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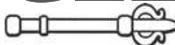
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# Geomatics, Landmanagement and Landscape

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*Scientific journal founded in 2012 at the University of Agriculture in Krakow*

**GLL** *Geomatics,  
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and Landscape*

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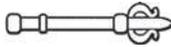
## FOREWORD

The scientific journal *Geomatics, Landmanagement and Landscape*, which as a quarterly appears from 2013 at the Faculty of Environmental Engineering and Land Surveying of the University of Agriculture in Krakow, is a valuable scientific title recognisable by experts from the field of geomatics, planning and spatial management as well as landscape formation. Research papers published in this journal constitute exchange of scholarly ideas of experts from many local and foreign research centres. The leading thought of articles published during three years time is rational management of space, environment and landscape benefitting GIS solutions which enable optimal exploitation of space and its modelling.

The next issue conforms to general scientific profile of that journal. In the presented item readers will find deliberations to the point of geodesic materials usage in multistage project process of landscape revitalization of the chosen village. Creating landscape revitalization project, authors used Polish and German experiences in that range. Conception of interactive map of hydromorphological diversity was also presented in this issue. Deliberations concerning conception of management of the Jagiellonian University Collegium Medicum area in Krakow Prokocim were presented in the next chapter of the issue. Readers will there also find problems that concern interactive maps of spatial phenomena prepared by means of programming methods of net addresses. The author performed here comparative analysis of programming techniques of URL addresses which evoke spatial phenomena map according to parameters put by the operator in the window of an interactive browser. The next chapter shows conceptions of a touristic map and nature protection forms created with use of open data sources and free software on the example of a chosen commune. These deliberations conform to general problematics of internet cartography. Moreover, in the current issue we will find review of acts from the range of spatial planning in Poland in the years 1928–2003. Readers will also find considerations on using numerical taxonomy methods (Wrocław taxonomy) for agriculture development conditions evaluation in communes of Małopolskie Voivodeship. Change rules in the process of land consolidation as well as in rural areas development in post-war Japan were also presented in the current issue.

That short characteristics of the presented papers reveals that within general scientific profile of the journal there is a great variety of topics in shown scientific articles. In my opinion, *Geomatics, Landmanagement and Landscape* journal constitutes a wide platform to transfer different scientific thoughts and experiences between research centres in Poland and abroad.

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## USAGE OF GEODETIC MATERIALS IN MULTISTAGE LANDSCAPE REVITALIZATION PROJECT PROCESS OF STRZELCE WIELKIE VILLAGE

Edyta Augustynek, Przemysław Baster, Arkadiusz Doroż, Marcin Klich,  
Cezary Piszcz

### Summary

Country revitalization is a long-term multistage process which needs consideration of historic and contemporary determinants. In the process of landscape revitalization in Strzelce Wielkie village (Szczurowa commune) performed within the frames of a programme based on international cooperation, Polish and German experiences in such investments realization as well as owned output in the range of theoretical elaborations were used.<sup>1</sup> Revitalization of Młynówka stream flowing previously through the whole place was accepted as the most important project challenge and at the same time future investment purpose emphasizing among others diversity of surrounding landscape in its upper, middle and lower flow. The first research already revealed great variety of forms in the elaborated area and existence of numerous historical elements both vegetal and architectural ones. Usage of geodetic materials contributed to localize and include in documentation particular landscape forms, enabled to perform multi-range *in situ* researches of country landscape and even recreating of 19<sup>th</sup> century spatial solutions<sup>2</sup>. Such elaboration made with use of maps and geodetic plans allowed to preserve elements that are important from the cultural heritage point of view and also to use them in prepared project conception of the place's spatial development.<sup>3</sup>

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<sup>1</sup> *In situ* researches were performed within the frames of international programme – Polish-German cooperation: „Integrated programming of rural areas development in Małopolska on the basis of Bavaria standards”, on the basis of the Partnership Agreement: „Conception of Integrated Proceedings in favour of Rural Areas Development” (2014–2015). Low-key tests and *in situ* tests in the range of landscape: dr inż. arch. Przemysław Baster (cooperation in the German side: landscape arch. Thomas Wurth), scientific care: prof. dr hab. inż. Urszula Litwin; plants analysis: dr inż. Zbigniew Koziara.

<sup>2</sup> Elaboration of existing state, valorization and project directives for the whole tested area – including all project charts presented in the paper – were performed by students of the 3<sup>rd</sup> year of engineer studies of Geodesy and Cartography specialization within the subject entitled Projecting of Urbanized Areas, under the guidance of dr inż. arch. Przemysław Baster. Scientific care: prof. dr hab. inż. Urszula Litwin; plants analysis: dr inż. Zbigniew Koziara (Faculty of Environmental Engineering and Land Surveying, University of Agriculture in Krakow).

<sup>3</sup> Conceptual project of Młynówka stream and town's centre revitalization was performed under the guidance of prof. dr hab. inż. Urszula Litwin by the students of the 2<sup>nd</sup> year of master's studies

## Keywords

revitalization • revalorization • rural areas design • Młynówka stream • landscape architecture • project process

## 1. Introduction

During discourses about Strzelce Wielkie landscape with local inhabitants it was affirmed that revitalization of dried up Młynówka and redesigning of surrounding area was the most important issue.<sup>4</sup> Nowadays, only its dry and overgrown riverbed covered with self-seeding of old growth of trees as well as flow ponds disappearing under water plants are evidences of that stream's past beauty. Renewed channeling of water to this historical watercourse would relieve water channels net built decades ago and prevent surrounding fields from flooding – which happened repeatedly through the last years.<sup>5</sup>

First, the discussed stream flew through the meadows belonging to Strzelce Wielkie, then it reached the town's centre to meander afterwards in unbuilt area and finally to find its river mouth to the nearby river. Every segment presents different landscape type. Near the beginning of the stream's course, the landscape is green with great amount of water elements. Two kilometers further, Młynówka flows to urbanized areas, crosses a big post-manorial pond and then goes with two meanders round the oldest village's buildings and monuments. The area around the third section of the discussed watercourse is the open landscape characterized by wastelands, meadows and fields largely belonging to Nature 2000 land.

## 2. Material and methods

The leading idea in outlining designed area's borders was to include there Strzelce Wielkie centre, Młynówka stream and parcels of land lying directly close to it. Noticeable both in documentation and reality, above mentioned area division to three sections which present three kinds of landscape was somehow reflected in project zones separated in the designed areas. There were four zones scheduled in the centre, one intermediate and two peripheral (at the beginning and at the end of Młynówka course).<sup>6</sup> Moreover, mentioned seven zones were divided into smaller parts – 43 proj-

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of Geodesy and Cartography specialization within the subject Design of Local Areas (Faculty of Environmental Engineering and Land Surveying, University of Agriculture in Krakow).

<sup>4</sup> Performing of widely understood environmental interview, social consultations and cooperating with local inhabitants is the basis of so called "Bavarian method", used in objective project and is the topic of separate elaboration.

<sup>5</sup> Such basic project assumption is in accordance with opinion presented already half of century ago that: "Preserving natural waters together with accompanying woodlot, fauna and flora joining former natural landscape with current development state should become a basic guideline of planning in landscape" [Rzymkowski and Chowaniec 1972, p. 59].

<sup>6</sup> Nomenclature and method of division into zones with reference to former researches of prof. Urszula Litwin (only from a stylistic point of view the word "zone" is in the paper described interchangeably with the word "area") [Litwin 1986, p. 47–54; 1988, p. 79–88].

ect subzones with characteristic borders and area development. It should be indicated that despite so diverse landscape in discussed areas, the same geodetic bases – independently from the elaborated zone and subzones – were used in prepared project documentation. However, as development of areas along Młynówka stream is strongly diverse, the way of using geodetic materials in analysis and designing of particular zones was also diverse. The difference concerns information which were read out from them, symbols placed there and the aim of their usage while determining and inscribing of project directives.

To perform described elaboration, all accessible bases, maps and plans that enable both gained information analysis and low-key and field results plotting were gathered:

- An ortophotomap – created from air photos and being orthogonal area projection made in the even scale for the whole range (scale 1 : 5000),
- Plan of existing area development – defining particular purpose, arrangement and development in the given area (scale 1 : 5000),
- A cadastral map – presenting property laws of land plots or their usage forms (scales 1 : 5000, 1 : 10000),
- A situational-height map – presenting area height together with situational objects arrangement (scales 1 : 5000, 1 : 10000),
- A record map – with division of plots and properties (scale 1 : 20000), serving to determine zones and subzones borders.

The paper describes the ways of usage of above mentioned geodetic materials in designing of three chosen area fragments which present every type of landscape. To display old growth of trees, unfold grown up water elements and also perform integration of historical forms, reduction of a part of young self-sown was necessary in the initial part of the stream course. While analysing the town's centre, joining historical news with existing state enabled to perform historical-landscape study as well as communicative-observation outline. Studies over Galician cadastre from the half of 19<sup>th</sup> century resulted in reconstruction of former functional, compositive, vision and communicative connections and also the primary town-planning arrangement. Particular attention is paid to historical elements: park-manor layout, a big pond, smaller manorial ponds, a monumental church with historical tree stand and also roads arrangement in the place's centre. By contrast, the area along the last Młynówka fragment is largely included in the zone of landscape protection named Nature 2000 which induced to leave it in almost unchanged state in respect of spatial development limiting the designer's activity to provide the best possible exposure of existing forms.

The elaboration was performed according to Bavarian and Polish methodologies of the four-stage design system: resource, valorization, guidelines, project.<sup>7</sup> Every work period concerned all mentioned characteristic areas with division to project subzones. In this way, the whole spatial system of elaborated landscape was analysed and valor-

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<sup>7</sup> This system is improved in Poland for decades [look at: Bogdanowski 1976, p. 76; 1999; 2000, p. 223–229].

ized together with plants profile. It was the basis for performing further planning works of this stream's revitalization as well as the centre's of the village. Restoration of projected area's former splendour, place identity and cultural heritage elements importance were regarded the most important aims of the elaboration<sup>8</sup>. Moreover, flood protection of nearby agrarian lands and also proposals of changes striving to improve inhabitants' life conditions are also undertaken.

### 3. Results and discussion

#### 3.1. Subzones 1–6, the beginning of Młynówka course (chart 1)

##### Resource and valorization

First six zones of the elaborated area is a territory where the Młynówka river starts its watercourse. The resource presents an existing state before elaborating the project. It is presented on several bases such as an ortophotomap, an area development plan or a situational-height map which in the following elaboration stages also became the basis to perform valorization and project guidelines. Also photographic documentation is taken as a part of elaboration; signs of photos and basic remarks resulting from area analysis were put to the ortophotomap. The flat and overgrown riverbed near which single historical trees grow attracts attention. Młynówka is obstructed in many places which is the reason of water-soaked lands that occur in the neighbourhood without access or with a very difficult one. The further surroundings of Młynówka are composed mainly of arable lands with some wastelands and ponds used for fish breeding. The area development plan informs about a very big variety of green lands – there are mainly wastelands and areas so overgrown that they are partly impossible to be crossed so they were decided to have been redesigned to greenery zones which would compose beautiful view for strollers along Młynówka.

Precise resource's determination enabled proper performing of its valorization. Positive elements that need to be redesigned are ponds that should be stocked with fry and their surrounding which ought to be enriched with tourist elements in order to make the area more recreational. There are also some elements of positive character such as historical trees growing along the riverbed living of which will both enrich landscape and will allow to preserve natural character of the elaborated area. Considerable amount of the river's initial watercourse is composed of lands of neutral or negative characters, dedicated to be redesigned.

##### Guidelines

Guidelines proposed by inhabitants which concern changes connected with Młynówka and nearby ponds were taken into account during design and most of them can be realized with small outlays. Regarding Młynówka, particular attention is paid to clearing up, flow capacity improvement and riverbed's deepening, greenery care, protection of

<sup>8</sup> About meaning of mentioned project aims: [Kowicki 1997, p. 5–43; Myczkowski 2003, p. 3–38; O tożsamość wsi III generacji... 1983].

embankments, barrages' restoration and also connecting the stream with nearby ponds. It should also play tourist function after creating integrated greenery system and places with viewpoints that will attract to admire nature beauty. Changes that regard ponds concern mainly their cleaning up and deepening, bank line's regulation and stocking. A lit path along the bank line and a beach beside a little bathing place would be local attractions.

Project guidelines were presented at the situational-height map. A pedestrian and bicycle path for inhabitants along Młynówka bank and around the ponds together with two bridges were projected. This path can serve both for walking persons and people physically active who run or cycle. The path was designed to demonstrate nature's beauty to the citizens in the best possible way.

### 3.2. Subzones 20–35, place's centre (chart 2)

#### Historical-landscape study

In the elaboration, the existing state of Strzelce Wielkie village's centre was presented by means of the situational-height map, the ortophotomap and pictures showing characteristic places of the discussed area. As opposed to already described and almost unbuilt area, buildings of farm character presenting variety of buildings and adjacent gardens occur in the centre. Strong historical conditionings concerning both town-planning arrangement and particular monuments appear in this area. That is why apart from resource's analysis and its valorization, historic-landscape study was additionally performed the aim of which is most of all pointing out the current state of historical building objects and plants which create positive memories and are a display of their picturesque place. The manor built in 19<sup>th</sup> century together with a surrounding park, historical trees along roads that derive from the same time and also – which was crucial in the study – the Młynówka stream were undoubtedly key elements of the elaboration that influenced historical town-planning arrangement and spatial structure of the village. The antique wooden church dedicated to St. Sebastian with attached free-standing starling bell-tower is still a distinctive historical object of the village though it does not already serve as a parish church.

In the range of greenery, the most important element is an old growth of trees around the mentioned church that consists of 14 trees regarded by citizens as nearly monuments of nature. The village's centre is rich in numerous historical trees which are located mainly along the Młynówka stream and near the manor, parallel to the road in the north part of elaborated area where the beautiful trees avenue displayed in the photo goes by. Lonely trees on the crossroads are also worth attention.

Mentioned above historical elements are commonly known and easy to find, however, many forms were only able to be localized and considered in the project thanks to geodetic materials. An Austrian cadastre played the most important role in historical-landscape study elaboration. It came into being during the emperor Franz Josef's reign, was made in scale 1 : 2880 and included a part of current Polish lands which were located in Austrian annexed territory. It goes as far as to say that

in 19<sup>th</sup> century Strzelce Wielkie were vibrant and full of life because the manor house together with farm buildings, a big park, numerous alleys, paths, trees and an orchard can be seen in cartographic elaboration. It is difficult not to perceive that many roads led to the parish church dedicated to St. Sebastian from almost every part of the place.

It is worth to notice that urban transport system and arrangement of the most important space elements were well-considered and created harmonious space. No doubt, such spatial development inspired admiration and was properly exhibited. Concept of spatial forms marked on cadastre in the third dimension enabled to determine the most important views existing in the 19<sup>th</sup> century (though they are not inscribed). It should be emphasized that most of them does not exist now as self-sown forecloses it or viewpoints and field forms (f.ex. bridges) essential for proper space observation did not endure.

The cadastre significantly served to design Strzelce Wielkie village centre in order to improve its functionality and the Młynówka river development. It made the basis of the project in presenting differences between current state and this from the 19<sup>th</sup> century; while creating the study, the cadastre was used for comparing with the area development plan and the situational-height map. It was just the profound cadastre's analysis that allowed to reconstruct and map the most important existing in history spatial forms on geodetic bases. Reconstruction of the most important prospectuses to be afterwards placed in the project and restored in reality in the future became particularly important. They are presented in the guidelines, on the situational-height map in scale 1 : 5000. The view from the manor to the parish church and manorial ponds can be distinguished among others. The view from the church to Młynówka and the manor attracts attention in the opposite direction.

As it was mentioned, to determine properly the most important differences in the village's centre development, it was necessary to perform cadastre comparative analysis with the development plan, the ortophotomap and the situational-height map. The first of these three bases delivered above all information about area purpose. It largely helped to realize which grounds were grown by self-sown and need clearing and also which is the state of roads in the area of Strzelce Wielkie village. It is also easier to determine location of wastelands and then to design their transformation in f. ex. recreational areas. Current placing and general look of architectural and natural objects were determined thanks to the ortophotomap. The Młynówka riverbed is overgrown and its borders became worn away and water supply was cut off which caused drying up of the river that is supplied only by precipitations water. The same situation is with ponds: lack of fresh water, overgrowing with bushes as well as lack of flowing water cause that they not only lost their former charm but are even difficult to be localized. A historic island placed on the Big Pond which is now difficult to recognize between short and medium greenery comprises a characteristic place. The last element which by influence of time and negligence lost its enchantment is the manorial park that is inscribed in the monuments with historic forest stand register, now without any fence or clear arrangement.

### Guidelines

Performing of the historical-landscape study connected with an analysis of the current state – so considering contemporary and even negative forms in the landscape – became fundamental to determine project guidelines for the discussed area. Both citizens and designers called the main aim as reinstating Młynówka current through the village centre, revitalization of the big pond with an island and also recreating of former smaller manorial ponds.

Concerning the stream, it was decided to direct tributaries to it as well as to clean and make water flow permeable to supply new water there. It should be provided by banks protection and fascining in order to preserve historic course with additional performing of alternative polders. It was decided to clean the bottom from trees and bushes growing in the river and also to complete plants along Młynówka. Designed ponds rebuilding is to be based on regulating of banks line and ponds shape revealing. Lit strolling-view paths and possibility to cross the pond to the island are additional elements. To make this area more attractive in terms of recreation, it was enriched with places to spend time nicely – f. ex. benches, piers and even a watering-place.

Proposed changes regarding the manorial park were most of all restoration of a fence which was destroyed, renewal of paths with preserving park's historical view, recovery of chaotic arrangement of forest stand as well as the state improvement of the manor which currently serves as headquarters of the local hunting circle named "Nadwiślan". Changes in high and low greenery system were made as well to recreate former views and also to create new distinguishing ones that will exhibit the most important landscape elements.

Summing up, it should be underlined that the work over the historical-landscape study mostly included analysis of gathered cartographic and text data and also Strzelce Wielkie place photographs. Creating the study, information from inhabitants which outlined the main directions of conducted works were very useful. As a result, elaboration including a very valuable and important comparison of history and the present time which means Austrian cadastre confrontation with contemporary geodetic materials came into being.

### 3.3. Subzones 36–43, the end of Młynówka watercourse (chart 3)

#### Resource and valorization

After flowing through the green lands and then the urban ones, the Młynówka riverbed runs in the open landscape. It is the area with small variety of forms (in comparison with both ones described above) and poor historical conditionings (in contrast to the village's centre). In that case, geodetic materials served to prepare a project of an area with predicted slight changes. It is easy to read from the ortophotomap that the designed area is occupied mainly by arable lands and meadows whereas the stream's banks are grown by self-sown. This area's location in the protection zone called Natura 2000 additionally determined more precise plants analysis – and this plants variety was signed in the area development plan. Native species of trees and bushes such as lime,

oak, alder, birch and lilac were mainly recognized. Further neighbourhood is composed of arable lands where grains, potatoes, root plants and meadows covered with grass and Leguminosae plants such as white clover or meadow clover are cultivated.

Current way of development was preserved on the most of the area. Only in the northern part corrections were done in order to increase attractiveness of the pedestrian and bicycle path, part of arable lands situated in the vicinity of the village's centre were also removed to confer on the area's more recreational character. The most northerly of designed area segments where a pumping station is located also needed redesigning. On the remaining vast area, small changes serve to expose plants that grow there and to state points from where the most beautiful far views stretch.

### Guidelines

In their guidelines, inhabitants pay attention to the need of making area attractive in respect of recreation which means creating a walking and bicycle path with integrated greenery system, greater amount of playing fields and also Młynówka flow capacity improvement and returning to its historical flow. The designer's guidelines concur in the majority with citizens' conclusions. The walking and bicycle path, sport and recreational areas, coffee-houses and a camp site together with adjacent area to play paintball were planned. The remaining changes concern only small elements of spatial development.

Creating a cafe with playground for children as well as tennis court for more active citizens were proposed in the closest vicinity of Strzelce Wielkie centre, in the bend of the Młynówka river. A bit further, a parking place was provided for visitors who want to watch panorama of the countryside from the observation tower which could become one of the main local attractions. In its vicinity, some resting places were prepared which should make pleasurable Sunday walks for citizens and tourists who visit Strzelce Wielkie. A small Młynówka pool was planned near the camp site where the lonely willow can be admired from the place situated on the floodbank. Landscape chart presents views that will be able to be watched by strollers during a saunter.

## 4. Results

Performed comprehensive conceptual project of spatial planning included the area of Strzelce Wielkie centre and surroundings of the Młynówka stream flowing through that village, from its source to estuary. In the elaboration, geodetic materials that included initial information concerning many aspects of elaborated issue were used. They not only allowed to familiarize with existing state but also enabled to perform *in situ* tests and proper determining of their results in project documentation. Geodetic materials were successfully used in performing researches and preparing project documentation concerning three different kinds of landscape. They became valuable source of information while designing both urbanized and completely deserted lands, full of historical elements and also totally deprived of them. In town-planning as well as in planning scales, using the wide range of geodetic information made the elaboration

more perfect both in places where many spatial changes were made and also where designer's interference was very slight. In-depth reporting of geodetic bases contributed to preserving of many forgotten or hidden elements of cultural heritage and to using them in created conception; it also enabled easier associating of information concerning different domains of science and art.

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## The list of project charts:

1. Spatial development of Młynówka and its surroundings in Strzelce Wielkie. Resource, valorization and project guidelines. Zones 1–6 (author: Marcin Klich).
2. Historical-landscape study of Strzelce Wielkie centre (authors: Edyta Augustynek and Arkadiusz Doróż).
3. Spatial development of Młynówka and its surroundings in Strzelce Wielkie. Resource, valorization and project guidelines. Zones 36–43 (author: Cezary Piszcz).

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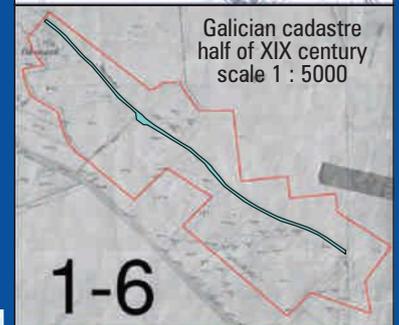
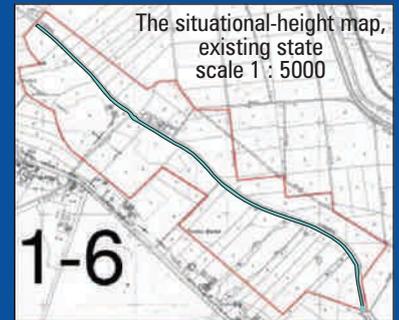
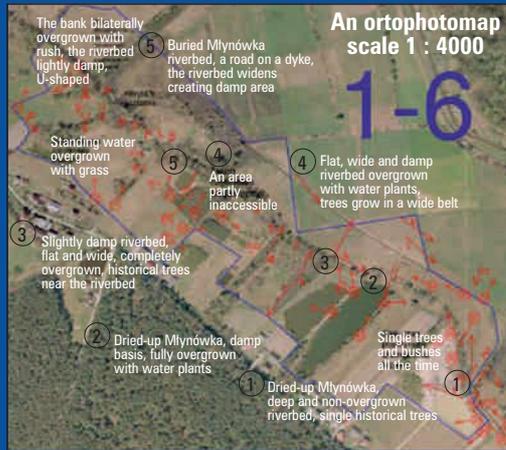
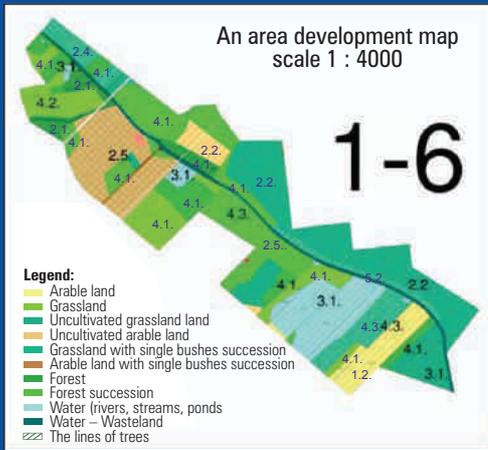
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# SPATIAL DEVELOPMENT OF MŁYNÓWKA RIVER AND ITS SURROUNDINGS IN STRZELCE WIELKIE PLACE, EXISTING STATE, VALORIZATION AND PROJECT GUIDELINES

## ZONES 1-6



Zone number	1-6
Object class	Meadow, pond, wastelands
Object type	Pond, single historical trees, right-bank not mowed meadows, left-bank mowed meadows, self-sown (trees and bushes along Młynówka),wasteland, in certain parts left-bank area overgrown and inaccessible (zone 4), channels
Fallow land	Right-bank meadows for zones 1-3, meadows on both sides in zone 4, whereas in zones 5 and 6 fallow land on both sides
Disarray, damages	Mechanical damage - pond excavation, channels, ditch, vegetation difficult to pass
Landscape	Positive
1. width, 2. height, 3. length	1. Width of self-sown diverse to 30-50 m 2. The highest 30 m
Area	Changed - pond, channels, area partly inaccessible to 20 m from Młynówka (zone 4)
Running water	Completely changed, dry or damp riverbed largely overgrown
Water profile	Natural U-shape, partly overgrown and invisible
Comments, remarks	Single historical trees (oaks), bushes, water channel in zones 3/4 border, standing water - sewage, left-bank area overgrown and inaccessible about 100 m from Młynówka - forest plants (zone 4), channel with standing water, joined with Młynówka, difficult to pass (zone 6)
Ecological value	Valuable
Age	> 20, single historical trees (oaks) > 50
Humidity	Damp, riverbed partly damp
Species composition	Native species - willows, oaks, locust
Bank	Partly mutually overgrown, lack of interior, hardly accessible
Species variety	Big
High woody plants	Single historical ones, many self-sowns
Photos' numbers	10, 11, 12, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 31, 32, 33, 34, 35, 36, 43, 44, 45, 46, 47, R28, R29, R30, R37, R23, R13, R14, R15, a, b, c, d, e, f, i, j, k, l, m, p, r, s, t, A, F, E, G, N, O, P, L, S
Current state (present)	Młynówka mostly overgrown, littered, with limited water supply, choked culverts, cut water supply. Lack of tourist and landscape infrastructure. Ponds are muddy, shallow
How it should be	Water flow should be cleaned and made passable, greenery cultivation on the whole length, mainly cutting out of trees and bushes. It should serve as flood protection. Building of bicycle paths and viewpoints as well as development of tourism. Ponds deepening and revitalization, building of an island, an arbour and a walking path



**Plants description:**

- Common bent (*Agrostis capillaris*)
- Catsaar (*Hypochaeris radicata*)
- Hairy sedge (*Carex hirta*) - marshlands, rivers, puddles, recultivated areas, peatlands, water deep to 50 cm
- Broadleaf cattail (*Typha latifolia*) - ditches, channels, standing and flowing waters, low and transient peatlands, fertile soil, silt, peat, deep to 1 m
- Common reed (*Phragmites australis*) - wetland, aquatic, peatlands, water-meadows, natural plant collectivities relieved from extensive usage (grazing, mowing), small biological diversity

**Guidelines and project solutions**

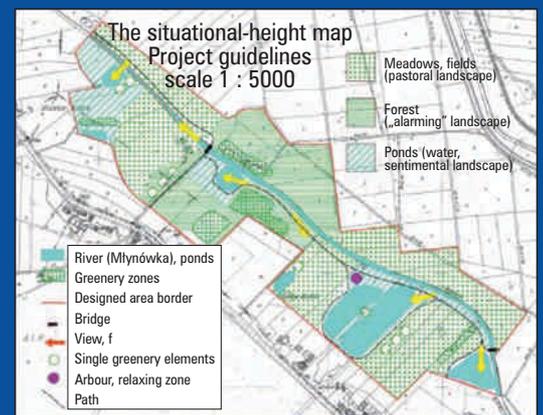
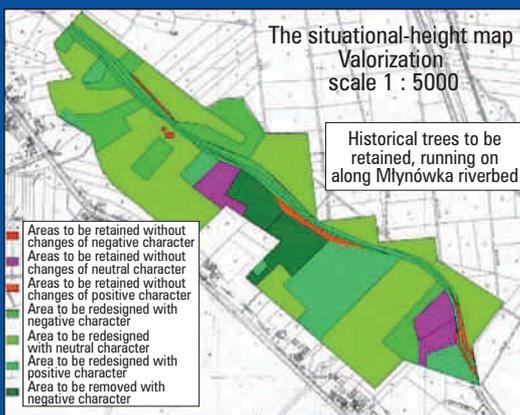
Changes that concern Młynówka:

- directing a channel flowing nearby to Młynówka
- cleaning, making passable and deepening of the riverbed
- greenery cultivation on the whole length of the river (trees and bushes cutting out from the riverbed)
- scarps protection (f. ex.: fascine fences)
- barrages renewal in order to enable water flow regulation
- building of a hydroelectric power station as alternative energy source
- it should serve as flood protection
- joining Młynówka with nearby ponds
- making possible of close flow regulation by means of water gates
- historical river course preserving

Młynówka can also perform tourist function after creating greenery integrated system and building attractions such as places with benches, barbecue spots and also viewpoints which could attract people keen on admiring nature beauty.

Changes that concern ponds:

- bottom cleaning, deepening
- bank line regulating
- stocking (attracting anglers)
- paths along the bank line
- paths lighting
- a beach, a small bathing water

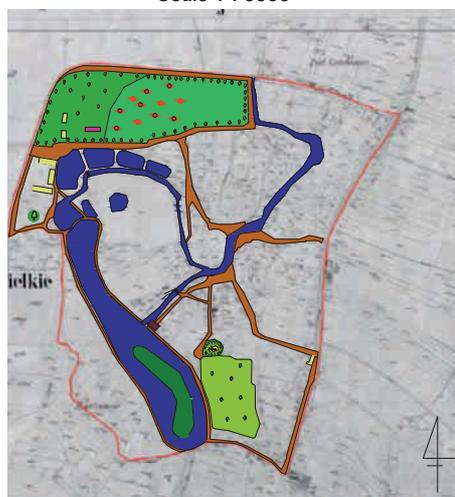


# SPATIAL DEVELOPMENT HISTORICAL-LANDSCAPE STUDY

# A-D

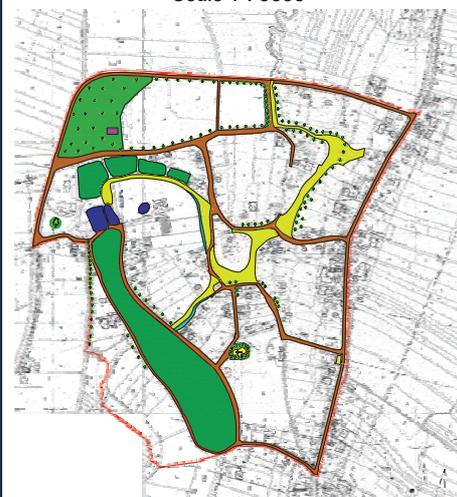


**Galician cadastre**  
Half of XIX century  
Scale 1 : 5000



- Legend:**
- manor-house
  - waters
  - buildings
  - church
  - orchards
  - alleys
  - roads
  - island
  - elaboration borders

**Situational-height map**  
Current state  
Scale 1 : 5000



- Legend:**
- manor-house
  - waters
  - buildings
  - church
  - marshy areas
  - scarp
  - roads
  - island
  - elaboration borders

**Half of XIX century**

- The church dedicated to St. Sebastian**
- The church served as a parish church
  - It came into existence in the years 1794-1795
  - In 1957 it was enlarged among others by extension of outhouses nave
  - In later years, a standalone staling bell-tower was added to the church building

**Current state**

- The church dedicated to St. Sebastian**
- At present, the role of a parish church is fulfilled by the church dedicated to Our Lady of the Scapular
  - There is an altar with Our Lady of the Scapular inside (copy, the original was transferred to the new church)
  - There are figures of St. Peter and St. Paul standing on both sides, the image of St. Sebastian is placed above the picture of Madonna

**The manor-house**

- The manor came into existence in XIX century
  - It belonged to well-known Polish family called Ossolinski
- The manor-house**
- At present, it serves as headquarters of the local hunting circle named "Nadwiślan"
  - The building is brick, raised on a rectangle plan, wide-front, covered with a gabled roof
  - Currently under repair

**The manorial square**

- Before the war, the park was enclosed, well-kept by a gardener, with paths and alleys
  - Most likely, there was a wooden fence from the road's side
- The manorial square**
- The landscape park inscribed to the register of monuments with historical forest stand which currently does not possess legible layout
  - Lack of the fence's remains

**Water**

- 22, 23 - The Big Pond with an island
  - 25 - Ponds
  - 27 - Pond
  - Centre - Młynówka river flew
- Water**
- The overgrown pond
  - Well-kept ponds, a bit overgrown
  - The overgrown pond, a hollow remained
  - Almost dry, supplied only by rain water

**Greenery**

- Some trees
  - Trees along Młynówka, 14 trees around the church
- Greenery**
- Single historical trees
  - Trees along the road
  - Many historical trees along Młynówka and old growth of trees near the church
  - 14 trees regarded by inhabitants as almost nature monuments

**Views**

- Most likely, there was a view from the manor to the ponds, an old historic church and the Big Pond
- Views**
- Currently the view is disrupted

Photos by:  
Dr inż. arch.  
Przemysław Baster



The manor-house



The trees alley



Młynówka river



The dyke



The church dedicated to St. Sebastian



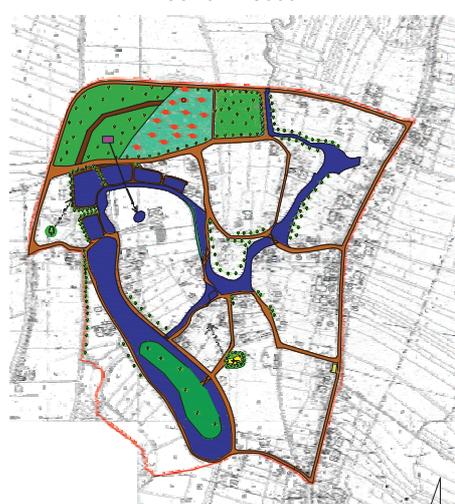
The pond (overgrown)

**Ortophotomap**  
Scale 1 : 10000



- Legend:**
- elaboration borders

**Situational-height map**  
Guidelines  
Scale 1 : 5000



- Legend:**
- park
  - orchards
  - roads
  - pond
  - church
  - alleys
  - manor-house
  - island

**Citizens and designers' guidelines:**

**Młynówka river:**

- directing tributaries to the river
- flow cleaning and making passable
- bridges renovation and widening
- scarps protection and fascining
- preserving of historical course, performing alternative polders
- building of a hydro power plant as an alternative energy source
- maintenance of greenery in the whole length (to remove trees and bushes from the riverbed, to supplement greenery system near Młynówka)

**The manorial square:**

- fence recreation
- improvement of the manor building's state and aesthetics
- preserving of historical view of the whole park

**Ponds:**

- the island's rebuilding
- walking and landscape paths
- regulated bank line, visible shape
- a path through the pond to the island

**Map of Strzelce Wielkie area development**



- Legend:**
- OPEN AREAS**
- Arable lands
  - Green grounds, set-aside
  - Arable lands, set-aside
  - Forest
  - Self-sown forest (succession)
  - Woodlots / shrubberies
  - Organized areas - park
  - Orchards / fruit bushes
  - Not exploited orchards
  - Wastelands
  - Various areas
- Buildings**
- Residential buildings
  - Farm buildings
  - Invested areas - schools, shops, manor houses, others
  - Urbanized, uninhabited area
  - Deserted building
- Roads**
- Asphalt road - good state
  - Hardened, gravelly road - bad state
- Waters**
- Waters (rivers, streams, ponds)
  - Wasteland water
  - Ditch - bed state
  - Breeding ponds
- Additional symbols**
- Churches, chapels, monuments, obelisks
  - Lanes of trees
  - Nature monuments
  - Unlisted dumping grounds
  - Scarps
  - Bridges, little bridges, culverts

**Legend:**

- OPEN AREAS**
- Arable lands
  - Green grounds, set-aside
  - Arable lands, set-aside
  - Forest
  - Self-sown forest (succession)
  - Woodlots / shrubberies
  - Organized areas - park
  - Orchards / fruit bushes
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- Residential buildings
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  - Urbanized, uninhabited area
  - Deserted building
- Roads**
- Asphalt road - good state
  - Hardened, gravelly road - bad state
- Waters**
- Waters (rivers, streams, ponds)
  - Wasteland water
  - Ditch - bed state
  - Breeding ponds
- Objects list**
1. Church, vicarage
  2. Shop, agricultural circle
  3. Historic manor house / hunting circle

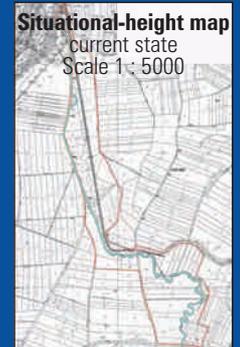
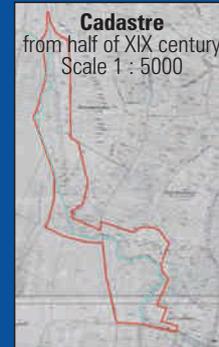
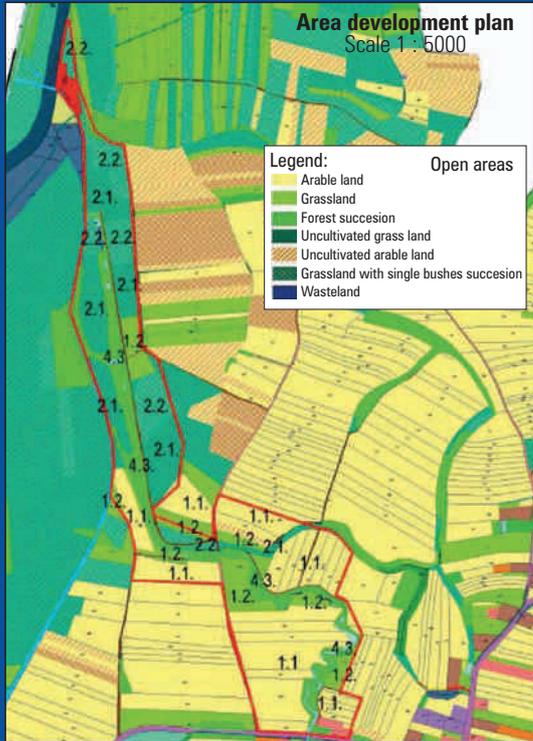
**Historical-landscape study**

Object: Strzelce Wielkie  
Commune: Szczurowa, Małopolskie Voivodeship

Authors:  
Edyta Augustynek  
Arkadiusz Doróż

Research supervisor:  
Prof. dr hab. inż. Urszula Litwin  
Small and in situ research:  
dr inż. arch. Przemysław Baster

## Current state, valorization and project guidelines



### Informative tables

Zone number	1-19, 23-37, 39-42, R1-R33
Photographies	Field, arable land, meadow
Object class/zone	Field, arable land, meadow
Object type	Arable land, non-mowed meadow, mowed meadow, high grasses
Fallow	—
Disarray, damages	—
Landscape	Positive
Natural value	1
1. Width, 2. Height, 3. Length	1.10 m, 2.30 m., 3. along Młynówka
Area	Flat
Running water	Damp riverbed, partly wet, overgrown, in certain parts deep and narrow, in the other – widened
Water profile	Natural
Comments, remarks	Drzewa i krzewy tylko wzdłuż Młynówki
Valuable	Valuable
Ecological value	< 50, historical trees > 50
Age	Mid-damp, damp
Humidity	Natural
Species composition	Native species – lime, oak, alder, birch, mountain ash, flax, wheat, corn, beet, cabbage, clover, buttercup, yarrow, dock, nettle, reed, common horsetail
Bank	Available with difficulties, available
Species variety	Medium, large
High arborescent plants	Concrete walls, low self-sown (to 20 m), historical trees to 30-40 m, bushes between trees



**Trifolium repens (clover (1975, R10), T. pratense (red clover (9, R9) – The most valuable plants for pastures. Previously, yellow pigment was received from flowers. Melliferous, placed in EU register of agricultural plants. Peculiar to hay meadows.**

**Ground elder (Aegopodium podagraria) – curative, damp habitat, fresh scrubland, water banks, fertile soils, likes nitrogen, humus half-shadowy or sunny habitats, edible, cosmetic, weed.**

**Alnus glutinosa (alder, black alder) – very resistant to stagnated water, along watercourses, pollen can be allergenic, it stabilizes ground and works against erosion in the mountains, avoids dry and sandy soils, photophilous (R2, 1972)**

**Fraxinus excelsior (European ash) – damp wetland forests, lives to 300 years, photophobic seedlings, ripe photophilous tree (R27, 1963)**

**Rye (Secale cereale) – economically, the most important representative of Secale genus. Grown on light soils (41)**

**Maize (Zea) – is characterised by great productivity and nutritive value.**

**Most of its crops is assigned for animals fodder production. It can be consumed by people after roasting or boiling. (12)**

**Potato (Solanum tuberosum L.) – plant species that belongs to Solanaceae family. Rich in starch tuber constitutes an edible part. It is an important fodder and industrial plant (3)**

### Guidelines

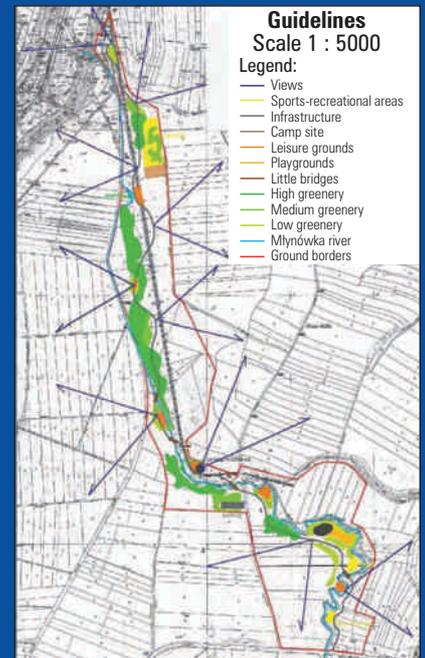
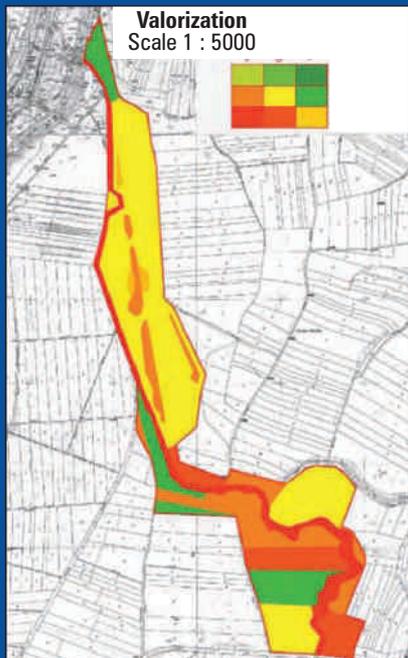
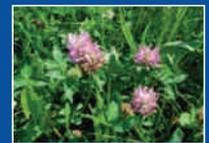
#### Inhabitants guidelines

- bicycle paths, sport playgrounds, recreational areas
- greenery system beyond the place
- deepening and flow capacity improvement of Młynówka riverbed
- removing trees from Młynówka riverbed
- preserving of Młynówka historical course

#### Project guidelines

- tourist attractions such as: a viewpoint, paintball
- a bicycle path
- weeding out of self-sown near Młynówka riverbed and removing it from there
- making of previous Młynówka riverbed passable
- integrated greenery system
- playgrounds for children
- parking place and cafe for tourists as well as inhabitants

Research supervisor: prof. dr hab. inż. U. Litwin  
Small and in situ research: dr inż. arch. P. Baster  
Vegetation analysis: dr inż. Z. Koziaara  
Elaboration's author: C. Piszcz





## AN INTERACTIVE MAP OF MOUNTAIN RIVER HYDROMORPHOLOGICAL DIVERSITY – CASE STUDY

Dawid Bedla, Karol Król

### Summary

New means and forms of media develop dynamically in the contemporary world. Field researches results do not have to be popularized only in text or tabular static elaborations forms. Widely available computer techniques and tools can be used to their presentation equally well. They enable creating internet applications which make interaction with a user possible through various components.

The aim of the paper is to present topic internet conception of a map which shows mountain river's hydromorphological diversity on the example of Wieprzówka stream. Project assumes spatial relation of objects observed in the field by means of geographic coordinates plotted on the interactive globe's map. Its informative and multimedia character was presumed in the map's project.

Field tests the results of which were presented on the map were performed within the frames of initiative to create given watercourses base proposed by the international ecological organization called in short WWF (World Wide Fund for Nature) and Poznań University of Life Sciences.

### Keywords

RHS method • mountain river's hydromorphology • internet cartography

### 1. Introduction

Rivers and streams' beds are particularly sensitive elements of river systems in Poland [Korpak et al. 2008]. In XXI century, Little Beskids rivers were subjected in many fragments to considerable anthropogenic impact on the environment. Anthropogenic changes can be very intensive and dynamic and with results often difficult to predict. To evaluate these changes' scale is not easy because in many areas anthropogenic factors affect omnidirectionally [Szwalec et al. 2007]. This influence has got complex character and far-reaching consequences [Wyżga et al. 2008].

In many Little Beskids rivers' fragments, riverbeds' systems are being interfered by not always reasonable technical regulation and also debris's exploitation. Riverbeds' narrowing was observed in fragments of watercourses subject to regulative works and human interference in a riverbed often caused that natural multi-thread simple river-

beds were transformed into one-thread ones with an even bottom and reinforced banks [Bojarski et al. 2005; Wyzga 2008]. Riverbeds regulation as well as debris material loss often caused bottom erosion and quick regression of river bottoms. Beds capacity increase and radical decrease of possibility to contain bankfull water in flooding areas resulted in growth of flood danger in the lower rivers fragments [Bojarski et al. 2005, Wyzga 2008]. These phenomena had to be minimized by damming up barrages which, however, caused watercourses permeability loss for fish [Bojarski et al. 2005].

Problems of protection from flood and riverbeds erosion have got global character. Negative phenomena connected with interference in watercourses run were also noticed in mountain European regions [Habersack and Piégay 2008]. Wyzga and co-authors [2008, p. 275] underline that “*interference in a riverbed also leads to loss of vertical riverbeds stability and radical decrease of biodiversity of fluvial and riverside ecosystems*”. Therefore, numerous activities are performed to restore natural watercourses’ profiles including riverbeds morphology, flow regime, and biodiversity of fluvial and riverside ecosystems [Nachlik 2005].

In the light of presented deliberations, permanent monitoring of anthropogenic impact on the environment degree in riverbeds and catchment area as well as its influence on natural environment are reasonable. Field researches results can be gathered in database of spatial information system [Król and Salata 2013] and presented in the form of an interactive map of spatial phenomena.

Internet applications can be successfully used to present surface waters and their catchment area profiles [Stachura et al. 2014a]. It can comprise a kind of fulfilling to field researches [Król and Szomorova 2015]. Their publication can influence increase of ecological consciousness as well as local societies focus on environment protection and shaping aspects [Stachura et al. 2014b, Król and Bedla 2015]. Various techniques and numerous computer tools including internet applications can not only serve to promote and inform but also collect opinions and comments of residents which can contribute to identify local environmental problems.

The aim of the paper is to present a project of topic internet map showing mountain river hydromorphological diversity on the example of Wieprzówka stream and to identify natural conditions that occur in its chosen fragments. Moreover, profile of chosen techniques and computer tools that can be used to create topic maps with use of open data sources and free software were presented in the paper.

## 2. Network application – project assumptions

Common access to open data resources and appearing of different geo-information tools including API (Application Programming Interface) programistic interfaces gave rise to internet cartography and formed the mainstream of “geographic information created by users” (VGI – Volunteered Geographic Information) [Goodchild 2007]. This trend reflects state of opinion and social changes that lie “*at the bottom of values and social attitudes*” within the frames of inhabitants’ approach to spatial phenomena occurring in their contiguity [Kostecka 2010]. Animation in the range of shaping and

strengthening of civil attitudes, developing and supporting of any initiatives that look for new ways of reconciling development of civilization with concern for natural environment can be noticed in the society [Sporek 2008, Hull 2008]. Great involvement of local societies in protection and promoting ecological space values can be observed in the last years. As a result of urban processes, most of human population of the world lives nowadays in cities. However, most often ecological consciousness of people comes beyond and over reality formed by things [Kostecka 2010]. Environmentally friendly initiatives can be realized by little research projects, spontaneous actions, often initiated in social media as well as information placed in the Internet in the form of web sites, blogs or topic maps [Król and Bedla 2013].

The main project assumption was to create interactive presentation of location of chosen hydromorphological points of Wieprzówka river in tested fragments with use of widely available computer tools and techniques as well as databases. The application's task was spatial reference and presentation of research results. This aim will be realized by text description and also graphics and photographs joined with POI points (point of interest, pushpin) marked on an interactive map according to geographic coordinates.

To create map application, data made accessible within the frames of OpenStreetMap (OSM) project were chosen. OSM is one of the best known and dynamically developing VGI projects. Its imperative aim is to deliver ready maps and "*rare geodata to all who need them*" [OSM 2015].

OSM map is a social project created by users from all over the world on the basis of data gained from various sources including own GPS measurements, air photos and others [Cichociński 2012].

OpenStreetMap databases are made accessible within the framework of the open licence ODbL (Open Data Commons Open Database License). It is the licence of "*authorship recognizance*" type, "on the same conditions" (attribution, sharealike). The licence enables redistribution, modification and usage of data with maintenance of the same liberties for the other users.

Leaflet library [2015] (BSD License, GPL – compatible free software licenses) was chosen to map POI points. Leaflet is the JavaScript library published in 2011. The tool supports creating internet maps and is placed next to OpenLayers and Google Maps API in the group of the most popular mapping JavaScript libraries. Leaflet's popularity results most of all from great efficiency and simple API and its usage does not need from a user advanced knowledge from the range of GIS spatial information systems [Donohue et al. 2014].

### 3. Tested object's profile

Wieprzówka is a mountain stream with length of about 28 km with special natural and landscape values. The watercourse flows in Rzycka Valley where numerous streams and brooks enter. Most of them carve deep and long valleys similar to ravines [Znikow 2001, Michalec et al. 2007]. The stream flows through such places as among others: Andrychów, Wieprz or Gierałtówice (wadowicki district, Małopolska). In Grodzisko

it flows into Skawa river forming one of its bigger left tributaries. The river is drinking water intake for Andrychów inhabitants.

The stream's sources are placed on the height of over 880 m asl. In Wieprzówka water supply system, the surface type prevails as its share is estimated at about 80% and the watercourse's bottom is covered with coarse-grained bottom material composed mainly from stone and graveled fractions [Książek et al. 2007].

Wieprzówka is an example of a mountain river which in the course of last dozen years was put to strong though spatially diverse anthropogenic impact on the environment. The river is characterized by numerous hydromorphological elements including billowses, waterfalls and plunge pools that occur in particular in the mountain fragment over Andrychów where interference in natural character of the watercourse is limited. In its lower fragment below Andrychów, the watercourse receives low-lying character [Zieliński 2003].

#### 4. Field researches

Hydromorphological tests of Wieprzówka river were performed in June and September 2014 on six fragments (two tests in three locations), below and in Andrychów town (Table 1). The works were performed within the framework of social initiative proposed by international ecological WWF organization (World Wide Fund for Nature) and Poznań University of Life Sciences. The initiative presumes to prepare database of watercourses or their fragments and to include that database in the process of elaboration of key documents from the range of water management. The example of such documents can be water management plans in the basins' areas or plans of water maintenance [Ustawa... 2001].

**Table 1.** Tested Wieprzówka fragments' profile

Fragment	Fragment's beginning coordinates	Fragment's end coordinates	Riverbed's width [m]	Fragment's length [m]	Threads' number	Number of point bars / middle bars
W <sub>1/1</sub> W <sub>1/2</sub>	49,834149N; 19,368339E	49,834592N; 19,367706E	12–13	50	1	2
W <sub>2/1</sub> W <sub>2/2</sub>	49,838294N; 19,355196E	49,838757N; 19,353136E	21–44	50	1–2	2–1
W <sub>3/1</sub> W <sub>3/2</sub>	49,851958N; 19,338931E	49,853079N; 19,337686E	12	50	1	1

Source: authors' study

Wieprzówka was chosen because of its diverse hydromorphological and natural character and social functions including its landscape and tourist ones. The river in its fragments preserved many environmentally valuable morphological elements including various accumulative forms (sand bars and gravel bars), bank erosion (a bank cut) and multi-thread fragments [Szozkiewicz et al. 2012].

In the tests, focus was put on river's hydromorphological conditions evaluation as its fragments are very diverse. Particular attention was paid to natural morphological elements (bars, bank cuts, multi-thread) and transformations within banks and riverbeds (Fig. 1). Conducting research, elements of anthropogenic origin were also catalogued including bridges, banks and riverbeds' strengthening, banks profiling and others.

Together with changes of natural character of watercourses the reason of which is sought in keeping endeavours and regulations of their flow, the trials were started to elaborate methods valorizing their state [Frankowski 2011]. Gebler and Jusik [2012, p. 4] state that [quote] "*only ecosystem approach to waters estimation that contains a row of biotic and abiotic elements will allow to know properly processes occurring in fluvial systems*". In the field tests, the Polish adaptation of the British method of geomorphological valorization called River Habitat Survey (RHS) was used [Raven et al. 1998a, 1998b, Environment Agency 2003, Szoszkiewicz et al. 2012]. Works over RHS method were carried out within the European programme STAR (Standardization of River Classifications). Its aim was to standardize research procedures and by that to receive comparable evaluation of European rivers' ecological state [Bis et al. 2005].

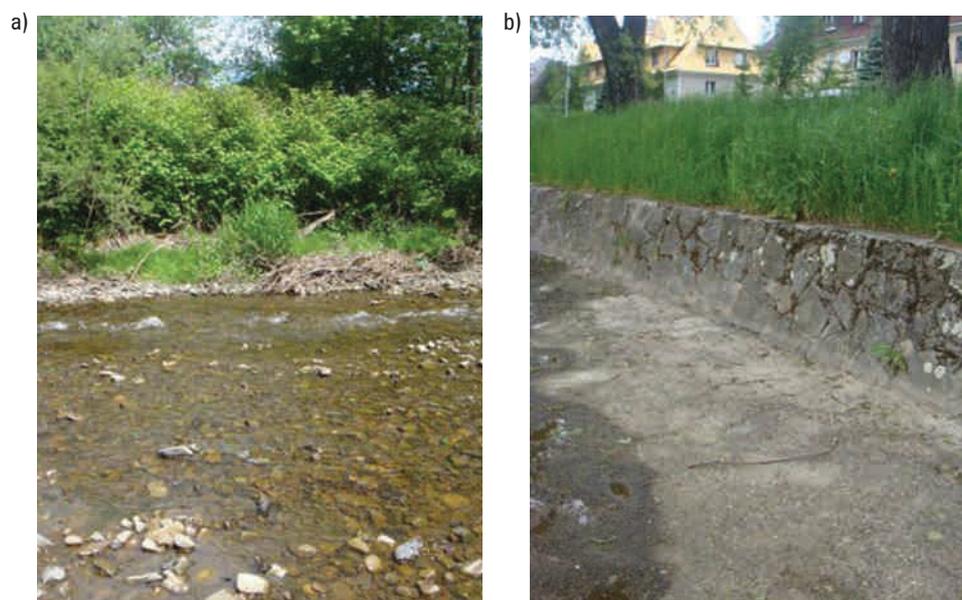
RHS is rivers' ecological state evaluation system with reference to their hydromorphological causations. This method is widely used in Great Britain and also in Germany, Sweden, Denmark, Czech Republic, Latvia and also in modified version in Italy, Greece and Portugal [Szoszkiewicz et al. 2005, Bielak et al. 2012]. The method gains popularity in Polish scientific centres as well [Frankowski 2011, Osowska and Kalisz 2011, Raczyńska et al. 2012, Spieczynski et al. 2013].

Description of river environment in RHS system can be used in statistic analyses and the method allows to classify and lead watercourses monitoring. Moreover, the method is precise, relatively simple in usage and does not need much financial investments. It is successfully used in local endeavours devoted to river valleys protection, watercourses restoration, monitoring as well as in researches of various kind [Trzaska and Mana 2008]. Results collected in such a way were put to analysis and presented in the map's application form.

Results of field tests were used to calculate HMS factor (Habitat Modification Score). This factor determines total degree of anthropogenic changes in rivers hydromorphology and allows to present in numerical way the range of river habitat's changes made by human beings [Wasilewicz and Oglęcki 2006]. HMS factor takes watercourse morphology transformations range into consideration including:

- banks transformations evaluated in control profiles (strengthening, profile, re-trenchment, multilevel bed, scarp trampling),
- riverbed transformations also estimated in control profiles (strengthening, profile, bars/dams, fords, culverts),
- transformations evaluated in the whole tested fragment which were not stated in control profiles (number and kind of water buildings, strengthenings, profiles and bank scarps rampart),

- the other transformations (water relation disturbance by dams, banks shift, waterbed realignment, widening and deepening, plants carving [Trząski and Mana 2008].



Photos by Dawid Bedla 2015

**Fig. 1.** Fragments  $W_{1/1}$  and  $W_{1/2}$ , a) Wieprzówka thread, b) riverbed with concrete bottom and concrete bank reinforcements

HMS factor assumes value from the range from 0 to 100 points. Low values of HMS point at the lack or slight transformations of watercourse hydromorphology, whereas high ones testify to strong anthropogenic impact on the environment.

## 5. Field researches results and conclusions

First two sections of Wieprzówka river are characterized by similar (low) transformations within the riverbed and banks, hence total HMS values are similar (Table 2). For the test fragment limited with  $W_{3/1}$  and  $W_{3/2}$  sections, the highest values of habitat modification score factor were stated which testifies to the greatest anthropogenic impact on the environment among tested sections. It is the one that flows through Andrychów town where: two culverts (16 points), banks (2 points) and the riverbed strengthenings (2 points), banks/bottom profile (1 point), two bridges beyond control profiles (2 + 2 points), two culverts beyond sections (16 points), two damming buildings (2 + 2 points), backwater as a result of damming building's presence (1 point) as well as strengthening of the whole bank's profile (3 points) were stated in research profiles.

The result of regulated fragment's valorization was in total 49 points (per possible 100), whereas in natural sections these values were 6 and 7 points (non-transformed fragments) (Table 2).

**Table 2.** Evaluation of Wieprzówka river habitat's transformation – HMS factor

Tested fragments	Estimation of modification in control profiles	Estimation of modification beyond control profiles	Total HMS
$W_{1/1}$ $W_{1/2}$	2	4	6
$W_{2/1}$ $W_{2/2}$	4	3	7
$W_{3/1}$ $W_{3/2}$	$16 + 2 + 2 + 1 = 21$	$4 + 16 + 4 + 1 + 3 = 28$	49

Source: authors' study

Gained points evaluation allows to conclude that despite considerable anthropogenic transformations observed in the area of tested fragments, their spatial diversity as well as relatively rich river-side flora create potential for rebuilding of river ecosystem.

## 6. Form and result of application's introduction

The map and application menu were written in the frames of HTML (HyperText Markup Language) hypertext document in the range of HTML5 specification [W3C 2015]. Particular application's components were formatted by means of cascading style sheets CSS (Cascading Style Sheets). The whole was placed on the data server as a web page.



Source: authors' study based on OpenStreetMap

**Fig. 2.** Map application "Chosen hydromorphological conditionings of Wieprzówka" fragment

Four kinds of POI points according to accepted division: road bridges, bars, foot-bridges and rock outcrops were mapped. Every kind of object was marked with a separate icon prepared in the form of PNG file. Icons were connected with text description and also graphics to characterize the given object (Fig. 2). The map created in such a way is elastic in edition and development and has got all features of internet dynamic maps as well (objects' symbols and descriptions in space, possibility to explore the whole globe's area, change of degree of map view's approach and others). Moreover, every element of the map can be modified both with respect of contents, elements' number and their location and web site within the frames of which the map was published fulfills international standards of creating web sites established by World Wide Web Consortium [W3C 2015].

## 7. Conclusion

Technical and practical aspects of elaborating a spatial phenomena digital map were presented in the paper. Net applications can be a perfect supplement for field research. They make possible to create interactive presentation of spatial phenomena and to popularize research results. Chosen computer techniques and tools accessible free of charge can be used to their composing.

Characterizing the tested river, it can be stated that its source part is particularly precious environmentally with rock outcrops, material bars or bank cuts. Below the river's source part, both natural morphological elements and infrastructure integrated in the flowing river can be met. From among tested fragments, the one that flows through Andrychów town turned out to be the most transformed.

River Habitat Survey method as well as interpretation of HMS synthetic factor enables to evaluate and characterize anthropogenic transformations of riverbeds. The researches show that fragments of the same river can distinguish with diverse value of the factor which indicated changeable dynamics of anthropogenic impact on the environment in the riverbed. HMS is a parameter that supports evaluation of ecological state of upland and mountain rivers. On the basis of its value, the degree of transformations caused by human activity can be concluded which simplifies evaluation and comparison of tested river fragments.

During the field tests, it was noticed that history of the river's knowledge is important for RHS method. Field interview with local inhabitants which revealed that Wieprzówka is a serious flood danger with regard for area dwellings in flood plains zone can also be helpful. Moreover, riverbed's transformations in the watercourse made in the past, for example route's changes, scarps' modification or backwaters' cutting off can be evaluated as natural elements which may influence the research result. Information of such kind makes up an important aspect while preparing restoration works and internet application can be a good tool of their presentation.

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## AREA DEVELOPMENT CONCEPTION OF THE JAGIELLONIAN UNIVERSITY COLLEGIUM MEDICUM – PROKOCIM

Robert Gradka, Paweł Kotlarz, Urszula Litwin

### Summary

The main aim of the paper was to elaborate a conception of spatial development around dormitories of the Jagiellonian University Collegium Medicum located in Prokocim – one of Krakow quarters. The area that is being elaborated comprises public space of academic commune which lives there. Lack of possibility to spend free time in the closest neighbourhood together with special landscape values and a very bad state of buildings and also outdated infrastructure became inspiration to create this conception. The task was characterized by works' multi-stages and its main goal was to create favourable conditions of functioning and friendly space for its inhabitants. Special attention should have been paid to demands concerning architecture, environment and landscape values with simultaneous preserving of economic balance while planning the conception. Planned assumption of modernization and development of objects and not only sporting and recreational ones can become a response for inhabitants' expectations and needs in the range of free time realization and spending.

### Keywords

conception • development • spatial order • spatial planning

### 1. Introduction

Spatial development is area shaping which takes architectural and landscape values into account and needs environment protection, cultural heritage protection as well as economic conditions [Hołuj 2008]. So spatial planning and development should be understood as every process regulated by the Act about planning and spatial development which decides about space shape and especially within the way of its development and purpose of given area and in the final effect – its usage. However, demands in the range of spatial order but also urban planning and architecture indicate the necessity to consider rules of construction law and executive decrees including technical and building norms.

Everything around the closest human neighborhood needs to be changed, especially considering the flow of time. All the more, it does not miss areas intensely exploited

by people and demands in relation to these places change. Relating to the object which was subjected to the case study, buildings as well as abutting infrastructure which came into existence in the previous century need modernization definitely. Old architecture with a great number of concrete elements is replaced by more aesthetic ones with proper choice of colours. These changes with help of spatial planning lead to changes of the given area development and also arranging of spatial order there. In case of places where current plan of spatial development exists, definite assumptions concerning space view are realized and in places without such plans there is study and fitting for existing state around researched area that should be relied on.

The task was to elaborate development of the area around dormitories and also physical education and sport study centre which needed preparing a map for project purposes that was made on the basis of properly concentrated direct measurement. All elements of existing state had to be taken into account there. Area measurement had to be performed in the way which enabled later usage of data to prepare a situational and height map as well as area numerical model. It was also important to familiarize oneself with current state and to provide documentary in descriptive, graphic and photographic ways. Development conception was prepared according to assumptions presented by area administration, students' self-government representatives and also dormitories inhabitants council. It fulfilled safety requirements set among others for the width of fire-fighting ways and foot traffic routes and it also considered access of new elements for disabled persons.

## 2. Characteristics of the object

The analysed area is the Jagiellonian University property situated in the south-eastern part of Kraków in Prokocim quarter. Development area includes three dormitories of the Collegium Medicum campus and the Physical Education and Sport study of total area over 4 ha. The whole object is located in one record parcel No. 165 and it is the urban area of medium urbanization with numerous green grounds surrounding the object. The campus which was built in the 90s of XX century is located about 10 km from the main university centres and from the city centre. Both buildings and surrounding space were designed according to current trends.

Previous development was full of damaged concrete and asphalt elements which were spoiling spatial order. Buildings create regular rectangular figures whereas surrounding area is composed of several concrete pedestrian routes with ruined and full of wastages surface, concrete stairs and big flower tubs with grass and placed on the elevation which makes their keeping difficult. The area around the Physical Education and Sport study building is composed of similar elements: concrete pedestrian routes, sport playfields the surface of which is cracked asphalt and stairs without any lighting which creates danger for users' health and life. The whole needs thorough renovation and development to create additional places of public usage as well as parking places and ramps for the disabled.

### 3. Measuring method

Elaboration of the situational and height map was the main element of area mapping. The map was made according to current standards of the Geodesic and Cartographic Documentation Centre and was accepted to the National Geodesic Documentation Resources. The map was also prepared for area modernization project aims.

The measured object is an area with great denivelation and surveys of both situational elements such as pavements, playfields, buildings and also the net of height points that give possibility to map the area shape faithfully were required. Tacheometric measurement bound to the points of national measuring framework with use of points of measuring points of GNSS technique was accepted as a measuring method. Used measuring technique together with proper density of measuring points enabled to prepare the map and also an area numeric model. Additionally, while performing an area interview, a photographic-descriptive documentation of the existing state was prepared. In that case, there was no spatial development plan and therefore assumptions concerning area view were determined by the study.

### 4. Stages of creating development

Preparing of development conception is characterized by many stages. Theoretical and substantial preparing is necessary in the initial preparation stage. The later works are performed in the proper order to receive satisfactory final effect. The works that should be done are as follows:

- to conduct area interview in order to determine the elaboration and later measuring ranges and the measuring method,
- to perform an area mapping (in that case the situational and height map, the area numeric model and also the photographic-descriptive documentation of the existing state),
- to consult with authorities that govern the area and also with the latter area users, in that case with buildings' administration and students' self-government representatives and also dormitories inhabitants council,
- to prepare project assumptions for anticipated elements and to confront them with performance possibility in the field and with demands set by proper norms,
- to elaborate development conception as a flat two-dimensional board and also on the basis of the area numerical model, the whole area three-dimensional visualization as well as of particular elements.

### 5. Assumptions of conception elaboration

The main project assumption was the smallest possible interference in existing area shape. New elements of both small architecture and pedestrian routes and playfields should have been slotted into existing area.

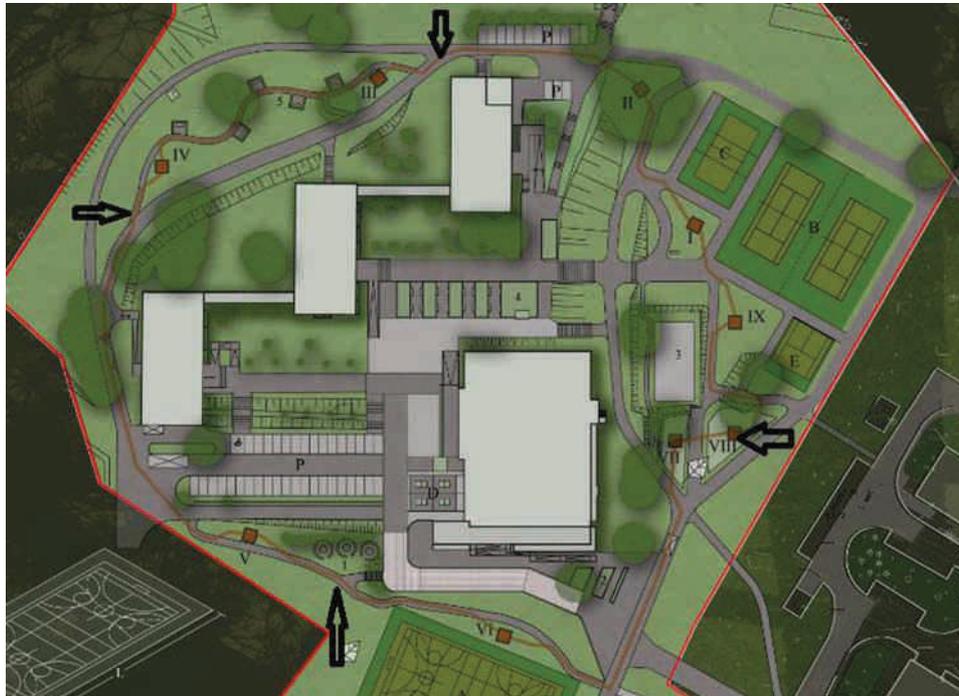
After consulting with students, administration workers and the Physical Education and Sport study workers, when initial proposals of changes elaborated by authors were presented, the list of modifications and new elements for campus area expected by users was prepared. They were as follows:

- planning of a health path running through the whole researched area on the natural surface and including 9 stands for motor exercises in its course,
- a multifunctional playfield with dimensions 50 x 28 m dedicated for basketball, handball, tennis and volleyball. Around playfield – 3 m of protective zone. Surface of the playfield – grass,
- two tennis courts, illuminated and fenced with PCV walls, with grass or brick powder surface,
- a playfield for beach-ball,
- a stand for squash,
- tables for table tennis placed permanently in determined spots,
- a place for a folding stage which enables to organize entertaining events in a safe way,
- modernization of pedestrian routes in order to improve users' safety and to adapt them to be used by the disabled,
- reconstruction of a ramp and stairs to the Physical Education and Sport study together with performing of proper illumination,
- location of leisure-recreational places as wooden tables and arbours,
- modernization of existing parking places with adaptation to the disabled needs.

Various models of leisure preferred in contemporary society were taken into account in the conception so as to prepare recreational area to be – both in the programme and its functions' ranges – the complex that will fully satisfy requirements of the future users. All sport objects, transport routes, ramps for the disabled and the other ones were designed according to directives determined by the law and mainly to the book by Neufert which enables to design even the most complex objects by programme and space. Parking places were designed with help of the guidebook by Korzeniewski.

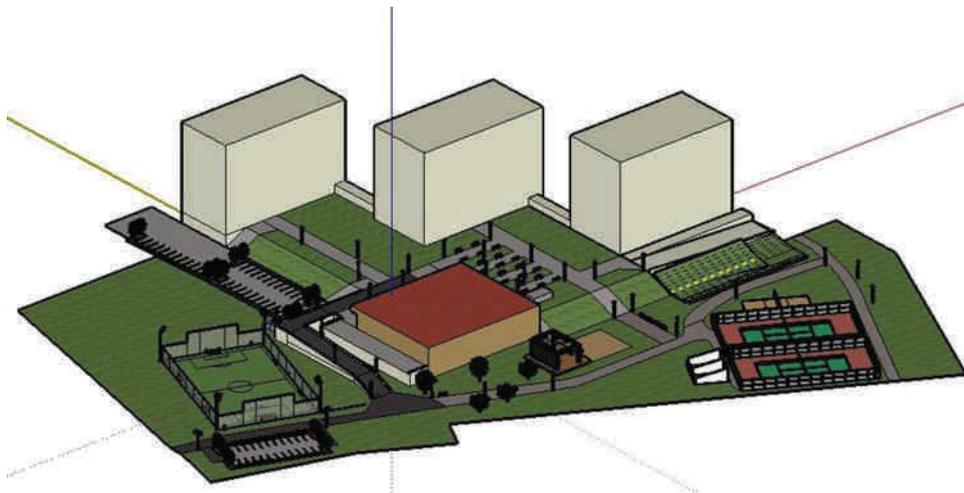
## 6. Summing up and conclusions

The final effect of the research was to perform development conception of the area of students living and learning in the Collegium Medicum in two- (Fig. 1) and three-dimensional space (Fig. 2). The authorities of the Jagiellonian University were the leading organ to consult and influence the final conception outline and the following area appearance. Safety of the area used by students and workers, framing in the conception objects that serve physical development and possible adaptation of objects to easy running of later conservational works and the ones aimed at preserving it in order were the main aims of the conception. Persons representing Students Self-government



Source: authors' study

**Fig. 1.** Development conception (2D) of the Jagiellonian University – Collegium Medicum (2014)



Source: authors' study

**Fig. 2.** Development conception (3D) of the Jagiellonian University – Collegium Medicum (2014)

required that the area would be supplemented with now missing elements. There were mainly places where students' meetings and cultural events might take place. The University authorities did not have concerns regarding places for an arbour, barbecue or stage to be framed in the conception. Linking of spatial development proper solutions such as transport, greenery system or sport buildings is the basis for creating good configuration based on harmony between designed elements and finally providing spatial order for that area without much interference in existing area shape. The elaboration fulfills the highest norms of: safety, fire-fighting and demands for the disabled by adaptation of pedestrian routes and ramps to the buildings.

It should be emphasized that this conception won the 1<sup>st</sup> place in a competition announced in public by the Jagiellonian University rector and is currently implemented.

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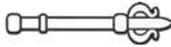
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## PRESENTATION OF OBJECTS AND SPATIAL PHENOMENA ON THE INTERNET MAP BY MEANS OF NET RESOURCE ADDRESS PARAMETERIZATION TECHNIQUE

Karol Król

### Summary

Over the course of several years, web cartography which changed the way of presentation and exchange of information gained new sense. Techniques development and availability of geo-information tools in connection with net data transfer new quality enabled to create maps accessible in real time according to user's preference.

The aim of the paper is to characterize and evaluate technique of parameterization for net resource URL address (Uniform Resource Locator). Examples of maps presented in a browser's window according to set parameters defined in accordance with rules in force in the range of API programistic interfaces of chosen map services were presented in the paper. Maps developed by URL link parameterization technique were put to functional tests. Moreover, efficiency and utility tests were performed.

Performed tests show that creating maps with help of discussed technique needs knowledge and expert abilities which may cause difficulties to less advanced users and its use allows to evoke maps in the browser's window but in the limited range.

### Keywords

URL resources addressing • web cartography • geo-visualization

### 1. Introduction

The Internet plays bigger and bigger role in interpersonal communication. It is among others influenced by new forms of information transfer, more perfect telecomputer tools and also access to cordless network services.

Over the course of several years, web cartography and topic data geo-visualization gained new sense, especially in modeling, analyses and presentation of phenomena occurring in natural environment and having spatial reference [Król and Bedla 2013, Prus and Budz 2014], also in spatial planning [Andrzejewska et al. 2005, Trystuła 2013, Król and Szomorova 2015], geo-marketing [Allo 2014], tourism and in many other levels.

Web cartography changes the way of presentation and information exchange. Kowalski [2000] notices that despite technological, economic and legal hindrances,

numerical maps, spatial visualizations and cartographic animations become an inseparable part of web publications.

Interest in web cartography results among others from techniques and geo-information tools including API programistic interfaces (Application Programming Interface) which enable creating of topic maps.

API programistic interface is a set of procedures, protocols and tools with help of which computer programmes communicate with each other. The map prepared in such a way can be enriched with contents chosen by a user and then put in frames of any hypertext document [Dąbrowski and Sawicki 2010].

Popularity of techniques available within API programistic interfaces results largely from the fact that they enable access to data of global range and support creating of interactive maps for personal use. Moreover, these techniques are relatively simple in using, increase efficiency of work with geographic information and they are also available free of charge [Chow 2008].

Attractiveness of interactive maps results most of all from advantages of the Internet itself as medium but also from their variety as well as quickness of access to geographic information by their means. Kowalski [2012] pays attention that beyond typical cartographic features, web maps have got two extra important features: interactivity and many-sidedness (hyper-mediality) thanks to which they perform functions transcended over typical cartographic tasks.

Web maps wide spectrum includes elaborations with different degree of complexity and varied content beginning from static maps and finishing at complex geo-information systems [Okonek 2010]. Importance of a new range of help available through map services such as Google Maps and Bing Maps increases. Interactive topic maps become more often a web services component and called mashups.

The aim of the paper is to characterize and evaluate the technique of parameterization for net resource URL address (Uniform Resource Locator) which enables creating of topic maps presented in the browser's window according to given parameters.

## 2. Materials, methods and tools

Trial to characterize the technique of parameterization for net resource network addresses (URL links) which allows to evoke in the browser's window a map of spatial phenomena with determined parameters was performed in the paper. Maps evoked by means of the objective technique as well as the technique itself were put to functional tests also described as "black-box testing". That method consists in programmes testing without access to particular information concerning their building. Tests are performed on the basis of functional assumptions that should be fulfilled by the programme according to documentation. Black-box testing method allows to test a chosen fragment of functioning of the whole programme and the test itself usually describes programme's response to activities given by a user. In that context, testing is understood as a process of software starting in a controlled way in order to consider if it acts according to expectations.

Functional tests allow to identify programme's imperfections such as incorrect or missing functions, irregularities in interface activity, mistakes in data structures or access to data bases or the problems with efficiency. However, they do not indicate where the mistake in programme's code is [Madiha and Waqas 2015].

Advantage of black-box testing method is performing tests from the point of view of routine using of application. It is advisable to perform tests by persons without programistic knowledge which increases result's objectivity. However, the method demands accurate specification and guidelines for tested cases.

While performing tests, attempts to measure map services efficiency, functionality available in the range of tested techniques identification and also evaluation of their availability for users without expert geo-information knowledge were made. Research of dependence between efficiency and usability and also the type of web browser where the map is evoked were not performed.

Efficiency tests of evaluated services were made with use of PageSpeed Insights (Google Developers) application. This application simulates service activity in stationary and mobile devices measuring its efficiency at the same time. The result of the test locates on the scale between 0 and 100 points. Estimation on the level of at least 80 points means that the tested web page functions relatively well, however, its chosen parameters could be optimized (Table 1).

**Table 1.** Web site efficiency according to the PageSpeed Insights test

Point scale	0–19	20–39	40–59	60–79	80–89	90–100
Realisation technique	Very bad, web site to be rebuilt	Bad, web site to be rebuilt	Mean, many elements should be improved	Sufficient, many elements should be improved	Good	Very good

Source: author's study

Functional tests consisted in wording questions to maps server. Questions took URL addresses form of definite web resource. URL address idea was in that case restricted to web site address which is written in the browser's address window. Attributes of URL questions (URL Query String Parameters) made accessible by chosen map services within API programistic interfaces were put to parameterization (Table 2). Services were chosen because of the number of users as well as popularity in the world according to the Alexa ranking – “The top 500 sites on the web, Reference, Maps” criteria [Alexa 2015].

System of Alexa statistics generating (Actionable Analytics for the Web) is the most popular in the United States of America and in Asia and slightly less in Europe. Patented technology of measurement allows to analyse numbers of users who visit web pages. Alexa rankings receive world-wide recognition and are a good point of reference for marketers and web site creators.

Uniform Resource Identifier (URI) is an internet standard that enables to identify web resources. URI is a chain of marks written according to a definite syntax. This

chain determines the name (URN) or address (URL) of the resource identified by given URI. URI can be classified as URL (Uniform Resource Locator) or URN (Uniform Resource Name). URI is a superior concept and includes URL and URN as two different ways of presentation of the same address.

**Table 2.** Tested map services

Map service	Base URL address of map resource
Bing Maps Create a Custom Map URL	<a href="http://bing.com/maps/default.aspx?parameters">http://bing.com/maps/default.aspx?parameters</a>
MapBox HTML embeds	<a href="https://a.tiles.mapbox.com/v4/parameters">https://a.tiles.mapbox.com/v4/parameters</a>
Google Maps Query String Parameters	<a href="http://maps.google.pl/maps?parameters">http://maps.google.pl/maps?parameters</a>
MapQuest Link to MapQuest	<a href="http://mapq.st/map?parameters">http://mapq.st/map?parameters</a>

Source: author's study

URL is a unified format of addressing resources which serves to identifying information, data or services available in the Internet, indicates resource location and the way of its downloading [Berners-Lee et al. 2004, Mayrhofer and Spanring 2010].

Evoking maps in the browser's window by means of URL link was tested according to project assumptions which included map presentation of two objects: Bagry Reservoir and Płaszowski Pond (Kraków, Małopolska). Moreover, while testing map services, particular attention was paid to documentation availability as well as trainings and help systems.

In IT, parameterization of URL addresses is ranked in the group of techniques of codes writing and described as WYWIWYG (What You Write Is What You Get). Supporting of codes programming (in slang also called as "hand coding") can be realized through applications with definite functionalities such as among others: key words colouring, automatic addition of words, context suggestions, additional windows of features, key short cuts, automatic shutting and colouring of brackets or validation of syntactic correctness [Filotowicz et al. 2011]. URL addresses parameterization was made by means of Notepad++ (6.8.0 version) application which is a developed text editor made accessible free of charge within the frames of general public licence GNU GPL (GNU General Public License).

### 3. Characteristics of chosen geodata deliverers

Buczek and Marmol [2007] notice that geo-information is an important element in the process of informative society shaping and one of the most efficient forms to present spatial information is a picture. Map services simplify spatial identification of objects, facts and events [Bac-Bronowicz et al. 2008]. Maps can well display developed

text description of object location or drive route [Korycka-Skorupa 2002, Medyńska-Gulij 2007].

There are many cartographic services with various popularity, map services market position and different functionalities available in the Internet.

The most famous are Microsoft Bing Maps, Google Maps, AOL MapQuest (North America), MapBox, OpenStreetMap, Baidu Maps (China, Japan) or Yandex Maps (Russia). In the paper, some of them were put to tests and characterized. According to Dąbrowski and Sawicki [2010], the biggest possibilities to create own maps are given by Google Maps [2015] and Bing Maps [2015] portals, particularly with regard to API programistic interfaces range. Google Maps and Bing Maps services were chosen because of free of charge available functionalities.

AOL MapQuest [2015] service was chosen considering firm history, specific character of make and its return to the world-wide market of map services. MapBox [2015] was tested taking into consideration connections with OpenStreetMap project and great importance attached to graphic quality of popularized orthophotomaps.

### 3.1. Microsoft Bing Maps

Microsoft is a firm from the computer brand the leading products of which are operating systems of computers and mobile devices. Microsoft also competes on the markets of cataloguing and information searching services (Bing browser) as well as map services (Bing Maps).

Microsoft Bing Maps is a wide spectrum of services connected with map elaborations popularizing. Bing Maps service provides access to road maps, satellite and air photographs and also three-dimensional buildings visualizations. Searching for objects and routing between given points are its basic functionalities. Moreover, it enables travelling on virtual city streets ("Streetside" application), routing and it also makes available different functions that can be used in creating web site applications. Service is joined with the Internet browsers such as Bing and Microsoft Internet Explorer.

Bing Maps makes accessible API programistic interface with help of which it is possible to create web applications with use of map elaborations through functionalities programming, adding own information to the map (points, lines and polygons) and many others.

### 3.2. Google Maps

Google Maps service was chosen according to its popularity. Google is now one of the most identified make in the world. Its name originates from math term "googol" which means a number  $10^{100}$  that was to reflect endless amount of information in the Internet [Boguś 2011].

Google browser is the most often visited web site in the world and Google Maps service takes in Alexa topic ranking [2015] the fourth place just after MapQuest, Bing Maps and Mappy services. In Google Maps map service, a user is able to browse road,

topographic, satellite and hybrid maps. Moreover, the service makes available many other functionalities including: objects searching, routing and its modification, looking through panoramic city presentations (Street View), exploration of virtual world images in three dimensions (Google Earth) and many others [Pawłowski and Malinowski 2008]. Google Maps has got open character, gives access to tools that enable users to create topic maps and place them in the Internet.

### 3.3. AOL MapQuest

AOL MapQuest map service is one of the three most popular ones in the world according to the ranking “The top 500 sites on the web, Reference, Maps” [Alexa 2015]. MapQuest service is an American pioneer on the map services market which has changed this brand’s perception. MapQuest platform is one of the first places in the Internet where interactive maps were available. The firm’s history starts in 1967 in cartographic services branch (road maps print-outs for petrol stations). In 1994 the firm was renamed “GeoSystems Global Corporation” and in 1996 MapQuest.com service came into existence. In 2000 the make was taken over by America Online.

### 3.4. MapBox

Mapbox [2015] is a map service established in 2010, presented as a platform for creators of various map solutions. MapBox team creates and makes accessible tools which serve to project and publish maps according to given parameters. The firm concentrates on creating interactive and possible to be configured maps from open data sources mainly from OpenStreetMap [2015] resources, LANCE-MODIS NASA (National Aeronautics and Space Administration) [2015] data and also its own sources. The aim of the firm is expansion on the map services market, especially in the range of non-standard topic elaborations, f. ex. illustrating the range of intensity of different spatial phenomena occurrence including these with environmental, economic and industrial importance. MapBox assumes the most commercial form of all tested services making available to sell access packets with definite specification. Free of charge access is the simplest in functionality.

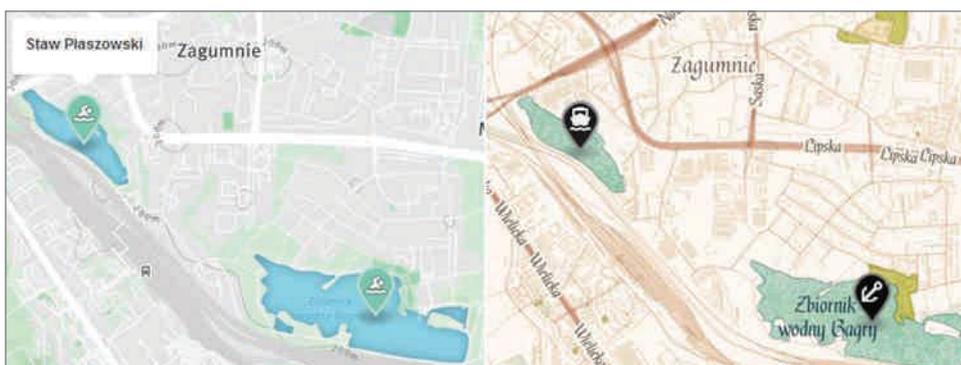
## 4. Characterization of chosen URL addresses parameterization aspects

Analysing technical-planning documentation of tested techniques, the one prepared and made accessible within the frames of Bing Maps (Bing Developer Center) help system was evaluated at the very most. Bing Maps (Create a Custom Map URL) network addresses parameterization technique is presented here in numerous examples. URL parameters available in API allow to create a link in the browser’s window that evokes an interactive map showing objects of points, lines and polygons character. Objects plotted on the map can be described with text and graphics. Usage of the links parameterization technique within Bing Maps service does not need to register user’s account

and one of its advantages is possibility to personalize a map and URL address programming simplicity.

Manual parameterizing of URL address of the concrete map with use of techniques available within MapBox service is possible, however, the solution is less effective than creating a map with help of the creator accessible after registration of the MapBox user's account. A map is constructed in the creator by means of graphic interface. Application generates URL address of the network resource. However, parameters of the map created in such a way are coded and it is not possible to edit them manually. The tool is well-developed and simple in usage, it allows to create personalized maps in an automated way. Though, it needs to be registered and logged. Moreover, to use a map created in such a way, a MapBox "token" is needed. A token is composed of a row of marks which allows to conjoin a network resource with a user as well as to generate statistics of f. ex. given map openings.

One of advantages of the MapBox creator is varied topic set of map bases and also possibility to diversify and personalize POI points (points of interest plotted on the map) (Fig. 1).



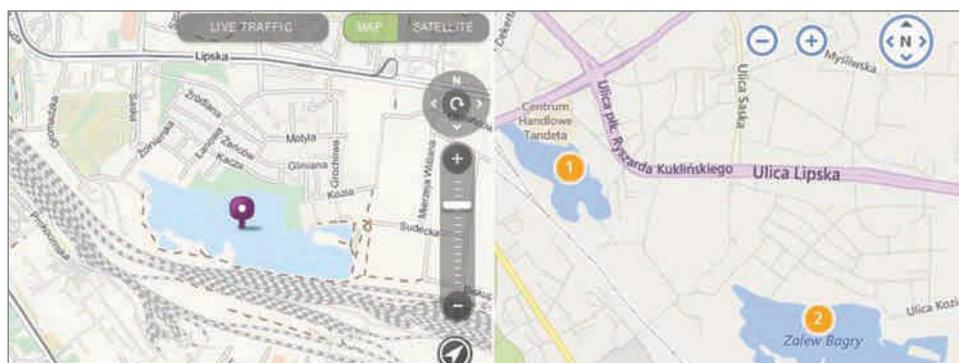
Source: author's study with MabBox usage

**Fig. 1.** Stylized map of Bagry oraz Piaszów reservoirs location in Krakow – “Run, Bike and Hike” and also “Pirates” map bases, view in the Internet browser's window

Constructing of dynamic maps with use of the URL addresses programming technique has got restrictions. Apart from matters of available functionalities, one of the basic limitations is URL address length. This limit is 2,048 marks and concerns every URL address regardless of a link programming technique. For example, MapBox token consists of 97 marks and it is an element of URL link. So it decreases the number of marks that can be used to plot own information on the map.

Users who are not interested in thorough investigation of coding documentation of questions to a server can use a form that in real time generates link to the map according to given parameters made accessible within MapQuest service (Fig. 2). URL

address creating consists here in entering of map attributes values in the fields of the form which is MapQuestweb site component. This solution is comfortable and useful. When the form is insufficient, users can have the use of documentation of extensive URL links parameterization.



Source: author's study with MapQuest and BingMaps usage

**Fig. 2.** The map of Bagry nad Płaszów reservoirs location in Krakow, prepared in MapQuest and BingMaps services, view in the Internet browser's window

Evoking a map in the browser's window according to programmed parameters of URL address is also possible within the frames of Google Maps service. Defining a question to the maps' server is realized by means of definite parameters of URL path (URL Query String Parameters). Examples of URL link parameterization with use of chosen attributes were presented in Table 3. Presented code is responsible for displaying an interactive map in the browser's window and is composed of the basic address of the map resource (<http://maps.google.com/maps>) and next chosen maps' attributes and their values, for example for Google Maps: `ll=50.036878,19.978551&q=Zalew+Bagry &z=14&t=k&hl=PL`, attribute "ll" values are latitude and longitude coordinates, whereas the parameter itself defines the point of map picture centering; "q=Zalew+Bagry" attribute evokes the question to the maps' server concerning the object called "Zalew Bagry" and when it exists – the marker is plotted on the map; "z=14" attribute defines the grade of approximation of map's view (the level of map browser's scale), and "t=k" attribute decides about the map base's type (possible values are: "m" – map, "k" – satellite, "h" – hybrid, "p" – terrain).

**Table 3.** URL address parameterization for example of GoogleMaps device

Google Maps, Query String Parameters
<code>http://maps.google.pl/maps?ll=50.037399,19.978213&amp;q=Zalew+Bagry&amp;z=14&amp;t=p&amp;hl=PL</code>

Source: author's study based on Google Maps

## 5. Tests form, results and conclusions

URL addresses recording (URL encoding) written in the browser's address line was performed with disregard of percent encoding. Marks reserved for URL (exclusive marks that play determined functions in URL addresses) were not replaced by the other marks sequence because it was leaved in competence of browser's software. Its task is marks conversion. In Table 4, a base URL address and its transformation in the browser's address window after evoking a map was presented, on the example of a question to MapQuest map server. Coma mark which belongs to the group of reserved marks with special purpose was replaced by marks sequence "%2C"; round bracket "(XX)" is converted to the marks: "%28XX%29" and plus mark "+" replaces the space one.

**Table 4.** URL address example – the base record and the transformed one after pasting in the browser's address window and marks conversion, on the example of MapQuest resources

Link to MapQuest – base record
<a href="http://mapq.st/map?q=50.032716,19.990521(Zalew+Bagry,+zbiornik+wodny+na+terenie+Krakowa,+powstały+w+wyniku+zatopienia+wyrobisk+źwirowni.)&amp;center=50.032716,19.99-0521&amp;zoom=14&amp;maptype=map">http://mapq.st/map?q=50.032716,19.990521(Zalew+Bagry,+zbiornik+wodny+na+terenie+Krakowa,+powstały+w+wyniku+zatopienia+wyrobisk+źwirowni.)&amp;center=50.032716,19.99-0521&amp;zoom=14&amp;maptype=map</a>
Link to MapQuest – transformed record
<a href="http://www.mapquest.com/?le=t&amp;q=50.032716%2C19.990521%28Zalew+Bagry%2C+zbiornik+wodny+na+terenie+Krakowa%2C+powsta%C5%82y+w+wyniku+zatopienia+wyrobisk+%C5%BCwirowni.%29&amp;center=50.032716%2C19.990521&amp;zoom=14&amp;maptype=map&amp;vs=map">http://www.mapquest.com/?le=t&amp;q=50.032716%2C19.990521%28Zalew+Bagry%2C+zbiornik+wodny+na+terenie+Krakowa%2C+powsta%C5%82y+w+wyniku+zatopienia+wyrobisk+%C5%BCwirowni.%29&amp;center=50.032716%2C19.990521&amp;zoom=14&amp;maptype=map&amp;vs=map</a>

Source: author's study based on MapQuest

Results of functional tests allowed to demonstrate lacks in locations of chosen environmental objects situated in Poland's area when evoking them by geographic names. These lacks were identified in MapQuest and MapBox services (Table 5). Testing consisted in trying to present in the browser's window the chosen object by means of its own name coded in URL address. Moreover, the result of the test was verified with use of the browser which is a component of evaluated service.

Geographic names of chosen reservoirs from northern, central, and southern Poland of local character: Warmia and Mazury – Surwile Pond, Hławki Lake, Tuchel Lake, Mazanskie Lake; Kraków – Płaszowski Pond, Bagry Reservoir and Gorlice vicinity – Klimkówka Reservoir were used in tests. Availability of geographic names of such objects in database can testify to its specificity's degree. Presentation of the map of objects given in the test with help of URL address parameterization technique in MapQuest and MapBox services is only possible when geographic coordinates are given. In case of MapQuest service, it can result from the fact that this service is the most popular one in the United States of America and works of its project team are concentrated on the North America. Moreover, both services are in a development phase.

**Table 5.** Criteria and result of functional tests

Test criterion	Bing Maps	Google Maps	MapQuest	MapBox
Resource access token	Lack	Lack	Needed for API	Registration required, necessary, authorized access
Object's evoking by its geographic name	Lacks not found	Lacks not found	Lacks found	Lacks found
Point objects presentation	Difficulties not found	Difficulties not found	Difficulties not found	Difficulties not found
Presentation of objects of surface character	Difficulties not found	Possible with API usage	With use of the other techniques	With use of MapBox interface
Access to user's interface	Free	Free	Free	Registration required, authorized access
Language version	Poland	Poland	English-speaking, In the new service uncover, problems with Polish marks projection	English-speaking
The other, characteristic	Developed and intuitive set of instructions (tutorial)	Shortcuts of link parameters recording	Not stated	Developed palette of map bases

Source: author's study

Bing Maps, Google Maps and MapQuest services enable free URL address parameterization and evoking a map of given parameters in the browser's window. Otherwise is in the event of MapBox service where usage of discussed technique is only possible after encoding in token's address (Table 6).

**Table 6.** An example of a hyperlink created by means of MapBox creator where token identifying the map with a user was coded

```
https://a.tiles.mapbox.com/v4/baku11.9b029369/page.html?access_token=pk.eyJ1IjoiYmFrdTEuX2Y2MDNmODNjODIxOTVmdmZDNkNmFiOTQ3MzczYTk2In0.vC2nSVRiOsYe5_becDDJaQ#14/50.0363/19.9708
```

Source: author's study based on MapBox

Efficiency tests of evaluated services come to similar level (Table 7). The high points score of responsive test (Responsive Web Design – RWD) allows to state that every service-provider sets much store by usability of map services and mobile devices.

**Table 7.** Web site efficiency according to PageSpeed Insights test

Map service	Bing Maps	Google Maps	MapQuest	MapBox
Desktop point score				
Page activity speed	84	91	78	71
Mobile point score				
Page activity speed	58	78	47	55
Usability	95	99	94	100
Sum	237/300	268/300	219/300	226/300

Source: author's study

Efficiency test consisted in measurement of efficiency and usability (only in mobile procedure) of URL address submitted to parameterization. URL addresses for particular map services differ in the way of recording and number of used marks. So the question appears if it influences the test's point result.

PageSpeed Insights belongs to Google applications group which would mean that applications were mutually optimized. However, point result of Google Maps (268/300) shows that the measurement depends on external conditions that cannot be influenced by programmers.

PageSpeed Insights efficiency and usability test has got synthetic character. Its result should be treated illustratively as contribution to farther studies in which users would take part. Moreover, it is one of many available tests which should be performed crosswise. Only tests performed in such a way will allow to estimate real efficiency and usability of Internet service.

From the user's point of view, from among evaluated services, web site resource address parameterization technique is the most accurately described in documentation and help system of Bing Maps service. With its help, a link which evokes a map with points described by text and graphics in the browsers' window can be created relatively simply. Google Maps and MapBox services develop possibility to locate their own objects on the map by means of web applications set into action in the browser's window (with exclusion of coding). Map Quest service presented in 2015 new opening of a maps browser which is still in a development phase. By contrast, MapBox draws users' attention to stylistics and map bases variety.

## 6. Summary

In communication, information's exchange and popularizing by means of the Internet, both in real time and in the form of a sent message, various communicators and Internet mail are often used. The technique presented in the paper allows in a relatively simple way to prepare a hyperlink which will evoke a map according to given parameters in the browser's window. Location of a service point, route or area range of any phenomenon can be coded in a hyperlink and then sent by e-mail, communicator or

made accessible on forum, in a commentary or blog's pages. Information prepared in such a way enriches a text message. Map's parameters can be coded manually or with use of a map generator.

Creating of spatial objects' maps by means of URL addresses parameterization technique needs expert knowledge, practice and geo-information abilities so it can present problems to less advanced users. So map services often make accessible solutions which automate link parameterization process (MapQuest, MapBox), usually in the form of web applications. Moreover, using described technique can be hindered by English-speaking documentation as well as lack of guidebooks and trainings of "step by step" type. URL links parameterization has also limited functionality. So it can serve to pass information on the map but in the limited range.

Application programmes (creators, code generators), usually net and relatively simple in use that automate and facilitate to create a map constitute alternative for URL questions coding. Their usage does not need expert geo-information knowledge and graphic service interface leads a user through a map's creating process which allows to define its parameters with help of icons, scroll bars and check boxes. Functionality of net map creators can be also limited and insufficient in case of more advanced projects. Then API programistic interface is used.

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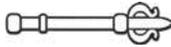
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## CONCEPTION OF A TOURISTIC MAP AND NATURE PROTECTION FORMS CREATED WITH USE OF OPEN DATA SOURCES AND FREE SOFTWARE ON A GRYBÓW COMMUNE EXAMPLE

Karol Król

### Summary

In the last decade, far-reaching changes in the way of using the Internet, which as a result of range, multimedia and interactivity plays bigger and bigger role in interpersonal communication, could be observed. These changes are accompanied by development of geo-information services which are usually associated with geo-visualization understood as presentation of geographic information on the maps. Attainability of computer techniques which enable creating of network applications activated users who often and often build their own topic services which connect chosen contents with a map base.

The aim of the paper is to analyse chosen data sources as well as techniques and computer tools which can be used to create topic maps according to the conception “user-creator” (producer), “user-producer” (produsage). The project of a topic map presenting chosen touristic object and also nature protection forms localized in the area of Grybów commune (Małopolska, nowosądecki district) was presented in the article. In conclusion, it was revealed that the created map is elastic in edition and development and its every element is possible to be modified. However, it has got some limitations. Its modification needs expert knowledge and access to a server and published data can be questionable for users.

### Keywords

prod-usage • prod-user • Internet cartography • OpenStreetMap

### 1. Introduction

The Internet is one of the most important elements of media environment where a contemporary man functions and is in many respects the most powerful of many media ranks – telegraph, telephone, radio and television [Morbiter 2009]. Quickly widespread, more and more cheap and widely available, it constitutes equipment of the most households both in cities and villages [Król 2006, Król and Wojewodzic 2006].

Internet in view of its range, multimedia and interactivity plays significant role in interpersonal communication [Pawłowska-Mielech and Bocek 2006]. Contents

published in the Internet as well as the form of their publication can influence receiver's behaviour and decisions, mould markets and create brands and they after all give possibility of having and using "virtual identity" [Ostaszewska 2013]. Information is available in the Internet for everyone and its placing is relatively quick and cheap [Mastykarz 2005].

In the last decade, far-reaching changes in the way of using the Internet can be observed. Statistic web sites gave up to contents generated dynamically by the users themselves [Król and Salata 2013]. These changes are accompanied by geo-information web services development known also as geospatial services or services of spatial data. They are usually associated with geo-visualization implied as geographic information presentation on maps [Gaździcki 2012, Sudra 2012].

Users exploit digital maps first of all for objects location, browsing of service centres, telephone/address data, routing of ride itineraries and also space exploration [Tkaczyk 2010].

Appearing of computer techniques which enable building of network applications with use of procedures, protocols and tools activated users who are more willing to create topic services joining chosen contents with the map base made accessible by geo-data suppliers.

The aim of the paper is to analyse widely available data sources as well as chosen techniques and computer tools which can be used to create topic maps according to the conception "user-creator" (producer), "user-producer" (produsage).

The project of a map presenting chosen touristic objects and also nature protection forms localized in the area of Grybów commune (Małopolska, nowosądecki district) with use of open data sources and free software was presented in the article.

### 1.1. Community of active users

"Produsage" is a term used for the first time by A. Bruns [2007] and it is a combination of the words "production" and "usage". This conception describes the current of changes connected with net resources usage and presents a pose of an active user who from a passive receiver becomes a creator of contents popularized in the Internet.

Development and attainability of Internet technologies including possibilities of cartographic components of web sites created a new group of "users-producers" or "users-creators" (producers).

Conception of a "user-producer" was presented by Y. Benkler [2002] and is tightly connected with a term "produsage". A "producer" is a user who runs activity called "produsage". Characteristic feature of users from the "producers" circle is inclination to joining into communities and working together over created content. It is usually work within the frame of voluntary service and taking part in "produsage" projects is voluntary. Moreover, in that model there is lack of predetermined work distribution or allotment of duties. Particular tasks are realized spontaneously according to users' preferences. Elaborations created in such a way are of open character and are available for the other members of society who can use and improve them. All of that as well as common access

to open data resources and geo-information tools including API programistic interfaces gave rise to Internet cartography and formed current of “geographic information created by users’ society” (Volunteered Geographic Information, VGI [Goodchild 2007]).

One of the most complex and dynamically developing VGI projects is OpenStreetMap [Cichociński 2012, Neis et al. 2012]. Various Internet services of “mashup” type where map elaboration is usually a web site’s component also form part of that current [Kowalski 2007].

## 1.2. Free software

Idea of free software has developed for over twenty years and is tightly connected with Free Software Foundation activity [2015] which was founded in 1985 by R. Stallman. History of free software started from strictly computer appliances such as servers operating systems and computer web management. Now it gains raising popularity. Expanding number of widely available programmes especially for office, graphic or multimedia usages is created [Bednarczyk and Rapiński 2011]. It concerns also trade programmes including spatial information system and Internet cartography.

Even though “open source” term is identified with “free software” one, there is significant difference between them. Free software philosophy concentrates on moral and ethic aspects of software accessibility whereas open source emphasizes its technical perfection. So free software is at the same time open source one (free and open-source software: FOSS), however, not every open source software is a free one. Considering ideological differences that separate free software and open source movements, they are used to be called FLOSS term (Free/Libre Open Source Software) [Ghosh 2001].

“Free as in free speech, not as in free beer” sentence reflects conception of idea reasoning of open software which is free as “free speech” and not as “free beer”. Free software is a matter of freedom of usage, not the price (lack of license fees). To emphasize this difference, free software is often called interchangeably “libre software” [GNU 2015]. “Free software” understood in the price context (f. ex. Internet Explorer or Adobe’s Flash Player) is made accessible free of charge but it differs from open source (f. ex. Mozilla Firefox) in the fact that users have not got an insight into programme source code and cannot modify it.

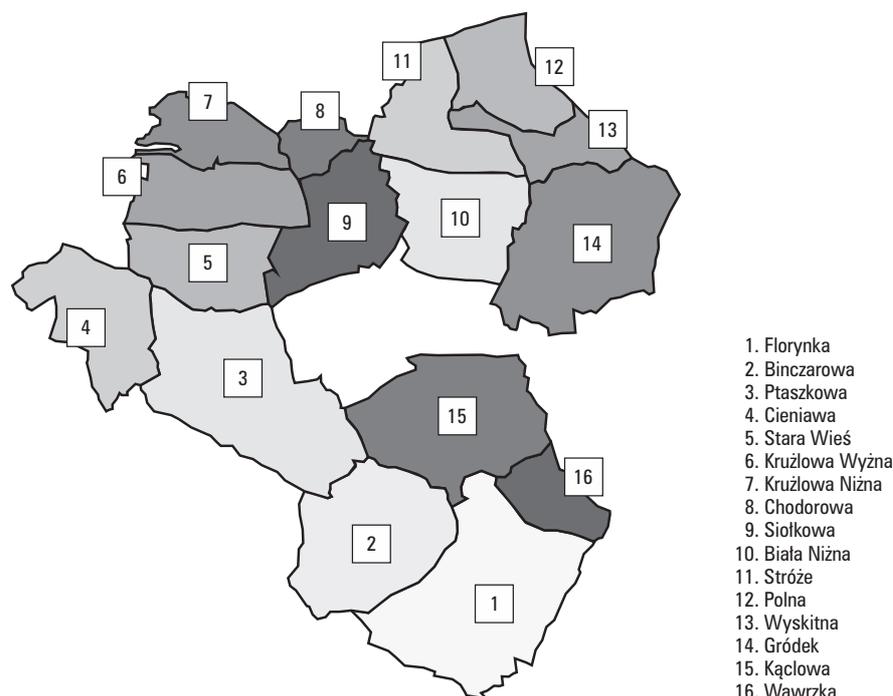
Lerner and Schankerman’s [2010] researches show that most of open source programmes are created in commercial firms which also offer close software. It is tightly connected with business model of its facilitating which can assume usage of open source programmes as the way to introduce clients to the other payable firm products.

Open source is the way of software creating and distribution based on sharing it together with a source code. Open source type programmes are not subject to patents and their usage does not need paying a licence fee. Open source idea base is to provide users with unrestricted access to source programme code which can be modified and made accessible [Deek and McHugh 2008]. Moreover, source code attainability allows to analyse applications operation, to detect and remove mistakes. It is connected with permanent access to actualizations and new functionalities.

### 1.3. Grybów Commune characteristics

Grybów land is situated in nowosądecki district in the midst of picturesque mountains and streams, in the river basin of Biała Tarnowska also called Dunajcowa or Grybowska. The river is a right-bank Dunajec tributary 101.8 km long.

Grybów Commune belongs to rural ones and consists of 16 village councils (Fig. 1). Its area is 15.301 ha, of which agrarian lands comprise 8.267 ha, including arable land of 3.727 ha and meadows and pastures together of 4.517 ha. Forests' area is 5.169 ha.



Source: author's study based on Grybów Commune map portal [GIS Grybów 2015]

**Fig. 1.** Grybów Commune administrative partition, demonstrative map

Administratively, the commune is located in Małopolskie Voivodeship in the range of nowosądecki district. 5,053 households compose all the village councils (including 3,014 farms) where 24,906 people are registered, therein the most in Ptaszkowa (704 persons), Biała Niżna (588 persons) and in Stróże (556 persons) [Gmina Grybów 2015].

Picturesque location as well as favourable climatic conditions decide about the fact that Grybów Land is reputed as one of the most beautiful places in Małopolska. Grybów city and nearby towns compose the centre of mountain touristic trails so that is a good starting point for mountain excursions and bike tourism.

Around Grybów city, there are Grybowski Mountains which compose north-western region of the Low Beskids. Many unique monuments including beautiful Orthodox

and catholic churches that testify to centuries-old historic and cultural tradition of the region can be found here [Szumlańska 2002].

The commune's strength is its attractive location and area shape, flora and fauna variety as well as cultural wealth reflected in many monuments and still cultivated traditions. In the commune's area, there are objects that create Wooden Architecture Route in Małopolska: St. Dymitr Orthodox church in Binczarowa, St. Bishop Wojciech church in Kałłowa, St. Mary's Birth church in Kruźłowa, St. Andrew church in Polna, All Saints church in Ptaszkowa and also beekeeping museum in Stróże [Grybów 2007].

Grybów Land can also be proud of holiday centres in Cieniawa, Grybów, Stróże, agrotouristic farms in Ptaszkowa, Siołkowa and Kałłowa, ski lift in Cieniawa and the ski lift and ski running route in Ptaszkowa. There is also vigorously active local population. Particular importance belongs to agrotourism and rural tourism and residents and the commune pay much more attention to the region's promotion in the Internet. Attention deserves to rich in information commune's web site [Gmina Grybów 2015], regional information portal "Grybów24" [Grybów24 2015] as well as activated in 2013 touristic map portal together with MPZP local plan prepared within the range of the project entitled "Activating of the communal map portal of Grybów Commune" and financed within Activity 413 Introducing of Local Development Strategies included in PROW for the years 2007–2013 [GIS Grybów 2015].

Despite the fact that the region takes more and more importance as touristic as well as recreational and rehabilitative centre and it can be attractive for investors, there is lack of factors in the commune's area which would favour its development [Kmak and Poręba 2006]. Absence of industry and work places, difficulties in running independent business and also decreasing profitability of small farms cause impoverishment of this area and carry along danger of their degradation in future [Kmak et al. 2003]. Features of local community are resourcefulness and initiative of its inhabitants and also the net of services rendered mutually in the form of next door favour or for some small price. However, the main source of incomes of local households is still hired work abroad. In the light of above mentioned, promotion of touristic values as well as Grybowska Land nature protection forms become particularly important.

Initiatives of the commune's promotion can be not only taken up by the Communal Government but also by communities of users-volunteers through various forms of activities in the Internet including blogs, forums and various topical map elaborations.

## 2. Project conception

In the conception's stage, several basic project assumptions were accepted:

1. The idea of promotion of touristic values and Grybowska Land nature protection forms illuminates the map's creating.
2. The map of monuments and nature protection forms will be fully prepared on the basis of free software (techniques and computer tools) and open data sources (geographical data bases).

3. The map will be created as the own service (mashup), topical, made according to the current “produsage, producer”.

In the light of accepted project assumptions, the map service OpenStreetMap was chosen as deliverer of geographical data. Basic point elements of the map – POI (point of interest – a marker, a drawing-pin) in the form of own graphics and also the other objects will be plotted on the map with use of Leaflet JavaScript library (BSD License, GPL – compatible free software licenses). Elements of navigation being part of application menu will be created by means of jQuery UI (MIT License, free software license). The map and application menu will be entered in the frames of hypertext document HTML (HyperText Markup Language) with format given by means of cascading style sheets CSS (Cascading Style Sheets) and published on the data server in the form of “mashup” type web site.

### 3. Data sources

OpenStreetMap (OSM) is a social networking project with the object of creating the world map accessible without any restrictions which could be edited by every user. The project was initiated in 2004 by Steve Coast from University College of London [Drop et al. 2013]. There was a notation in the project mission that its superior aim is to deliver both ready maps and also “*unadorned geodata to all who need them*”. [OSM 2015].

OSM map is created by users all over the world on the basis of data from GPS manual receivers, air pictures and the other available sources (f. ex. data passed free of charge by territorial council entities, firms or institutions) and also sketches made in the field. OSM data base is being built by volunteers. Appearing of new resources is depended of the users’ eagerness and willingness to perform for example measurement in the field or image tracing of available air pictures [Cichociński 2012].

OSM data are kept in a relational PostgreSQL base. The basic data unit is a node which can appear independently as a point object or as a part of a complex object. Nodes are composed in ways which can be linear or surface. Mentioned types build relations that serve to logical joining of objects which compose the greater entirety. Data have got spatial reference in geographic coordinate system WGS84 [Drop et al. 2013].

OSM data bases are made accessible within the frames of ODbL open license (Open Data Commons Open Database License). This is a license “attribution”, “share-like” type and it is recommended by Open Data Commons to publish all types open data. The license enables free data redistribution, modification and usage with the same privileges for the other users.

### 4. Techniques and tools

Leaflet [2015] is JavaScript library published in 2011 written by Vladimir Agafonkin and used to create interactive map applications. Next to OpenLayers and Google Maps API, it is in the circle of the most popular mapping JavaScript libraries and is used by such internet web sites as Facebook [2015], Foursquare [2015] or Pinterest [2015]. The

library allows users to create and make accessible their own topic maps, to organize information layers, mark, describe and present objects in space and many others. The project concentrates on efficiency, usefulness and simple API. Moreover, with regard to relatively small size of the library as well as support for interactions evoked by means of touch panel, Leaflet is regarded to be one of the best libraries for designing maps for mobile devices [Donohue et al. 2014].

Usage of Leaflet library does not need from users advanced knowledge from the range of spatial information systems GIS (especially issues connected with coordinate systems) and programming of basic functionalities of a map is relatively simple.

Leaflet library is not connected with any deliverer of map elaborations. With its help, access to different base maps can be received. It is most often used with maps created on the basis of OpenStreetMap project data which enables free of charge usage of geographic documented data.

Leaflet library allows to implement interactive maps put fluently together in real time from tens of tiles comprising the map's fragments to the structure of hypertext document. In OpenStreetMap terminology, maps are called tiled web maps or slippy maps. This term describes contemporary internet maps which can be increased and moved.

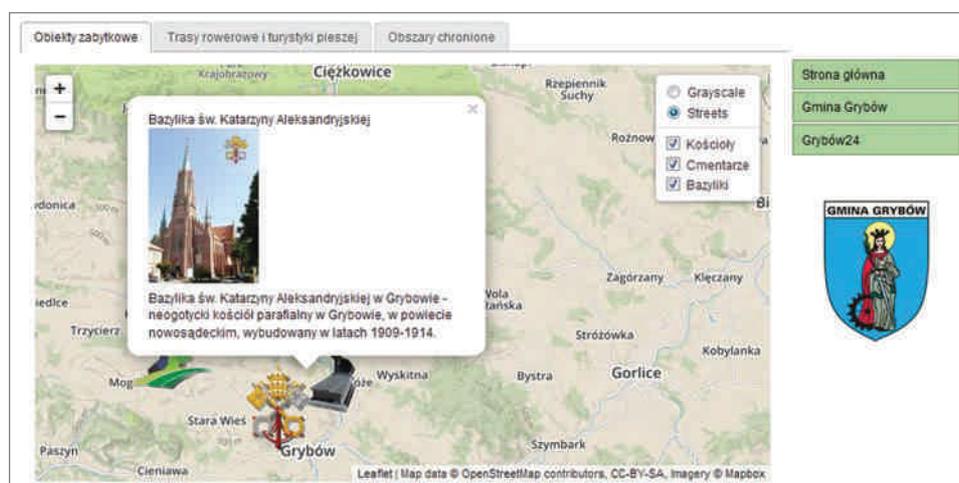
To create map service, chosen scripts created on the basis of jQuery UI (jQuery User Interface JavaScript Library [jQuery UI 2015]) were also used. JQuery UI is a set of widgets with determined functionality which allows to create interactive network applications. "Widget" term is connected with a feature of JQuery scripts which takes the form of external modules. These modules can be freely "sticked" in or out the structure of a base document. Widgets allow to organize elements which are part of application interface.

JQuery is a light programistic library for JavaScript language, created in 2006 [Król and Szomorova 2015]. JavaScript is an object-oriented programming language which enables to create dynamic Internet services [Salata and Król 2012]. JQuery UI supports to project interaction with a user. The content and objects presented in the application's window gain dynamic character. Objects' dynamics expresses in the possibility of their dragging, catching, dropping, resizing, sorting and selecting. JQuery UI also delivers techniques and tools that enable to create animation effect, for example dynamic presentation or hiding elements in different configuration (show, hide, toggle) [Stachura et al. 2014].

## 5. Form and result of application's introduction

Basic part of formed application is an interactive map that bases on OpenStreetMap resources. The map together with navigation elements was placed in the structure of a hypertext document prepared with use of basic markers obligatory in HTML5 specification [W3C 2015]. 10 kinds of POI points (markers) were plotted on the map according to the accepted division: Orthodox churches, churches, chapels, basilicas, synagogues, cemeteries, institutional buildings, museums and open-air museums,

sports buildings as well as places to sleep in and catering. Every kind of a point was marked with a separate icon prepared in the form of PNG file. The icons were related with text description and graphics which characterize given object (Fig. 2). Considering a great number and variety of the points, they were grouped and placed in topic layers which can be freely included and excluded. Similarly, maps of nature protection forms which were plotted with marking of their spatial range were prepared. Moreover, to increase transparency, menu which enables changing of map base kind was created.



Source: author's study based on OpenStreetMap

**Fig. 2.** The map and interface of application content management, view in the window of the Internet's browser

Application prepared in such a way is elastic in edition and development. Their every element can be modified. It also fulfils international standards of Internet web sites formation established by World Wide Web Consortium [W3C 2015]. Considering mentioned features, it can be in a relatively simple way put into any web site. It has got, however, some restrictions. It was created through hand-coding technique (Hand-Coding Web Pages) and placed in data server. Edition of the map created in such a way demands from a user expert knowledge and access to the server (edition of files on the computer disk and then overwriting of the previous ones put in the server). Some solution could be writing in of a map into web site structure manager by means of CMS system (Content Management System) which helps to edit contents in the web site window. Moreover, quality of content published in such a way which can be out of date, inaccurate or completely unreal could arouse doubts between users. Service creditability can be built by giving data sources and regular content updating. All that needs time and work costs and that is why there is such a small number of independent services of local character.

## 6. Conclusions

The Internet is developing very dynamically. Techniques and tools that are made accessible there enable users' quick exchange of information as well as creating and putting there contents of various forms. Conception presented in the paper presents idea of an individual topic map with subjective commentary and created by users community. This conception provides full freedom and independence in deciding about character of contents drawn into the map. Moreover, it is not connected with any costs of licence buying.

History, culture and widely understood characteristics of Grybów Commune was described in many published papers – memoirs, jubilee books, annuals, guide-books, scientific papers and the others. They comprise a rich source of information about commune's history and contents written there are often used as documented material for various multimedia elaborations.

Grybów Commune is well represented in the Internet by The Commune Council web site, the regional information portal as well as the map portal. The Commune publishes in the Internet developed map service that displays touristic values, capital causations, location of service points, planning, record and another issues. However, this service has got closed character for the users. There is lack of independent initiatives in the Internet which are taken up by local communities that would concentrate on promoting of commune's values with help of small information-touristic portals. This space can be filled with topic map services created by users.

The Internet map service where text description and photo documentation of presented objects is completed by their location in space can be perfect completion to published elaborations. Numerous techniques and geo-information tools made accessible free of charge in the Internet and developed by users communities can be used for topic map services building. There are no limits or restrictions for applied contents. Map topics can be both a touristic route with a viewpoints list and also a map of unrestrained waste dumps. A map prepared in such a way can be published in the Internet as a web site's component or sent as a link.

Rural areas development can result not only from real local activities from the range of environment protection and shaping or infrastructure development. It is tightly connected with social development understood as level increase of education, initiative as well as awareness and responsibility for surrounding environment. Bigger and bigger role is played by digital media including the Internet and various map services. They provide access to spatial information, enable participation of local community in planning process, allow to promote touristic, natural and economic values of regions. They comprise information flow channel which in the light of increasingly bigger commonness of mobile devices will become more and more important.

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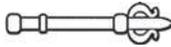
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## SPATIAL PLANNING IN POLAND IN YEARS 1928–2003. REVIEW AND RESEARCH OF ACTS RECORDS<sup>1</sup>

Urszula Litwin, Magda Pluta

### Summary

Spatial planning in Poland has got long history. The first significant Act regulating rules of spatial economy in Poland was the Decree of the Polish President from 16<sup>th</sup> February 1928 about constructional law and settlements buildings. The successive acts from the range of spatial planning such as the Decree from 2<sup>nd</sup> April 1946 about planned state spatial economy, the Act from 31<sup>st</sup> January 1961 about spatial planning, the Act from 12<sup>th</sup> July 1984 about spatial planning and also the Act from 7<sup>th</sup> July 1994 about spatial planning were introducing numerous changes forming *ipso facto* spatial planning system in Poland.

The paper is a revision of recording of the most important acts influencing directly spatial politics on the national, regional and also local levels.

### Keywords

spatial planning in Poland • acts and laws • system changes

### 1. Socio-economic determinants of regional development in Poland

The period of Poland's partition is the time of regional diversity of economy, level of civilization and also life quality. As the author notices [Bański 2007], Polish lands were treated in a peripheral way. In the interwar period, spatial planning in Poland was conditioned by economic and civilizational polarization of the country. Also economic crisis from the turn of the twenties and thirties had significant influence. Building of the Central Industrial District was the greatest investment of that period. Its superior aim was to locate the main industrial branches in the central part of Poland as well as economic activation of poverty areas. The second important investment of that period was harbour building in Gdynia together with a coal main line. Activities in the first years after the II World War (WWII) were connected with rebuilding country from ruins, industry nationalization and also carrying out of land reform [Bański 2007]. As authors say [Dziewoński, Malisz 1978], after the WWII, it was possible to change radi-

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cally Poland's spatial structure in order to decentralize industry and equalize regional differences. According to the authors [Węclawowicz et al. 2006], deconcentration of industry from the region of the Upper Silesia proceeded in northern direction along the axis connecting coalfields with the Baltic Sea. Unfortunately, as opposed to assumptions and considering state's necessities, the process of rebuilding was performed where it was possible. That is why the previous spatial structure was copied which caused big disproportions in social and economic development in the range of industry location, technical infrastructure and agriculture development level. According to the author [Bański 2007], spatial structure after the WWII was based on communication connections network between the most important city centres, moreover, two main industry axes which crossed in the area of the Upper Silesia were distinguished. The level of areas investment decreased in eastern direction which resulted from disproportions of technical infrastructure arrangement, therein most of all railway and road network and also location of the main city centres which were concentrated in the western and central parts of the country [Węclawowicz et al. 2006]. At the same time, the author [Bański 2007] emphasises that in the years 1950–1955 six-year-plan that assumed heavy industry development was realized which as a result contributed to its more regular location. In that period, cities and settling system dynamic development also took place. In the years 1950–1970, participation of cities inhabitants increased from 39% to over 52% of population in general. New city centres of medium size came into existence (Białystok, Lublin, Rzeszów) and they were in turn connected by means of transport system with already existing ones. In that way, transport system had its greatest concentration in the central part of Poland. In the 1970s, economic development of the country was still continued and location of new factory units was scattered which favoured decreasing of developmental differences of various regions. As the author says [Bański 2007], in the 1980s, economic development slowdown was observed which did not significantly change country spatial structure depiction. In the period of socialist economy in Poland, activities aiming to soften spatial disproportions including industry location, technical infrastructure, living conditions and standarts were observed. According to the author [Bański 2007], processes of balancing involved most of all areas of southern and central parts of the country. Consecutively, the year 1989 initiated radical transformation of all elements of socio-economic life including spatial planning. From that time, entitlement funds started to flow into Poland including in the subsequent time European Union means which were among others spent on regional country development. Economic transformation significantly influenced state spatial structure. Process of population concentration in city centres which caused development of the biggest city agglomerations and contributed to spatial polarization of the remaining areas was observed.

## 2. History of spatial planning in Poland on the basis of chosen laws

The first important law regulating rules of spatial economy in Poland was the Decree of the Polish President from 16<sup>th</sup> February 1928 about constructional law and settle-

ments buildings [Rozporządzenie... 1928]. From that time, process of spatial planning in Poland was changed several times by enacting the following laws including:

1. The Decree from 2<sup>nd</sup> February 1946 about planned spatial development [Dekret... 1946].
2. The Act from 31<sup>st</sup> January 1961 about spatial planning [Ustawa... 1961].
3. The Act from 12<sup>th</sup> July 1984 about spatial planning [Ustawa... 1984].
4. The Act from 7<sup>th</sup> July 1994 about spatial planning [Ustawa... 1994].
5. The Act from 27<sup>th</sup> March 2003 about spatial planning and development [Ustawa... 2003].

Trials to regulate the process of spatial economy were already performed in the first years after recapturing independence [Niewiadomski 2001]. The Decree of the Polish President from 16<sup>th</sup> February 1928 about constructional law and settlements buildings [Rozporządzenie... 1928] was the first so extensive act regulating simultaneously matters of building plans, parceling out areas, parcels of land merging as well as transforming of parcels imperfectly built up. According to Art. 1 (Dz. U. 1928 Nr 23, poz. 202), rules of the Decree applied in construction, building changes and maintenance of any over- and underground buildings both in housing estates and outside them and also appliances connected with buildings or these helpful in construction process. Moreover, they had application in creating new plots in housing estates understood according to the Act as cities and towns, health resorts of public usefulness character, country and factory settlements, worker's colonies and also concentrations in one group of at least 10 dwelling houses (Art. 6, Dz. U. 1928 Nr 23, poz. 202). In Art. 7 (Dz. U. 1928 Nr 23, poz. 202) for the first time, concept of building plan the aim of which was to regulate principles of developing cities and towns was introduced and then in Art. 8 (Dz. U. 1928 Nr 23, poz. 202), general plans enclosing whole estate area, its substantial part or a couple of estates and also particular plans made with reference to the general plan and containing only parts of separate estates were distinguished. Plans of general premises regulated the way of areas development and management by determining control lines that separate areas with various purpose, introducing division of localities to zones according to the way of building and also indication of longitudinal and transversal profiles existing and projected in a plan of main roads (Art. 10, Dz. U. 1928 Nr 23, poz. 202).

Detailed premises plans precisely determined possibility of shaping of new building by defining impassable building lines, division of streets and plans for elaboration area as well as the way of building upon plots, therein determination of mutual distance between building lines (Art. 14, Dz. U. 1928 Nr 23, poz. 202), proper isolation of living houses, buildings density (Art. 15, Dz. U. 1928 Nr 23, poz. 202), buildings height and also the size of undeveloped area on the plot (Art. 16, Dz. U. 1928 Nr 23, poz. 202). For the area of urban communes and resorts accredited as these having public usefulness character, the way of development was regulated by police-building rules. With reference to the following Acts from the range of spatial planning, the Decree of the Polish President from 16<sup>th</sup> February 1928 about constructional law and settlements buildings

[Rozporządzenie... 1928] as the only one pays attention to the necessity of building aesthetics conservation (Art. 20, Art. 262, Dz. U. 1928 Nr 23, poz. 202).

As observes [Niewiadomski 2001], as a result of constitutional transformations after the WWII, law regulations in force stopped to respond to changing political conditions. Despite possibility to create new spatial order, considering the State needs, rebuilding process was performed in such a way that – as a result – previous spatial structure was copied and the Decree enacted on 2<sup>nd</sup> April 1946 about planned spatial development, (Dz. U. 1946, No. 16, poz. 109) was introducing conditions of spatial planning centralization simultaneously preferring country interest to citizens one. According to Art. 8 [Dekret... 1946], works in the range of spatial planning were performed by the Main Department of Spatial Planning and also by subordinate to it Regional Directorates of Spatial Planning and Local Offices of Spatial Planning. Art. 1 (Dz. U. 1946 Nr 16, poz. 109) introduces concept of Spatial Management Plan as the document to which every public and private actions in the range of area using and population arrangement should be subordinated. Moreover, in Art. 2 (Dz. U. 1946 Nr 16, poz. 109), there is division to national, regional and local plans elaborated according to directives of the State economic politics the main assumption of which was to determine lands purpose for various aims. National plans described arrangement of main city centres together with giving out the bases of their development and functions, rules of service in the field of transport, energy industry and telecommunications and they also defined country division into regions as the basis of uniform state administrative partition (Art. 3, Dz. U. 1946, Nr 16, poz. 109). Regional plans beyond definition of land purpose were introducing division of regions areas into districts and communes (Art. 4, pkt 2, Dz. U. 1946, Nr 16, poz. 109). Local plans were prepared for areas of housing estates and apart from pointing at the lines which delimited areas with various purpose they determined the way of buildings, minimal area of plots, streets and the other land roads profiles, water-pipe and sewerage networks as well as periods and ways of a local plan realization (Art. 5, pkt 2, Dz. U. 1946 Nr 16, poz. 109). As the author states [Niewiadomski 2001], the Decree from 2<sup>nd</sup> April 1946 about planned spatial development (Dz. U. 1946 Nr 16, poz. 109), had from the assumption epizodic character and was replaced by the Act from 31<sup>st</sup> January 1961 about spatial planning [Ustawa... 1961].

Records of the above mentioned Act preserved centralized character of spatial planning assuming that it is a part of spatial economy system and settlements should be based on prospective plans of national economy development as well as long-term national economy plans (Art. 1 pkt 3, Dz. U. 1961 Nr 7, poz. 47). According to the Act (Art. 1 point 3, Dz. U. 1961 Nr 7, poz. 47), results of research of natural, demographic, economic and social conditions and also technical elaborations were considered on the second place. Just as in case of the Decree from 2<sup>nd</sup> April 1946 about planned spatial development [Dekret... 1946], the Act from 31<sup>st</sup> January 1961 about spatial planning [Ustawa... 1961], assumed preparing plans on the three levels: for the country area, for areas of particular voivodeships or their parts as well as areas of particular settling units, their parts or complexes with the assumption that the plan of the highest grade is the basis for elaboration of a lower grade plan [Niewiadomski,

2001]. Legislator paid attention to necessity of building spatial correlations between various areas serving for proper country development simultaneously emphasizing that determining of use and way of area management should take place according to needs resulting from economic and social development programme (Art. 1 pkt 2, Dz. U. 1961 Nr 7, poz. 47). As the author states [Niewiadomski 2001], relation between spatial and economic planning meant in practise that every investment enclosed in the national plan needed spatial correction with reference to existent state of area management and in particular to different planned investments. In that period, general plans were marked out for the whole voivodeship area and particular plans – for the part of voivodeship area in case of realization of serious investments or the other economic activity of great significance for taking shape of the given area (Art. 4, Dz. U. 1961 Nr 7, poz. 47). The same division was also in force for local plans of spatial economy which were performed for settling units areas, their parts or complexes. The aim of the local general plan was to determine basic development directions and scale and also rules of area economy for the whole time of the plan. Moreover, the general plan was determining spatial planning programme and means in the period of long-term economic plan (Art. 14, point 1, Dz. U. 1961 Nr 7, poz. 47). The local particular plan was completion to the general plan and it specified decisions concerning locations of lines that demarcate areas of various purpose as well as lines of buildings, rules of area infrastructure and arrangement and also permissible buildings height (Art. 17, pkt 3, Dz. U. 1961 Nr 7, poz. 47).

The successive changes in the range of spatial planning in Poland fell on the turn of the 1970s and 1980s. At the end of the seventies, a new Acts appeared in the Polish law which took over the part of cognizances of the Act from 31<sup>st</sup> January 1961 [Ustawa... 1961]. One of them was the Constructional Law enacted on 24<sup>th</sup> October 1974 (Dz. U. 1974 Nr 38, poz. 229) and also the Act No. 196 of the Council of Ministers from 29<sup>th</sup> December 1977 about investments location which determined the rules of gaining decisions about investments location regardless of the Act in force decisions. Appearing of the new independent Acts influenced unfavourably Polish situation of spatial planning. The response for these problems was enacting on 12<sup>th</sup> July 1984 the Act about spatial planning [Ustawa... 1984] according to which spatial planning was correlative with socio-economic planning. Considering the lack of correlation between the range of territorial spatial plans and socio-economic ones, in practise socio-economic issues dominated these connected with spatial planning. In relation to the previous Acts, apart from national, local and regional plans, the Act introduced a new kind of spatial plan – plans of functional areas which were prepared for areas distinctive in relation to special economic, social, cultural and also natural and environmental functions fulfilling. Evaluating regulations of the Act from 12<sup>th</sup> July 1984 [Ustawa... 1984], attention can be paid to the fact that the most activities from the range of spatial planning were oriented to adaptation to the needs of the state's centralized system. Despite the necessity of preparing and enacting plans on every level of administrative division, because of the lack of territorial government, they were in practise prepared and approved by national authorities [Niewiadomski 2001].

Turning point in spatial planning process falls on 1989 when the process of socio-economic changes as a result of political system in Poland was commenced. Tasks in the range of spatial planning were divided between particular levels of territorial government. According to the Act from 7<sup>th</sup> July 1994 [Ustawa... 1994], spatial planning in the range of determining purpose and rules of area management except inland sea waters and also territorial sea belonged to own tasks of the commune (Art. 4, pkt 1, Dz. U. 1994 Nr 89, poz. 415). Tasks of voivodeship self-government concentrated around shaping and pursuing spatial planning politics in the voivodeship including enacting development strategy and voivodeship spatial management plan and also coordinating over-local programmes of spatial planning (Art. 4, pkt 2, Dz. U. 1994 Nr 89, poz. 415). On the central level, tasks of the Council of Ministers as well as proper organs of government administration was to shape spatial politics of the country through pursuing governmental politics of regions and also coordinating with this politics development strategy and voivodeships spatial management. As author indicates [Kolipiński 2014], to keep continuity of spatial planning according to the new Act, properties of previous urban and communal National Councils were taken over communes independently realizing spatial politics in the range of enacting and changes of local plans of spatial management. In the range of regional planning, voivodes took over eligibility of former voivodeship National Councils and their tasks were to do duties of local representatives of government administration and their eligibilities were confined to conceptual and study works [Kolipiński 2014]. The Act from 7<sup>th</sup> July 1994 about spatial planning [Ustawa... 1994] determined the range and also the ways of proceedings in matters of areas purpose for definite aims as well as the rules of their development (Art. 1 Dz. U. 1994 Nr 89, poz. 415). These actions were to be based on the rule of balanced development with compliance of the demands of spatial order, urban planning and architecture, architectural and landscape values and also demands in the range of environment protection, health, security, cultural heritage protection, needs of state security as well as space economic values (Art. 1, Dz. U. 1994 Nr 89, poz. 415). Spatial planning in the commune was based on three basic planning documents. Definition of commune spatial politics was determined in the Study of Determinants and Spatial Development Directions (Studium Uwarunkowań i Kierunków Zagospodarowania Przestrzennego, SUiKZP), which among others took into account causations resulting from previous area purpose, development and infrastructure (Art. 6 pkt 4, Dz. U. 1994 Nr 89, poz. 415). Local plan of spatial development according to the Art. 7 Dz. U. 1994 Nr 89, poz. 415) was the communal regulation – the act of local law taking at the same time into consideration government and self-government tasks. Recordings of the local plan determined above all area purpose, lines delimiting areas with different purposes and also their development conditions. As the author notices [Kolipiński 2014], the local plan was the basis to give administrative decisions on the grounds of which it was possible to start investment and construction actions. In case of lack of a local plan, Art. 2 pkt 2 (Dz. U. 1994 Nr 89, poz. 415) admitted to decide about Conditions of Building and Area Development (Warunki Zabudowy i Zagospodarowania Terenu, WZiZT). Specification of accurate conditions which have to be fulfilled by a building plot to achieve decision occurred not until the Act from from 27<sup>th</sup> March 2003 about spatial planning and development [Ustawa... 2003]. On

voivodeship level, the basic planning document correlated with strategy of voivodeship development was the plan of voivodeship spatial development which determined rules of spatial structure organization such as basic elements of settling network, social and technical infrastructure arrangement as well as demands from the range of natural environment protection and culture properties protection (Art. 54b pkt 2, Dz.U. 1994 Nr 89, poz. 415). Shaping and accomplishing of state spatial politics was performed through ideas and based on them programmes defining government tasks and serving to accomplish supralocal public aims which influenced state spatial development (Art. 56 pkt 1, Dz. U. 1994 Nr 89, poz. 415). According to the author [Niewiadomski 2001], the Act from 7<sup>th</sup> July 1994 about spatial planning [Ustawa... 1994] enabled to separate strategic spatial planning function from operational spatial planning through introduction of spatial politics acts which fulfil function of instruments accomplishing both politics.

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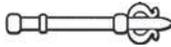
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## THE ROLE OF A LOCAL PLAN AND A PROGRAM OF RURAL MANAGEMENT WORKS IN SPATIAL DEVELOPMENT OF A RURAL COMMUNE IN CONDITIONS OF SOUTH-EASTERN POLAND

Jacek M. Pijanowski, Edyta Sobaś

### Summary

Many rural communes are currently affected by the problem of unfavorable spatial and structural changes which manifests in chaotic building development and increase of unprofitable phenomena in agricultural productive space. The aim of the paper is to analyze spatial development of the chosen commune in conditions of south-eastern Poland and the way of its management in case of possession or lack of a local plan and a program of rural management works. The Subcarpathian Nozdrzec commune was used as a sample of the research.

Performed analyses show that the surveyed commune has got numerous problems in the range of building structure, agricultural productive space development and landscape changes. The significant result of the analyses establishes that part of local plans did not guarantee proper building development and did not include decisions concerning agricultural productive space development at all. The commune also did not execute programs of rural management works which enable solving numerous problems of structural and spatial character. These problems also make possible to carry out many goals, including the equalization of developmental chances of rural areas in regard to urban ones.

### Keywords

rural areas development • local plan of spatial development • program of rural management works • land development decision

### 1. Introduction

Spatial planning in rural areas, regulated by the Law on Spatial Planning and Development of 27 March 2003, concentrates in practice almost exclusively on built-up and protected areas [Pijanowski 2014, Ziobrowski and Pijanowski 2008]. An areas purpose should be established in the basic (as intended) planning document which should be prepared for every commune in Poland – the *local plan of spatial development* (miejscowy plan zagospodarowania przestrzennego, MPZP).

However, rural communes in most cases do not prepare such plans but they usually carry out *the study of conditions and directions of spatial development* (studium uwarunkowań i kierunków zagospodarowania przestrzennego, SUIKZP), that in general determine commune's spatial policies. When there is lack of MPZP, building development takes place on the basis of the land development decision (decyzja o warunkach zabudowy, WZ) (art. 59) given by a commune and the decision on the location of public investment (decyzja o ustaleniu lokalizacji inwestycji celu publicznego, ULI) (art. 50) [Ustawa... 2003]. As originally intended by the legislator, the WZ decisions were to be a support tool for building development used in case of lack of MPZP. However, these decisions came to be the basic instrument of spatial planning, which is a subject of general criticism as they intensify spatial chaos (uncontrolled buildings scattering and development of investments contrary to SUIKZP settlements follow as a result) [Pijanowski 2014, Ziobrowski and Pijanowski 2008].

However, even in case of having an MPZP by a commune, the building scattering problem still remains unsolved as new plans include too big areas where investment activities are allowed, in consequence resulting in the scattering of buildings. Moreover, MPZP does not solve wide problems of rural areas such as agrarian overpopulation, neglected agrarian infrastructure or the huge negligence in the range of farms spatial structures improvements or rural water resources management. In spatial planning, rural and forest productive space is not generally treated in the same way as built-up areas. Defects of proper spatial development of rural areas can be improved by programs of rural management works (program prac urządzeniowo-rolnych, PPUR) [Ziobrowski and Pijanowski 2008, Bielska and Kupidura 2013] which will be considered in the paper's continuation.

Rural areas in Poland are in a state of great retardation in relation to countries from the western European Union. In these countries, complex activities from the range of rural management works which join aspects of land consolidation, rural renovation and also rural water resources management are important for the proper spatial and structural development. Simultaneously, activities in favor of non-agricultural development allow obtaining a positive socio-economic effect. These activities are tightly coordinated with spatial planning instruments. In general, PPUR takes into consideration many significant activities in rural areas which are substantially extraneous to spatial planning – such as for instance improvement of agrarian structure and farms working, possibility to gain lands in order to increase farms area or building and modernization of rural transport roads [Pijanowski et al. 2012, Woch 2008, Noga 2001]. The above-mentioned statements indicate legitimacy of local planning and PPUR coordination. Rural areas need new approach which can significantly contribute to so-called integrated development of rural areas [Magel 2015, Pijanowski 2014, Sobolewska-Mikulska 2015].

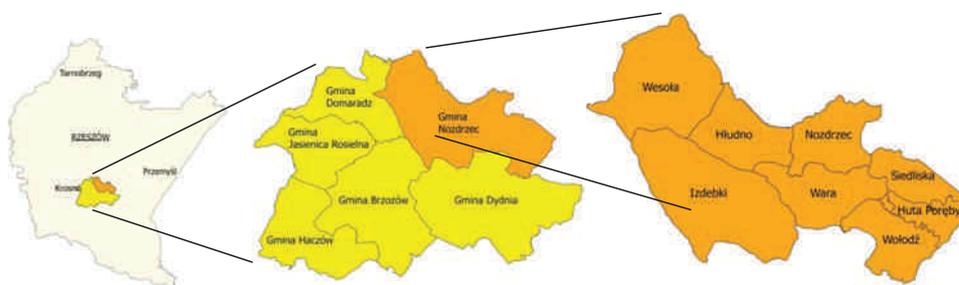
## 2. Aim and methodology

The aim of the paper was to determine the influence of MPZP and PPUR on rural commune's development in south-eastern Poland conditions. The method of descriptive-logic analysis was used in the article. The starting point was the analysis of the

available research results and also the analysis chosen for the Nozdrzec commune research. Local plans from 2014 and also from 2002 and 1998 as well as WZ decisions published in years 2011–2014 were in particular used as basic documents. The web portal [www.gison.pl](http://www.gison.pl), from where the Nozdrzec commune's map showing the current state of local plans was obtained, turned out to be of great help. A lot of data of demographic character were gained from the Local Data Bank of the Main Statistical Office (Główny Urząd Statystyczny, GUS). The presented land and buildings evidence data were gathered from the District Authority Office in Brzozów.

### 3. General characteristics of the research area

The rural commune of Nozdrzec is one of the 160 communes of the Subcarpathian Voivodeship. It is located in the district of Brzozów and occupies the area of 121 km<sup>2</sup>. The villages: Hłudno, Huta Poręby, Izdebki, Nozdrzec, Siedliska, Wara, Wesoła and Wołodź are included in its area (Fig. 1). The selected commune is situated in the Dynowskie Foothill grounds, being characterized by high landscape values. Hill relief areas at altitudes of 240.7 m (in the San River Valley) to 464m above sea level dominate here. [Ciupka 1999]. According to statistical data, the Nozdrzec commune is one of the most densely populated communes of the district of Brzozów. In 2013, the number of its inhabitants was 8,398 which constituted 12.7% of the district's population (GUS). Nevertheless, a decrease in population in the Nozdrzec commune (as in the whole district), which has been continuing since 2010, has been observed.



Source: author's study, Quantum GIS program

Fig. 1. Location and division of the commune of Nozdrzec against the background of the district of Brzozów and the Subcarpatian Voivodeship

Concerning land usage structure, the commune of Nozdrzec stands out within the district with great contribution of agricultural area (22.6%).

As emerges from the land and buildings register data, agricultural area (użytki rolne, UR) occupies 7,462 ha, i.e. 61.8% of the commune's area. Arable lands (5,951 ha), permanent pastures (886 ha) and permanent meadows (315 ha) dominate here, whereas built-up arable lands occupy 278 ha. Forest lands as well as wooded and shrubby ones,

built-up lands, grounds under water, ecological grounds and wastelands compose: 33.0%, 3.5%, 1.3%, 0.1% and 0.3% of the general area of the commune, respectively.



Photo by E. Sobaś 2015

**Fig. 2.** Nozdrzec District panorama

Considerable UR acreages are not fully used by local population. The agriculture of the commune of Nozdrzec is characterized by the low efficiency including surplus of labor per hectare. Cereals and root crops cultivation with prevailing potatoes are predominant. Cattle, pigs and poultry prevail in animals breeding. Most of farms produce agricultural products for own use. As a result of the low incomes gained, farmers are forced to look for other sources of livelihood – mainly in private firms and services. Pensions and annuities are sources of livelihood for many people. In 2013, the unemployment rate for the district of Brzozów came to 24.3% (GUS). Tourism and recreation, together with the services sector that is connected with the towns of Brzozów and Dynów, are supplemental functions of local economy [Studium 1999b]. The service network in the commune is poorly developed. Only Izdebki and Nozdrzec have got sales and service points. In view of the existing investments and utility infrastructure, the most favorable areas to be built-up are located along the main roads. The Nozdrzec commune is distinguished by a building development called the linear settlement (“ulicówka”) where farm buildings, gradually displaced by residential one-family buildings, are predominant.

The Nozdrzec commune inhabitants are well equipped with technical infrastructure. Only the sewage system stands out as a serious problem – in 2013 it included hardly 11.8% of the households. The remaining buildings have got septic tanks. For the local people the lack of water, i.a. due to insufficient water networks, is another nuisance. In 2013, 78.2% of the commune’s inhabitants used the water system (GUS). Relying on the factor of agricultural productive space valorization which for the commune of Nozdrzec was 70.6 points – soils quality and agricultural utility (56.6 points), agro-climate (8.0 points), land relief (1.2 points) as well as water conditions (4.8 points) should be recognized as average. Because of their specific natural topographic features,



Photo by E. Sobaś 2015

**Fig. 3.** Example of a majority of the farm transport roads in a commune – here the villages of Izdebki and Wara



Photo by E. Sobaś 2015

**Fig. 4.** Example of the poor condition of irrigation ditches in the villages of Izdebki and Nozdrzec



Photo by E. Sobaś 2015

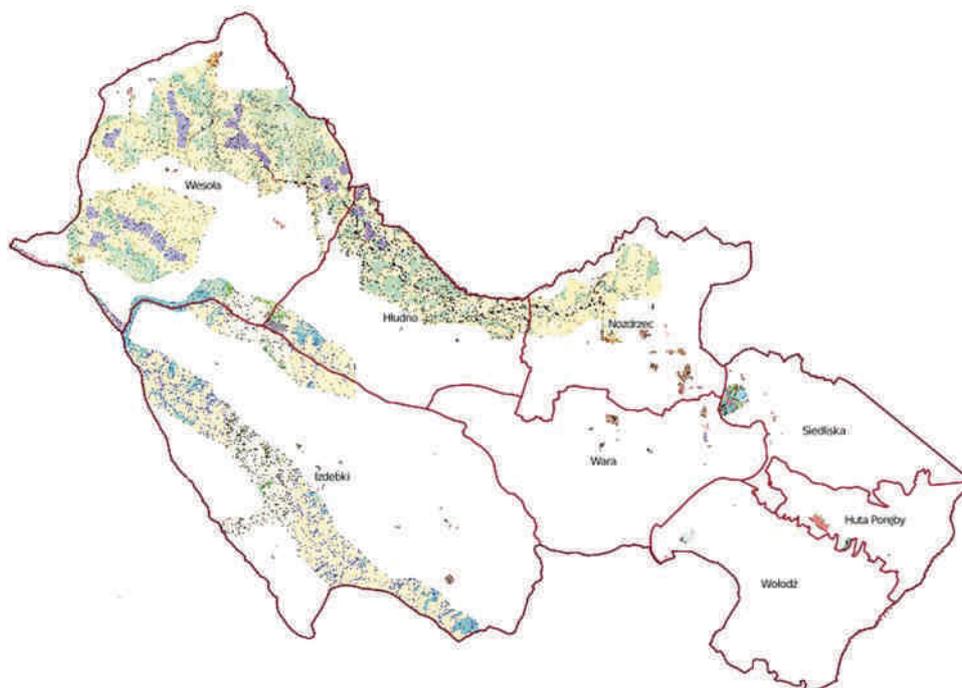
**Fig. 5.** Example of water erosion in the agricultural productive space of the village of Izdebki

two places called Izdebki and Wesoła were qualified to areas with unfavorable farming conditions (obszary o niekorzystnych warunkach gospodarowania, ONW). The problem of most farms is incorrect spatial fields arrangement (rozłóg) and their small area. Up to 93.4% of a commune's parcels are smaller than 0.50 ha.

Moreover, the arable lands of the commune of Nozdrzec are characterized by deficiencies in terms of the access of the roads to farmlands, whereas existing roads of agricultural transport are in a very bad condition. They are mainly unpaved, and unsuitable for the modern agricultural machinery transit (Fig. 3). Also the silted, overgrown and littered drainage/irrigation ditches (Fig. 4) and water erosion (Fig. 5) constitute problems.

#### 4. Spatial development and local planning

SUiKZP, accepted in 1999, is the basic realization instrument of spatial policies in the commune's area. [Studium 1999a, 1999b].) Moreover, the commune has MPZPs. 77 smaller areas included in local plans were pointed in the Commune Council's Resolution from 2010 [Uchwała 2010]. From 2011, further MPZPs were enacted and the existing plans were modified. The report prepared by the Nozdrzec Commune Office according to the state from December 2014 demonstrates 940 ha of area covered by local plans which is only about 8.0% of the total commune's area (Fig. 6).



Source: <http://www.portal.gison.pl/nozdrzec>

**Fig. 6.** Areas of Nozdrzec commune included in local plans of spatial development



Source: Geoportal

Fig. 7. Hłudno's space included partly in MPZP

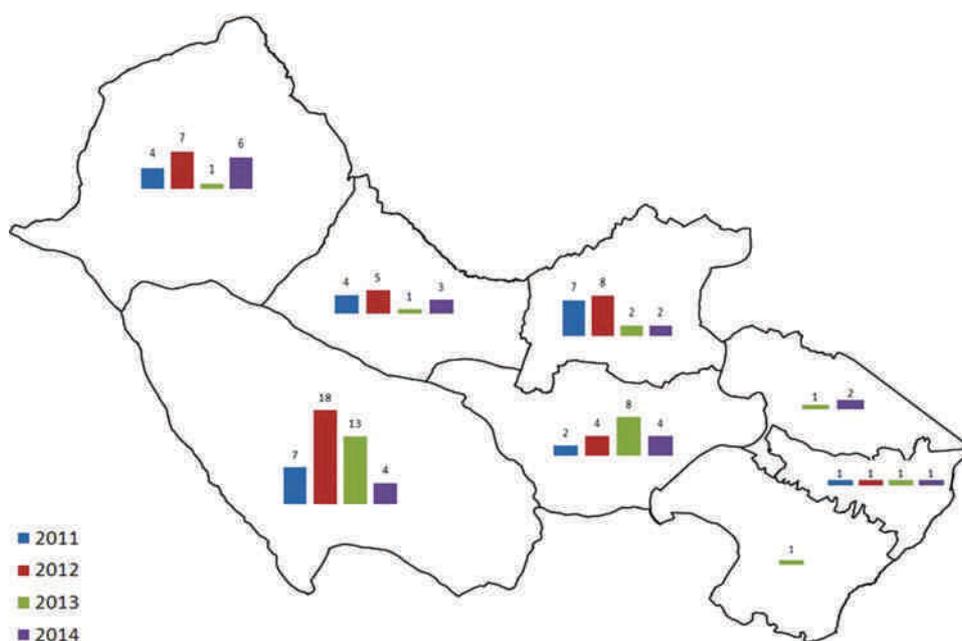


Source: Geoportal

Fig. 8. Wara's space where the building development takes place on the basis of WZ decision

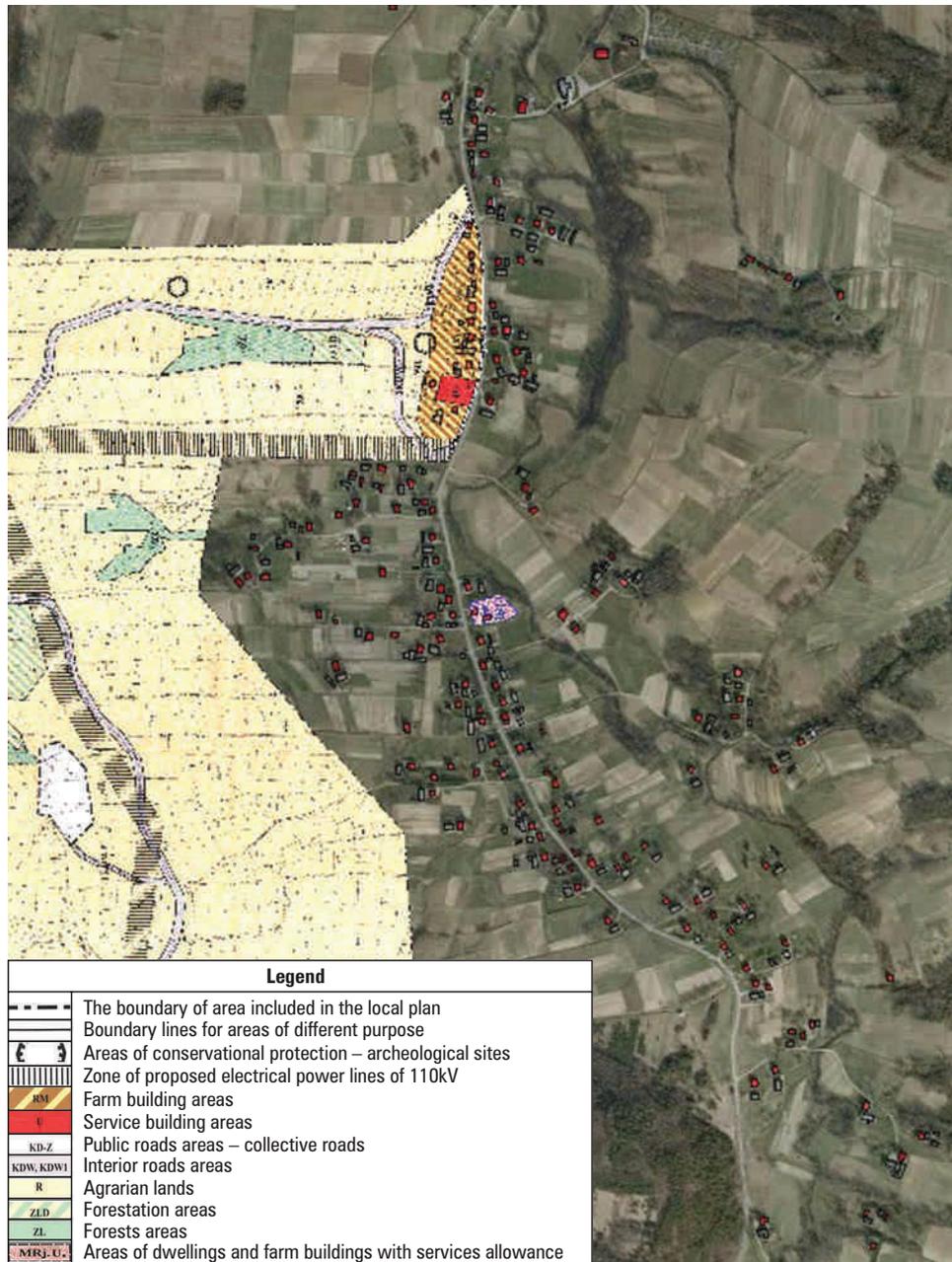
MPZPs concern the areas intended for housing and farm building, often with services admission. Older local plans usually include the area to 1 ha and their establishments are very general. However, MPZPs enacted after 2010, include big areas of former agricultural productive space. The analysis of aerial pictures revealed that it is difficult to find differences in built-up areas' structure between areas included in MPZP and these without local plans. Figure 7 presents Hłudno's space included partly in MPZP, whereas Figure 8 presents Wara's space which is not included in the local plan. In both places the building development was carried out on the basis of WZ decision.

In order to inspect the impact that the lack of MPZP had on the commune's spatial development, and the building development created as a result, WZ decisions in the Nozdrzec commune released in the years 2011–2014 (ULI decisions were not included in the analysis) were analyzed. In that period, 118 WZ decisions were issued mainly for plots located along communal roads. The greatest number of these decisions, that is 43, was issued in 2012. There were 28 of them in 2013, in 2011 – 25, whereas in 2014 there were only 22 decisions (Fig. 9). Izdebki village is the largest in size in the commune of Nozdrzec. In spite of that, MPZPs do not cover large area here although the most investments were realized there. It mainly results from high landscape values. Varied road route of the village with numerous serpentines became the reason of organizing occasional events such as former rallying or current longboard competitions.



Source: authors' study based on WZ decisions gained from Nozdrzec Commune Office

**Fig. 9.** Number of decisions in the commune of Nozdrzec released in the years 2011–2014 according to the villages



Source: authors' study based on <http://portal.gison.pl/nozdrzec/>

**Fig. 10.** Building dispersion in south-western part of Nozdrzec village, resulting from the building development on the basis of WZ decision. Area included in MPZP where ordered building development occurs was marked with signature marks

Moreover, there are numerous monuments and other attractions such as the Bukowski family manor together with surrounding park or ponds attractive for fishermen. These factors have significant influence on tourist traffic and also one-family building development. In turn, Wołódz is a countryside mostly covered with forests so during 4 years only one WZ decision for it was issued. This place is included together with Siedliska and Huta Poręby to the commune areas of the lowest population density.

So the place's attractiveness and transport approach are of great importance for investments location. Building does not practically develop where transport difficulties occur as it is in the countryside situated on the other side of San River (Wołódz, Siedliska and Huta Poręby), from where access to the Communal Office requires ferry transfer.

In the analyzed period, up to 79.0% of all WZ decisions in the Nozdrzec commune were issued for housing single-family building. Percentage of these decisions for farm building was only 5.0%. Decisions for the remaining kinds of building i.e. housing single-family terraced ones and productive and service ones were less than 1%.

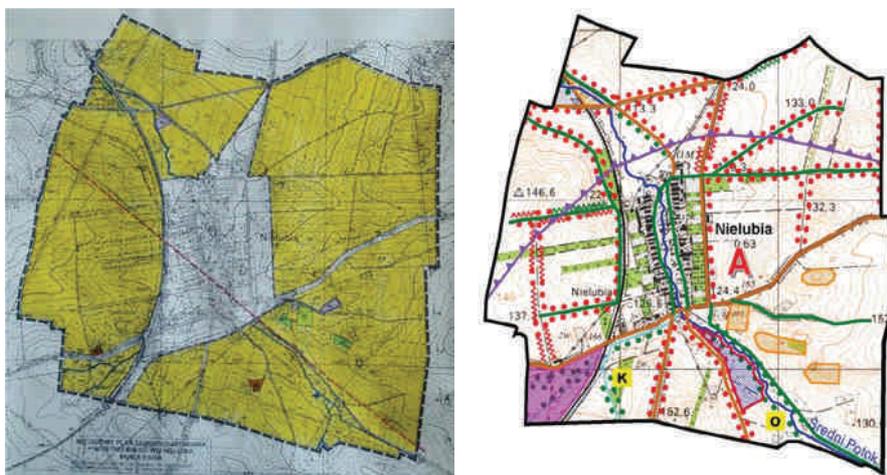
The results of analyses allow to state that in the Nozdrzec commune the spatial management in the basis of WZ decisions poses a threat for effective space shaping and simultaneously enacted local plan does not guarantee rational building development. Too large area of new land plots/ construction lands decides about that. As a result of such practice, building develops in a dispersed way and building forms and styles chaos dominates. MPZP should be the legal instrument to counteract uncontrolled building dispersion – but in Polish practice it is only possible in case when it includes small and possible to quick building, equipped with utility infrastructure areas (Fig. 10).

##### 5. Spatial development and program of rural management works

The program of rural management works (PPUR) of communes are in Poland non-formalized elaborations aimed at multifunctional development of rural areas and agriculture development. These programs are usually preparatory stages to implement instruments of the Rural Development Programme (Program Rozwoju Obszarów Wiejskich, PROW) concerning in particular land consolidation together with post-consolidation management (farm roads, meliorations and others). For many rural communes, PPURs have got equal (or even greater) meaning than MPZP because of their pro-investment and pro-developmental character. These programs rely on inventory of rural space existing state. Thanks to these programs, it is possible to undertake essential activities aiming at the improvement of life and work conditions in the given area, agricultural and non-agricultural economy sectors development as well as protection and shaping of the natural environment and landscape while taking into consideration local conditions. It is also extremely important that these programs enable to determine costs and sources of financial support for the realization of assumed goals. It should be indicated that PPURs can only become obligatory when they will be accepted by the commune council in the form of resolution or if their decisions are included in MPZP.

In local planning – also in rural areas – the legislator concentrated notations mainly in the areas dedicated for construction lands. There is lack of notations that enable

rational shaping of rural productive space described as open areas. The subject of this space appears only in the context of the range of analyses towards the needs of MPZP preparation – whereas these plans do not formulate proper settlements concerning this space. Therefore, enlarging areas included in new local plans cannot often lead to effective solutions in the range of rural areas development. Figure 11 illustrates a scale of differences between the MPZP and PPUR settlements in regard to rural productive space on the example of Lower Silesian Nielubia village (Żukowice commune, Głogów District) [Małek and Smyk 2014].



Source: Małek and Smyk 2014

Fig. 11. Nielubia village – MPZP decisions on the left and PPUR – on the right

The growing socio-economic development in rural areas forces to look for new solutions in the range of shaping and improvement of the current state of spatial order – mainly in the context of providing sustainability. Generally, there is lack of elaborations for rural areas which would be in favor of not only agriculture development but also non-agricultural economic development with assumption of paradigm of integrated multifunctional development. It is indicated by analyses results in the commune of Nozdrzec. It has no PPUR the superior task of which should be according to authors' opinion simultaneous realization of many goals such as creating structural and spatial bases for the development of agriculture, leisure and agrotourism as well as improving conditions of production and work in agriculture but also people's life and work conditions through:

- lands consolidation connected with building or improving the state of rural transport roads and melioration devices, water management and even flood protection,
- nature protection and also landscape maintenance and development,
- development and restoration of rural settlement units.

Considering natural specificity, the Nozdrzec commune constitutes good place for the development of ecological agriculture which also should be an important element of PPUR as its areas are natural and not contaminated with industry. Apart from productive function, agriculture has fundamental importance for shaping and maintaining of rural landscape.

It should be mentioned that in the Nozdrzec commune within the PROW 2007–2013 and consolidation works were performed in the Hłudno village and reclamation action from the range of ditches modernization, building and modernization of rural transport roads as well as grounds reclamation were performed within post-consolidation management. However, land consolidation failed to/did not fulfill every need of local community – including farmers – concerning for instance water and anti-erosion meliorations or village's restoration. In other words, these actions were not complex enough. Multifunctional evolvement of rural areas is a chance for the development of the Nozdrzec commune as agriculture still plays a dominant role here. Competent integrating of additional non-agricultural functions into rural space can contribute to improving the population's life conditions, including among others creating new work places and, in consequence, stopping migration of working-age population. The region's uniqueness reflected in the characteristic for south-eastern Poland landscape and natural values as well as cultural heritage has great importance for the development of agro-tourism which is a chance for the commune's development and promotion.

Creating modern villages with the proper infrastructural base providing places for work, leisure and recreation should be, therefore, a priority. Also, undertaking of tasks from the range of technical infrastructure expansion, such as the water supply and sewage systems, roads modernization, construction of sidewalks and street lights as well as building a bridge on the San River in order to provide more efficient communication for inhabitants of Wołodź, Siedliska and Huta Poręby with other commune's residents is essential for the commune of Nozdrzec. Renovations of public utility buildings, like schools, creation of playgrounds for children or schoolyards or at last setting up the first nursery in the commune, are also important. Restorative works of culture monuments are not out of the question as well. Performing the aforementioned actions would surely create an attractive place for settlement and creating new production and service facilities. PPUR might become a chance for multifunctional development of the commune of Nozdrzec giving possibility of acquiring funds and presenting a further schedule of activities.

## 6. Conclusions

In general, current spatial planning of the commune of Nozdrzec negatively influences rural areas development. In the multifunctional model of the development which presumes equalization of disproportions between cities and villages, development problems of agriculture and country should be treated comprehensively, including the whole area and not only the chosen elements. Despite covering parts of the area with MPZPs, the commune is not able to fully control dispersion of building development.

Moreover, the existing local plans have got very general arrangements and their main aim is to determine new building areas. The basic communal planning instrument turns out to be a WZ decision instead of a MPZP.

The binding spatial planning system in Poland is ill-suited to rural population needs because it is most of all concentrated on built-up areas. There is lack of elaborations strictly oriented on integrated development of rural areas that would join building aspects, landscape and also agricultural productive space. PPUR might turn out to be such a document. It should be widely executed, particularly in rural communes struggling with big structural problems in agricultural productive space.

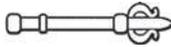
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## EVALUATION OF POSSIBILITY TO USE TYPOLOGICAL PROCEDURE AND WROCŁAW TAXONOMY TO ANALYSE AGRICULTURE DEVELOPMENT CONDITIONS ON THE EXAMPLE OF THE FORMER KRAKÓW VOIVODESHIP COMMUNES

Barbara Prus, Marta Szylar

### Summary

The paper presents comparative analysis of two methods: typological procedure and Wrocław taxonomy method. Possibilities of their usage to evaluate agriculture development conditions were also presented. Particular attention was paid to comparison of proceedings course, particular methods stages and also gained results. Chosen analysis methods allow to delimitate problem-areas for which the tested phenomenon has got complex character. Agriculture development conditions are influenced by numerous factors starting from variables of natural character, through demographic determinants economic factors in other words called socio-economic factors. Presented procedures allow to distinguish areas similar with regard to some features found as diagnostic ones, whereas these methods can be used to describe multipurpose phenomena because variables number accepted to the analysis is not restricted and the research area can be freely selected. The received result is helpful to estimate affiliation to extracted commune types. Analyses were performed in the area of the former Kraków Voivodeship excluding the municipal commune of Kraków. A commune was the field of the basic evaluation of performed research. Comparison of typological procedure and Wrocław taxonomy method allows to conclude about advantages and disadvantages of particular methods. The range of described methods applicability is also possible to define.

### Keywords

typological procedure • Wrocław taxonomy • agriculture development conditions

### 1. Introduction

Performing development determinants analysis needs among others using of methods that enable to identify problems and delimit areas with compliance of a big number of research variables [Prus 2014, Leszczyńska 2010]. The main task of research evaluative methods is to systematize the set of elements with regard to chosen features [Kolenda 2006]. In spatial researches concerning territorial units, the main aim is both to system-

atize them and also to indicate possible links and dependences occurring between them [Frankowski 1991]. Thanks to procedure performed in such a way, assignation of similar types of units which fulfill uniformity requirements in the range of morphological, structural, functional and genetic features can be performed. So the effect of these researches is not only tested objects set taxonomy but also possible description of developmental processes and cause-and-effect connections [Śleszyński 2012]. Showing similarities or differences between chosen areas can have numerous practical applications. First of all, it enables evaluation of socio-economic conditions [Gawroński et al. 2014], development state of tested area or for instance land development and investment. Information about problematic grounds occurrence is useful while preparing local plans, regional programmes and development strategy [Wysocki 2010].

Both typological procedures and taxonomic methods are used in almost every science field [Domański 1964, Frankowski 1991]. Typology is most often used in such fields as botany or zoology, however, geography also uses that procedure in order to organize research units or spatial testing of phenomena arrangement. Typology fulfills various functions which can be written in three words: terminological, evaluative and heuristic. Terminological aim consists in introducing systematized and precise ideas in the range characteristic for a given scientific field. Evaluative objective is connected with need to systematize the set of elements such as things and phenomena that belong to the definite scientific field. However, heuristic aim results from necessity to describe the set of things and phenomena in the way which allows to compare it with definite types that in turn allows to reveal facts and regularities not noticed earlier [Domański 1964, Wysocki 2010].

Among area delimitation methods that enable to research multi-criterion phenomena, the typology procedure (that consists in separating similar areas which fulfill uniformity requirements in the range of representative features) and also the Wrocław taxonomy method (which allows to analyse phenomena of complex character on the basis of dendrites theory assumptions) can be distinguished [Kowalski 1977]. Typological procedure not only enables to systematize spatial units but also allows to value objects paying special attention to tested phenomena so it allows to define which of types chosen in that procedure has got the most favourable conditions. The Wrocław method being one of taxonomic procedures shows most of all connections between particular research units (e.g. communes). The Wrocław taxonomy is included in dendritic methods and is based on rules and definitions that come from the dendrites theory. It allows to construct a dendrite map which is a coherent and open one [Grabiński, Wydymus, Zeliaś 1989]. The basis to build a dendrite map is a distance between objects matrix. The dendrite map consists of vertexes that represent particular elements (territorial units) and linking edges the length of which depends on distances between units [Nowak 1990].

An article is based on the analysis of agriculture development conditions which served to delimit areas by means of two methods. Agriculture is one of the oldest forms of human activities and at the same time one of basic economy branches. Agriculture history includes millennia of transformations first connected with adaptation to local

natural conditions and later to economic and social changes. However, the goal was still the same – it was and is to produce food products by plants growing and animals breeding. But agriculture influence is much wider. It not only contains food economy but also shapes environment, changes landscape, delivers raw materials for the industry, creates worksites and influences regional politics [Bański 2007, Bański 2013]. Hence, agriculture development state evaluation should be based both on analysis that concerns actual situation of the particular region [Fogel 2010] and also study of effects that result from historical causations. Polish rustic lands still demonstrate considerable diversity both with regard to various natural and social conditions [Dudzińska M., Kocur-Bera K. 2014; Konieczna J., Trystuła A., 2014; Nowak M., Pawlewicz K., Szczepańska A. 2014], historical post-communist events [Kühne et al. 2015] as well as post-annexation ones [Hałasiewicz 2010]. The research of units spatial diversity state from the agriculture development conditions point of view is still very important especially because of occurring socio-economic and environmental transformations or changes connected with technical development [Bański 2013].

Research area presented in the paper contains the part of Małopolskie Voivodeship within the administrative borders of the former Kraków Voivodeship. Kraków Voivodeship existed in the years 1975–1998 as the one of 49 voivodeships. It came into existence by virtue of the Act from 28<sup>th</sup> May 1975 about two-stage administrative division of the country and about the change of the Act about national councils. The voivodeship's area included about 3,254 km<sup>2</sup> inhabited by over 1.2M people. Rural economy of the former Kraków Voivodeship was characterized by flaked territorial structure of individual farms which was distinguished by crops mosaic [Baran-Zgłobicka, Zgłobicki 2012], diverse structure of possession and also decrease of arable lands area in favour of non-agricultural usage [Bański 1997, Salata et al. 2015, Prus 2012].

The aim of the paper is to evaluate possibilities of using the Wrocław taxonomy method as well as typological procedure to study research units spatial diversity degree paying special attention to agriculture development conditions. Methods presented in the paper: the typological procedure and the Wrocław taxonomy method served to delimit communes of the former Kraków Voivodeship in order to reveal similarities between these administrative units considering agriculture development conditions. They also allowed to classify lands with the most and the least favourable conditions of agriculture development. The basic assumption was to predicate researches on the same output set of variables. The types of communes which in terms of chosen representative features are the most similar from the point of view of set aim were scheduled within the frames of researches. Most often, procedures of such type concern units of the basic territorial division of the country [Śleszyński 2013].

## 2. Material and methods

Data for the tested area of communes of former Kraków Voivodeship were gained from sources of public statistics (GUS, Puławy PIB IUNG data). Base set of variables

included 6 example features the discrete values of which collected for 38 communes were combined in Table 1. Kraków urban commune's area was excluded from analyses with regard to its non- agricultural character. Features with demographic character ie. percentage of people who make the living by working in agriculture, with natural character: quality of natural environment expressed by point indicator of agricultural valorization of productive space given by IUNG in Puławy were assumed towards the needs of the present study. Socio-economic features assumed to analyses describe: mean farms size in particular communes [ha UR], farm equipment value [100 thousand PLN · ha<sup>-1</sup>], area percentage of arable lands in communes general area [ha] and also farm animals stock [SF/100 ha UR]. It was accepted that these features in a simplified way are representative for relative variables influencing widely understood agriculture development conditions. Base set of variables was the research basis both in the typological procedure and in the Wrocław taxonomy method.

**Table 1.** Base set of variables accepted for researches that describe socio-economical development level and also natural conditions of farm production in communes of former Kraków Voivodeship

No.	Commune	Population living on work in agriculture [%]	Mean size of a farm [ha UR]	Value of farm equipment [100,000 PLN · ha <sup>-1</sup> ]	Farm animals stock [SF/100 ha UR]	Arable lands in general area [%]	Natural environment quality [points]
		$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	$x_6$
1	Alwernia	34.2	1.37	2.8	65.1	60.8	72.3
2	Biskupice	36.7	1.84	2.8	67.4	85.1	86.7
3	Czernichów	44.6	1.72	2.8	75.8	73.4	76.4
4	Dobczyce	49.1	1.88	2.3	79.1	65.0	74.2
5	Drwinia	53.0	2.77	4.5	74.8	47.4	84.1
6	Gdów	49.5	2.27	2.7	74.3	79.1	87.7
7	Golcza	68.5	2.91	5.9	74.8	86.4	88.9
8	Igołomia-Wawrzeńczyce	73.6	2.40	6.7	60.1	90.4	97.9
9	Iwanowice	61.6	3.07	5.9	83.8	90.4	97.0
10	Jerzmanowice-Przegonia	43.4	2.55	3.5	74.5	85.5	78.1
11	Kłaj	31.5	1.25	2.9	80.7	41.4	86.8
12	Kocmyrzów-Luborzyca	45.1	2.01	7.2	61.3	84.9	100.9
13	Koniusze	80.4	3.50	7.9	72.1	92.9	101.2
14	Krzeszowice	34.7	0.98	2.6	59.3	54.2	77.8

15	Liszki	37.7	1.97	3.2	71.6	81.5	85.1
16	Michałowice	61.7	2.85	6.8	80.7	88.7	95.2
17	Mogilany	35.7	1.61	1.6	70.7	78.0	79.6
18	Myslenice	42.0	1.83	2.3	86.5	57.5	69.4
19	Niepołomice	35.9	1.50	2.3	78.5	72.6	83.6
20	Nowe Brzesko	71.2	2.37	6.5	60.6	83.9	98.2
21	Pcim	47.1	2.42	1.5	88.9	42.6	46.9
22	Proszowice	74.9	2.31	7.9	69.9	88.6	102.3
23	Raciechowice	73.6	3.14	5.8	77.8	67.9	70.6
24	Radziemice	80.6	3.89	7.7	69.6	92.0	99.8
25	Siepraw	39.9	1.36	1.5	87.2	74.8	73.6
26	Skała	50.3	2.22	4.8	74.8	73.9	92.8
27	Skawina	32.8	1.41	2.4	79.3	67.7	84.0
28	Słomniki	65.7	3.14	6.9	75.7	83.4	95.1
29	Sułkowice	38.2	1.62	2.8	83.6	56.2	72.6
30	Sułoszowa	68.2	2.21	6.4	77.8	89.8	77.9
31	Świątniki Górne	25.7	0.89	1.3	60.7	78.6	79.3
32	Tokarnia	58.6	2.80	2.5	100.5	46.1	41.0
33	Trzyciąż	65.1	3.81	6.3	79.6	77.9	78.9
34	Wieliczka	31.7	0.89	1.5	56.2	78.6	81.6
35	Wielka Wieś	38.6	2.35	3.7	64.8	83.9	87.2
36	Wiśniowa	65.2	3.20	6.0	99.8	56.0	49.2
37	Zabierzów	34.6	1.20	1.3	49.9	66.5	87.3
38	Zielonki	42.2	1.73	4.4	60.6	91.2	96.6

Source: authors' study based on GUS and Puławy PIB IUNG data

In the first stage of both methods, from among features that describe agriculture development conditions, diagnostic features were selected according to the assumptions that representative features should be: essential with reference to the tested phenomenon and corresponding to issues of performed analysis, characterized by great variability and consequently in significant degree diversify tested objects as well as be poorly correlated with the other diagnostic features and strongly correlated with these not approved as diagnostic [Wojnar 2008].

For further analyses, diagnostic features for every informative group were accepted including groups of demographic character with  $x_1$  one – population living on work in agriculture [%], for socio-economic group  $x_4$  one – farm animals stock [SF/100 ha UR] and for natural features  $x_6$  one – natural environment quality [points]. It can be

observed that spatial variability of analysed features on the tested area is significantly diverse. The last and common for both procedures stage was standardisation of diagnostic features depending on commission to mutual direct comparability of features described with help of different units.

**Table 2.** Matrix of correlation features between variables accepted to the analyses

Variables	Population living on work in agriculture [%]	Mean size of a farm [ha UR]	Value of farm equipment [100,000 PLN · ha <sup>-1</sup> ]	Farm animals stock [SF/100 ha UR]	Arable lands in general area [ha]	Natural environment quality [points]
	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>6</sub>
x <sub>1</sub>	1	0.848	0.861	0.202	0.378	0.230
x <sub>2</sub>	0.848	1	0.748	0.373	0.273	0.090
x <sub>3</sub>	0.861	0.748	1	-0.013	0.534	0.519
x <sub>4</sub>	0.202	0.373	-0.013	1	-0.429	-0.619
x <sub>5</sub>	0.378	0.273	0.534	-0.429	1	0.720
x <sub>6</sub>	0.230	0.090	0.519	-0.619	0.720	1

Standardisation was performed by means of zero unitarisation as well as features distinction to stimulants and destimulants. Formulas for standardisation took the forms (1) and (2):

$$\text{– for stimulants:} \quad S = \frac{x_i - x_{\min}}{x_{\max} - x_{\min}} \quad (1)$$

$$\text{– for destimulants:} \quad S = \frac{x_{\max} - x_i}{x_{\max} - x_{\min}} \quad (2)$$

Calculations were performed by means of Excel 2007 sheet, Numerical Taxonomy programme, whereas the result of spatial arrangement of objects was presented in QGIS programme.

### 3. Research results

#### Typological procedure

The typological procedure led to allocation of characteristic formations of territorial units (types) complying with requirements of uniformity (similarity) in the range of some features considered as diagnostic ones.

By means of point method, there were performed: reduction of multi-feature space, estimation of synthetic factor (Ws) which is the sum of standardized diagnostic features

(Table 3) and then gathering units by an analytic method (analysis of values distribution on coordinates axis) with separating types which are located in the following class ranges:

- type I:  $Ws \in < 1,16; 1,36)$
- type II:  $Ws \in < 1,36; 1,83)$
- type III:  $Ws \in < 1,83; 2,00)$
- type IV:  $Ws \in < 2,00; 2,25 >$

**Table 3.** Values of synthetic factor describing agriculture development conditions in communes of the former Kraków Voivodeship

No.	Commune's name	Synthetic factor's value $Ws$	No.	Commune's name	Synthetic factor's value $Ws$
1	Alwernia	1.66	20	Nowe Brzesko	1.32
2	Biskupice	1.89	21	Pcim	1.48
3	Czernichów	1.75	22	Proszowice	1.50
4	Dobczyce	1.69	23	Raciechowice	1.16
5	Drwinia	1.70	24	Radziemice	1.35
6	Gdów	1.81	25	Siepraw	2.01
7	Gołcza	1.49	26	Skąła	1.89
8	Igołomia-Wawrzeńczyce	1.26	27	Skawina	2.15
9	Iwanowice	1.93	28	Słomniki	1.66
10	Jerzmanowice Przegonia	1.77	29	Sułkowice	1.95
11	Kłaj	2.25	30	Sułszowa	1.38
12	Kocmyrzów Luborzycza	1.85	31	Świątyniki Górne	1.84
13	Koniusze	1.42	32	Tokarnia	1.40
14	Krzyszowice	1.62	33	Trzyciąż	1.49
15	Liszki	1.93	34	Wieliczka	1.68
16	Michałowice	1.84	35	Wielka Wieś	1.81
17	Mogilany	1.86	36	Wiśniowa	1.40
18	Myslenice	1.89	37	Zabierzów	1.59
19	Niepołomice	2.07	38	Zielonki	1.82

Division was performed taking assumption about as big as possible intra-group coherence into consideration. Presented ranges guarantee the biggest types similarity described by the lowest values of coefficient variations in the groups.

**Table 4.** Results list of analyses performed according to typological procedure assumptions

Type's name	Communes qualified to types
Type I – with weak values of agriculture development	Igołomia-Wawrzeńczyce, Nowe Brzesko, Raciechowice, Radziemice
Type II – with average values of agriculture development	Alwernia, Czernichów, Dobczyce, Drwinia, Gdów, Gołcza, Jerzmanowice Przegonia, Koniusze, Krzeszowice, Pcim, Proszowice, Słomniki, Sułoszowa, Tokarnia, Trzyciąż, Wieliczka, Wielka Wieś, Wiśniowa, Zabierzów, Zielonki
Type III – with good values of agriculture development	Biskupice, Iwanowice, Kocmyrzów Luborzycza, Liszki, Michałowice, Mogilany, Myślenice, Skała, Sułkowice, Świątniki Górne
Type IV – with very good values of agriculture development	Kłaj, Niepołomice, Siepraw, Skawina

Communes with the most similar agriculture development conditions were put together in grouped types. Moreover, values of reduced factor *W*s allow to conclude that the most favourable conditions of agriculture development are characterized by type IV. 4 of 38 communes were qualified to type I, in the most numerous type II as much as 20 communes appeared. Type III concentrates 10 communes, whereas in the best type there are also 4 ones.

#### Wrocław taxonomy

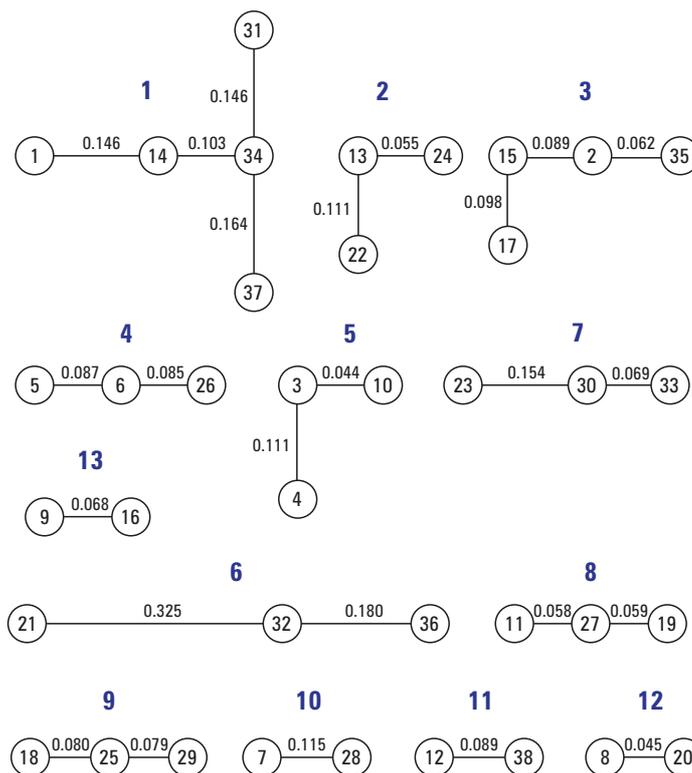
As basis of objects division into groups in the Wrocław taxonomy method, matrix of Euclidean distance was taken. Distance matrix was calculated on the basis of standardized diagnostic features. Next, probability between units was determined preparing a disconnected dendrite map assuming that the greatest probability between units is marked by the smallest value of calculated Euclidean distance. The units which are mostly similar to each other considering agriculture development conditions were put together in sequence.

**Table 5.** Specification of communes with their closest neighbours on the basis of the matrix of Euclidean distance

Commune No.	The smallest distance	The closest neighbour	Commune No.	The smallest distance	The closest neighbour
1	0.146	14	20	0.045	8
2	0.062	35	21	0.325	32
3	0.044	10	22	0.111	13
4	0.111	3	23	0.154	30
5	0.087	6	24	0.055	13
6	0.085	26	25	0.079	29
7	0.115	28	26	0.085	6
8	0.045	20	27	0.058	11

9	0.068	16	28	0.115	7
10	0.044	3	29	0.079	25
11	0.058	27	30	0.069	33
12	0.089	38	31	0.146	34
13	0.055	24	32	0.180	36
14	0.103	34	33	0.069	30
15	0.089	2	34	0.103	14
16	0.068	9	35	0.062	2
17	0.098	15	36	0.180	32
18	0.080	25	37	0.164	34
19	0.059	27	38	0.089	12

A disconnected dendrite map was created next (Fig. 1).



Source: authors' study

**Fig. 1.** Disconnected dendrite map of 1–13 clusters

**Table 6.** The smallest distance between 1 and 2 clusters objects

Object from cluster 1	The closest neighbour from cluster 2	Distance between objects
1	13	0.5126
14	13	0.4236
31	13	0.6505
34	13	0.2622
37	13	0.0889

**Table 7.** The smallest distance between 2 and 3 clusters objects

Object from cluster 2	The closest neighbour from cluster 3	Distance between objects
13	35	0.8079
22	35	0.7128
24	35	0.7978

**Table 8.** The smallest distance between 3 and 4 clusters objects

Object from cluster 3	The closest neighbour from cluster 4	Distance between objects
2	6	0.2706
15	6	0.2255
17	6	0.2928
35	6	0.2734

**Table 9.** The smallest distance between 4 and 5 clusters objects

Object from cluster 4	The closest neighbour from cluster 5	Distance between objects
5	3	0.1989
6	10	0.1921
26	10	0.2708

**Table 10.** The smallest distance between 5 and 6 clusters objects

Object from cluster 5	The closest neighbour from cluster 6	Distance between objects
3	21	0.5484
4	21	0.4870
10	21	0.5870

**Table 11.** The smallest distance between 6 and 7 clusters objects

Object from cluster 6	The closest neighbour from cluster 7	Distance between objects
21	33	0.6433
32	23	0.7135
36	23	0.5782

**Table 12.** The smallest distance between 7 and 8 clusters objects

Object from cluster 7	The closest neighbour from cluster 8	Distance between objects
23	19	0.7188
30	19	0.5958
33	19	0.5378

**Table 13.** The smallest distance between 8 and 9 clusters objects

Object from cluster 8	The closest neighbour from cluster 9	Distance between objects
11	29	0.2680
19	29	0.2100
27	29	0.2269

**Table 14.** The smallest distance between 9 and 10 clusters objects

Object from cluster 9	The closest neighbour from cluster 10	Distance between objects
18	7	0.6226
25	7	0.6275
29	7	0.6368

**Table 15.** The smallest distance between 10 and 11 clusters objects

Object from cluster 10	The closest neighbour from cluster 11	Distance between objects
7	12	0.5396
28	12	0.4804

**Table 16.** The smallest distance between 11 and 12 clusters objects

Object from cluster 11	The closest neighbour from cluster 12	Distance between objects
12	28	0.4804
38	28	0.5224

**Table 17.** The smallest distance between 12 and 13 clusters objects

Object from cluster 12	The closest neighbour from cluster 13	Distance between objects
8	16	0.4633
20	16	0.4360

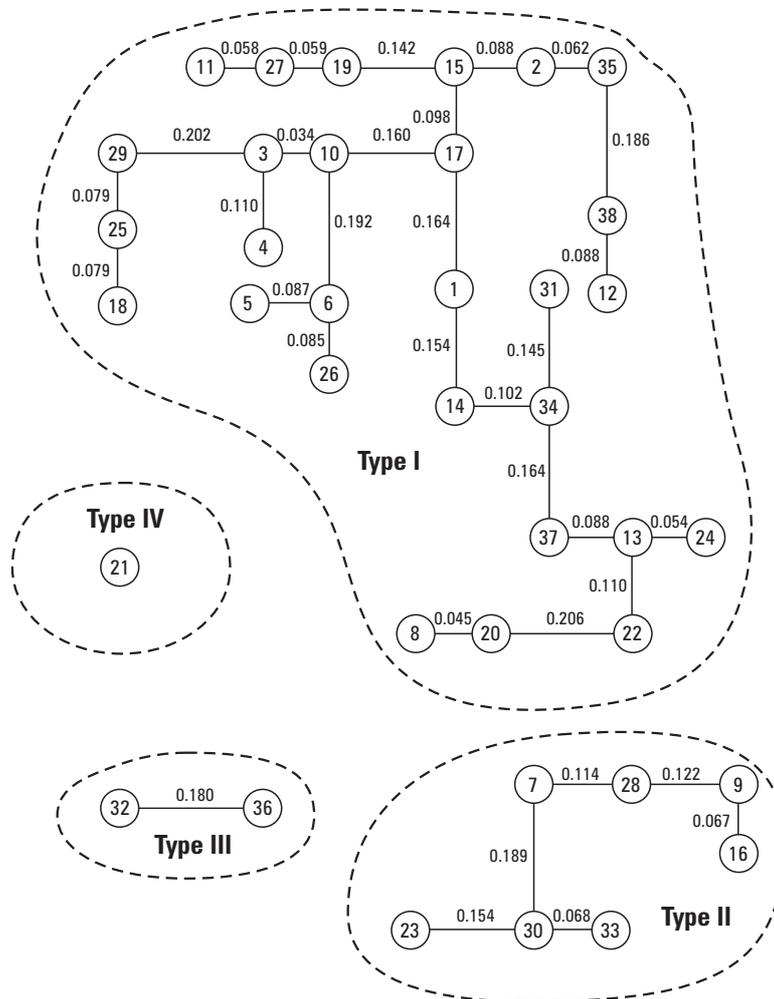
In order to create a connected dendrite map, the smallest distances between grouped clusters in the disconnected dendrite map were found. And to that end, it is necessary to find the smallest distance between objects for every pair of clusters. Considering the very big number of clusters and objects, presented in Tables 6–17, example pairs of chosen clusters were presented. On the basis of combination of the clusters nearest to each other and the nearest objects in these clusters (Table 18), the connected dendrite map was created (Fig. 2).

**Table 18.** Specification of the nearest connections between 1–13 clusters

Clusters' connection		Objects' connection		The smallest distance
Cluster	The closest neighbour	Objects	The closest neighbour	
1	2	37	13	0.0889
2	1	13	37	0.0889
3	8	15	19	0.1424
4	5	6	10	0.1921
5	3	10	17	0.1610
6	9	21	18	0.3816
7	10	30	7	0.1891
8	3	19	15	0.1424
9	5	29	3	0.2030
10	13	28	16	0.1228

Table 18. cont.

Clusters' connection		Objects' connection		The smallest distance
Cluster	The closest neighbour	Objects	The closest neighbour	
11	3	38	35	0.1863
12	2	20	22	0.2069
13	10	16	28	0.1228



Source: authors' study

Fig. 2. Assigned typological groups

The obtained connected dendrite map grouped objects so that every tested object (a commune) would be joined with at least one other element. To group units in the Wrocław method which means gaining typological groups that bring together communes with similar agriculture development conditions, the longest connections between objects were removed. The amount of eliminated edges decided about the number of appointed typological groups. Like in typological procedure, 4 types of communes were fixed which means that 3 longest connections were removed:

- between Myślenice (18) and Pcim (21) the edge with length 0.381
- between Pcim (21) and Tokarnia (32) the edge with length 0.325
- between Proszowice (22) and Słomniki (28) the edge with length 0.234

As a result of above actions, four typological groups were created (Table 19).

**Table 19.** Results specification of analyses performed by means of Wrocław taxonomy method

Type's name	Communes qualified to the types
Type I	Alwernia, Biskupice, Czernichów, Dobczyce, Drwinia, Gdów, Igołomia-Wawrzeńczyce, Jerzmanowice Przegonia, Kłaj, Kocmyrzów Luborzycza, Koniusze, Krzeszowice, Liszki, Mogilany, Myślenice, Niepołomice, Nowe Brzesko, Proszowice, Radziemice, Siepraw, Skała, Skawina, Sułkowice, Świątniki Górne, Wieliczka, Wielka Wieś, Zabierzów, Zielonki
Type II	Gołcza, Iwanowice, Michałowice, Raciechowice, Słomniki, Sułoszowa, Trzyciąż
Type III	Tokarnia, Wiśniowa
Type IV	Pcim

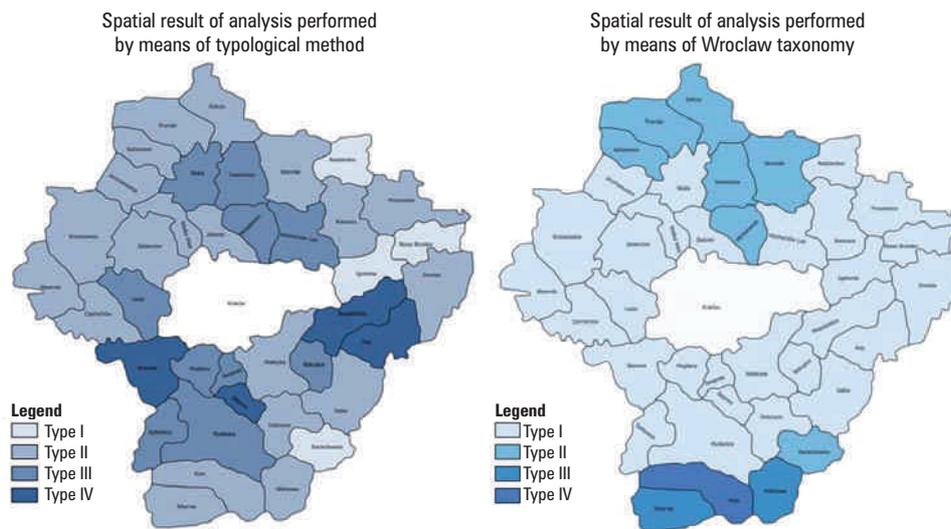
It should be remembered that the Wrocław taxonomy does not allow to evaluate fixed areas paying special attention to their assessment (advantageous – little advantageous). Division enabled only to assign types with similar agriculture development conditions. Like in typological method, four types of communes were obtained. However, in this method the type does not decide which of the communes has got the most favourable conditions and which one – the least. Type I concentrates up to 28 communes. Seven ones were matched to type II, two – to type III and one – to type IV.

#### Comparison of typological procedure with Wrocław taxonomy method

Comparing course of action it can be noticed that calculations in both tested methods can be done simultaneously to the moment of standardisation of diagnostic features. Next, the typological procedure provides multi-feature space reduction and then grouping of diagnostic features on the basis of calculated reduced factor, whereas the Wrocław taxonomy method needs to perform a number of partial analyses that enable to identify single connections between units accepted for research until the moment of creating of so called connected dendrite map.

Comparison of results obtained after performing both procedures (Fig. 3) can lead to conclusion that direct spatial comparison of research results is not possible. The

further statistical analyses should be performed to state which of fixed types can be classified as the one with the most favourable conditions of agriculture development. It can be observed how much the results of both procedures differ from each other. Division of the same space to uniform types does not basically agree. The typological procedure diversifies area of the former Kraków Voivodeship absolutely more, taking agriculture development conditions into consideration. Its usage also helps to determine which of particular communes belong to the types of the most and the least favourable conditions of agriculture development. Higher synthetic factor's value ( $W_s$ ) allows to classify a commune as the better one from the established aim's point of view. Such possibility is not provided by the Wrocław taxonomy where – by means of a dendrite map – similarity between discussed areas is presented. Division to particular types does not result from the statement in which units more favourable conditions of agriculture development occur but only from resemblance of these conditions in particular communes. As it can be observed in picture 7, the Wrocław taxonomy to a small extent diversifies units in respect of accepted criterion.



**Fig. 3.** Comparison of spatial distribution of obtained results

On the basis of presented analysis of agriculture development conditions in the area of the former Kraków Voivodeship, some conclusions concerning the methods themselves can be drawn. The typological procedure and the Wrocław taxonomy were compared by means of 10 aspects (Table 20).

**Table 20.** Comparison of typological procedure and Wrocław taxonomy

	Typological procedure	Wrocław taxonomy
Base of analysis	Synthetic factor	Distance matrix
Algorithm difficulty degree	Very easy	Easy
Work consumption	Mean	High
Base of division of objects to groups	Analysis of values distribution of synthetic factor on numerical axis	Removal of the longest edges of a connected dendrite map
Way of presenting results	Choropleth, table	Dendrite map – coherent and open one
Simplicity of results interpretation	Easy – colours or hatches scale on a choropleth	Easy – rules and concepts from dendrite maps theory
Differentiation of research area in terms of accepted analysis aim	Considerable	Slight
Evaluating objects paying attention to determined phenomenon	Yes	No
Advantages	<ul style="list-style-type: none"> <li>• very easy calculations;</li> <li>• legible imaging of results which allows to study spatial phenomena diversity;</li> <li>• method's little work consumption;</li> <li>• possibility to assess objects paying special attention to studied phenomenon</li> </ul>	<ul style="list-style-type: none"> <li>• possibility to picture even very complicated connections between objects;</li> <li>• exceptionally legible expression of classification results</li> </ul>
Limitations and difficulties	<ul style="list-style-type: none"> <li>• lack of ambiguity when choosing diagnostic features;</li> <li>• difficulties in determining divisions of synthetic factor (division into types)</li> </ul>	<ul style="list-style-type: none"> <li>• work consumption of calculations in case of a bigger (&gt;30) number of objects;</li> <li>• technical limitations connected with presenting results in case of great amount of data;</li> <li>• lack of possibility to assess objects (it only shows similarities)</li> </ul>

Despite some similarities connected with preliminary preparing of data (diagnostic features choice, standardisation), the basis of analysis for both procedures is different. In typology, a reduced factor which is a sum of diagnostic features after standardisation values is determined. In case of the Wrocław taxonomy, the basis as in many taxonomic methods is a distance matrix. When it comes to algorithm difficulty degree, both procedures are similar – in both cases calculations do not cause problems. Both algorithms are transparent. Much bigger differences concern methods' work consuming. Taking this aspect into consideration, the typological procedure turns out to be much

better. In the Wrocław taxonomy, calculations, though not difficult, need many tables and sheets to be prepared on the basis of which the following objects can be joined with each other. Additionally, to obtain a connected dendrite map, the procedure should be performed several times joining firstly singular objects and then clusters. Methods' diversity can also be noticed in the way of determining final, homogenous groups. In typology, groups are determined on the basis of synthetic factor's value. These values' distribution is analysed. The factor's ranges are defined considering the most similarity of objects in the group so the closest values of the reduced factor. In the Wrocław taxonomy, a connected dendrite map that joins all objects with each other is created first of all. Division to types is performed by removing the longest edges from the dendrite map so separating the most distant (the least similar) objects. Both the typological procedure and Wrocław taxonomy do well in terms of results' presentation and interpretation. In the typological procedure results can be presented in the table, however, the choropleth that illustrates phenomenon's spatial diversity is most often used. On the basis of colours scale and hatching difference it is easy to determine location of objects of the same type. The Wrocław taxonomy belongs to taxonomic dendrite methods so the name indicates the way of analysis results' presentation. A dendrite map allows to interpret results easily and also enables to illustrate very complicated connections between particular objects and their groups. Additionally, rules and concepts from dendrites' theory become helpful in results interpretation. Taking diversity of tested area and also possibility to assess objects with regard to agriculture development conditions into consideration, the typological procedure did much better. Every type extracted in that procedure includes at least a few communes. In division made by means of the Wrocław taxonomy, most of communes is located in the first group. One type is represented by just one element and the other – by two ones. Analyzing results gained in that procedure, the conclusion can be drawn that agriculture development conditions in the area of the former Kraków Voivodeship are little diverse. However, spatial diversity of particular features accepted to the analysis and diagnostic features in particular indicates completely different conclusions.

Last two verses of the table (Table 20) are specific recapitulation of presented comparison. The main advantages as well as appearing difficulties and limitations while using both methods were collated. Synthetic factor's calculations simplicity and also legible illustrating results by means of the choropleth belong to benefits of the typological procedure. It is not very work-consuming, diversifies objects well with regard to analysed phenomenon and makes possible its assessment. Lack of ambiguity when choosing diagnostic features made on the basis of correlation matrix and units grouping rules can be included in its disadvantages. Among virtues of the Wrocław taxonomy, possibility to illustrate even very complicated connections between objects with dendrite map's help and also easy and intuitive interpretation can be underlined. However, this method has got some defects. Most of all, great difficulties appear together with increasing number of objects – both in calculations and in constructing and presenting the dendrite map.

#### 4. Conclusions

Performed typological procedure allowed to divide the area of the former Kraków Voivodeship to commune's types with good, very good, average and the weakest conditions of agriculture development. A few communes appeared in every type. Comparing spatial arrangement of types with spatial diversity of diagnostic features, it is easy to find relationship between demographic, economic and natural conditions and determined conditions of development.

The Wrocław taxonomy by means of the dendrite map illustrates similarity of conditions prevalent in particular communes. It can be determined in an easy and simple way which of the communes are the most and least similar to each other with regard to the tested phenomenon. So the dendrite map presents a specific map of likeness. However, taxonomic procedure did not allow to diversify this area significantly with regard to agriculture development conditions. What is equally important, it cannot be determined on the basis of the dendrite map and without performing additional statistic analysis in which communes conditions are more and less favourable.

Conclusions that result from comparing of both procedures come to mind by themselves. The typological procedure is for sure less time-consuming than the Wrocław taxonomy. Moreover, on the basis of its results, grouped types can be clearly characterized with respect to its own merits. It diversifies analysed space in a better way. The Wrocław taxonomy does not enable substantial characteristics. It only shows objects' similarity. Apart from that, this is a very time-consuming procedure. It is necessary to perform many combinations in order to choose the shortest possible connections so as the dendrite map could group tested objects in the most uniform types. Although the dendrite map being a picture of a performed procedure's result is easy to interpret and shows objects' similarity in a simple way, it is difficult to prepare. The greater amount of analysed elements, the higher the level of difficulty.

Summing up, it can be stated that performing researches of phenomena that are possible to be characterized by means of variables set, the typological procedure seems to be more favourable. However, if the aim of analyses is to show similarities between tested units, the Wrocław taxonomy can be used providing that the number of tested elements in the set is not very big.

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