2.5. SOILS IN THE VICINITY OF THE NA JAZACH LAKES

Bogumił Wicik

The surroundings of Na Jazach lakes are at present completely afforested. Up to the middle of the XX century, ground under cultivation covered a narrow strip of land 100–200 m wide, at the southern side of lakes Mielec and Gościąż, the flat area between lakes Mielec, Tobyłka, Brzózka, and Wierzchoń, and small patches by the Ruda riverhead.

On the glacifluvial terraces varigrained sands with gravels and small boulders are the soil substratum, and finegrained sands on dunes. Both types of sediments contain only 2–4% of particles smaller than 0.02 mm. Dune sands are devoid of $CaCO_3$. Carbonates as well as limestone and dolomite fragments are present in glacifluvial sands, usually beneath the groundwater table only from the depth of 2.5–4 m.

The majority of the area around lakes is covered by soils not influenced by the groundwater, well aerated, with hydrologic regime characterized by leaching. Morphological and chemical features indicate that these soils are of cambic arenosol type (podzolic order).

In general, the sequence of morphological horizons and their features are as follows:

0–4 cm. O – ectohumus mor/moder with Ofh horizon well developed, separated clearly from mineral substratum, overgrown with roots, light brown in colour, very acidic in reaction (pH KCl 3.0–3.2). Under a pine forest this horizon is 6–7 cm thick, and 100–200 yr old.

4–15 cm. AEes – ash-grey in colour, loose sand, single-grain structure, small amounts of roots, pH KCl from 3.3 to 4.2. Distinct transition to lower horizon. The horizons 0–15 cm contain 0.10–0.15% of Fe_2O_3 and 0.4–0.75% of Al_2O_3, soluble in boiling 10% HCl. Organic carbon content is 0.6–1.3%, 30–50% of it is connected with iron and aluminium. Humus (carbon) is soluble in 0.1M sodium pyrophosphate (Aleksandrowa 1960).

15–40 cm. B_{FeBr} – rust-coloured with fine grey-brown spots, loose sand with scarce usually branched roots. Gradual passing to the underlying horizon. It contains 0.20–0.26% of Fe_2O_3 and 0.1–0.6% of Al_2O_3 soluble in boiling 10% HCl. During the summer season strong drying reaches a depth of 40–45 cm.

40–75 cm. $B_{FeBr/c}$ – dark-beige in colour, loose sand with single roots, pH KCl 4.5–4.9. Indistinct lower limit.

From the depth of 75–90 cm the bedrock of loose sands are to be found with traces of the ancient layering preserved. They contain 0.14–0.17% of Fe_2O_3 and 0.2–0.5% of Al_2O_3 soluble in boiling 10% HCl. At the depth of 100–150 cm pH KCl reaches 4.8–5.2.

Locally, on sandy gravels or sands with boulders (residuum of glacial deposits), which occur in small patches, vertic cambisols are to be found.

In a group of hydrogenic soils, eutric histosols dominate. On the lakes borders, in the Ruda stream valley, and in bottoms of numerous depressions originated due to the ice melting and situated to the east of Lake Gościąż, eutric histosols of lowmoors occur. They are mostly overgrown by alderwoods. The upper parts of peat profiles to a depth of 1.5–2.0 m are usually strongly decomposed. They are neutral in reaction. The majority of eutric histosols contains 12–20% of ignition residue and 2–8% of $CaCO_3$.

2.6. VEGETATION OF THE GOSTYNIŃSKIE LAKE DISTRICT

Klemens Kępczyński† & Andrzej Noryśkiewicz

According to the geobotanical classification (Szafer 1972), the Płock Basin (Kondracki 1978) belongs to the Kujawy District of the region of Wielkopolska-Kujawy of the Great Valleys Belt of the Baltic Division.

The plant cover of the Płock Basin ranges from very dry to submerged habitats and lakes (Fig. 2.14).

The area is beyond the natural range of *Abies alba*, *Sorbus torminalis*, *Taxus baccata*, and *Tilia platyphyllos* and is within the so-called "Middle-Polish gap" of *Picea abies* distribution (Szafer 1972). Those species do not grow spontaneously in forests of the Płock Basin, while *Fagus sylvatica* and *Acer pseudoplatanus* are assumed to be beyond their closed range but are found in woods with varying frequency. Beech occurs only sporadically, whereas *Acer pseudoplatanus* is a natural constituent of all forest layers in riverside carrs and less frequently in mixed deciduous forests.

The most common forest component is *Pinus sylvestris*, growing both in pine and mixed forests and in deciduous forests, where it has been introduced. A frequent species in pine communities is *Betula pendula*, and somewhat less frequent is *Quercus robur*. *Q. petraea*, on the other hand, occurs more frequently in *Potentillo albae-Quercetum* (Załuski & Cyzman 1994).

The tree layer in deciduous forests, depending on the type of soil, is composed of *Tilia cordata, Quercus robur, Q. petraea, Carpinus betulus,* and *Acer platanoides*, and the understory consists mostly of *Corylus avellana, Euonymus verrucosus*, and *E. europaeus*. In riverside carrs the components of the tree layer are *Fraxinus excelsior, Ulmus minor, U. glabra, U. laevis, Acer pseudoplatanus, Populus alba, P. nigra, Salix alba, S. fragilis,* and *Alnus glutinosa*, and the shrub layer has *Sambucus nigra, Viburnum opulus,* and *Prunus padus*. In wet alderwoods *Alnus glutinosa* is dominant and the shrub layer is composed of *Salix cinerea, S. aurita*, and *S. pentandra.* Some shrub species such as *Frangula alnus* have a wide ecological scale and can be found both in pine forests and in various forms of wet deciduous forests.

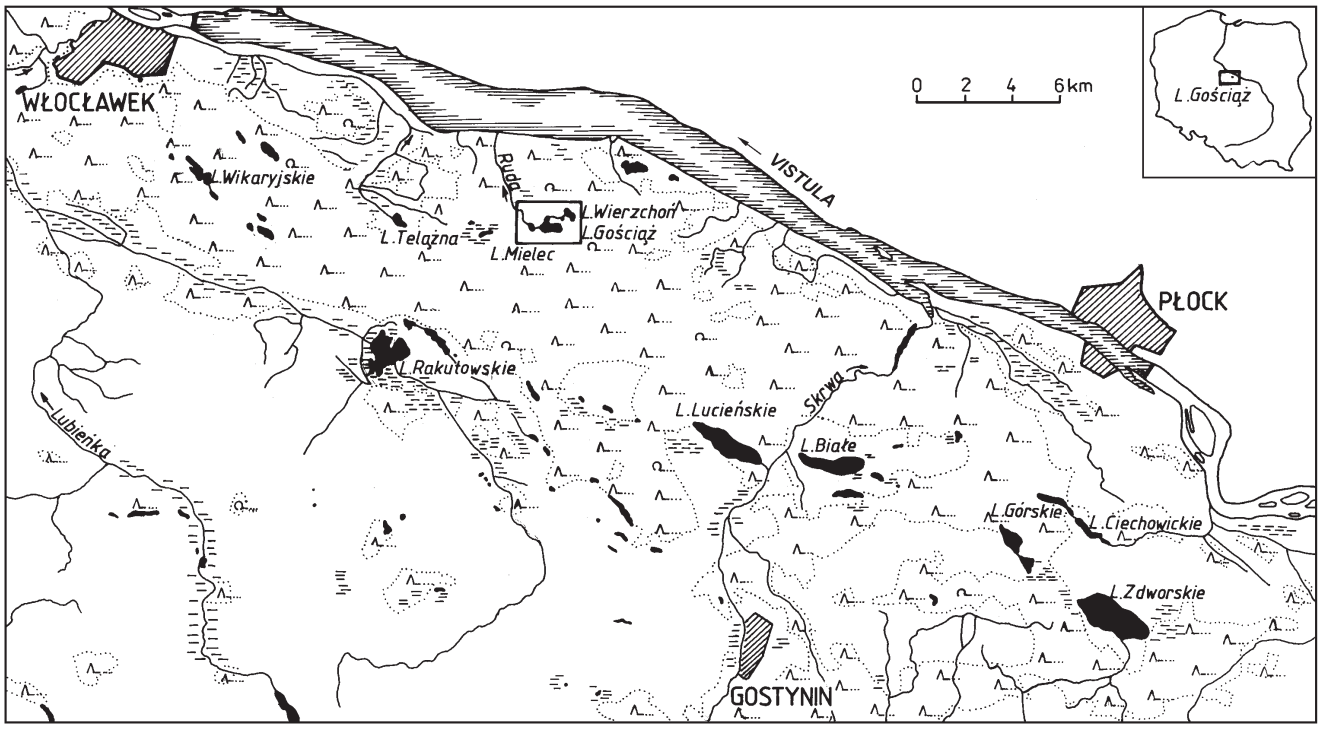

Fig. 2.14. Distribution of forests, swamps, and lakes in the Płock Basin. The hatched part of Vistula valley forms today a dammed lake.

The flora of the area is fairly rich (about 1000 species of vascular plants). It includes representatives of various geographical elements (classification adopted after Walter 1954, Kępczyński 1965 and partly after Polakowski 1963). Most numerous are the representatives of the Middle European and the Boreal elements. Less frequent are the species of the Pontic and the Atlantic elements. Species assigned to other elements are found only sporadically.

Most species of the Middle European element are widespread. Particularly well represented are forest and brushwood taxa, species of deciduous forests being more numerous than those of pine forests. Particularly noteworthy is the scattered occurrence of plants belonging to the mountain group, such as *Aconitum variegatum, Allium ursinum, Fagus sylvatica,* and *Acer pseudoplatanus*.

A considerable number of taxa within the Middle European element are rare species protected by law (Cyzman 1991, Cyzman & Rejewski 1992, Kępczyński & Cyzman 1992a, b, c, Kępczyński & Noryśkiewicz 1992, 1993a, b, Kępczyński & Załuski 1978, 1982, 1988, Rejewski & Olesińska 1974, Tomaszewicz 1977, Załuski & Cyzman 1994). The following species are rare in the Płock Basin: *Thalictrum aquilegifolium, Corydalis bulbosa, C. intermedia, Agrimonia odorata, Pulmonaria angustifolia, Lathraea squamaria, Utricularia australis, U. minor, Scutellaria hastifolia, Carex montana*, and *C. remota*.

Species representing the Boreal element occur mainly in all types of mires (*Stellaria crassifolia, Andromeda polifolia, Utricularia intermedia, Scheuchzeria palustris, Rhynchospora alba, Carex limosa*) but are less frequent in forest and brushwood communities (*Dryopteris cristata, Salix nigricans, Alnus incana, Viola epipsila, Circaea alpina*) and in aquatic communities (*Callitriche autumnalis, Utricularia vulgaris, Potamogeton praelongus*). Many of these taxa are rare in the Płock Basin. Numerous species representing the Boreal element are protected.

Of particular interest is a large group (about 70 species) of xerothermic plants belonging to the Pontic element. Many of them are rare and protected. They occur in xerothermic grasslands, thermophilous brushwood, open oak forest and open pine and mixed forests. The xerothermic plants rare in the Płock Basin are: *Thesium ebracteatum, Pethrorhagia prolifera, Gypsophila fastigiata, Isopyrum thalictroides, Chamaecytisus ratisbonensis, Trifolium montanum, T. lupinaster, Astragalus arenarius, Vicia cassubica, Laserpitium pruthenicum, Verbascum phoeniceum, Asperula tinctoria, Scabiosa canescens, Campanula sibirica, C. persicifolia, Aster amellus, Inula hirta*, and *Asparagus officinalis*.

The few species belonging to the Atlantic element are *Spergula morisoni* and *Teesdalea nudicaulis*. Other species (*Radiola linoides, Hydrocotyle vulgaris, Juncus squarrosus* and *Cladium mariscus*) form the group of pseudo-Atlantic taxa. Other geographical elements have only few representatives in the flora of the area.

A large number of species (61) in the Płock Basin is under various forms of protection by law.

A large part of the basin area is occupied by forest

communities preserving to a large extent their natural character. In particular, the communities of the class *Alnetea glutinosae* are represented by *Salicetum pentandro-cinereae*, *Ribo nigri-Alnetum*, and *Sphagno squarrosi-Alnetum*, and of the class *Querco-Fagetea* by *Circaeo-Alnetum*, *Carici remotae-Fraxinetum*, *Astrantio-Fraxinetum*, *Tilio-Carpinetum*, and *Potentillo albae-Quercetum* (acc. to Matuszkiewicz 1981). Particularly interesting is the latter of the above mentioned associations, occurring only over small areas but containing in its herb layer many floristic peculiarities, such as *Trifolium lupinaster, Cimicifuga europaea, Laserpitium pruthenicum, Aquilegia vulgaris*, and *Iris sibirica* (Kępczyński & Cyzman 1992c).

All forest communities maintaining their natural character show considerable differentiation, depending on the habitat conditions. Comparatively large areas are covered by riverside carrs (*Circaeo-Alnetum*), wet alderwoods (*Ribo nigri-Alnetum*), and willow brushwood (*Salicetum pentandro-cinereae*). *Tilio-Carpinetum* stands are rather small. Of particular interest are the riverside carrs of piedmont type (*Carici remotae-Fraxinetum*, *Astrantio-Fraxinetum*), only recently reported from the area (Cyzman 1991, Kępczyński & Cyzman 1992a, b).

The pine forest communities are represented by the subcontinental association *Peucedano-Pinetum* and much less frequently by the suboceanic *Leucobryo-Pinetum*. Fragments of the dry pine forest *Cladonio-Pinetum* occur on the most impoverished soils. The swamp pine forest *Vaccinio uliginosi-Pinetum* or the swamp birch forest *Betuletum pubescentis* occur on bog soils. Larger areas, particularly on more fertile soils, are covered by mixed pine forests, forming two associations: the subcontinental *Querco roboris-Pinetum* occupying considerable parts of the basin, and the less frequent subboreal *Serratulo-Pinetum* in its Sarmatian variety (Cyzman 1991).

An important part of the plant cover is formed by non-forest vegetation, e.g. aquatic, reedswamp, mire, meadow, pasture, grassland, scrub, ruderal, and segetal communities. As the Płock Basin has numerous water bodies, water courses, drainage ditches, and cut-over bogs, there is a great diversity of aquatic and rush vegetation.

Aquatic vegetation is represented by associations from several classes: *Charetea* (*Charetum fragilis*, *Nitellopsidetum obtusae*, *Charetum tomentosae*), *Lemnetea* (*Lemno-Spirodeletum polyrrhizae*, *Wolffietum arrhizae*, *Lemnetum gibbae*, *Lemno-Utricularietum*, *Hydrocharitetum morsus-ranae*), *Potamogetonetea* (*Potamogetonetum pectinati*, *P. filiformis*, *P. lucentis*, *P. perfoliati*, *Ranunculetum circinati*, *Elodeetum canadensis*, *Ceratophylletum demersi*, *Myriophylletum spicati*, *Potamogetonetum compressi*, *P. natantis*, *Nupharo-Nymphaeetum*, *Polygonetum natantis*) and *Utricularietea intermedio-minoris* (*Sparganietum minimi*, *Scorpidio-Utricularietum minoris*) (Tomaszewicz 1977, Kępczyński & Noryśkiewicz 1993a).

The reed-swamp vegetation occupying fairly large surfaces is mostly represented by communities of the class *Phragmitetea*. Less frequent are *Scirpetum maritimi*, *Cladietum marisci*, and *Caricetum appropinquatae*.

Fens on the shores of eutrophic lakes and along water courses are formed by associations of the order *Caricetalia fuscae* and of the alliance *Magnocaricion*. The mires arise in hollows without drainage. They develop there mainly as low sedge communities of the order *Scheuchzerietalia palustris* and associations of the class *Oxycocco-Sphagnetea*. The most interesting communities are *Caricetum limosae*, *Rhynchosporetum albae*, *Caricetum diandrae*, *Eriophoro vaginati-Sphagnetum recurvi*, and *Sphagno-Caricetum rostratae* (Kępczyński & Noryśkiewicz 1992).

Meadows and pastures are formed by various communities of the class *Molinio-Arrhenatheretea*. The sandy areas are occupied by psammophilous grasslands, represented by associations of the class *Sedo-Scleranthetea* (*Spergulo vernalis-Corynephoretum*, *Diantho-Armerietum elongatae*, *Festuco psammophilae-Koelerietum glaucae*). Open slopes are overgrown by communities of the class *Festuco-Brometea* (*Potentillo-Stipetum capillatae*).

Different synanthropic communities occur around human settlements. The ruderal associations of the classes *Artemisietea* (*Tanaceto-Artemisietum vulgaris*, *Echio-Melilotetum*), *Chenopodietea* (*Sisymbrietum sophiae*, *Urtico-Malvetum neglectae*), and *Plantaginetea* (*Lolio-Plantaginetum*) develop near buildings, roads, and local rubbish dumps. In cereal and root crop fields occur segetal associations of the class *Secalietea* (*Vicietum tetraspermae*, *Papaveretum argemones*) and of the order *Polygono-Chenopodietalia* (*Lamio-Veronicetum politae*, *Galinsogo-Setarietum*, and *Echinochloo-Setarietum*). The semi-natural herb and scrub communities of the class *Artemisietea – Alliario-Chaerophylletum temuli* and *Eupatorietum cannabini* develop near riverside carrs.

On the whole, the flora and vegetation of the Płock Basin is very rich and diverse.

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