Ecological Questions 4/2004: 99–104

Sites of medieval settlements as refuges for vascular plants

Zbigniew Celka

Department of Plant Taxonomy,
Adam Mickiewicz University, Niepodległości 14, 61–713 Poznań, Poland,
e-mail: zcelka@main.amu.edu.pl

Abstract. The paper shows the importance of medieval occupation-sites (earthworks, castles, open settlements) as refuges of vascular plants. Field research has been conducted since 1992 and comprised 230 sites in the Wielkopolska region (mid-western Poland). On the studied sites, in total 800 species was recorded, including 48 rare, vulnerable or endangered species and 24 species protected by the law.

Key words: earthworks, medieval, refuge habitat, settlement, flora, vascular plants.

1. Introduction

In the anthropogenic (cultural) landscape, nature is dominated by objects created by people. A significant role is played there by archaeological sites, transformed by human activity in the Middle Ages or even earlier. In Poland such sites are quite numerous, including earthworks, castles and open settlements. Medieval settlements were usually located in places that were not easily accessible, such as hills, islands or peninsulas surrounded by a river, lake or bog. Particularly interesting are remnants of medieval and prehistoric earthworks or fortified towns. They were surrounded by defense works, most often by a circular ditch and an earth bank supported by timber palisades or timber-laced ramparts. Such settlements played an important role in the early history of Poland. Fortified towns constituted centers of state administration, trade, judicature and military service, as well as major sites of social life. At present the significance of their remnants results mainly from their large number and the specific shape that makes them easily recognizable in the field.

On the one hand, the sites of medieval settlements are sources of invasion of many species associated with cultivation or accidentally introduced there. On the other hand, they are refuges for rare, vulnerable or endangered vascular plants: ruderal and segetal weeds, and old crops (cultivation relicts). In this paper we present data on the role of earthworks and other archaeological sites as refuges for vascular plants.

2. Methods and studied sites

The research on the flora of earthworks and other medieval and prehistoric settlements was started in 1992. Observations were carried out in all phenological seasons in different parts of the Wielkopolska region. The number of earthworks

in the region approaches 500, which accounts for 20% of all objects of this type in Poland (Antoniewicz, Wartołowska 1964; Kurnatowska, Łosińska 1983). Localization of those objects in the field was based on various archaeological sources, presented in details in the monograph "The Vascular Plants of the Earthworks of Wielkopolska" (Celka 1999). The work includes also brief archaeological and environmental descriptions of the studied sites. Investigations were conducted in 230 sites for several years, and the results were recorded in the form of floristic lists, herbarium specimens, cartographic documentation and photographs.

The size of the studied sites varied considerably. About 60% of the objects were small, covering less than 0.25 ha each. The smallest ones were only 10 m in diameter (e.g. in Młodasko near Pniewy). Larger objects that covered up to several hectares (e.g. 200 m x 220 m at Grzybowo near Września) were rare.

3. Results

Due to deforestation and changes in water conditions, caused by drainage and other factors, many medieval earthworks (about 60%) are now parts of rural landscape, surrounded by arable fields and grassland. Quite numerous are earthworks and castles located in urban areas, in towns, villages or their immediate neighborhood (over 20%), as well as inside or along the edges of woodlands (nearly 15%).

Thanks to their well-preserved ridges, cones or ditches, earthworks are still clearly distinguishable in the field and are specific refuges for flora and vegetation. Habitat diversity of those sites and their isolation enables survival of many plant species. It results from the diversity of earthworks' elements: banks, cones, ditches and lises (flat areas in the middle of the settlement). They are colonized by various plant formations: forest, bushes, meadow and agrophytocoenoses. Even if each patch is small, their coexistence on one site has a positive effect on the total number of species. Large objects, covering more than 1 ha, usually have a very rich flora. Even modern intensive farming on some sites does not have a negative influence on the flora. As an example one of the largest earthworks in Wielkopolska can be quoted. It is located in Grzybowo near Września and covers about 5 ha. The outer bank of the object is covered by a wide tree belt, with well-developed bush and herb communities along its borders. The watercourse flowing through the ditch forms small flood plains and the flat area within the ring had been cultivated until recently when it was laid fallow. The flora of this site exceeds 140 species. A similar situation is observed in Giecz (near Września), one of the most important objects linked with the early history of the Polish State. It is one of the largest medieval earthworks in Wielkopolska (4 ha) and has the richest flora: 238 species (Celka 2000a). Some parts of the site are still intensively used (archaeological museum, church). Species of various synecological groups can be found there, e.g. *Calamagrostis stricta*, *Campanula bononiensis*, *Carex disticha*, *Conium maculatum* and *Acer campestre*. The mosaic of habitats positively affects also the flora of small archaeological sites. An example is a small earthwork (0.18 ha) at Smuszewo site 1 (near Wągrowiec). Rich xerothermic grassland has developed there, with *Libanotis pyrenaica*, *Veronica teucrium* and *Vicia tenuifolia*. Its banks are covered by xerothermic bush communities, with *Crataegus monogyna*, while the ditch is cultivated. Many segetal weeds are observed there, including *Consolida regalis* and *Stachys annua*, which are declining in Wielkopolska. The flora of this object consists of over 100 species.

Among the plants found on the studied sites, the most numerous were meadow taxa, representing chiefly the class *Molinio-Arrhenatheretea*. About 120 recorded species belong to this class, and 10% of them are threatened in Wielkopolska (Żukowski, Jackowiak 1995). These include *Allium angulosum*, *Lathyrus palustris*, *Trisetum flavescens* and *Triglochin maritimum* (fig. 1). The best-developed grasslands with many rare species are located in the earthwork at Bonikowo (near Kościan) in the valley of the Obra River (eg. *Ophioglossum vulgatum*, *Dianthus superbus* and *Parnassia palustris*), and at the site in Przybroda (near Poznań), in the monotonous rural landscape, close to a railway route (*Cnidium dubium*, *Hydrocotyle vulgaris* and *Serratula tinctoria*).

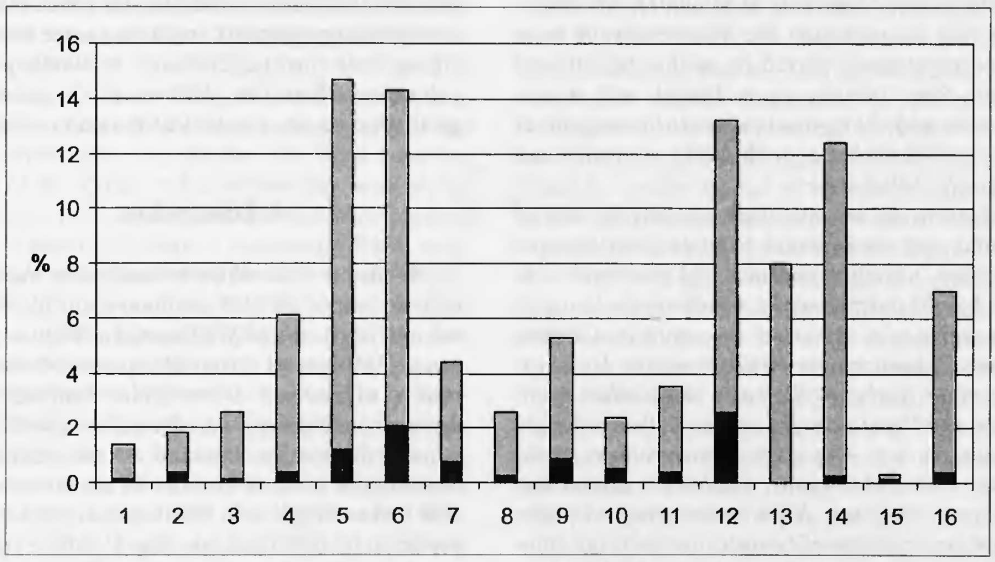

Figure 1. Contributions of protected, rare, vulnerable and endangered species (black colour) to socio-ecological groups; 1 – *Lemnetea, Potamogetonetea, Utricularietea intermedio-minoris, Montio-Cardaminetea*; 2 – *Scheuchzerio-Caricetea fuscae*; 3 – *Bidentetea tripartiti, Isoëto-Nanojuncetea*; 4 – *Phragmitetea*; 5 – *Molinio-Arrhenatheretea, Agropyro-Rumicion crispi*; 6 – *Sedo-Scleranthetea, Festuco-Brometea*; 7 – *Trifolio-Geranietea sanguini, Rhamno-Prunetea*; 8 – *Nardo-Callunetea, Epilobion angustifolii, Fragarion vescae*; 9 – *Vaccinio-Piceetea, Quercetea robori-petraeae*; 10 – *Salicetea purpureae, Convolvuletalia sepium*; 11 – *Alnetea glutinosae, Alno-Padion*; 12 – *Quercion, Carpinion, Fagion, Alliarion, Sambuco-Salicion*; 13 – *Polygono-Chenopodietalia, Secalietea*; 14 – *Eragrostietalia, Sisymbrietalia, Onopordion, Eu-Arction, Polygonion avicularis*; 15 – *Asplenietea rupestris*; 16 – Species of unclear phytosociological classification

Grassland species of the classes *Festuco-Brometea* and *Sedo-Scleranthea* are represented by 114 species, including 10 species that are threatened in this region, e.g. *Betonica officinalis*, *Campanula bononiensis*, *Lithospermum officinale*, *Lavatera thuringiaca*, *Libanotis pyrenaica* and *Scabiosa columbaria*. The best-developed patches of xerothermic grassland with many endangered species were found at Dormowo (near Międzychód), Laskownica Mała and Smuszewo site 1 (near Wągrowiec), Koziegłowy and Świętne (near Konin). At Świętne the only population of *Orobanche purpurea* in Poland was found recently (Zając, Zając 2001). Special attention is due to the very small earthwork at Dormowo (about 10 m in diameter), which is isolated among farmlands, situated close to a lake and includes very interesting xerothermic flora. For example, *Stachys recta*, *Thesium linophyllon*, *Veronica teucrium*, *Helianthemum nummularium* ssp. *obscurum*, *Phleum phleoides* and *Salvia pratensis* were recorded there.

Forest species representing the xerothermic oak forest communities and mesophilic broad-leaved forest communities of the class *Querco-Fagetea* account for about 8% of the flora of the studied sites. Among them, about a dozen species are threatened in Wielkopolska, e.g. *Actaea spicata*, *Bromus ramosus*, *Campanula latifolia*, *Cardamine impatiens*, *Gagea minima*, *Listera ovata*, *Sorbus torminalis* and *Viola mirabilis*. Because of the presence of rare forest species, special attention should be paid to archaeological sites located in woodlands or at their edges, and to sites found in isolated forest islands surrounded by fields. The first group is represented, for instance, by the object at Kociałkowa Górka (near Poznań), with a large population of *Melica uniflora*, *Sorbus torminalis*, *Corydalis cava*, *Acer campestre* and *Galium odoratum*, and as well as the earthwork at Niesulice where *Melittis melissophyllum* was rediscovered after 130 years. It is noteworthy that this species is currently reported only from 5 localities in

Wielkopolska (Żukowski et al. 2001). An important role in increasing the biodiversity of large agroecosystems is played by earthworks situated within forest islands, e.g. at Trzciel, with *Actaea spicata* and *Polygonatum multiflorum*, or at Jastrowo-Ostrolesie, with *Viola miribilis* and *Epipactis helleborine*.

Earthworks are colonized not only by taxa of natural and semi-natural habitats from the surrounding, namely woodlands and grasslands, but also by old ruderal weeds, which are declining in this region, e.g. *Asperugo procumbens*, *Carduus nutans*, *Chenopodium bonus-henricus*, *Hyoscyamus niger*, *Verbena officinalis*, *Onopordum acanthium* and *Nepeta cataria*, and as well as old segetal weeds, e.g. *Alopecurus myosuroides*, *Avena fatua*, *Consolida regalis*, *Euphorbia exigua* and *Lathyrus tuberosus*. A particular group of plants found on remnants of historical settlements comprises taxa that were cultivated in the Middle Ages and now are naturalized. They are relicts of cultivation. This group includes *Malva alcea*, *Lavatera thuringiaca*, *Allium scorodoprasum* and *Origanum vulgare* (Celka 2000b). Their occurrence is closely linked with archaeological sites, for which they are distinguishing elements and at the same time increase their floristic diversity. In Wielkopolska cultivation relicts were observed at 106 archaeological sites, i.e. at over 46% of the studied objects.

4. Discussion

Remnants of earthworks and other medieval defense works are still common elements of the cultural landscape of Wielkopolska. They support many plant species. Over 800 species of vascular plants of several dozen plant families and syntaxonomic groups were recorded on such sites. Among the species observed on the studied archaeological sites, as many as 48 are rare, vulnerable and endangered in Wielkopolska, and 24 are protected by the Polish law (fig. 2). Those species account for 9% of the present flora. 13 species from the Polish Red List (Zarzycki, Szeląg 1992) were recorded. This means that threatened species find favourable living conditions on archaeological sites (fig. 3).

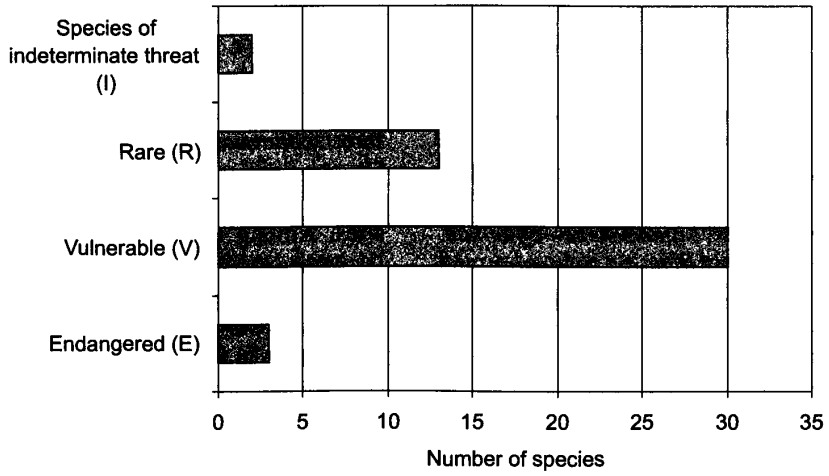

Figure 2. Contributions of rare, vulnerable and endangered species found currently in archaeological sites in Wielkopolska

A specific group among the studied sites consists of several dozen objects located in the agricultural landscape of Wielkopolska. They function there as habitat islands, of which role in increasing the biodiversity of agricultural space was discussed by many authors (e.g. Karg, Karlik 1993; Ryszkowski 1995; Banaszak 1998, 2002). Among the 230 studied sites, 71 are located within such habitat islands in the agricultural landscape. As many as 584 species of vascular plants from 80

families were recorded there, accounting for over 70% of the whole flora. The geographical-historical composition of such islands was dominated by native species (over 80%). Within this group, contribution of non-synanthropic spontaneophytes and apophytes was very similar. The large contribution of the former one is noteworthy because, for example, in forest islands at the southern edges of the 'Puszcza Zielonka' Landscape Park, non-synanthropic spontaneophytes accounted for only 24.3% (Ratyńska, Szwed 1998a). Among alien taxa, archaeophytes (59 species) dominate over kenophytes and ergasiophytes (in total 44 species). The geographical-historical composition of habitat islands, particularly of those containing earthworks, results from a combination of various factors, such as age of a given object, its origin, habitat diversity and others (see also Wasiłowska 1998). Larger islands usually have greater habitat diversity, which has positive effect on species richness. Similar relations were observed in forest islands at the Wieliczka Foothills by Dzwonko and Loster (1988), and at the southern edges of the 'Puszcza Zielonka' Landscape Park by Ratyńska and Szwed (1998b). The minimum and mean number of species found in the studied sites increase in successive island size classes. The habitat diversity of earthworks enables coexistence of species from various plant communities, and increases the floral and phytocoenotic diversity. Such sites are colonized by species typical of xerothermic grassland (e.g. *Thalictrum minus* or *Filipendula vulgaris*), aquatic habitats (e.g. *Batrachium trichophyllum* or *Potamogeton crispus*), forest and shrub communities (e.g. *Anemone ranunculoides* or *Gagea lutea*), and meadows (e.g. *Avenula pubescens* or *Briza media*).

It can be concluded that forest islands containing archaeological sites have particularly rich flora, due to great phytocoenotic diversity. This diversity results from the habitat diversity of medieval settlements, their long history (over 50% of the objects were built over 1000 years ago), varied size (ranging from 0.01 ha to several hectares), large contribution of non-synanthropic spontaneophytes and archaeophytes, and as well as the presence of specific plants termed prehistoric and mediaeval cultivation relicts, such as *Malva alcea*, *Lavatera thuringiaca* and *Allium scorodoprasum*.

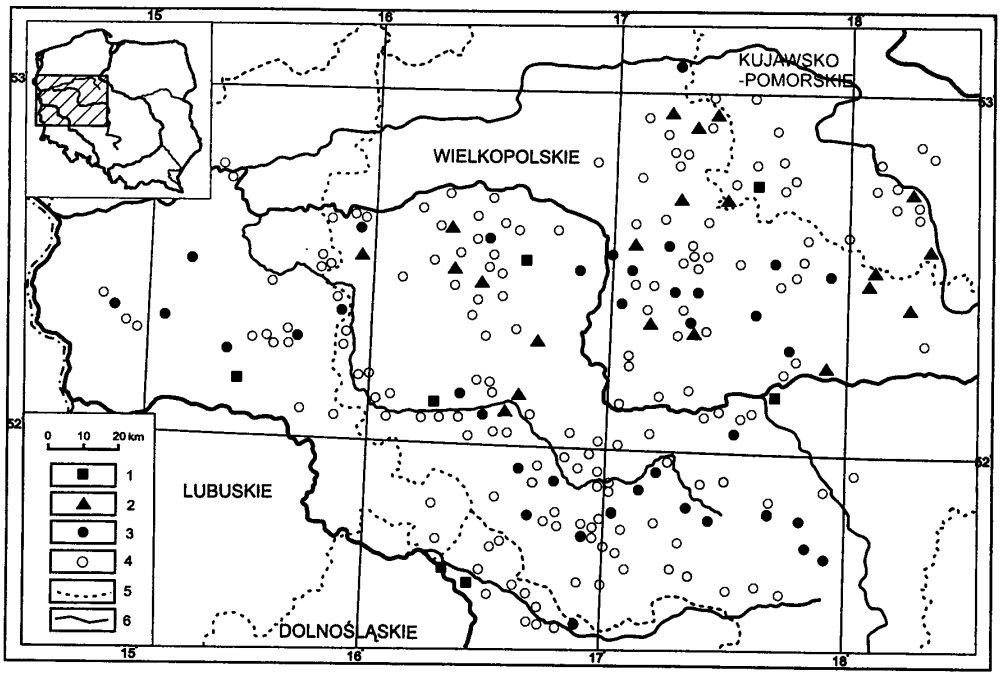

Figure 3. Refuges of meadow (1), xerothermic (2) and forest (3) species in archaeological sites in Wielkopolska (4) – other archaeological sites; (5) – borders of provinces; (6) – rivers (smaller map: location of Wielkopolska in Poland)

This study was supported by the Committee for Scientific Research, Poland, grant No. 6P04G 08420.

References

Antoniewicz W., Wartołowska Z. (eds), 1964, Mapa grodzisk Polski [Carte des enceintes fortifiées en Pologne], IHKM PAN, Wyd. PAN, Wrocław–Warszawa–Kraków: 1–64.

Banaszak J. (ed.), 1998, Ekologia wysp leśnych [Ecology of forest islands], Wyd. Uczelniane WSP w Bydgoszczy, Bydgoszcz: 1–326.

Banaszak J. (ed.), 2002, Wyspy środowiskowe. Bioróżnorodność i próby typologii [Habitat islands: biodiversity and typological attempts], Wyd. Akademii Bydgoskiej im. K. Wielkiego, Bydgoszcz: 1–302.

Dzwonko Z. & Loster S., 1988, Species richness of small woodlands of the Western Carpathian foothills, Vegetatio 76: 15–27.

Celka Z., 1999, Rośliny naczyniowe grodzisk Wielkopolski [The Vascular Plants of the Earthworks of Wielkopolska], Prace Zakładu Taksonomii Roślin UAM w Poznaniu, Bogucki Wyd. Naukowe, Poznań 9: 1–159.

Celka Z., 2000a, Zróżnicowanie flory naczyniowej grodziska w Gieczu (pow. średzki) [Der Verschiedenheit der Gefäßflora aus dem Burgwall in Giecz (Gem. Środa)], Studia Lednickie 6: 351–372.

Celka Z., 2000b, Problems of Cultivation Relicts, [in:] B. Jackowiak, W. Żukowski (eds), Mechanisms of anthropogenic changes of the plant cover, Publications of the Department of Plant Taxonomy of the Adam Mickiewicz University, Poznań 10: 185–191.

Karg J., Karlik B., 1993, Zadrzewienia na obszarach wiejskich [Tree lines and woodlots in rural areas], Zakład Badań Środowiska Rolniczego i Leśnego PAN, Poznań: 1–46.

Kurnatowska Z., Łosińska A., 1983, Weryfikacja grodzisk wielkopolskich na półmetku [Verfikation der Burgwälle in Grosspolen], Muzeum Archeologiczne w Poznaniu, Fontes Archeologici Posnaniensis, 32: 25–62.

Ratyńska H., Szwed W., 1998a, Ekologiczna specyficzność drobnych zadrzewień. Szata roślinna [The distinct ecological character of small woodlots. Plant cover], [in:] J. Banaszak (ed.), Ekologia wysp leśnych [Ecology of forest islands], Wyd. Uczelniane WSP, Bydgoszcz: 193–198.

Ratyńska H., Szwed W., 1998b, Charakterystyka szaty roślinnej [Description of the plant cover], [in:] J. Banaszak (ed.), Ekologia wysp leśnych [Ecology of forest islands], Wyd. Uczelniane WSP, Bydgoszcz: 43–80.

Ryszkowski L., 1995, Problemy ochrony różnorodności biologicznej w przestrzeni rolniczej [Problems of protection of biodiversity in the agricultural space], [in:] R. Andrzejewski, R. J. Wiśniewski (eds), Problemy różnorodności biologicznej, Materiały Konferencji „Nauka na rzecz różnorodności biologicznej", Warszawa, 13 grudnia 1995, Oficyna Wydaw. Instytut Ekologii PAN: 95–112.

Wasiłowska A., 1998, Problemy synantropizacji wysp leśnych w krajobrazie rolniczym [Problems of synanthropization of forest islands in the agricultural landscape], [in:] J. Banaszak (ed.), Ekologia wysp leśnych [Ecology of forest islands], Wyd. Uczelniane WSP, Bydgoszcz: 279–292.

Zając A., Zając M. (eds), 2001, Atlas rozmieszczenia roślin naczyniowych w Polsce [Distribution atlas of vascular plants in Poland], Nakładem Pracowni Chorologii Komputerowej Instytutu Botaniki Uniwersytetu Jagiellońskiego, Kraków: 1–716.

Zarzycki K., Szeląg Z., 1992, Czerwona lista roślin naczyniowych zagrożonych w Polsce [Red list of threatened vascular plants in Poland], [in:] K. Zarzycki, W. Wojewoda, Z. Heinrich (eds), Lista roślin zagrożonych w Polsce [List of threatened plants in Poland], 2nd ed., Instytut Botaniki im. W. Szafera, PAN, Kraków: 87–98.

Żukowski W., Jackowiak B., 1995, Lista roślin naczyniowych ginących i zagrożonych na Pomorzu Zachodnim i w Wielkopolsce [List of endangered and threatened vascular plants in Western Pomerania and Wielkopolska (Great Poland)], [in:] W. Żukowski, B. Jackowiak (eds), Ginące i zagrożone rośliny naczyniowe Pomorza Zachodniego i Wielkopolski [Endangered and threatened vascular plant of Western Pomerania and Wielkopolska], Prace Zakładu Taksonomii Roślin UAM w Poznaniu, Wyd. Nauk. Bogucki, Poznań 3: 9–96.

Żukowski W., Celka Z., Jackowiak B., Chmiel J., Latowski K., Szkudlarz P., 2001, Rozmieszczenie wybranych gatunków roślin ginących w Wielkopolsce [Distribution of selected species of threatened plants in Wielkopolska], Prace Zakładu Taksonomii Roślin UAM w Poznaniu, Wyd. Nauk. Bogucki, Poznań 12: 1–68.