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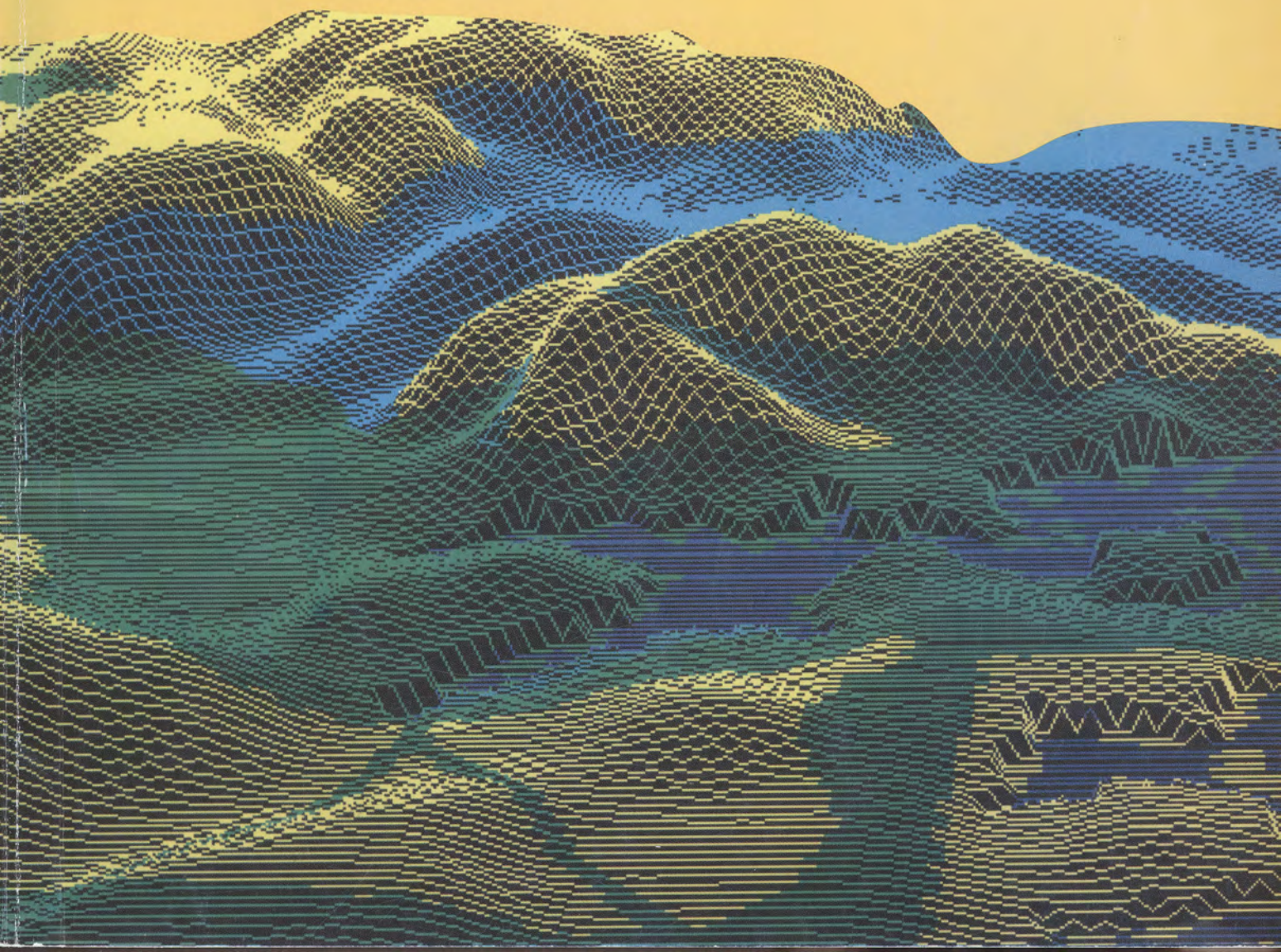

Fig. 2: Priessnitz sanatorium in the Jesenik Spa.

Photo E. Quitt

Illustrations to E. Quitt`s paper.

Fig. 8: Specific forms of recreation in summer houses in Horní Lomná.

Photo J. Havrlant

Illustrations to J. Havrlant`s paper.

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Drobného 28, 602 00 Brno
Czech Republic
(fax) 420 545 422 710
(E-mail) geonika@geonika.cz
(home page) http://www.geonika.cz

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Articles

Reports

TOPOCLIMATIC PROCESSES IN THE LOWER BOUNDARY ATMOSPHERIC LAYER OF THE JESENÍK SPA (CZECH REPUBLIC)

Evžen QUITT

Abstract

The Jeseník Spa (Lázně Jeseník) is the most prominent climatic spa resort in the Czech Republic. Increased interest in the possibility of using topoclimatic processes occurring in the lower boundary atmosphere layer in balneotherapy is, therefore, quite logical. The paper is accordingly focused on the possible development of microadvection or microcirculation as a function of the character of the active surface, its slope or orientation aspect. Attention is also paid to the measure of patients' comfort, which is considerably affected by pleasant or unpleasant feelings of temperature or humidity. Individual sections are illustrated with thematic maps and graphs.

Shrnutí

Topoklimatické procesy ve spodní části mezní vrstvy ovzduší lázní Jeseník.

Lázně Jeseník jsou nejvýznamnější klimatické lázně v České republice. Je proto pochopitelný zvýšený zájem o možnost využití topoklimatických procesů ve spodní části mezní vrstvy ovzduší při balneoterapii pacientů. Autor si všímá zejména možnosti vzniku mikroadvekce nebo mikrocirkulace závisející na charakteru aktivního povrchu, jeho sklonu či orientaci. Pozornost je věnována i míře pohody pacientů kterou ve značné míře ovlivňují příjemné nebo nepříjemné pocity teploty či vlhkosti. Jednotlivé kapitoly doprovázejí ukázky tématických map a grafů.

Key words: *topoclimate, balneoclimate, Jeseník Spa, Czech Republic*

1. Introduction

The world-famous Jeseník Spa (Fig. 1), known until year 1947 as the Gräfenberg Spa, has been serving the diseased for nearly two centuries. The spa came to existence and later became world-known thanks to Vincenc Priessnitz (1799-1851) who founded in 1822 the first hydrotherapeutic sanatorium in the world, located at a picturesque place on the slopes of Gräfenberg – today's Studniční vrch Hill. The information about successful cold water therapy soon spread even abroad. At the present time, the spa is used – with respect to its favourable climate – also for the curing of diseases of upper and lower respiratory passages, neural disorders, disturbed metabolism, blood circulation diseases, etc. For these purposes there are among other things 40 curative springs in the local spa, and a number of spa facilities of which the most popular is the Priessnitz sanatorium (Fig. 2 – see cover – p. 2) and the Balneological Institut.

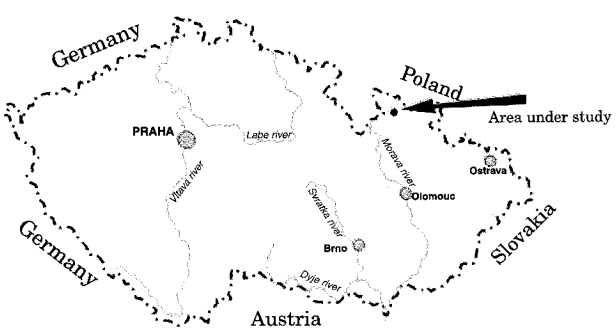

Fig.1: Area under study

The recent boom of information science and the rapid development of information systems emphasize the significance of topoclimatic processes research as an important source of data for balneology since the various thematic databases (geobotanical, biogeographical, hydrogeological, paedological, remote sensing) are inspiring for using the data and documentation in considerations about a possible development of diverse processes in the lower boundary atmosphere layer, their duration or intensity in particular.

Climatological analysis of lower boundary atmosphere layer finds its greatest employment especially in analyzing energy balance, air flowing and in the assessment of the vertical stability of temperature stratification. Although the processes occurring in the boundary atmosphere layer can be characterize by directly measured values of some climatic variables, the values are representative only for a narrow profile

of the measuring site and do not hold for other relief forms, other slopes or terrain exposures, other types of active surface or parent rock. It is also numerical models which are incrementally used to simulate energy flows in parallel with data directly measured in the field. The numerical models serve to establish factors most affecting the time and spatial structure of temperature field, humidity and wind in the boundary atmosphere layer as they facilitate a prognosis of its condition in case that the input values of the model are changed (e.g. impacted by anthropogenic factors).

Normal simulation is usually made for the impact of topography and different active surface heating on the situation in the ground boundary atmosphere layer as differences in the exposure and slope inclination cause an uneven supply of solar energy, i.e. uneven heating of the surface and – consequently – of the air. The temperature differences lead gradually to air pressure differences and hence to the development of local circulation systems. This is why the piedmont relief of the Jeseník Spa (the most prominent climatic spa resort in the Czech Republic) surroundings is observed to exhibit development of montane and valley winds and to them related convection on slopes. The thermally conditioned circulation often markedly modifies even the macrosynoptic flowing in the entire region.

2. Thermal conditions under the regime of positive energy balance

In accordance with the daily course of active surface energy balance, day period is divided into two basic parts: periods of positive/negative energy balance. The positive balance day part is characterized by the prevailing gain of radiation energy thanks to solar radiation. Intensity of ground atmosphere layer heating on slopes with northern or southern aspect depends especially on the incidence of solar radiation (insolation), i.e. on slope inclination and Sun declination with the maximum values occurring at noon. Slopes inclined to the East experience a higher intensity of heating as their insolation is highest in the morning, which means an earlier arrival of the temperature maximum. Slopes of western aspect show a reversed modification of the daily temperature course, i.e. the temperature maximum in the afternoon.

The intensity of direct solar radiation falling not only onto the horizontal plane but especially on surfaces inclined to sunrays under different angles and exposed to different cardinal points is very important for explanation, monitoring and quantification of various processes occurring in the ground and lower part of the atmosphere boundary layer. The size of direct solar radiation falling onto active surface is given both by the parameter of Sun position (zenith angle), exposition (azimuth) and surface inclination (slope angle). Exposition variability results in a relatively high variability of direct solar radiation intensity.

Annual course of direct solar radiation intensity falling on the slopes depends on the slope exposure and angle. Comparing the intensity of direct solar radiation falling onto a horizontal surface with the intensity recorded on the slope we find that the greatest differences during the day occur in morning and evening hours, and in winter months during the yearly course. With respect to the noon sharp, the daily course of direct solar radiation intensity exhibits left and right asymmetry on eastern and western slopes, respectively, and the daily insolation maximum is increasing with the increasing slope angle to morning and evening hours in the eastern and western slopes, respectively. Northern and southern slopes will give us another image: The maximum insolation of both slope exposures falls to midday hours and while the intensity of direct solar radiation increases with the increasing slope angle on the southern slopes, it rapidly decreases on the northern slopes.

Heliotherapy is one of important means of the complex medical treatment available in the Jeseník Spa. Active medium in it is solar radiation applied according to patient's response. Furthermore, close surroundings of the spa town can boast of nearly above-normal total values of annual, monthly and daily direct solar radiation with normal values characteristic of flat topography being observed only exceptionally. Most important criteria to choose walking routes for the patients in the respective months are as follows:

- Alternation of walking trail sections with very diverse (contrasting) sums of direct solar radiation provides a healthy stimulation for the patients.
- Alternation of higher/lower light treat, namely in the cold part of the year (especially from November to January).
- Occurrence of anabatic microadvection up to microcirculation brings mildly humid and clean air (in warm part of the year from June to September) whose temperature is markedly changing even over a short section of the promenade.

All this makes it possible to select sound combinations of both stimulating and sparing factors.

The data on insolation intensity in the closer surroundings of the spa can be best used when plotted in maps. Construction of maps to illustrate average totals of direct solar radiation in individual months of the year was based on slope inclination which markedly affects the intensity of insolation. The more perpendicular is the angle of sun rays falling onto the surface, the greater is their intensity per unit area. As compared with the situation in which sun rays are

perpendicular, the irradiated surface area is doubled already at an incidence angle of 30°. It means that the surface with aslant irradiation enjoys only a half of what falls on the surface perpendicular to the rays. No less important for the amount of solar radiation falling onto the ground surface is the surface orientation to cardinal points. By analyzing the map documentation it is possible to delineate on the map sums of direct solar radiation in the respective months (Fig. 3) and the climatic characteristic prepared in this form can be directly employed in balneotherapy.

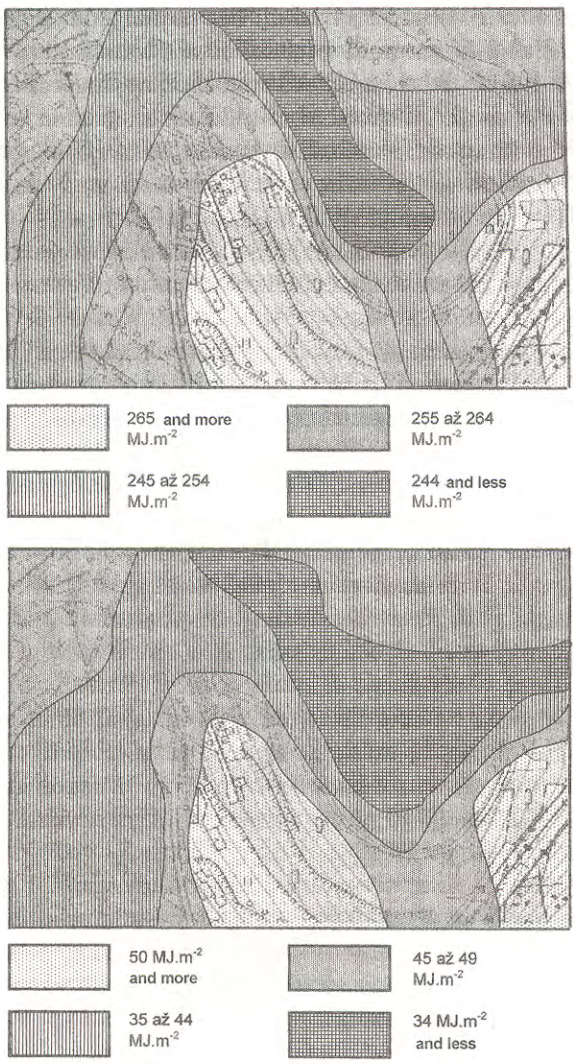

Fig. 3: Average sums of direct solar radiation in July and January in MJ.m^{-2}

Variances in the intensity of insolation in the surroundings of the Jeseník Spa can sometimes lead to surface temperature differences that are often greater than 10 °C and it is thanks to these temperature contrasts that there are pre-requisites in the ground and lower parts of atmosphere boundary layer for the development of a thermally-conditioned convection (so called anabatic) flowing which usually becomes a part of extensive convective circulation. In clear and calm weather and especially in the warm part of the year, anabatic flowing rates in the lower boundary atmosphere layer in the vicinity of the Jeseník Spa can range between 2 – 4 m.sec^{-1}.

The very broken piedmont relief in the surroundings of Jeseník city (432 m a.s.l.) has favourable pre-conditions for the development of very strong convection circulation fluxes due to the above mentioned temperature contrasts on the southern slopes of Jehlan (878 m a.s.l.) and Studničný vrch Hill (992 m a.s.l.), but also on those of the Přední vršek Hill (590 m a.s.l.) and the Železná hora Mt. (580 m a.s.l.). The anabatic flows (Fig. 4) link up at greater elevations with the descending compensatory flowing above the opposite slopes of the Javořík (772 m a.s.l.) and the Bukovický vrch Hill (557 m a.s.l.) with a northern aspect and hence less insolated and colder. Anabatic flowing in the region of the Jeseník Spa is therefore a part of an extensive circulation system which is enclosed by the descending flowing at larger elevations. Fig. 4 presents a schematic illustration of the main factor participating in the development of the processes. To enhance the illustration, the vertical scale of the schematic profile is much exceeded.

The above described circulation occurs in a situation when surfaces of the same temperature and same air pressure come to a mutual crossing. The number of solenoids above the well-insolated southern slopes falling into the Staříč Brook valley would then increase, which leads to a circulatory acceleration – anabatic flowing. Conditions for the development of such a circulation are met especially in the warmer part of the year from April to October. In the colder part of the year with a relatively short daytime, the factors initiating or supporting the circulation cannot develop properly. Conditions favourable for the development of the circulation are observed to exist also in autumn months when the number of days with a clear and calm weather often surmounts a half of the period.

Anabatic microadvection is important also with respect to the dispersion of atmospheric admixtures. The ground and lower part of atmosphere boundary layer affected by heated air transmission is several meters (in extreme cases several tens of meters) thick and it is this atmosphere layer in which a majority of small and up to now difficult-to-control (household combustion equipments) and large industrial sources of air-pollution are situated. Heated air rising along the slopes brings the atmospheric admixtures from lower places to higher elevations in which they can significantly impact cleanliness of the air and its unobjectable hygienic character. Apart from the transmission of dust and gaseous emissions from the processes of combustion, very important with respect to atmosphere hygiene

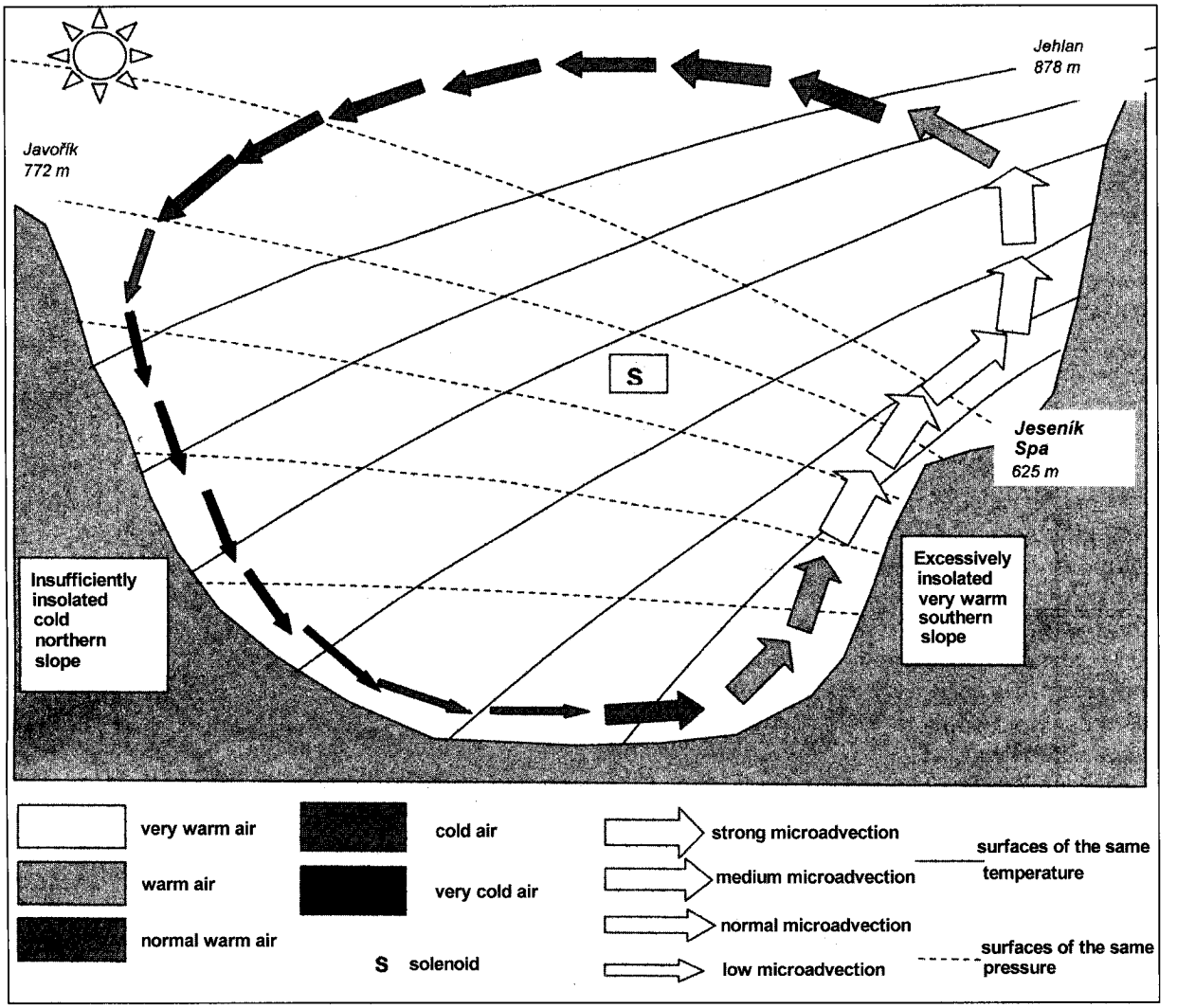

Fig. 4: Schematic illustration of anabatic microcirculation in the cross-section of Stařič Brook valley (markedly elevated vertical scale)

in the spa resort is also the transmission of annoying odours, bacteria and other infects.

In addition to the extensive circulation system affecting the entire Stařič Brook valley, there is also a smaller local advection of warm air occurring between the more and the less insolated surfaces, whose intensity however ranks with that of the by an order higher system an integral part of which it is. Very important for the spa and for the walking trails of its patients is the above-average insolated and to the south-west oriented slope starting from the Kalvodova Street (Children Health Centre Karolína) through the Růžová and Priessnitzova Streets, and ending near the spa ring at the place of the Jubilee memorial (Fig. 5). Apart from the excessive insolation, the slope has in its lower part also a low aerodynamic roughness of active surface, which reflects together with the surrounding less insolated surfaces in an increased possibility of anabatic microadvection development. Under a less cloudy and calm weather, there is an anabatic transmission of warm air up the slope occurring from early afternoon hours in the period from spring to autumn (Fig. 6).

This ascending flow with pronounced stimulative effects reaches the air layer of 2 to 5 meters thick, bringing atmospheric admixtures such as dust and gaseous emissions, annoying odours, pyoderm backeria, trichophyta and other inhalation alergens collected on the way to the locality of the spa walking trail from a distance of even several hundred meters (from the Kalvodova Str.).

This is why it is absolutely necessary to supervise over the most environment-friendly method of combustion possible used in this "collection area" both in compliance with Czech Law no. 86/2002 Gaz. on atmosphere protection and especially according to a prepared Spa Status and its stipulations about strict adherence to prohibited rearing and keeping farm animals – beef cattle, sheep, horses and hogs in particular – in periods with a possible occurrence of anabatic microadvection (from April to end of September). The annoying odours, bacteria and inhalation alergens from animal excrements, feeds and from stabled animals can easily reach the walking trail at a distance of even several hundred meters and thus significantly impair both

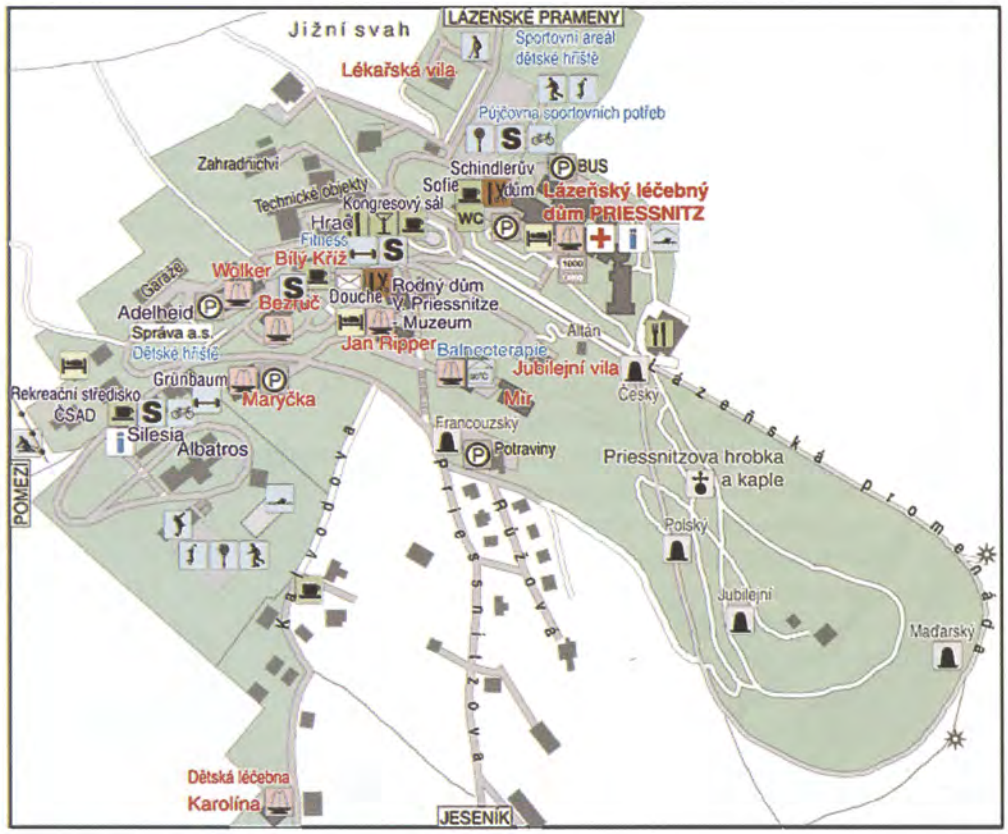

Fig.5: Plan of Jeseník Spa

the curing process and the patients' comfort during aerotherapy.

With respect to insolation intensity, the anabatic microadvection usually appears on the SW slope between the Karolína Children Health Centre and the Jubilee memorial in April at the earliest, under clear and calm weather in afternoon hours when the slope shows an average incidence of 6.5 MJ.m^{-2} direct solar radiation. It usually starts showing only in the early afternoon hours and does not last longer than until 15.00 o'clock. In May, daily sums of direct solar radiation on this slope reach about 8.5 MJ.m^{-2} (surroundings about 8.1 MJ.m^{-2}). The insolation variances result in temperature contrasts that are large enough to provoke anabatic microadvection gradually passing into microcirculation. And the microcirculation is to be met with here regularly in the afternoon hours in the following summer months. As late as in September, the south-western slope still enjoys some 5.6 MJ.m^{-2} direct solar radiation, which is still enough – taking into account the lower insolation totals recorded in the surrounding surfaces – to generate a temperature gradient that can subsequently lead to anabatic microadvection.

Conditions favourable for the development of anabatic microadvection are also seen on the SE-oriented slopes of the Železná hora Mt., whose slope angle and exposure lead to daily totals of solar radiation nearly comparable with those recorded on the slope below the Jubilee memorial. However, intensive insolation occurs here namely in spring and autumn in the morning hours when a greater part of solar energy is consumed to warm up the cold morning air and the temperature contrasts required for the initiation of anabatic microadvection cannot develop. Thanks to the low aerodynamic roughness of active surface and a greater slope inclination (ca. 15°), anabatic microadvection (gradually up to microcirculation) is recorded here only in the summer months of June, July and August. Warm air rises up along the Železná hora Mt. slopes towards the Maryčka, Bezruč and Wolker health centres mainly in the morning hours, proceeding further along the ski area to the edges of a mixed forest where it slowly fades. This anabatic microadvection, too, brings atmospheric admixtures and annoying odours "collected" on the way to places with health institutions from a distance of several hundred meters. This is why it is necessary to constantly supervise over combustion processes which must be environment-friendly (from April to end September) and to adhere to the strict prohibition of rearing and keeping farm animals as the annoying odours from exrements, feeds and stabled animals can easily penetrate even into the atmosphere of more distant spa houses.

Another area with the development of anabatic microadvection is to be found in the vicinity of the spa

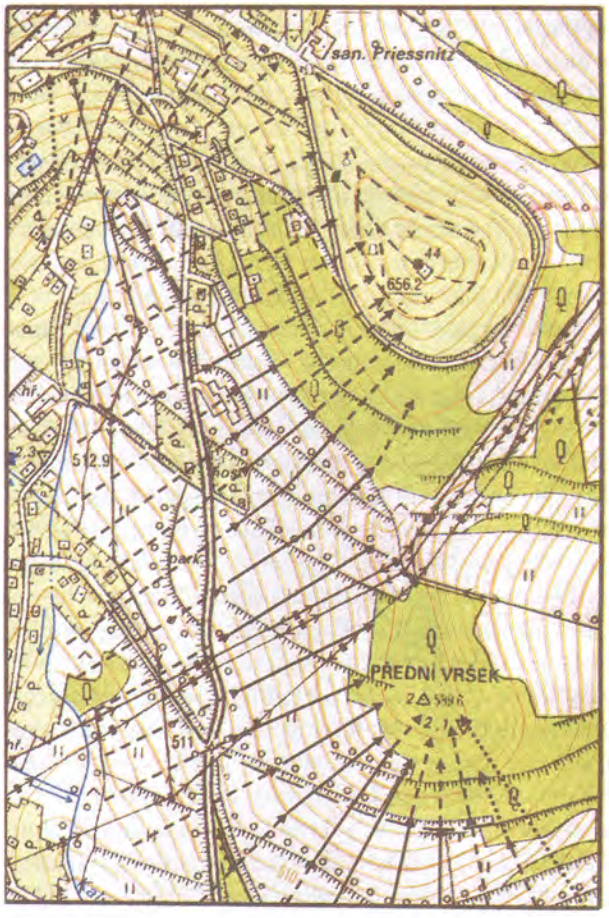

Fig. 6: Anabatic microadvection under clear and calm weather in morning hours during the warm part of the year (full-dashed-dotted arrow for very strong-strong-weak microadvection, respectively).

premises on the east-south-eastern slope of the Bělá River valley. Although a favourable angle and exposure of the slope result in the period from June to September in daily totals of solar radiation comparable with the slope beneath the Jubilee memorial, the insolation is most intensive in the morning hours when a major part of solar energy is consumed to warm up the cold morning air. Still, the very favourable low values of active surface aerodynamic roughness and the greater slope angle initiate anabatic microadvection only from June to August when the warm air rises up the Bělá R. valley slopes to the spa promenade but does not continue farther to the Priessnitz sanatorium.

3. Temperature conditions under the regime of negative energy balance

Temperature differences due to different slope insolation or due to different use of received solar energy by diverse active surfaces gradually disappear under a clear and calm evening weather. The influence of active surface and terrain relief does not become less important, though. Air occurring in the vicinity of the surface gradually cools down by effective radiation, which reflects in its increasing specific weight and density as compared with air situated higher above the surface. The phenomenon results in a so called "down-flow" of this colder (heavier) air along the slopes to lower altitudes. These processes gradually lead to the development of local temperature inversions under clear and calm weather.

Intensity of the above processes was quantified from the data on the area of cold air collection zone, anticipated cold air production under clear and calm weather, slope gradient and particularly from the data on active surface aerodynamic roughness, i.e. factors affecting the intensity of the catabatic microadvective displacement of cold air with higher specific weight to lower altitudes. As mentioned above, the processes very closely relate to the development of cold air lakes and to their time of duration, frequency of incidence and particularly to the degree of stable temperature stratification of the ground and lower boundary atmosphere layer. With the gradual filling of the Bělá R. and Stařič Brook valleys with cold air, the lower boundary of catabatic microadvection gradually rises to ever higher elevations. Typical indented relief forms such as slope dells furthermore cause a concentrated cold air outflow – canalization – and the places of their opening can significantly increase the negative impact of the cold air on the surrounding environment. In this context we cannot but point out also the atmospheric transmission of air polluted by solid or gaseous substances or annoying odours.

Under clear and calm weather, cold air descending from the slopes gradually fills the valleys of Bělá and Stařič streams and all linking indented relief forms. Final area of this local temperature inversion is in principle depending on the duration of negative radiation balance (night length), and therefore it may be larger than that plotted in the attached figure. Apart from the duration of negative radiation balance the area of inversions also depends on radiation intensity, cold air production and ventilation intensity.

The layer with a temperature inversion is characterized by air temperature in it rising with the increasing elevation. This implies that the temperature stratification is stable. The upper surface of the inversion layer is interceptive (closing). This is why we can tell what may get into the atmosphere in the inversion layer, what may concentrate in it gradually in the course of night or even in the course of several subsequent days, and what may dwell there until the inversion diffusion. In addition, the stable stratification of ground boundary atmosphere layer makes it impossible or just hampers in a better case the blending of air in vertical and horizontal directions. All this is the main reason for the inversion layer to very often exceed the highest admissible concentrations of harmful substances even at relatively small (household fireplaces) sources of air pollution. This is also why the ground part of the

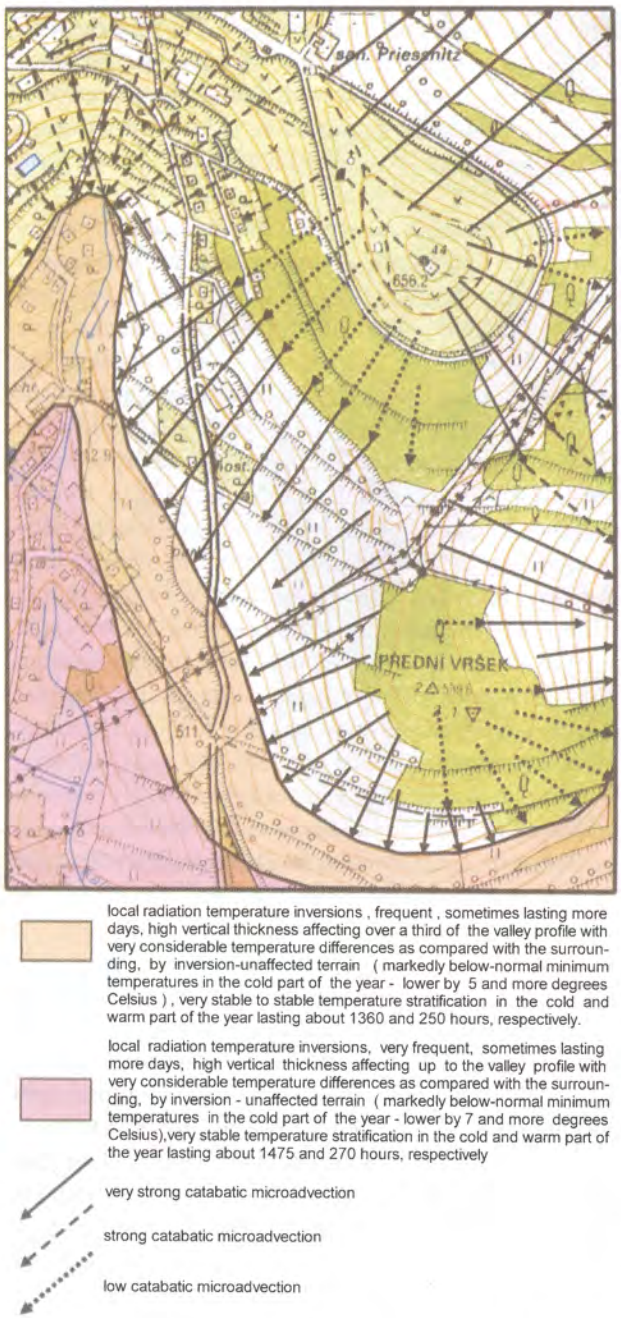

Fig. 7: Catabatic processes under clear and calm weather at night during the warm part of the year

inversion layer is observed to exhibit a more frequent occurrence of fogs under favourable humidity.

Thanks to the favourable conductivity of parent rock the slopes of Staříč Brook and Bělá River valleys are great "producers" of over-chilled air. Their active surfaces are mostly of a very low aerodynamic roughness, which is – together with the above mentioned facts – a main reason to the intensive catabatic processes. Result of this catabatic microadvection is a development of strong local radiation temperature inversions occurring frequently also under positive radiation balance, i.e. in the daytime. Elevation of inversion level in them depends primarily on the duration of the temperature inversion. It is on average ranging from 50 – 60 m above the alluvium, which indicates that the stable stratification sometimes fills more than a half of the valley profile.

Thanks to the favourable soil thermal conductivity combined with abundant grasslands and low-density orchards, the slopes above the spa premises represent a very ample source of cool air, which – combined with the favourable slope gradient and aerodynamic roughness of active surface – leads to intensive catabatic processes. Affected by the transmission (cool air microadvection), the ground atmosphere layer reaches a thickness of several meters. This depends on the nightime duration and on the intensity of efficient surface radiation. This is how the catabatic microadvection from the slopes above the spa passes by most of health institutions from Silesia up to Bílý Kříž. The only locality saved is the Priessnitz sanatorium situated outside the trajectory of this transmission (Fig. 7). Cold air descending into the lower altitudes brings atmospheric admixtures and may very significantly impact air cleanliness and its hygienic character. In addition to dust and gaseous emissions, there are also annoying odours, bacteria and diverse infects whose transmission may be important for the spa operation. This is a reason why it is necessary in demarcating the spa premises on the occasion of preparing the new Spa Status to require a strict adherence to the prohibition of rearing and keeping farm animals, cattle, horses, pigs and sheep in particular as the annoying odours, bacteria and inhalation alergens from their exrements, but also from the feeds of farm animals can be easily displaced to distances of several hundred meters from the air-pollution sources thanks to this catabatic microadvection.

The very powerful descending microadvective processes induced at night by the higher production of cold air are also recorded on the west-south-western slope between the Spa and the Přední vršek Hill (590 m a.s.l.) where the slope has a sufficient angle and low aerodynamic roughness to let the air cooled by the surface "flow down" over the Růžová and Priessnitzova streets to lower situated places, accumulating in the slope dell flown through by the Kalvodka Brook. Unfortunately, it is also the Karolína Children Health Centre that is situated in this pronounced inversion locality and a sports ground below the spa cure house of Albatros on its very edge. However, as the inversions normally occur at night, the position of the sports ground on the inversion edge does not matter.

4. Sensible temperature

Basic thermal characteristics do not always provide a sufficiently clear picture of requirements imposed on the thermal regime of humans by weather and climate. The feeling of outdoor temperature in human beings

is affected not only by the momentary air temperature but also by other factors such as air humidity, wind, solar radiation, etc. Efforts to establish the measure of thermal comfort for the human organism and to quantify the amount of heat withdrawn from the human being by the atmosphere led to an introduction of more or less complex factors.

A so called equivalent temperature summarizes air temperature, humidity and partly also air pressure into one value. It is defined as a temperature acquired by air when all water vapour contained in it is condensed and the air is heated by the released heat under pressure which remains at all times the same. Equivalent temperature can be calculated by using the following formula:

$$Te = T - 2e$$

where:
T_e – equivalent temperature; T – air pressure; e – pressure of water vapours in torrs.

A disadvantage of equivalent temperature as a bioclimatic quantity is the fact that it does not take into account air movement which plays a considerably important role in withdrawing heat from the human organism. This is why Robitzsch and Leistner constructed a physioclimagram that would take into account the effect of wind on various meteophysiological degrees of the feeling. The diagram enables us to differentiate more when assessing conditions of cold, comfort and stuffy air by means of equivalent air temperatures and wind velocity. Directives issued by the German spa association introduce an equivalent temperature of 50° for the assessment of thermal load. According to these Directives the number of days with the equivalent temperature of 50° is not to be more in health climatic spa than 25 in a year.

The frequency of equivalent temperature in the individual feel classes provides a much better picture of climatic conditions for human beings in the open nature than mean or extreme values. Feel classes specified in the graphs are as follows: chilly, very cold, cold, rather cold, pleasant, rather muggy, muggy. With respect to bioclimatic terms, most interesting for us is the frequency of the "pleasant" class interval and its representation in the respective months of the year. Another important characteristic is the frequency of the "muggy" feel which is very unpleasant for persons suffering with heart or blood circulation system disorders (Fig. 8).

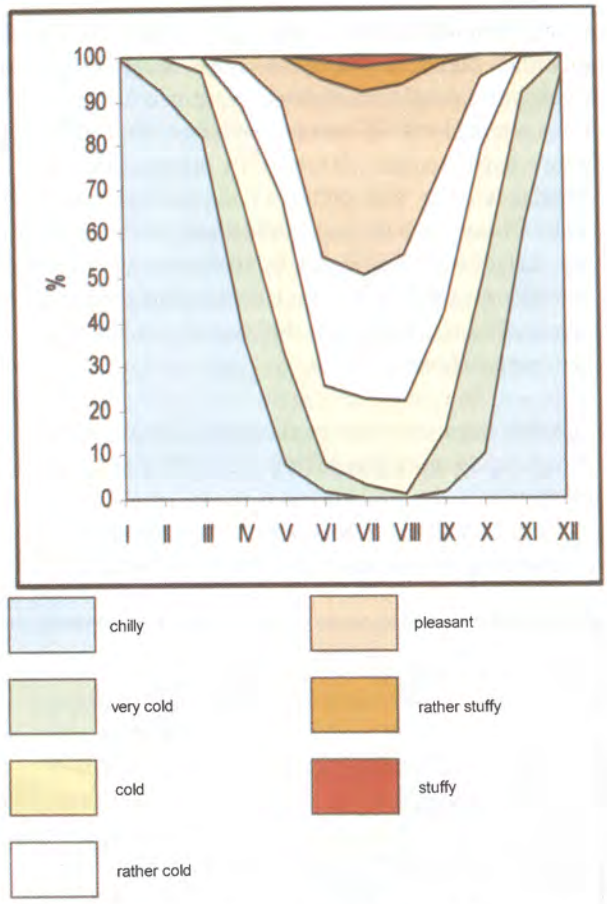

Fig. 8: Frequency of sensation classes by equivalent temperatures

5. Sensible humidity

Content of water vapours in the air is very important for temperature management of the human body. Intensity of water evaporation from the body surface depends on the degree of saturation. Complications may occur especially at temperatures above 15 °C and concurrent higher air humidity, and they also depend on physical activity. As compared with a stay in humid

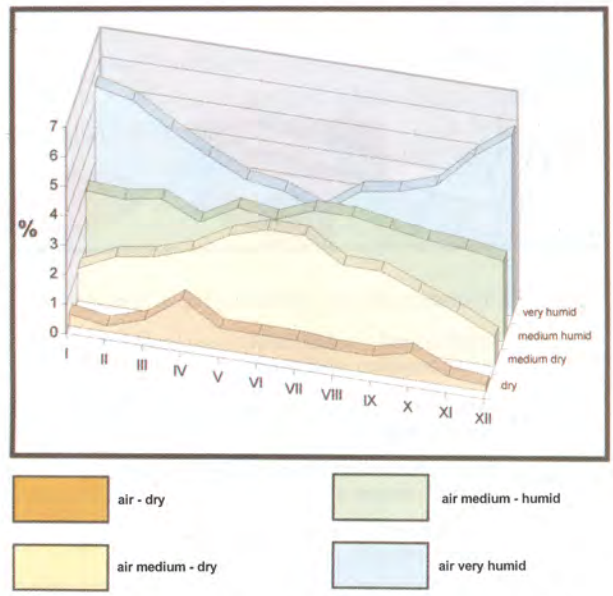

Fig. 9: Frequency of categories of relative humidity affecting human organism

air, the amount of water evaporated in dry air can be four-times higher at the same temperature. In humid atmosphere, people start sweating much sooner than in dry atmosphere. Of course, there are other affecting factors such as age, glands with internal secretion, physical activity and general constitution that play a role. Obese persons, especially those with a smaller body surface exhibit at higher temperatures bodily water expenditure which is several times higher than in thin persons. The constitutional differences get balanced at low temperatures, however.

Humidity conditions can be classified in four categories according to mean relative humidity (Fig. 9) as follows:

- very humid air above 85 % relative humidity
- medium-humid air of 75 - 85 % relative humidity
- medium-dry air of 50 - 75 % relative humidity
- dry air below 50 % relative humidity.

Dry air takes away humidity from mucous membranes of air passages, getting them dry and irritated. Densifying saliva and mucus, it hampers their secretion. In contrast, humid atmosphere makes the nasal mucous membrane better supplied with blood. Protective tools of human organism against the impact of both humid and warm atmosphere is suppressed appetite and slowed digestion.

6. Topoclimatic characteristics of the flow

The most important impact on the formation of boundary atmosphere layer structure in the Jeseník Spa is that of the very broken piedmont relief which primarily affects

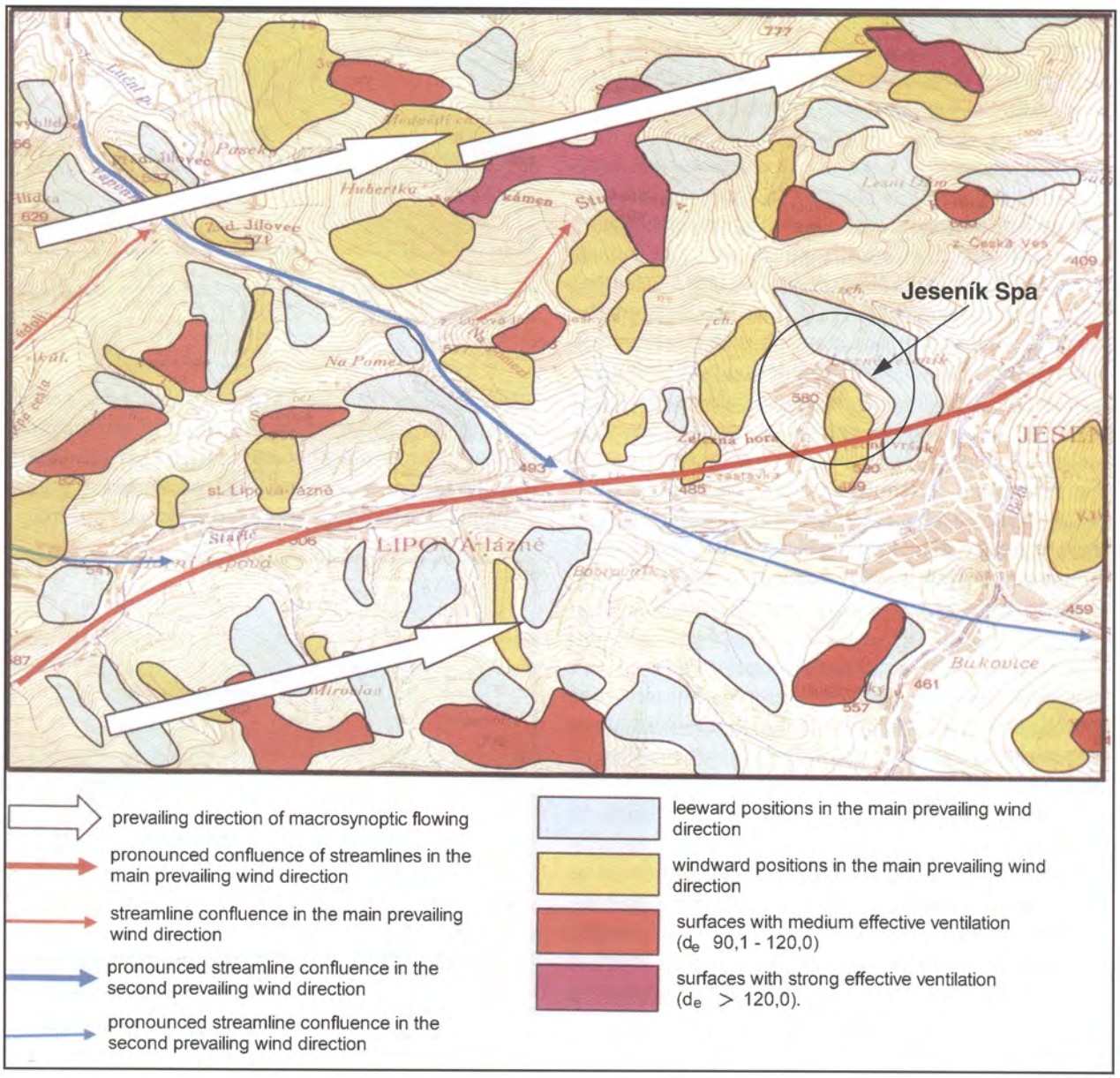

Fig. 10: Streamline deformations and effective ventilation intensity in the main- and second prevailing wind directions

the basic climatological characteristics of air flow as well as the degree of stratification stability, which are quantities decisive for spreading and dispersion of air pollutants. Another significant effect on the transmission of contaminated air within the boundary atmosphere layer and its diffusion is that of the flow environment turbulence. Flowing in the boundary atmosphere layer and its turbulence are most affected by ground surface roughness. In terms of aerodynamics, roughness has two components the first one of which is affected by the character of active surface, i.e. its coverage with grass, trees, etc. and is normally described by aerodynamic roughness of the surface whose size is usually given as several tens of percent from the mean height of obstacles. Another factor significantly affecting the flowing is considered to be terrain undulation, i.e. its vertical articulation. This component whose size is usually larger than that of the previous factor is defined as surface macro-roughness.

Wider surroundings of Jeseník can be considered homogeneous in terms of macroclimatic characteristics of the flowing. Dominant in establishing the intensity of ventilation is first of all wind field modification in the lower boundary atmosphere layer due to surface macro-roughness, i.e. due to vertical articulation of terrain relief. Variables to be established are velocity or velocity attenuation and streamline field deformation in the ground and lower boundary atmosphere layers with respect to macrosynoptic flowing in the upper boundary atmosphere layer. Potential and effective possibilities of ventilation were studied by using the method of E. Kaps based on an assumption that the degree of ventilation of indented forms depends on their volume and surface area. In terrain model profiles the fact was derived from the distance of upper slope edges, floor width and valley depth. Indicator of effective ventilation de is a multiple of the ventilation value with the ratio of mean velocity from the given direction (main prevailing or the second prevailing) to the minimum wind velocity inducing turbulence.

Wind field characteristic of the main dominant wind direction is illustrated in Fig. 10. According to data provided from the peak station of Praděd Mt., the dominant direction of macrosynoptic flowing was considered to be the West-South-West as the data from this climatic station are not affected by the orographic situation of the near and more distant surroundings. The terrain model was used to demarcate the most conspicuous windward and leeward positions in the wider surroundings of the Jeseník Spa and the lines of a very pronounced concentration up to confluence of streamlines in the valleys of Staříč Brook and Bělá River. Plotted are also some less important streamline concentrations in smaller side valleys. Modification of wind field in the main and secondary annual prevailing wind direction and intensity of effective ventilation are illustrated in Fig. 10. The main annual prevailing direction is considered to be an azimuth of 216.5°, the second annual prevailing direction being considered an azimuth of 34.6°. The most conspicuous deformation of streamlines in the main prevailing direction can be found in the valley of Staříč Brook, which further continues through the valley of Bělá R. up to Písečná village. A smaller streamline concentration can be seen in the main prevailing wind direction at the Ztracený potok Brook, which fades before Vápenná village. In the second prevailing wind direction, a pronounced accumulation of streamlines can be found especially in the valley of Vápenný potok Brook. The confluence begins already between villages Žulová and Skorošice, through Vápenná and the flow finally opens into the Staříč Brook valley in Lipová Spa. Subsequently, passing by Jeseník city it fades in its outskirts Bukovice. A somewhat lesser accumulation of streamlines occurs with the second prevailing wind direction in the valley of the Jesenný potok Brook which opens into the Staříč valley. Furthermore, the figure presents a demarcation of areas with an increased intensity of effective ventilation – peak altitudes and windward slopes of the main and second prevailing wind direction in which the indicator value of effective ventilation de ranges between 90.1 – 120.0. Altitudes with strong effective ventilation (de>120) rise above the surrounding peak plane (in our case – the Studničný vrch Hill).

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Author´s address:

RNDr. Evžen QUITT, CSc.
Academy of Science of the Czech Republic
Institute of Geonics, Branch Brno
Drobného 28, 602 00 BRNO, Czech Republic

Reviewer:

Assoc. Prof. RNDr. Miroslav Vysoudil, CSc.

EXTREME DROUGHTS IN CENTRAL EUROPE IN THE PREINSTRUMENTAL PERIOD

Jan MUNZAR

Abstract

The two disastrous floods occurring in the territory of the Czech Republic within a time span of merely five years (July 1997 in the watersheds of the Odra and Morava Rivers, and August 2002 in the watersheds of the Vltava and Labe Rivers) underlined the fact that the study of hydrometeorological extremes should not be undervalued. However, there is another weather extreme at an opposite pole, viz. a drought, which also represents a risk of atmospheric origin. This fact was demonstrated not even one year after the flood in August 2002, with the occurrence of an extraordinary spell of drought not only in the Czech Republic but also in a number of other European countries in 2003 (Demuth, 2003).

In order to analyze the long-term occurrence of drought extremes – spells of drought – it was possible to obtain, from the grant project of I. Sládek (2002), a series of selected, homogenized and processed precipitation data from eight precipitation stations, but for a period starting "only" from the end of the 19th century to the year 2003. Therefore, possibilities were checked of using proxy-data for the documentation of extreme drought occurrence for the period before the beginning of instrumental precipitation measurements. Primary attention was paid to the documentation of drought occurrences from the 16th century to the end of the 19th century. There are five "model" years chosen from this period of time, in which extraordinary spells of drought affected not only practically the entire territory of the current Czech Republic but also parts of some neighbouring central European countries. The model years for which weather characteristics are presented are 1540, 1590, 1616, 1790 and 1842.

Shrnutí

Extrémní sucha ve střední Evropě v preinstrumentálním období

Dvě katastrofální povodně na území České republiky v rozpětí pouhých pěti let – v červenci 1997 v povodí Odry a Moravy a v srpnu 2002 v povodí Vltavy a Labe – připomněly, že se nevyplácí podceňovat studium hydrometeorologických extrémů. K nim však patří i protipól povodní – sucho, rovněž riziko atmosférického původu. Potvrdil to necelý rok po povodni v srpnu 2002 výskyt mimořádného sucha v roce 2003 nejen v Česku, nýbrž i v řadě dalších evropských zemí (Demuth, 2003).

Pro analýzu dlouhodobého výskytu extrémů sucha – suchých období – se podařilo při řešení grantového projektu I. Sládka (2002) vybrat, homogenizovat a zpracovat srážkové řady 8 stanic za období „jen" od konce 19. století do roku 2003. Proto byly také prověřovány možnosti využití proxy-dat pro dokumentaci výskytu extrémního sucha z období před počátkem měření srážek. Hlavní pozornost byla věnována dokumentaci výskytu sucha od 16.do konce 19. století. Z tohoto období bylo vybráno pět „modelových" roků, během nichž mimořádné sucho postihlo nejen prakticky celé území České republiky, nýbrž i části některých sousedních států střední Evropy. Jedná se o roky 1540, 1590, 1616, 1790 a 1842, jejichž charakteristika je prezentována.

***Key words**: extreme drought, preinstrumental period, proxy-data, Czech Republic, Central Europe*

Introduction

To be able to proceed to the assessment of drought occurrence before the beginning of regular precipitation measurement we have to find answer to a question of when the instrumental era actually started in the territory of the today's Czech Republic (Fig. 1). The oldest measurement of precipitation was recorded by Josef Stepling (1716 – 1778) in the Prague-Klementinum station in 1752 but the records preserved hold only for the monthly precipitation sums from February to December (Fig. 2). An analysis made by C. Kreil indicated that the year 1752 was characterized by rainy summer and dry autumn with more details on the spell of drought being not known.

The Prague secular precipitation series however begins from 1 May, 1804 and is unfortunately not quite homogeneous as the ombrometer was improperly placed in the yard of the Klementinum station until the year 1843. Precipitation was also measured in Brno in the period from 1803 – 1837 but the only data documented from the series are monthly precipitation sums and the precipitation station has not been precisely localized up to now. It can be seen from the above facts that

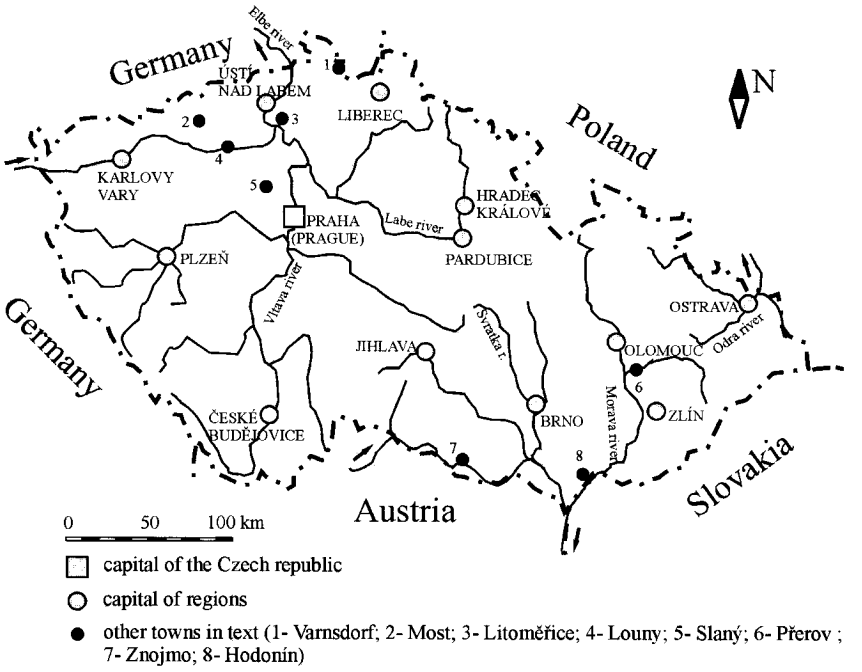

Fig. 1: Orientation map

although the beginnings of precipitation measurement date back more than 250 years, the mentioned oldest records from the first existing precipitation stations were unusable for the purposes of the grant resolved by chief researcher I. Sládek (2002). In order to link up with the secular precipitation series it appeared useful that the documentation on the occurrence of drought from indirect – so called proxy-data is in an ideal case traced to the end of the 19th century.

Problems of drought documentation in the preinstrumental period

Older information on the occurrence of hydrometeorological extremes can be obtained only from the historical (mostly written) sources of diverse kinds. However, the original historico-geographical research of this orientation has to face a number of problems due to a considerable diffusion of the required data in various sources and due to inaccuracies and errors in the historical sources, difficult interpretation and verification, not speaking of paleographical and philological issues as the historical data sources are often old manuscripts written in old German, etc. Unlike records on floods and other extreme weather phenomena, reports about the occurrence of dry years or spells of drought are very scarce since the economic consequences of dry years were not commented in details in the historical sources. Prof. F. Augustin (1894) correctly remarked that his list of historical records about the occurrence of drought is incomplete as "all cases of drought were not recorded in the past". It is therefore not possible to consider years with no weather records a priori for being normal.

This is corroborated for example by an analysis of two old prints from the 16th and 17th centuries: The well-known Czech Historical Calendar by Daniel Adam of Veleslavín from 1590, which mentions various extremes from the period of 1347 – 1588 has only one record on a drought spell in this span of 240 years – in year 1540. The Chronicle published by H. Roch (1687) and concerning regions of Lusatia, Bohemia and Silesia does not mention drought occurrence at all and most of the records are about windstorms, thunder storms, hailstorms, floods, etc. Information on the occurrence of drought spells are missing also in some contemporary climatological monographs. This can be exemplified by a high-standard publication about climate fluctuation in Europe in the 16th century and its social dimension (Pfister et al., 1999), which was contributed to by experts from many countries and which contains only a chapter on the opposite extreme: on European floods in 1501-1600.

Other problems appear with a too general localization and dating. A brief information about a "drought in Bohemia occurring in 1394" can hardly be used for the purposes of studying the fluctuation of drought occurrence in the past. Firstly, the specification of the affected region is too general, secondly we would know nothing either about the season of the year or about the duration of the drought spell. The problems of dating do not apply only to the old chronicles, though. Assessing a spell of drought in the 19th century on the basis of precipitation measurement in Prague, Prof. Augustin for example informs as follows: "This year a lack of rain was observed in the spring months of March and April and then in the summer months of June and August. In spring, there was no rain in Prague from 22 March to 3

(53)

mercurius thermoſcopicus 104. partibus ebullientis aquæ diſtabat.

Pluviæ Quantitas.

. . . . .			Jul.	4.	$1\frac{5}{16}$
Febr.	1^{ll}	$2\frac{3}{16}^{lll}$	Aug.	1.	$5\frac{1}{16}$
Mart.	0.	$1\frac{1}{2}$	Sept.	0^{ll}	$11\frac{14}{16}^{lll}$
April.	1.	$0\frac{13}{16}$	Octob.	0.	$0\frac{5}{16}$
Maj.	2^{ll}	$6\frac{10}{16}^{lll}$	Nov.	0.	$2\frac{13}{16}$
Jun.	1.	$9\frac{1}{2}$	Dec.	0.	$2\frac{12}{16}$

Summa Pluviæ, & nivium menſibus nominatis delapſarum eſt $13^{ll}\ 8\frac{12}{16}^{lll}$ Menſe Januario defectu vaſorum, ſeu inſtrumentorum hyetometricorum, quantitas nivium delabentium menſurari non potuit: aſſumi interim poteſt ſine notabili errore eam fuiſſe $1^{ll}\ 4^{lll}$; quare aquæ toto anno lapſo e cœlo per nives & pluvias deſcendentis quantitas eſt $1^{l}\ 3^{ll}\ 0\frac{12}{16}^{lll}$. Iſtud ita intelligendum eſt, quod aqua pluvia, vel nivium liquatarum, ſi non difluxiſſet, vel in vapores reſoluta abiiſſet in auras, ſed ſuper ſolo reſtitiſſet, in fine anni altitudinem pedis unius, & quatuor digitorum fere habuiſſet.

D 3 Sc-

Fig. 2: Results of the oldest measurement of atmospheric precipitation in the territory of the Czech Republic, made by Professor Josef Stepling (1716-1778) in the Prague-Klementinum station in 1752 (Stepling, 1753).

May for as long as 42 days ...". But what can be considered the "this year" when the Augustin's publication appeared in 1894? It was demonstrated through verification that the description applied to the "last" year (1893) because the work was published later than Augustin expected. Similar inaccuracies can be met with also in works of our contemporaries when they write about "this year's" spell of drought without a proper date and their article is published a year or two later.

Not too much conclusive for the documentation are historical data about corn prices as weather factors were not the only reason for their increase in a number of cases. Factors playing a role included speculations of tradesmen as well as war events and their impact. Václav Kněžovský in his memoirs from the town of Slaný commented upon the year of 1590 as follows: "And it was in this Year of Our Lord that the whole summer was very dry and that there was no rain from the Exaudí Sunday to the Monday after the commemorative day of the birth of Virgin Mary... And prices went rapidly up due to the spell of drought – but it was also due to local bakers cheating more before the harvest than after it... Lord be merciful to us and give us more rain so that flour mills here in the town can work again".

The last chronicle entry also indicates a different historical dating of events according to the church calendar, which must be converted to the present usage. In this case, the moving feasts Sunday of Exaudí fell in 1590 to 3 June, and the commemoration of the Birth of Virgin Mary fell to 8 September which was Saturday, and which means that the period of drought lasted from 3 June to 8 September (96 days) and the first rain arrived on 10 September.

An interesting document about the occurrence of drought in extreme years is represented by dates on so called hunger stones which are under water at normal water levels. Being marked by our forefathers, these hunger stones appeared above the water surface in our streambeds at a very low water level and discharge, signalling a lack of food as water mills could not operate and the harvest was usually poor. The Labe (Elbe) River in Litoměřice could be crossed with nearly a dry foot for instance in 1834, 1842, 1868 and 1892, the local stones indicating the hungry years of 1660 and 1842 (Schreyer, 1965).

Examples of historical drought records

The oldest concrete information on the drought occurrence in Czechia can be considered an entry of 1121 from the Latin Cosmas Chronicle; it describes severe spells of drought which lasted whole three months – from March to May (Hrdina, 1975). It is however not known whether the drought spells affected also Moravia or the Czech part of Silesia.

A greater frequency of weather records from various areas of the Czech territory can be met with only in the course of the 16th century. A chronicler wrote for example that the summer of 1532 was dry and four days of rain arrived only after 4 July in the Jihlava region (i.e. western margin of Moravia). As to the parallel weather in Bohemia, K. Pejml (1966) informs of the summer in 1532 to be also "apparently dry and warm" on the basis of an indirect information from the Mimoň surroundings about poor crop and food shortage.

In 1536, Jan of Kunovice made a note in his calendar on 16 November that up to now the weather (in south-eastern Moravia) was "warm and extremely dry" – unfortunately, we do not know when it began as the summer weather records are missing. The very dry

summer in this year was also observed in northern Bohemia (low water level on the Labe R.). In contrast, the year of 1540 in which an extreme spell of drought affected a considerable part of Europe is documented by observations made by Jan of Kunovice only as a year of coming extreme drought. It follows from his diary that the last day of rain in south-eastern Moravia was 14 April 1540; entries for eight days after 19 April speak of "clear and dry weather", and the last spring entry of 16 May mentions "clear, hot weather and wind" (with other entries originating only from the late autumn). By coincidence, the data from Moravia combine well with the Chronicle of Louny and an information that there was no rain in this region (north-western Bohemia) from 16 May to 29 July 1540.

A hitherto little used source of weather records in the past is preserved correspondence. For example, from a letter of the Moravian nobleman Karel Senior of Žerotín dated 15 May 1596 and addressed to his clerk in Dřevohostice we can learn about a spell of drought occurring in the spring of that year. It appears however that the dry period did not last long since the next letter dated 5 June 1596 does not contain any remark on it, agreeing with the sales of oats before the harvest because a good crop is expected.

The probably oldest separate historical print devoted to drought in central Europe is a German publication issued in Zhořelec (Görlitz), Upper Lusatia in response to a local spell of drought occurring in 1590 (Hellmann, 1921). It was written by preacher Martin Bohemus (i.e. originating from Bohemia). Although it is impossible to get a copy of this historical publication up to now, it can be assumed from the dating of the foreword (22 September 1590) that the drought spell referred to is that occurring in summer or before the beginning of September. This is in a good compliance with the above mentioned information from Bohemia (the Chronicle of the town of Slaný) where the dry period was observed to last from 3 June to 10 September.

A Czech print of a long name: "About a terrible and big spell of drought, rain withdrawal and hence a consequent lack of water, the drought not remembered by anybody of contemporaries hundred and more years old, etc." originates from 1616 and was published in Olomouc (Fig. 3). It is a sermon which is likely to have been additionally extended for print, held by its author – Evangelic priest Daniel Senior Philomates, graduate from a German seminar in Wittenberg, in the church of Domaželice in the Přerov region (central Moravia). The text is of a genuinely theological character and contains mostly a list of historical disasters of the Old Testament. Surprisingly enough, it does not include any concrete data about the spell of drought in the mentioned year (it is a paradox that most of these data are contained in the print title). Moravian rivers of Morava, Bečva and Haná are mentioned only at one place in the text but with no relation to the historical hydrometeorological extreme (Philomates, 1616).

Synthesis of regional records

The first step to be made in studying the issue of preinstrumental period drought spells in the territory of the existing Czech Republic was to gather all available compilations of historical records and entries on weather extremes. The oldest of them is a German-written work of a pioneer of Czech meteorology A. Strnad dated from the year 1790 (Fig. 4), which concerns historical weather in the Bohemian Kingdom in the period from 633-1700, and in whose conclusion the author points out that he would like to spend more time to study details of weather extremes occurring in the 18th century. Unfortunately, he died in 1799 and could not therefore bring his plan to reality (Krška-Šamaj, 2001).

F. Augustin (1846-1908), the first professor in meteorology at Charles' University in Prague, published a work on drought occurrence in Bohemia in 1894, in which he summarized all available brief records about the occurrence of the extreme from 962-1893, dwelling on indirect proxy-data from different sources for the period before the year 1800, and making use of precipitation measurement records from only a single station in Prague-Klementinum for the assessment of drought incidence in Bohemia during the 19th century.

The above two compilations and their titles might suggest that it is generally possible to attempt at an assessment of the long-term fluctuation of drought extremes for more than a thousand years ago. However, the mentioned entries in the oldest chronicles are very incomplete and in many cases the information was taken over from foreign chronicles with no demonstrable verification of its relation to the Czech territory.

The best starting point finally appeared in the study by K. Pejml (1966), devoted to climate fluctuation in a vine- and hops-growing district of northern Bohemia in the period of years 1500 – 1900. All the above mentioned three works concern only Bohemia (the last mentioned one only its north-western part). Up to now, there is no similar work existing for the remaining part of the region and for the eastern part of today's Czech Republic (Moravia and the Czech part of Silesia).

This is why the attention was first focused on a gradual collection of the Moravian and Silesian data (the Morava R. and Odra R. basins) from the most

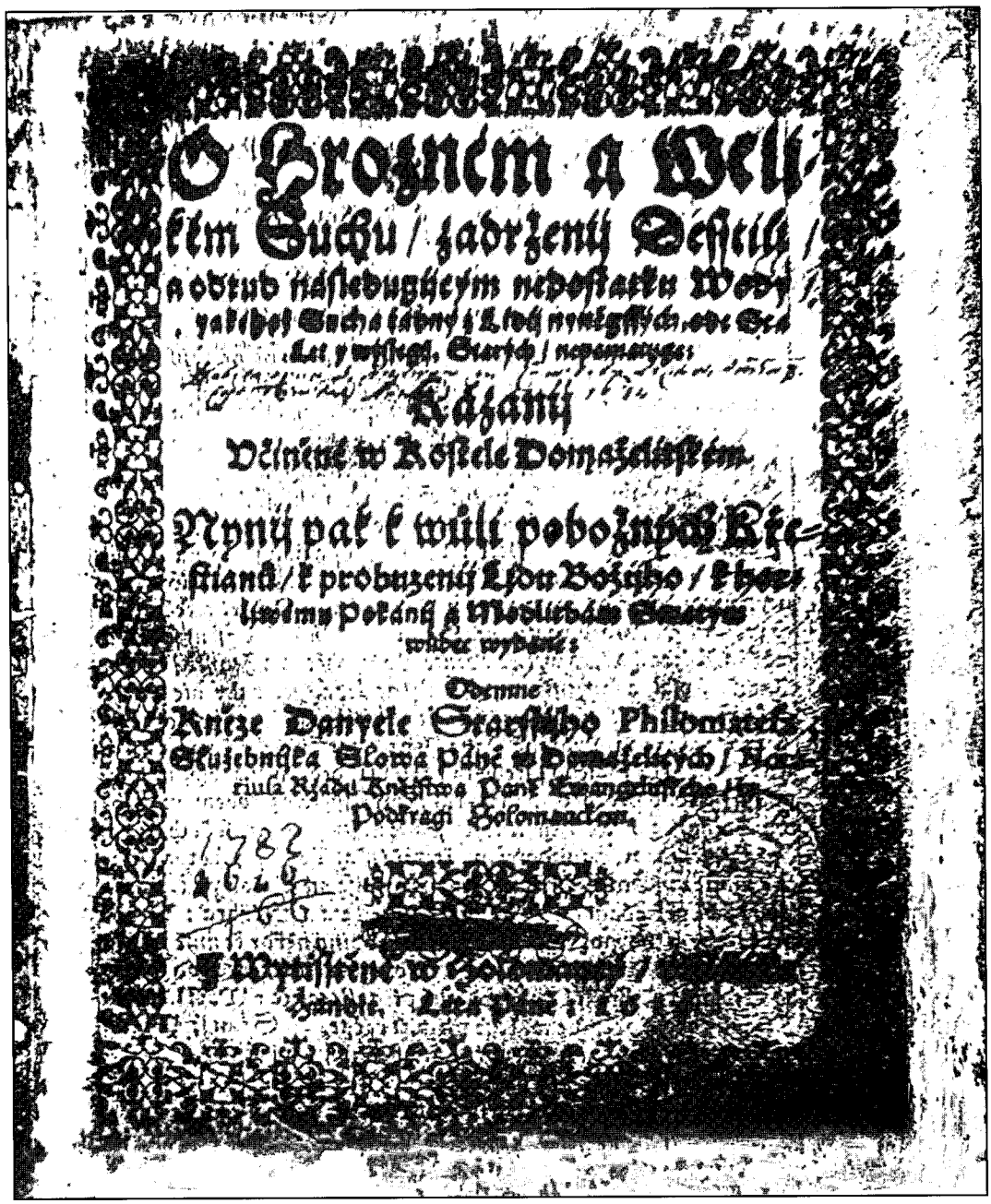

Fig. 3: Front page from the oldest preserved Czech print with the theme of drought (Philomates, 1616). Its author – Daniel Senior Philomates was born in Přerov, ordinated in Wittenberg in 1608 and served as a vicar in Domaželice near Přerov (central Moravia) in 1613 – 1618.

varied available sources and archives, which had to be confronted with the drought records from Bohemia. The procedure made it possible to select five "model" years from the period between the 16th and 19th centuries, in which extraordinary spells of drought affected practically the entire Czech territory and/or some of neighbouring central-European countries. The model years selected are those of 1540, 1590, 1616, 1790 and 1842. With respect to the grant project and its contents, the main aspects of drought events studied were hydrometeorological with impacts of the drought spells being of the secondary importance.

Examples of extreme spells of drought in the Czech lands and abroad in the period from the 16th – 19th centuries

1540: Extreme spell of drought. The region of Louny in Bohemia had no rain from 16 May to 29 July (75 days), and another period without rains lasted 67 days until 4 October. Harvest began very early in České Budějovice (24 June). Very dry summer – with no more records on a duration of the drought spell – is confirmed by entries from Moravia (Olomouc and Jihlava). Water courses and springs dried out and there was a bitter lack of water.

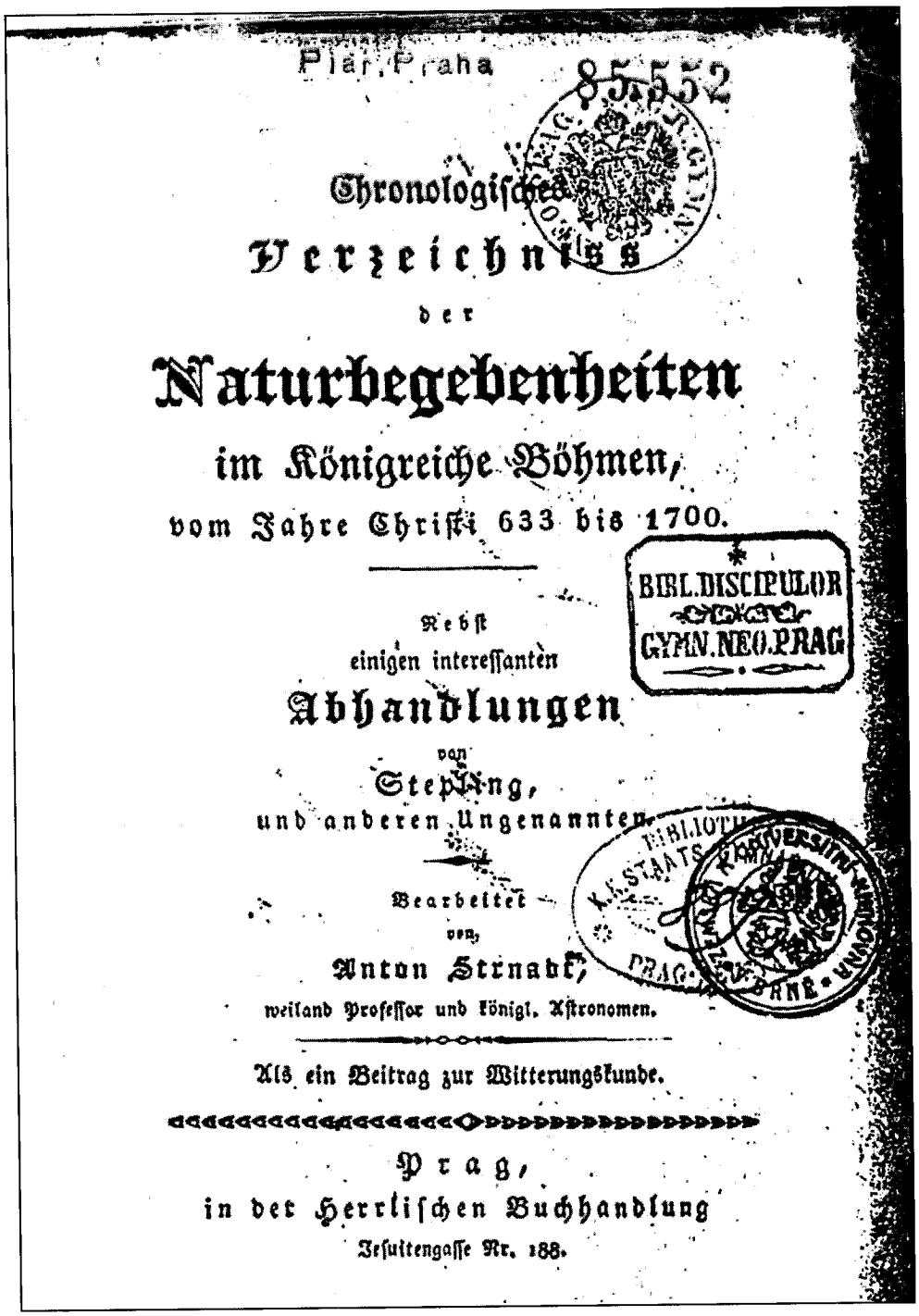

Fig. 4: Front page for the survey of weather extremes in the Kingdom of Bohemia until 1700, whose author was Professor Antonín Strnad (1790).

Poor vegetable harvest but excellent wine. Very early harvest. Numerous forest fires.

The summer was enormously warm and dry nearly in the whole of Europe. Regensburg did not see a drop of rain falling from March to November. Kitzingen and Bayreuth did not have a thorough rain (Grundregen) for 17 weeks but ample dew appeared every morning, which refreshed the field crops. The extremely hot weather and drought are also reported to occur in the Würzburg region where only five days were recorded in the long period of 26 weeks "with some drops of rain" (Glaser, 2001). Wine was very strong, sweet and cheap; a giant decorated butt made for the "wine of the millennium" has been preserved in the Würzburg court wine cellars. In Saxony, the period with no rain lasted 19 weeks; the Zschoppau River nearly dried out making only a tiny stream that could be crossed in shoes (Weikinn, 1965). According to Pfister (1999), the year of 1540 witnessed the longest period of drought in Switzerland in the last

700 years, which started on 13 March. In the following period until the end of September there were only six sporadic rains occurring in Zurich at the beginning and in mid-May, mid-June and at the beginning of August. The month of July had not a single day with precipitation. The situation was similar in Hungary where the year of 1540 connects with an extreme spell of drought (Nemes, 1996). Also the Thames River in England nearly dried out and the sea water reached up to London.

1590: The extreme drought is documented both in Bohemia and Moravia. In Bohemia, there was no rain in the town of Slaný from 3 June to 10 September (99 days), and then another spell of drought occurred until 9 October (29 days). The town of Litoměřice had hardly 2 or 3 rains from 10 June to 21 September, and Dobruška recorded a period of drought lasting from 17 June to 6 August (53 days). The chronicle of Varnsdorf informs that the region had no rain for as long as 38 weeks; it appears, however, that the record was taken over from a foreign (German) source. In Moravia, the region of Olomouc reported a severe spell of drought about 25 July when flour mills could not work due to low water and bakers could not sell bread for 8 days. On the other hand, the ample crop of vinegrapes is documented also here (and good wine is mentioned in records from Louny, too). The hydrometeorological extreme is confirmed – with no precise date mentioned – also from Lipník and Drahotuše. A chronicler from Frenštát p. Radhoštěm writes as follows: "The heaven above us was as if made of iron, yielding no rains, only keeping too much heat in the ground and drying out all crops right from the roots. Hence the lack of everything..." Observed were frequent forest fires, drying out streams and water courses. Marek Bydžovský of Florentinum made a note in his Czech chronicle among other things that "rivers rather deep and wide could be crossed with dry foot, being spoiled and smelling, having a green cover on them". (Let us add that the extreme spell of drought is missing in the Strnad's list of 1790.)

In Germany, the spell of drought in this year is recorded in the above mentioned old print (Bohemus, 1590). Records from Saxony inform of 38 weeks with no rain, and the same dry period is mentioned for Königsberg (today's Kaliningrad). The chronicle of Halle describes an arrival of unseen before periods of oppresive heat and drought from the end of the first June decade to 11 November (i.e. approx. 22 weeks). A record from Hammelburg near Würzburg specifies the hot and dry period to occur from 1 May to Christmas (34 weeks). According to records from Kitzingen, there was no morning dew occurring for 9 weeks in the summer (Glaser-Militzer, 1993). This is why the water levels in rivers and streams were very low. According to Weikinn (1965) "the river of Zschoppau was so small..... because there was no rain for 38 weeks". The Saala and Elbe Rivers were so low that it was possible to cross them on foot. Rivers in the territory of today's Poland nearly dried out, too (Bóbr, Kwisa, Kaczawa, Widawa, Olawa and other). The Oder R. could be crossed at any point (Girguś, 1965).

1616: A severe spell of drought occurred both in Bohemia and in Moravia. In Bohemia, the town of Louny had no rain from 3 April to the end of July (119 days) and abundant rain arrived only in October. In Varnsdorf, the period with no rain lasted from 3 April to 29 September (i.e. nearly 180 days). In Litoměřice, the Labe (Elbe) River recorded a low water level from 10 June to 21 September. Astronomer Daniel Basilius of Deutschenberg informs that "The year of 1616 was hot and the ground was as if roasted, rivers dried out – which was also documented by our Vltava (Moldau) River that was brought to stinking...". In Moravia, the chronicle of Drahotuše mentions a period with no rain to be observed from 22 May to the Christmas (216 days) with a response to the spell of drought occurring in that year being the above mentioned old print (Philomates, 1616).

The hydrometeorological extreme is reported also from Germany and Switzerland. In Saxony, the spell of drought was specified to last from the Easter (31 March of the Julian calendar) to 29 September. In Jena, an extreme spell of heat is reported from mid-February until summer, and in Zwickau from 1 May to 29 September (Glaser-Militzer, 1993). A record from Fischingen in Switzerland mentions a dry period from 6 June to 30 July (54 days) in which even morning dew did not occur (Pfister, 1999). This demonstrably documented dry year is not mentioned either by Strnad or Augustin in their surveys of weather extremes.

1790: An extreme spell of drought is reported both in Moravia and in Bohemia. In Moravia, the regions of Olomouc and Hodonín had no rain from March to 26 June and from the spring sowing to 24 June, respectively, but the drought is mentioned to last even later (dried out streams, the manor sluice was empty from 4 April to the "Paul" /30 June?/). The region of Telč reported that the Velký potok Brook in the forests was observed to dry out as well as a lot of wells. In Bohemia, the manor of Jindřichův Hradec reported over 500 half-acres (96 hectares) forest burnt down. Numerous great devotions and religious processions begging for rain took place in the Pelhřimov region; the rain came as late as only on 25 June.

A detailed description of the weather course in Bohemia in this year and its impact on farming was made by František Vavák – the "neighbour" and village magistrate in Milčice (middle Labe R. Basin) in his memoirs from 1770 – 1816. The entry of 26 June informs that "we have not seen a drop of rain whole 18 weeks

– yes, and the main period of drought occurred from St. Wenceslas (28 September) last year to 26 June this year, altogether 39 weeks with only some snow that fell three times in winter ...From the beginning of July although some places were given abundant moisture..., there was not even a little rain in our surroundings for 9 days and the soil never got properly supplied with water...the little rains left us on 16 July and great winters arrived, cold winds...on 26 (of the same month), a spell of hot weather and warm winds arrived once again..." An abundant rain came only on 8 and 11 September and "everything got green". A period of drought appeared on about 28 September, ample water fell at the beginning of November (Skopec, 1912).

Severe spells of drought and very low water levels were also recorded in Germany (Weikinn, 1965). In Chemnitz for example there was no water in the river nearly the whole of May and June due to extreme drought. Nearly empty rivers in summer and autumn are also reported from north-western Thuringia. The Elbe River in Magdeburg recorded a yearly minimum of 48 inches (ca. 122 cm) below "no. 1" (normal?) on 20 August. In Hungary, the year of 1790 was one of three years occurring in the 18th century with a severe drought incidence (Nemes, 1966).

1842: An extremely severe drought spells were recorded both in Bohemia and in Moravia. In Bohemia, the region of Most did not have any rain from the spring sowing to 21 July, and České Chvojno near Chabařovice experienced a spell of drought lasting 94 days from 4 April to 7 July. The region of Louny did not have rain the whole summer: meteorological records from Chlumčany inform of two "thin showers" only as if a dew in mid-May and before 28 September; Blšany report the first rain arriving on 7 September and the first abundant watering of soil on 21 September. The memorable spells of hot weather and drought in Varnsdorf started in June and lasted until the beginning of October. In Plotiště nad Labem – today a part of the town of Hradec Králové – no rain was recorded from 27 March to 28 September (185 days).

In the eastern part of the Czech Republic, Jaroslavice in the Znojmo region had no rain from 15 May to 24 August (101 days). A record from Rýmařov indicates that there was a mid-summer period of 6 weeks with no rain. In the Vsetín region (Střítež), there was no proper rain for 13 weeks in summer and a mill on the Rožnovská Bečva River was out of operation for 16 weeks.

Consequences of the drought spell were disastrous. The extremely low water level on the Labe R. in Litoměřice is documented by the date on the local hunger stone; navigation had to be stopped for a number of weeks (Pejml, 1966). In Prague, the minimum water level of the year on the Vltava (Moldau) River was measured on 24 August. The Morava River nearly entirely dried out, too, and as the period with no rain continued, water disappeared not only from the rivers but also from the wells (e.g. in Litoměřice /Bohemia/, in Těšany near Brno and Záhoří /Moravia/).

Very low water levels occurred also in Germany, e.g. on the Weiser Elster R., on the Elbe where the allegedly lowest water level of 2 ells (ca. 130 cm) below zero was recorded in Dresden in August (Weikinn, 1965). According to F. Baur (1959) who summarized summer precipitation in central Europe for the months of June-August as an average for 10 gauging stations in one and a half century (1804 – 1956), the year of 1842 takes the fifth place in the list of the driest years (behind the years of 1911, 1904, 1818 and 1835). According to minus deviations of the summer precipitation (June-August) from the long-term average of the homogeneized series in Prague-Klementinum until 1956, the year of 1842 was the third driest one – after years 1904 and 1911.

Fluctuating occurrence of dry summer periods

The first attempt at a long-term assessment of the fluctuating occurrence of the summer spells of drought (from June to August) in Bohemia was the work of K. Pejml (1966). On the basis of his long-term research of climate in the north-Bohemian vine- and hops-growing district in 1501 – 1900 he summarized the basic characteristics of dry and hot summer periods as follows: They are characterized by an utter lack of precipitation, by drying out springs and water courses. In northern Bohemia, they showed markedly in the ceased navigation on the Labe River. Carriages or even people could get across the river easily. There is an absolute shortage of forage and this is why the livestock is dying or must be killed. Rogation processions are held for rain to come soon, harvest is early and hops of usually poor quality. But a dry summer does not necessarily be always connected with a generally poor harvest. There is for example a well-known saying of wine-makers that "Weinjahre – Peinjahre" (Years good for wine bring worries – shortage of other crops).

Results arrived at by Pejml for individual decennia starting with an interval from 1501 – 1510 and ending with 1901 – 1910 are presented in Fig. 5. It follows from the figure that the occurrence of dry summer periods was usually more numerous than that of wet periods. The highest number of dry years (7 of 10) was found out in 1531 – 1540 and 1741 – 1750 or in 1751 – 1760. However, the conclusions could not be verified for the entire Czech territory with respect to the grant project duration (only 1 year) and a lack of relevant documents for five centuries from other regions of Bohemia, Moravia and Silesia.

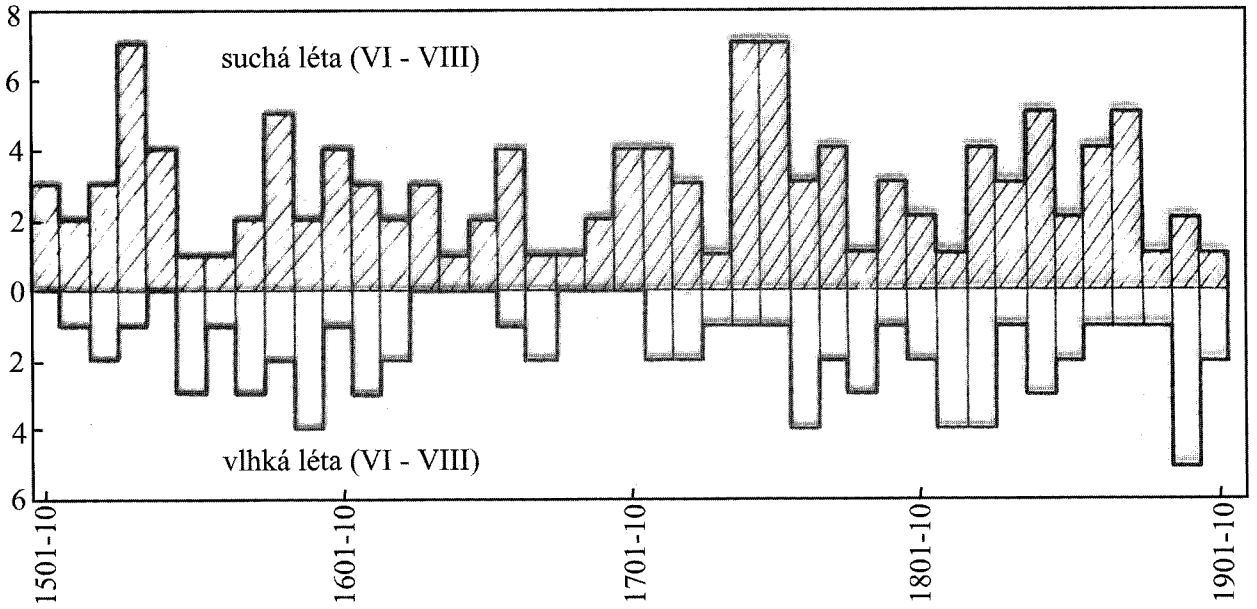

Fig. 5: Within a weather reconstruction for north-western Bohemia and on the basis of proxy data, K. Pejml (1966) worked out a frequency of the occurrence of dry and wet summer periods (June-August) for individual decennia in the period from 1500 – 1900 (dry summers hatched).

Conclusion

The study and analysis of the data obtained on drought before the beginning of the systematic precipitation measurements on more secular stations situated in the territory of the Czech Republic indicated that a fairly comprehensive documentation about the occurrence of this hydrometeorological extreme will be available from approximately the second half of the 16th century, which would extend records of so called "instrumental" drought by more than 300 years into the past.

It should be pointed out, however, that none of former chroniclers or rural scribes was a meteorological observer in the contemporary sense of the word; they rather made records on historical events significant for them – making only marginal comments on weather (which

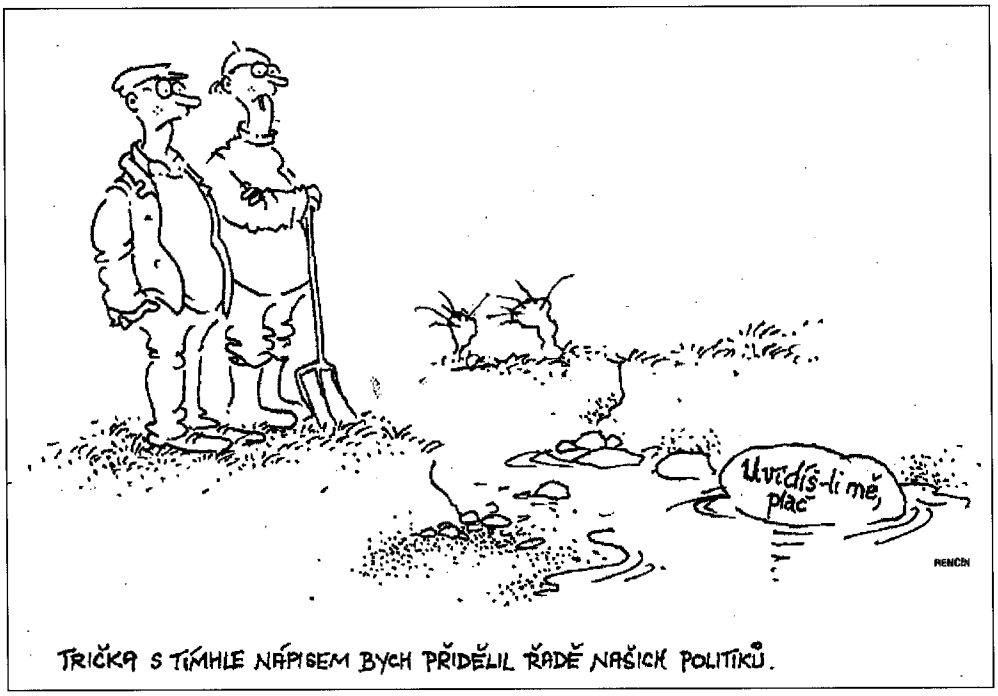

Fig. 6: Inscription on the stone reads as follows: "IF YOU HAPPEN TO SEE ME, START CRYING". Characters in the picture comment the inscription with the following words: "T-SHIRTS WITH THIS LEGEND SHOULD BE GIVEN TO A NUMBER OF OUR POLITICIANS". (Cartoonist Vladimír Renčín used in daily press the theme of the so called hunger stones to valuate the Czech political scene of the 1990s.)

to a certain extent holds true also for the extraordinary memoirs of F. Vavák, undoubtedly representing one of important cultural and historical documents). This is why their entries are observed to have serious gaps sometimes. We have to come to terms with the fact that the segmentation of these weather records both in time and place cannot be changed any more. Nevertheless, there is still a lot of useful data that can be yielded from the otherwise unhomogeneous material (Fig. 6).

We assume that this one-year initial attempt at a documentation of drought occurrence in the preinstrumental era has cast enough light on the topical character of the issue and outlined the direction for expected further long-term research.

Concluding we would like to bring to memory to the fact that it was the severe spell of drought in 1874 (which arrived short after the disastrous flood on the Vltava and Ohře Rivers in May 1872) that evoked an urge to summon a symposium (meeting of experts) in the parliament to draft preventive measures of which one was the establishment of a Hydrographic Committee for the Kingdom of Bohemia in the following year – 1875 - a milestone and a very beginning of the Czech hydrological service.

Acknowledgement

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Author´s address:

RNDr. Jan MUNZAR, CSc.
Academy of Sciences of the Czech Republic
Institute of Geonics, Branch Brno
Drobného 28, 602 00 Brno, Czech Republic
munzar@geonika.cz

Reviewer:

RNDr. Ivan SLÁDEK, CSc.

CHANGES IN THE USE OF SECOND HOUSING FACILITIES IN THE MORAVIAN-SILESIAN BESKIDS MTS.

Jan HAVRLANT

Abstract

One of the phenomena occurring in the Beskids Mountains (Moravskoslezské Beskydy Mountains) in the hinterland of the Ostrava agglomeration, namely a specific form of tourism and recreation developed in the second half of the last century – second housing facilities in individual recreation: cottages and summer houses - is analyzed in this article. This phenomenon significantly influenced some natural landscape elements, as well as the settlement structure in the territory of the Beskid Mts. The paper studies specificity of the development and other potential changes in utilizing numerous properties for second housing, against the background of political-social and socioeconomic transformation in the years 1948 and 1989.

Shrnutí

Změny využívání objektů druhého bydlení v Moravskoslezských Beskydech

Příspěvek analyzuje jeden z fenoménů beskydského zázemí ostravské sídelní aglomerace, jímž se ve 2. polovině minulého století stala specifická forma cestovního ruchu a rekreace – druhé bydlení v objektech individuální rekreace – chatách a rekreačních chalupách. Tento fenomén v Beskydech výrazně ovlivnil některé přírodní krajinné složky i sídelní strukturu území. Příspěvek se zabývá specifiky vývoje a dalšími možnými změnami ve využívání početných objektů druhého bydlení na pozadí politicko-společenské a sociálně-ekonomické transformace po zlomových letech 1948 a 1989.

***Key words**: recreation, second housing, Moravian-Silesian Beskids Mts., Czech Republic*

1. Introduction

The Beskids Mts. region of tourism and recreation, represented in the Czech part of the Western Carpathians especially by the Moravian-Silesian Beskids Mts., became an important tourist area at the beginning of the last century and since 1960s together with the Podbeskydská pahorkatina Upland. It became the most important recreational hinterland for the Ostrava residential and industrial agglomeration, comprising in addition to its largest residential center of Ostrava (320 thousand inhabitants), the towns of Havířov, industrial Karviná, Orlová, Frýdek-Místek, Třinec, Český Těšín, Bohumín and several minor settlements in their hinterland (with approx. more than 1 million inhabitants), closely connected by strong socio-economic ties.

Most communes with the recreational function are localized in the northern surroundings of the Moravian-Silesian Beskids in the micro-region of Frýdek-Místek and in the Podbeskydská pahorkatina Upland near the Žermanice water reservoir and in Karviná at the Těrlicko water reservoir built in the 1960s, and also in the south-western foothills of the Beskids Mts. in the micro-region of Vsetín, especially in the Rožnovská Bečva river valley (Fig. 1).

Second housing in the near Beskids hinterland of the Ostrava agglomeration, with the most frequent kind of recreation in the form of summer house activities, has been representing an important -today even traditional- phenomenon for already 4 decades, which was accelerated at the beginning of the 1960s under social and political conditions totally different from those of today.

2. Objectives and methods of research

The objective of the work was to analyze one of the phenomena occurring in the Beskids hinterland of the Ostrava industrial agglomeration, viz. a specific form of tourism and recreation in the given period – i.e. second housing in the objects of individual recreation (cottages and summer houses).

For a detailed analysis of this important phenomenon with specific forms of recreation influencing the

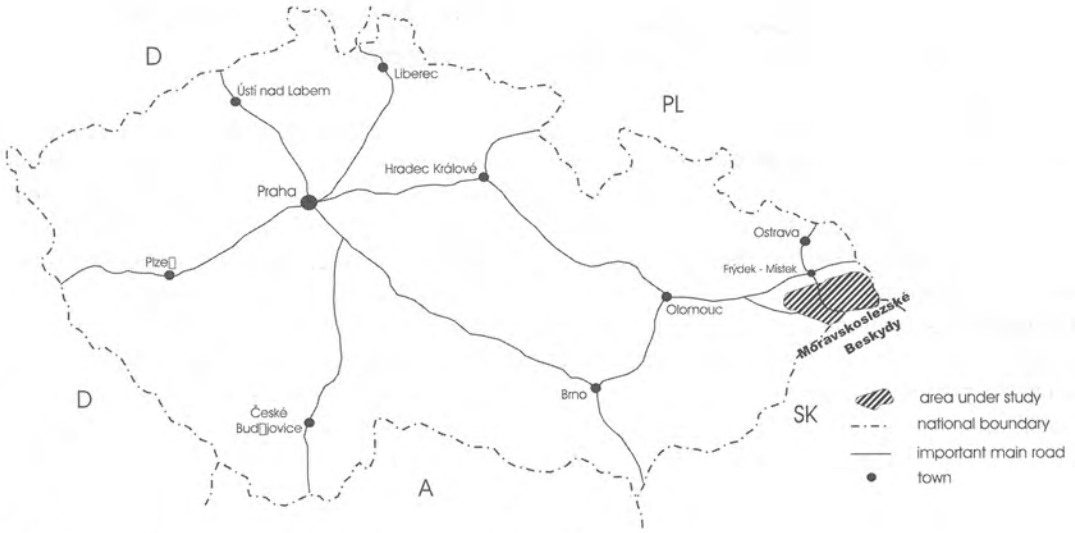

Fig. 1: The Moravian-Silesian Beskids Mts. - Area under study

landscape with the biota and also the settlement structure of the territory, a method of field research was used among other things in combination with a statistic assessment of personal inquiries made in approx. 800 (more than 10%) of randomly selected users of country cottages and summer houses in 15 most important recreational areas in the Moravian-Silesian Beskids and Podbeskydská pahorkatina Upland, situateded in 22 communes with approx. 50 recreational localities.

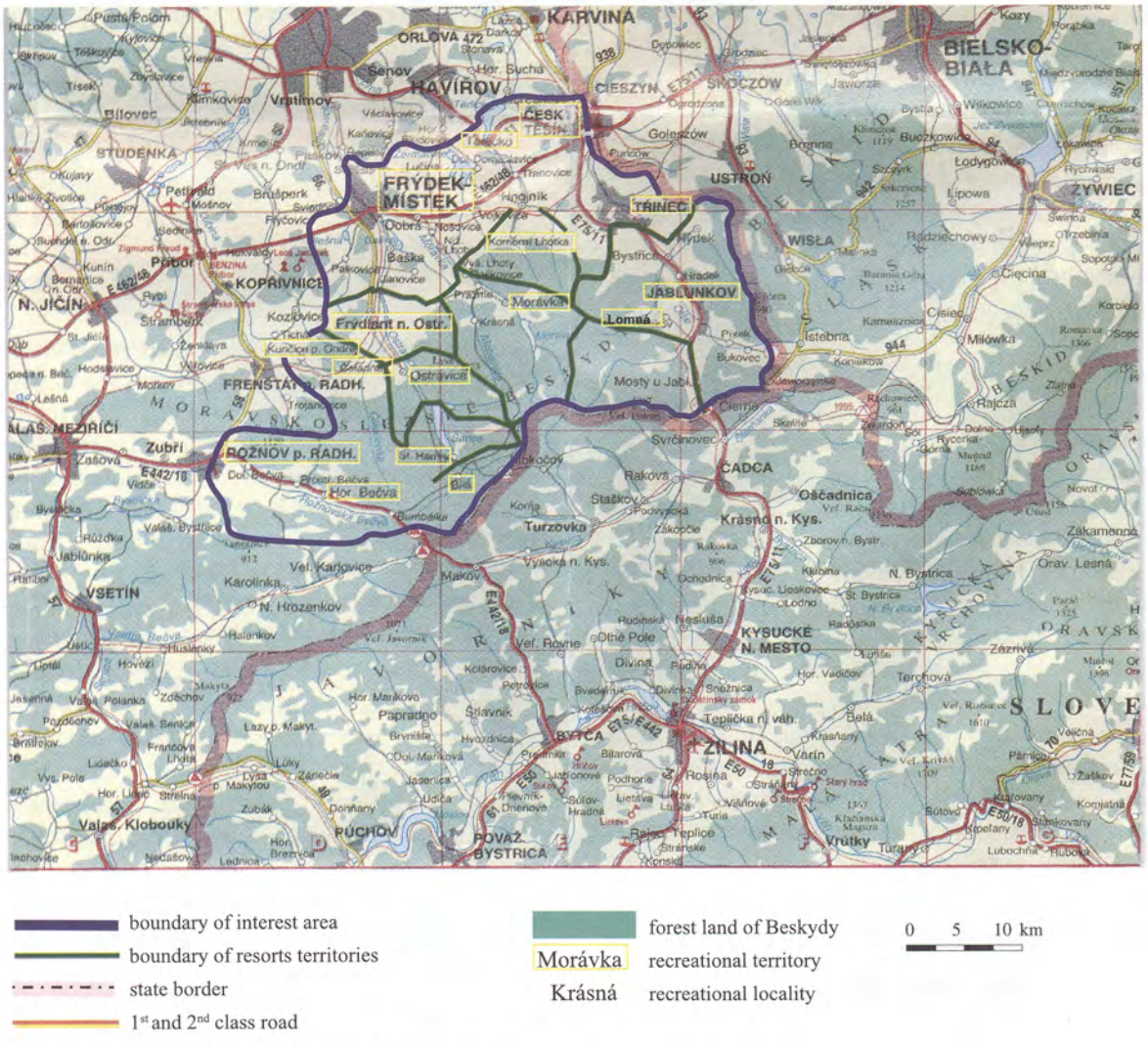

Fig. 2: Recreational territory of the Beskids Mountains

A total of 60 aspects of second housing in the period of 2001 – 2003 was analyzed for main characteristics, significant features, as well as for specific features of partial recreational regions (Frýdek-Místek, Těrlicko-Žermanice, Třinec, Jablunkov, Lomná, Komorní Lhotka-Řeka, Morávka-Krásná, Frýdlant-Malenovice, Ostravice, Čeladná-Kunčice, Staré Hamry, Bílá, Rožnov-Horní Bečva - Fig. 3). There were 3 areas of questions to be inquired – data relating to land property and second housing facilities, data relating to the object users, and data relating to attitudes of these users to potential changes in the use of the recreational facilities.

3. Specific features of the second housing development

The Post-war period meant a lot of specific troubles in the development of tourism in the whole country. Till the end of the 1950s, conditions for the wide and more complex development of tourism and recreation and for building new recreational facilities were difficult due to understandable reasons. Pre-war traditions of tourism in the Beskids were disturbed by disrupted economy and nationalization of private property. Impossibility of a wider development of free travelling abroad and at home in the newly arisen social and political structure of the

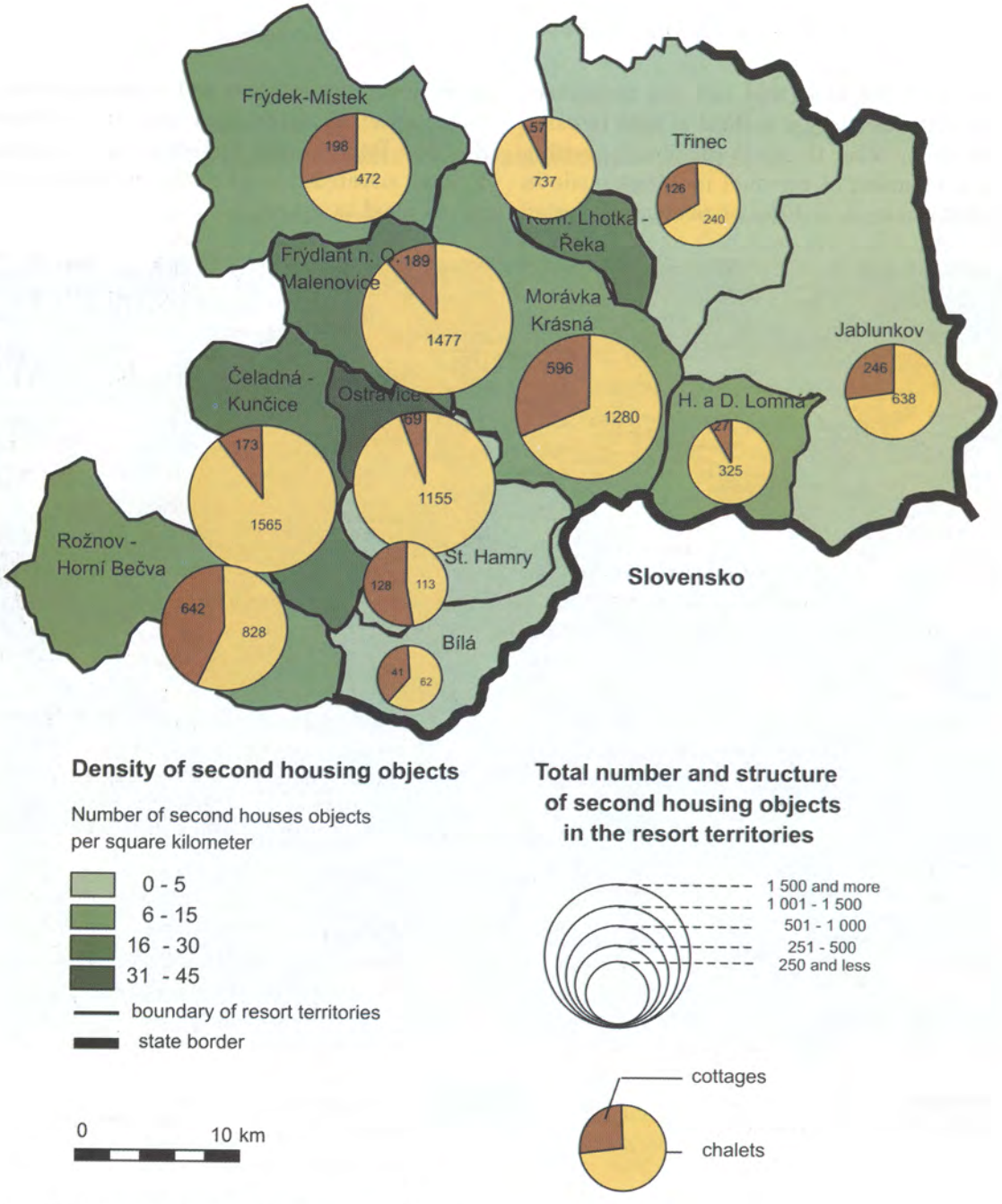

Fig. 3: Second housing objects in the recreational areas

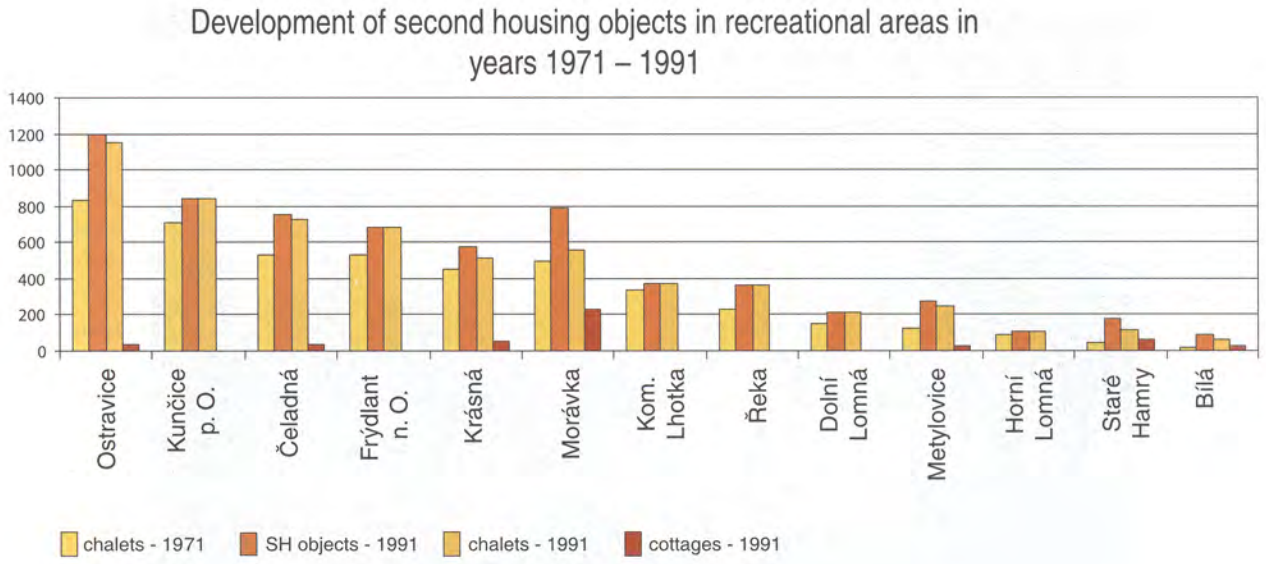

Fig. 4: Development of second housing objects in recreational areas in years 1971-1991

Czechoslovak Republic on the one hand, and development of extremely industrialized regions including the Ostrava agglomeration (developing coal mining and processing and extensive metallurgy operations in Ostrava, Karviná, Třinec, Frýdek-Místek and other centers, employing at that time tens of thousands workers) on the other hand – with all negative impacts on the environment in the industrial areas, especially in the natural elements of landscape, with extensive devastating impacts, facilitated at that time the development of the aforesaid specific forms of tourism and recreation in the near Beskids Mts. hinterland.

The increasing wealth among a part of urban population employed in preferred branches of heavy industry, and new trends and efforts to force in different lifestyle, gradual shortening of working hours and extended holidays and other aspects contributed to an intensive development of holiday and weekend individual recreation activities in newly built cottages. A fast development of the second housing was promoted just in the period connected with a high intensity of urbanization and industrialization processes. The development trend of second housing in the Beskids area was a consequence of sociopolitical and socioeconomic transformation and other circumstances.

At the same time, the territory witnessed a massive construction of collective recreational facilities, especially company and selective trade-union recreation that became another phenomenon in the recreational territories of Beskids and near water reservoirs.

From the viewpoint of second housing development in the recreational hinterland of the Ostrava agglomeration, the construction of these private summer houses in the 1960s and 1970s was especially concentrated in valleys and foothills, in well accessible localities, usually along water courses, where whole colonies of summer houses and chalets were growing in at that time still a well-preserved and attractive natural surrounding of the Ostravice River valley and in the valleys of its affluents Morávka, Čeladénka etc. The recreational objects were typically simply furnished bricked or wood summer houses whose architecture was very unhomogeneous, however (Fig. 5 – 8; fig. 8 see cover p. 2). The ongoing building of summer houses and the fast growing share of individual and corporate recreational facilities in which people were spending their days-off, together with the currently decreasing share of permanently inhabited houses led to the development of extensive recreational colonies and to the gradual change in the function of communes which were transformed into recreational settlements. Spontaneous, many a time uncontrolled building of summer and holiday houses was influenced by the overall social development. The above-mentioned aspects influenced a general development of tourism and reacreation practically in entire Czechoslovakia in the 2nd half of the 20th century, and the Beskids hinterland of the Ostrava agglomeration was not an exception.

Typical examples of recreational communes in the Beskids are Ostravice (today with almost 1,200 objects of individual recreation), Kunčice pod Ondřejníkem (840), Čeladná (724), Frýdlant nad Ostravicí (682), Malenovice, Morávka, Krásná, Komorní Lhotka, Řeka, Dolní a Horní Lomná, Nýdek, Horní, Prostřední and Dolní Bečva, Rožnov pod Radhoštěm, Staré Hamry, Bílá and Těrlicko, Lučina, Soběšovice and Dolní Domaslavice (Fig. 4) in the vicinity of the Ostrava industrial agglomeration. At the beginning of the1990s, there were in total 9,410 objects of second housing registered in the exposed micro-region

Fig. 5: Specific forms of recreation in summer houses in Ostravice. Photo J. Havrlant

of Frýdek-Místek, of which 8,830 (94%) were summer and holiday houses and chalets (ČSÚ, 1991).

Commuting for these forms of recreations was at the beginning mainly by mass public transport. Transport by bus and railway was used in the direction to the Beskids from Ostrava-to Frýdek-Místek – Frýdlant – Ostravice – Kunčice pod Ondřejníkem – Frenštát pod Radhoštěm and from Ostrava to Český Těšín – Třinec – Mosty u Jablunkova and further to Slovakia; to more distant locations, similarly to a near recreational hinterland of Ostrava agglomeration to water reservoirs. Transport by private passenger cars was of ever-growing importance and significantly predominated at the turn of 1970s and 1980s.

Attractive for inhabitants of large cities were especially summer activities by water in the near hinterland of Ostrava agglomeration and winter recreation in the mountains.

One of the secondary factors of individual recreation development in the Beskids was also a growing potential of mountain cottages that were becoming vacant, where was a distinct influence of depopulation in the mountain settlements due to numerous migrations of younger economically active population to cities and towns of the Ostrava agglomeration. Many buildings were situated in hardly accessible terrain, steep clearings and meadows and also in distant valleys of Morávka, Staré Hamry, Bílá and others. After the old owners had died, the houses got vacant and available. The desire to live permanently in higher mountain locations, with difficult accessibility, in modestly furnished Wallachian wooden cottages was getting weaker and fading out in the younger generation. In this period of intensive urbanization processes the city population was increasing especially thanks to migrations. At the same time however the number of people commuting for work from the Beskids hinterland to industrial centers of the Ostrava agglomeration was increasing, too.

At the beginning of the 1990s, the number of second housing objects in the whole Beskids area amounted to 11,200. In the density of area built-up with Second Housing (SH) objects the Beskids were ranked at the 5th place in the whole of the Czech Republic, behind Central Bohemia, and the regions of Krkonoše Mts., Pilsen and Brno. On a national scale the region of Frýdek-Místek has an important ranking. The Frýdek-Místek area achieved the density of SH objects of nearly 9 objects per square kilometer (i.e. 8th place among all districts in the Czech Republic), especially thanks to natural potential of the Beskids and good accessibility by traffic. However, compared with the districts of Prague – West, Brno-City, the figure is 3.5 times lower (ČSÚ, 1991).

Recreational communes outstanding in this indicator among the municipalities of the micro-region are as follows: Ostravice (0.5 objects/sq. km), Frýdlant n. Ostravicí, Malenovice, Kunčice pod Ondřejníkem, Metylovice, Raškovice and Řeka, where the indicator ranged from 0.25 – 0.5 (Fialová, 2001).

The indicator of the *number of second housing objects* per 100 permanently inhabited objects that also documents the recreational or residential function of the area it was shown that the recreational spaces of the micro-region achieve 30 – 40 second housing objects per 100 permanently inhabited objects. When comparing the communes, the commune of Ostravice is markedly above others with a value of up to seven times higher.

(The indicator "Number of recreational cottages per 100 permanently inhabited houses" is in the comparison with e.g. Bohemian borderland insignificant due to different situation).

As for *the Number of holiday-makers in second housing objects per 1,000 permanent residents* the communes of Frýdek-Místek micro-region rank on average positions (100 – 200 per 1,000 permanent residents), which is comparable with the recreational areas in the regions of South Moravia, South Bohemia and Vysočina; as compared with the hinterland of Prague, the values are by 2 up to 4 times lower. However, within the area of interest, Ostravice ranks much higher above other communes with a figure 10 times higher than the average value (2,480), which proves its important, nevertheless unilaterally established recreational function.

In the last 15 years, most of the recreational locations with the second housing objects have undergone no substantial changes in their numbers. Accommodation capacities in private SH objects, especially in recreational summer houses, predominate many times over those meant for common tourism – in all exposed recreational communes and localities. Their utilization is, however, limited to a low number of users.

Economic transformation in the 1990s influenced to a considerable extent also the sphere of second housing. Considering social, socioeconomic, psychological, ecological and other factors, we cannot expect any further extension of these recreational forms of second housing in the hinterland of Beskids in a form originally characteristic of the region.

In the 1990s, new tendencies occurred that influence the current development of tourism and recreation including second housing in the Ostrava agglomeration hinterland. Main features are represented by a significant decrease of building new objects meant for individual recreation. The number of summer houses and chalets virtually does not increase. New construction is currently limited mainly due to the strict protection of forest-land resources within the Protected landscape area of the Beskids Mts. and due to the existing protection zones of water reservoirs in Ostravice and Morávka. The strictly controlled development of the recreational building is under competence of the construction departments of municipal authorities and is, in fact, restricted to a category of country cottages for recreation. However, a considerable part of the old original country cottages were exempted from the housing resources in the Beskids already some time ago to serve for recreational purposes.

4. Analysis of second housing aspects in the Beskids Mts.

Characteristic data of land properties and objects:

- Size of land properties with second housing objects in partial recreational locations in the Beskids is very diverse and reaches 350 – 850 sq. meters, it is larger is mountain locations of Morávka and Krásná with a higher number of old cottages, located on forest and agriculture land with meadows and pastures (max. 3,665 sq. meters).
- the area of interest is 40 – 80 sq. meters.
- The distance of SH objects in partial recreational locations (RL) in the Beskids from the place of permanent residence is also very diverse due to

Fig. 6: Specific forms of recreation in summer houses in Malenovice. Photo J. Havrlant

recreational gravity of large city centers in the region. While in the RL of Žermanice and Těrlicko reservoirs the users are recruited mainly from the Ostrava agglomeration inhabitants, three quarters of them permanently live within a distance of 30 km which means that their summer houses become places of everyday recreation in summer time; the RL of Bečva and Bílá are commuted for recreation by over a third of users of the second housing objects from more distant places of the Moravian-Silesian region and from the Zlín region (over 60 km).

- This is in conformity with the naturally differentiated time accessibility of the second housing objects. Objects that can be reached in more than 1 hour belong to about a third of users in the RL of Rožnovská Bečva; on the other hand, the recreational localities of water reservoirs and dam lakes can be reached within 30 minutes by even two thirds of users. Recreational localities of Frýdlant, Ostravice, Kunčice and Čeladná are accessible for two thirds of users within three quarters of an hour thanks to a speedway from Ostrava to Frýdlant n. Ostravicí and they also create a potential for everyday form of short-term, day-by-day recreation of city inhabitants and for other activities.
- In the territory of Beskids the second housing objects have been used most since the first half of the 1960s to the first half of the 1970s. An exception to this are suburban parts of the Ostrava agglomeration, where these objects were built only after water reservoirs had been finished; and where also a more intensive exchange of users has been going on.
- Recreational objects are used by 40 – 60 % of users throughout the summer season, one third to a half of users (in RL of Rožnov – Bečva even two thirds of users) use them for more than two weekends in a month; one to two thirds of the respondents use their recreational objects primarily at the time of the main summer holidays. In the RL of Řeka – Komorní Lhotka the objects are used primarily for a short-term relaxation during weekends by inhabitants of the industrial area of Karviná; however, at the time of the main summer holidays these are used by only about one tenth of them. The question is whether this aspect results from the specificity of recreational location or whether it is already a new trend in using the second housing objects.
- From the architectural viewpoint approximately half of the objects in the Beskids are of a character of brick wood-panelled summer houses; in the RL of Bečva, Lomná and Ostravice there is a slight predominance of wooden, mostly plainly furnished recreational objects, partly holiday houses. However, around water reservoirs the bricked objects make almost a half of all recreational objects. Recreational objects prevailing in the foothill locations are single-storey summer houses with three habitable rooms and with 5-6 permanent beds on average.
- SH objects are generally used by 1 to 2 families, mostly by 5 persons, in the foothill locations by 6 to 7 persons. However, these days almost half of elderly families arrive without children, many of whom have their own families and their interests and orientation are different.
- As far as the value is concerned, one quarter to one half of respondents value their second housing object between only CZK (Czech crowns) 250,000 to 500,000, minor part between CZK 500,000 to 750,000. However, in the exposed and most sought RL of Rožnovská Bečva, Ostravice and Morávka there were up to a fifth responders who valued their objects at more than 1 million CZK, which relates to a potential further utilization of the second housing objects.
- The economic exploitation of land properties in montane and piedmont regions is currently insignificant unlike in Poland and less so in Slovakia. Agriculture use, growing of vegetables and fruits are at the present time predominated by the cultivation of ornamental woody species and plants – wherein dominates foothill recreational location of Rožnov, Bečva, Čeladná, Frýdlant and Ostravice and surroundings of water reservoirs. Presently, private grounds are virtually unused for breeding cattle or other animals. Certain exceptions are seen in the locations of Morávka, Krásná and Kunčice, where a couple of elderly cottagers are engaged in small animal husbandry, especially dogs.

Data on holiday-makers:

- The inquiry surveys covered all age groups of population; there was a slight prevalence of men of elder generation, in the age category of 51-60 years. More numerous were also age groups over 40 and over 60 years, of more than 4 fifths of married couples.

  Respondents were mostly people with the secondary education with or without school-leaving examination.
- Almost half of users of the recreational objects are currently rather worse financially situated (majority of them stated a net monthly income per one household member ranging from 5,000 – 7,500 CZK; a minor part states up to 10,000 CZK per household member).
- Owners of the second housing objects reside predominately in aforesaid large cities of the Ostrava agglomeration in typical multi-thousand housing estates built prevailingly in the 1960s-1980s in cooperative and state-owned flats, fewer of them live in corporate or private flats. Only less than a fifth of the object owners posses a family house for permanent housing of their own (second

housing objects were mostly built simultaneously or early after the construction of housing estates).

- Of the inquired persons more than four fifths own a flat of 1st category, while in municipal flats in housing estates there are predominately 3 persons living in common households.
- Ihousing conditions in their municipal permanent residence are excellent or satisfactory, and surprisingly enough even in large municipal housing estates up to four fifths of respondents are satisfied with the surrounding neighbourhood. The objects of second housing are not considered by them to resolve their possible problems with permanent housing.
- Categories predominant in the economically active population are work-people in the category of employees (30-60% of respondents), whereas employees in industry considerably prevail – a quarter up to two thirds of them, in services up to a half of the economically active population.
  Group of pensioners is very numerous (one quarter to one half in individual recreational locations).
- One half to four fifths of respondents acquired the land property by purchase and one third of them inherited it from their parents. The grounds were most frequently acquired between 1965 – 1981. However, grounds with second housing objects in the surroundings of the Těrlická and Žermanice water reservoirs were acquired by many responders often in the 1980s or later, which bears the evidence of certain changes in spending leisure time, recreation, self-realization and value orientation of ancestral users from the near centers of the Ostrava agglomeration and it also shows considerable changes in using second housing objects after the breaking year of 1989.
- Recreational objects of second housing were purchased by one third to one half owners; acquired by heritage by more than a quarter of the present users. A certain exception is the RL of Čeladná – Kunčice p. Ondřejníkem, where the cottages were purchased by three quarters and inherited by only a tenth of the respondents and in the RL of Lomná, where the objects were acquired by only about a tenth of the present owners (presently, this recreational location has a lower grade of attractiveness owing to a lower lever of basic and additional infrastructure).
- More than 90% of users are satisfied or very satisfied with the surroundings of their second housing objects, but in the RL of Žermanice and Těrlicko water reservoir only about three quarters are satisfied, which results, among other things from insufficient services – especially complementary services in the recreational locations, densely built-up area and from the intensive landscape exploitation in the near environment and also from the inferior quality of water in summer months.
  The inferior quality of water troubles especially users in RL by water reservoirs, but also in the RL of Frýdlant, Malenovice and Morávka – Krásná.
- As far as the leisure time in recreational objects is concerned, males showed a slight prevalence of activities connected with cottage maintenance (various adaptations of ground and repair of objects etc.) over passive relaxation. Relaxation prevails by a considerable third in RL of Těrlicko and Žermanice water reservoir, together with sport activities and staying by the water and gardening, by which this specific location for summer recreation differs from all other Beskids RLs.
  Females prefer most passive relaxation and resting forms of recreation. More than one fifth of sojourn time was spent only by gardening, above all in the RLs by water reservoirs (here also staying by water) and in the RL of Ostravice, Rožnov, Bečvy. Most of recreational objects users spend their leisure time practically "for themselves". Closer contacts in relation to resided neighbors or holiday-makers are not emphasized; on the contrary, they prefer peace and relaxation in the privacy of their own objects. Only sporadically, e.g. in the RL Kunčice pod Onřejníkem – Čeladná, a minor part of the respondents stated socializing with their neighbors. Thereby the whole area differs e.g. from the recreational hinterland of Prague.
- Holiday-makers in all RLs in the area of interest regard among more serious problems, traffic infrastructure problems, bad access roads and, with the exception of Čeladná, also inadequate bus service; less serious is noise caused by motor vehicles and insufficient household waste disposal.
  The problem of overpopulation is perceived by a relatively high number of holiday-makers in the RL of Žermanice and Těrlická water reservoirs, Frýdlant, Malenovice, Kunčice and Ostravice.
  Insufficient supply of retail shops, especially groceries is perceptible in the RL of Malenovice, Kunčice, Bečva, Ostravice, Bílá and by both water reservoirs.
  In the RL of Ostravice, Bílá there is a clear discontent with infrastructure and services like – boarding & catering, culture and medical care facilities, as well as sport and recreational facilities, above all the non-existence of swimming pools etc., which directly relates to the earlier preferred facilities of collective and individual recreation and to the neglected development of facilities for free tourism and travelling.
- Deficiencies in other services and infrastructure are surprisingly not perceived as substantial. Except for aforesaid problems, one half to 70% of users basically does not lack anything, which can be to

a great extent explained by a specific structure of users (age, lower living standard etc.).

Utilization of the second housing objects in future:

- Similarly to the present custom practice also in future 70 – 90% of users will prefer utilization of second housing objects only for their own needs – individual recreation.
- A fifth of second housing object owners at max. considers an adaptation of their recreational objects into permanent housing facility in a more pleasant environment and in a relatively well-accessible foothill of the Beskids. For other especially elderly users, the reasons for only recreational use consist in costly transport by own means of transport, unsatisfactory and expensive public transport, and also rather bad supplies etc.
- Economic transformation and increased prices reflected also in other aspects, in the increase of land property costs, increase in house taxes for permanent housing, energy costs, a marked price increase of building materials, services etc. All that has founded totally different conditions not only for the construction work itself, but also for modernization and utilization of the second housing objects, especially for people with average or low incomes. The second housing objects still mean a profitable deposit of savings, however, their use and maintenance has become costly, in particular for owners in more distant locations.
- Only 10 – 20% percent of respondents consider the sale of their second housing objects in partial recreational locations, on the contrary more than three quarters of owners (in the RL of Čeladná up to 98%) absolutely reject such an alternative.
- Only individuals consider renting or offering the object for a free tourism. This possibility to rent the object of second housing was considered by a quarter of the owners at max. More owners would rent their second housing object under favourable financial conditions only in the recreational localities near water reservoirs in the hinterland of the Ostrava agglomeration and in Morávka (15%); at most 15% of owners in the RL of Lomná, Frýdlant and Malenovice considered a potential exchange of the second housing objects to other location.
  A certain exception constitutes about a tenth of owners in the exposed RLs of Ostravice, Rožnov – Bečva and Morávka, which is a considerable change compared with the period before 1990.
  The reasons for the prevailing lack of interest of the owners in a small business, e.g. in accommodation and other service are to a great extent dependent on social structure and mentality of people, concerns for their property and also on specific historical, political and demographic development, which was proven in a suppressed motivation to private enterprise over the period of 42 years of socialistic economy, passed onto next generations. Another factor for this passivity was previous intensive migrations of people in a productive age to large cities of the Ostrava agglomeration, accentuating growth of population in a post-productive age, etc.
- The second housing object owners, who would offer their service, are willing to provide mainly accommodation services, other services only exceptionally, which constitutes a threat for a further development of free tourism and travelling in the Czech part of the Beskids.

Fig. 7: Specific forms of recreation in summer houses in Horní Bečva. Photo J. Havrlant

- Necessary conditions for transformation of second housing objects to a permanent housing or boarding houses are above all extensive building adaptations a reconstruction of objects – for up to one quarter of families considering this alternative. Vast majority or respondents absolutely rejected a possibility of this variant (in Čeladná – Kunčice even 86%).
- In the eastern border zone of the Beskids in the RLs of Lomná and Třinec new job opportunities in the location could change the decision-making in one third of the respondents. The SH object owners here are predominately citizens of Karviná and Třinec areas with impacted structure (unemployment rate over 20% in 2003).

5. Conclusion

New opportunities of self-realization in other forms of tourism and recreation caused that many people change the principles of value orientation, which is reflected in the style of spending their leisure time. In the selected groups of population, there is partly also a decrease of leisure time that was previously dedicated to recreational activities, objects maintenance etc. Many more options for a free tourism and recreation and more frequent travelling especially abroad have contributed to the change of opinions and trends. New forms of tourism and recreation, with a fast development of various activities, e.g. cycling, skiing, water sports, horse-riding, golf, tennis etc. and use of other facilities have contributed to the decrease of interest in the building of new recreational objects and maintenance of the old ones.

In the area of interest a prevailing majority of recreational second housing objects remains and will remain without an importance for tourist industry, which is a weak point for the whole field of travelling in the Beskids with extensive but unusable accommodation capacities in greatly prevailing objects of individual recreation. Impossibility of further increase in accommodation capacities in the mentioned recreational locations– caused by the present above-average recreational burden to the territory and by landscape protection – have become to a great extent a limiting factor for the further development of tourism and recreation.

Also, a wider use of the second housing objects e.g. in nowadays preferred agrotourism, hipotourism etc. is very exceptional and unrealistic in the Czech part of the Beskids due to an absolute lack of interest in these kinds of business activities.

A reserve in utilizing for recreational purposes consists in numerous facilities of company or trade union recreation that have not been fully transformed into commercial use yet.

A new phenomenon in the Beskids hinterland of the Ostrava agglomeration is the construction of luxurious, perfectly furnished family houses and modern villas designed for permanent housing, as well as for needs of everyday recreation of their owners, but in principle without any opportunity to be used by visitors and general public. Examples of new or reconstructed family hotels (boarding houses) – as we know them from the Alpine countries, but these days also from the Krkonoše Mts., Šumava Mts. or from the Polish and Slovak parts of Beskids border zones are still rather exceptional. The carried out public inquiry demonstrated that the recreational potential of numerous objects of second housing in the Beskids hinterland cannot significantly contribute to a positive general development of local tourism in the future by improving basic and complementary infrastructure.

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Author´s address:

Assoc. Prof. RNDr. Jan HAVRLANT, CSc.
Department of social geography and regional development
Faculty of Science, University of Ostrava
Chittussiho 10, 710 00 Ostrava,
Czech Republic
jan.havrlant@osu.cz

Reviewer:

Ing. Halina KOTÍKOVÁ, Ph.D.

TERRITORIAL SOCIO-ECONOMIC SYSTEM OF BORDERLAND IN THE SILESIAN REGION AND MORAVIAN-SILESIAN REGION AND STRATEGIES OF ITS DEVELOPMENT IN THE PERIOD OF POLITICAL AND ECONOMIC TRANSFORMATION

Franciszek KŁOSOWSKI, Radim PROKOP, Jerzy RUNGE

Abstract

Some of the cross-border relations in the Silesian and Moravian-Silesian regions - the euroregion of Těšínské Slezsko / Cieszyn Silesia – are discussed. In this borderland, the process of transformation following the social and political changes after 1990 triggered some integration trends in the co-existence of the developing multi-ethnic society. Such trends are influenced by public activities in the most varied spheres of economic and social life on both sides of the border.

Shrnutí

Teritoriální sociálně-ekonomický systém v příhraničí Slezského regionu a Moravsko-slezského kraje a strategie jeho rozvoje v období politické a ekonomické transformace.

Příspěvek se zabývá některými vztahy v česko-polské příhraniční oblasti v euroregionu Těšínské Slezsko. Transformační vývoj po roce 1990 zde nastartoval integrační trendy v rámci rozvíjejícího se multietnickéhou soužití, které ovlivňuje veřejné dění v nejrůznějších sférách hospodářského a společenského života na obou stranách státní hranice.

***Key words**: international integration, industrialization, urbanization, multi-ethnic co-existence, Cieszyn Silesia, Poland, Czech Republic*

Introduction

Among Polish and Czech Euroregions, the Euroregion Cieszyn Silesia (Śląsk Cieszyński / Těšínské Slezsko) represents a specific area because its both parts (Polish and Czech) show not only high similarity of spatial and functional structure and similar historical stages of transformation, but also, for many centuries, they represent political, administrational and cultural unity. The Olza (Olše) river, because of its upper course located in the Zaolzie area, practically did not make any problems in socio-economic contacts of the inhabitants on both sides of the borderland. This situation changed after the national border was established on this river in 1920. Euroregion Cieszyn Silesia is also one of elements in the whole borderland of Silesian region and Northern Moravia (Fig. 1).

One should bear in mind a considerable historical autochthonity of the Cieszyn Silesian inhabitants, which results in numerous family relations between

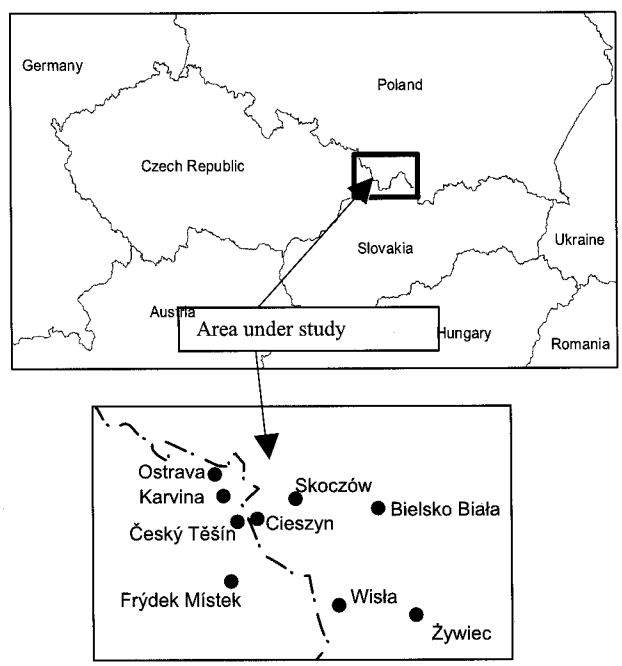

Fig. 1. Localisation of Silesian Region and Northern Moravia

the inhabitants of its both parts. As a result of post-war international treaties and internal policy of Poland, in many other Euroregions the autochthonous population had left their lands, and new populations often with different cultural and economic standards immigrated. Considerable physiographical hindrances such as mountain ranges and rivers as well as political conditions made it very difficult or even impossible for some regions to maintain family connections (e.g. Euroregions Baltic, Bug, Tatras). It was also the language cognation and differentiation of religions and religious frankness that played an important role in the development of the unity of Cieszyn Silesia.

Taking into account the above premises and the 85th anniversary of the division of Cieszyn Silesia, which will take place in 2005, we would like to present this paper with the aim to show the basic characteristics of transformations which occurred in this region after the war (especially after 1990), with the application of the territorial social system of Chojnicki (1988).

Cieszyn Silesia, considered here as a Euroregion of the same name, includes 54 administration communities. These include the whole Cieszyn district (12 communities), the whole Karviná district (16 communities), the district of Jastrzębie Zdrój, some parts of the Bielsko-Biała district (communities of Jaworze and Jasienica) and the Frýdek-Místek district (23 communities). Inasmuch the attachment of these territorial units to the Euroregion is univocal, its area and population are quoted differently in different statistical papers. The Euroregion's area ranges from 1400 to 1528 km^2 and its population is between 630 and 657 thousand. If we consider the lower limits of these intervals to be actual values, the population density in the Euroregion is 450 inhabitants per 1 km^2, and in the Polish part – 337.5 inhabitants per 1 km^2 and in the Czech part 499 inhabitants per 1 km^2. The population concentration in Cieszyn Silesia is therefore highest among all Polish and Czech Euroregions. It may be said therefore, that despite the fact that the area studied represents one of the smallest Euroregions in terms of area coverage, its historical, economic and geopolitical features make it one of the most important Euroregions in Poland and Czech Republic. Its location within the Moravian Gate at the old route linking Central and Eastern Europe with countries of South Europe influenced the development of not only transport function, but also social and economic transformations. The importance of this Polish-Czech borderland is for instance demonstrated by the fact that as much as 24 border crossings were established there (most of them for local transboundary contacts).

1. Features of the territorial social system of Czech-Polish borderland

1.1 Development of the system

Cieszyn Silesia was changing in time and space due to certain integration and disintegration factors associated with the character of regional and local geographical space, associated political, demographic, socio-economic and national-cultural processes and structures. The history of this area is very complex, which results mainly from changes of national attachment of this territory (Popiołek, 1972). It is essential however that practically from the 14th century to 1920 this area (except of its small northern part) represented a unity in the frameworks of the first Czech, then Austrian, and finally Austro-Hungarian state systems.

The territorial integrity of the area studied is most of all a derivative of its stable historical and geographical unity, which underwent some qualitative changes not earlier than in 1920. The territorial integrity of Cieszyn Silesia developed gradually, mainly by expansion of development impulses initiated by subregional centres of socio-economic growth. This appeared during the stage of industrialisation of Northern Moravia in the 19th century. The historical borders of this region did not block the migration streams from the adjacent Silesia, Galicia and later also from Slovakia towards Ostrava and the neighbouring towns. Mainly due to the influence of external economic impulses which conditioned the occurrence and development of coal mining and metallurgy, the area studied transformed from the primarily partly-closed economic region into the open one, which developed also its internal structure. Also economic-settlement integrity was ahead in time of organisation-administrative integrity, which, for instance, in the districts of Karviná and Frýdek Místek showed some inconsistency in the spatial organisation of the western part of Cieszyn Silesia. These circumstances of regional transformations resulted in post-war conceptions of social transformation and economic restructuring of the Ostrava region.

1.2 System-forming factors

The regional structure of the Czech part of Cieszyn Silesia developed in several stages and was associated with other subregions of the Ostrava region. The most dynamic development of this area occurred from the 1870s to 1910 and in the period of socialistic industrialisation (1950 – 1970), while these areas went through several development stages. These include:

- pre-industrial stage – with predominating rural settlement and the role of development centres played by such administrative-political centres as Cieszyn, Fryštát[1], Frýdek and Jablunkov;

[1] The town of Fryštát was affiliated to Karviná into one administrative unit in 1941 (and then once again in 1948) with the common name - Karviná

- early phase of industrialisation – coal industry and metallurgical industry started to develop, outstripping the hitherto traditional textile production in Podbeskydí (district Frýdek-Místek and Nový Jičín, Ustroń);
- stage of economic and settlement growth which determined basic characteristic of production potential in the Ostrava region;
- peak stage of capitalistic development from the 1880s to the beginning of the 20th century;
- period of stabilisation of the region's economy and extension of the original settlement structure of the period between the two wars with monofunctional industrial towns (Karviná, Orlová, Třinec, the Silesian part of Ostrava, Petřvald and Bohumín in some extent);
- period of the post-war socialistic industrialisation with a culmination development of heavy industry and new areas of housing development (Jastrzębie Zdrój, Havířov, Orlová);
- period of economic stagnation with trends of decreasing coal production, beginning of the process of political transformation and transition to free market economy;
- stage of region's economy division into 3 segments (agriculture, industry, services) with considerable changes including ecological aspects.

These stages of transformation are best visible in the Ostrava-Karviná part of Northern Moravia, because this area underwent the greatest spatial-functional transformations of the contemporary population-settlement structures. Both in case of economic enterprises and population processes, the development impulses came from outside the area studied, which suggests that a dynamic, wide-scale urbanisation occurred there transforming the agricultural part of Northern Moravia into a typical industrial region. Similar transformations occurred in the Polish part of Cieszyn Silesia, i.e. in the Katowice region (Rybnik and Katowice conurbations). The specificity of these processes influenced mainly the economic sphere causing certain consequences also in the socio-demographic sphere.

Natural environment plays an important role in the transformation of territorial social system of Cieszyn Silesia. On the one hand, some of its components became a premise influencing economic activity (natural resources) and on the other hand they represented certain limitations and barriers in the urbanisation process. Their influence is best visible in the spatial organisation of settlement system or agriculture. Together with technological progress and intensification of economic activity, the importance of the natural environment decreased, leading to the development of extensive anthropogenic landscapes.

1.3 Character of the system and forms of activities

In the conception of a system, a certain area is considered in a wider context (system surroundings), in this case at the background of typologies and classification of geographical regions (Ivanička, 1980; Gardavský, Hampl, 1982; Demek, 1984).

The economic-settlement homogeneity of the Cieszyn region has much in common with the Ostrava region but in case of Moravia-Silesia area there are some structural differences which are treated as heterogeneity. Cieszyn Silesia itself is not homogeneous and as compared to the Polish part of the Euroregion it has more common or similar indices in the southern part, where landscape elements of the natural environment are most important.

Functional character of the system is reinforced by infrastructural facilities, especially by a well-developed transport (road and railway) infrastructure and telecommunication infrastructure. Numerous economic and settlement connections of the western part of Cieszyn Silesia with Ostrava-Karviná region, influenced its political division in 1920 and its economic policy.

1.4 The beginning

The primary development factors of Cieszyn Silesia were connected with feudal craft production, especially with the processing of local raw materials for textile, wood and agricultural production. Their function represented a transitional role between a self-sufficient feudal food agriculture and the beginning of free market economy reaching behind the regional range only in rare cases. As a result of industrialisation in the regions of Ostrava and Karviná and in the Třinec area, the Ford's economic model was introduced. The industry changed primary spatial-functional relations and became a leader in the economic sphere. The initial beginning of coal mining as compared to metallurgy had only a relative character and transformed into a strong functional relation. Together with the introduction of machine engineering and building industry, the economic interdependencies were increasing.

The beginning of industrial production resulted in the neglected sphere of population concerns. The large inflow of immigrants to the industry caused mitigation of social bonds and development of conflicts between the autochthons and the newcomers. These phenomena, typical also in other industrialising regions, represented result of the inconsistent concerns of different political, economic, ethnic or religious groups. The territorial social system of Cieszyn Silesia was not able to balance the nation-wide preferences of industry development by a strategy of more differentiated and comprehensive development of the region, which existed all the time as a specific "internal colony".

As a result of external influences some reversible reactions occurred, i.e. towards certain socio-demographic, ethnic or cultural transformations. In the Czech Republic there are not many regions which may be compared in this aspect with Cieszyn Silesia. Migration for work – as a basic determinant of socio-professional activity of the society – transformed the Czech borderland from a relatively homogeneous area into a multi-ethnic one. Simultaneously, the influence of the economic base had a primary importance in the territorial structures of the system studied, whereas the effects of the migration movements were only of the secondary importance.

1.5 The structure of the system

Every system shows the complexity of compound elements, which means the presence of a certain structure of internal and external relations. In Polish geographical literature the complexity of a system is seen in relations between human entities and distinguishing subsystems and external systems. Chojnicki (1988) concludes that the socio-economic structure of the system is not univocal, which is also true for a system approach to Cieszyn Silesia. It includes three kinds of relations of social organisation, i.e. production-technical structure of economy, institutional structure of economy and social structure of the society. In the socio-economic system the human factor is conformed to the economy; human needs depend on the production process, exchange and consumption.

Taking into account the character of mutual relations between the inhabitants of Cieszyn Silesia, they were considerably affected by mass, impetuous migrations. They were conditioned by existential-workers' impulses in the industrial sphere, which took over redundant workers from the overpopulated territories of the Beskids Mountains and the Karpackie Foothills (The Western Carpatihan Foothills). Relatively enclosed and functionally simple communities settled in this area from generation to generation were placed in new, difficult conditions of everyday existence in the conditions of rapidly developing social stratification. Unknown categories of industrial workers developed in the professions, which required suitable qualifications. The role of intellectual potential in education, culture and different organisation-technical initiatives grew with some delay. Due to the development of transport system the access to individual localities became easier.

The traditional agricultural area quickly transformed into a dynamically developing industrial region. Social structure of the villages' population was still subjected to the interest of towns and it was influenced by labour market with jobs available in the industry. The migration of population from villages to towns increased. The relations of Cieszyn communities were influenced also by ethnic structure, where the key position was occupied by Czech and Polish populations (before 1945 also by the German population and after the war by Slovak, Gipsy and Greek populations). At present this concerns also foreigners, especially those from post-communistic eastern countries. Generally, integration processes favour majority groups at a given area, leading to the assimilation of the minority. Despite these problems, the Czech population has accustomed to the multi-ethnic character of Cieszyn Silesia, especially in the 1990s, when social problems became very important at the stage of political transformation and its consequences.[2]

The present structure of three ethnics in the Czech part of the Cieszyn region results from the complex political development in the period between the wars and from the motivated economic migrations connected with socialistic development of the Ostrava region. Population centres of this region moved from the former areas of coal mining and metallurgy to new housing estates, constructed according to social rules of the former political regime. Their housing environment deprived of private features affected the contemporary life style and the development of social contacts of the different groups of population in the urbanising area of Cieszyn Silesia.

Relations with other systems are represented mainly by infrastructural links associated with the technical infrastructure. Most of all, the transport network plays a supraregional function. In the past it was mainly associated with railway transport, but in modern times with road transport. At the beginning, the town of Bohumín represented the main railway junction, where lines from Racibórz (1847), Czechowice Dziedzice (1855), Cieszyn (1869) and Ostrava were crossing. The Košice-Bohumín railway opened in 1871 significantly influencing the region's development. Coal mines in the area of Karviná and Orlová and Třinec as a town of metallurgy could develope thanks to this railway link. Its original route was reconstructed in the post-war years of the Ostrava region development and there were also some new services added – between Dětmarovice and Karviná. The railway between Český Těšín and Kunčice (now a part of Ostrava) provides for the connection with the southern part of the Ostrava-Karviná region (Územní plán Velkého územního celku Ostrava- Karviná, 1999 - Plan of Area Development) and has a key importance for the new town of Havířov. In case of intrasystem services between the western edge of Cieszyn Silesia, Ostrava agglomeration and Podbeskydí,

[2] According to the Czech census of 2001, the population in the Czech part of the Euroregion declared Czech nationality (i.e. Bohoemian, Moravian and Silesian) at 80 %, Polish nationality at 10 %, and Slovak nationality at 5 %. The remaining 5 % were other nationalities or the nationality was not declared.

the so-called Frýdlant railway operates. It links Ostrava with Frýdek-Místek and continues to Central Moravia. At present, however, it is only a local route between Český Těšín and Frýdek-Místek, which represents also the main transport connection between Euroregions of Cieszyn Silesia and Euroregion Beskydy (Beskydy – Územní plán, 1999 – Plan of Area Development). It used to link Cieszyn Silesia from Bielsko to Cieszyn and further to Central Moravia.

As compared with the period between the wars, Bohumín lost its function of the most important railway junction for international contacts. Also Český Těšín, which used to include services of fast trains directly to Cieszyn only partially performs this function at present ("Olza" railway service between Katowice and Žilina). On the other hand, the importance of border crossing in Zebrzydowice – Petrovice u Karviné has increased. Ten express and fast passenger trains operate every day via this crossing in both directions, mainly to Warsaw (via Katowice) and further to Moscow.

Cieszyn Silesia has also an extensive road network including international routs E75 and E462, which join northern and southern Europe. However taking into account the role and intensity of vehicle carriages (both passengers and loads) in the regional, interregional and international scale, there is a clear lack of motorway network which would reduce transport concentration via e.g. the largest Czech-Polish border crossing Boguszowice-Chotěbuz. Also the technical condition of road network is rather poor, while the number of vehicles travelling on these roads is growing fast showing seasonal character (summer holiday season). In the integration of border and transborder connections, the important role is played not only by contacts on the state level, regional level or business level, but also by direct contacts between the inhabitants. This shows the importance of the function of border crossings, which help to develop local transboundary contacts between the neighbours. This is an essential function of border crossings, which are a derivative of transport connections. There was a large improvement in this aspect in the 1990s, when 24 border crossings started to operate (most of them relating to local transboundary contacts).

1.6 Social relations

Social relations represent a considerably large sphere of interactions conditioned by the activity of individual people, different communities and the whole society. These relations may have a character of social subsystem and they are influenced by individual and group decisions. In biological-family relations of Cieszyn region there is a correlation between the settlement intensity in this multi-ethnic environment and ethnic roots of the family connections. More intensively than in other regions, we can find ethnic connections in the relations based on the kindred. They considerably influenced (more than the number of contacts between the persons) the relations between the social groups. According to sociologists, the family environment has an essential influence on ethnic homogamy or heterogamy. Factors most conclusive for ethnic representation in marriages include numerical force, ethnic unification, number of contacts between people of different nationality, possibilities of participation in cultural life, relationship or language separateness, level of socio-cultural development and life style of different nations. These relations are even more important in the case of highly differentiated nationalities in the Czech part of Cieszyn Silesia[2].

Investigations in the Czech part of the Euroregion made by the Silesian Institute in Opava in 1997-98 showed that Czech community as an ethnic majority shows the largest participation in homogeneous marriages, whereas heterogeneous marriages are predominated by immigrated Slovak population. Due to the considerable spatial movement, the national differentiation of families in Cieszyn Silesia is higher than in other regions of the Czech Republic.

Sociological studies showed that the families of partners coming from a national homogeneity are usually heterogeneous at present; this mainly concerns the young generation. Together with the increase of education level, in all social groups of Polish and Czech communities, the percentage of mixed marriages decreases, whereas in the case of Slovak population, this percentage is observed to increase.

In case of communication relations in social, cultural and economic contacts, language plays a very important role. Ability to speak mother or nation's tongue indicates a certain attachment to the nation. Czech population has the best ability to speak their mother tongue, both in written and oral form – 93 % of population. 84 % of the Polish minority declare ability to speak their mother tongue, and so does 80.7 % of the Slovak minority. Ability to speak Czech is confirmed by 89 % of the Polish population and by 54 % of the Slovak population.

It is interesting that the Polish and Slovak populations that use in communication their mother tongues or a mixture of both languages, can speak better Czech than those who use only the Czech language. More then a half of the Czech population can communicate in Slovak (15.6 %) and Polish (12.8 %), i.e. in the languages of ethnic minorities. All ethnic groups that live in Těšínské Slezsko do not have any problems with the language communication.

A certain part of Czech and Polish nationals (especially those who have lived in Cieszyn Silesia for several generations) often use the local Teshen dialect, which

is a colloquial form of common language used in everyday contacts. In 1997, Czech nationals usually spoke Czech (68%), a mixture of Czech and Polish (9%) and Slovak (8%). Polish nationals usually spoke a mixture of Polish and Czech (75%), Polish (7%), Czech (4%) and dialect (11%). Slovak nationals usually spoke a mixture of Slovak and Czech (75%), Slovak (14.5%), Czech (5.9%), Polish (0.5%) and dialect (3.7%). As compared to the north-western region, Slovak nationals living in the Ostrava region are more interested in their own mother tongue or in the mixture of Slovak and Czech. As far as the Polish population is concerned, monolingual orientation decreased in the period 1987 – 1997 towards the mixture of Polish and Czech. In the areas of mixed nationalities such as in Cieszyn Silesia, the communication moves according to language habits, which may illustrate certain trends in the process of language assimilation. For Cieszyn Silesia, bilingual communication in family groups becomes a typical factor in the Czech part. Based on a poll carried out in 1998, this applies to 10.3% families in Czech population, 10.3% in Slovak population and 22.1% in Polish population (Hernová, Sokolová, 2000). For the Polish part of the analysed region we have not enough true information about the ethnic structure.

Relations of accessibility and capacity of the service system in the area of Cieszyn Silesia are not well balanced, which usually results from differences in socio-economic development. Technical obsoleteness resulted from numerous regional and local factors, which may be summarised in the opinion that the impetuous growth of industry was not able to assure proper conditions of service development. In this respect a special role was played by Cieszyn, which, for many centuries, was not only an administrational centre but developed also cultural, educational and trade functions. Also such towns as Fryštát[1], Frýdek-Místek and Skoczów developed this kind of activity. A bit later services developed in Český Těšín as an essential element of economic base of the town, and in Wisła and Ustroń tourist function developed (the latter developed also health-resort function). Monofunctional industrial centres such as Karviná, Orlová, Bohumín or Jastrzębie Zdrój developed service functions to a different scale. Unlike these towns, Slezská Ostrava[3] and Třinec were using the adjacent towns (Moravská Ostrava[3], Český Těšin) to provide for service needs of the inhabitants. In the post-war period, due to the extensive housing development and building reconstruction, Třinec was one of these towns, which showed the highest progress in the development of service sphere. Havířov gained the priority concerning trade function at the Cieszyn borderland, which resulted in the increase of its attractiveness. Some progress was also observed in other towns of the Cieszyn borderland, such as Karviná, Český Těšín, Frýdek-Místek and Třinec. Due to the liquidation of collective forms in trade network (Jednota-Jedność), rural districts in the wide area of Podbeskydí suffered most. Because of the liquidation of mobile shops, trade network in distant, small villages disappeared and the access to trade became very difficult especially for older groups of population.

Services of the higher order, i.e. education and culture, developed mainly on the basis of newly established universities and secondary schools. The branch of Uniwersytet Śląski (University of Silesia) in Cieszyn was set up in 1971 and the first university in the Czech part of Cieszyn Silesia – Slezská univerzita (Silesian University) – was set up in Karviná in 1990. University education started also in Jastrzębie Zdrój as the Centre of Didactic Education of University of Silesia was established there. This is contributed to also by museum and library institutions in Cieszyn, Český Těšín, Karviná, Wisła, Skoczów and Ustroń. These facts may be treated as a historical turning-point in the development of intellectual potential in the region. And still new institutions are being set up, e.g. College of Foreign Languages in Cieszyn. Very important in the region under study are also other services such as health service (well developed in Cieszyn, Ustroń, Karviná, Havířov, Frýdek-Místek and Třinec) and tourist service (Wisła, Ustron, rural districts of Brenna, Istebna, Koňákov[4] and Těrlicko).

1.7 Relations in the period of transformation

The transformation period in Cieszyn Silesia, in the present social relations, is a necessity, as this area succeeded to exploited and structurally deformed economy based on raw material-, energy- and labour-consuming technologies left by the socialistic regime. Production cycle was not finished in its terminal stage and therefore lost its contact with effective industries, which disappeared from the region. Underestimation of intellectual factors in material production and social self realisation as well as underestimation of natural and human potential was a large barrier for a faster progress.

Pre-requisites for rapid acceleration of economic and social transformation have not occurred yet. There is not enough investment, technical infrastructure is under-developed, there is a stagnation process of job exchanges according to the needs of labour market. There are no mechanisms of competition on the labour

[3] In 1941, Slezská Ostrava (Silesian Ostrava) and Moravská Ostrava (Moravian Ostrava) together with other 11 communes were connected into one administrative unit (town) of Ostrava

[4] The seat is an administrative part of Český Těšín

market. On the other hand, the hitherto restructuring activities in the Czech part resulted in the fact that employment in coal mines decreased reaching 1/3 of the value of 1998 and coal production was reduced from 17.8 million tones in 1990 to 12.4 million tones in 1998 (without CSM mine in Stonava). The biggest problem of economy transformation still concerns the so-called industrial giants in metallurgy production (Třinecké železárny in Třinec, Iron Smelters and Cable Factories in Bohumín, Plate Mills in Frýdek-Místek), even if the production and employment were reduced by more than a half. Significant changes in this respect were recorded in other industries. Despite a considerable reduction of activities in the sphere of heavy industry and the increase of services in national economy, the borderland still represents a significantly industrialised area with the traditional industrial structure (Figs. 2, 3).

1.8 Ecological relations

The key problems of Cieszyn Silesia, especially in its Czech side, include ecological problems. In the region studied, there is a considerable impact of different types of pollution from industry, which causes devastation of the natural environment on both sides of the border. Over-normative emissions have occurred here for many decades since the beginning of coal-mining. This impact intensified after World War II. Most of these impacts were of negative character and showed in anthropogenisation of all elements of natural environment. Human impact associated with industrialisation was most intensive in Karviná and Třinec. Destructive character of certain industrial activities is especially visible in such industries as coke industry, power engineering industry, chemical industry, which produce considerable quantities of wastes, solid and liquid material that are dumped on heaps and transported to watercourses.

Fig. 2. Market in Cieszyn. Photo: J. Pustelnik

Similar problems occur in Polish side of Cieszyn Silesia, where coal mining was reduced (liquidation or joining of coal mines in Jastrzębie Zdrój and Kończyce) on one hand, and on the other hand, a difficult process of transformation takes place in machine and electrical engineering industry, metallurgy or light industry. A gradual division of region's economy into three basic segments (agriculture, industry, services) is very important – in the Cieszyn district as many as 58.7% of the workers are employed in services.

The transformation process with not large enough number of jobs results in increasing unemployment whose rate exceeds 10%, especially in the Czech side of the region.

Apart from the Ostrava agglomeration, anthropogenic relief developed also in all western and eastern parts of the region. Development of large-scale depressions and heaps finished but their consequences are still bitterly felt. The basins of coal dust around the coal mine of CSA in Karviná and Doubrava disappear gradually and instead reclamation works of small scale, large-scale landscape reclamation in the mining area occurs.

River pollution is a long-lasting problem. At the beginning of the 1990s, some rivers belonged in Class 5 of water cleanliness – the Olza (Olše) R. from Český Těšín and the Lučina R. from Havířov. Such proecological activities as larger amount of wastewater subjected to purification, more efficient wastewater treatment

plants or increase of the importance of closed water circulation resulted in a considerable improvement of the cleanliness of river waters in the region. Now, Class 4 of water cleanliness includes the Ostravice River from Frýdek-Místek and the Olza (Olše) River from Karviná, and Class 3 includes the Olza R. from Třinec, the Lučina River from the dam in Žermanice and the upper course of Wisła R. with its tributaries.

Main producers of atmospheric pollution are the coal mine in Stonava, Iron Smelters in Třinec and the Power Engineering Plant in Dětmarovice. This concerns mainly solid pollution with dust aerosol of SO_2 and NO_x. In case of all these gases, their emissions were reduced by a half during the period from 1992-1997. Another problem, which has occurred recently, are mine gases from old, not-working exploitation fields. Forest areas are an indicator of emission and deposition activities. The forest area of Karviná still exhibits a decreasing trend in terms of coverage. On a larger scale of the Beskids Mountains, which have an essential tourist function and water management function for the whole borderland, the area of forests is observed to decrease.

The nation-wide interest in the solution of ecological problems develops slowly, but the reached results are not neglected. The most extensive surface devastations disappear gradually and the area restores its original use. Many harms were suffered by suburban agriculture, which is able to overcome difficult local conditions through reclamation. In future, one will have to take into account the increasing preference of ecological stimulators in all social and economic activities and their permanent importance for generations in the area studied.

2. Development conditions and transformation strategies of the Euroregion Cieszyn Silesia

The development of borderlands requires a specific approach due to their specific character. According to many authors these areas are subjected to numerous difficulties because of their location. The most often quoted barriers include their peripheral location towards political and economic centres of the country, large distance from main transport routes, not sufficient enough level of infrastructure. Moreover, poorly "permeable" borders considerably limit co-operation possibilities, which intensifies social-cultural differences on the both sides of the border. The unquestionable influence of a border on economic processes was investigated in numerous works. Many scientists point to a temporal range of border influence after it had been formally liquidated.

Recently, together with the liberalisation of border relations, new possibilities appeared. The increase of border permeability makes it possible to intensify mutual relations. This may result in a considerable increase of the dynamics of economy development. In this respect, local development is very important as it may activate areas, which are not recognised by regional or central authorities. The plans of regional development are the basis to define general functions and importance of these areas.

Euroregions are institutions, which support development of borderlands and intensify co-operation between the two sides of the border. Objectives of Euroregion are as follows:

- improvement of the every day life conditions of borderland population;
- intensification of mutual economic contacts;
- suppression of historical prejudices;
- cultural co-operation, etc.

The state border between Poland and Czechia established in 1920[5] disrupted the territorial unity of Cieszyn Silesia and the phase of "closed border" started. In fact, for the next 70 years, until the beginning of political-economic transformation of the countries in Central-Eastern Europe, the state border on the Olza and the Odra rivers set back the development of the borderland. Despite political declarations for the unity and co-operation of the former socialistic countries, the contacts between the border areas, especially families living on the two sides of the river, were very difficult.

At the beginning of the 1990s, the second phase of transformations (the phase of "filter border") in the borderland studied occurred. It showed liberalisation of transboundary movement, establishment of new border crossings, considerable increase of dislocations, and, simultaneously, equalisation of development possibilities of borderland areas, which used to be separated by an impermeable spatial barrier of the state border. Development impulses first go along transport routes, leading to road border crossings on both sides of the border. This phase undoubtedly occurs at present.

The phase of an "open border" is a perspective phase in the process of state border formation. This phase is identified with a situation of formal liquidation of the border when both countries join the European Union.

Two essential questions may be asked now:

- What type of processes are typical for the area of Cieszyn Silesia (identified here with the Euroregion) – processes of integration or disintegration?

[5] Czechoslovakia in 1920

Fig. 3: Town-hall in Český Těšín. Photo: J. Pustelnik

- What are advantages and disadvantages of both areas in the process of integration with the European Union?

The external integration relations include the process of developing regional labour markets based on hard coal mining, iron metallurgy, textile industry and railway transport in the 19th century. Such centres as Ostrava and Karviná were developing on the Czech side of the border and Cieszyn, Skoczów, and Bielsko-Biała on the Polish side. The location of Cieszyn Silesia in Central Europe plays an important role in the road and transport system.

Internal integrational relations include territorial compactness, regional awareness and cultural-education traditions

External disintegrational relations include political division of this area after 1920, and the internal relations of this type include local differentiation of socio-economic characteristics, especially differences in the process of post-war model of regional structure transformations (assumptions of development strategies).

Diagnosis of the territorial social system of Cieszyn Silesia shows considerable similarities of its both sides, especially in case of their economic base and the nature of population transformations. The transformations on both sides of the border:

- were realised in peripheral areas in relation to political and governing centre. This, surprisingly, either due to historical aspects, or level of the hitherto infrastructural development or cultural aspects, made the economic transformations easier;
- were based for many years on the predominating role of traditional industries (coal mining, iron metallurgy, machine building industry);
- because of the lack of sufficient local job opportunities, they required considerable dislocations in the form of permanent migrations or commuting to work;
- also influenced the need to prepare plans of spatial management including development of satellite towns or housing developments in old urban centres.

Apart from these similarities, there are also differences concerning e.g. population dynamics, development of services, role of agriculture in economy or social infrastructure. The restructuring activities, which were taken up earlier in the coal mining of Ostrava-Karviná industrial region, not only resulted in the liquidation of this industry from central region, but also smoothened the consequences of political-economic changes after 1990 (e.g. low unemployment). In Katowice region the situation was more complex, because delays in restructuring overlapped with the decreasing dynamics of socio-demographic development, unemployment problems and emigration abroad.

Both parts of the Euroregion represent essential components of the regional settlement system. On the Czech side, they compose an agglomeration system of socio-economic links with clear concentration in Ostrava. On the Polish side, the system of links is more complex. Two settlement systems of conurbation features occur there (Katowice and Rybnik) and also two important large subregional centres, which used to be capitals of the provinces until 1998 (Bielsko-Biała and Częstochowa). Therefore, side by side with the strong subregional

relations to the capital of Podbeskydí, the Polish side of Cieszyn Silesia shows numerous links with the Rybnik conurbation and also with the Katowice conurbation.

The following question appears here: Do these features suggest integrational or disintegrational character of the system studied? Although the establishment of the Euroregion occurred just several years ago, numerous transborder relations including family contacts have occurred here for many years. The differences in the post-war economic situation of Poland and Czech Republic caused numerous social migrations and migrations due to living conditions in the borderland area. These migrations intensified at the beginning of the period of liberalisation of custom regulations, i.e. at the beginning of the border stage as a "filter".

The economic links between the both sides of Cieszyn Silesia are weaker against this background and they decrease together with the decrease of the importance of coal mining as the main factor of development on the Czech side. The employed Polish citizens in these coal mines represent a small percentage of the employed total.

Based on the investigations, including interviews with the representatives of local authorities on both sides of the border it may be assumed that the Euroregion of Cieszyn Silesia is at the beginning of the process of economic-infrastructure integration. It is concentrated in the selected towns or areas and it decreases towards the external part of the border.

The second problem is identification of advantages and disadvantages of the Euroregion in the light of integrational processes with the European Union. The material studied shows that despite the multi-century long traditions of joined socio-economic development, the division of Cieszyn Silesia into two sides in 1920 caused a mitigation of relations between the both communities, intensified by strong internal urbanisation and migration flow from outside the region. After 1945, coal mining (Jastrzębie Zdrój, Karviná, Orlová), iron metallurgy (Třinec) and machine building industry (Cieszyn) became the main factors of economic development. Therefore despite some similarities of the main sectors of economy at the first stages of its transformation, it decreased later on and a supplementary function developed.

What are the possibilities of development of Cieszyn Silesia after widening the borders of the European Union? The border infrastructure and tasks fulfilled by this infrastructure will become useless. The recently decreasing market trade (including alcohol turnover) will disappear due to the process of equalisation of prices. Also, supplementary businesses will disappear (small-size catering facilities, currency exchange offices). The lack of the border will weaken the scale of the contemporary migrations connected with shopping and then it may influence the change of the position of poorly used recreation-tourist base on the both sides of the Olza River. More efficient promotion of the values of the region will be necessary as the neighbouring tourist regions have a more efficient base and a greater tourist movement. The contemporary forms (mainly information about different cultural-sports events organised mainly in Cieszyn) are not sufficient. There is a need of a regional tourist agency with differentiated forms of recreation-tourist services in the towns of Cieszyn Silesia, wider co-operation between the scientific-research institutions located on the both sides of the border (University of Silesia Katowice – Cieszyn, Silesian University Opava – Karviná, Silesian Institute – Opava), better promotion of the Cieszyn Library (known Książnica Cieszyńska) in over-regional environments, or more numerous interdisciplinary investigations of this area, at least in the light of the coming 85th anniversary of Cieszyn Silesia division. If the expectations concerning the data of joining the European Union in 2004 come true, it will be a good opportunity to assume studies balancing the socio-economic transformations of the Polish-Czech borderland at the contact of the Silesian province and the Moravian-Silesian region in the period of the recent 100 years.

The limitation of the role of the state border on the Olza and the Odra Rivers or its perspective liquidation will undoubtedly result in the further increase of spatial movement of the inhabitants, including also job migrations. The formation of the job market of the whole Czech-Polish borderland will require detailed investigations and undertaking of certain joint practical activities on the both sides of the Odra and the Olza Rivers. It is assumed that the joint economic policy and development of labour market are the most important and the most difficult tasks in the process of borderland integration. Non-existence of language problems and bilingualism of many of the inhabitants are additional factors favouring the co-operation, which puts Cieszyn Silesia in a better position than other Euroregions.

Good transport accessibility (including the condition of roads, the accompanying infrastructure and type and number of transport connections) is a factor influencing the spatial movement of the inhabitants of the borderland. The transit location of Cieszyn Silesia in Europe will extort in near future the integrated aspect of this region, where many road investments were taken, unfortunately still not enough as compared to expected integration consequences.

Taking into account the above prognosis, a similar situation may occur here as the situation of the

Katowice conurbation, which, during the last 200 years, transformed from two border regions into one. In case of the Katowice conurbation, this change resulted from some changes in the course of the state border, where this case concerns liquidation of the border.

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Authors´ addresses:

Dr. Franciszek KLOSOWSKI
University of Silesia Katowice
Faculty of Earth Sciences
Bedzińska Street 60, Sosnowiec
Poland
fklosows@wnoz.us.edu.pl

Prof. Dr. Jerzy RUNGE
University of Silesia Katowice
Faculty of Earth Sciences
Bedzińska Street 60, Sosnowiec
Poland
jrunge@wnoz.us.edu.pl

Assoc. Prof. RNDr. Radim PROKOP, CSc.
Silesian Institute of Silesiae Museum
Slezský ústav Opava
Nádražní okruh 31, 746 48 Opava
Czech Republic

Reviewer:

Prof. RNDr. Petr ŠINDER, CSc.

LANDSCAPE MICROSTRUCTURES AND THEIR FATE IN THE CENTRAL PART OF THE BOHEMIAN-MORAVIAN UPLAND

Pavel TRNKA

Abstract

The role of small-area landscape structures (microstructures) in the agricultural landscape, which originated in the period of small-scale production and extensive management as a "secondary product", is examined in this paper. Such structures represent striking elements peculiar to the landscape and frequently determining its original character. At the same time, they function in the landscape as a fine web of stabilizing effects, as a valuable testimony to the efforts of whole generations before us. Therefore, their presence or absence can be one of the criteria in evaluating the condition of our cultural landscape. Comparison of two model areas in the region of Vysočina (Upland) can document their often diametrically different fates.

Shrnutí

Krajinné mikrostruktury a jejich osud v centrální části Českomoravské vrchoviny

Příspěvek poukazuje na roli maloplošných krajinných struktur (mikrostruktur) v zemědělské krajině, které vznikly v období malovýrobního a extenzívního hospodaření jako „vedlejší produkt". Představují pohledově nápadné prvky, které krajinu ozvláštňují a mnohdy spoluurčují její svébytný ráz. Současně fungují v krajině jako jemné předivo stabilizujících účinků a jsou cenným svědectvím o úsilí celých generací před námi. Proto jejich přítomnost či naopak absence může být jedním z kritérií v hodnocení stavu naší kulturní krajiny. Srovnání dvou modelových území v kraji Vysočina dokumentuje jejich mnohdy diametrálně rozdílný osud.

Keywords: *cultural landscape, landscape microstructures, scattered greenery, land consolidation, agricultural land decline, restoration process, Bohemian-Moravian Upland, Czech Republic*

1. Introduction

Activities of man occur within a certain primary landscape structure created by nature and using its natural potential. Thus, a secondary landscape structure originates (characteristic land use pattern) which is an important attribute of the landscape system since it is at the same time a bearer of ecological and aesthetic properties of the given territory. However, the landscape has another attribute – memory. Landscape's memory refers to more or less obvious reflections of the former appearance of the landscape resembling the time/space continuity of all processes occurring in it. Therefore, the landscape can be compared to a mirror faithfully reflecting the condition of the society and people inhabiting and managing it. By means of the study into the past and into relatively recent changes occurring in the landscape we can understand the present condition of the landscape which is only a momentary time cross-section. It was primarily farming which has shaped the landscape into the appearance which is often called euphemistically a ***cultural landscape***.

2. Origin and development of the cultural landscape of the Bohemian-Moravian Upland

Beginning of the birth of the cultural landscape in the Czech lands can be situated into the period of Neolithic Age roughly 7000 years ago in the middle of the postglacial climatic optimum – Atlanticum (8000 – 6000 years B. P. – before present, in terms of Ložek, 1973). Then, the first bearers of the Neolithic agrarian culture peregrinating upstream the Danube and its tributaries got to the region of Moravia. At that time, the landscape of southern Moravia was (with but small exceptions) overgrown with continuous climax forests. This exception consisted of the last enclaves of steppes and forest steppes on loess plateaus with chernozem soils persisting from the previous climatic period (Boreal). Just there, the first farmers settled thereby triggering the revolutionary process of the landscape cultivation by humans. Neolithic farmers and their followers felled and burned forests to gain fields, pastures and space for their seats. These newly arising landscape elements differentiated the original forest landscape enriching it

not only with the cultural species of commercial plants and domesticated animals but also with the wildlife and flora of a "cultural steppe" (among other things with the first segetal and ruderal species). The extent of the territory colonized and cultivated by humans in the course of millenniums increased, however, it was limited to the most fertile and climatically most favourable regions for a long time – so-called ***old cultural (colonized) areas*** (Moravian grabens, the Elbe river basin /Polabí/, the lower Moldau river basin /dolní Povltaví/ and the Ohře river basin /Poohří/). It was only in the early Middle Ages (12th – 14th century), during a so-called inland colonization, that the human civilization spread to ***new cultural (colonized) areas*** – upland and submontane regions and thus also to the Bohemian-Moravian Upland.

The area of the Bohemian-Moravian Upland (to a great extent corresponding to the present administrative unit – the region of "Vysočina" – Fig. 1) was colonized in its central part not until the second wave when all areas with more favourable climate and soil had been already colonized. With the exception of commercial provincial paths and their guards the landscape was covered predominantly with beech – and higher altitudes with fir/beech virgin forests. The colonization spread from several centres (the most important of them being the Žďár monastery of the Cistercian order – documented as of 1252) in the form of burning local forests in place of which fields and pastures came to existence and agrarian settlements and fortresses were established. The process of deforestation and the establishment of settlements continued until the mid-18th century. A frequent motive to appropriate these areas little favourable for farming was extraction and processing of minerals, silver ore in the region of Jihlava, iron ores in the Žďár region. At the beginning of the 16th century, metallurgical technology was improved by using charcoal furnaces, which resulted in the increased consumption of beech wood produced in charcoal kilns. Unusual development of glassworks dependent on the same source of energy contributed to the decline and fragmentation of local forests. As a result of the changes, the so far enclosed landscape scenery represented by the extensive forest complexes could suddenly offer an opened view (Bukáček, Matějka, 2000).

This important stage in the development of the landscape near Žďár related to iron metallurgy was definitely finished due to the use of standard coal in the second half of the 19th century. Surprisingly, even in this busy period more serious disturbances in the landscape ecological stability did not occur. Also, memory structures of the landscape worked as well as their potential to regenerate a previous condition (with the exception of the original species composition of forest stands). This is why the traces after ferrous metallurgy

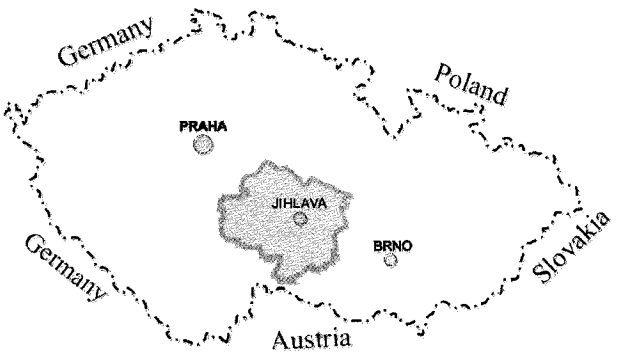

Fig. 1: Area under study.

have been almost wiped off and only old residents and experts know localities affected by mining (e.g. numerous mine pits in the forests) or slag heaps in the terrain.

Only the 20th century brought more radical changes into the local country. The landscape's character was shaped by the gradual growth of towns, building of factories, roads and energy networks. Open forests originally dominated by broadleaves were converted to fast-growing and high-yielding monocultures of conifers (Norway spruce) already some time ago. Thus, the landscape used for agricultural purposes did not markedly change, however, the area of fields was increased at the expense of meadows and ponds. Moist plots were used for meadows only locally drained by shallow rills. Stony plots with shallow soils served as pastures. The landscape was virtually interwoven with a network of rural roads (sporadically with alleys of fruit trees) and watercourses accompanied by riparian stands. Small-scale husbandry provided to the agricultural landscape the appearance of the colourful mosaic of plots and spots, picturesque at sight and generally relatively balanced and stable. The landscape which was not stressed by modern chemical preparations was a good home for a number of butterfly species and other pollinators, birds and small field game. Balks housed a myriad of colourful flowering herbs and shrubs. Yet it was no idyll as poverty forced the local population to a really thorough exploitation of the modest landscape's productive potential up to the last grazed balk. Nevertheless, a place remained there also for so-called ***landscape microstructures*** which, on the one hand, originated as the secondary product of human activities and, on the other hand, as a product of the landscape's regeneration potential.

3. The fate of landscape microstructures

What can be considered a landscape microstructure? The heterogeneous set can include various small-area elements, namely diverse forms of scattered greenery. ***Dispersed permanent greenery*** was concentrated along farm-tracks and country roads also accompanying

small streams. Outcrops of the bedrock provided for the existence of tree groups, groves or game refuges. The most frequently occurring microstructure were grassy balks copying the pattern of field arrangements bearing a surprisingly low coverage of continuous woody vegetation at that time, rather only soliters and clumps of fruit trees as balks were usually mown and sometimes also grazed. Another important microstructures are ***ecotone margins*** of the forest mantle, at higher altitudes usually created by deciduous trees and shrubs contrasting with their foliage colours on the dark background of the spruce monocultures in autumn. A microstructure still typical of the Vysočina region are ***stone walls*** mainly of a linear character on the boundaries between the plots or even within the plots still existing in the form of heaps of gathered stones. In the vicinity of villages or right inside their intravillans, drystone walls are used to fence the individual plots. Landscape microstructures can also be considered purely ***human artefacts*** such as field roads, paths, agrarian terraces, historical boundary demarcations, small sacral structures and other "identification signs" forming the landscape's character.

In strict terms, it is also adversely functioning microstructures that belong in the group – new wounds and only partly healed scars made to the landscape by environment-unfriendly human activities, e.g. quarries, loam pits, waste dumps, field dunghills and other devastating elements. While the number of elements of the last-mentioned group rather increases, ecological and culturally-historical valuable elements begin to disappear from our landscape during recent decades. It is particularly the activities with beneficial effects on the existence of the structures that had been observed to stop. Rather than being endangered by direct liquidation, they are impacted by an increasing abandoning of cultivated land due to the down-sizing of agriculture. The study of changes in landscape microstructures is important to understand the complex and often inconsistent historical development of the Bohemian and Moravian landscape. According to historical maps, photographs and later also aerial photographs, the rural landscape of Vysočina used to be characterized by a mosaic of fields, meadows and pastures combining with isles of forests and village settlements occurring along roads and watercourses till the mid-50s of the last century. The landscape microstructures were evidently tended (mown or grazed balks and road ditches) thus creating a favourable impression of a properly treated and moreover sufficiently stable landscape. This somewhat idealised condition of the landscape continued till the start of socialist collectivization at the beginning of the 50s of the 20th century. The originally rational need to increase the area of land, particularly of arable land, to use mechanization changed to a brainless political target lacking professional self-control and finally even the sound common sense. A seemingly effective conception to produce fodder for livestock on arable land which was moved from pastures to shady large-capacity cowsheds became a disaster for meadows originally rich in species. They were not counted with any longer and, therefore, they were drained on a large scale and subsequently ploughed. Hardly accessible meadows inattractive for large-scale production were left as fallow land gradually changing into forest. Together with meadows, there were other "obstacles" to the mechanized agricultural mass production that gradually disappeared.

The period of collectivization of Czech agriculture was characterized by extensive strips of land, stream regulation and ploughing of permanent grasslands. Undesirable unification of the rural landscape occurred on a greater part of the Czech territory with all environmentally adverse consequences. Many ecologically valuable habitats such as small ponds, hedges, stone walls, game refuges and peasant (grassy) orchards lost their economic significance for modern agrarian technologies, frequently becoming even an obstacle and being therefore abandoned or completely removed. At the end of the 70s, the transformation of traditional, originally varied and multifunctional rural landscape into a single-purpose production area culminated in our country. This planned process of new structural and organizational changes in the landscape affected virtually the whole area of the Czech Republic (Lipský, 2001). Namely lowland areas with fertile soils used by farmers already for millenniums were systematically "cleaned" and their structure simplified. The following (Tab. 1) overview offers a possibility to compare a rural landscape traditionally used by small-scale agriculture with a landscape cultivated by large-scale farming practices based on some parameters of landscape management.

In the actually existing landscape, all traits mentioned above will obviously not occur at the same time and in such a striking form. Nevertheless, it is quite evident that only a sufficiently diverse and multifunctionally used landscape offering enough free niches for wildlife species will provide for their return to the cultural landscape. Only then there will be relatively advanced communities starting to develop in the landscape through natural processes of regeneration or with the assistance of humans (controlled succession), which will become centres of ecological stability favourably affecting functions of the landscape as a whole.

4. Comparison of two model areas

The simplification of the rural landscape did not occur everywhere in the same intensity. Under natural conditions of the Bohemian-Moravian Upland, it affected particularly plateaus, widely opening valleys and river

floodplains while sloping land areas retained (at least at some places) their traditional looks of fine-grained structure of both used and unused or only sometimes used areas. The different fate of the landscape and its microstructural elements can be demonstrated on an example of two model areas from the former district of Žďár (Fig. 2): ***Měřínsko*** (partial watershed of the Balínka River) and the ***Fryšávka river watershed***. Although the two areas under comparison somewhat differ in their primary landscape structure (Měřínsko is situated in the central, more planated part of the Vysočina region, the Fryšávka watershed is a part of the Žďárské vrchy Highland with more broken topography), they entered the period of collectivization with a similar small-scale structure of striped fields with a frequent occurrence of agrarian, erosion-control balks and stone walls, combined with a colourful mosaic of valley meadows and some pastures. Extensive complexes of coniferous forests on watershed ridges created a vista on the horizon. Unregulated watercourses were bordered by nearly continuous stands of willows and alders. Aerial photographs from the 50s show a surprisingly low proportion of dispersed greenery which was rather of a point character. The area of unused or unusable plots was small. The further development of the two landscapes under comparison occurred already according to different scenarios.

4.1 The case study of Měřínsko (Měřín region)

The studied area of Měřínsko occupies about 50 km^2 at altitudes ranging from 450 to 690 m a.s.l. A greater

Traditional (harmonic) rural landscape	**Contemporary (intensively used) rural landscape**
structural heterogeneity (diversity) of multifunctional landscape	structural homogeneity (invariability) of monofunctional landscape
small-area structure of use enabling the existence of an interlinked network of biotopes	large-area structure of use with barrier and isolation effects for the biota
large number of diverse landscape elements, fully functional	limited number of more resistant landscape elements with endangered existence
spontaneously developed mosaic character of near-natural and cultural biotopes	intentionally developed uniform monotony of cultural biotopes
functional and visual harmony of landscape character (positive perception of aesthetic values of the landscape)	functional and visual disharmony of landscape character (contradictory to negative perception of the landscape)
occurrence of near-natural ecosystems in addition to unstable agroecosystems	absence of stable ecosystems, predominance of unstable agroecosystems
high species diversity in semi-natural ecosystems	impoverished species diversity in disturbed ecosystems
favourable ecotonal effect (interactivity of numerous species across the ecosystems)	negligible ecotonal effect (low-interaction neighbourhood of several species across unstable ecosystems
numerous specialists (stenoecious species on oligo-mesotrophic ecotopes	several ubiquists (euryecious species) on eutrophic to hypertrophic ecotopes
limited competition of specialists in separate niches, presence of antagonists and symbionts	expansive competition of euryecious species, absence of their antagonists
low-loss nutrient cycles in near-natural ecosystems providing non-wood-producing functions	high energy and nutrient-loss agroecosystems dependent on additional external inputs providing high production of biomass

Tab. 1: Some structural and functional contrasts between the traditional and contemporary (intensively used for farming) rural landscapes (Trnka, 2000)

Fig. 2: Map of the former Žďár nad Sázavou district with marked areas under study

part of the area is taken up by the Měřínská kotlina Basin with the relief of flat hilly lands bordered by the pronounced ridge of the Arnolecké hory Mts. in the North (with the highest peak of Dědkovská hora Mt. – 694 m a.s.l.), in the South changing into the broken Velkomeziříčská pahorkatina Hilly land with characteristic outcrops of syenite blocks (Hrádek, 1978). Draining axis of the whole area is the Balínka River with both regulated and freely meandering reaches of the stream. Soil cover is dominated by oligo-mesotrophic cambisols, gleyed in depressions and endangered by erosion on slopes. With respect to climatic aspects, the region is cold (mean annual temperature 5.5 – 6.5°C) with higher precipitation (700 – 800 mm). Although the conditions of agricultural production are rather below-average, agricultural land occupies 72 % of the area with the percentage of arable land being high (77 %) and forest coverage amounting to only 21 %.

The landscape of Měřínsko (Fig. 3, Fig. 4) had to absorb several stages of land consolidation the last of which occurring in the mid-70s was characterized by the creation of extensive stripes of arable land (Fig. 5, 6 - see cover - p. 3). Related technical measures consisted in the removal of all obstacles preventing the smooth operation of agricultural machines. This resulted in the development of enormously large blocks of land (the largest maxifield was 258 ha – Fig. 7), thereby requirements were fulfilled of the socialist regime to intensify agricultural mass production, however, with no regard to the appearance and non-productive functions of the landscape. Already at that time, the implementation of land consolidation brought about discussions in the expert public due to their extent and form. The most marked criticism of experts occurred in the study written by members of the former Geographical Institute of the Czechoslovak Academy of Sciences in Brno (Buček, Ungerman et al., 1978). What were the concrete consequences of this land consolidation that was insensitive and not friendly to environment?

1. *Effects on the landscape relief*

– Large-scale disturbance of the Velkomeziříčská pahorkatina Hilly land topography (relief planation, removal the typical outcrops of syenite rocks and boulders at exposed places, filling of the shallow

Fig. 3: Village of Měřín in 1936 (old postcard)

Fig. 4: Village of Měřín in 2004 (highway D1 with noise-proof barriers). Photo P. Trnka

valleys, removal of 385 erosion-control anthropogenic agrarian elements /particularly balks/ at a total length of 54 km).

2. *Effects on the water cycle*
- Straightening and further recess of streams, accelerated runoff, pipe-lining of small watercourses /at a length of 5.4 km/ (according to SMS data – now Agricultural Water-Management Administration Brno, some 53.14 % of the total length of watercourses were regulated in 1994);
- Large-scale drainage of lands and subsequent loss of the retention capacity of soils, landscape xerotization;
- Reduction of retention areas in alluvial plains as a result of abolishment (plough up) of permanent grasslands, increased flood risk and silting of recipients.

3. *Effects on the soil*
- Starting of the process of accelerated erosion due to the creation of extensive and ill-shaped plots exceeding the limiting length of slopes;
- Soil compaction by heavy mechanization reducing precipitation seepage and supporting surface washing.

4. *Effects on biotic components*
- Liquidation of dispersed greenery (4,232 trees and nearly 6 ha shrubs) and reduction of permanent grasslands;
- Drastic reduction of biodiversity at all levels (genetic, generic, ecosystem).

5. *Effects on the landscape as a whole*
- Extensive denaturalization (removal of natural elements/formations from the landscape);
- Simplification and uniformization of the landscape (loss of landscape diversity and character, unnatural unification of different landscape units and types);
- Ecological destabilization of the landscape with plough-up amounting to 80 %.

6. *Effects on the agricultural use of the landscape*
- Disproportional enlargement of arable land blocks (extreme example can be a strip of land sized 257.58 ha);
- Heterogeneity of soil and moisture conditions within the new fields, hampering management practices and reducing yields;
- Problems caused by the passage of machines across lands where roads were abolished.

7. *Effects on the recreational use of the landscape*
- Loss of the landscape attractiveness for recreation activities (disturbance of the landscape character, reduction of aesthetic and landscape-forming elements – Fig. 8 – see cover - p. 4);
- Evident impairment of the landscape passability (no roads), making intimate contacts of humans with the landscape impossible;
- Loss of "human dimensions" of the landscape, disappearance of important identification signs in the landscape (e.g. small sacral structures, boundary demarcations);
- Impaired historical integrity of rural landscape. Already after several years, many land properties were markedly damaged by erosion and Agricultural Cooperative Měřín began to ponder on remedial measures while at least some of them had to be implemented at considerable financial costs. Even at today, after nearly 30 years, it is possible to claim

Fig. 7: A part of the consolidated maxifield (258 ha). Photo P. Trnka

that consequences of land consolidation are still obvious in the local landscape. Most of the lands are affected by water erosion. Farmers try to face it by means of grassing the most threatened plots. The sward typically returns to the same place after years, i.e. into terrain depressions and alluvial plains. What can we do in such a landscape to improve its unsatisfactory condition? Short-term but easier measures such as environment-friendly agrarian technologies or more varied range of crops are in the hands of farmers. In strictly economic terms, the large-scale field structure of agricultural land resources is in fact convenient for the newly established joint-stock company (Agro Měřín, a.s.), but in the near future, the orientation towards a reduction of negative externalities and non-production functions of agriculture will be definitely forced in anyhow.

Measures to be adopted with respect to long-term planning will be as follows:

- To divide the extensive fields of arable land by means of stable elements and to use the already worked out general plan of the local territorial system of ecological stability for the region of Měřínsko;
- To reconstruct or build new field roads which could fulfil the function of interaction elements after plantation of linear greenery;
- To improve runoff conditions and retention capacity of the watershed through the revitalization of watercourses and their immediate vicinity, building of collection and interception ditches, and renewal of formerly abundant small reservoirs.

The efforts to rectify unfavourable conditions of the rural landscape are supported both by the Czech government and EU although these measures are very costly and their positive effects will show only after several years. However, if we want to see a cultural landscape which has preserved its specific character in analogical natural conditions, we can visit the ***Třebíčsko Nature Park*** only 10 km south of Měřín (Fig. 9, 10). A more favourable fate affected a more distant watershed of the Fryšávka River, right-hand tributary of the Svratka River.

4.2 The case study of Fryšávka

Since the 1970s, the Fryšávka watershed landscape ranks among traditional areas attracting the attention of experts of diverse scientific lines. Thanks to Professor Vaníček the phenomenon of cultural rural landscape of high scenic charms has become known even abroad and the area was recorded into the Green Book of Outstanding European Landscapes (IUCN, 1978). Natural characteristics of the whole watershed (about 67 km^2) and evaluation of its importance can be found in a comprehensive study (Vaníček et al., 1985) and also as a re-edition in a paper published by the Environmental Regional Centre "Prameny Vysočiny" (Rouš [ed.], 1995). This paper includes only indications of developmental trends which manifest themselves in a comparison with the initial condition of the 1970s.

The Fryšávka watershed was affected by collectivization practices a little later and only partly particularly in wide open valley reaches, in the upper reaches along the village of Fryšava and then in the central reach

Fig. 9: The Třebíčsko Nature Park (15 km south of Měřín): Aerial photograph shows an abundance of well preserved landscape microstructures (www.horacko.cz)

near Sněžné. However, steep sloping plots have often preserved their traditional appearance of fine-grained structure of used and unused areas, viz. overgrown stone walls, small watercourses, accompanying vegetation, meadows rich in species and pastures with isles of spring areas under slopes complemented by larger or smaller segments of farm forests. General character of the landscape evokes the impression of a historical relict which has been preserved in spite of all historic peripetias until the present time. It is precisely this face of landscape that is today thought desirable to be maintained both with respect to ecology and aesthetics (Fig 11 – see cover p.4, Fig. 12).

The high representation of ecologically valuable landscape elements obviously relates to largely extensive agriculture in conditions already marginal and with a conservation regime in the Žďárské vrchy Protected Landscape Area (PLA). However, we cannot expect the high natural and aesthetic value of the beautiful landscape to be maintained automatically without human effort. In the intensively used rural landscape, small

Fig. 10: The Třebíčsko Nature Park: occurrence of dispersed greenery is bound to the outcrops of syenite boulders. Photo J. Sucharda

elements of the landscape structure left to their own fate soon become a subject to the pressure of stressing factors from neighbouring unstable areas. On the other hand, in a landscape with suppressed economic activities, the spontaneous process of secondary succession occurs as an outer expression of the development of landscape structures in the course of time.

Down-scaling of agricultural activities namely in the ***less favoured areas (LFA)*** where the Fryšávka watershed belongs in would triggers a ***restoration process*** directed in our climatic conditions to the stabilization of forest ecosystems. Succession processes with regeneration effects predominating in such a landscape are as follows:

- microstructures of grassy balks and herby fallow lands gradually disappear;
- originally small patches of dispersed greenery expand melting into larger areas;
- linear elements become denser and stone walls disappear under full-grown trees and shrubs;
- boundaries between contrasting plots disappear and ecotonal transitions come to existence;
- pre-forest stages of tree species emerge on abandoned meadows and pastures;
- expansive ruderal plant species often predeminate on derelict arable land, hampering a further development towards post-agrarian fallow lands;
- ruderalization tendencies are observed even in grasslands of alluvial plains.

All the above mentioned processes were observed in the Fryšávka watershed in the course of the 90s. Seen by eyes of ecologists and naturalists, the improved biodiversity could be valued as a positive phenomenon but the period of time is too short to make final conclusions. Problem consists in the fact that these processes occur in the landscape spontaneously while they should be controlled by humans. Farmers will logically have a different view of such a development, considering the undesirable desolation of the formerly cultural landscape a consequence to the sad economic situation of Czech agriculture and current agrarian policy.

5. Discussion

Sometimes we can hear an opinion that preservation of well-balanced cultural landscape, particularly in piedmont and upland regions, is an example of intuitive ecological feeling of former generations. Insensitive interventions into the natural character of the landscape were made also in the past but they occurred over long-term periods their extent being limited. Nature was therefore able to eliminate them or absorb them after a certain time. If we wish to conserve traditional features of the rural landscape which have been -at least at some places- preserved until these days, we have to look for a compromise, i.e. for a conformity between the seemingly conflicting requirements:

- To preserve environment-friendly agriculture in the landscape (e.g. integrated forms of growing systems or organic farming);

Fig. 12: Contemporary land use pattern in the Fryšávka River valley near the village of Nový Jimramov – on the grassy slopes (formerly fields) there are visible lines of stone walls with trees. Photo P. Trnka

- To make it possible for people to move freely across the landscape (to assure passability) and to perceive its aesthetic values;
- To ensure concerns of nature and landscape protection particularly to conserve or increase biodiversity.

Traditional agricultural systems that have created landscape with numerous enriching elements required a considerable input of skilled labour which is now missing. If the rural landscape is to be visually colourful, ecologically valuable and with its historical integrity preserved, it is necessary that the society awards the farmers properly for their care of the landscape in the form of additional compensations. In marginal regions, aspects of landscape protection/conservation can prevail over the production functions which can be guaranteed only by thoughtful agrarian policy in close coordination with environmental strategies. In this respect, an inspiration is offered by the approach of EU countries to the support of countryside development and conservation of cultural and historical values of the rural landscape. So-called ***Agri-environmental programmes*** become one of the priorities of Common Agricultural Policy their introduction being obligatory also for Czech Republic. Within the framework of the ***Programme of Preservation of the Landscape*** the Czech Ministry of Environment supports a return of polyfunctional dispersed greenery into the landscape, maintenance of the landscape in a good cultural condition and restoration of biodiversity in the form of subsidies and grants. The Žďárské vrchy PLA Administration runs recruitment campaigns to win farmers to participate in the projects but the so far results show to be only a partial success.

6. Conclusion

The fine network of landscape microstructures such as grassy balks, lines of shrubs and trees on stone walls, herby fallow land on extreme sites, overgrowing field roads with lines of fruit trees, old high-stem orchards and wetland herb-rich meadows are elements which used to be an integral part of the Vysočina region before the 1950s. It would be rather simplifying to consider them an anachronism, a product of small-scale farming methods which would have no place in the contemporary landscape used for agriculture.

In the period of "cleaning operations", these traditional microstructures irreversibly disappeared from many regions (see Měřínsko). However, sooner or later, they will have to be substituted by other, namely eco-stabilizing elements (e.g. within the local TSES) at a considerable cost. In localities where the typical picture of the Vysočina landscape has been preserved until these days (and these microstructures are most important for perception), the present situation is slightly better (see Fryšávka). Changes in the socio-political situation and the introduction of market criteria showed on the face of the rural landscape in marginal conditions inconsistently, rather adversely – by desolation of the landscape. Let us hope that the typical scenic beauty of Vysočina will be successfully preserved with a substantial help from various supporting programmes both for us and for future generations in its real appearance not only on the canvases of landscape-painters or on yellowing photographs in archives.

Acknowledgement

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Author's address:

RNDr. Pavel TRNKA, CSc.
Mendel University of Agriculture and Forestry
Dept. of Landscape Ecology, Faculty of Agronomy
Zemědělská 1, 613 00 BRNO, Czech Republic
e-mail: trnka@mendelu.cz

Reviewer:

Assoc. Prof. Ing. Jan LACINA, CSc.

THE WARSAW REGIONAL FORUM 2004

Antonín VAISHAR

In October 2004, Stanislaw Leszczycki Institute of Geography and Spatial Organization of the Polish Academy od Sciences held an international conference "Central and Eastern Europe: Changing Patterns of Human Activity". An impuls to organize such an event was the growing efficiency of a considerable amount of bilateral cooperations of the Institute with its partner institutions in central- and east-European countries, namely the cooperation of the host Institute with the Centre for Regional Studies of the Hungarian Academy of Sciences.

The Conference was preceded by an excursion to north-eastern Poland neighbouring with Belorussia. Its route was directed in the Białowieża Primeval Fores (Puszcza Białowieska) which is an example of the only one lowland virgin forest in Europe protected in such a way enlisted in the UNESCO world's heritage. Furthermore, the region is attractive and shows developing tourism. The excursion continued through borderland areas characteristic by unfavourable economic development, depopulation tendencies and occurrence of national and religious minorities. A certain regeneration is expected by the regions from more intensive cross-boundary contacts with Belorussia, which might stimulate the sector of services. The excursion was complemented with a round-tour through the centre of the region, the town of Białystok.

The Conference was attended by some 50 geographers and experts in regional issues from 14 countries, who presented over 40 papers at general meeting and in two parallel sections. Regarding a very good position of the organizing Institute in European geography, the participation of experts from foreign countries was relatively high. The presented papers expressed a wide range of problems namely of humane geography of which many responded to current development after the accession of new countries including Poland in the European Union. Some papers were focused on analyses of transformation and post-transformation phenomena in the respective countries, and the last group of papers informed of concrete regions or towns and their problems. A reasonably set-up programme provided enough space for a relatively ample discussion. The Conference was closed with a panel discussion

Fig. 1 : Typical rural housing area in north-eastern Poland. Photo A. Vaishar

on "Regional policy after enlargement of the European Union". The success of the event was undoubtedly contributed to by excellent organization and hospitality of colleagues from the host Institute.

Ambition of the Conference was to lay founda tions for a new tradition of similar events organized in Central and Eastern Europe. The next conference of the series is to be held in Hungary in year 2006. It is assumed that the development of such a tradition would have a considerable contribution for the contacts of Central-European geographers with their colleagues from both Eastern and Western Europe.

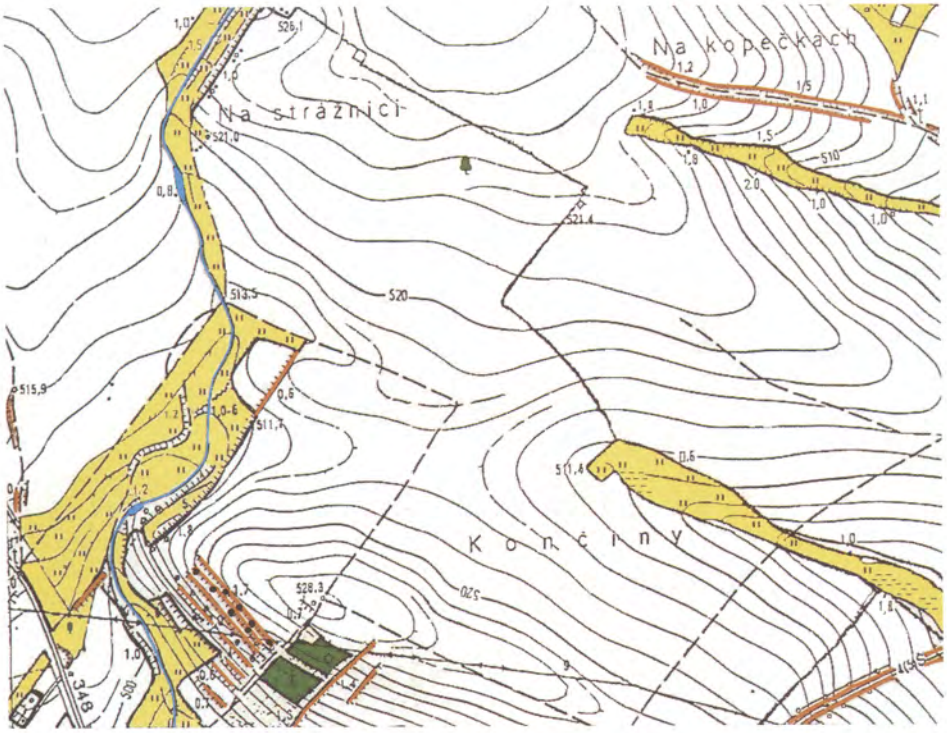

Fig. 5: Example of map segment: land use and microstructure elements – situation before the land consolidations (1962).

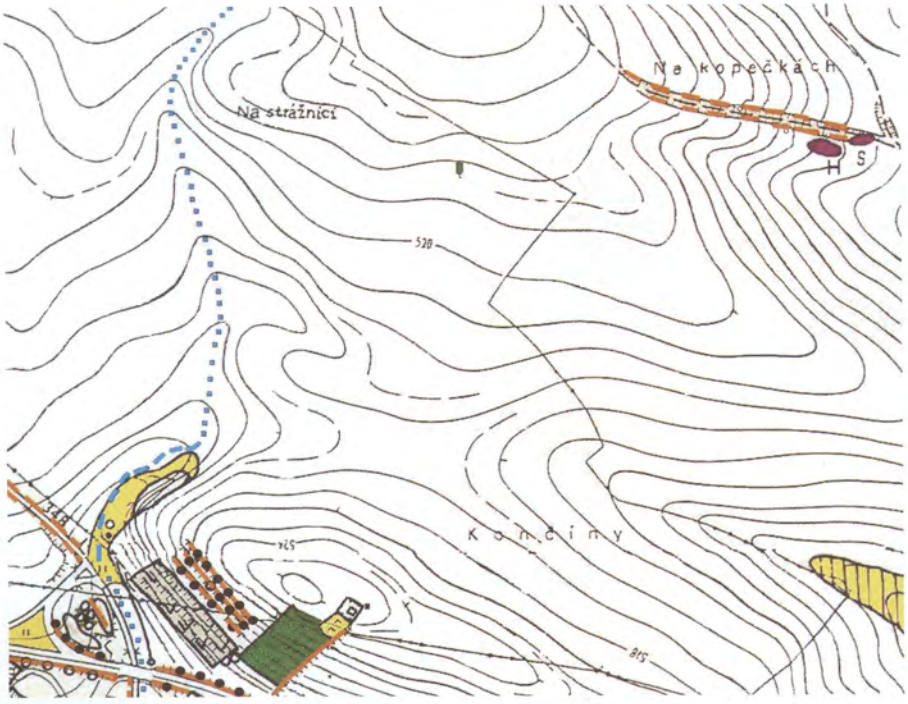

Fig. 6: Example of map segment: land use and microstructure elements – situation after realization of the land consolidations (2003).

Legend to the Figs. 5 and 6:

- *Near natural herbaceous linear communities*
- *Near natural herbaceous linear communities with open canopy of tree species*
- *Ruderalized herbaceous linear communities*
- *Non-regulated watercourses*
- *Regulated watercourses*
- *Piped Watercourses*
- *Shubs and trees*
- *Solitary tree*
- *Water surfaces*
- *Water-logging of mapped units*
- *Ruderal areas: H - dung pit, S - dump*
- *Cultural grasslands*
- *Grasslands and pastures under extensive management*
- *Forest and game refuges*
- *Gardens and small-scale orchards*
- *Arable land*

Illustration to Trnka`s paper.

Fig. 8: The Měřínsko study area: the contemporary rarely preserved microstructural elements.

Photo P. Trnka

Fig. 11: Typical scenery of rural landscape in the Fryšávka River catchment.

Photo P. Trnka

Illustrations to P. Trnka's paper.