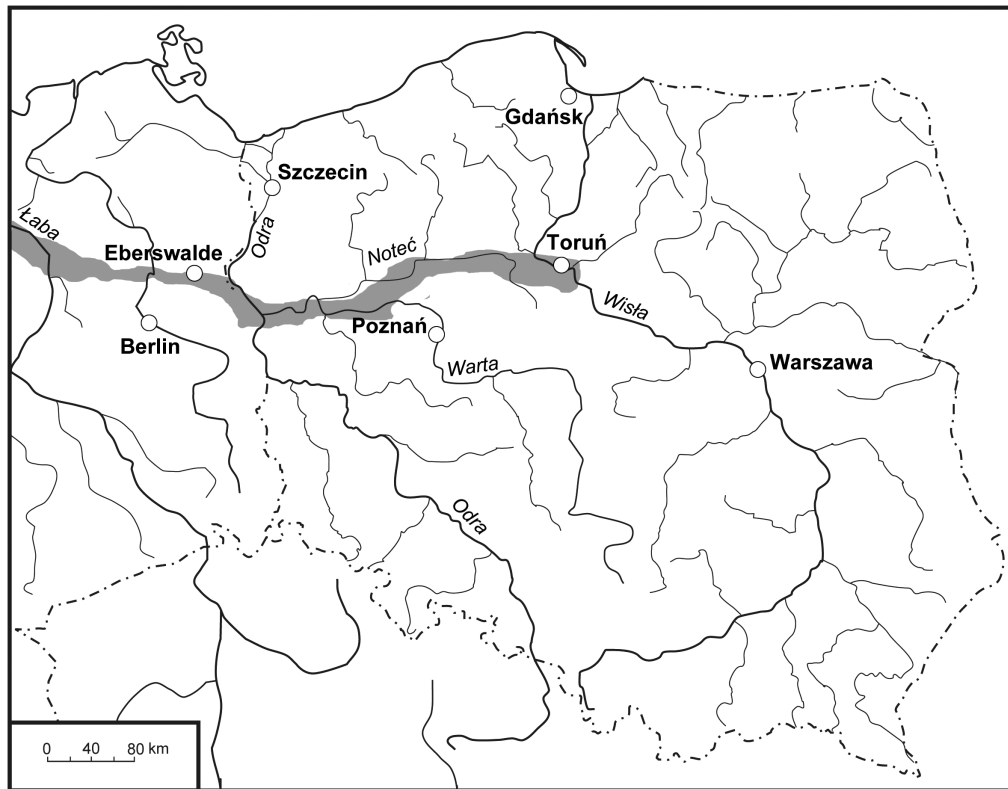


Fig. 1. The Toruń-Eberswald Proglacial Stream Valley (TEPSV)

lower terraces of the Noteć River valley, thick fen-peat layers were established. In some places, their thickness reaches even 10 m. On the other hand, in the case of the Warta River valley, characterised by a distinctly greater activity, alluvial soils developed on flood terraces. In some places, the edge of the TEPSV rises high and then falls steeply towards the valley. The greatest denivelations, up to 100 m above the bottom of the proglacial stream valley, can be found in the region of Santok, Czarnków, Ujście and Nakło near Noteć. Small thaw-lakes (e.g. in the neighbourhood of Międzychód, Sieraków and Krucz) add variety to sandy sandurs filling the bottom of the extensive basin.

The main hydrological axis of the TEPSV is the lower course of the Warta and Noteć rivers. The Noteć River (388 km long) is the main right-hand tributary of the Warta. It is characterised by low water flow values: 6.3 (Pakość), 23.0 (Ujście) and 76 m³/s (Nowe Drezdenko). Mean values of the river channel bed decline range from 1 in the upper to 0.1‰ in the lower course of the river. Due to extensive areas of peat deposition in the lower and middle courses as well as numerous flow lakes in its upper course, the river is characterised by small fluctuations in water level and flooding phenomena are extremely rare.

There are few available empirical data concerning the original character of the Noteć river valley (Kaniecki

2011). Nevertheless, certain historical materials survived, among others: notes of Jan Długosz from the 15th century, as well as maps and descriptions dating back to the 17th and 18th centuries. On their basis, it is possible to conclude that the entire Noteć valley was once a swamp of an average width of 3-4 km. The river itself was characterised by a winding course and a tendency for frequent changes of its bed or for splitting its channel into arms and branches. The natural river bottom was uneven, especially in segments of small decline, where silty sediments dominated and migrating sandy bars frequently emerged above the water surface during low water levels.

This was inaccessible and boggy terrain, which could only be passed along road embankments, requiring constant conservation works. At the turn of the 15th and 16th centuries, the Noteć was treated as a navigable river used mainly for timber transport. Significant changes in water relations in the proglacial stream valley area were connected with the construction of the Bydgoszcz Canal (navigation on this canal started in 1774). The canal was intended as a water way for the transport of goods via the Noteć and lower Warta rivers to Berlin and Szczecin. Subsequent significant changes in the Noteć river valley occurred as a result of melioration works carried out in 1870s. They resulted in a considerable restriction in the areas of marshes and lakes, situated in the Noteć river valley. For example, the water level

in Lake Gopło (Gniezno Lake District) decreased by 2.7 m.

Geobotanical sketch of the Toruń-Eberswald Proglacial Stream Valley

The TEPSV is contained within boundaries of the Brandenburg-Wielkopolska Watershed. From the place where the Warta flows into the Odra River up to Bydgoszcz, it constitutes, almost in its entirety, the part of the Noteć-Lubuskie Region (Matuszkiewicz 2008).

On higher, sandy terraces in the valleys of the Noteć and Warta rivers, in particular, in their western part (Gorzów Valley), coniferous forest landscapes are dominant. The poorest sites of loose dune sands are occupied by reindeer moss pine forests (*Cladino-Pinetum*). A subatlantic fresh pine coniferous forest (*Leucobryo-Pinetum*) is growing on slightly more humid sites (Noteć Forest). Towards the east, analogical sites are more and more frequently occupied by a subcontinental pine coniferous forest (*Peucedano-Pinetum*) (Bydgoszcz Forest).

On more fertile sites in the slope areas of the proglacial stream valley, richer forest communities can be found, such as, oak-hornbeam forests (*Galio-Carpinetum*), while in the western part – also rich lowland beech forests (*Melico-Fagetum*). Riparian willow forests (*Salicetum albo-fragilis*), as well as willow scrubs (*Salicetum triandro-viminalis*) are remains of natural vegetation in the flooded areas of the Warta River. On the other hand, in the peaty Noteć River valley (especially in its eastern part), ash-alder riparian forests (*Fraxino-Alnetum*) form natural type of vegetation, whereas in its most marshy fragments – wicker stands (*Salicetum pentadro-cinereae*) and alder swamp forests (*Ribo nigri-Alnetum*) can be found.

Petasites spurius can be found growing along the banks of the Warta and Noteć rivers in the western part of the TEPSV. *Scolochloa festucacea* occurs among rushes along the Noteć river, in dispersed localities that mark the southern range of its occurrence, while small clusters of scrubs with *Betula humilis* can be found near Nakło on the Noteć.

Following large-scale regulation operations in the TEPSV, a significant drying of localities (particularly in the Noteć River valley) took place. Dense, impenetrable marsh forests and wicker scrubs disappeared completely from the landscape and were replaced by extensive complexes of sedge and meadow communities. Fresh meadows with a small proportion of wet *Molinia* meadows are dominant. In many places, *Senecio aquaticus*, rare in the region, can be found. In the eastern part of the Noteć River valley, halophyte species are becoming increasingly frequent among meadow and rush vegetation. Apart from species dispersed

in the entire valley (*Trifolium fragiferum*, *Festuca arundinacea*), these include: *Lotus tenuis*, *Melilotus dentatus*, *Sonchus paluster*, *Tetragonolobus maritimus*, *Triglochin maritima* and even obligatory halophytes: *Glaux maritima*, *Aster tripolium*, *Spergularia salina* and *Salicornia europaea*, can be found.

Clusters of xerothermic vegetation are a characteristic element of the vegetation associated with the edges of the TEPSV. On the steep edges of the proglacial stream valley in the Czarnków region, *Gentiana cruciata* can be found, whereas in the neighbourhood of Nakło on the Noteć (“Skarpy Ślesińskie” reserve) – *Adonis vernalis*, *Anemone sylvestris*, *Aster amellus*, *Stipa Joannis*, *Campanula sibirica* and *Oxytropis pilosa* are numerous.

The Toruń-Eberswald Proglacial Stream Valley constitutes an important ecological corridor of international significance (Liro 1995). An important marshy region which belongs to the RAMSAR network is situated near the outlet of the Warta to the Odra River. It is a breeding and concentration site for many migratory water-marsh bird species. The entire nature of the TEPSV, from the outlet of the Warta River in the west to Bydgoszcz in the east, is protected within the framework of: 1 National Park (“Ujście Warty”), 2 landscape parks, 22 NATURA 2000 areas, 29 nature reserves and 10 areas of protected landscape.

ROUTE OF THE TRIP: stops and sight-seeing sections

The route of the botanical trip comprises four field points (stops) connected by sections, which pass through landscapes characteristic for the Toruń-Eberswald Proglacial Stream Valley. Shortly after leaving the Obrzycko Palace, we will drive south, crossing the Warta River valley, which constitutes the southern boundary of the Warta-Noteć interfluvium. From the bridge over the Warta River, we can see fragments of willow and willow-poplar riparian forests. Moreover, clusters of species of alien origin spreading along the valley are also visible (among others, *Echinocystis lobata*, *Impatiens glandulifera*, *Reynoutria japonica*, *Solidago canadensis*). Travelling parallelly south along the river bank, we can observe, among others, well-developed acid oak forests. Leaving the river bank southward (about 1.5 km), we arrive at the first field spot.

1. Thermophilous oak forest (*Potentillo-albae-Quercetum*)

A very valuable fragment of this association under protection within the Natura 2000 network, known under the name of “Obrzycko Oak Forests” (“Dąbrowy Obrzyckie”) will be shown at this spot. The main problem connected with this area was comprehensively presented by M. Wojterska and K. Wiszniewska, on the first day of the Conference (see also p. 29). Thanks

to the monitoring, which has been conducted for 20 years now, a distinct disappearing of this community was observed confirming a tendency, reported also from other regions, for the withdrawal of thermophilous oak forests. At this spot, it is also worthwhile to pay attention to: (i) expansion symptoms of alien species, in particular, of *Impatiens parviflora* and *Padus serotina*; (ii) spreading of the native nitrophilous *Urtica dioica* species; (iii) the role of two tree species – *Fagus sylvatica* and *Picea abies* – in the structure of the dynamically changing plant community. The key problem in the discussion will be the management of the main protection object in this Natura 2000 area, i.e., the thermophilous oak forest.

From the Warta River valley, we move in the direction of the Noteć Forest situated between the rivers: Warta (in the south) and the Noteć (in the north). Travelling this time towards east, along the north Warta bank, we can observe for some time fragments of the valley transformed, in various degrees, by man. In the places we pass, it is worth noticing numerous alien species (e.g. *Impatiens glandulifera*, *Reynoutria japonica*, *R. sachalinensis*, *Robinia pseudoacacia*). In the town of Oborniki, we turn north and at the beginning we are accompanied by an enchanting valley of the Welna River and, after a few kilometres, we are surrounded by pine coniferous forests. Already in this section, passing through eastern portions of the Noteć Forest, it is worth to pay attention to a characteristic system of inland dunes and variations in the coniferous forest structure, which depends on forest management. Before we deal with these coniferous forests closer, I would like to draw your attention to the azonal element of the Noteć Forest, namely, an extensive bog complex in the neighbourhood of Chlebowo.

2. “Bagna” peat bog near Chlebowo in the Noteć Forest

At this point, it is worthwhile to remind you that although Wielkopolska is an area where marshes occur with medium frequency, but the proportion of peatbogs and poor fens is small and the “Bagna” peatbog complex near Chlebowo is one of the biggest. It occupies a trough depression slightly tilted westwards and surrounded by dune belts from the north, west and south. The trough was formed by the Baltic continental glacier during the Poznań stadial. At the present time, the central part of the complex constitutes a dead peatbog with numerous post-peat holes, from which peat used to be excavated. They can be up to several hectares in size and up to 2.5 m deep. From the east and partially from the south, the complex is surrounded by poor fens and meadows, as well as coniferous forests with a small proportion of heath communities and psammophilous grasslands. A number of arable fields occur on the side of a nearby village. The complex is drained by artificially dug canals and a system of melioration ditches. Ultimately, waters from the peatbog flow into the Warta River.

Within confines of this complex, we find a peatbog (strict) reserve (4.42 ha in size), which was placed on the Corine biotopes checklist, while the entire “Bagno Chlebowo” constitutes part of the OSO refuge in the NATURA 2000 system known as “Bagno Chlebowo” (PLH300016), as well as part of the Protected Landscape Area “Noteć Forest” established in 1989.

Since the beginning of the 19th century, the “Bagna” complex near Chlebowo was subject to strong anthropopressure. On the one hand, drainage of this area and lowering of the water table made peat exploitation, carried out with changing intensity, possible, but, on the other hand, it led to the partial peatbog extinction. Several roads with hard surface were constructed in the entire area, which resulted in the establishment, in the central part of the complex, of several dozen of large post-peat excavation pits with open water tables. These peat ponds are used by local residents for recreation purposes. In addition, the local hunters’ club has some raised hides there. The principle elements of spatial management in the neighbourhood of this complex comprise forest economy (tree felling), as well as extensive and intensive farming.

The results of the above-mentioned activities manifest themselves in the following ways: (i) disappearance or extinction of the most sensitive indigenous species (*Carex limosa*, *Drosera intermedia*, *Rhynchospora alba*, *Saxifraga hirculus*, *Scheuchzeria palustris*); (ii) partial regeneration of peatbog communities, once peat exploitation was terminated; (iii) spreading of species of alien origin (*Aronia ×prunifolia*, *Bidens melanocarpus*, *Juncus macer*, *Padus serotina*). The course of these processes is botanically monitored, which allows a fairly precise observations of the rate and size of synanthropization and adoption of appropriate conservation actions.

The next objective of the trip is the Noteć River valley. We reach it going north in the direction of Czarnków. From the scenic point of view, it is undoubtedly one of the most interesting places in Wielkopolska. In order to appreciate it fully, it is first necessary for our coach to cross the valley and, then, to turn back, so we can look at the steep edge at the southern edge of the valley. We climb to its top, not without some effort. After reaching it, we drive down to the ferry crossing in the place called Ciszkowo.

3. Ciszkowo in the Noteć River valley

At this spot, our attention is drawn, among others, to the occurrence of garden angelica (*Archangelica*) occurring in riverside communities of the Noteć river, as well as by the accumulation of xerothermic species on the edge of the valley, which we earlier saw from some distance. Plant communities in this type of places comprise many species unique for the region of Wielkopolska. In Ciszkowo, they include, among others, *Carex*

caryophyllea, *Gentiana cruciata*, *Libanotis pyrenaica*, *Polygala comosa*, *Sanguisorba minor*.

„*Archangelica* vs. *Angelica*”. The occurrence of garden angelica along the river bank, gives an opportunity for a short taxonomic and ethno-botanical discussion. The genus *Archangelica* (family *Apiaceae*, subfamily *Apiioideae*, tribe *Peucedaneae*), in the newer works is included in the genus *Angelica*. On the basis of fruit traits, it is differentiated into the following subspecies: *Archangelica officinalis* (Moench) Hoffm. ssp. *officinalis* and ssp. *litoralis* (Fr.) Thell. or *Angelica archangelica* L. ssp. *archangelica* and ssp. *litoralis* (Fr.) Thell.

It is usually a biennial plant, monocarpic, hemicryptophyte. It can reach the height of up to 2 m and distinguishes itself by spherical umbels. Its fruits ripen at the end of July and beginning of August. Garden angelica is allochoric and its ripe fruits utilise water as a means of transport (hydrochory). It is an aromatic and oleiferous plant.

A. officinalis occurs in central (in the mountains) as well as northern and north-eastern Europe and in western Siberia. This plant has been cultivated for many centuries (in Scandinavia and Island, it was known already in the 10th century) and, therefore, its natural range is difficult to establish.

It is both a medicinal and food plant. Its unique properties are also indicated by its names: in Latin – archangels (archangel), English – holy ghost, French – L’herbe du Saint Esprit (Holy Spirit herb), German – Heiliggeistwurz, Engelwurz (angel’s root) and Theriakwurz. Candied petioles were used in confectionary industry,

while from its rhizomes, the famous alcohol beverage “Benedictine” was manufactured in Middle Ages.

From Ciszkowo we head southwards in the direction of the town Wronki. It gives an opportunity to cross the Noteć Forest again, this time in its more central part. We stop for a moment near the place called Jasionna to take a close look at the fairly representative patch of coniferous forest vegetation, with several nicely developed populations of typical but not very common species.

4. Pine coniferous forest near Jasionna

As mentioned above, pine coniferous forests (*Leucobryo-Pinetum*, less frequently – *Cladinio-Pinetum*) constitute the dominant element of the Noteć Forest. They developed on poor podzolic soils and, in their majority, are of anthropogenic nature. In the case of many areas, their contemporary condition is the result of numerous insect gradations, primarily, of the pine beauty moth (*Panolis flammea*). These insects damaged the primary forest communities and forced direct interference of man. Intensive forest management exerts influence on the diversification of coniferous forest phytocoenoses. Neighbouring forest communities frequently demonstrate considerable floristic and structural differences; from strongly transformed (among others, comprising *Padus serotina*) to those similar to natural ones, in which large populations of rare native species can be found, e.g. *Lycopodium clavatum* or *Arctostaphylos uva-ursi*.

After exhausting activities, fruitful discussions and, hopefully, excellent impressions, we are now returning to Obrzycko.

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