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Article

The effect of the COVID-19 pandemic on the socio-economic development of municipalities with different nature protection regimes in the Czech Republic

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Abstract: The COVID-19 pandemic profoundly affected human societies worldwide. This study focused on the socio-economic development of the western border region of the Czech Republic, specifically comparing municipalities within protected areas (Šumava National Park, established in 1991, and Bohemian Forest Protected Landscape Area, established in 2005) and those outside protected areas. A total of 39 municipalities of similar size and history were included, and 17 socio-economic indicators covering demography, landscape use, and municipality income were studied. Data recorded in 1991, 2001, 2011, and 2021 were used to describe the development of the study regions over the last 30 years, compare the situation shortly after the establishment of protected areas with the last decade, and identify changes in the economy following the COVID-19 pandemic in 2019–2021. ANOVA was performed to determine the association between the size and location of a municipality (outside or inside a protected area) and the socio-economic indicators. The results showed significant changes in demography, landscape use, and the economy during the studied period of 1991–2021. A few insignificant but noticeable trends were detected in population aging and the number of educated residents with a university degree. The most significant changes over time were found in municipalities located in the national park. However, contrary to expectations, there were no substantial population movements to the municipalities in protected areas during the COVID-19 pandemic. The demographic and economic changes followed a very similar trend during the studied years and were more dependent on municipality size than on other factors. This result is likely influenced by globally limited business and tourist activities in 2019–2021.

Keywords: border region; socio-economic development; COVID-19; demography; protected area; Šumava National Park

1. Introduction

The crisis caused by COVID-19 has inevitably affected human activities around the globe, and the Czech Republic is no exception. The Czech government implemented various measures to prevent and control the COVID-19 pandemic during 2019–2021. These regulations focused on limiting social contacts to prevent the virus from spreading among the population [1–3]. This was accomplished through several strict long-term lockdowns, school closures, remote work, and travel restrictions [4]. Such government anti-COVID measures imposed substantial social and economic costs on society globally. However, the marginal regions (i.e., regions located along the German and Austrian borders) were more significantly affected. The lack of synchronization in the implementation of anti-COVID measures in neighboring countries led to the loss of employment contracts for many Czech residents working

abroad temporarily or permanently. Even transboundary cooperation among local municipalities was interrupted, delaying ongoing projects and preventing new ones from starting. The anti-COVID measures also strongly reduced income from tourism and recreation, which are important economic drivers in the sparsely populated border regions with preserved nature. These measures severely hindered the gradual recovery of the local economy from the slump experienced during the recession at the end of the first and the beginning of the second decade of the 21st century. Conversely, it is assumed that people migrated from cities to villages, seeking countryside locations to endure the lockdowns with access to outdoor spaces. However, there are not many studies focusing on such demographic and economic shifts.

For this purpose, we utilized our previous study based on population data from 1991 and 2011, where we identified changes in demographic, socio-economic, landscape use, and municipality income indicators among municipalities with different nature protection regimes—national park, protected landscape area, and unprotected landscape in the border region [5]. The existing large data set was extended to include the missing population data from 2001 and, most importantly, the latest data from 2021, which includes the COVID-19 era. Similarly, we focused on socio-economic differences among municipalities with different nature conservation values and landscape protection. Municipalities located in protected areas, i.e., national parks (NP) and protected landscape areas (PLA), were included, as well as municipalities outside of protected areas. In the Czech Republic, these protected areas are proclaimed under Act No. 114/1992 Coll. on Nature and Landscape Protection on sites of scientific or aesthetic importance or uniqueness. These sites are tourist attractions and worth protecting due to their representative biological diversity, unique geology, or typical elements of the landscape character. Under Czech demographic conditions and land use history, it is impossible to place protected areas outside of populated landscapes, which imposes some restrictions on the socio-economic development of municipalities located there. There are limitations in agricultural practices, building new roads or railways, locating industrial buildings, mining prohibition, etc. [5]. The management of such territories must be carried out according to zones of graded protection to preserve and create the optimum ecological functions of the protected areas while allowing a convenient way of living for present residents. Even recreational use must be admissible with regard to the natural values of the protected area. The economy of municipalities located in protected areas seems to be limited by nature conservation. On the other hand, there is a strong positive correlation between an increasing percentage of wilderness and decreasing unemployment rates, even if sometimes only seasonally [6,7]. This indicates that national parks and protected landscape areas can provide new job opportunities. Municipality incomes might not be correlated with business activities in the protected area because some economic entities might have their headquarters in different parts of the country, thus their income is not included in the municipality budget where the business is operated [8]. This is the case in the Šumava NP, where some income from tourism flows to a different region [9,10]. However, there are opposite examples where local people benefit from the protected area, such as in the Biospheric Reserve Entlebuch [11] or the Bavarian Forest NP [7,12–14] located near the Šumava NP. Several studies mention that even a few job positions can positively affect the local economy [15,16].

This study focuses on different socio-economic factors of the municipalities inside and outside the protected areas during 1991–2021. Our previous study [5] proved the importance of municipality size as the ultimate parameter affecting the socio-economic situation of selected municipalities between 1991–2011, with a low impact on their location inside or outside the protected zone. This extended study focuses on changes in the same socio-economic indicators; however, the last newly tested decade (2011–2021) includes the COVID-19 pandemic. The anti-COVID regulations applied by the government during this time undoubtedly caused an economic recession. However, the extent of the impact might differ according to municipality locality or specific demographic factors, such as the number of educated residents with a university degree. In this study, we elucidate the effects of anti-COVID measures on the gradual recovery of the local economy from the slump that the area suffered in the recession at the end of the first and the beginning of the second decade of the 21st century and whether the municipalities located in border regions under different protections (protected areas vs. unprotected border regions) were affected differently. We attempt to show the possible demographic and economic shifts caused by long-term restrictions avoiding social contact during the COVID-19 pandemic in 2019–2021 and test if these conditions significantly affected the development of protected areas.

2. Materials and methods

2.1. Study area

The study area is located on the southwestern border of the Czech Republic (**Figure 1**) and extends from the northern border of the Bohemian Forest PLA, across the Šumava NP, to the eastern border of the future Novohradské hory PLA, which was recently protected as a natural park. There are also many smaller protected areas located here, such as the National Nature Reserve (NNR) Terčino údolí, National Natural Monument (NNM) Hojná voda, Žofínský prales NNR, Čertova stěna–Luč NNR, and sites in the NATURA 2000 network: special protection areas (SPA) designated for birds (Boletice, Novohradské hory, Šumava) and many sites of community importance (SCI) designated for habitats, plant, and animal species. The study area includes the following municipalities: České Budějovice, Český Krumlov, Domažlice, Klatovy, Prachatice, and Tachov [17,18]. Historically, the study area is part of the Sudetes, specifically the Poor Sudetes [5,19].

The climate in this region varies with altitude, with decreasing mean temperature and increasing precipitation from 900 mm to 1600 mm [17,20,21]. Vegetation cover includes dense forests of beech mixed with fir at lower altitudes, spruce forests in the high mountains, ash-alder growths, peat bogs in waterlogged areas, mountain grasslands, and pastures characteristic of the Šumava NP [5]. At the lowest altitudes in the Bohemian Forest PLA, there are also oak forests [22]. The area hosts several protected species, with the most valuable ecosystems being those unaffected by human activities [17,18].

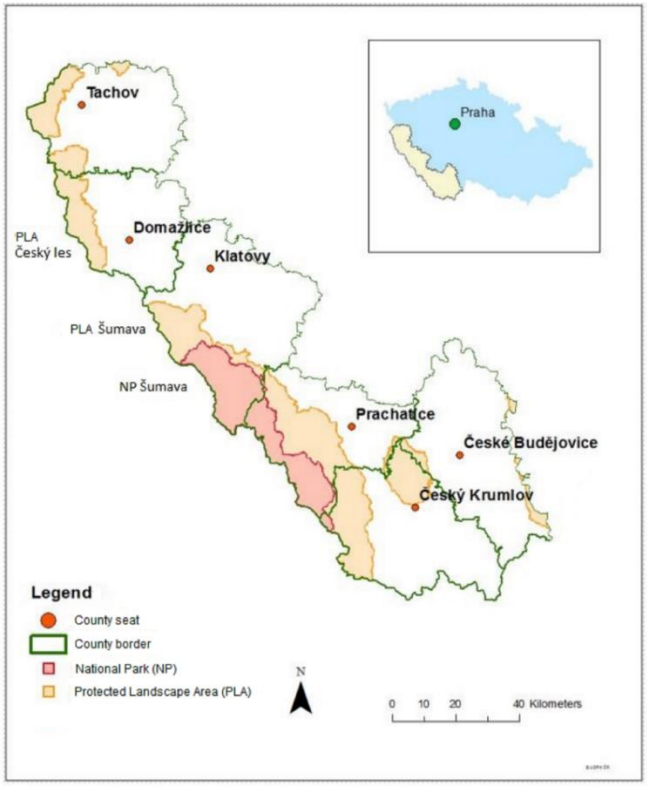

Figure 1. Map of the southwestern border region of the Czech Republic showing the large protected areas: NP—National Park (pink), PLA—Protected Landscape Area (orange).

2.2. Settlement history

The earliest human settlements in the study area date back to the 7th and 8th centuries, when Slavic people inhabited sites along streams. Population density increased during the Middle Ages, with both Czech and German cultures present in the area; Germans predominated in the central part of the Šumava, while Czechs settled more in the Šumava foothills [23–28]. Significant changes occurred in 1918 when Czechoslovakia was established, and Czechs were moved to sites on the southwestern border. In 1938, most of this area belonged to Germany, but after World War II in 1945, Germans were expelled, and the area was abandoned. Attempts were made to recolonize the area with Czechs and emigrants, but the number of residents never reached the previous population density [23,29,30]. From 1948 to 1989, the border was closed, and a border zone 2–6 km wide with restricted entry was established. During this time, more than a hundred municipalities ceased to exist in this area [31–34].

The most important industries historically and recently have been forestry and wood production. In the past, wood production was connected to the paper industry and, to a lesser extent, to local glass production, which no longer exists [34–37]. Agriculture in the Šumava region was never a significant income source, although it provided food for local people, with cattle breeding and fish farming more common at lower altitudes (Bohemian Forest and Novohradské hory). Mechanical engineering plants and raw mineral material processing are also present in the region [38,39]. Since the establishment of the NP and PLA, tourism has provided a major part of income in

this area [8,9].

2.3. Municipalities studied

The municipalities studied were located either within the NP or PLA or outside these protected areas. The number of residents was considered using a method from the Czech Statistical Institute (CSI), where municipality size is measured by the number of residents per km^2 [40–43]. This method enabled us to select municipalities with very dense populations (e.g., Kubova Huť) and those with high tourism indicators (e.g., Modrava). A total of 39 municipalities were selected (**Figure 2**).

Demographic data for these 39 municipalities were obtained from the CSI for the years 1991, 2001, 2011, and 2021, when population and household censuses were conducted. The CSI also provided data on socio-economic factors (years 2003, 2011, and 2021), and information about municipality budgets (years 1994, 2011, and 2021) was obtained from the Czech Ministry of Finance. Land use changes were obtained from the State Administration of Land Surveying and Cadastre.

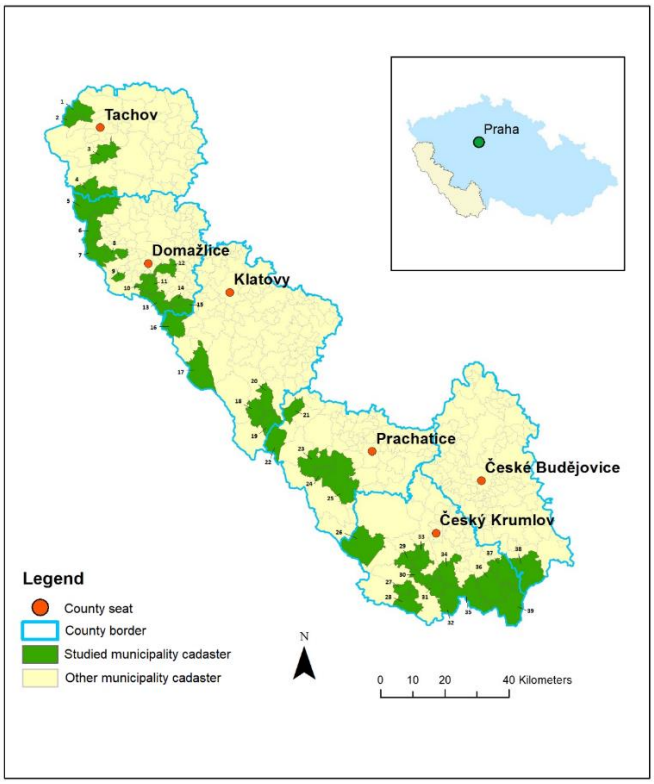

Figure 2. Cadastral map showing the locations of the municipalities studied (green).

1—Halže, 2—Obora, 3—Staré Sedliště, 4—Třemešné, 5—Bělá nad Radbuzou, 6—Rybník, 7—Nemanice, 8—Postřekov, 9—Pec, 10—Tlumačov, 11—Mrákov, 12—Zahořany, 13—Všeruby, 14—Chodská Lhota, 15—Pocinovice, 16—Chudenín, 17—Železná Ruda, 18—Srní, 19—Horská Kvilda, 20—Rejštejn, 21—Stachy, 22—Kvilda, 23—Horní Vltavice, 24—Lenora, 25—Volary, 26—Horní Planá, 27—Lipno nad Vltavou, 28—Loučovice, 29—Světlík, 30—Malšín, 31—Rožmberk nad Vltavou, 32—Horní Dvořiště, 33—Bohdalovice, 34—Rožmitál na Šumavě, 35—Dolní Dvořiště, 36—Malonty, 37—Benešov nad Černou, 38—Horní Stropnice, 39—Pohorská Ves.

2.4. Data analyses

Statistical analyses were performed using STATISTICA 12 and general linear models. We used the Shapiro-Wilk test to determine whether the data was normally distributed before performing ANOVA and whether a logarithmic transformation was necessary (log x + 1). ANCOVA was used to identify changes in the selected factors with the number of residents in 1991 as a covariate, and the independent variable was the type of protected area (PA: 0—outside protected area, 1—Bohemian Forest PLA, 2—Šumava NP). To test for changes over time, we performed a repeated measures ANOVA with "time" as a factor.

Maps were prepared using ArcGIS 10.4 with map layers from two databases: ArcČR500 and AOPK ČR.

3. Results

3.1. Demographic indicators

The total number of residents in the selected municipalities did not significantly differ between those inside and outside the protected areas (p = 0.343). However, a decreasing trend in population was detected in Šumava NP, with an average of 1121 residents in 1991 dropping to an average of 1094 in 2021 (**Figure 3**). An ANOVA test showed a significant effect of time on the number of residents (p = 0.039). Time also significantly affected all other demographic factors tested, whereas location (inside or outside the protected area) did not. We analyzed the productive age population (15–64 years), which increased from 1991 to 2001, remained stable until 2011, and decreased in 2021 to below the 1991 level. **Figure 4** shows these differences in the percentage of productive population from the total number of residents during 1991–2021. We also tested the unemployment rate. **Figure 5** clearly depicts the relationship between the unemployment rate and the productive age population (15–64 years). The trend line of the unemployment rate (**Figure 5**) is very similar to that of the productive population (**Figure 4**). The unemployment rate increased from 3.2% in 1991 to 7.24% in 2001, rising even more steeply to 8.55% in 2011, before dropping significantly to 5.02% in 2021, mirroring the decrease in the productive population.

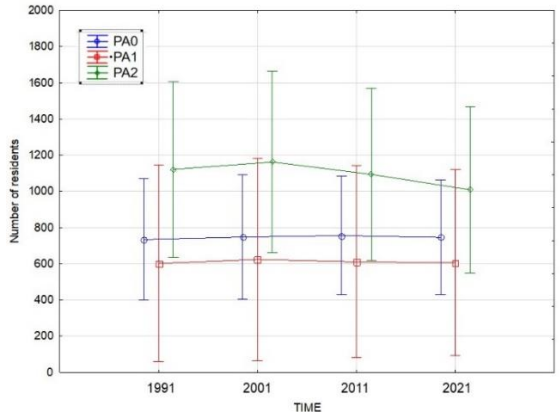

Figure 3. ANOVA showing changes in number of residents per municipality from 1991 to 2021.

Locality type: PA0—outside protected area, PA1—Bohemian Forest PLA, PA2—Šumava NP. Vertical bars denote a 0.95 confidence interval.

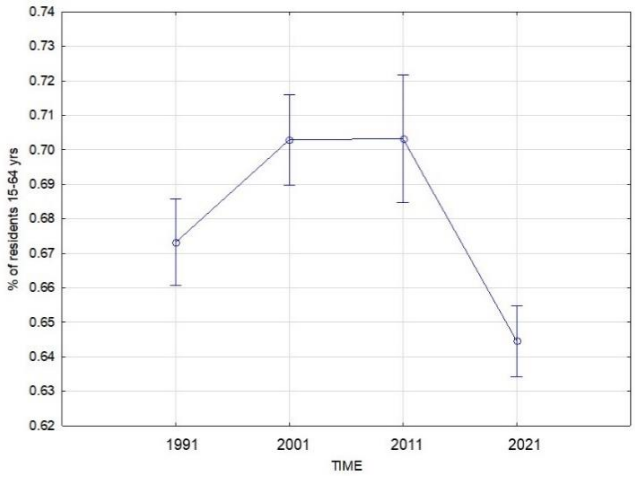

Figure 4. ANOVA showing changes in % of productive age population (15–64 years) in studied municipalities from 1991 to 2021. Vertical bars denote a 0.95 confidence interval.

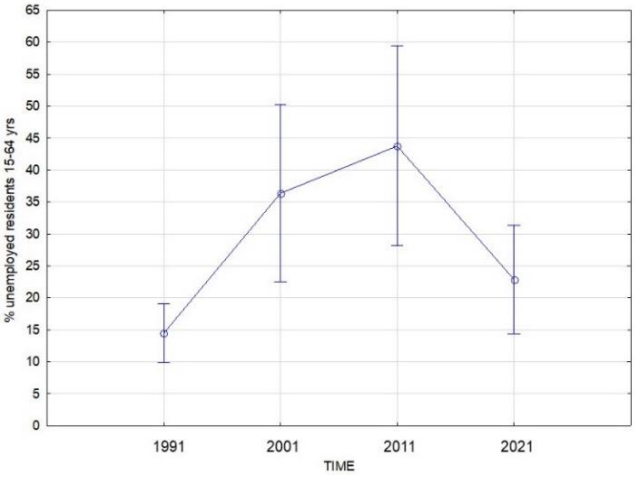

Figure 5. ANOVA showing changes in % of unemployment rate in studied municipalities from 1991 to 2021.

Locality type: PA0—outside protected area, PA1—Bohemian Forest PLA, PA2—Šumava NP. Vertical bars denote a 0.95 confidence interval.

3.2. Socio-economic indicators

The socio-economic situation is determined by factors such as the number of residents, education, municipality size, and income per resident. **Figures 6–9** show these factors and their changes from 1991 to 2021.

First, we tested the number of residents with a university degree (**Figure 6**). ANOVA showed an insignificant increasing trend in educated residents over time ($p = 0.761$). Similarly, nature protection did not significantly affect population education. Of the total number of residents, 0.83% had a university degree in 1991, increasing to 1.09% in 2001, 1.82% in 2011, and 2.83% in 2021.

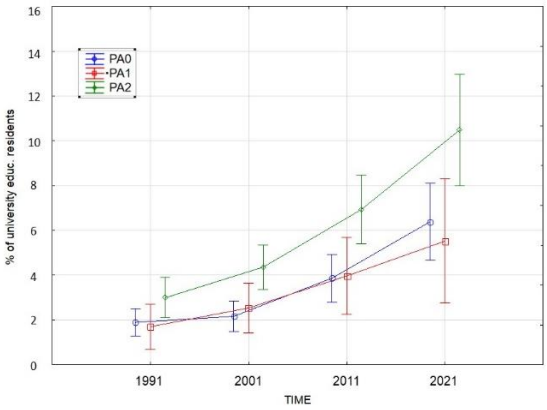

Figure 6. ANOVA of the educated residents with a university degree (% from the total number of residents per municipality) in the years 1991–2021.
Locality: PA0—outside protected area, PA1—Bohemian Forest PLA, PA2—Šumava NP. Vertical bars denote a 0.95 confidence interval.

Municipality income in the studied area was 312,141 thousand CZK in 1994 and increased to 1,472,361 thousand CZK in 2021. We tested the effects of locality (outside or inside the protected area), time, and the interaction of both factors on municipality income per resident (data were transformed using log $x + 1$) with ANOVA (**Figure 7**). The results revealed significant effects of locality ($p = 0.020$), time ($p = 0.030$), and their interaction ($p = 0.000$). The average income per resident increased from 9948 CZK in 1994 to 54,910 CZK in 2021. The highest income per resident was recorded in municipalities located in Šumava NP, followed by municipalities outside any protected area, and the lowest income was in municipalities in Bohemian Forest PLA. The rising effect of income per resident was significant in 1994 only ($p = 0.0005$) as shown in the box plot (**Figure 8**). In 2011 and 2021, there was a rising trend in this parameter, but the results were not significant. We also tested the percentage change in incomes among localities with different protection regimes. When comparing municipality incomes per resident from 1994 to 2021 ($p = 0.0021$), we found that the highest proportional increase in financial means flowed to municipalities outside any protected area, followed by Bohemian Forest PLA, with the lowest income increase occurring in municipalities in the Šumava NP (**Figure 9**).

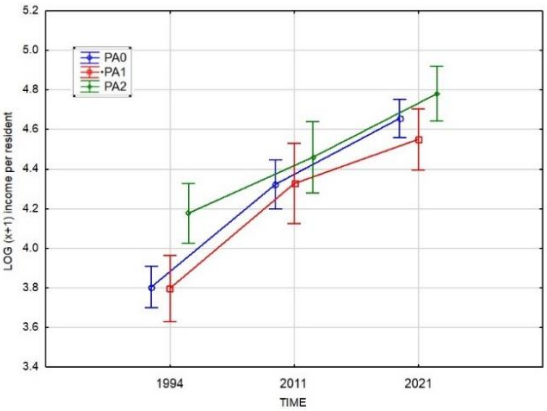

Figure 7. ANOVA showing changes in municipality incomes per resident (data log-transformed) in 1994–2021.
Locality: PA0—outside protected area, PA1—Bohemian Forest PLA, PA2—Šumava NP. Vertical bars denote a 0.95 confidence interval.

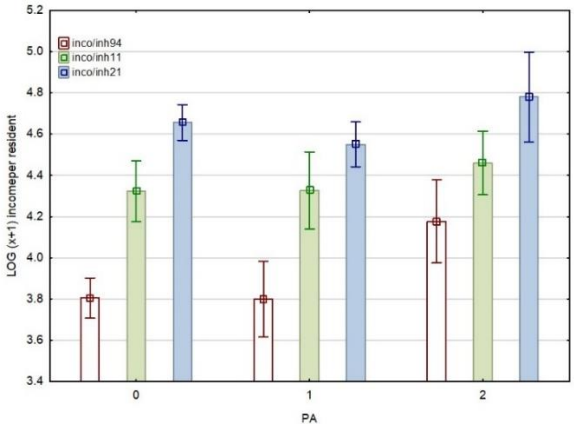

Figure 8. Box plot showing the income per resident in localities with a different protection regime (0, 1, 2) in 1994, 2011, and 2021.
Locality: PA0—outside protected area, PA1—Bohemian Forest PLA, 2—Šumava NP. Vertical bars denote a 0.95 confidence interval.

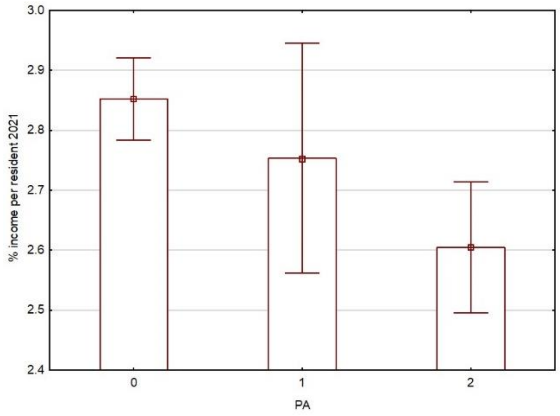

Figure 9. Box plot showing differences in a percentual increase of income per resident among localities with a different protection regime (0, 1, 2) in 2021.
Locality: PA0—outside protected area, PA1—Bohemian Forest PLA, PA2—Šumava NP. Vertical bars denote a 0.95 confidence interval.

3.3. Landscape indicators

The area covered by the municipalities studied increased from 1611.36 km^2 in 1993 to 1653.32 km^2 in 2021. The significant increase in the area covered by the municipality Srní, from 21.823 km^2 to 33.485 km^2, was due to the closure of the Dobrá Voda military training area at the end of the 20th century and the inclusion of this land in the municipality property. Changes in the areas covered by other municipalities did not exceed 3 km^2.

The number of new houses increased from 7348 in 1991 to 10,216 in 2021. ANOVA showed no significant effect of house increase inside or outside protected areas. The analyses revealed a significant effect of time (p = 0.000), indicating that house development was present in all studied localities and increased gradually from 1991 to 2021 (**Figure 10**).

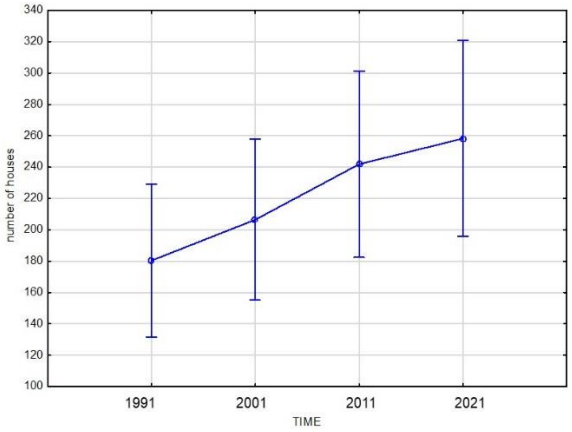

Figure 10. ANOVA showing the increase in the number of houses in the years 1991–2021.
Vertical bars denote a 0.95 confidence interval.

We also attempted to test changes in the number of unoccupied and recreational houses, which are commonly present along the border in the Czech Republic. However, it was not possible to test this factor due to differences in the methodology of house counting in each studied decade. The first official counting (1991) distinguished abandoned houses, houses used occasionally for recreation, and houses for permanent living. This counting showed discrepancies because some recreants had a permanent living address on their recreational property. This led to a change in the methodology of official house counting, and by 2021 it was based on permanent living addresses.

Furthermore, we tested changes in land use (arable land, forest, and grasslands) with ANOVA. Our results revealed a significant decrease in arable lands in all tested localities (p = 0.023), particularly outside protected areas (**Figure 11**). There was an insignificant increase in forest land but a significant increase (p = 0.017) in grassland extent, replacing arable land (**Figure 12**).

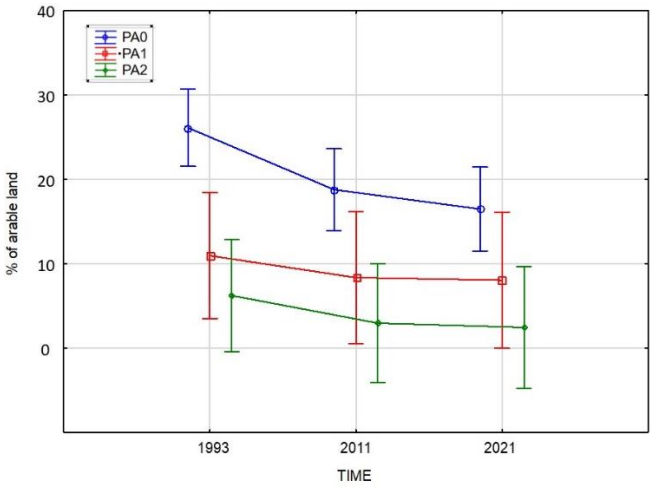

Figure 11. ANOVA showing the decrease in arable land in the years 1993–2021.
Locality: PA0—outside protected area, PA1—Bohemian Forest PLA, PA2—Šumava NP. Vertical bars denote a 0.95 confidence interval.

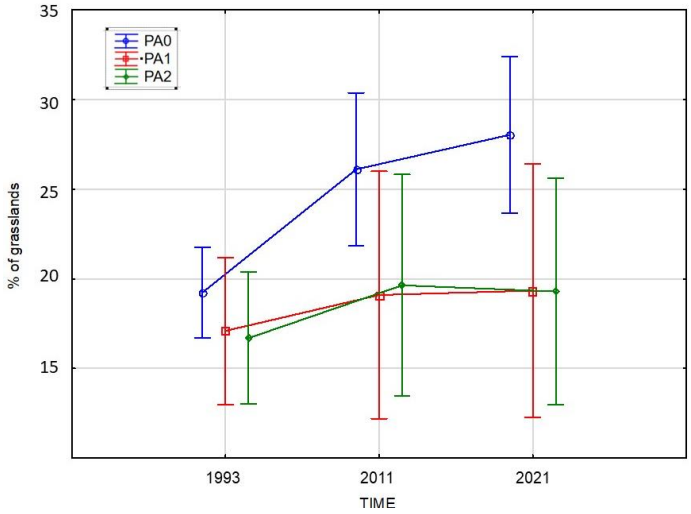

Figure 12. ANOVA showing the increase in grassland in the years 1991–2021.
Locality: PA0–outside protected area, PA1—Bohemian Forest PLA, PA2—Šumava NP. Vertical bars denote a 0.95 confidence interval.

Descriptive statistics provide accurate values used for the presented figures. These statistics include average, minimum, and maximum values with standard deviations of demographic and socio-economic indicators (**Table 1**), landscape use indicators (**Table 2**), and municipality incomes (**Table 3**).

Table 1. Descriptive statistics of demographic and socio-economic indicators.

Variable	Descriptive statistics				
	Valid N	**Average**	**Minimum**	**Maximum**	**Std. Dev.**
Number of residents in 1991	39	806	27	3917	762
Number of residents in 2001	39	828	50	4068	787
Number of residents in 2011	39	812	72	3744	742
Number of residents in 2021	39	784	58	3652	713
% residents in prod. age 1991 (15–64)	39	0.67	0.59	0.75	0.04
% residents in prod. age 2001 (15–64)	39	0.70	0.63	0.81	0.04
% residents in prod. age 2011 (15–64)	39	0.71	0.61	0.76	0.03
% residents in prod. age 2021 (15–64)	39	0.65	0.59	0.71	0.03
% unemployment 1991	39	3.24	0.00	11.92	2.37
% unemployment 2001	39	7.24	0.00	18.26	4.34
% unemployment 2011	39	8.55	2.80	22.22	4.08
% unemployment 2021	39	5.02	1.84	13.24	2.48
% residents with univer. degree 1991	39	0.02	0.00	0.05	0.01
% residents with univer. degree 2001	39	0.03	0.00	0.10	0.02
% residents with univer. degree 2011	39	0.05	0.02	0.15	0.03
% residents with univer. degree 2021	39	0.07	0.02	0.24	0.04

Table 2. Descriptive statistics of landscape use indicators.

Variable	Descriptive statistics				
	Valid N	**Average**	**Minimum**	**Maximum**	**Std. Dev.**
Number of houses in 1991	39	188	13	503	136
Number of houses in 2001	39	204	19	584	144
Number of houses in 2011	39	246	30	624	167
Number of houses in 2021	39	262	29	652	176
% arable land 1993	39	0.18	0.00	0.48	0.14
% arable land 2011	39	0.13	0.00	0.44	0.13
% arable land 2021	39	0.1	0.00	0.44	0.13
% forests 1993	39	0.54	0.19	0.88	0.18
% forests 2001	39	0.54	0.19	0.88	0.18
% forests 2011	39	0.54	0.19	0.88	0.18
% forests 2021	39	0.55	0.19	0.88	0.18
% grasslands 1993	39	0.18	0.05	0.28	0.06
% grasslands 2011	39	0.23	0.05	0.49	0.10
% grasslands 2021	39	0.24	0.06	0.48	0.11

Table 3. Descriptive statistics of municipality incomes.

	Descriptive statistics				
	Valid N	**Average**	**Minimum**	**Maximum**	**Std. Dev.**
Municipality income (in thsd. CZK) 1994	39	8003.62	458.82	50,553.04	11,745.47
Municipality income (in thsd. CZK) 2011	39	18,527.62	2156.00	72,716.00	17,421.20
Municipality income (in thsd. CZK) 2021	39	37,752.85	3209.00	154,174.00	35,951.24
Municipality income/inhabitant 1994	39	9948.14	1954.09	47,972.42	8456.95
Municipality income/inhabitant 2011	39	27,166.69	2013.87	88,715.76	16,295.62
Municipality income/inhabitant 2021	39	54,910.55	21,557.60	300,307.69	46,578.13

4. Discussion

This study reveals long-term demographic changes in the population along the southwestern border of the Czech Republic. Data from four official counts of houses and residents in 1991, 2001, 2011, and 2021 were included. This long period captures significant political changes as well as the COVID-19 pandemic in 2019–2021, all of which impacted human activities and socio-economic conditions in the studied municipalities. The municipalities were selected based on their location and protection regime (none, protected landscape area, national park) to test presumed population shifts from the countryside to cities with the establishment of protected areas [6,7,44] and opposite shifts from cities to the countryside during the Covid-19 pandemic due to social contact restrictions [2,3,45].

Our study is based on numerous factors (total number of residents, productive age residents, unemployment rate per municipality, landscape usage, municipality income, etc.) monitored over three decades. Most recent literature focuses on one factor, such as the effect of tourism on the local economy [46–48], or considers only

protected areas without comparing them to surrounding areas [8]. Although the western border of the Czech Republic has been discussed in many papers [49,50], none compared the effects in protected areas with those in similar unprotected areas as we did in this study and our previous work [5]. Some studies of large protected areas rely on questionnaires depicting the current situation without evaluating changes over time [9].

In the second half of the 20th century, a restricted border zone several kilometers wide was created in the study area, leading to ecosystems largely unaffected by human activities and worth preserving as protected areas [51,52]. The Šumava National Park was established in 1991 (with the Protected Landscape Area Šumava existing since 1963), and the Bohemian Forest Protected Landscape Area was established in 2005. These protected areas influenced socio-economic development, such as new house construction and business limitations. A previous study [5] compared demography, economy, and landscape use between 1991 and 2011 to evaluate the effect on municipalities inside and outside protected areas. It found significant differences in these factors but not necessarily associated with being in a protected area; rather, it was related to municipality size. No significant profit decline was caused by restrictions connected to protected areas, as was assumed by the public. Local examples, such as the Biospheric Reserve Entlebuch [53] and the nearby Bavarian Forest NP [7,12–14], show the economic benefits of being in a protected area. However, in the Czech Republic, particularly in Šumava NP, some residents live and work in the protected area but have permanent residences elsewhere, so their incomes are not included in the local budget [8]. This situation can make it difficult for local residents to appreciate the benefits of development restrictions when tourism income goes elsewhere [9,54]. However, living in a protected zone does not necessarily disadvantage the socio-economy, as shown by the previous study [5].

The last decade tested in this study includes the COVID-19 pandemic (house and resident counting in 2021), where significant population and economic shifts were expected due to the threat of virus spread and mortality in densely populated cities, along with government restrictions on social contacts [2,3,45]. The relatively small but steady number of people moving from urban to rural areas in search of a healthier quality of life [55,56] highlights the vulnerability of urban life in densely populated cities exposed by the Covid-19 pandemic [57,58]. This shift was also supported by the widespread acceptance of remote work for professions allowing it.

Our results revealed a significant effect of time (1991–2021) on demographic and economic parameters (total number of residents per municipality, productive age population, unemployment rate, population with university degrees, municipality income per resident, and landscape use). The total number of residents per municipality gradually increased without extreme outliers, as shown in **Figure 3**. The establishment of protected areas (NP) or the Covid-19 pandemic did not significantly affect the population of the studied municipalities. We observed a clear trend of population aging (**Figure 4**), indicated by a decline in the productive age group (15–64 years), which is also related to a decrease in the unemployment rate (**Figure 5**). This population aging did not show significant differences between localities inside or outside protected areas and applies to the entire western border region of the Czech Republic [59].

The economic situation in the studied municipalities, measured by income per resident, showed significant changes over 1991–2021 (**Figures 7** and **8**). Incomes increased independently of whether the locality was inside or outside the protected area, and even the last decade, including the COVID-19 pandemic, did not show a steep economic drop. **Figure 10** depicts the percentage income changes according to locality protection status in 2021. Municipalities outside the protected area received the most financial means per resident, followed by those in the PLA, with the least in NP municipalities. As mentioned, this may be influenced by residents working in the protected area but living elsewhere, so their incomes are not counted in the local budget, particularly in the Šumava NP [8].

We also focused on changes in land use, finding small but significant differences from the previous study [5] in the conversion of arable land to grasslands, typically not exceeding 3 km². Our attempt to reveal changes in the number of unoccupied and recreational houses, especially for the last decade (2021), was not possible due to methodological changes in house counting by the Czech Statistical Institute across different decades.

5. Conclusion

The aim of this study was to determine the effect on the socio-economic development of municipalities inside and outside protected areas, especially in relation to historical events such as the establishment of national parks (NP) and the COVID-19 pandemic era. This was done by comparing similar municipalities over a period of 30 years (1991–2021). The tests covered 17 indicators measured in 39 municipalities over these three decades. Based on the study's objectives, we conclude that there were significant differences in demography, economy, and landscape usage; however, these differences were not associated with whether a municipality was located inside or outside a protected area.

The presented results revealed differences in economic development across the decades. During the first decade in particular, the municipality location played a role, with the highest income per resident detected in the municipalities within the protected area of the Šumava NP. However, this trend was not statistically significant. One major factor contributing to this difference is the high price of real estate in the NP municipalities. Expensive houses attract a wealthy upper class, drawn by the beauty of untouched nature. Conversely, young people tend to leave these expensive localities in search of areas with a more favorable ratio of salary to living costs. In the last two decades, the income difference diminished somewhat, but the location of the NP continued to positively influence the development of municipalities. This slowdown in economic development within the NP could be interpreted as a consequence of market saturation during the first decade.

Our results did not show any significant outliers for the last decade, which included the Covid-19 pandemic (counting houses and residents in 2021). The differences among municipalities located inside or outside protected areas remained very similar across all tested decades, including the last one with restrictions on social contact. More detailed socio-economic studies and questionnaire surveys could help in the future to better understand the changes observed in our study.

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