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Land-use changes and their social driving forces in Czechia in the 19th and 20th centuries

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Abstract

This paper is an overview of the major land-use changes in Czechia over the past 150 years, with a focus on the social forces driving these changes. Sources of land-use data are also discussed. Though economic development is seen as the key impact on land use before 1945, under communism (1948–89), the importance of political decisions was crucial. The post-war period is analysed in greater detail as this was the era of the most significant landscape changes. The most recent period encompassed a return to market conditions, resulting in environmentally favourable land-use changes. © 2001 Published by Elsevier Science Ltd.

Keywords: Long-term land-use change; Society development; Social-driving forces; Czechia 1845–1999

Introduction

The study of global land-use changes cuts across several academic disciplines and fields of inquiry. Global environmental changes include nature–society interactions, the search for natural resources to find adequate nutrition, population growth, connections between land use and climatic change and many other pressing issues (Turner II et al., 1990). These changes set an overall goal of achieving sustainable development.

In order to understand the current state of land use and to forecast future trends, a historical perspective is especially important. Regional land-use studies make it possible to compare the importance and the structure of the 'driving forces' of land-use changes at different spatial levels — national, regional, and local. The research reported in this paper analyses changes in different land-use categories and their structure as part of a continuing effort to understand land-use/cover change (LUCC) in different regions in the light of uneven regional conditions and histories.

Land-use changes reflect different phases of socio-economic development (i.e. social metabolism) and political climates, as well as environmental changes. Current land use has been greatly influenced by social driving forces and also by natural conditions. Historical land-use studies clearly confirm that the recent state of land use is also the result of long-term nature–society relations. It is fortuitous that historical land-use data from Czechia are available from the years that represent important milestones of modern Czech history. The article compares land-use changes between 1845 and 1948 (under conditions of a market economy), between 1948 and 1990 (under a rigid centrally planned economy and a totalitarian regime), and 1990–1999 (after the re-introduction of a market economy). These data allow detailed regional analyses (not discussed in this article). Additional data include the years 1882, 1897, 1921, 1929, 1961 and 1970. The paper also discusses related topics including the influence of different social conditions on land-use changes.

Data sources and the database

Data sources

The article presents selected results and also data sources for the research project 'Land-Use/Land-Cover Change: Development, Consequences, and Perspectives'. The nature of our data sets as well as other features have

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been described in detail in a number of previous articles and publications (see Bičík and Jeleček; 1999, Bičík et al., 1996; Bičík, 1995). The database is created from archival data containing some 13,000 cadastral units covering the territory of Czechia. The average area of each cadastral unit is 609 ha. The cadastral data of 1845 and 1948 were received from the Central Land Survey and Cadaster Archive files. More recent land-use data (1990, 1999) came from the computerised database of the Centre of the Czech Land Survey Office in Prague.

What makes studies of the former Austro-Hungarian Empire unique and of great interest is that detailed land-use data were first collected on Czech territory more than 180 years ago as part of cadastral records (originally called '*stable cadaster*'). In the early 19th century it was necessary to gather data that would serve as a base for land tax calculations. In addition, a precise triangulation network came into existence and detailed cadastral maps (scale 1:2880, later 1:2000) were created between 1826 and 1843. The plot sizes and extent of different land-use categories have been calculated from these cadastral maps. This, then, is a unique and extensive land-use data set.

Modifications of the original data

In order to create a data set with fully comparable data, the following modifications of the original data have been made:

(a) Simplification of the 48 land-use categories from archival files (1845, 1948) and of 12 land-use categories from the computer database files (1990) into the following eight land-use categories: arable land (abbreviated AL), permanent cultures (PC), meadows (Me), pastures (Pa — together with Me permanent grassland = PGL), forest areas (FA), water areas (WA), built-up areas (BuA), and remaining areas (RA). These basic categories can also be grouped into three more general ones (agricultural land = AGL, forest areas, and other areas = OA).

(b) For the sake of comparison over space and time (approximately 25%, cadastral units have changed their areas and new ones have been established), some 10,000 comparable so-called basic territorial units (BTU) covering the whole territory of Czechia were created by joining those cadastral units whose areas have changed over the period examined. The average area of one BTU is 790 ha. Approximately, 70% of the total consist of one cadastral unit only; the rest are composed of two or more, so that the BTU areas do not differ more than by 1% in the three compared years 1845, 1948, and 1990. Approximately, 30 GIS tables, charts, and cartograms have been created for all 76 Czech districts, as well as for Prague and seven former Czech provinces.

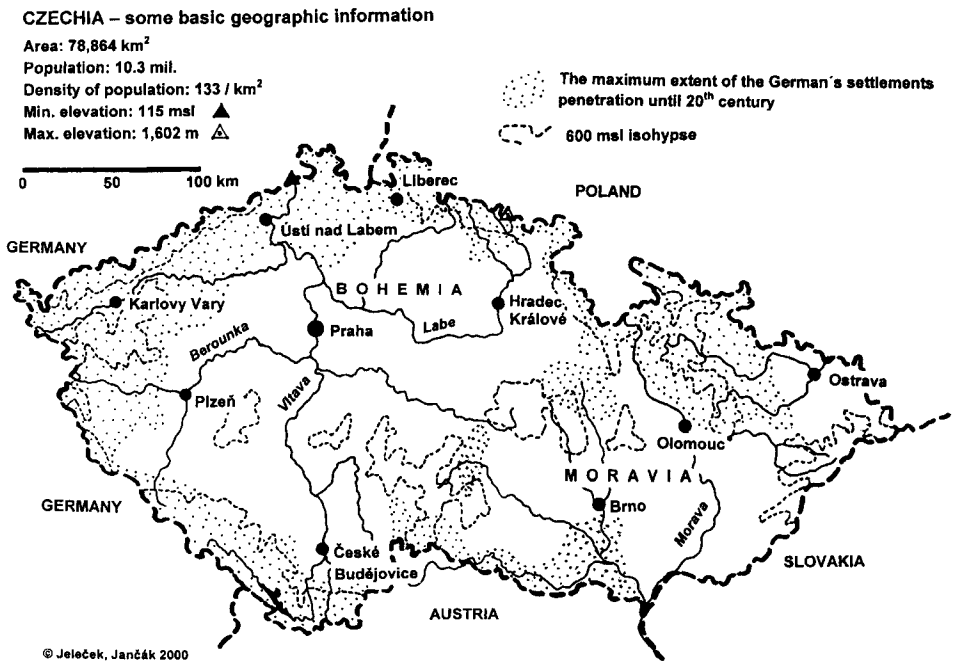
Historic–geographical roots and the consequences of the political and economic developments in Czechia

Since the onset of the Industrial Revolution in the first half of the 19th century, basic changes in landscapes and the environment have occurred as a result of the processes of industrialisation followed by urbanisation and demographic growth. In the agricultural landscape these changes have also been driven by the impacts of the agricultural revolution. During the second-half of the 19th century entirely new industrial, demographic, and transportation systems came into existence along with the creation of industrial regions and the so-called production–agricultural regions. These regions differed from each other mainly in terms of the structure of crops that reflected natural conditions and market demands. This basic agricultural differentiation of the territory of Czechia has survived until recently.

Czechia was the most industrialised part of the Habsburg monarchy, composed, since 1867, of territories of present-day Austria, Czechia, and Slovenia (the so-called Cis-Leitania), Hungary, Slovakia, and Croatia (Trans-Leitania). It is apparent that pressure on landscapes and on the land-use structure in Czechia has been very intensive compared with other parts of the Empire. The share of Czechia's production compared to total production of Cis-Leitania in 1913 was as follows: hard coal 86.7%; brown coal 84.0%; iron ore 53.7%; sugar beet 95.3%; beer 56.6%, etc. In the year 1900, some 60.7% of all steam engines used in the industries of Cis-Leitania were in Czechia's territory; in 1913 this share was 59.3%. Czechia covered only 26.4% of Cis-Leitania, but contained 38.5% of its arable land and 35.5% of the population. In spite of these facts, Czechia's population paid 46.6% of ground taxes and 42.2% of all taxes collected in Cis-Leitania in 1913 (Přehled, 1960). These figures reveal that landscapes of Czechia were more intensively used than landscapes in other parts of the Empire. This fact was also reflected in the structure of agricultural land.

The introduction of coal and steam engines in the 19th century fundamentally changed the ways in which industry was distributed. Natural conditions did not dominate, especially in the mountainous border regions, rich in water and timber — resources that gradually lost importance. Later, new historical elements like railways, electrical energy and internal combustion engines enabled the spread of industrialisation into a number of other regions (Jeleček, 1994).

During the 19th century, Czech agriculture was influenced by the transition from the agricultural revolution into a technological and scientific revolution in agriculture. In relation to Czechia, the agricultural revolution is characterised by an extensive expansion of cultivated land, especially of arable land to the detriment of pastures. This expansion reached a maximum in the



1860s and 1870s. At the end of this period, fallow land accounted for less than 5% of the total arable land. Part of the agricultural ground rent generated by differences in soil fertility was also enlarged by the increase of the agricultural land area.

From the 1880s, agriculture in Czechia began to concentrate on intensive tillage of the better soils, where the additional capital investments proved to be more effective and also yielded a larger location rent. This meant an increase in ground rent arising from greater investments, and, therefore more extensive use of mechanisation, chemicals, land improvement, plant and animal breeding, the introduction of new systems of land management and, later (after 1918) the exploitation of new power systems (steam power, electricity and the combustion engine, respectively). This was part of the technological and scientific revolution, especially of its second phase (1900–1945), and created the basic conditions for the additional increase in fertility and economic value of land and, consequently, also of the intensification and specialisation in agricultural production (for more about the agricultural revolution and technological and scientific revolution in agriculture, see Jeleček, 1995a).

From the perspective of land use and environment, the production of 'new' energy (electricity) was largely concentrated in the traditional heavy industrial regions. As power production has always been based on coal mining, formerly dominant light industries gradually lost their prime importance and the economy, over time, shifted to iron and steel production, heavy machinery and the chemical industry. This process began on a reasonable scale in the 1920s and 1930s (Kopačka, 1992), and substantially influenced the land-use structure of coal mining regions in Northwest Bohemia and Northern Moravia (Bohemia is the western part of Czechia, and Moravia the eastern section).

These basic features were partly changed under the new geopolitical and economic position of Czechia after 1918, when independent Czechoslovakia came to existence. The huge and custom-free market of the former Habsburg Empire was lost, the importance of heavy industry was emphasised more, and the industrialisation of Slovakia began. Slovakia (the eastern part of the former Czechoslovakia) was, in 1918, the least developed part of the new state.

The most dramatic landscape and environmental changes, however, occurred after World War II. As a consequence of the war, approximately 3 million ethnic Germans were transfered from Czechoslovakia in 1945–47. Thus, vast regions, mainly in the frontier, suddenly became virtually uninhabited, and despite resettlement efforts, the population of these regions has never reached the pre-war level. In land-use terms this meant an important decrease of agricultural land (especially of arable land) and the increase of forests as well as of meadows and pastures.

The relatively recent Communist period (1948–1989) saw dramatic changes. Czechoslovak politics and economy were fully oriented towards the Soviet Union

under Communism. The processes of nationalisation and so-called socialist industrialisation led to an enormous increase in the exploitation of natural resources. The impacts on land-use structure were enormous (compare Bičík, 1992; Bičík and Štěpánek, 1994b; Štěpánek, 1992).

The process of industrialisation (usually described as a gradual change of agrarian countries or regions into industrialised ones), however, was greatly converted into the so-called 'socialist industrialisation' in post-war Czechoslovakia. This meant *de facto* nationalisation of most production (industry and agriculture) and the installation of a rigidly planned economy.

The post-war industrialisation was associated with very intensive use of all available social and natural resources. The concept of energy self-sufficiency had been historically based on exploiting domestic coal. Thereafter the 'steel concept' for the economic development of bureaucratic socialism prevailed in Czechoslovakia. Industrial development was shifted exaggeratedly towards heavy and energy-producing industry (located mainly in border regions and large cities) and generated a rapid increase of resource demand, including agricultural land where areas were confiscated for construction, under conditions of high consumption per unit of production and with inefficient technologies. Fertile lowlands along rivers were damaged by the location of the chemical industries and some power plants, waste materials from mines, sand pits, etc. (Jeleček, 1994). Due to these changes, arable land decreased substantially in these areas.

By the 1950s and 1960s the Czechoslovak economic structure was fundamentally changed. It was typified by a high demand for raw materials and fuels, which were mostly imported from the Soviet Union. These demands were also related to a lower degree of technological development than in the West (much influenced by the existence of the infamous Iron Curtain). This led to very high consumption of materials and energy per unit of production and by the lower quality (use-value) of the products. Immense electricity production was based on brown-coal-fired power plants and coke production for smelting and caused an enormous increase in the deterioration of the environment. Environmental damage was even higher during the 1970s due to the extensive re-development of the economy (for more details compare Kopačka, 1992, 1994).

From 1989, key land-use trends in Czechia have been changed again under the new political and economic conditions. The major driving forces of land-use changes are again economic. Czech agriculture, now open to competition from EU states and North America, is leading to more intensive use of fertile land. Less fertile soils are gradually being converted back into permanent grassland or to forests. Similar processes occurred in Austria also (see Krausmann, 1999).

Land-use changes in different periods and their principal social driving forces

Basic historical trends in land-use changes 1840s–1990s

In this paper, indexes depicting changes in percentages and annual averages in hectares are used. Additional data concerning changes in acreage of individual land-use categories and in percentages of total area (in years 1882, 1897, 1921, 1929, 1961, and 1970) in Czechia can be found also in Jeleček, (1995b). The trends in land-use changes over the past 150 years are as follows (compare Table 1):

(1) The share of forest areas and other areas (including 'residual areas' and built-up areas) on the territory of Czechia has been increasing in the long term. However, most of this increase has been recorded in the last 50 years; (2) the share of permanent grassland decreased up to the end of the 1980s; (3) the share of arable land has been decreasing from the end of the 19th century to the present. After 1945, the decrease of arable land became dramatic, especially between 1948 and 1961. Most of this loss occurred in the mountainous frontier. The highest share of arable land in the Czechia's territory was reached at the end of 19th century (51.6% of the total land). Today it represents only 39.3%, but remains the largest land-use category by area. Agricultural production reached its peak at the end of the 1980s when it was about 15–25% higher (depending on types of crops) than the present.

As market-economy mechanisms have been gradually re-installed since 1990, land-use changes are again being driven mainly by economic forces. This fundamental change has resulted in positive land-use changes. The share of arable land continues to decrease; on the other hand, forest areas are increasing. Of prime importance, however, is the rapid increase of permanent grassland (1990–99, by 13.8%, i.e. by 115,000 ha).

Table 1
Share of selected land-use categories in the area of Czechia 1845–1999 (in %)

Year	AL	PC	PGL	AGL	FA	OA
1845	48.2	*1.1*	**17.6**	66.9	*28.8*	4.3
1897	**51.6**[a]	1.5	14.2	**67.3**	28.9	*3.8*
1929	50.6	1.5	13.4	65.5	30.0	4.5
1948	49.9	1.9	12.9	64.7	30.2	5.1
1961	42.7	2.6	12.6	57.9	32.7	9.4
1970	42.1	2.7	11.8	56.6	33.0	10.4
1990	41.0	**2.9**	*10.5*	54.4	33.3	12.3
1999	*39.3*[b]	3.0	12.0	*54.3*	**33.4**	**12.3**

[a] Values in boldface are the maximal level from 1845 till 1999.
[b] Values in italics are the minimal level from 1845 till 1999.

Table 2
Land-use change in Czechia during periods 1845–1948–1990 (in 1000 ha, and %)

Land-use category[a]	Period 1845–1948		1948–1990		1990–1999		1845–1999	
	ha	%	ha	%	ha	%	ha	%
AL	108	2.8	− 704	− 17.9	− 129	− 4.0	− 725	− 18.9
PC	59	65.6	76	51.0	11	4.9	146	162.2
Me	− 17	− 2.3	− 142	− 19.8	87	15.1	− 72	− 9.8
Pa	− 355	− 54.0	− 47	− 15.5	28	10.9	− 374	− 56.8
AGL	**− 205**	**− 3.9**	**− 817**	**− 16.0**	**− 3**	**− 0.1**	**− 1,025**	**− 19.3**
FA	**103**	**4.5**	**247**	**10.4**	**4**	**0.2**	**354**	**15.5**
WA	− 24	− 33.3	3	6.3	.	.	.	.
BUP	39	84.8	41	48.2	33	26.2	113	245.7
RA	41	18.1	526	197.0	.	.	.	.
OA	**56**	**16.3**	**570**	**142.5**	**− 3**	**− 0.3**	**623**	**181.1**

[a]Abbreviations: AL — arable land; PC — permanent cultures (gardens, orchards, vineyards, hopfields); PGL — permanent grassland; Me — meadows; Pa — pastures; AGL — agricultural land; FL — forest land; WA — water areas; BuA — built-up-areas; RA — remaining areas (roads, railroads, plots of land used in industry and agriculture surrounding buildings, coal carriers, etc); OA — other areas (WA + BuA + RA)*.
*Valid also for tables 3 and 4.

Table 3
Average change of land-use categories per year in Czechia (in ha)

Land-use category[a]	Period			
	1845–1948	1948–1990	1990–1999	1845–1999
AL	1049	− 16762	− 14333	− 4708
PC	573	1809	1222	948
Me	− 165	− 3381	9667	− 468
Pa	− 3447	− 1119	3111	− 2429
AGL	**− 1990**	**− 19425**	**− 333**	**− 6656**
FA	**1000**	**5881**	**444**	**2298**
WA	− 233	71	.	.
BUP	379	976	.	734
RA	398	12524	.	.
OA	**544**	**13571**	**− 333**	**4045**

Basic historical periods (distinguished by their political-economic character) can be briefly characterised in land-use terms by the annual average change in hectares — see Tables 2 and 3:

(1) 1845–1948: in general, no major land-use changes occurred. Arable land continued to decrease; on the contrary, agricultural land began its permanent decrease due to a very slow increase in forest areas and a relatively small increase in other land-use categories.
(2) 1945–1990: period of extensive changes. Changes included a dramatic decrease of arable land and also decreases of meadows, pastures and agricultural land. On the other hand, other areas (including remaining areas) have increased. This was also true for forests (they increased by about 2.5 times compared with the period 1845–1948) and permanent land category cultures (gardens, orchards, vineyards, etc.).
(3) 1990–1999 four issues are notable: (a) Almost the same decrease of arable land area occurred as during the longer period, 1948–1990; (b) the second biggest increase in permanent cultures occurred after the period 1921–29; (c) Intensive increase of permanent grassland began; (d) The intensity of agricultural land decrease and the increase in forests slowed down; (e) Other areas decreased slightly — a phenomenon recorded for the first time since 1845.

Tables 2 and 3 document clearly the fundamental difference between the periods 1845–1948 and 1948–1990. The large decrease of arable land, and agricultural land (partially converted to forests) could have been beneficial in terms of environmental quality; however, much of former agricultural land was converted to 'other areas'. In the period 1845–1948 pastures and meadows were the main sources for the expansion of other land-use categories, including arable land. After 1948, arable land became the main source of conversion to other land cultures, while pastures were next. Only the category of permanent cultures continuously grew in area mainly due to residential housing projects when new family houses were surrounded by gardens and orchards.

The period 1845–1948: main social driving forces and land-use changes in various sub-periods

The boom in the capitalist mode of production after the 1848/49 revolution, i.e., after serfdom was abolished, freeing large labour force and leading to industrialisation,

called for extensive economic development and use of resources during the third-quarter of the 19th century. It was this extension of arable land that was terminated in the 1870s. Whereas the acreage of arable land was extended by 7.1% in the period 1845–1882, it decreased by 1.8% in the next period (1882–1897) (Jeleček, 1995b).

During the fallow farming period (approx. until the 1870s), farmers kept at least one-third of their arable land temporarily under 'relatively' permanent grass. The useful environmental role of fallow land (i.e. improving soil fertility and anti-erosional effects) was later changed to use as meadows and pastures, although such areas have continually decreased in size. The total abolition of fallow farming by the end of the 19th century brought down the permanent extension of the cultivated arable land area by about one-third (compared to the early 19th century) and, together with the increment of arable land, these were new areas which had been permanently 'bare' and exposed to the natural and anthropogenic impacts. Land cultivation damaged natural ecosystems and initiated large-scale soil erosion, the effect of which is determined also by the species of cultivated plants (the biggest erosional potential is related to corn and root-crops such as potatoes, sugar-beet, etc.).

Further expansion of agricultural land was not possible after the 1880s. Therefore, the feeding of the rapidly growing non-agricultural population required improvements in the efficiency of agriculture rather than the expansion of arable land. The solution was intensive forms of farming, i.e. intensive exploitation of the historically influenced land-use structure. This was carried out through capital investment into the most fertile plots by mechanisation, use of chemicals, crop rotation, etc. There was also a protracted agrarian crisis in the 1880s and 1890s intensified also by the competition with American grain, which was cheap and rapidly transported by steam ship to Europe. This factor influenced the changes described above.

These changes, together with continual afforestation over time contributed to the geomorphologic stabilisation of the landscapes in hilly regions. The economic progress and increase of arable land area in fertile territories led to the reinforcement of the agricultural character of the lowland parts of Czechia where the share of arable land on the agricultural land area increased greatly.

The boom in agriculture during the first decade of the 20th century did not affect the continued decrease in arable land and, within the period 1897–1921, its decrease amounted to 8.7%. This was much influenced by World War I — due to lack of farmers, many of whom became soldiers, to work for the land. For the same reason, permanent grassland increased greatly. After the establishment of the Czechoslovak Republic in 1918, extensive land reform and partial splitting of the big noble estates caused a wave of extensive mobilisation of land through small-scale production by peasant farmers, to whom areas of land, formerly owned by nobility, had been sold. Under this reformation process, arable land increased by 4.1% in the period 1921–1929. This was the second largest increase in all of the nine periods observed (see Table 4). Permanent grassland acreage increased greatly and, only in this period, did forest area decrease. The impact of the world economic crisis in the 1930s is not very apparent, because data from 1938 were not available.

The period 1945–48 was dominated by large-scale population movements in the all of Central/Eastern Europe. Due to the eviction of Czech Germans from Czechoslovakia, some 3 million hectares of their land became state property (and mostly remain state property today).

Table 4
Average change of land-use categories per year in Czechia during nine periods 1845–1999 (in 1000 ha)

Land-use category[b]	Period[a]								
	I	II	III	IV	V	VI	VII	VIII	IX
AL	7.35	−0.33	−11.46	19.63	−1.71	−43.46	−5.00	−4.70	−14.33
PC	0.73	−0.06	−0.71	2.63	1.21	4.31	0.89	0.60	1.22
Me	−0.86	−0.06	2.63	−8.00	0.54	−2.00	−5.89	−3.15	9.67
Pa	−6.35	−0.27	−0.42	−7.75	−1.83	−0.01	−1.67	−1.65	3.11
AGL	**0.97**	**−0.73**	**−9.96**	**6.50**	**−1.79**	**−41.08**	**−11.67**	**−8.90**	**−0.33**
FA	**0.32**	**0.20**	**7.13**	**−14.25**	**1.29**	**15.31**	**2.89**	**1.10**	**0.44**
WA	−0.78	0.00	0.79	−1.88	0.04	.	.	−0.05	.
BUP	0.13	0.27	.	.	.	.	.	0.70	.
RA	−0.78	0.40	.	.	.	.	.	6.95	.
OA	**−1.32**	**0.66**	**4.67**	**−7.50**	**1.79**	**26.00**	**8.89**	**7.60**	**−0.33**

[a] Period: I = 1845–1882; II = 1882–1897; III = 1897–1921; IV = 1921–1929; V = 1929–1948; VI = 1948–1961; VII = 1961–1970; VIII = 1970–1990; IX = 1990–1999.

[b] Abbreviations: AL — arable land; PC — permanent cultures (gardens, orchards, vineyards, hopfields); PGL — permanent grassland; Me — meadows; Pa — pastures; AGL — agricultural land; FL — forest land; WA — water areas; BuA — built-up-areas; RA — remaining areas (roads, railroads, plots of land used in industry and agriculture surrounding buildings, coal carriers, etc); OA — other areas (WA + BuA + RA).

Some 1.9 million in-migrants, mostly from other parts of Czechoslovakia, partially resettled at the border regions. However, the pre-war population size has never been achieved and many villages and plots of land were abandoned. More than 1000 settlements ceased to exist and the economic functions of such areas almost collapsed (Štěpánek, 1992b). Conditions in the eastern frontier were not so dramatic, because these regions had never been settled by Germans.

This post-war development resulted in an unusually high decrease of agricultural and arable land in the 1950s in border regions originally settled mainly by ethnic Germans. The result was a dramatic decrease of arable and (less 516,000 ha, i.e. 16.8%), of agricultural land (less 534,000 ha, i.e. 10.5%; both figures refer to the period 1948–1961). Most of these changes were politically driven.

The period 1948–1990: main social driving forces and land-use changes

Land-use changes after 1948 were influenced by two major factors that originated from the fundamentally different social, economic and political system which had been installed in 1948 under communism. First, there were *the general economic tendencies* that led to a serious decrease of arable land in mountainous and less fertile regions, a decrease of meadows and pastures in fertile regions and an increase in the mountainous frontier. There was also a slight increase in forest areas in all of Czechia (the largest was recorded during the period 1948–1961, especially in the frontier regions), a large increase of built-up areas and of all of 'other areas'. Even more important, however, were *specific conditions* in post-war Czechoslovakia including the transfer of Czech Germans from Czechoslovakia as the most influential land-use factor in the border regions (see above).

The second specific condition was the so-called 'socialist' extensive industrialisation and urbanisation programme. In different periods of the long Communist rule (1948–89), however, different driving forces of land-use changes were in effect.

After 1948, the development of land-use structure, namely the loss of agricultural and arable land, was mainly caused by construction projects: this included industrial plants, transportation lines, open-pit mining, residential housing, etc. Agricultural land was continuously confiscated for non-agricultural activities. Tables 2 and 3 show the great increase of built-up areas and the so-called other areas. In this way, the post-war era differed greatly from previous periods (see Bičík, 1992; Jeleček, 1995b).

The decrease of agricultural and arable land in the frontier regions was mainly connected with post-war political decisions, as explained above. These mountainous border regions were usually not suitable for large-scale agricultural production based on co-operatives and state farms and therefore some reverted to forests. Many fields were converted to pastures and meadows. These changes positively affected the environmental situation in hilly frontier regions (Bičík and Štěpánek,1994a). But in Northern Bohemia, in the fertile foothills of the Ore Mountains, large areas of agricultural land were lost to open-pit coal mining and related industries (Bičík, 1988). Most of the forest increase over the period 1948–1961 was concentrated in the mountainous frontier.

The index of change (which represents the area of land-use change as a percentage of the total area) within the period 1845–1948 was 4.7%; in the period 1948–1990 it was 11.3%, and for the entire period 1845–1990 it reached 14.6%.

Also, the period 1948–1990 can be divided into shorter segments representing different stages of economic, social and political development in Czechia. Only by chance are there data on land use for whole territory of Czechia. These data correspond with societal development. Due to the lack of space in this article only the most typical features, trends and their causes are shown. The precise data concerning land-use changes are shown in Table 4.

The period 1990–1999: emergent economic factors dominate again

The fall of the Berlin Wall and the consequent downfall of eastern-European communist regimes from 1989 brought fundamental changes to the political, social and economic system in Czechia. This was a key historical moment that terminated the long period of Communist domination over politics and economic affairs.

The most important post-1990 processes that influenced land-use changes were (1) the restitution of private property that had been nationalised under Communism (including agricultural land, farms, forests, etc.); (2) the partial privatisation of state property; (3) increasing environmental awareness among the population as environmental information became freely available, with better enforcement of environmental laws; (4) transformation of agricultural co-operatives into (a) so-called 'transformed' co-operatives where legal rights of landowners are respected, (b) agricultural stock companies or limited-liability companies. Only a few farmers returned to individual private farming due to the small area of farms they had owned before 1948 (compare Bičík et al., 1996; Jeleček,1995a); (5) removal of the Iron Curtain, and increasing accessibility of the border regions to everyone who desires to engage in economic activities; (6) the restitution of a land market accessible (so far) to Czech citizens only.

The key tendencies of post-1990 land-use changes are (compare Tables 2–4): (1) the decrease of agricultural and especially arable land; the total decrease is the second

largest for the entire period 1845–1999; (2) the extent of meadows and pastures began to increase seriously, especially in highlands and mountains; (3) built-up areas and 'other' (mainly 'residual') areas increased considerably; (4) forests continue to expand slightly.

However, these general tendencies often result from different or even contradictory trends in different regions. As the system of agricultural subsidies has been fundamentally changed since 1992, an intensive decrease of arable land and an intensive increase of permanent grassland and forest areas is observable in mountainous and hilly regions. A slight increase of forests has also been recorded in lowlands. It is not economically viable to invest money into less fertile soils anymore. Agricultural subsidies, however, are currently fairly low compared with EU-countries (about one-half) and most of the money is allocated into non-productive agricultural functions. As a result, the impact of natural conditions on farming and land-use structure is now more important than earlier.

Conclusions

The following social driving forces had a great impact during the study period on land-use changes: (1) events after World War II including the abolition of a market economy, the exodus of Germans from Czechoslovakia and 40 years of Communist rule; (2) cyclic development of the economy and changes of Czechia's geopolitical and geoeconomic position up to 1948; (3) impacts of the Industrial Revolution and Agricultural Revolution in the 19th century and their transition into technological and scientific revolution both in industry and agriculture. These processes provoked changes in modes of production; (4) social and political events such as the land reforms in the 1920s, state agricultural policy — the legal system of land tenure management, agricultural land protection; (5) impact of World War I.

A permanent historical decrease of arable land had positive environmental impacts as it was transformed into other categories of agricultural land and especially into forests. Apart from the current introduction of a market economy in Czechia, the competition with more protected and subsidised West-European and North-American agriculture, results in significant changes in the structure of Czech agriculture and the land-use structure itself, including its greater regional differentiation. Forests and permanent grasslands are now expanding in the less fertile regions, i.e., mainly in the mountainous frontier. Forests are slowly expanding across the entire Czech territory. The intensity of arable-land exploitation in more fertile lowland regions is increasing, but its area is still decreasing. In total, the growth rate of permanent grasslands and 'residual areas' is highest. The impact of differential rent II (i.e., the intensification of agriculture in fertile regions only, and the extensification of farming in less favourable areas) effects have become very strong. Generally, the gradual decrease of arable land is economically desirable and also results in positive environmental consequences (see also Turner II, 1990).

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