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SOIL REGIONS OF POLAND ACCORDING TO AG BODEN CRITERIA

Abstract: The purpose of this paper is the delimitation of the main structure of the soil cover in Poland. The German methodology, used to define high-level taxonomic units, is applied. The method applied is useful for the presentation of the soil cover structure in small-scale maps (e.g., maps of continents).

Key words: soil geography, AG Boden, Poland's soils

1. THE NOTION OF “SOIL REGION” AND “SOIL LANDSCAPE”

In German soil geography, spatial units of several taxonomic orders are distinguished. They correspond to the main levels of the physical-geographical hierarchy, that is, to the topical, chorical and regional levels (Fiedler 2001, p. 349). The basic object of charting are so-called soil forms (*Ger.* Bodenformen). They comprise soils of the same type (or subtype), formed from one kind of parent rock, e.g., brown loess soils, brown sandy soils, etc. Soil forms are good characteristics of the local soil conditions. The kind of parent rock (e.g., loess) indicates the lithogenic characteristics and allows for conclusions about most of the physical characteristics of the soil. The type of the soil, on the other hand, brings information about its hydrological, chemical and biological features.

In smaller scales (1:50 000 – 1:500 000) groups of soil forms (*Ger.* Bodenformengesellschaften) are the charting objects; they usually

correspond to geomorphologic units. In smaller scales (smaller than 1:500 000) soil forms are gathered together into the so-called groups of soil types (*Ger.* Bodentypengesellschaften), which characterize soil regions (*Ger.* Bodenregionen). A soil region is a territorial unit of the highest level. It comprises regions within which soil-forming processes exhibit common tendencies, allowing indicating the so-called leading soils and typical soils (*Ger.* Leit- und Normboden). Within soil regions, units of lower level are distinguished, namely soil landscapes (*Ger.* Bodengrosslandschaften). The delimitation of regions and landscapes is based on the analysis of lithogenic criteria (*ibid.* pp. 350–351; AG Boden 1996, p. 282).

2. SOIL MACROSTRUCTURES OF GERMANY

The overall description, suggested in German instruction for soil charting, comprises 12 soil regions and 38 soil landscapes. They are listed in table 1.

Table 1.

Soil regions and soil landscapes of Germany (after AG Boden 1996, pp. 282–285)

Soil region	Soil landscapes of the region
1. Coastal region	1.1. Landscapes of North Sea islands 1.2. Landscapes of intertidal zones and North Sea coast-land 1. 3. Landscapes of marshes and swamps in the tidal zone 1.4. Estuary landscapes
2. Interregional riverine landscapes	2.1. Landscapes of lower terraces (including swamp and dune landscapes) 2.2. Landscapes of older terraces
3. Young glacial region	3.1. Landscapes of ground moraine and clay terminal moraine plains in the young glacial areas of northern Germany 3.2. Sandur, valley sands, and sandy terminal moraine landscapes in the young glacial areas of northern Germany 3.3. Landscapes of the Swabian-Bavarian young glacial area 3.4. Landscapes of ice-marginal valleys and of depressions in young glacial areas

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4. Old glacial region	4.1. Landscapes of ground and terminal moraine in the old glacial areas in northern Germany and Rhineland
4.2. Landscapes of ground moraine with a shallow bottom layer of solid rock
4.3. Sandur, valley sands, and sandy terminal moraine landscapes in the old glacial areas of northern Germany
4.4. Landscapes of the Swabian-Bavarian old glacial area
4.5. Landscapes of ice-marginal valleys and of depressions in old glacial areas
5. Alpine Foreland region	5.1. Landscapes of alluvial cones and plains in the Alpine Foreland
5.2. Tertiary hill landscapes of the Alpine Foreland
6. Loess and loess-sandy region	6.1. "Boerde" landscapes with thin loess cover
6.2. "Boerde" landscapes
6.3. Loess landscapes in mountain and upland areas
7. Mountain and upland region
built of sediment rocks, with
discontinuous loess cover	7.1. Landscapes on carbonate rocks
7.2. Landscapes on siliceous rocks
7.3. Loess landscapes
8. Mountain and upland region
built of carbonate rocks	8.1. Landscapes on carbonate rocks, with loesses and loess-like formations
8.2. Landscapes on carbonate rocks
8.3. Landscapes on marl rocks, with loesses and loess-like formations
8.4. Landscapes on limestone, sometimes with loess (or other sediment) cover
9. Mountain and upland region
built of non-metamorphic
rocks (sandstones, mud-
stones, siltstones, marls)	9.1. Landscapes with a mosaic of sandstone, mudstone, siltstone, often with loess
9.2. As above, without loess
9.3. Landscapes with the predominance of mudstone and siltstone
9.4. Landscapes on sandstone and marl, sometimes with loess-like formations
10. Mountain and upland region
built of igneous and meta-
morphoic rocks	10.1. Landscapes on alkaline volcanic rocks, sometimes with loess-like formations
10.2. Landscapes on acidic volcanic and metamorphic rocks
11. Mountain and upland region
built of shale	11.1. Landscapes of fine-grain shale, with varying share of greywacke, limestone, sandstone, and quartzite, sometimes with loess-like formations
11.2. Landscapes with predominance of quartzite, greywacke, sandstone, conglomerates and fine-grain shale

12. Alpine region	12.1. Flysch and molasse landscapes of Prealps
	12.2. Carbonate rock landscapes of Calcareous Alps and Helveticum
	12.3. Siliceous and marl rock landscapes of Calcareous Alps and Helveticum

As we have mentioned, parent rock is the main criterion for specification of soils units of Germany. Due to that, the borders of soil regions and landscapes largely coincide with the borders of physical-geographical units. This is true both in the case of units regarded as unique in physical geography (individual physical-geographical regions) and in the case of types that are non-unique in space (geocomplex types, landscape types). Some examples of such coincidence are: the southern border of the old glacial soil regions (no. 4 in Table 1), the southern border of the physical-geographical landscapes of the periglacial lowland type and the southern border of the physical-geographical region “Central-European Lowland” provinces; the northern border of the soil region “Alpine Foreland” (no. 5 in Table 1), as well as the border of the physical-geographical province “Northern Alpine Foreland”; the range of the riverine landscapes of the Upper Rhine River (no. 2) and the borders of the Upper Rhine Lowland macroregion¹. More examples similar to these can be found.

3. METHODOLOGY USED IN THE PAPER

According to the recommendations of AG Boden (1996), the highest-level units were delimited using an analysis of physical-geographical soil-forming factors, taking into account, in particular, the lithogenic factor. Small-scale maps of landscape components were used (mostly geological maps), as well as landscape maps and maps of physical-geographical regions. The borders of the specified units were compared with small-scale maps of soil types and kinds (among others, Uggle 1983; Bednarek, Prusinkiewicz 1990; Wicik 2005).

Units of the “Bodenregionen” rank have been specified. In accordance with the terminology used in the physical geography in Poland,

¹ Names of physico-geographical regions of Germany after Kondracki 1997.

they were defined as region types or types of soil macrostructures. In some cases, the original description was modified. The modifications were needed because the German description is not fully compatible with natural conditions in Poland (e.g., old glacial regions in eastern Poland, upland regions with large share of glacial material) or else because the German description is too simplified (coastal region). In general, however, both divisions coincide to a large extent. Within the region types, main units of lower-level are indicated (equivalent to "Bodengrosslandschaften").

4. SOIL MACROSTRUCTURES OF POLAND

In accordance with the AG Boden (1996) criteria, nine soil regions can be specified in Poland; they are continuations or counterparts of the regions specified on the territory of Germany. These are (Fig. 1): the coastal region (1), the riverine regions (2), the young glacial region (3), the old glacial region (4), the region of the Northern Carpathian Foreland (5), the loess region (6), the mountain and upland region built of sedimentary rocks with discontinuous cover of Quaternary sediments, including loess (7), the mountain and upland region built of igneous and metamorphic rocks, that is, the Sudeten region (10), and the Carpathian region (12).

– THE COASTAL REGION

This region has a very small area. Soil landscapes specified in the German map legend do not occur there. For the territory of Poland, sand-dune and sand-spit landscapes have to be added. A narrow strip of such soil landscapes occurs along the coasts of the Uznam Island (also in Germany) and of the Wolin Island, on the Trzebiatowskie Coast, Słowińskie Coast, Hel Sandspit, and Vistula Sandspit². Characteristic soils are: various stages of development of Podzols, including podzolic soils called "bielica" (seldom encountered in Poland), that is, soils in whose profiles the eluvial horizon E occurs under the raw humus level O (no humus horizon A).

² Names of physico-geographical regions of Poland after Kondracki 1978.

Fig. 1. Soil regions of Poland (schematic contours; generalization according to Kondracki 1976, p.101)

– INTERREGIONAL RIVERINE LANDSCAPES

Because of the small scale map, they are marked only schematically on the map. But even in this scale the necessity of a scheme different from the one suggested by AG Boden can be seen. In Poland's conditions, it seems that a much more appropriate division is the geomorphologic-landscape division used in physical geography (cf. Kondracki 1978, Richling 1992). In this categorization, floodplains (with young alluvial soils) and higher terraces (e.g., sand-dune terraces) constitute separate categories. In the most recent landscape classification of Poland, riparian mountain geocomplexes are also distinguished as a separate category (e.g., stony alluvial soils unsuitable for agriculture). As compared with the AG Boden description, it seems necessary

to supplement the characteristics of the riparian landscapes with delta landscapes (e.g., Żuławy), which do not occur in Germany. As a result, for the needs of soil geography in Poland, the classification used in physical geography seems more useful. This comprises:

- 2.1. Floodplain landscapes in lowlands and uplands
- 2.2. As above, in mountain regions
- 2.3. Landscapes of higher terraces in lowlands and uplands
- 2.4. As above, in mountain regions
- 2.5. Delta landscapes

– THE YOUNG GLACIAL REGION

In this case, the German description seems adequate. The three types of soil landscapes specified in it are characteristic for the sub-provinces: South Baltic Coastland, South Baltic Lakeland, East Baltic Coastland, and East Baltic Lakeland. The young glacial soil region coincides with the physical-geographical landscapes of the same type.

– THE OLD GLACIAL REGION

This region encompasses the physical-geographical subprovince of Central Polish Lowlands and fragments of upland provinces. As compared with the German description, it was necessary to include two more units. The first one concerns old glacial landscapes with a large share of silt (also of aeolian silt) that, according to the Polish terminology, is not included in loesses. These cover deposits without carbonates influence the increase of water retention capacity of soils. Because of that, Stagnosols and Mollic Gleysols occur next to Cambisols and Luvisols. Silt soils of old glacial areas occur, among other places, in the following physical-geographical mezoregions: the Rawska and Siedlecka Plateaus, the Warszawska Plain and the Błońska Plain (Wicik 2005, p. 206). Another addition are the so-called Polesie landscapes, also called riparian-lacustrine landscapes (Kon-dracki 1976, 1978), with their characteristic mosaic of carbonate (also karstifying) rocks, sand, clay, peat and others. This landscape type does not occur in Germany; it occurs in eastern Poland and continues

westward of Poland's borders. The completed list of soil landscape types is as follows:

4. 1. Moraine landscapes in the old glacial areas of the Lowlands
4. 2. Moraine landscapes with a shallow bottom layer of solid rock (the northern part of Polish Uplands)
4. 3. Sandur, valley sands, and sandy terminal moraine landscapes in old glacial areas
4. 4. Landscapes of ice-marginal valleys and depressions in old glacial areas
4. 5. Moraine landscapes with a shallow bottom layer of karstifying rock, and a large share of sandy plains and swamps (the Polesie area)
4. 6. Old glacial landscapes with a large share of silt

– THE REGION OF THE NORTHERN CARPATHIAN FORELAND

This region belongs to the same type as the Alpine Foreland. Its landscape structure is also similar: plateaus, built of the Tertiary rocks covered by Quaternary glacial sediments (the sub-Carpathian equivalent of the type 5.2), intertwine with valleys and plains built of sands (5.1).

– THE LOESS REGION

According to the opinions of J. Jersak quoted in the soil geography handbook by Bednarek and Prusinkiewicz (1990, s. 196), the following loess spreads occur in Poland: Horodelski, Sokalski, Nałęczowski, of Western Roztocze, Opatowski, Miechowski, Raciborski, as well as the loess spreads of the northern slopes of the Carpathians and small spreads in the Sudeten Foreland. The small-scale geological map of Poland (Rühle, Mojski 1968), the landscape map by Kondracki (1978) and the map of Poland's soils by Uggle (1983) show a somewhat larger range of the loesses (e.g., including the Wrocław Plain). More recent small-scale soil maps of Poland (e.g., Wicik 2005) combine loess and other silt sediments into one category. The map of soil regions of Germany (AG Boden 1996, p. 286), in turn, indicates that the areas

regarded as “loess soil landscapes” border on our country. In this situation, both the terrains built of loess and those built of various loess-like formations were included in the loess region — including the Żytawa-Zgorzelec Depression and the Wrocław Plain. All “loess” landscapes have been classified as the type 6.3 — loess landscapes in mountain and upland areas, although small patches of loess are located also in lowland areas, e.g. in the Radomska Plain and Trzebnickie Hills. Taking the leading soil type (*Ger. Leitbodentyp*) as the criterion, loess landscapes in Poland have been divided into two subtypes: 1. with dominance of Chernozems (areas: Wołyńskie, Sandomierskie, Proszowickie, Rzeszowskie, Opolskie), 2. with dominance of Cambisols and Luvisols (the remaining regions).

– THE MOUNTAIN AND UPLAND REGION BUILT
OF SEDIMENTARY ROCKS WITH DISCONTINUOUS QUATERNARY
SEDIMENT COVER, INCLUDING LOESS

This region takes up a significant area in the province of Polish and Ukrainian Uplands. Because of the very small scale of the map, Świętokrzyskie Mountains were included in it, although in a more detailed scale they would be classified as regions of type 8 and 9 (cf. Chapter 2). Compared with the German description, it seems necessary to supplement the characteristic of the parent material by glacial and fluvioglacial sediments of older glacial periods. The remaining specifications remain unchanged, except that it seems superfluous to distinguish loess landscapes here. This region includes therefore two types of soil landscapes:

7. 1. Landscapes on carbonate rocks
7. 2. Landscapes on siliceous rocks.

– THE MOUNTAIN AND UPLAND REGION BUILT OF IGNEOUS
AND METAMORPHIC ROCKS

This region includes Sudeten Mountains together with most of the Western Sudeten Foothills and with parts of the Sudeten Foreland. The small scale of the map (Fig. 1) does not allow to take into account

the lithological mosaic of the region, e.g. fragments built of sandstone (Stołowe Mountains, Kaczawskie Mountains), glacial till areas, loess areas etc. It seems, however, that even in such small scale certain modifications of the German description should be made. They consist in introduction of the category of foreland and foothill landscapes (with a large share of Quaternary material, such as clay, sand, loess-like silt), as well as in taking into account the bioclimatic factor (soil vertical belts) at higher elevations in the mountains (e.g. Karkonosze).

– THE CARPATHIAN REGION

This region is distinguished analogously to the Alpine region. As in the case of the Carpathians, it seems appropriate to introduce the category of foothill landscapes. The difference as compared with the Sudeten type is in the character of the parent material. The soils of the Carpathian foothills are most often formed not on glacial sediments, but on flysch rock-waste or on aeolian sediments. The remaining subcategories remain unchanged, that is, the following landscapes are distinguished: flysch landscapes (Outer Carpathians: Beskidy and Bieszczady), carbonate landscape (Western Tatras, Pieniny, and other), landscapes on igneous rocks (Eastern Tatras). In the case of this unit, it is necessary to take into account the bioclimatic factor (soil vertical belts).

5. DISCUSSION AND CONCLUSIONS

Soil-geographical regionalization according to the criteria of AG Boden has the character of a framework. The territorial units specified there do not always satisfy the criterion of uniqueness. Rather, they are types of regions, specified on the basis of the age, types, and genesis of the parent rock. In the delimitation of the units, the lithogenic factor is taken into account to a large extent, but the bioclimatic one is not adequately taken into account. The question arises, how useful is such regionalization? It seems that the methodology presented by AG Boden can be helpful, above all, in presentation of soil as an element of an evolving geosystem. Based on the classification of soil regions, one can present, for instance: characteristic of the soils

generations (cf. Kowalkowski 1988), the role of periglacial processes in the formation of the contemporary soils profiles, as well as other issues related to the landscape development in time. Soil regions and landscapes can be also regarded as reference fields for a discussion of the mezostructure of the soil cover (cf. Bednarek, Prusinkiewicz 1990, pp. 218–228). This issue has a great theoretical and practical importance. The similarity, and sometimes even the identity, of soil and physical-geographical units emphasizes the unity of the landscape system, and, to quote Boris Polynov, soil is the mirror of the landscape. For these reasons, it seems that soil regions specified using the AG Boden criteria are a useful complement of “classic” maps of soil types. They can be also applied in soil geography courses, physical geography courses and in geocology courses. Finally, they can be also useful in complex space management, which takes into account the regional specifics of landscape conditions.

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