

## Post World War II development and present state of non-forested area at Zhůří – Hutská hora Mt.

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### Abstract

A reconstruction has been made of the post World War II changes in land use/land cover within the Zhůří – Hutská hora Mt. enclave, an area of secondary grassland on the Kvilda Plains in central Bohemian Forest, with respect to the history of its management. The evaluation of the last fifty years development is based on a quantification of changes identified by visual interpretation of a time series of aerial photographs, and by field surveys. Among seven monitored categories of land use/land cover, significant expansion occurred of the forest-covered area, from 21.5% of total area in 1949 to 35.9% in 2000. Within the same period, the secondary grassland area shrank from 54.6% to 43.5%. These changes resulted from natural regeneration processes, which started as a consequence of either complete abandonment of agricultural land, or reduced intensity of management of the remaining grassland plots. The rate of these changes was enhanced by the neighborhood of Norway spruce (*Picea abies*) forests, and also by the climatic conditions favoring the growth of seedlings of this tree in mountain habitats.

*Key words:* land cover, land use, aerial photography, secondary grassland, secondary succession, Bohemian Forest, human settlements, military area, medieval history

### INTRODUCTION

Even though the first human influence on the natural ecosystems in the Bohemian Forest goes back to the Bronze Age, about 2000 BC, and is related to the trade trails crossing the mountains, the main human impact on deep forests covering the Bohemian Forest mountain range started in the Middle Ages (BENES 1996). The first extensive colonization of the highland region of Kvilda Plains in central Bohemian Forest took place after the Thirty Years War (1618–1648) and was combined with extensive human impact on the mountain nature. Woodcutting for heating in local glass manufactures and for timber use and trade then became the main activities of the local population (ALBRECHT 1979). Deforestation culminated in the 18<sup>th</sup> and 19<sup>th</sup> centuries. The new clearings started to be cultivated or managed as grassland, predominantly by regular mowing for hay and/or as pastures. Agriculture, which at first started just as a marginal human occupation in the Bohemian Forest, gradually became the main basis of the poor mountain crofters' livelihood. This change occurred along with the gradual decline

of earlier traditional human activities such as gold washing and mining, trade on the so-called Golden Trail, and glass manufacturing, in the 16<sup>th</sup> to 17<sup>th</sup>, 18<sup>th</sup> and 19<sup>th</sup> centuries, respectively. Although agriculture played only a secondary role in local economy until the beginning of the 20<sup>th</sup> century, it did significantly change the landscape structure and gave rise to relatively large areas of secondary grassland in the Bohemian Forest (PRACH & al. 1996).

This paper provides a brief description of the historical development of land use and management within the Zhůří enclave, situated on the Kvilda Plains and occupied by secondary grassland. The main attention is paid to the last fifty years, the period for which a time series of aerial photographs is available. On their basis, it has been possible to quantify the changes in land use/land cover and relate them to the present-day state of this secondary grassland. The paper provides information complementary to the results of the research project carried out in the Zhůří enclave between 1997 and 2001 (see MAŠKOVÁ & al. 2001, and other relevant papers in this issue of *Silva Gabreta*).

Topographic Czech/German nomenclature follows ZÁRUBA & KOBLASA (2000).

### **Long-term history of land use**

The oldest records of human activities in the Bohemian Forest are connected with gold. Gold extraction started there already in prehistoric times. In the 3<sup>rd</sup> to 1<sup>st</sup> centuries BC, the Celtic people exploited a secondary source of gold: they washed the gold-containing sand deposits along the Otava river and its tributaries. The Slavs continued with gold washing in a more systematic way, especially in the 9<sup>th</sup> to 10<sup>th</sup> centuries AD and later on until the 16<sup>th</sup> century (HORPENIAK 1995). A connection between gold and metal extraction and the first settlements in the area of the Kvilda Plains is suggested by a document dated 1345, in which John of Luxembourg, King of Bohemia, confirms the ownership rights over the Gevilde grove beyond the Rejštejn (Unterreichenstein) settlement to his bailiff managing royal land from the town of Písek. Without providing the opportunity for developing lucrative extraction of precious metals, the Kvilda Plains area would clearly have been useless to a landlord from a richer inland area. Any other kind of economic use of the mountain forests (e.g., for timber exploitation, hunting or grazing) was out of question under the given economic conditions and in the remote and uninhabited mountainous region (KUDRNÁČ 1991).

It was particularly at the peak of the Middle Ages that the requirements for gold greatly increased. Gold washing, which had gradually exhausted the available resources, was then being replaced by gold mining. The first extensive permanent settlements founded in the Bohemian Forest in the 14<sup>th</sup> century were closely connected with the gold mining activities ordered by King John of Luxembourg (1311–1346). This also applies to the foundation of the town of Kašperské Hory (Bergreichenstein), which became the center of the most important gold-mining district of Bohemia at that time. Also John's son, King and Emperor Charles IV (1346–1378), showed a great interest in the region and ordered a system of castles to be built there. Dominant among these castles was Kašperk (founded in 1356), which protected the frontier of Bohemia, the trade trail passing through the region, and the gold mines (HORPENIAK 1995).

In this period, the so-called Golden Trail was completed, which belonged to the most important mediaeval trade trails of Central Europe. It connected the Danube valley with the crown lands of Bohemia, and the main commercial article was not gold, but salt. (The name Golden Trail was invented later and had a symbolic meaning, stressing the extraordinary profitability of that trail, see KUBŮ & ZAVŘEL 1994, 1995a). King and Emperor Charles IV, who wanted to strengthen the economic position of the mining town of Kašperské Hory, ordered the third main branch of the trail, the so-called Upper Golden Trail, to be completed. It started at Kašperské Hory town, crossed the deep valley of Losenice stream, ran along the

Kozí Hřbety (Ziegenruck) ridge towards a barrier tower at the present Zhůří village (through the enclave now studied), and across Zhůřská slat bog to Horská Kvilda (Innergefield) settlement, where it joined an already existing branch of the Golden Trail ending in Passau, Bavaria (KUBŮ & ZAVŘEL 1995b).

The importance of the Golden Trail started to decline at the end of the 16<sup>th</sup> century, when the Hapsburgs decided to favor import of salt to Bohemia from Austria. In the 18<sup>th</sup> century, all trade traffic along the Golden Trail came to an end. Gold mining also declined after the Thirty Years War, i.e., in the second half of the 17<sup>th</sup> century. Building of glass manufactures, timber exploitation and animal farming gradually replaced the declining trade and gold mining. The oldest glass manufacture of the Kašperské Hory district was built at Svojsče (Zwoischen) before 1523, later ones were at Podlesí (Vogelsang), Zlatá Studna (Goldbrunn), Antýgl (Antiegel) and Jelenov (Hirschenstein). Until the 19<sup>th</sup> century, timber from the large forests provided a rich resource basis for glass manufacturing. This activity, however, declined in the Bohemian Forest in the second half of the 19<sup>th</sup> century, when glass furnaces started to be heated with coal and new glass factories were built closer to the Bohemian coal-mining districts (HORPENIAK 1995).

As a result, the local population concentrated more on agriculture, even though gold mining, trade, glass manufacturing or forestry still ranked among important economic activities at that time. Scattered separate crofts made it possible to use efficiently the relatively low natural potential for agriculture and to reduce the impact of farming practices on local ecosystems. Except for crop production (mainly rye, potatoes, oats), cattle and sheep breeding became an inherent part of local farming. Most of the agricultural production was used up in family self-supply. This agricultural management protected secondary grassland from natural successional processes, i.e., gradual overgrowing of the area by forest. A secondary equilibrium thus established itself between human activities and local ecosystems. Along with this scheme being applied to most of the deforested areas, some deforested plots were left without any agricultural management. Secondary succession occurred in these plots, which have eventually been re-incorporated into forest ecosystems (ZELENKOVÁ 2000).

### **Foundation of Zhůří (Haidl) village**

History of the Zhůří enclave as an area occupied by secondary grassland is relatively short in comparison with that of some other parts of the Bohemian Forest. The Fiscal Scroll of 1678 mentions the then existing adjacent settlements. They were: Kašperské Hory (Bergreichenstein), Rejštejn (Unterreichenstein), Kozí Hřbet (Ziegenruck), Lidlovy Dvory (Liedlhofen), Červená (Rothsaifen) and Horská Kvilda (Innergefield). These settlements were mostly founded during the colonization of the area, either in connection with gold washing and glass manufacturing, or along trade trails. The village of Zhůří (called Haidl in German) was not mentioned in the Fiscal Scroll, which means it did not yet exist in 1678 (HAAS 1954). It was probably founded as late as 1720: the first official record of a village called "Haydl" appears in SCHALLER (1785). The German name of the village is apparently derived from that of the nearby Haidlberg (Zhůřská hora in Czech), meaning a hill with a heath; the Czech name Zhůří is of a later date (VOJTASOVÁ 1984). The existence of two glass manufactures making glass, situated on the NE facing slope of the Huťská hora Mt., was probably the original reason for founding the Zhůří settlement after clear-cutting the forest. At that time, Zhůří belonged administratively to the domain of Kašperské Hory town (ZÁRUBA & KOBLASA 2000). After 1850, it belonged to Horská Kvilda village. Unfortunately, historical records on the enclave are scarce. It is therefore impossible to present a more systematic chronological overview of the economic development of the Zhůří settlement and its population. One can estimate from available sources (KOTYŠKA 1895, CHYTIL 1930, KUDRLIČKA 2001, NOVÁKOVÁ & al. 1991) that

**Table 1.** – Number of inhabitants (all of German origin) and houses at Zhůří settlement from 1870 to 1980 according to CHYTIL 1930, NOVAKOVÁ & al. 1991, ZÁRUBA & KOBLASA 2000 (x – number of houses not given in the records).

Year	1800	1869	1890	1900	1910	1921	1930	1939	1959	1970	1980
Population	176	190	153	168	139	128	113	113	41	14	16
Houses	22	x	20	20	19	18	20	x	x	3	3

the number of inhabitants reached its maximum at Zhůří in 1869, counting about 190 persons, all of German origin, living in about 20 houses (Table 1).

### **Land use changes within the Zhůří –Huťská hora enclave since 1945**

The situation described above lasted until 1945–47 when all ethnic German population was displaced from the territory and the settlement was left uninhabited.

An attempt to resettle the territory with people from other countries (Slovakia, Romania) was unsuccessful and stopped completely in 1952, when all inhabitants had to leave their temporary new homes. This was because a new military base was established at Zhůří, which eventually became a part of the air-defense system of the Warsaw Pact countries.

These events also influenced significantly the development of the local ecosystems. Most of former arable land and grassland was left fallow. No permanent civic residence was allowed, and the houses that had been there were systematically destroyed, sometimes also serving as targets in military training operations. On the other hand, new buildings for technical supply to and accommodation of the troops, and three family houses for permanent military staff with families were built there.

The agricultural activities of a new military agricultural and forestry enterprise (“Military Forests and Farms”), which managed the Zhůří enclave between 1952 and 1990, did not sufficiently substitute the original farming system. The new management consisted mainly of random mowing of meadows and very rarely of cattle grazing, to keep the area suitable for military training.

In 1990, the army terminated its activities and withdrew its soldiers and equipment from the area. At the same time, the enclave became part of the Šumava National Park/Biosphere Reserve, the three family houses were privatized and are now used for recreational purposes. Other abandoned technical facilities, mostly built of concrete, have been left without any use till now.

Between 1990 and 1995, the State farm of Katovice made use of the enclave for cattle grazing and random hay cutting. Since 1995, the area has belonged to a private farmer living at the lower situated Svojše village. A part of the enclave is now mown for hay once in a year while the rest is used as occasional pasture of cross-breed beef cattle.

### **Aerial photographs**

Perhaps the most objective retrospective review of the impact of different management on land cover development in the enclave after 1945 can be made on the basis of interpreted aerial photographs of the territory.

## MATERIAL AND METHODS

With respect to the principal historical events related to political changes affecting the Zhůř enclave, and after previewing the photographs, we chose four time horizons of aerial photographs. From a time series of thirteen existing terms of aerial photographs of the region, we selected those taken in 1949, 1959, 1975, and 2000 (Figs. 1a–4a). The photographs of 1949, 1959 and 1975, usually one or two photographs representing the whole enclave on each date, were scanned, histogram matching enhanced, and geo-referenced to an already existing digital ortho-rectified image (Křovák's projection) of 2000. The scale of the source photographs varied between 1 : 10 000 and 1 : 5 000.

We distinguished seven classes of land use/land cover from the images, using a visual interpretation key: roads, technological plots, built-up areas, islands of trees and shrubs, forest, clear-cuts, secondary grassland and plots with successional secondary woodland (possibly under sporadic influence of low impact grazing).

We have classified the secondary grassland as plots of permanent grassland subject to more or less regular management. In the aerial photographs, we can distinguish secondary grassland according to a smooth image texture with no signs of bushes and expansion of grass hummocks, which are the symptoms of absence of management. Evident overgrowth and gradual regression to forest communities characterize the class of secondary successional plots. The forest class includes tree stands with closed canopy originating from either forest planting or natural rejuvenation, or from long-term secondary succession. The class of islands of trees and shrubs is represented by small-scale clusters of woody species growing mainly on heaps of stones bordering grassland plots, and along roads.

The classes of land use/land cover were display-digitized from the registered images, built into coverages to get the topology of the classes, and the coverages were overlaid in order to quantify temporal changes among the classes within the period of 1949–2000. Further studies will attempt at evaluating, employing a similar approach, the data derived from the oldest maps available. Especially valuable will be the data from the military mapping accomplished during the rule of Joseph II (1780–90) and data from the maps of stabilized cadastral areas, dating back to 1870.

## RESULTS AND DISCUSSION

The described method has provided two complementary types of information: qualitative and quantitative.

The former information can be seen from the enhanced original photographs (Figs. 1a–4a). We can recognize especially the changes in the pattern of land cover within the open (non-

**Table 2.** – Percentage of all land use/land cover categories within the statistical area between 1949 ad 2000 (see aerial photographs and maps in Fig. 1a,b – 4a,b).

	1949	1959	1975	2000
roads, technogenic plots	1.0	2.2	2.3	2.2
built-up areas	0.3	0.5	0.3	0.2
islands of trees and shrubs	0.4	0.6	0.9	0.8
forest	21.5	18.5	29.6	35.9
clearcuts	2.1	1.3	0.9	2.4
secondary successional plots	20.2	17.9	22.0	15.0
secondary grassland	54.5	59.0	44.0	43.5



Fig. 1a. – Aerial photograph of Zhūrī enclave in 1949.

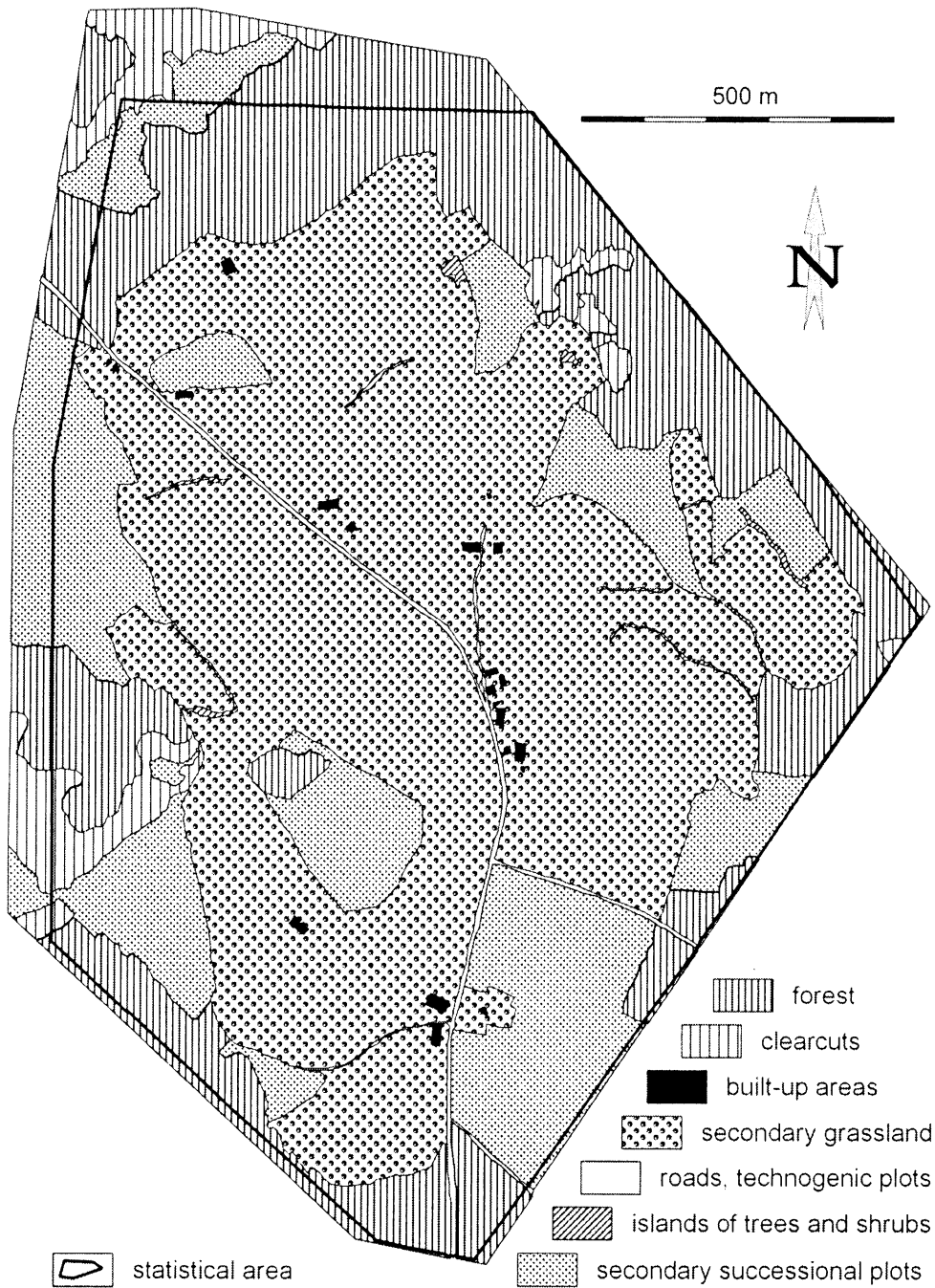


Fig. 1b. – Land use/land cover map of Zhūří enclave in 1949.



Fig. 2a. – Aerial photograph of Zhûřĩ enclave in 1959.



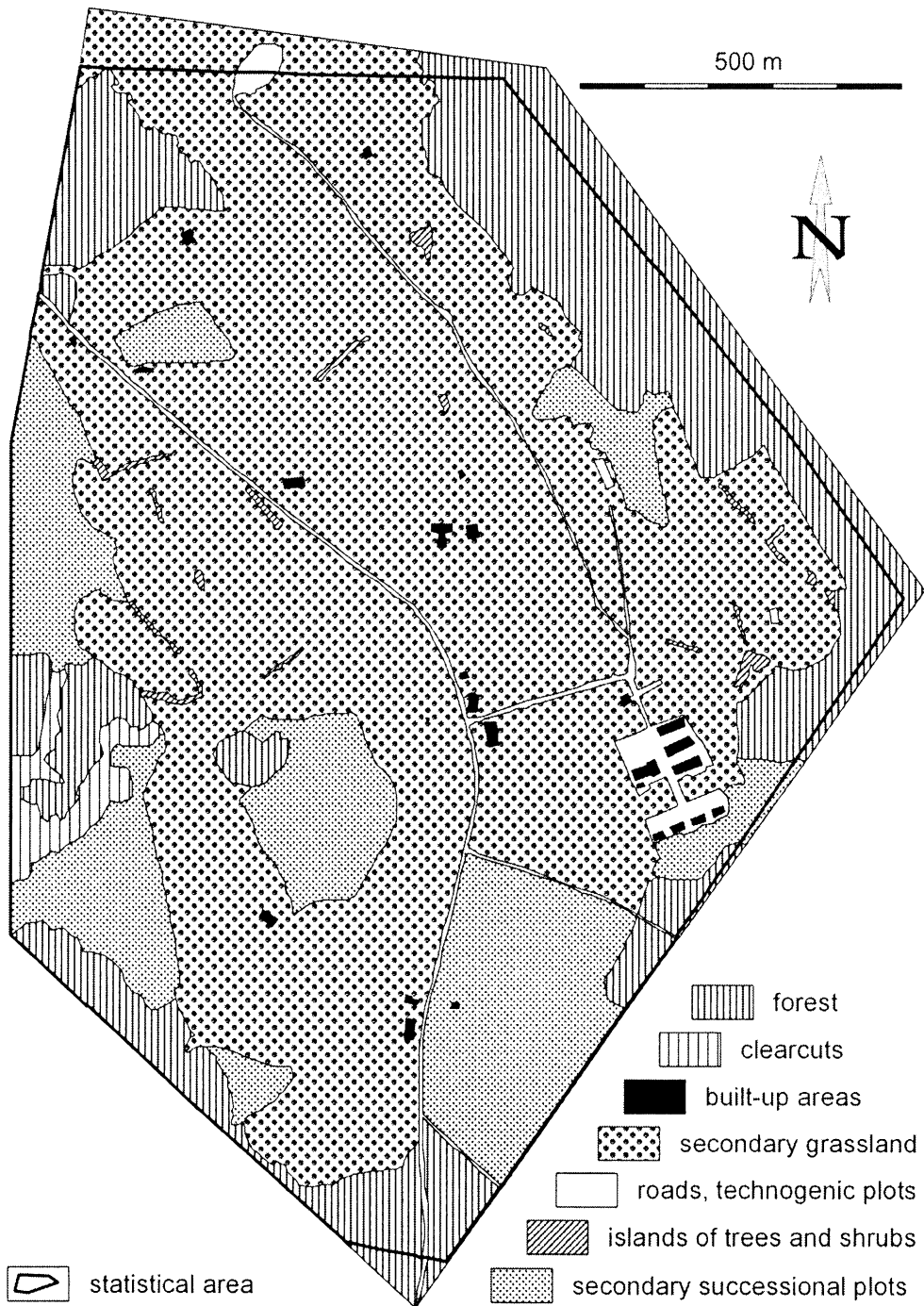


Fig. 2b. – Land use/land cover map of Zhůří enclave in 1959.

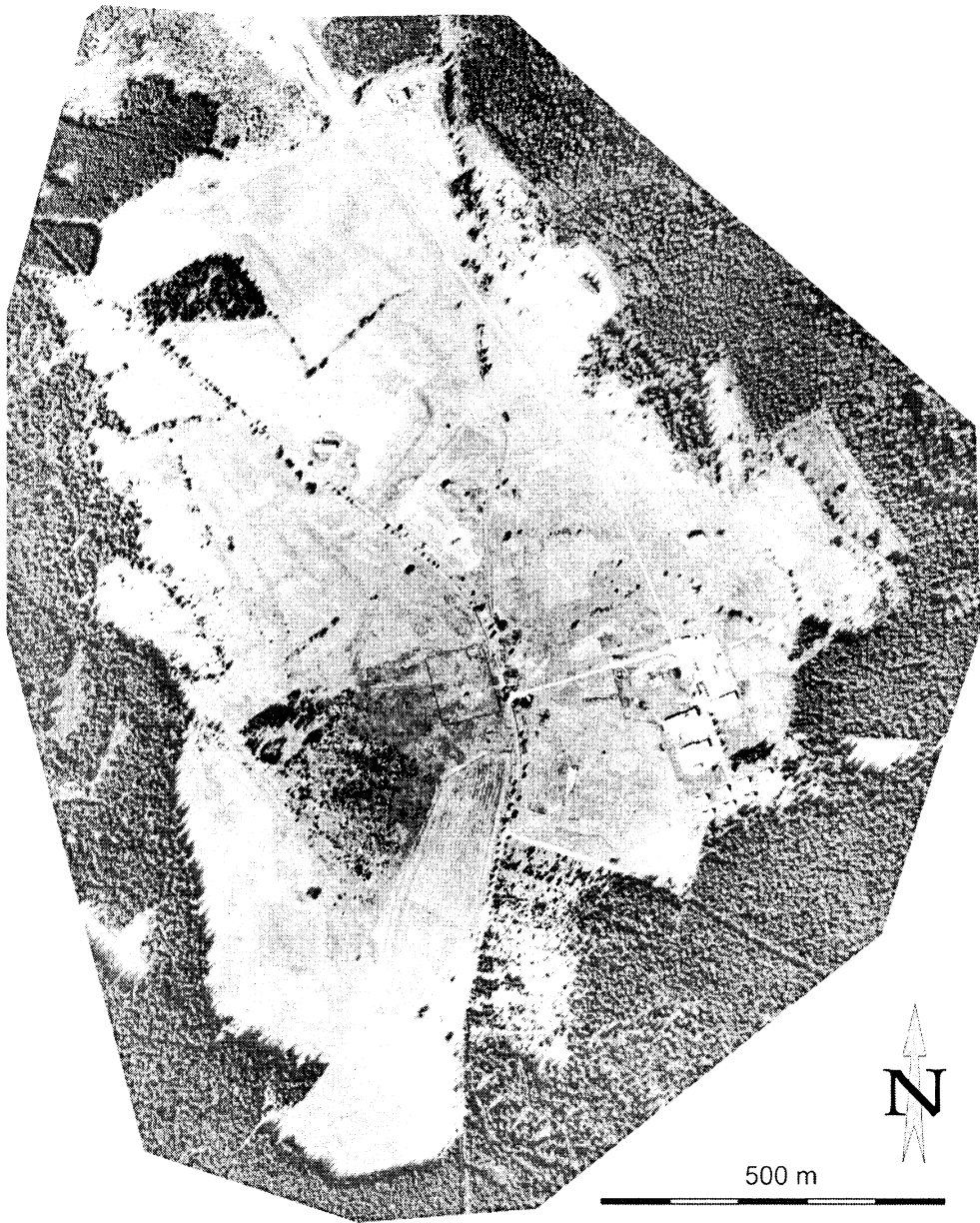


Fig. 3a. – Aerial photograph of Zhūřǐ enclave in 1975.

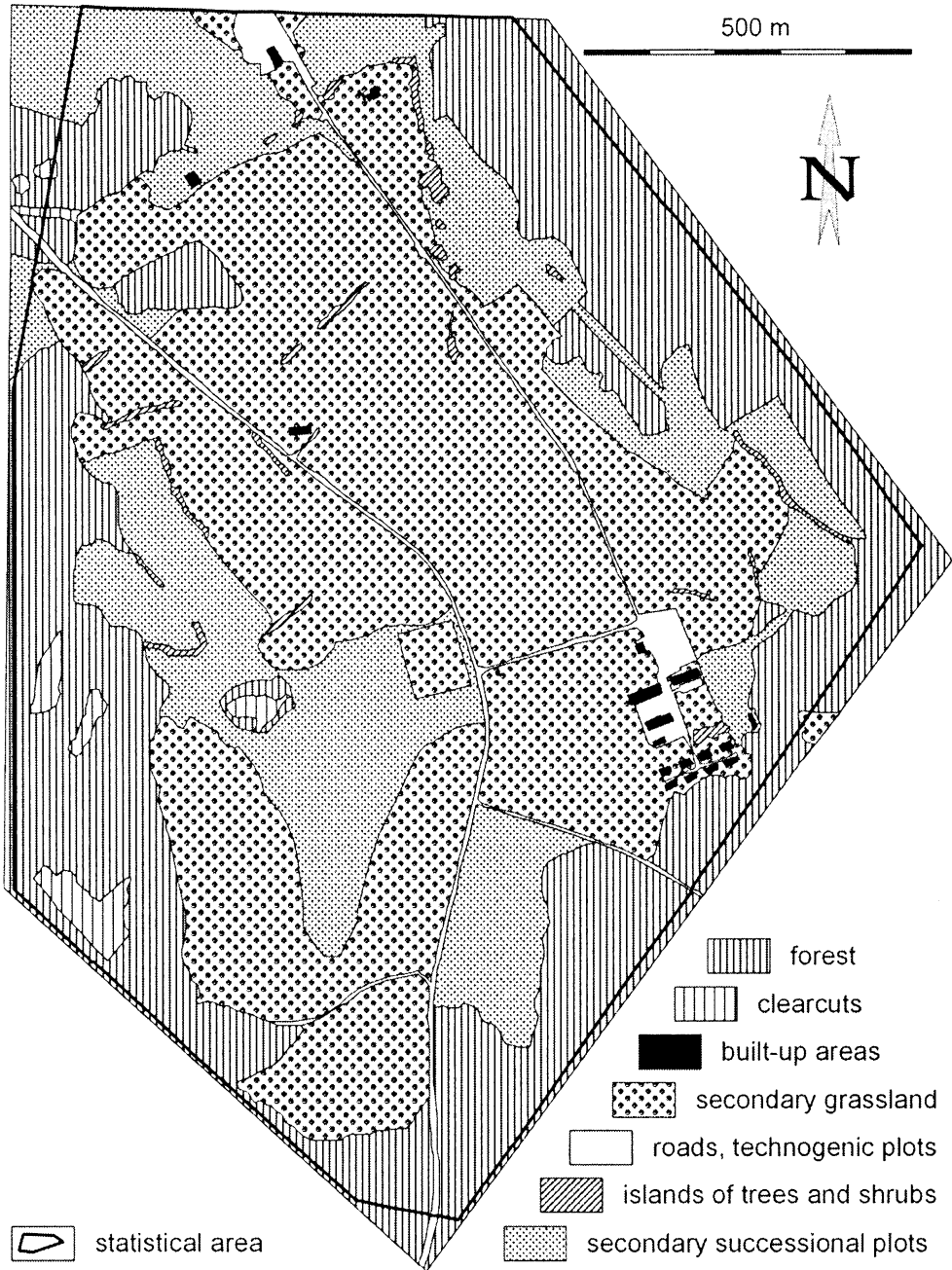


Fig. 3b. – Land use/land cover map of Zhǔrǐ enclave in 1975.

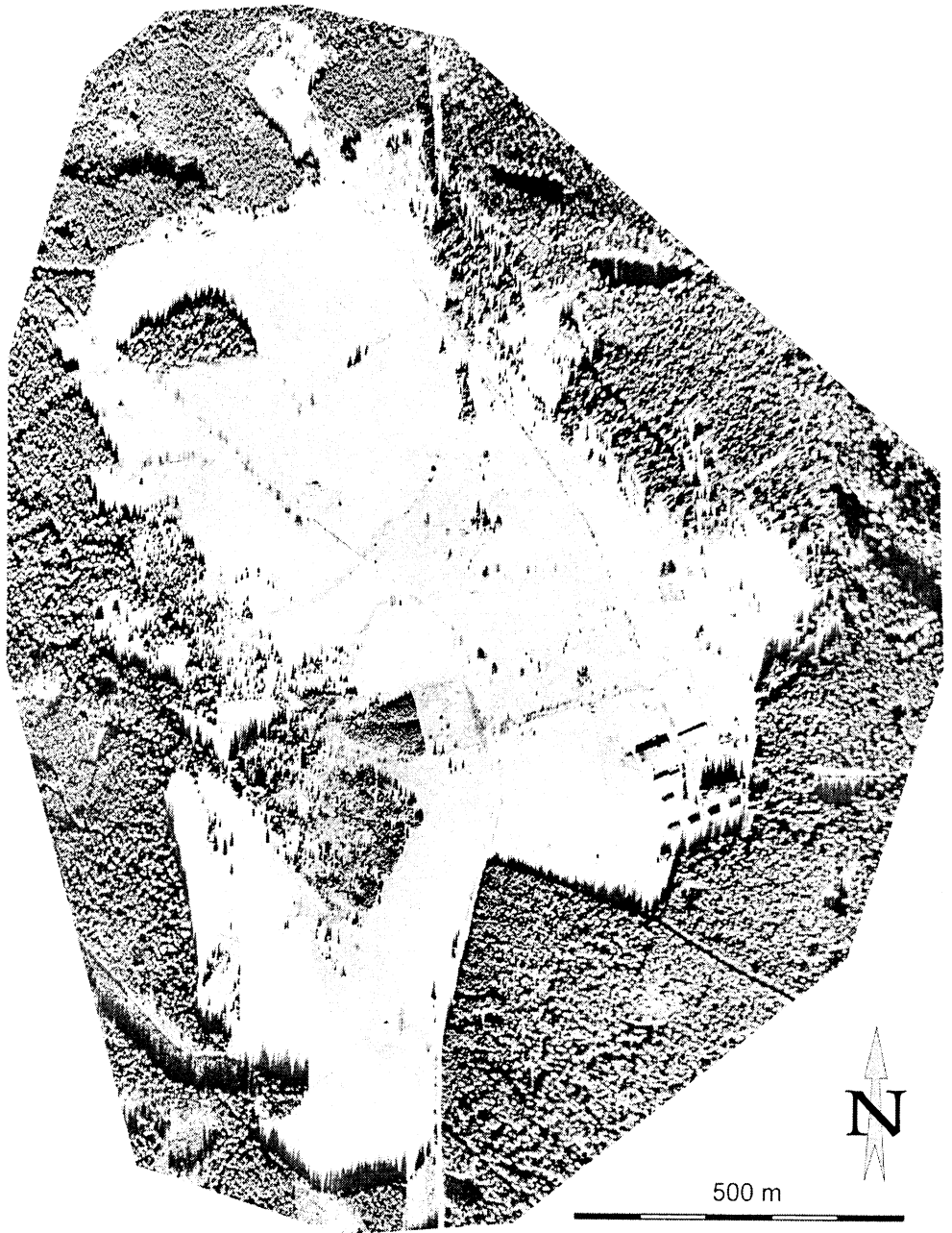


Fig. 4a. – Aerial photograph of Zhůří enclava in 2000.

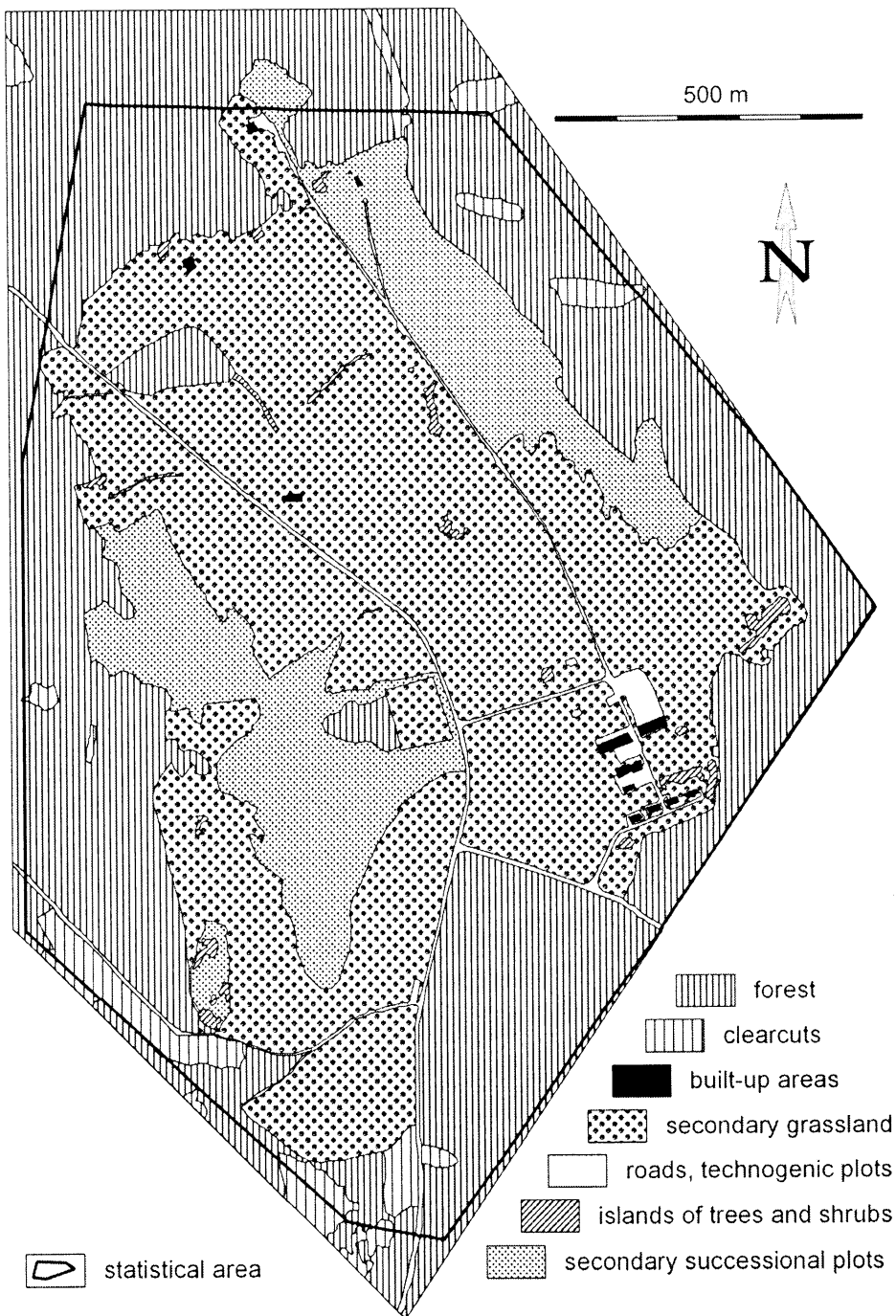
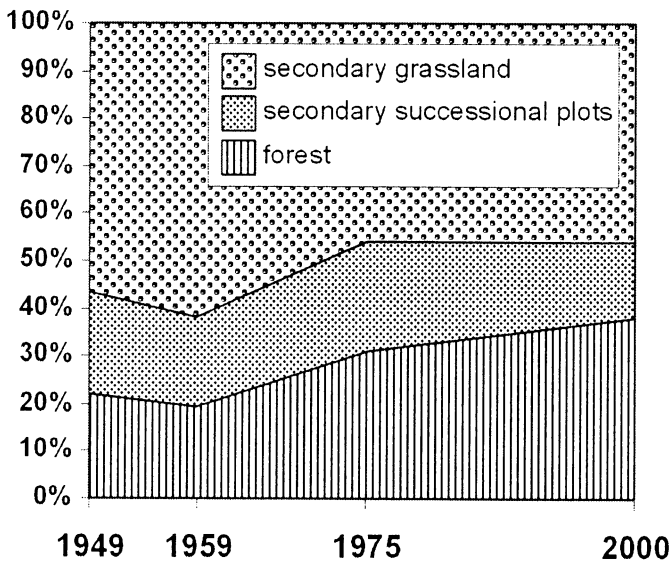


Fig. 4b. – Land use/land cover map of Zhǔrǐ enclave in 2000.



**Fig. 5.** – Changes in the percentage proportions between the three main categories of land use/land cover (secondary grassland on deforested sites, secondary successional plots in unmanaged grassland, and mature forest) within the statistical area of the Zhůří (Huťská hora Mt.) enclave.

forest) area. While the picture of 1949 shows a rather geometric pattern not only because of scattered farmhouses but also because of the delineation of arable land, meadows and pastures, the later photographs have mostly lost this field fragmentation. On the contrary, new bare soil spots, an irregular network of roads, and a complex of technical facilities and buildings appeared there in 1959, with the army as the new user of the enclave. Military activities also led to extensive clear-cuts (situated in the top part of the image). These clear-cuts were used for building a radio locator tower. The next two photographs, of 1975 and 2000, document the natural regeneration processes, which started there thanks to the climatic conditions characterized by frequent abundant rainfall, and to the neighborhood of forests dominated by Norway spruce (*Picea abies*), but containing also easily spreading deciduous trees (especially birch, *Betula pubescens*, and rowan, *Sorbus aucuparia*) along the forest edges. This process is most notable at the edges of the Zhůří enclave, where canopy closure reached the phase of mature forest in 2000 (top and bottom parts of the images).

The process described above is presented in semi-quantitative terms in Figs. 1b–4b. Accompanied by Table 2, the figures show the distribution and total areas of the seven classes of land cover/land use on each of the aerial photographs. Fig. 5 displays the three most extensive classes, namely the forest, successional woodland and secondary grassland, to demonstrate the proportions between them and the trajectory of the changes.

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