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EDITORIAL

Rationales for the AUC Geographica publishing model

Vít Vilímek¹, Josef Novotný², Antonios Mouratidis³

¹ Charles University, Faculty of Science, Department of Physical Geography and Geoecology, Prague, Czechia

² Charles University, Faculty of Science, Department of Social Geography and Regional Development, Czechia

³ Aristotle University of Thessaloniki, Department of Physical and Environmental Geography, Thessaloniki, Greece

AUC Geographica (formerly *Acta Universitatis Carolinae, Geographica*) is a journal with a long tradition published by Charles University (issued continuously since 1966). See also the Editorial for the 50-years anniversary (Vilímek 2015). It is an open access journal applying no publication fees, or no hidden charges such as page charges or submission fees charged prior to peer review. The journal is financially supported by Charles University and is committed to operate on a non-commercial basis. Although this means certain constraints, it applies a publishing model that deliberately opposes growth- and profit-oriented journals and publishers that tap public funds through subscription fees, open access publication fees, or both (using the largely uncompensated work of reviewers and editors). We believe that the current hegemony of growth- and profit-oriented academic journals and publishers is not only associated with a reckless waste of public resources, but it also amplifies already substantial inequalities in global academia and lowers the average quality standards of academic output. These three trends are unfortunate and destructive. Therefore, both institutional and personal commitment to alternative publishing models in academia is the need of the hour. We believe that the support of traditional university-based journals such as AUC Geographica represents an alternative that is worth following and supporting. The basic concept behind this effort is to be scientifically strict yet fair and supportive, challenging authors with ideas and questions, with the sole aim of assisting them in improving their research output.

Thematic focus and type of papers

Submissions focusing on academically and practically relevant topics in the fields of physical geography, geo-ecology, human geography, regional as well as international development, demography, cartography, and geoinformatics are welcome. AUC Geographica mostly publishes original research articles, but also invites authors to submit review papers. We are

also able to organize monothematic (or half-monothematic) issues.

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AUC Geographica is committed to inclusion and equality. It applies no restrictions with respect to the thematic focus of submitted works in the field of geography and related disciplines. In addition, it applies no restrictions to the geographic origin of authors or location of their institutions or other aspects of the authors' background.

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AUC Geographica strives to publish papers that meet the rigorous standards of academic work. AUC Geographica is indexed in several databases such as Scopus (since 1975) and has been selected for coverage in Clarivate Analytics products and services as well. The character of the editorial board became international in 2007; nevertheless, this is a continuous process that also reflects the progress in our geographical disciplines.

The journal has recently extended and internationalized its editorial board. It now consists of experienced experts from different areas of geography, who guarantee the quality of published works. After initial submission, each article is screened by one or multiple editors. Papers that do not meet the basic standards are rejected directly. All other submissions are sent for peer review by at least two independent experts identified by the journal editors. The journal editors supervise the quality of peer-reviews and communicate the results and requirements to the authors.

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A comparative appraisal of environmental conditions in two urban low-income communities in Accra, Ghana

Ronald Reagan Gyimah¹, Louis Kusi Frimpong^{2,*}, Golda Anambane³,
Rosemary Anderson Akolaa², Stephen Leonard Mensah¹,
Harriet Danso-Abbeam⁴

¹ University of Ghana, Department of Geography and Resource Development, Ghana

² University of Environment and Sustainable Development, School of Natural and Environmental Science, Ghana

³ University of Ghana, Institute of Statistical, Social and Economic Research, Ghana

⁴ Environmental Resources Research Center, Ghana Atomic Energy Commission, Ghana

* Corresponding author: lkfrimpong@uesd.edu.gh

ABSTRACT

This paper examines (i) the state of environmental conditions in two low-income urban communities in Accra, Ghana, using a Participatory Rapid Assessment (PRA) method, and (ii) changes in the environmental conditions in the two low-income communities over the years using the PRA method. The PRA was augmented with qualitative interviews with selected heads of household and other stakeholders from the study communities. The results showed that environmental conditions in the two study communities were poor as indicated by the computed average scores for the environmental problem areas. However, conditions were poorer in Chorkor compared to La. The paper recommends that local governments units in Ghana must prioritise sustained, improved, and reliable funding for Water, Sanitation, and Hygiene (WASH) to ensure undisruptive implementation of environmental health programs and policies. This must be accompanied with improved community education and sensitization on proper sanitary practices, which have the potential to mitigate the effects of disease epidemics such as cholera in the two communities. The study also provides important perspectives on differentials in environmental conditions in low-income communities in urban Ghana.

KEYWORDS

environmental conditions; environmental health; rapid assessment; hazards; Accra

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1. Introduction

Rapid urbanisation is a characteristic feature of most developing countries (UN-DESA 2010). Projections show that by 2050, about 68% of the world's population will be living in urban areas, with a larger share of this population expected to come from developing countries (Ritchie and Roser 2018). In regions such as Africa and Asia, rapid and unsustainable urban growth have had a consequential impact on the management of urban areas due mainly to resource constraints and poor planning. Unsustainable urbanisation in developing countries has significantly impacted human health due to challenges in accessing social and environmental services (World Health Organisation (WHO) 2016). Problems relating to the provision of essential environmental services have consequently impacted the environmental conditions of urban areas, which pose a serious threat to the health and safety of residents (Heymann and Rodier 2001; Nelson et al. 2005).

Environmental problems in cities of global south countries have been exacerbated by social and economic inequalities which stems from ineffective policies and lack of inclusivity in the planning and management of cities (Arku and Marais 2021). As argued by Cobbinah et al. (2017), poor urban communities' face a disproportionate share of the environmental problems in cities which invariably indicate uneven exposure to environmental health burdens. While acknowledging the efforts made over the years through the enactment of environmental health policies and establishment of governing structures, the problem is still persistent and likely to exacerbate as a result of increased population and poverty (Cobbinah et al. 2017). Using the situation of Ghana as a case in point, while 24% of households in urban Ghana have access to pipe-borne water inside their dwelling, 26% of them have access to pipe-borne water outside their dwelling (Ghana Statistical Service (GSS) 2014a). In the Accra metropolis, 37% and 39% of households share bathrooms and toilet facilities respectively (GSS 2014b; Antwi-Agyei et al. 2020). Due to the lack of toilet facilities in many houses occupied by households, public toilets are the commonly used sanitary facilities, especially in poor urban communities (Tanle and Kendie 2013; Peprah et al. 2015). Aside from water and sanitation, urban areas in Ghana such as Accra, Kumasi, and Tamale face a huge challenge with waste management. For instance, only 10% of the about 12,710 solid waste generated daily in areas is collected (Miezah et al. 2015).

There has been a plethora of studies on the enormity of urban environmental challenges in Ghana (see Owusu 2012; Oteng-Ababio 2013; Mensah, 2014; Cobbinah and Korah 2015; Owusu-Sekyere et al. 2016; Cobbinah et al. 2017; Oteng-Ababio et al. 2017; Songsore et al. 1998; 2005; 2009; Songsore and McGranahan 2007; Songsore 2017). However, further

understanding is needed regarding how environmental problems can be measured and scaled to facilitate assessment of environmental problems across space and time. This brings to the fore the issue of environmental hazard indicators as an important tool or measure in assessing environmental conditions in urban areas. In Ghana, the well-known studies that assessed environmental conditions in urban communities using proxy environmental hazard indicators are Songsore et al. (1998; 2005; 2009). Indeed, in their study, Songsore et al. (1998) argued that the use of the PRA method, which uses standardized environmental hazard indicators for assessing environmental conditions can facilitate continuous assessment and monitoring of environmental conditions in urban communities. This paper builds on previous studies by Songsore et al. (1998; 2005) and adopts the PRA method to assess the environmental conditions in two low-income indigenous communities in Accra, Ghana's capital.

The choice of two low-income indigenous communities in this paper is premised on the fact that previous studies that have used the PRA in assessing environmental conditions focused on communities of varying socio-economic statuses (see Songsore 1998; 2009). The expected results from these studies have been obvious from the onset since high-income communities have for a long time enjoyed unparalleled access to essential environmental services. The intention of these studies admittedly have been to build a case that a section of urban residents is privileged compared to others, and thus make a case for equal access to essential environmental services for all. On the other hand, these studies often mask the differentials in the environmental conditions in low-income communities, since the situation is often worse for some low-income communities than others. Therefore, the present paper seeks to depart from the long held assumption that poor communities are similar because of the commonality of their environmental problems. In view of this, the paper seeks to address the following objectives (i) assess the state of environmental conditions in La and Chorkor, two low-income communities in Accra using the PRA method, and (ii) examine the extent of progress made over the years in improving the environmental conditions of La and Chorkor using the PRA method. In all, the paper attempts to provide a better understanding of varying environmental problems faced by urban low-income communities.

After this introduction, the paper presents a conceptual model on human ecology and environmental health. Next is the institutional and policy frameworks that guide environmental management in local communities in Ghana. This section is intended to contextualise environmental problems within the institutional and policy frameworks in Ghana. The study area and the methodology are next presented. Followed by the results, discussion and conclusion.

1.1 Human ecology and environmental health problems: An overview

The environment – a very significant component for human well-being and health, can also be a source of problems for residents. These problems are manifested through pollution and poor environmental conditions (European Environment Agency (EEA) 2022). Yet, a good environment provides residents with essential amenities such as clean water and air (EEA 2022). Improving environmental quality through the provision of these amenities could prevent diseases and safeguard the health of residents (EEA 2022), especially those in urban communities. Poor environmental conditions – one of the major causes of mortality, accounts for more than 8 out of 10 of major diseases and injuries across the globe (Cissé 2019). Among these conditions is the critical role played by food and water contaminations in disease transmission (Cissé 2019), which accounts for about 93 million illness and 140,000 deaths in Africa (WHO 2018). An important framing within the disease-environment nexus is the concept of human ecology (Li 2017), which has become an important conceptual lens for understanding population and space-based environmental problems (Dudley and Poston 2015). The concept provides a nuanced understanding of human organisation in space, their use of resources, and how daily activities impact the physical conditions of their habitat (Kassam et al. 2011; Milner-Gulland 2012). Changes in population including the scale, composition, and pace of population growth contribute to a variety of environmental-related concerns since such changes affect how the physical environment is managed, and the ability of the environment to cope with pollution and other negative externalities (de Sherbinin et al. 2007; Dietz et al. 2007). Human activities and poor management of the environment often release pollutants into the surroundings which affect human health (Babayemi et al. 2016).

Related to the ecology, environment and human health interrelationships, is the different pathways provided by environmental conditions or hazards through which pathogens spread (Songsore et al. 1998). Akin to this are three main concepts in the environmental health literature. First, the process and the rate of release of pollutants in both time and space (Eckelman et al. 2020), second, the transmission process of pollutants through different pathways such as food, water, and air (Corvalan and Kjellstrom 1996) and third, the contact between people and pollutants in their immediate surroundings (Songsore et al. 1998). The latter is a function of the convergence of variables such as the quantity and duration of contact with sources of pollutants. Thus, daily exposure is likely to increase the impact and severity of environmental health burdens.

The spread of diseases among urban dwellers is a function of their interaction with the environmental

risk factors present in their environment (Flies et al. 2019). These environmental health risk factors are created and conditioned by how people manage and use the environment in which they live. However, exposure to environmental health risks varies depending on where one lives because of variations in exposure levels to environmental pollutants in different surroundings. This differential exposure also reflects issues such as social and spatial inequalities, and unevenness in access to environmental services (WHO 2010).

The foregoing discussion necessitates the need to employ human ecology as a conceptual lens to explain how urban low-income communities are often characterised by poor environmental conditions, and to devolve the implications of these conditions on the health of residents. The human ecology model is significant in the context of this study because it provides the basis for understanding residents' use of environmental services and their outcomes such as access to and use of water and sanitation (Marten 2010), hygienic food environment (Sotiangco et al. 2016), and conservation of biodiversity in a changing urban climate (Ogato 2013). Despite these essential merits offered by the model in understanding the interdependence between humans and their environment, it has also received a couple of criticisms. Arguing from a human-environment ecological perspective, Ray and Jacob (2015) argue that there is always a difficulty in comprehending fully, the diverse and infinitesimal relationships in ecological analysis. This situation according to the authors can occasion decision-making without recourse to sound ecological analysis. Further, on the limitation of the ecological analysis, Ray and Jacob (2015) suggest that political institutions, economic systems, and local social systems often compel people to make decisions irrespective of whether such decision impinges on the sustainability of human societies, the environment within which they live or even their own welfare within the larger surroundings.

1.2 Institutional and policy framework for urban environmental management in Ghana

Urban environmental problems are handled at the local government level within Ghana's decentralised administrative system, which is the Metropolitan, Municipal and District Assemblies (MMDAs). The Environmental Health Department (EHD) of the MMDAs is a legally established unit that is in charge of managing water and sanitation issues in the MMDAs (Ministry of Health 2005). In addition to water and sanitation, the EHD is also required to collaborate with other state and non-state actors to provide a healthy environment that enhances the safety of the populace. Personnel who work in the EHD are called Environmental Health Workers (EHW) and they are required to discharge environmental health and sanitation

services at the MMDAs. This includes monitoring and reporting of environmental problems for appropriate actions to be taken. They are also to ensure that proper sanitation, hygiene and waste management practices are complied with in accordance with national laws and policies, and local government bye-laws (Ministry of Health 2005).

Aside from the local government administrative structure, there are also national policies which aim to guide the delivery of services, allocation of resources, and the management of the Water, Sanitation and Health (WASH) sector. Two policy documents, the National Water Policy (NWP) and The National Environmental and Sanitation Policy (NESP) are given attention here. The NWP, which was launched in 2007 aims to provide a framework for the sustainable management of water resources in the country. It aims to bring water management within Ghana's decentralised administrative structures under one umbrella, and also link water use to other sectors such as sanitation, agriculture, and energy (Monney and Ocloo 2017). It combines policy documents from three agencies which are the Ghana Water Company Limited (GWCL), which is in charge of urban water supply, the Community Water and Sanitation Agency (CWSA), which is in charge of rural water supply, and the Water Resources Commission (WRC), which is in charge of regulating and managing water resources in the country (Netherlands Development Organisation (SNV) 2018). By harmonising the policies of the agencies, the NWP aims to integrate water management and supply for sustainable economic and social development. The second policy document which is the NESP was developed in 1999 and focuses on all aspects of environmental health including sanitation and waste management. At the local level, the implementation of the policy is carried out by the MMDAs through the EHD.

Despite efforts made to improve environmental health conditions in urban areas, there are limitations that have stymied the effective and efficient implementation of these policies at the local level. These include inadequate funding for agencies and local government institutions as well as a high dependency on external funds for sanitation-related investment, which is also a challenge in itself as its utilisation is often regulated. There are also problems regarding inter-sectoral coordination in the implementation of these policies as well as inadequate human resource capacity at the local level.

1.3 Environmental context of study communities: La and Chorkor

La and Chorkor are indigenous low-income communities in the Greater Accra Metropolitan Area (GAMA). La is the administrative capital of the La Dade-Kotopon Municipality, while Chorkor is located in the Ablekuma South Sub-Metro of the Accra Metropolis

(Figure 1). La and Chorkor have a total population of 98,683 and 78,918 respectively (GSS 2014b; GSS 2014c). Both are slum communities and have similar social and cultural characteristics. They are also characterised by high levels of unemployment, poverty and deprivation, as well as overcrowded houses with inadequate access to water, sanitation, private bathrooms, and drainage systems (Darko-Gyeke and Kofie 2015; Quaye 2018). Both communities lie along the coast and have sandy beaches, also the Kpeshie and Chemu lagoons located within the outskirts of the two communities respectively are polluted with human and liquid waste. Further, these lagoons serve as a principal outlet through which major drainage channels in Accra empty their waste into the sea (Boadi and Kuitunen 2002; Oteng-Ababio and Arguello 2014). Chorkor is one of the many low-income communities in Accra which depends on groundwater due to its availability and affordability (Ketadzo 2019). But a recent study has shown that this groundwater contains a mean lead concentration of 1.00 mg/l which is above the WHO recommended lead limit of 0.01 mg/l (Ketadzo 2019). Likewise, studies have also shown that poor environmental conditions contributed to the high cholera cases recorded in 2014 in La and its environs (Ansong 2015).

2. Methodology

2.1 Data collection process

The data used in this study is from a household survey conducted in the study communities in 2016, by the first and third authors together with two other research assistants. The study adopted the PRA method which involved constructed values on indicators (McGranahan et al. 2001; Songsore et al. 1998; 2005). The constructed values are based on Key Informant Interviews (KIIs), Focus Group Discussions (FDGs) with community members and field observations carried out in the study communities. In addition to the PRA, the data included qualitative interviews with residents and other stakeholders in the study communities. La and Chorkor were randomly selected from a pool of indigenous communities in the Greater Accra Metropolitan Area (GAMA)¹. Incidentally, these two communities were part of the 2001 and 2005 citywide PRA of the environmental conditions in residential communities in the Accra metropolis (see McGranahan et al. 2001; Songsore et al. 2005). Thus, by conducting the PRA in these two communities, the paper provides insight as to whether environmental conditions as measured using environmental indicators in previous studies have changed over the years. Subsequently, the PRA scores generated by Songsore

1 GAMA is the unofficial name given to the larger functional area of Accra, Ghana's capital.

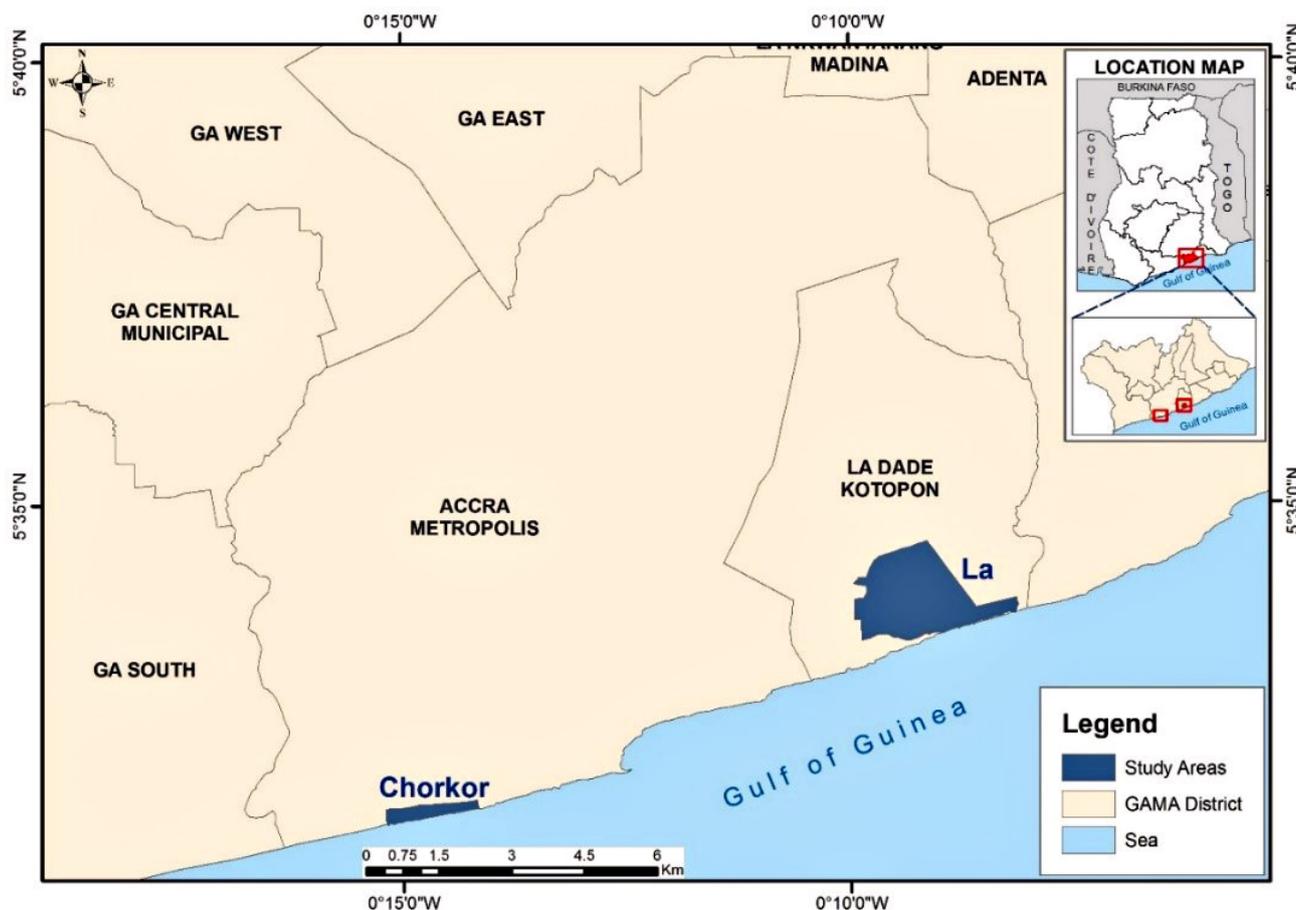


Fig. 1 Map of study areas.

et al. (1998) were used as the benchmark scores. The qualitative data was collected through in-depth and KIIs with household heads and community leaders in the two communities to complement data gathered from the PRA. In total, 36 KIIs (i.e. 18 from each community) were conducted. The 18 key-informants comprised of 2 Assembly members, 2 environmental health officers in charge of one of the communities, 2 planning officers in charge of one of the communities, 2 traditional leaders, i.e. one from each of the community and 10 residents who were conveniently sampled from the two communities (i.e. 5 from each community).

2.2 Use of indicators and rationale

The PRA is one of the research methods used for assessing environmental problems in urban communities and can be adopted in studies focusing on intra and inter-urban analysis of environmental conditions and services (McGranahan et al. 2001). Environmental indicators provide the opportunity for routine monitoring of community environmental problems, and can systematically quantify environmental risk factors in a community.

In the study by Songsore et al. (1998), nine major environmental problem areas were identified as having strong implications for the health status of urban

residents. These areas include; water, sanitation, hygiene, sullage/drainage, pests, housing problems, indoor and outdoor air pollution, food contamination and solid waste. Within each environmental problem area, there are specific indicators which are measurable and provide more information on the problem area they fall under. Upon physical observation by the researchers and their assistants coupled with interaction with residents and key informants such as assembly members², traditional leaders, and representatives of interest groups, weights were assigned to the individual indicators under the problem areas. Not all indicators were assigned the same weight because some indicators are deemed to be essential or instrumental to the problem areas than others. For instance, in Appendix 1, an indicator like 'water from ponds/streams as principal source of water supply within community' is assigned a higher score than 'frequent water supply interruptions within community' because the former is deemed to be a serious challenge than the latter in terms of its contribution to environmental health risk. The sum of all weights assigned to the specific indicators gave the overall score or value for the problem area. Individual

2 Assembly members are elected officials who represent members of their electoral areas in the various MMDAs.

communities were then assessed based on the indicators, and weights were assigned to these indicators to ascertain how close or far their weights are to the maximum weight³ there is for that indicator.

2.3 Weighting procedure of environmental problem areas and indicators

The scoring system consisted of two stages. The first stage generally entailed the allocation of weighted scores to the problem areas. A total score of 100 was distributed to the nine environmental problem areas (e.g., water, sanitation, hygiene, sullage/drainage, pests, housing problems, indoor and outdoor air pollution, food contamination and solid waste). At this stage, experts from the field of environmental health from academia, government institutions, and non-governmental organisations gave their opinions and suggestions on the appropriate score that should be assigned to each problem area out of a maximum score of 100. This was done during a stakeholder consultation (see Songsore et al. 1998). An important consideration in the distribution of the maximum score was the contribution of the problem area to the disease burden of the Greater Accra metropolis.

The second stage entailed the weighted scoring of indicators/hazards within individual environmental problem areas. Indicators for each problem area were chosen and weighed individually. The weighting was done to reflect the relative impact of distinct hazards within each problem area while taking cognizance of the problem area's overall importance. The second stage had two main steps. In the first step, the average score for each problem area was doubled and then distributed among the hazards/indicators under each problem area, thus making the new total a maximum score of 200. Hence, if all hazards were present, the overall score allocated to that problem area in the first stage would be two times as high in the second stage. In the second step, maximum scores were assigned to each hazard/indicator in the problem areas (see Appendix 1) based on opinions shared by stakeholders. The impact of environmental problem areas on health risk was then assessed by their scores, where the higher the score the more severe the environmental problem area and vice versa.

2.4 Computing of the indicators into aggregate data and analysis of results

In applying the environmental indicators as a rapid assessment tool, La and Chorkor were divided into four blocks (sub-locations). La was divided into the following divisions; New Lapkana, Abese, Adiembra

and Lakpakpa. Chorkor on the other hand was divided into the following divisions; Lanteman, Chemuana, Alhaji and T-Gardens. To create a community average for each problem area, the indicators for each problem area were scored at the block level (see Appendix 1). The sub-total from the blocks on each of the problem areas were summed up and divided by 4 as expressed in equation 1. Thus, the average score for each problem area was based on the aggregate of the individual indicators in that problem area within individual blocks. The grand maximum score was determined by aggregating each of the nine problem areas as defined in equation 2.

In the rapid assessment, the total score for each community (La and Chorkor) was expressed as a percentage of the maximum score as defined in equation 3. The scores were further expressed in quintiles of environmental burden, where the first quintile is between 1% and 20% and the fifth quintile between 81% and 100%. The first quintile had the least serious environmental risk condition, whereas the fifth quintile had the most serious environmental risk or burden. The results were expressed as quintiles of aggregated environmental burden for each community. This measures the level of deprivation and the level of risk each community is exposed to as far as environmental risk factors are concerned. The following equations were used in constructing weighted indexes for the environmental problem areas;

$$\text{Community Average (e.g. La)} = \frac{\text{Sum (Sub locations)}}{4}, \quad (1)$$

$$\text{Grand Maximum Score} = \text{Sum (Sub Total of Environmental problems)}, \quad (2)$$

$$\frac{\text{Percentage of Environmental Problem Area}}{\text{Problem Area}} = \frac{(\text{Mean Score})}{(\text{Maximum Score})} \times 100, \quad (3)$$

3. Results

3.1 Index of environmental conditions for La and Chorkor

Table 1 shows that the mean score for water as a problem area was 19.78 and 26.30 representing 53.4% and 71.1% for La and Chorkor, and put them within the third and fifth quintiles respectively. Comparative analysis within the blocks on this problem area indicate that while Adiembra was the worst-off block in the case of La, Alhaji was the least worst-off in the case of Chorkor. The findings also revealed that Chorkor's problem with water is more acute than La (see Appendix 1), even though being in the third quintile is still an undesired situation for La. Results from the PRA, as summarised in Table 1 also shows that sanitation remains a serious problem in both communities. Both La and Chorkor recorded a mean score of 24.00

³ The maximum weight is the maximum score assigned to an indicator. The study used the maximum weight computed by Songsore et al. (1998) as the benchmark for the study.

and 27.15, representing 80% and 91% and put them within the fourth and fifth quintiles respectively. While all four blocks in La were equally worst-off in this problem area, Chemuana was the most affected block in the case of Chorkor (see Appendix 1). Field observation and qualitative interviews indicated that there were a litany of sanitation problems in the two communities, albeit residents in Chorkor were worst-off. Open defecation and littering of faecal matter in polythene bags are widespread in Chorkor, but also a situation which is not hard to find in La. Public toilets remain the main source of toilet facilities for most households and these are provided by the government, Non-Governmental Organisations (NGO's) and private entities at a regular fee ranging from 30 to 50 pesewas (0.07 to 0.11 USD). Unfortunately, some residents resort to other alternative means of convenience if they are unable to pay these fees, or when there are long queues to use the facilities during rush hours. This leaves most people defecating in unauthorised locations, particularly along the beaches (see Figure 4).

The PRA also revealed that residents face unhygienic conditions in the two communities as, La scored 12.1 and Chorkor scored 17.4 representing 62% and 89%. This places them in the fourth and fifth quintiles respectively (see Table 1). Whereas Abese was the worst-off block in this problem area in the case of La, Lanteman and Chemuana were the worst-off blocks in the case of Chorkor (see Appendix 1). Some of the unhygienic practices identified during the field-work include unwashed hands in food preparation, unwashed dishes in households, and inadequate public bath facilities among others. The qualitative interviews below capture the concerns of residents regarding water access and usage, sanitation and the hygiene situation in the study communities. The quotes show that the irregularity with the flow of pipe-borne water creates conditions whereby residents have to pay more for water access. Field observations showed that the main source of water supply (pipe-borne) was located outside the dwelling, and water used for household chores was stored in open containers, making residents very susceptible to infectious diseases such as cholera, as most households do not treat water before using it. There was also evidence of exposed pipelines in drains in the two communities putting users' or residents' health at risk as indicated in figure 2 and 3.

Response on water in La:

Access to water has been a major problem in the community, although over the years the situation has improved. From my next house neighbour, I get water, but frequent water interruption has been very difficult for my house chores duties (45-year-old female tenant).

Response on water in Chorkor:

... although in our house we have pipe-borne water, it is only accessible to the landlord." We, therefore, collect water from the neighbourhood pipe stand of which we

pay GH 0.50 (\$ 0.085) per bucket (10 litres). We are also forced to store water in barrels for several weeks due to the frequent water interruption, which affects its quality and taste, as a result, we mostly rely on sachet water for drinking (38-year-old female tenant).

Response on access to toilet facilities in Chorkor:

Many houses do not have toilet facilities so we all depend on the public toilets. Unfortunately the toilet facilities are not many. I think in my area we have just two. How can two public toilets serve all the people here? That is why many people go to the beach to ease themselves (41 year old Assemblyman).



Fig. 2 Pipelines found along and in drains in Chorkor.



Fig. 3 Pipelines found in drains in La.



Fig. 4 Open Defecation along the Beach in Chorkor.

There is a huge gutter behind us which has now become a receptacle for waste but you find people selling around this place. Conditions in our houses are also not good and that is why most people get cholera and malaria all the time (36-year-old female resident).

Response on sanitation in La:

Where people sell food in this area is not good at all. You find people selling close to drains which can transmit various diseases. Even conditions in peoples' homes are not hygienic (52-year-old Assemblyman).

Table 1 shows that the mean score for pest infestation was 12.48 and 21.30 representing 50.7% and 86.6% for La and Chorkor and places them in the third and fifth quintiles respectively. In this problem area, while Abese was the most affected block in La, Alhaji was the least affected block in Chorkor. Here also, the result shows that pest infestation is a serious problem in the two communities and is attributable to the poor environmental conditions, albeit Chorkor's situation is more acute between the two communities (see Appendix 1). Pest infestation is a conduit for the spread of diseases such as typhoid and malaria. There was also evidence of uncovered foods, food sold near drains, dusty eating areas, indiscriminate dumping of waste in drains and choked drains in the two study communities. The results also revealed that with respect to the mean score for food contamination, La had a total score of 10.4, while Chorkor also had a total score of 16.9, representing 49% and 81%, thus placing them in the third and fifth quintiles respectively (see Table 1). This situation increases the risk of transmitting foodborne diseases such as cholera, dysentery, and typhoid fever. Findings from the individual blocks in this problem area indicate that Abese was the most affected block in La, while Alhaji was the least affected in Chorkor.

The study also found that even though drainage facilities in the two communities were designed to facilitate the movement of rainstorms. Overcrowding, the extension of buildings to accommodate the increasing population, and the erection of structures at unauthorised places have blocked some of these drains. Such occurrences pose health risks to residents especially during the wet season as they facilitate the spread of pathogens. Results from the PRA (see Appendix 1) also indicate that drains clogged with waste and silts were the acute problems in the two communities. On this indicator, La scored 13.2 while Chorkor scored 20.3, representing 56% and 87%, putting La and Chorkor in the third and fifth quintiles respectively (see Table 1). Here also we find that, comparatively, Chorkor is worse-off than La. Compared within the blocks, while New Lakpana was the least affected block in this problem area, it was the Alhaji and T-Gardens blocks in the case of Chorkor (see Appendix 1). The qualitative interviews with households in the study communities and field

observations showed that there were practices that increased food contamination. The interviews also confirmed that residents have problems with their drainage as they are mostly filled with refuse, sand and silt, which impedes the flow of water and serves as a breeding ground for pests.

Response on pest infestation from Chorkor:

The environmental conditions in most homes are deplorable. You find litter all around and the surroundings are not clean at all. This allows houseflies, cockroaches, and mice to enter people's homes (41 year old male household head).

Response on food vending practices from La:

In this community most of the food vendors here do not cover the foods that they sell, sometimes they are sensitised on the negative effects of their actions but they continue to do the wrong thing. It is actually very difficult to sometimes buy and eat food from the street (27 year old female resident).

Response on drainage from Chorkor:

The gutters in this community are filled with a lot of refuse and sand, this does not allow the easy flow of wastewater. As a result, it breeds a lot of mosquitoes and you know this causes malaria among a lot of us (36 year old male household head).

Proximity to and poor management of refuse dumps contribute to the spread of diseases. The results from the PRA revealed that La and Chorkor scored 12.9 and 17.5, representing 67% and 91% on the management of solid waste. This places them in the fourth and fifth quintile ranks respectively (see Table 1). The problem of waste management as identified in the two study communities is an epitome of the situation in most parts of Accra. Figure 5 provides some evidence of the current situation where solid wastes are dumped along the shoreline and indiscriminately in the community. Backyard waste dumps as a result of long-distant dumping sites and lack of skip containers were a common feature in both communities, especially in Chorkor. Many of the dumpsites were found along the beaches, and there were no properly commissioned landfill sites in both study communities. This makes residents very vulnerable to infectious diseases. Inter-block comparison indicates that while Abese was the most affected block in La, it was Alhaji in the case of Chorkor. From the above discussions, it is clear that residents of La and Chorkor were susceptible to both indoor and outdoor pollution due to the poor environmental conditions. Hence, findings from the PRA also revealed that practices such as use of wood/charcoal for cooking, mosquito coils as repellents, smoking of fish and occurrences such as pollution from maize mills, burning, and odour from sanitary and solid waste facilities were predominant. In this problem area, La and Chorkor scored 4.9 and 9.7, representing



Fig. 5 Indiscriminate Dumping of Solid Waste in Chorkor.

42% and 82%, this places the two communities in the third and fifth quintile respectively. Here, while Abese was the most affected block in La, Chemuana was the least affected block in Chorkor (see Appendix 1).

Housing is one of the major challenges and is responsible for the poor environmental conditions in the two communities. Since most people, particularly migrants, do not have decent dwelling places due to the short supply of rental housing units. Overcrowding in housing units is a common feature in the two communities. The PRA showed among others that inadequate and inappropriate housing conditions, overcrowding, and unplanned housing layouts are some of the housing problems confronting the two communities. In this problem area, La and Chorkor scored 8.53 and 11.45 representing 63% and 84%, this places La and Chorkor in the fourth and fifth quintiles respectively (see Table 1). At the block level while Adiembra was the least affected block in La, it was the case of Lanteman and Chemuana in Chorkor (see Appendix 1). The qualitative interviews revealed that residents in the two communities are confronted with varying challenges on solid waste management, air pollution and housing. The quotes below capture some of these perspectives.

Response on solid waste in Chorkor:
We live with a lot of filth in this community because we don't have enough waste communal containers. The few ones available too are left to overflow when it is full. This leads to increase in houseflies, and is a problem for houses who are around the dumpsites, but what can we do, we have to live with it (41 year old male household head).

Response on air pollution in La:
In this area what we suffer mostly with regards to air pollution is the smoke from the women who cook and sell, sometimes it is very bad that it affects our breathing (52 year old Assemblyman).

Response on housing challenges in Chorkor:
As for housing, many people are living in wooden structures because it is cheap to rent from those areas or easy to erect one. The problem with those places is that they don't have gutters, toilet facilities and other important amenities. But because they don't have the money to rent nice places, they are very happy here (36 year old female resident).

3.2 Quintiles of aggregate environmental burdens in La and Chorkor (2001–2016)

The rapid assessment tool was used in 2001, 2005, 2009, and 2016 for monitoring the environmental health conditions of residential communities in the GAMA by (McGranahan et al. 2001; Songsore et al. 2005; 2009; Gyimah 2017). The results of these studies showed that several residential communities were susceptible to environmental health diseases such as cholera, malaria, and dysentery due to the poor environmental conditions. However, environmental conditions in Chorkor in 2001 and 2005 were better than La for most of the problem areas. A later assessment showed that conditions in La improved somewhat

Tab. 1 Environmental Health Indicators and Total Weighted Environmental Health Index for La and Chorkor, 2016.

Indicators	Max Score	La			Chorkor		
		Means Score	%age (%)	Quintile	Mean Score	%age (%)	Quintile
A. Water	37.0	19.78	53.4	3	26.30	71.1	4
B. Sanitation	29.9	24.00	80.3	4	27.15	90.8	5
C. Pests	24.6	12.48	50.7	3	21.30	86.6	5
D. Sullage/Drainage	23.4	13.20	56.4	3	20.30	86.8	5
E. Food Contamination	21.0	10.35	49.3	3	16.95	80.7	5
F. Hygiene	19.6	12.08	61.6	4	17.40	88.8	5
G. Solid Waste	19.2	12.90	67.2	4	17.45	90.9	5
H. Housing Problems	13.6	8.53	62.7	4	11.45	84.2	5
I. Indoor/Outdoor Air Pollution	11.8	4.92	41.7	3	9.69	82.2	5
Grand Total	200	118.22	59.1	3	167.99	84.0	5

in the 2016 assessment while those in Chorkor have remained the same (Gyimah 2017). Overall, results, as shown in Appendix 1, indicate that La and Chorkor scored 118 and 168 out of the maximum score of 200. This represents 59% and 84% and places La and Chorkor in the third and fifth quintiles respectively. The inference here is that the environmental conditions in La have significantly improved than Chorkor. This suggests that Chorkor is one of Accra's most deprived communities, and therefore most vulnerable to diseases associated with poor environmental conditions. Notwithstanding this, findings for La in Table 2 indicate that there are still some challenges with regards to sanitation, waste management, and housing problems

4. Discussion

The findings indicate that low-income urban communities continue to face significant environmental challenges owing to limited provision and access to basic environmental services (Appiah-Effah et al. 2019; Mariwah et al. 2017). Beyond the problem of insufficiency, the result shows that the extent of environmental challenges varies across low-income communities and within the communities. This situation suggests that these communities ought to be treated differently according to their own needs and peculiar problems, while priority must also be given to specific locations in the individual communities. The findings also show that Chorkor's environmental problems are worse when compared to that of La. This is not to discount the environmental risk conditions in La, but in terms of exposure and severity to environmental health risks, Chorkor is the worst-off among the two communities. The study has also shown that even though WASH and environmental health problems need to be given attention by policymakers, there is

also the need to prioritise which areas require more investment in specific communities. For instance, in La, the municipal authority has to devote resources to addressing sanitation and management of solid waste. In the case of Chorkor, there is the need to look at the environmental sector as a whole since every aspect of the sector seems to be moving from bad to worse. This point is in tandem with the human ecology model on environmental health which suggests that environmental health risk factors are shaped by levels of exposure to pollutants and a situation that may vary by location (Flies et al. 2019), and which are also occasioned by the way people manage and organise their environment.

In addition to the differentiation in the extent of environmental challenges in low-income communities, the result also shows that environmental conditions can worsen or improve temporarily. Reference is made to the case of La, where in 2005 it was in the fourth and fifth quintiles when it comes to water and sanitation respectively. However, the 2016 PRA shows a move to the third and fourth quintile on water and sanitation respectively. Chorkor on the other hand shows a downward spiral of environmental quality over the years. For instance, the 2005 PRA placed Chorkor in the third and fourth quintile on water and sanitation respectively. However, it moved to the fourth and fifth quintile in the 2016 PRA for water and sanitation respectively. A multiplicity of factors might account for the improved environmental conditions in La, including effective monitoring and investment in critical environmental services. The situation of Chorkor on the other hand raises serious concerns about potential health outcomes for residents since the enormity of environmental problems increases the pathways for pollutants into the environment (Corvalan and Kjellstrom 1996), and the disease burdens of residents. The above findings call for both prioritisation and sustenance of efforts towards improving

Tab. 2 Quintile of Environmental Burden in La and Chorkor (2001, 2005 and 2016).

Indicators	2001		2005		2016	
	LA	Chorkor	La	Chorkor	La	Chorkor
A. Water	4	2	4	3	3	4
B. Sanitation	5	4	5	4	4	5
C. Pests	5	5	5	5	3	5
D. Sullage/Drainage	5	5	5	4	3	5
E. Food Contamination	5	2	5	4	3	5
F. Hygiene	4	3	4	4	4	5
G. Solid Waste	5	5	5	5	4	5
H. Housing Problems	4	3	5	4	4	5
I. Indoor/Outdoor Air Pollution	4	4	5	5	3	5
Quintile of Aggregated environmental burden	5	4	5	4	3	5

Source: Songsore et al. 2001; 2005; Field Survey 2016

access to environmental services in poor urban communities in Ghana (Monney and Antwi-Agyei 2018) as part of the quest toward achieving universal access to critical services such as clean potable water by 2030.

The findings can also be situated within the larger structural problems in Accra such as overcrowding, increased unemployment, and inadequate infrastructure (Owusu and Afutu-Kotey 2010; Okyere et al. 2021). Inequality in Accra has skyrocketed and poverty permeates many areas in the capital (Awumbila et al. 2014). Conspicuous are the conditions of low-income indigenous communities in Accra of which the two study communities are a part. For most residents in these communities, surviving the urban life is more important and therefore conditions of the environment are not immediate problems that they often attend to. However, these conditions pose a serious environmental health risk that increases the disease burden in these areas. The above point resonates with the suggestion by Ray and Jacob (2015) on the limits to ecological analysis, which is the issue of how economic systems and context often forces people into situations where they pay little to no attention to how their actions and inactions affect or is affected by the environment in which they live. Without holistically addressing the socio-economic and environmental needs of residents in Chorkor and other similar low-income communities, the situation is going to worsen. On the other hand, the study has shown that situations can improve over time as exemplified in the case of La. This differential exposure also reflects issues such as social and spatial inequalities, and unevenness in access to environmental services (WHO 2010).

The findings of the study evokes critical questions about the institutional arrangement for environmental management at the local level, in this case the local government system. The findings raise issues regarding how environmental problems in the communities are prioritised, and the mechanisms for ensuring sustained investment in WASH and other related environmental problems in the MMDAs where the communities are located. As was evident in the study, most problems bordered on the lack thereof of essential environmental services and facilities. Additionally, the findings bring to the fore the need to strengthen and improve the capacity of the EHD of the MMDAs of the two study communities. This is essential in the identification of the peculiar environmental needs and enhancing their ability to draw partnerships to facilitate investment in WASH. This will be instrumental in closing the infrastructural gap since the MMDAs on their own cannot raise sufficient funds to close this gap.

5. Conclusion and policy implications

The study aimed at comparing the environmental conditions of two low-income communities in Accra i.e. La and Chorkor. This was undertaken using the PRA

method, which has been used in previous studies in Ghana, and involves the assessment of environmental conditions using objectively constructed environmental hazard indicators. Thus, by applying the PRA method, the paper sought to unravel the extent of change in environmental conditions in the two study communities' post-previous PRA studies, as well as perspective on the differences in environmental conditions that exist between them. Thus, challenging the narrative and the notion that often-homogenised environmental problems in low-income communities in urban Ghana.

The findings show that the two study communities face serious environmental challenges. However, the average index for all environmental problem areas was high and closer to the maximum average scores for Chorkor when compared to La. This placed Chorkor in the fifth quintile on almost all the environmental problem areas, showing clearly that Chorkor's environmental conditions have remained the same or worsened when compared with previous studies. For La, even though the environmental conditions were not good, the findings show that it has moved up to the third quintile on most of the environmental problem areas, suggesting some modest improvement over the years. The paper recommends that there should be sustained and reliable funding to MMDAs to effectively implement policies and projects on WASH. In addition, there is a need for infrastructural and socio-economic development in low-income urban communities to reduce poverty and improve the social and economic wellbeing of residents. Lastly, the authors recommend effective and efficient community education and sensitization on proper sanitary practices which have the potential to mitigate cholera epidemics in the two communities. These policies and projects must prioritise the worst affected blocks. For instance the Abese and Adiembra blocks contributed most to the poor environmental conditions in La, even though Abese was the worst affected block among the four in almost all the nine problem areas. In the case of Chorkor, Lanteman and Chemuana were the most affected blocks, but Lanteman was the worst affected block among the four in all the nine problem areas. In view of the foregoing, the Abese block in La and the Lanteman block in Chorkor should be prioritised in the application of the aforementioned recommendations.

Despite the relevance of this study in revealing the differentials in environmental conditions of urban low-income communities, the general applicability of the findings are limited by the use of only two communities. Hence, future studies could use more than two low-income communities from different MMDAs in the GAMA in order to make a significant generalisation of the findings. Also, the inventiveness of residents in dealing with the environmental problems in the communities were not considered. This obscures the creative abilities of residents of urban informal communities and slums in solving the environmental problems

confronting them. Future studies can explore this to propagate the positive role of these communities in helping address Accra's socio-environmental problems, which are often regarded by authorities to be created by residents from low-income communities

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Appendix 1: Results of Proxy Indicators for Rapid Assessment of Environmental Health Status of La.

A. Water	Maximum Score	Sub-locations (Blocks)				All of La	Sub-locations (Blocks)				All of Chorkor	
		New Laka.	Aba./Kow./Abe.	Adie.	Laka.		Lanteman	Chemuana	Alhaji	T Gard.		
Indicators		Mean Score					Mean Score					
1. Ponds/streams as principal source of water supply within community	6.7	-	-	-	-	-	-	-	-	-	-	-
2. Pipelines on ground surface and in drains (cross contamination)	4.8	-	4.8	4.8	-	2.4	4.8	4.8	4.8	4.8	4.8	4.8
3. Frequent water supply interruptions within community	4	4	4	4	4	4	4	4	4	4	4	4
4. Principal source of potable water supply outside house compound	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
5. Vendors as principal source of potable water supply within community	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
6. Potable water stored in open containers	3.1	-	3.1	-	-	0.775	3.1	3.1	3.1	3.1	3.1	3.1
7. Use of common dip cup for drinking water	2.8	2.8	2.8	2.8	2.8	2.1	2.8	2.8	2.8	2.8	2.8	2.1
*8. Distance above 200 meters from water collection points	2.7	-	-	-	-	-	-	-	-	-	-	-
*9. Queuing time of 20+ minutes at water collection points	2.4	-	-	-	-	-	2.4	2.4	2.4	2.4	2.4	1.8
*10. Pay as you use for water	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
*11. Community self-assessment of water quality using own indicators	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Sub-Total for Water	37	17.3	25.2	19.3	17.3	19.775	27.6	27.6	22.4	27.6	27.6	26.3

B. Sanitation	Maximum Score	New Lakt.	Aba./Kow./Abe.	Adie.	Lakt.	All of La	Lanteman	Chemuana	Alhaji	T Gard.	All of Chorkor
Indicators	Mean Score	Mean Score									
5.9	5.9	5.9	5.9	5.9	5.9	5.9		5.9	5.9	5.9	5.9
4.1	4.1	4.1	4.1	4.1	4.1	4.1		4.1	4.1	4.1	4.1
3.3	-	-	-	-	-	3.3		3.3	-	3.3	2.475
3.1	3.1	3.1	3.1	3.1	3.1	3.1		3.1	3.1	3.1	3.1
3.1	3.1	3.1	3.1	3.1	3.1	3.1		3.1	3.1	3.1	3.1
2.7	-	-	-	-	-	-		2.7	-	-	0.675
2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5
1.9	1.9	1.9	1.9	1.9	1.9	1.9		1.9	1.9	1.9	1.9
1.7	1.7	1.7	1.7	1.7	1.7	1.7		1.7	1.7	1.7	1.7
1.7	1.7	1.7	1.7	1.7	1.7	1.7		1.7	1.7	1.7	1.7
30	24	24	24	24	24	27.3		30	24	27.3	27.15

New Lakt.	Aba./Kow./Abe.	Adie.	Lakt.	All of La	Lanteman	Chemuana	Alhaji	T Gard.	All of Chorkor
Mean Score	Mean Score								
5.3	5.3	-	-	1.325	5.3	5.3	5.3	5.3	5.3
5.2	5.2	-	5.2	3.9	5.2	5.2	-	5.2	3.9
4.4	4.4	4.4	4.4	3.3	4.4	4.4	4.4	4.4	4.4
2.8	-	2.8	-	0.7	2.8	2.8	2.8	2.8	2.8
2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
2.2	-	2.2	-	0.55	2.2	2.2	2.2	2.2	2.2
7. Evidence of lice in children's hair within community	2	-	-	-	-	-	-	-	-
Sub-Total for Pests	24.6	7.9	22.6	7.1	12.3	22.6	17.4	22.6	21.3

C. Sullage/Drainage	Maximum Score	New Lskp.	Aba./Kow./Abe.	Adie.	Lakp.	All of La	Lanteman	Chemuana	Alhaji	T Gard.	All of Chorkor
Indicators											
1. Evidence of mosquito and other larvae within stagnant water bodies	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
2. Pools of stagnant water (cesspools)	3.9	-	-	-	-	-	3.9	3.9	-	-	1.95
3. Drains choked with garbage, weeds and silt	3.7	-	3.7	3.7	3.7	2.775	3.7	3.7	3.7	3.7	3.7
4. Pools of stagnant water in drains	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
5. Evidence of children playing in and around stagnant water	3	-	3	-	-	0.75	3	3	3	3	3
6. Absence of narrow drains in the community	2.9	2.9	-	2.9	-	1.45	2.9	2.9	2.9	2.9	2.9
7. Evidence of flood risks within community	2.1	-	-	2.1	-	0.525	2.1	2.1	-	-	1.05
Sub-Total for Sullage/Drainage	23.4	10.6	14.4	16.4	11.4	13.2	23.3	23.3	17.3	17.3	20.3

D. Food Contamination	Maximum Score	New Lskp.	Aba./Kow./Abe.	Adie.	Lakp.	All of La	Lanteman	Chemuana	Alhaji	T Gard.	All of Chorkor
Indicators											
1. Evidence of defecating children around food vending area/ cooking area with the home	3.2	-	-	-	-	-	3.2	3.2	-	-	1.6
2. Uncovered vendor prepared food/uncovered prepared food left-overs within the house	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	-	2.6	1.95
3. Food sold near public toilets	2.5	-	2.5	-	-	0.625	2.5	2.5	-	2.5	1.875
4. Food sold near drains	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
5. Use of unwashed or rotten vegetables for cooking/raw eating	1.8	-	1.8	-	-	0.45	1.8	1.8	-	-	0.9
6. Using (naked) hand as means of serving food.	1.7	-	-	-	-	-	1.7	1.7	1.7	1.7	1.7
7. Food sold in eating places without running water	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
8. Dusty eating areas or eating areas along main transportation arteries with vehicular smoke pollution	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
9. Serving food in leaves/paper	1.5	-	1.5	-	-	0.375	1.5	1.5	-	1.5	1.125
10. Lack of medical certification of food vendors (from health inspectors)	1.5	-	-	-	-	-	1.5	1.5	1.5	1.5	1.5
11. Food cooked in the open for sale	1	1	1	1	1	1	1	1	1	1	1
Sub-Total for Food Contamination	21	8.9	14.7	8.9	8.9	10.35	21.1	21.1	9.5	16.1	16.95

<i>E. Hygiene</i>		New Lskp.	Aba./Kow./Abe.	Adie.	Lakp.	All of La	Lanteman	Chemuana	Alhaji	T Gard.	All of Chorkor
<i>Indicators</i>	<i>Maximum Score</i>	<i>Mean Score</i>					<i>Mean Score</i>				
1. Hands not washed after toilet	3.5	-	3.5	-	-	0.875	3.5	3.5	3.5	3.5	3.5
2. Hands not washed before food preparation/eating	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
3. Evidence of spitting around in community	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
4. Evidence of unwashed plates/dishes in house compound	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
5. No facility for hand washing attached to toilet, chopbars, etc.	1.8	-	-	-	1.8	0.45	1.8	1.8	-	-	0.9
6. Presence of children/adults with open sores/running noses	1.6	-	-	-	-	-	1.6	1.6	1.6	1.6	1.6
7. Communal handwashing practices within home	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
8. Absence of household bathroom facility	1.3	-	-	-	-	-	-	-	-	-	-
9. Presence of barefooted children in community	1.3	1.3	1.3	-	-	0.65	1.3	1.3	1.3	1.3	1.3
10. Inadequate public bath-house facilities	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Sub-Total for Hygiene	19.6	11.4	14.9	10.1	11.9	12.075	18.3	18.3	16.5	16.5	17.4

<i>F. Solid Waste</i>		New Lskp.	Aba./Kow./Abe.	Adie.	Lakp.	All of La	Lanteman	Chemuana	Alhaji	T Gard.	All of Chorkor
<i>Indicators</i>	<i>Maximum Score</i>	<i>Mean Score</i>					<i>Mean Score</i>				
1. Mounds of uncollected garbage within community	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
2. Indiscriminate dumping of garbage in community	4	-	4	4	-	2	4	4	-	4	3
3. Evidence of uncovered solid waste within house compound	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
4. Evidence of children playing around waste dumps and/or scavenging in them	3.4	-	-	-	-	-	3.4	3.4	-	3.4	2.55
5. Paper and plastic litter within community	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
6. Evidence of animals scavenging on waste dumps and spreading the litter	2	-	2	-	2	1	2	2	2	2	2
Sub-Total for Solid Waste	19.2	9.9	15.9	13.9	11.9	12.9	19.3	19.3	11.9	19.3	17.45

G. Housing Problems	Maximum Score	New Lakp.	Aba./Kow./Abe.	Adie.	Lakp.	All of La	Lanternman	Chemuana	Alhaji	T Gard.	All of Charkor
1. Evidence of crowding in sleeping places	2.4	-	2.4	-	2.4	1.2	2.4	2.4	2.4	2.4	2.4
2. Absence of mosquito/insect screens in building	2	2	2	-	2	1.5	2	2	2	2	2
3. Evidence of domestic animals sharing dwelling places with humans	1.8	-	-	-	-	-	-	-	-	-	-
4. Droppings of domestic animals in and around house compound	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
5. Evidence of crowding and unplanned layout of houses	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
6. Evidence of people sleeping outside of rooms in community	1.1	-	-	-	1.1	0.275	1.1	1.1	1.1	1.1	1.1
7. Evidence of leaking roofs during rains	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
8. Evidence of damp walls	1	-	-	1	-	0.25	1	1	1	1	1
9. Presence of noise pollution from artisanal works/micro-enterprises etc.	0.7	0.7	0.7	0.7	0.7	0.7	-	-	0.7	0.7	0.35
10. Evidence of dirty floors	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
11. Evidence of cracks in walls	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Sub-Total for Housing Problems	13.6	7.3	9.7	6.3	10.8	8.525	11.1	11.1	11.8	11.8	11.45

The impact of reduced time spent outdoors during the Covid-19 lockdown on the health and well-being of young people in Czechia

Dominik Rubáš^{1,5,*}, Tomáš Matějček^{1,2,3}, Roman Kroufek⁴

¹ Charles University, Faculty of Science, Department of Social Geography and Regional Development, Czechia

² Charles University, Faculty of Science, Department of Physical Geography and Geoecology, Czechia

³ J. E. Purkyně University in Ústí nad Labem, Faculty of Science, Department of Geography, Czechia

⁴ J. E. Purkyně University in Ústí nad Labem, Faculty of Education, Department of Preschool and Primary Education, Czechia

⁵ Technical University of Liberec, Faculty of Science, Humanities and Education, Department of Geography, Czechia

* Corresponding author: dominik.rubas@natur.cuni.cz

ABSTRACT

It was not officially possible to leave the cadastral territory for recreational purposes in Czechia during the period from the 1 March to the 21 March 2021. The aim of this study was to evaluate how this lockdown affected the amount of time young people spent outdoors and their health and mental well-being. Our research was aimed at students at all levels of school. Immediately after the end of the strictest phase of the lockdown, we conducted a questionnaire survey and collected data from more than a thousand students at elementary schools, secondary schools and universities, as well as 160 parents of 269 pre-school and primary school children. The answers to the close-ended questions were evaluated by statistical analysis, while the answers to the open-ended questions were evaluated using thematic analysis. The results show that the impact of restrictive measures on the health and psyche of young people was significant, especially for female students. Lockdown significantly reduced respondents' opportunities to spend time outdoors. Male students spent significantly more of their free time in front of computer screens. Respondents living in buildings without a garden and young people who could not use a recreational building outside the district of residence were most affected by restrictions during the lockdown.

KEYWORDS

COVID-19; lockdown; contact with nature; health; well-being; place attachment

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1. Introduction

The global COVID-19 pandemic represents an unprecedented challenge to the world's population. In Czechia the extraordinary situation was the lockdown in March 2021, which was the most restrictive regulation in the entire duration of the pandemic.

During this period, all persons were prohibited from leaving the territory of their resident district (except for travels to work or necessary travels to medical facilities). At night (from 21:00 to 04:59) the free movement of persons was restricted even more, only with few exceptions. Even during the day, citizens were ordered to stay at their place of permanent residence or domicile, with exceptions (some of them have been mentioned above). Another exception was a trip for the purpose of staying in nature, but under the conditions of presence of only members of one household and only in the cadastral territory of the municipality in which the person resides. For a closer understanding, it is good to remember that the cadastral territories of municipalities are significantly unbalanced in terms of area: from 0.42 km² in the municipality of Závist to 496 km² in the case of Prague (CZSO 2020). Another exception was a stay in one's own recreational building, but only in the same district as the residence (Government of the Czech Republic 2021). Together with the introduction of the above-mentioned restrictions of mobility, the use of mouth and nose protection was also newly ordered in the outdoor environment, namely in the built-up area of the municipality, including city parks.

It is crucial for our research that for the purpose of recreation or stay in nature in the first three weeks of March 2021, it was not possible, with some exceptions, to travel outside of the domiciliary cadastral territory (i.e., usually near surroundings of the village, town, or city). There was a significant restriction on the free mobility in the natural environment, people were forbidden to visit their favorite places outside of the domiciliary cadastral territory.

It is well known that staying in nature is beneficial in many ways. Research confirms that children should be given the opportunity to enjoy positive experiences with nature from an early age (Kellert 2002), as these direct experiences play an important role in developing positive beliefs, attitudes, and behaviors towards the environment (Tilbury 1994). Love for nature, as well as empathy for other living creatures, is already formed in the period of pre-school education (Wilson 1994) and it is desirable to further develop it during compulsory schooling (Kroufek et al. 2021). Nisbet et al. (2009) found that a close relationship with nature is directly proportional to the time spent in it. Direct experiences are most effective in the process of creating a positive relationship with nature (Aaron and Witt 2011), significantly more effective than indirect or mediated experiences. Unfortunately, the mediated experience with nature with the development of

modern digital technologies is increasing (Kellert 2002). The current generation of young people does not have enough opportunities to every day experience the natural environment on their own (Tani, Surma-Aho 2012). That is why the mission of educational institutions should be to mediate contact with nature for all learners.

In Czechia (Pastorová et al. 2011; Ministry of Education, Youth and Sports 2021), as well as in Slovakia (Fedorko 2020a), pupils' stay in the outdoor environment is enshrined directly in valid curricular documents. In response to COVID-19, the World Health Organization (UNICEF 2020) also recommended the maximum possible education in the outdoor environment. However, this was prevented for a long time under concerned period, as in connection with the COVID-19 disease, schools in the Czechia closed almost all year round in the 2020/21 school year.

Human needs include not only the need for contact with nature, but also contact with specific places. We understand the place here as a center of meanings filled with individual experiences (Tuan 1990). Space thus becomes a place if the individual gives it meaning based on experience with it. For a person, it becomes a part of his life. Relph (1976) even writes that being human means having and knowing your place. In the space of experience, one creates one's favorite places, to which one often builds a strong emotional attachment, Tuan (1990) even mentions the term *topophilia*. If a person is not in this place for a long time, he will start to miss the place. On the contrary, staying on site makes him happy. Often one forms this emotional bond with the place where one spends the holidays, where one goes for recreation.

One can also form place attachment, which gives meaning to life (Proshansky et al. 1983). According to Jack (2010), direct and repeated childhood experiences from specific places have the greatest influence on the creation of this bond, together with the social meanings that children and others (e.g. family members) ascribe to them. In this way, a young person often creates a place attachment¹ to the residence of his relatives. The ban on visiting such places can then have a significant impact on the individual's physical and mental health. The possible effects of pandemic stressors on the lives of children and adolescents are described in detail, for example, by de Figueiredo et al. (2021). The words of Norberg-Schulz (1994, p. 18): "Modern man has long believed that science and technology freed him from direct dependence on places. This belief proved to be an illusion ..." resonate when imagining a young man sitting at a computer at home instead of at a school he has been banned

1 We emphasize that we also include an interpersonal component in the place attachment concept, so we do not distinguish to what extent the negative impact on individuals is caused by the limitation of contact with a close person or with a place.

from entering and his favorite places he has also been banned from entering.

It follows from the above mentioned that limiting the stay in nature and limiting contact with favorite places can be a very frustrating circumstance for humans. In our research, we focused on the perception of this situation by young people and asked ourselves the following research question:

What was the impact of restrictive restrictions on living in nature on the health² (overall well-being) of young people?

In addition to the impact of lockdown on health and well-being, we were interested in where young people spent time during lockdown, whether the cadastral territory of the village satisfied their need to spend time in nature, what were the main barriers on the way to nature, whether young people were prevented on their way to the recreational building or behind relatives, or whether these people spent more free time at the screens because of the lockdown.

2. Methodology

Data were collected using two online questionnaires (Google Forms tool). The first questionnaire was designed for elementary school pupils (ISCED level 2),³ secondary school students (ISCED level 3–5) and university students (ISCED level 6–8). The second questionnaire was completed by parents of primary school pupils and pre-school children (ISCED level 0–1). Data collection took place immediately after the toughest lockdown, specifically in the period from 25 March to 15 April 2021. The questionnaire contained items focusing on 3 areas: a) closer identification of the respondents (age, sex, degree of study, place of residence and region in which they spent the lockdown, ownership of a garden, the possibility of using a recreational building, the possibility of visiting relatives), b) the possibilities of the respondents to spend time in nature during the lockdown, c) the effect of the lockdown on the physical and mental health of the respondents.

The questionnaires contained a combination of closed and open items. Their formulation was discussed with sociology surveys experts before the questionnaire was sent out. The research plan of the project, of which this research is a part, was approved by the ethics committee of the PF UJEP (4/2020/04). Subsequently, a pilot study was conducted among elementary school pupils and among secondary school and university students. Less comprehensible items

have been reformulated. Respondents answered closed items using a five-point Likert scale (Chytrý and Kroufek 2017). In most cases, they expressed a degree of agreement (certainly agree – rather agree – I can't decide – rather disagree – definitely disagree), for the item devoted to the question of the degree of change in the possibility of spending time in nature, the scale was different (extremely – strongly – moderately – partially – not at all).

The respondents of this research were elementary school pupils (N = 377), secondary school students (N = 203) and university students (N = 479). The selection of respondents was made based on personal contacts of the authors and subsequently expanded by the snowball method. Instead of pre-school children and primary school pupils, their parents answered (N = 160), some of whom answered for more children (a total of 269 children were obtained). Respondents from all 14 regions of Czechia were represented. In terms of sex distribution, 30% of men (boys) and 70% of women (girls) participated in the research.

For the basic distinction of the two main groups of respondents, we use the following terms: students (includes answers of elementary school pupils, secondary school students and university students – i.e. young people from about 11 years and older) and parents (includes answers of parents of primary school pupils younger than about 11 years and pre-school children).

Statistical analysis was performed in IBM SPSS Statistic 27. Due to the evaluation of individual items, which are answered using Likert scales (i.e. ordinal data), non-parametric tools were used, namely Mann-Whitney U test and Kruskal-Wallis test.

The answers to the open-ended questions were evaluated using thematic analysis, which provided a better understanding of the answers to the questions with a selection of predefined options, and also revealed some additional information. The thematic analysis of the answers to each of the questions was carried out in three steps. In the first step, the main categories of answers were selected. In the second step, the answers were classified into the categories established in the previous step, and the answers that were considered representative of one of the categories were marked, as well as the answers that could not be clearly classified into the established categories. In the third step, a summary of the most important findings was made.

3. Results

Firstly, the results of this research are presented in summary and then the results are related to selected variables (sex, degree of study, garden ownership, ownership of a recreational building outside the municipality, visits to relatives) are presented.

Figures 1 and 2 show that the cadastral territory of the municipality fully satisfied the need to spend

2 According to the WHO (Kühn and Rieger 2017), health is “a state of complete physical, mental and social well-being”.

3 ISCED classification (UNESCO 2012).

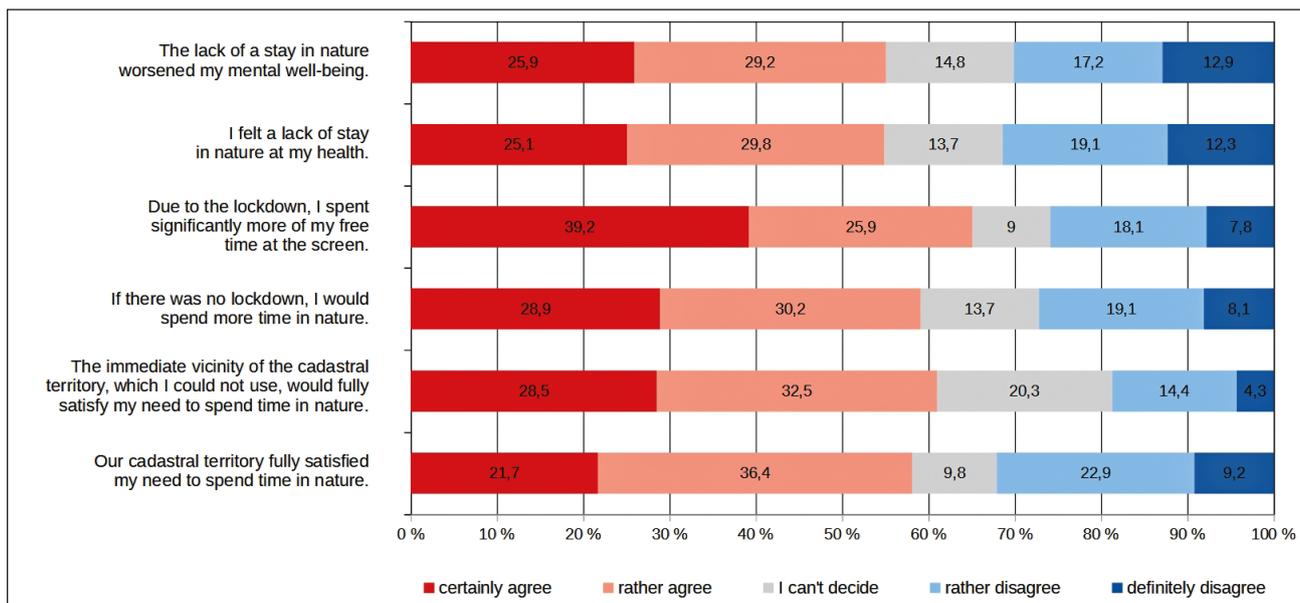


Fig. 1 Answers of students to the close-ended questions.

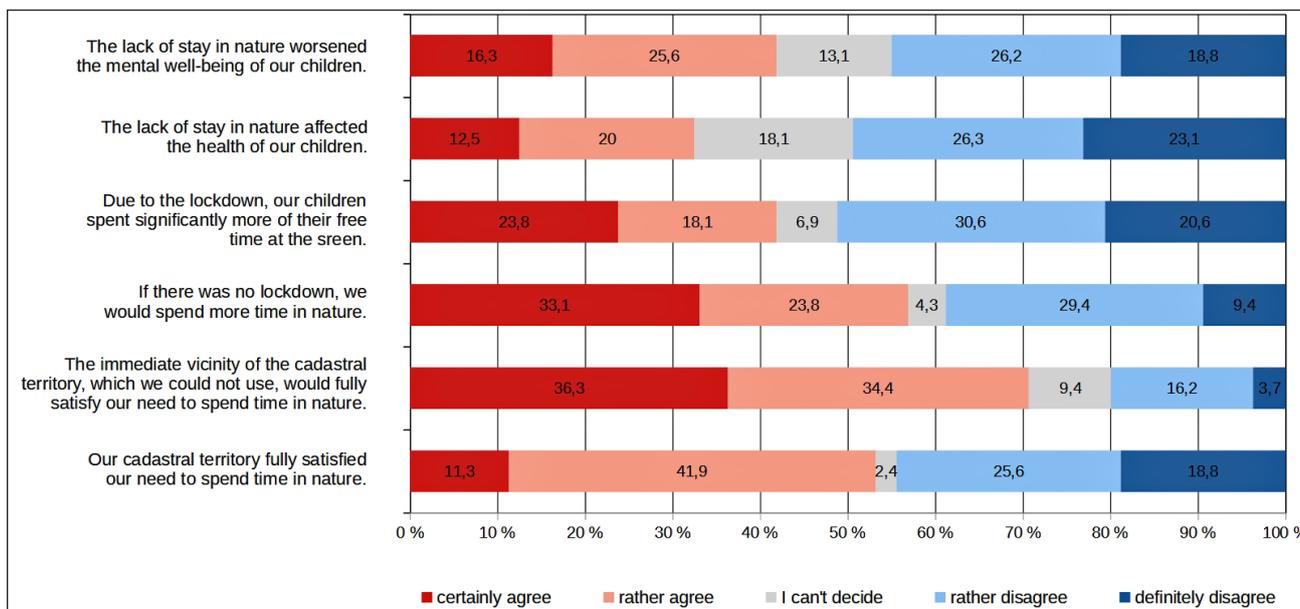


Fig. 2 Answers of parents to the close-ended questions.

time in nature (“I definitely agree”) to about one-fifth of young people. From the parents’ point of view, it was even only 11% of cases. The situation would be significantly better if it were possible to visit the immediate vicinity of the cadastral territory. In this case, the share of negative answers (I rather/definitely disagree) would fall to less than 20%.

If there was no lockdown, 59% of young people and 57% of parents with children would spend more time in nature. In the supplementary question, we found out what were the main respondents’ barriers on the way to nature (more answers could be marked). It turned out that the main obstacle was *the impossibility to go to nature with friends* (44% of students and 33% of parents). The second most important obstacle turned out to be *the obligation to wear a respirator*

(37% of students, 34% of parents). Almost 25% of students (26% of parents) answered that they were hampered by *fears of a high concentration of people in one place*. This was one of the paradoxes of restrictions aimed at reducing people’s contacts. It often happened that people in some localities were concentrated even more than without a lockdown, because they were not allowed to travel to remote places. For almost 24% of students (9% of parents), the fear of *ignorance of the boundaries of the cadastral territory* was another barrier in the way to nature (another paradox of restrictions). Instead of mentally relaxing, these people feared that the area in which they moved was already in a “forbidden zone”.

Almost two thirds of the young people surveyed spent significantly more of their free time at screens

than in nature due to the lockdown. From the parents' point of view, it was about two-fifths of the children. The lack of stay in nature was felt by their health (e.g. poorer concentration, lack of fresh air, increased eye fatigue, etc.). 55% of students and the same proportion of young people lack of stay in nature worsened their mental well-being. Parents noticed a worsening of their children's health in about a third of cases and an impact on their psyche in 42%.

3.1 Effect of sex

The lockdown experience seems to be influenced by sex. The deterioration of physical and mental health was reported more by women, while men spent significantly more free time at the screens, see Tab. 1.

3.2 Effect of degree of study

Significant differences were found within the perception of lockdown between elementary school pupils, secondary school students and university students. Younger respondents had a higher increase in time spent on screens of electronic devices, at the same time they expressed a higher degree of satisfaction of the need to stay in nature in the cadastral territory. The elders, on the other hand, declared a more significant impact on their mental well-being. There is no difference in the perception of physical health among the respondents. They also agreed that the lockdown only partially affected the possibility of spending time in nature. Complete results can be found in Tab. 2.

Tab. 1 Sex differences in lockdown perception – students (Mann-Whitney U test).

	Women		Men		Z
	M	SD	M	SD	
Our cadastral territory fully satisfied my need to spend time in nature.	3.35	1.30	3.50	1.28	1.68
The immediate vicinity of the cadastral territory, which I could not use, would fully satisfy my need to spend time in nature.	3.65	1.18	3.70	1.10	0.34
How much has the lockdown changed my chances of spending time in nature?	2.57	1.09	2.44	1.14	-1.56
If there was no lockdown, I would spend more time in nature.	3.54	1.29	3.47	1.34	-0.80
Due to the lockdown, I spent significantly more of my free time at the screen.	3.62	1.37	3.97	1.26	3.66***
I felt a lack of stay in nature at my health	3.46	1.15	3.08	1.37	-3.88***
The lack of a stay in nature worsened my mental well-being.	3.49	1.36	3.04	1.37	-4.60***

*** $p < 0.001$; M = mean, SD = standard deviation, Med = Median, Z = test criterion

Tab. 2 Differences of lockdown perception by degree of study – students (Kruskal-Wallis test).

	Elementary school		Secondary school		University		H
	M	SD	M	SD	M	SD	
Our cadastral territory ...	3.66	1.17	3.20	1.27	3.24	1.37	24.19***
The immediate vicinity ...	3.51	1.13	3.83	1.27	3.72	1.18	14.83***
... chances of spending time in nature	2.49	1.08	2.60	1.00	2.54	1.16	1.47
... spend more time in nature	3.63	1.31	3.62	1.19	3.40	1.33	7.61*
... free time at the screen	3.94	1.26	3.78	1.32	3.49	1.41	22.22***
... my health	3.33	1.40	3.39	1.35	3.39	1.34	0.26
... my mental well-being	3.13	1.38	3.51	1.33	3.53	1.36	21.14***

* $p < 0.05$; *** $p < 0.001$; M = mean, SD = standard deviation, Med = Median, Z = test criterion; the full wording of the items is in Table 1

Tab. 3 Descriptive statistics of answers – parents.

	M	SD	Med
Our cadastral territory fully satisfied our need to spend time in nature.	3.01	1.37	4
The immediate vicinity of the cadastral territory, which we could not use, would fully satisfy our need to spend time in nature.	3.83	1.19	4
How much has the lockdown changed your childrens' chances of spending time in nature?	2.46	1.15	2
If there was no lockdown, we would spend more time in nature.	3.42	1.44	4
Due to the lockdown, our children spent significantly more of their free time at the screen.	2.94	1.51	2
The lack of stay in nature affected the health of our children.	2.73	1.35	3
The lack of stay in nature worsened the mental well-being of our children.	2.94	1.39	3

M = mean, SD = standard deviation, Med = Median

Table 3 presents the results of descriptive statistics for parents of children in pre-schools and primary schools. Because the data were collected based on information from parents, not directly from children, we did not include them in the analysis above.

3.3 Effect of garden ownership

If the respondents spent the lockdown in a building that has a garden, this relatively significantly affected most of the monitored indicators. Respondents (61% of students) who had the opportunity to spend time in the garden felt less confined and declared less impact on their physical and mental health. On the contrary,

respondents from buildings without a garden (35% of students) were more negatively affected by this fact. See Tab. 4. For parents of younger children, the same significant differences were found only if the need to spend time in nature in the cadastral territory was satisfied ($Z = -2.24$; $p = 0.025$) and the perception of a change in the possibilities of spending free time in nature by their children ($Z = -3.20$; $p = 0.001$).

3.4 Effect of ownership of a recreational building outside the district

Ownership of a recreational building outside the district of permanent residence divided the students'

Tab. 4 Influence of garden ownership in lockdown perception – students (Mann-Whitney U test).

	Without garden		With garden		Z
	M	SD	M	SD	
Our cadastral territory ...	3.20	1.35	3.49	1.26	-3.22***
The immediate vicinity ...	3.69	1.19	3.68	1.14	-0.44
... chances of spending time in nature	2.75	1.13	2.43	1.07	-4.27***
... spend more time in nature	3.65	1.30	3.48	1.30	-2.07*
... free time at the screen	3.80	1.34	3.67	1.35	-1.71
... my health	3.61	1.30	3.26	1.38	-3.96***
... my mental well-being	3.62	1.32	3.28	1.38	-3.84***

* $p < 0.05$; *** $p < 0.001$; M = mean, SD = standard deviation, Med = Median, Z = test criterion; the full wording of the items is in Table 1

Tab. 5 Influence of recreational building ownership in lockdown perception – students (Kruskal-Wallis test).

	No		Yes, but we still wouldn't go		Yes, we would go		H
	M	SD	M	SD	M	SD	
Our cadastral territory ...	3.47	1.29	3.65	1.06	2.95	1.34	29.46***
The immediate vicinity ...	3.64	1.17	3.43	1.17	3.86	1.10	11.59**
... chances of spending time in nature	2.48	1.09	2.12	1.03	2.94	1.06	45.79***
... spend more time in nature	3.46	1.32	3.08	1.30	3.96	1.12	38.44***
... free time at the screen	3.66	1.35	3.50	1.39	3.96	1.30	12.51**
... my health	3.31	1.36	3.05	1.45	3.73	1.25	22.48***
... my mental well-being	3.35	1.37	3.01	1.37	3.68	1.31	19.03***

** $p < 0.01$; *** $p < 0.001$; M = mean, SD = standard deviation, Med = Median, H = test criterion; the full wording of the items is in Table 1

Tab. 6 Visits of relatives and lockdown perception – students (Kruskal-Wallis test).

	No		Yes, but we still wouldn't go		Yes, we would go		H
	M	SD	M	SD	M	SD	
Our cadastral territory ...	3.52	1.28	3.67	1.16	3	1.32	41.32***
The immediate vicinity ...	3.64	1.17	3.72	1.13	3.69	1.17	1.01
... chances of spending time in nature	2.37	1.11	2.43	1.08	2.89	1.02	51.34***
... spend more time in nature	3.29	1.33	3.34	1.32	4.03	1.09	67.91***
... free time at the screen	3.53	1.39	3.65	1.35	4.04	1.23	29.49***
... my health	3.19	1.41	3.25	1.34	3.72	1.21	29.39***
... my mental well-being	3.22	1.40	3.22	1.39	3.73	1.23	29.02***

*** $p < 0.001$; M = mean, SD = standard deviation, Med = Median, H = test criterion the full wording of the items is in Table 1

Tab. 7 Visits of relatives and lockdown perception – parents (Kruskal-Wallis test).

	No		Yes, but we still wouldn't go		Yes, we would go		H
	M	SD	M	SD	M	SD	
Our cadastral territory ...	3.25	1.32	3.58	1.35	2.64	1.35	10.81**
The immediate vicinity ...	3.66	1.18	4.47	0.70	3.76	1.29	7.07**
... chances of spending time in nature	2.09	0.97	1.84	0.90	3.01	1.15	27.69***
... spend more time in nature	3.07	1.47	3.16	1.21	3.85	1.37	10.79**
... free time at the screen	2.79	1.53	2.95	1.51	3.12	1.50	1.51
... health of our children	2.47	1.38	2.84	1.30	2.96	1.33	4.84
... mental well-being of our children	2.57	1.35	2.79	1.27	3.34	1.38	10.40**

** $p < 0,01$; *** $p < 0,001$; M = mean, SD = standard deviation, Med = Median, H = test criterion; the full wording of the items is in Table 3

respondents into three different groups. The largest group ($N = 735$) does not own such an object, the second group ($N = 107$) owns it, but even if there was no lockdown, it would not use it, the third group ($N = 216$) owns it and would use it in the current period. The latter group represents the respondents who were most affected by the lockdown, both in terms of satisfaction with contact with nature and in terms of perception of their own physical and mental well-being. On the contrary, the second group, which owns a recreational building, which it would not use anyway, represents the least affected individuals by the lockdown (see Tab. 5). Parents who own a recreational building outside the district of residence and would normally visit it were significantly less satisfied with the possibilities of the cadastral territory than parents who would not go to it or do not have it ($H = 7.37$, $p = 0.025$). The same parents are also more convinced that the lockdown limited the possibility of their children spending free time in nature ($H = 5.41$, $p = 0.025$).

3.5 Visits of relatives

Less than half of the young people interviewed visit relatives regularly, and almost two-thirds of them would increase their opportunities to spend time in nature. Thus, as in the previous case, we identify a group of respondents who would visit relatives in the current period, whose place of residence is a suitable starting point for nature walks – this group represents respondents significantly limited by lockdown, perceiving the highest impacts on their physical and mental health and at the same time declaring the highest increase in time spent with electronics. The opposite is the group that has the same opportunity but would not use it even if it could (Tab. 6).

The possibility to visit relatives from whose residence they regularly undertake nature trips has proved to be a strong change in the case of parents of younger children, see Tab. 7. Parents who would go to such relatives with their children were the least satisfied with the possibilities offered by the cadastral territory, they were convinced that the lockdown

changed the possibilities of their children to spend time in nature, and at the same time they perceived the deterioration of the health and especially the mental well-being of their children at the highest level.

4. Thematic analysis of open answers

The results of the thematic analysis aimed to several supplementary open-ended questions, can be summarized in the following points:

- Unsurprisingly, respondents who spent it in smaller rural settlements with naturally attractive surroundings were satisfied with the place where they spent the lockdown. However, several respondents stated that the surroundings are beautiful, but they are already beyond the boundaries of the cadastral territory.
- Several respondents in large urban cadastral territories were also satisfied, but they usually complained that there were more people than usually in naturally attractive places (in terms of preventing crowding, the lockdown was rather counterproductive, which was caused by the fact that people could not visit restaurants, attend cultural events, spent time in parks, etc.
- To several respondents (or their children) their surroundings soon became banal, while others stated that they had discovered new places in their cadastral territory thanks to the lockdown.
- In some cities, parks were the only way to spend time in nature.
- Many respondents declared that their own garden, where they spent much of their time, was very important to them.
- In general, respondents expressed higher overall satisfaction with their own garden, with beautiful natural surroundings (usually villages) or with a large cadastral territory (large cities).
- On the other hand, respondents living in urban areas, in an apartment, were dissatisfied (they were bothered, for example, by noise, from which there was nowhere to run). Respondents in villages

- whose cadastral territory is small or naturally uninteresting (fields) were also dissatisfied.
- Several respondents stated that they spent the whole period outside their place of residence (usually a cottage, less often with relatives) and these respondents were usually very satisfied overall.
 - Those whose recreational building is located in the same district as their residence had a significant advantage (they could therefore visit it, as many of them directly mentioned).
 - Many of the respondents who spent time in a naturally attractive environment were aware of their advantages (large garden, living in a village with beautiful surroundings) and at the same time could not imagine how they would manage such a situation in a city apartment.
 - Respondents who own a recreational building but would still not use it at the time of lockdown specified in several cases that their recreational buildings are not adapted for a colder season.
 - Respondents also mentioned reasons that were not directly dependent on the lockdown as obstacles to the trip to nature, especially work or study workload, laziness, bad weather and in several cases also illness or quarantine after contact with the infected person.
 - The fact that it was not possible to spend time in nature with friends was often mentioned as a barrier to the trip to nature.
 - Several respondents (only students; there was no such answer from parents) also stated that they did not look for nature, so the lockdown did not affect them in this regard.
 - In their answers, a number of respondents mentioned dissatisfaction with the fact that they could not go skiing in the mountains (the lockdown occurred during the ski season).
 - The answers also show that if the children spent more time at the screens than usual, it was mainly due to the closure of schools (distance learning) and kindergartens (parents worked from home and needed to entertain the children).
 - Some responses also show that the combination of various measures (closure of schools, including kindergartens, distance learning, failure to meet relatives or friends as well as mental deprivation and cadastral territory lockdown) has multiplied many problems that would not be such problems on their own.
 - Although distance learning was often cited as the main reason why respondents spent less time in nature, several university students said they had more time to walk in nature, because they spent more time than usual thanks to the distance learning. Several respondents who sought the opportunity to relax in nature, especially from digital means of communication, also spent more time than usual during the lockdown.
 - In several answers, a summary statement appeared in various variations that the lockdown did not affect *how often* we went out, but strongly affected *with whom* (or *without whom*) and *where* we went and also *how* we enjoyed our stay in nature.
 - In rare cases, the thematic analysis also revealed a certain ignorance or misunderstanding of certain terms (confusion of the terms cadastral territory and built-up area, ignorance of the term recreational building, etc.).

5. Discussion

The positive effect of living in the natural environment on human physical and mental health has been documented several times (Pretty 2006; Nisbet et al. 2011; Capaldi et al. 2014; Lanza-León et al. 2021; Barrable et al. 2021). Dai et al. (2021) states that closeness to nature is potentially valuable in preventing infectious diseases and that it increases the quality of life. Nature walks with friends also help maintain social relationships (Lenaerts et al. 2021). The inclusion of staying in nature in regular human activities, whether it is recreation and relaxation (White et al. 2019) or the educational process at all levels of schools (Daniš 2019; Fedorko 2020b) is therefore a completely logical step. However, the last months and years, as a result of the lockdowns associated with the resolution of the COVID-19 pandemic, pose a challenge to humanity in this regard. In March 2021, lockdown deprived the inhabitants of the Czechia of the opportunity to travel outside the cadastral territory, while at the same time schools were closed. In this research, it was found out to what extent such a lockdown affected pre-school children, primary school pupils, elementary school pupils, secondary school students and university students.

The results of our study suggest that the deterioration of physical condition and mental well-being during the lockdown was more declared by women. The findings of an Iranian study (Khalilnezhad et al. 2021) indicate that natural areas were also missing from women during the restrictions associated with the COVID-19 pandemic. Roe et al. (2013) also point to the greater sensitivity of women. The conclusions of their study suggest that there may be a gender difference in the perception of nature as a mechanism for coping with stressful situations (in environments with a smaller green area, women were significantly more stressed than men).

Lockdown has reduced, as in other countries (de Lannoy et al. 2020), the amount of time spent in the natural environment. Although the respondents indicated that the cadastral territory does not always allow sufficient livelihood in this direction, and if it were not for the lockdown, they would spend more time in nature. At the same time, however, they declared that their own lockdown had a rather weak effect on their behavior. Less affected were those who live in a house

with its own garden, which allowed for an outdoor stay in a “safe” environment. The positive influence of one’s own gardens has also been documented from Italy (Spano et al. 2021), Brazil (Marques et al. 2021) or Iran (Khalilnezhad et al. 2021). Also Löhmus et al. (2021) found that more greenery around the home is associated with fewer symptoms of depression and anxiety. In this context, however, Sharifi and Khavarian-Garmsir (2020) and Rios et al. (2021) point to the “environmental injustice” resulting from the COVID-19 pandemic. Children from families with higher socio-economic status are more likely to have “holiday homes” in rural areas with large gardens. In contrast, children from socio-economically weaker families were often literally locked in small city apartments during the lockdown with very limited opportunities to visit nature (recall that city parks were closed in some parts of the world). Our research shows that young people spending a lockdown in a house with their own garden declared a deterioration in mental well-being in 51% of cases, while those without their own garden in 64% of cases.

According to Vágner, Fialová et al. (2004) and Vágner, Müller, and Fialová (2011) 11.2% of households own (more precisely a second home) (in Prague and some other larger cities up to 25% of households). In a certain way (e.g. by sharing within the extended family), about 30% of households use second-housing objects. This roughly corresponds to our results (almost 70% of respondents said they do not own a holiday home). Although more than 78% of recreational buildings are located within a distance of 40 km from the place of residence, it can be assumed that objects whose owners cross the district border when traveling to them predominate.

Howlett and Turner (2021) mentions that more than three-quarters of parents from rural areas responded they were satisfied with their children’s nature opportunities during pandemic measures, while only 40.5% parents from urban areas were satisfied with it. Our research shows that parents who spent time with children in a house with their own garden declared significant or extreme restrictions in spending time in their children’s nature only in 13% of cases, while parents from buildings without their own garden in 38% of cases. Students living in a house with their own garden felt a significant or extreme restriction in spending time in nature in 18% cases, while those without their own garden in 28% cases.

An interesting typology of respondents crystallized within the research. In addition to the majority, which do not own a recreational building and cannot travel to relatives whose residence is a suitable starting point for nature trips, two significantly different groups have formed. The first group had this option, but the respondents would not use it anyway, they were least affected by the lockdown. It seems that it includes respondents without much interest in staying outdoors. The second group were those who also

have a similar opportunity and if there was no lockdown, they would certainly use it. These respondents felt to be limited by the lockdown at the highest level, were most sensitive to the increase in stays at electronic devices and at the same time declared the most significant deterioration in physical and mental health. These are probably respondents who are active in everyday life, staying in nature is a normal activity for them and the given restrictions fell on them in full force. The young people most affected by the restrictions are the young people who would like to visit the recreational building and at the same time spend the lockdown in the building without their own garden. More than two thirds of these respondents stated that they felt the lack of stay in nature at their health, resp. worsened their mental well-being. Of the respondents who own a recreational building but would not use it, less than half reported health complications and “only” 43% affect the psyche.

The identification of these two groups of respondents’ points to a link between the effects of a pandemic on individuals’ health and their place attachment. Places (e.g. recreational buildings) can have a very positive effect on the health of individuals. However, the lack of contact with these places can have an unwelcome effect on them, which was also shown in our study. Counted et al. (2021) report that place attachment disrupted responses during a COVID-19 pandemic can be loneliness, despair, or protests. Meagher, Cheadle (2020) found that people with a greater connection to their home showed better mental health during the constraints associated with the COVID-19 pandemic. This finding underlines the importance of the text in the mandatory curriculum of the Czechia: “Various activities and tasks should naturally awaken in pupils a positive attitude towards their place of residence” (Ministry of Education, Youth and Sports 2021, p. 47). Let us specify that by home we do not only mean the given object – the building, but also the spatially larger area in which the individual feels at home.

Respondents from the ranks of elementary school pupils, secondary school students and university students declared a rather negative effect on their physical and mental health. Older students emphasized this fact. This is consistent with the findings of a study in American adolescents from the same period (Jackson et al. 2021), which demonstrated a significant positive effect of outdoor living on mental health during a pandemic. Similar results are obtained by Pouso et al. (2021). Based on the responses of more than 5000 respondents from 9 countries, the authors of this study found that COVID-lockdown had a significant negative impact on individuals’ mental health and that contact with nature has helped people better bridge the lockdown. This study also finds a relatively interesting finding: younger people were more likely to experience symptoms of anxiety and depression during lockdown than older people, although this is

exactly the opposite. This finding has been confirmed in other studies (Fancourt et al. 2020; Valiente et al. 2020). Also, Candeias et al. (2021) states that young adults experienced anxiety and general discomfort more often than the older generation during a pandemic. The authors of the study attribute this to a lower psychological level of adaptation in younger people. In our study with the declaration *Lack of stay in nature worsened my mental well-being*, respectively *I felt on my health* certainly agreed on average 26% of young people, while the declaration *Lack of stay in nature worsened the mental well-being of our children*, respectively *affected the health of our children* certainly agreed on average only 14% of parents. This finding is therefore either at odds with the above results of the cited studies or, on the contrary, confirms them (parents perceive the influence on the psyche of their children less significantly than the children themselves).

The positive impact of the natural environment on the mental health of individuals during the COVID-19 pandemic was confirmed by a systematic review (25 articles) by Lanza-León et al. (2021), from Spain and Portugal, Ribeiro et al. (2021), from a US university environment, Larson et al. (2022). Zabini et al. (2020) even found a short-term positive effect of watching nature videos on the psyche of Italian respondents.

Parents of children of pre-school and younger school age rather declared the absence of changes in the use of electronics, the stay in nature decreased, although not dramatically. Significant changes in these two variables were reported by researchers from Canada (Li et al. 2021) or Iran (Rajabi et al. 2021), who, however, reflected the entire period of the pandemic and not just three weeks.

Browning et al. (2021) found that a higher proportion of screen time worsened the mental health of American students. Our study shows that students who spent significantly more of their free time at the screens felt a negative effect on their psyche in 67% of cases, while students who did not spend significantly more of their free time at the screens observed an effect on their psyche “only” in 30% of cases.

The presented research is limited by several facts that the authors are aware of. The sample of respondents was non-random, we worked with an available set of respondents. This fact does not make it possible to generalize the conclusions, although it is possible (and appropriate) to draw attention to some more general tendencies which have the ambition to exceed the availability of the sample used. Interpretive limitations can also be found in the method of collecting data on pre-school and early school children, as data were collected from the parents of these children. The results also need to be interpreted with respect to the timing of the lockdown within the year. Lockdown took place in March, when the ski season ends, the beginning of the spring hiking and cycling season is dependent on the weather during this period and for

some recreational activities (swimming, mushroom picking) there are practically no conditions during this period. With the exception of skiing, this is a period in which outdoor recreational activities are run less than in other parts of the year. (This fact is nicely described by the Czech folk adage, which says: *In March we will climb behind the oven.*)

The last limit is the fact that despite the timing of data collection and repeated warnings that information about the lockdown was collected in March 2021, respondents were able to reflect in their reactions the entire period of the COVID-19 pandemic in the Czechia, when the scope and method of lockdowns changed several times.

6. Conclusion

Lockdown, which was implemented in Czechia in March 2021, was probably the most significant restriction in the fight against COVID-19. The prohibition of leaving residential cadastral territory caused a lower intensity of stay in the natural environment for children and adolescents and led to several negative phenomena, including deterioration of physical and mental health and an increase in leisure time spent in front of the screens. Lockdown had the greatest impact on those individuals who were accustomed to traveling in the natural environment outside their immediate surroundings. The question thus remains whether the benefits of similar extreme restrictive measures outweigh their negative effects on human well-being.

Also, in the light of experience from other countries and the ongoing pandemic, it is appropriate to integrate the stay in nature into the educational process, even if this process takes place in a distance form. This would reduce the forced stay in front of the screens and increase the amount of time spent outdoors.

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Tourism management in the Arctic coastal zone of Northern Eurasia

Anton Mosalev¹, Alexandr Sanin^{2,*}

¹ Financial University under the Government of the Russian Federation, Russia

² Lomonosov Moscow State University, Russia

* Corresponding author: eather86@mail.ru

ABSTRACT

This article analyzes the recreational activity in the Arctic region of Northern Eurasia and the influence of geographical and economic factors on its recreational potential. The SWOT analysis showed that the Arctic tourist region has a number of strengths and opportunities for further development. However, to realize these opportunities, it is necessary to reduce the negative impact of weaknesses and neutralize the existing threats to tourism in the region. At the same time, it is necessary to consider the political, economic, social and technological factors that were identified as a result of the PEST analysis. Processes related to the melting of permafrost due to climate changes represent a special threat, which is significantly constraining the future development of tourism in the region. The major problem of the Arctic region is the low level of development of recreational infrastructure, which results in the high cost of touristic tours. The article suggests two strategies for the future development of tourism in the Arctic region. The first is based on premium tourism, offering unique services that are not offered anywhere else. The second one is an active development of budget-priced tourism focusing mainly on the Russian market in the Russian Arctic and the European market in Northern Scandinavia and Svalbard.

KEYWORDS

nature management; Russian Arctic; the Northern Eurasia; tourism; SWOT-analysis; PEST-analysis

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1. Introduction

Currently, the trend of intensification of economic activity in the Arctic region, especially the mining industry and transportation of mineral resources is observed. There is a tendency for violent conflicts between different types of human activity, in particular, between environmental activity on the one hand, and industrial, transport, special (military) and recreational activity on the other. Traditional land-use of small peoples of the North also comes into conflict with industrial activity for the same territorial resources (Dushkova and Evseev 2012). However, conflicts between tourism and other types of human economic activity, as a rule, are not as acute as other types of land-using with each other. The impact that tourism has on natural landscapes is also noticeably less in comparison with the impact of industrial activity, in particular, mining.

Human economic activity is increasingly affected, both positive and negative, by the emerging trend towards climate warming and its consequences. Among them, the most important for human economic activity is the degradation of permafrost and the reduction of the area of ice cover in the Arctic Ocean (Aybulatov 2005; Gramberg, Laverov, and Dodin 2000; Dodin, Evdokimov, and Kaminsky 2007; Tatarnikova 2014).

The research focuses on Northern Eurasia, which, along with the northern part of North America (along with Greenland) and it is one of the two parts of the Arctic region. Two countries have access directly to the coast of the Arctic Ocean in the north of Eurasia: Norway and Russia (as well as located on the island of Iceland). However, the northern regions of Sweden and Finland can also be attributed to the Arctic region to some extent, and possibly all of these countries.

There are different approaches to determining the spatial boundaries of the Arctic region. For example for Russian Arctic, the authors understand it as the Arctic coast of Russia from the border with Norway to Chukotka region, and the Arctic shelf of the Russian Federation. On land, the border is conventionally drawn along the Polar circle. A similar approach can be applied to the countries of the Scandinavian Peninsula, as well as to North America the coast is located to the south of it (for example, the White sea coasts or the Gulf of Bothnia), the first few tens of kilometers of territory adjacent to the coastline, economic activity on which is somehow connected with the sea is being considered.

Within the Arctic countries, as a rule, the Arctic region includes those administrative territorial units that have access to the Arctic Ocean. For example, in Russia it is Murmansk Region, the Nenets, Yamalo-Nenets and Chukchi Autonomous Districts, Arkhangelsk Region, Krasnoyarsk District and the Republic of Sakha (Yakutia), including the Arctic islands that are part of them. However, not the entire territory of

the listed regions is considered as the Arctic region of Russia, but only their municipalities with direct access to the seas of the Northern Arctic Ocean (Soldatenko and Alekseev 2020).

Further intensification of recreational activity is quite promising for economy arctic countries in general and economy of Arctic region in particular. Unlike industrial activity, it does not enter into acute conflicts with other types of human activity. Some types of recreation, such as ecological and ethnic tourism, on the contrary, have a positive impact on the other types of human activity. There are opportunities for a significant increase in tourist flows (both external and internal), which is confirmed by the example of other Arctic territories in the world: Svalbard, Greenland, Alaska, and the Canadian Arctic archipelago (Sevastianov 2018; Tourism for development 2018; Doiron 2011 etc.). However, this requires significant investments in recreational infrastructure, as well as consistent advertising campaigns to promote the region among potential tourists, especially in those countries from which the largest number of them come (Germany, the Scandinavian countries, China, the United States etc.). It seems optimal here, as the experience of developing other tourist destinations of Russia and the world shows, to use partnership between state and private business, which allows the state and private business to combine their efforts to achieve their goals. The article also identified other strengths and weaknesses of the Arctic as a tourist region, in addition to those listed above, using the example of the Russian Arctic, which occupies most of Northern Eurasia, opportunities for its development and threats to this development (which was done in the form of a SWOT analysis). The economic, political, technological and social components of the environment external to the Russian Arctic as a tourist region were also evaluated, which directly affects the development of tourism in the region. The latest assessments include a PEST analysis conducted, as well as an assessment of the impact of technological features on the development of tourism. Both SWOT analysis and PEST analysis are most often performed for a specific company or enterprise, but there is no reason not to apply it to regions considered as tourist sites, as it was done for the Arctic region on the example of the Russian Arctic.

To date, various scenarios of permafrost degradation in the Arctic and its consequences have been considered in the literature (Kutepov and Sheko 2002; Filatov et al. 2012 etc.). However, the impact of this process on the tourism industry of the region is poorly considered, there is an opinion that the increase in temperatures opens up new opportunities for the development of tourism in the region (Soldatenko and Alekseev 2020).

The purpose of the article is to identify the features of tourism in the Arctic region within Northern Eurasia, its relationship with other types of human economic activity, as well as to develop recommendations

for the development of tourism, taking into account the need to preserve the unique natural landscapes of the Arctic.

The global changes taking place in the world, in particular, the COVID-19 pandemic and its consequences cannot but affect tourism in the Arctic, in particular, in Northern Eurasia, and all components of the external environment for the tourism industry. The ongoing economic and social processes carry both opportunities and threats for the development of tourism in the region.

2. Materials and methods

In order to achieve the goals set in the article, a review of Russian and foreign literature on the research topic was carried out, emphasis was placed on sources fully or partially devoted specifically to tourism in Northern Eurasia. The Arctic region of the continent was considered as a tourist destination, its strengths and weaknesses, opportunities for development and threats to this development were identified (SWOT analysis). The authors have developed recommendations to maximize the opportunities for development and reduce the negative impact of possible threats to this development. A PEST analysis was also performed to assess the political, economic, technological and social component of the environment in which the Arctic region of Northern Eurasia is located as a tourist destination.

The authors actively used statistical data for regions with access to the Arctic coast, in general, and for tourism on them in particular. Cartographic information and Earth remote sensing data have been used as well.

3. Results and their discussion

3.1 Some trends for environmental management in the Arctic region of the Russian Federation

The following trends are observed in the structure of human activity in the coastal zone of the Arctic seas.

1. In contrast to the 1990s and partly the first decade of the 21st century, the role of military (special) activity is beginning to increase, for example, in Greenland and Russia, which is associated with some strengthening of the armed forces of the Russian Federation in general, and its Navy in particular. The second reason is the exacerbation of relations between the Russian Federation and many leading world states in general, and in the Arctic region (the United States, Canada, Norway, etc.) in particular. The trend towards militarization of the Arctic region, in particular, Northern Scandinavia, may increase due to the entry of Sweden and Finland into the NATO.

Similar processes of activation of the economic activity of the military should be expected in other countries with access to the Arctic, due to the growth of geopolitical tensions in the world in general and in the Arctic region in particular, which may restrain the recreational development of the region in certain areas. During the Cold War, special nature management on the territory of the modern Russian Arctic and beyond, was the leading one on some parts of the coast and had a significant impact on the environment, in particular, pollution, including radiation from nuclear weapons tests and large household garbage.

2. In contrast to the 1990s and partly the first decade of the 21st century, the role of transport is beginning to increase, especially within the so-called Northern Sea Route along the northern coasts of Eurasia (Tatarnikova 2014; Sevastyanov 2018; Lukin 2020). It is known that Vladimir Putin, the President of the Russian Federation, has set the goal of achieving the volume of cargo transportation of 80 million tons along the Northern Sea Route by 2020. For a number of reasons, in particular, due to the COVID-19 pandemic, this result was not achieved, however, there is an increase in the volume of cargo transportation along the Arctic coasts and there is every reason to expect its growth in the future. The increase in cargo traffic is the results of increasing of mining in particular, polymetallic ores near Norilsk and coal on Taimyr Peninsula, as well as natural gas in the Arctic coastal zone and their transportation. Moreover, the active use of technologies that allow natural gas to be liquefied for shipment by special tankers from the newly built port of Sabetta on Yamal. In the future, the role of transport activity may increase even more in connection with the possible use of the Northern Sea route for the transport of goods from East Asia to Western Europe. Nowadays trend towards climate warming has been observed, which, in turn, causes a decrease in the ice content of the ocean area. It makes positive impact on the organization of transportation of mineral resources and other types of transportation. Due to the COVID-19 pandemic, the volume of cargo transportation along the Northern Sea Route has decreased slightly in the last two years, but after the recovery of the global economy, we can expect its further growth. The growth of cargo traffic along the Northern Sea Route is also planned due to the deterioration of economic and trade relations between Russia and the countries of the European Union, in particular, difficulties with the insurance of Russian vessels and a ban on them entering European ports.

The Northern Sea Route is part of the so-called Northern Sea Transport Corridor, which includes the Russian part of the Pacific coast in eastern Asia. Norway, which has a long access to the Arctic coast, can intensify the use of the Northern Sea Route for trade with China, which is currently carried out mainly by sea, as well as Sweden and Finland. The latter two countries could use Norwegian or Russian ports for this.

3. The role of recreational activity is increasing (Aybulatov 2005; Tatarnikova 2014; Lukin et al. 2016a; Grushenko 2018; Zubakina and Pogodina 2016; Dushkova and Evseev 2012; Lukin et al. 2016b). Some types of tourism have already been developed in the region, while others have potential opportunities for development. Thus, tourism to the North pole is actively developing with access from Murmansk by sea (Lukin et al. 2016a; Zubakina and Pogodina 2016). A number of direction of tourism, such as adventure tourism (hunting including photo hunting, fishing, hiking etc.), ethnographic tourism, cruise tourism etc. can potentially get much more development than at the present moment. Thus, the literature (Gramberg, Laverov, and Dodin 2000; Dodin, Evdokimov, and Kaminsky 2007) notes the potential attractiveness of cruise routes along the Northern sea route, which would become one of the most unique tours offered around the Earth. This route is comparable in uniqueness with the trip along the Trans-Siberian railway, which is quite popular among foreign tourists. At least one such cruise has already been organized. It included visiting of the land of Frans-Joseph and Novaya Zemlya on the way (Sevastyanov et al. 2015). Two more cases of organizing cruise tourism from Murmansk to Anadyr were noted in 2017 (Sevastyanov et al. 2015).

The COVID-19 pandemic and the growth of geopolitical tensions in 2022 has significantly complicated foreign tourist trips for Russians, which contributes to the growth of domestic tourism. This trend may also affect the Arctic region. To a lesser extent, the tendency to decrease the percentage of foreign trips due to an increase in domestic ones due to the COVID-19 pandemic is also observed in the Scandinavian countries.

3.2 Features of recreational activity in the Arctic region

Recreational activity could enter into mutually beneficial relationships with other types of human activity that are common in the region, and have a positive impact on the economic situation of local residents, as indicated by the experience of other tourist regions of Russia and the world. Among the foreign experience (not only for the Arctic region), it is of particular interest to take into account the interests of local residents and coordinate with them programs for the development of tourism in the Arctic regions, partnership between the state and private business in the tourism industry, types of tourism that have developed in certain regions of the Arctic, control of recreational flows, both organized and unorganized recreants. Comparison of the Russian and Scandinavian Arctic with the Arctic territories in North America shows that the problems of tourism development in these regions are largely similar: poor development of tourist infrastructure, high prices for consumer goods, the problem of littering of the most attractive places for

tourists, the need to determine the portrait of a typical tourist, etc.

At first glance, recreational activity inevitably conflicts with environmental management. However, there are also many mutually beneficial options for their relationship, the main of which is the development of eco-tourism, which can supplement the income of natural reserves, but not cause significant damage to their landscapes. After all, world experience shows that partnership between state and private business is optimal for recreational activity, which allows developing tourism while minimizing financial costs and negative impact on natural landscapes (Lukin et al. 2016b; Kruzhalin et al. 2015; Lexin and Porfiriev 2015; Korostelev and Biletsky 2014). Here, the implementation of the touristic cluster approach, which is well-established in many tourist areas around the world, is promising (Kruzhalin et al. 2015; Korostelev and Biletsky 2014; Menshikova 2019). This is possible in the case of controlling tourists, in particular, the organization of their movement along ecological trails, as confirmed by the experience of numerous natural parks around the world. Ecotourism is particularly promising in this regard, which is the most priority and competitive in the Arctic, especially for its Western part of Russian Arctic (Grushenko 2018; Zubakina and Pogodina 2016; Lukin et al. 2016b) and Northern Scandinavia, as well as Svalbard and Iceland, where it is already actively developing. However, in the Asian part of the Russian Arctic there are many potentially interesting sites from the point of view of ecological tourism as well, such as Wrangel island (included with the list of UNESCO World Natural Heritage Sites) or the Large Arctic preserve on Taimyr Peninsula.

Cruises on the Northern sea route makes sense to ensure the possibility of their technical implementation and reduce their cost of combining with the wiring of transport vessels. Moreover, it makes sense to organize calls to port cities along the route for the organization of hunting, fishing, and industrial tourism (Norilsk, the port of Sabetto, Bilibinskaya nuclear power station). There are excellent opportunities for amateur hunting and fishing outside the Russian Arctic, in particular, in Greenland, but these activities should be strictly regulated in order to avoid damaging populations of rare and endangered animals. If there is a need for delays on the coast, tourists can be taken to the departed ship by helicopter. Helicopter trips over the most beautiful places along the route of ships (Kamchatka, the Lena Delta, the Bering Strait, the most beautiful Norwegian fjords, islands of the Canadian Arctic archipelago and parts of the coast of Greenland etc.) can also be included in the tour program as an additional service.

Cruise tourism is already quite popular in the region. For instance, in 2018, 3,938 people (23 cruises) visited the regions of the Arctic zone of the Russian Federation on cruise ships, and in 2017 – 2,521 people

(25 cruises). A much larger number of tourists, including by sea, arrive in Svalbard.

From the experience of the coastal zone of tourist region in Russia, in particular, the Krasnodar region, the positive impact of recreation on local residents is obvious. This includes work places in the tourism industry, and the possibility for locals of providing various services to tourists, in particular, organizing trips to hunting and fishing, renting personal vehicles and houses. It is known about the positive impact of tourism on the well-being of local residents, including small peoples of the North for some Arctic regions

The experience of tourism development in Svalbard can be used as an example for the Russian Arctic. The revenue of tourism and culture enterprises located on the island amounted to 5 billion rubles. Svalbard Airport receives more than 80 thousand passengers per year. Dozens of cruise ships visit island every year (in 2017 more than 84 thousand cruise tourists arrived in island). A slight decrease in tourist activity was observed in 2021 and especially in 2020 due to the COVID-19 pandemic, but now there is a recovery in the tourist flow. In addition to Svalbard, the popularity of cruises to Franz Josef Land, the northernmost land in the Arctic region of the Russian Federation, is growing. Alaska achieved results that are even more impressive. It was visited by 1.1 million cruise passengers (Sevastyanov 2018).

The Western Arctic of Russia is a priority part of Russian Arctic region (just like, for example, the southern part of Greenland for Denmark) for tourism development. In the all-Russian rating of Russian regions as tourist destinations, it is the Murmansk and Arkhangelsk regions that took the highest place among Arctic regions of state. This is due to its proximity to Europe and Central Russia, from which most tourists come. Among other reasons are its high population density, and the better development of infrastructure, in particular transport, in comparison with other Arctic regions. Although even in the Murmansk and Arkhangelsk regions, there are far fewer settlements with hard surface road. The situation is even worse for settlements in the Urals and eastward away from it. Eastward of Yamalin the coastal zone belonging to the Arctic coast, there are no railways, the northernmost of which are located in hundreds or even thousands of kilometers from the coast. Similar problems are typical for remote parts of the Arctic territories of other countries, for example, the Canadian Arctic Archipelago (here the situation is complicated by the fact that it consists of many islands, navigation between which is difficult due to navigational conditions), the northern coast of Alaska, the northern part of Greenland. As for Northern Scandinavia, it is characterized by an even higher population density and the level of development of tourist infrastructure than the European part of the Arctic region of Russia. However, for this region there are problems associated with poor

transport accessibility, in particular, the lack of flights to the north of Sweden (Brouder 2013).

There are a number of factors constraining Arctic tourism. The most important of them are low income levels of many Russian citizens, distance from major centers and low infrastructure development. However, for some tourists the remoteness of the Arctic territories is a positive factor. The low level of income of Russian tourists can be compensated by attracting foreign tourists, in particular, from neighboring Scandinavia, Germany and some other states. In more detail, the factors constraining the development of tourism, as well as positively influencing it, are considered as the weaknesses and strengths of the Arctic as a tourist region below, among the results of the SWOT analysis carried out for it.

Recreational, as well as other types of human activity, should take into account adverse and dangerous natural processes that are typical of the coastal zone of the region. Dangerous natural processes and their consequences are similar for the entire Arctic region, both in the north of Eurasia and in the north of North America, including on the islands (with the exception of Alaska, where volcanism and earthquakes are added). The most threatening processes in the region include processes of abrasion and thermal abrasion, storm events and accompanying waves, processes associated with permafrost on land (thermokarst, frost heaving, ice formation, partly waterlogging and flooding etc.). Moreover, for mountainous areas of the coastal zone (for example, in the north of Scandinavia, in Alaska, etc.) slope processes (landslides and others) can be taken place. A climatic adverse process, in particular, severe winter frosts, affects as well (Kutepov and Sheko 2002). They, together with the remoteness from the most developed part of Russia, USA, Canada and other Arctic states and the weak development of the transport network (especially a shortage of rail transport) greatly complicate economic development of the region.

In particular, thermoabrasion processes sometimes cause significant rates of coast retreat, up to several meters per year. For example, within the Russian Arctic the highest intensity of such processes is recorded for the Laptev sea, it reached 18 m/year (Aybulatov 2005). Due to the rise in the level of the World Ocean, the activation of thermoabrasion processes is expected, which has already been noted. It inevitably threatens the objects which located in the immediate vicinity of the coastline. Processes related to the dynamics of permafrost soils threaten the stability of roads and buildings. The threat from such processes becomes more acute due to the recorded tendency of increasing of average temperatures. Especially processes associated with permafrost rocks typical to Arctic territory eastward away from Urals mountings, as if to the European Arctic part of Russia they are distributed in a narrow coastal strip, or missing while eastward away from the Urals is much farther; to the East from Yenisei reaching the Russian border in the South.

The emerging climate changes, in particular, the reduction of the area of the ocean area covered with ice activates a number of adverse and dangerous processes. Due to the increase in the ice-free period, the impact of waves on the sea coast increases, hence the rate of thermal abrasion. Some increase of precipitation have been revealed (Kutepov and Sheko 2002), increasing intensity of waterlogging, which embrace all the new areas that increases the cost of drainage.

All the above-mentioned adverse and dangerous natural processes can also threaten recreational infrastructure facilities, which are already clearly insufficient.

3.3 SWOT analysis of the Russian Arctic as a tourist region and PEST analysis for it

The Arctic as a tourist region is considered below by the authors of the article on the example of the Russian Arctic, which occupies most of Northern Eurasia. The results of the SWOT analysis performed for this region are given below. Most of them are peculiar to some extent to the Arctic territories of other countries. To assess the current state of the Arctic region as a tourist destination and determine the prospects for the development of tourism in it, the authors performed a SWOT analysis. The results are shown in table 1 below.

Tab. 1 Results of SWOT analysis of the Arctic tourist region of Russia.

Strengths of tourism in the Arctic region	Weaknesses of tourism in the Arctic region
<ul style="list-style-type: none"> - The destination is «exotic» and unusual for the most tourists, the uniqueness of the tourist product that can attract tourists from all over the world. - A variety of possible types of tourism in the region: cruise, ethnographic, extreme, adventure, excursion, event, religious, etc. The possibility of combining two or more of these types of tourism within one tour. - Esthetic resources of the region, beauty and uniqueness of landscapes, flora and fauna. - Natural landscapes are relatively little changed by man, which attracts a lot of tourism. The richness and originality of flora and fauna. - Unique natural phenomena such as the polar day, the Northern lights and some others can attract and already attract tourists who have never seen them. 	<ul style="list-style-type: none"> - The cost of many tourist services, in particular, the cost of cruises can begins at several thousand US dollars. - Remoteness of the region from the main economic centers, densely populated areas of the Russian Federation, European and Asian States (except for the Scandinavian countries). - Weak level of development of tourist infrastructure (and transport infrastructure in general), especially in the Asian part of the Russian Federation. - Unfavorable climatic conditions, which strongly reduce the duration of the tourist season, make the stay of tourists uncomfortable, and in some cases can pose a threat to their health and even life. Their unaffordability increases from West to East of Russia. - Risks to the health and life of recreants associated with the risk of storms, frequent non-flying conditions, strong frosts and other natural dangerous processes. For the same reasons, it is more difficult for tourists to plan the logistics of their travels - Lack of opportunity (or limited opportunities) to develop some mass tourism destinations, for example, beach and bathing recreation. - Perceptions of Russians and residents of other countries about the region, according to which tourist trips there are often not expected.
Opportunities for tourism development in the region	Threats to tourism in the Arctic region
<ul style="list-style-type: none"> - The development of international cruise routes (Norway-Russia, Alaska-Chukotka, possibly Greenland-Iceland-Norway-Russia or Saint Petersburg-Murmansk around the Scandinavian Peninsula etc.). - The combining transport and touristic trips on the Northern Sea Route. - The creation of combined touristic routes using air, river, sea and rail transport, which will make the trips cheaper and more diverse. - Reduction of international tension, which activates international cooperation in the field of tourism. - Warming of the climate, which will lead to the improvement of the conditions for navigation and will make the region more attractive for tourism. - Development of small and medium-sized businesses in the tourism sector, which will lead to the improvement of the touristic infrastructure, a greater variety of recreation and will increase its comfort. - The increase of the income level of residents of Russia and those countries with the largest tourist flows (Germany, China, Scandinavian countries, etc.). - The increase of the number of independent tourists, which, as the examples of such Russian region as Krasnodar region show, has a positive effect on the level of well-being of local residents. - Development of competition in the tourism business, which will reduce prices and improve the quality of touristic services. - Improving the transport accessibility of the region, in particular, the construction of new railways and highways, airports, an increase in the number of flights of passenger trains, buses, airplanes, sea and river vessels. All this can be used by both organized and independent tourists. 	<ul style="list-style-type: none"> - Exacerbation of conflicts with other types of human activity: military and environmental ones, which may lead to restrictions on the possibility of visiting a number of attractive areas for tourism, industrial, etc. - Complication of the geopolitical situation, which will limit opportunities for international cooperation in the field of tourism, in particular, will make it more complicated to obtaining tourist visas and other documents necessary for organizing tours. - The decrease in the level of income of the population in Russia and the countries from which the largest number of tourists arrive (USA, Germany, China, Scandinavian countries, etc.). - Climate changes and their possible consequences (although they represent not only threats, but also opportunities). - Adverse and dangerous natural processes in general and their activation, in particular, degradation of permafrost. - The increased of competition by other tourist regions, especially those of them, whose climate and recreational potential are similar to the Russian Arctic, in particular, Alaska and Greenland.

Some trends can be considered for the Arctic tourist region both as opportunities and as threats. In particular, the possible recovery of international tourist flows after the end of the COVID-19 pandemic may contribute to the influx of foreign tourists to the Arctic. On the other hand, the restoration of opportunities for foreign travel may negatively affect domestic tourism, because in that case Russians may go abroad instead of Russian Arctic. A similar situation is possible in the Scandinavian countries, but it will be mitigated by an increase in the flow of tourists from the rest of Europe, for which these countries, especially Norway, are very attractive as a tourist destination. The warming of the climate will make the temperatures for tourists visiting the region more comfortable, and will improve the ice conditions for ships. But it also conduces the melting of permafrost, which can lead to damage or complete destruction of the region's infrastructure (roads, buildings, pipelines), which will negatively affect its accessibility and convenience for tourists. A similar mixed effect (including both positive and negative consequences) of global climate warming will have on Arctic tourism in North America, which is also characterized by the ubiquity of permafrost.

To assess the "background" on which the development of the Arctic within Northern Eurasia as

a tourist region is carried out, a PEST analysis of the Arctic region as a tourist object was also carried out. Its results are shown below in table 2.

There are regional features of the various Arctic territories and different countries, and within a single country, especially Russia due to its large territory, which are also evident when considering the threats and opportunities for Arctic as a touristic region as well as its strengths and weaknesses. Thus, the level of infrastructure development, including tourism, gradually decreases when moving within Russia from West to East, in the same direction increases the severity of climatic conditions, in particular, values of winter temperatures as well as the duration of the ice period. Due to this, as well as the proximity to Central Russia, St. Petersburg and foreign countries, the Western Arctic is the most attractive for tourism, which is also confirmed in the literature (Zhilenko 2021).

The rest of the Russian Arctic coast is of interest for routes through the Northern Sea route, and to a lesser extent for other types of tourism. However, in the Eastern Arctic there are a number of unique, attractive sites for tourists, such as the so-called "mammoth" routes in Yakutia, which allow tourists to see the remains of ancient mammoths frozen in permafrost.

Tab. 2 Results of PEST analysis of the Arctic region as a tourist object within Northern Eurasia.

PEST analysis for the Arctic region of Eurasia as a tourist destination	
Political factors	Economic factors
<p>The growth of geopolitical tensions in relations between Russia and European countries, in particular, Scandinavia, as well as between Russia and the United States and Canada. The conflict between the interests of China and the interests of countries with access to the Arctic coast.</p> <p>Curtailing cooperation between Russia and the rest of the Arctic region.</p> <p>The use of Arctic waters is regulated by the 1982 UN Convention on the Law of the Sea, which regulates the legal regime of maritime spaces (open sea, continental shelf, exclusive economic zone, territorial sea, etc.), including in relation to the Arctic marine spaces.</p> <p>The use of the Barents Sea, along which the border between Russia and Norway runs, is regulated by the Agreement between the Russian Federation and the Kingdom of Norway on the Delimitation of Maritime Spaces and Cooperation in the Barents Sea and the Arctic Ocean of September 15, 2010.</p> <p>The 1958 Geneva Conventions on the High Seas, on Fisheries and protection of Living Resources of the High Seas, on the continental shelf, on the territorial sea and the adjacent zone can also be applied to the waters of the Arctic Ocean, but they also do not reflect the specifics of the international legal regulation of the Arctic marine spaces.</p> <p>There are also a number of other international and regional agreements regulating the use of the Arctic Ocean.</p>	<p>The weak level of development of transport infrastructure (especially in the Russian Arctic), which determines the significant costs of its creation for the development of tourism. Severe climatic conditions, which cause additional costs for heating the premises and a number of others, which affects the cost of tours to the region.</p> <p>Harsh climatic conditions, in particular, low winter temperatures, as well as the widespread permafrost, especially in the Asian part of Russia, significantly complicates and increases the cost of construction and operation of infrastructure facilities, in particular, railways and highways.</p> <p>The high level of prices for everyday goods, which repels tourists.</p> <p>The economic feasibility of other types of human economic activity (in particular, the extraction of mineral resources) on the coast areas that are attractive for tourism, which repels recreationists.</p> <p>Low density of the local population, which makes it difficult to organize tourist trips, especially independent ones, to the Arctic regions.</p>
Social factors	Technological factors
<p>Fatigue of some tourists from other, more accessible tourist destinations, which may encourage them to visit the Arctic region.</p> <p>A decrease in the standard of living, especially in Russia, because of the COVID-19 pandemic, as well as events in Ukraine, which may lead to a decrease in the tourist flow.</p> <p>Conflicts between the small peoples of the North and tourists, as well as the alien population (especially acute in Russia).</p> <p>The lack of perception of the Arctic territories as a tourist region among the majority of potential tourists.</p> <p>Low level of awareness of potential tourists about recreational opportunities in the Arctic.</p>	<p>Lack of icebreakers, without which it is impossible to move on water in most of the Arctic waters for a significant part of the year (especially in the Asian part of the Russian Arctic).</p> <p>Difficulties in the operation of some equipment in winter due to low temperatures, especially in the Asian part of Russia, in winter.</p> <p>Logistical difficulties for tourists, especially independent ones, when visiting the Arctic region.</p>

Among the Arctic territories of other countries, Northern Scandinavia seems to have the greatest attractiveness for tourists due to the relatively high level of infrastructure development and proximity to densely populated European countries with solvent populations.

4. Conclusion

At present, Arctic tourism is mostly related to the premium segment of the touristic market (especially in Russia), and it occupies an extremely small part of it on a global, European and Russian touristic market. There are two ways to develop Arctic tourism that do not exclude each other. One of them is development of premium tourism niche of the tourist market. Other way is developing of an «economy-class» tourism. The first way involves further increasing the number of Arctic cruises, as well as increasing their diversity, and organizing individual tours (helicopter, off-road, hunting, fishing, there may be completely different options). This, of course, includes such a unique tourist product as tours to the North Pole. The second involves the development of mass tourism in the most developed and densely populated Northern regions. In Russia, for example, there are Murmansk region, West part of Arkhangelsk region and in the vicinity of other large cities in the European North, including in the Asian part (Norilsk, Salekhard, Magadan, Anadyr). Comparatively large (in comparison with Greenland, the north of Canada, the Asian part of Russia) population density is also characterized by Northern Scandinavia, which is already characterized by mass tourism, which has a high potential for further development here. Mass budget-priced tourism can include hunting, fishing tours, excursions, event tourism (for example, visiting folk festivals of the indigenous peoples of the North: the Sami on the territory of Finland, Sweden, Norway and Russia, Nenets and Komi in Russia etc.).

When developing both premium and budget tourism in the region, it is necessary to take into account the threats identified in the study for the recreational development of the Arctic. The most acute of them at the moment is the degradation of permafrost and its consequences, including for tourism. These include the activation of flooding and waterlogging processes, as well as damage and destruction of buildings and structures, including tourist infrastructure facilities. It is necessary to observe the condition of permafrost rocks and take into account the consequences of their degradation during the construction of any engineering structures.

The processes taking place in the economy and society in general and in the tourism industry in particular open up a number of opportunities for the Arctic region, but at the same time exacerbate many problems that are characteristic of it. In particular,

it is possible to aggravate conflicts between tourism and other types of economic activity: transport use of the region, extraction of mineral resources, military human activity etc.

The intensification of other types of economic use in the Arctic, especially transport and industrial, leads to a significant increase in the impact on the unique natural landscapes of the region. Tourism, especially some of its types, such as ecological, cruise, etc., can be organized in such a way that it will have minimal impact on natural landscapes.

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Distribution strategies of new and renewed regional industrial breweries in the context of Czech identity and the traditional beer market

David Hána*, Kryštof Materna, Jiří Hasman

Charles University, Faculty of Science, Department of Social Geography and Regional Development, Czechia

* Corresponding author: david.hana@natur.cuni.cz

ABSTRACT

The geography of the brewing industry is currently undergoing substantial shifts. While most attention has been paid to the boom of microbreweries, newly established regional breweries have been neglected and little is known about how they are gaining a position among consumers in stable and saturated markets. The aim of this article is to investigate what strategies new breweries use to establish distribution regions and which factors are at play based on the consumers' economic and socio-cultural preferences, all within the contextual influence of market development and territorial identity. The research is based on the mapping of distribution regions of seven new Czech breweries and interviews with their representatives. The breweries first opt for a contagion strategy focusing on local customers to provide a basis for further expansion. The hierarchy strategy with a preference for wealthier customers in distant cities subsequently prevails. The choice and success of the chosen strategy depend on the interaction between regional market development and consumers' territorial identity. In Czechia, local breweries, especially those that have restored and maintained historic brewery buildings, are attracting consumers from cities, while consumers from the countryside prefer nationally known beer from big industrial breweries.

KEYWORDS

distribution regions; distribution strategy; neolocalism; regional breweries; territorial identity

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1. Introduction

The dynamic development of large industrial breweries in the world brewing industry is gradually coming to an end after two centuries. The production concentration in ever-larger breweries and the conquest of new markets are already reaching their natural limits.¹ In countries in the late phase of beer market development (for more about beer life-cycle see Hána et al. 2020; according to product life-cycle in Vernon 1966; Dicken 2015), the market is saturated and not very dynamic, and breweries in the vast majority focus on maintaining existing outlets² (Hasman et al. 2016). Only three deviations are dynamising this environment: acquisitions, microbreweries, and new industrial breweries. In the case of the strongest players in the market, the strategy is to acquire competing companies and take over their outlets (Bennison et al. 1995; Dicken 2015; Materna et al. 2019; Hasman et al. 2021). A major global innovation in the brewing industry in recent decades is the emergence of thousands of microbreweries (Wojtyra et al. 2020; Materna et al. 2021), but these remain largely associated primarily with their own brewery restaurant or its immediate surroundings (Pachura 2020). Significant expansion into new markets rarely occurs here. New, regional³ breweries have a different position: trying to embark on the path of higher production – but they have to fight for new, relatively large and firmly occupied outlets (c.f. Hasman et al. 2016). However, these actors are practically neglected by existing research (unlike microbreweries and large corporations).

To gain a foothold in the market and create a distribution region, breweries must choose an appropriate strategy. The spatial division of the Czech beer market after 1989 (Hasman et al. 2016) shows six basic strategies for expanding the distribution region of Czech industrial breweries, which are based on the general typology of spatial strategies of retail chains in terms of developing their retail network (Bennison et al. 1995). The aim of the article is, therefore, (1) to

find out which strategies these breweries choose for the creation of their distribution region and (2) to explain which factors influence the choice of strategy. It combines quantitative and qualitative approaches. First, the newly created distribution regions of seven new breweries were mapped, while in two cases, we used unique annual time series. The findings obtained in this way are then explained with the help of structured interviews with representatives of the surveyed breweries (see Kuehn and Parker 2021).

The research was carried out in Czechia – a country with a significant brewing tradition, many historical brewing buildings, a saturated market, and the current dynamics of the emergence of new microbreweries. Czechia has been among the centres of European brewing since the Middle Ages (Kopp 2014; Kubeš 2022), in which we can look for the roots of one of the world's most famous beer styles – Pilsner lager (Mittag 2014; Yool and Comrie 2014). Since the middle of the 19th century, all of these core areas have undergone industrialization and concentration of the brewing industry into a smaller number of larger companies (Likovský 2005; except Bavaria, see Maier et al. 2020), but in Czechia, this natural market trend continued artificially in the form of controlled closure of nationalised breweries in the centrally planned economy of the communist era during the years 1948–1989 (Likovský 2008). At the time of the culminating industrial revolution in 1910, there were about 300 industrial breweries in Czechia and about 400 other smaller breweries (Likovský 2005, 2008). During the two world wars and the economic crisis, many of these breweries ceased, suspended or reduced their production (as in all European brewing areas). After the Second World War, most of these breweries fell to final, state-controlled closure instead of being restored. In 1990, there were only 70 industrial breweries left in Czechia and only one microbrewery (Kratochvíle 2005).

In recent decades, this Czech specific history has resulted in an even sharper rise in the wave of microbreweries (e.g., Wojtyra et al. 2020), and at the same time, there is the unique potential of hundreds of ruined but still standing historic buildings of former small industrial breweries, where it is possible to consider resuming beer brewing. And indeed, in more than 50 cases of the approximately 500 newly established Czech breweries after 1989, they have restored original breweries in historic buildings (Pivídky.cz 2021), moreover, these are relatively successful. A full quarter of the 44 restored Czech breweries, with available data on production in 2018, exceeded the limit of at least 5,000 hl per year. In the case of breweries established after 1990, in the same year, only 9 out of 324 companies with available data on the production produced 5,000 hl. Five renewed breweries and only two newly established produced above 10,000 hl and officially moved into the category of industrial breweries (RIBM 2019). In other

1 The article focuses only on the draft beer sector. The bottled beer industry is not the content of this article because both industries differ in geographical nature and operate relatively independently from each other.

2 For simplification, we use the term “outlets” for various services where a beer can be tapped, e.g., restaurants, wine bars, bistros, or sports clubs.

3 According to Czech-Moravian Microbreweries Association, the yearly production of 10,000 hl is the official threshold between microbrewery and industrial brewery. This division, however, does not cover the case of breweries, which are large enough to make their own distribution region, but still usually do not reach the threshold of 10,000 hl. We thus call these breweries as “regional breweries” and define them as breweries with production above 2,500 hl and supplying more than 100 outlets.

traditional brewing regions unaffected by the centrally planned economy, the onset of renewed breweries has virtually not occurred (viable enterprises have remained in the market and the others have disappeared definitively).

In the following section, we discuss the factors behind the choice of distribution strategy of new breweries and their success or failure with customers in the selected distribution region. Then, we present the methods, results, and discussion of our research on the selected Czech breweries.

2. Basis for the research on factors of distribution regions' dynamics

In the research on the dynamics of a draft beer distribution region, which is based on the contractual relationship between the producer and the consumers, we can focus on three key subjects (their basic relations are schematised in Figure 1). They include actors in the aforementioned relationship, i.e., (1) producer's strategy in searching for markets (e.g., Maye 2011; Hasman et al. 2016; Pachura 2020) and (2) consumer preferences in the search for goods for their consumption (e.g., Materna et al. 2019; Wojtyra 2020). When they find each other and sign (3) a contract, they start product distribution which can, in multiple numbers of relationships with other consumers, create a distribution region (Hasman et al. 2016). Direction and intensity of the dynamic flow of goods in such spaces can be an indicator of production capacities and business strategies on the side of the producer and demand for products on the side of territorially anchored consumers. In their decisions, both actors are influenced mainly by (1) the contextual factors of the environment in which they act which is primarily beer market development (Hána et al. 2020; according to product life-cycle, see Vernon 1966; Dicken 2015) and (2) territorial identity (e.g., Schnell and Reese 2003; Schnell 2013; Hasman et al. 2021).

Let us look at this relationship in detail. Why does a producer decide to distribute his product to specific consumers in a certain region? Every company is looking for the most advantageous strategy for product distribution or to occupy new markets, where it could then distribute its product, all while withstanding strong competition. Choosing a suitable strategy for product distribution may ensure a good position in the market and possible expansion for the producer. There are six basic types of beer distribution strategies to outlets (Hasman et al. 2016) which are adapted from the typology of spatial strategies of retail chains in the development of their retail network (Bennison et al. 1995):

1. Contagion – the brewery aims to seize neighbouring territories.

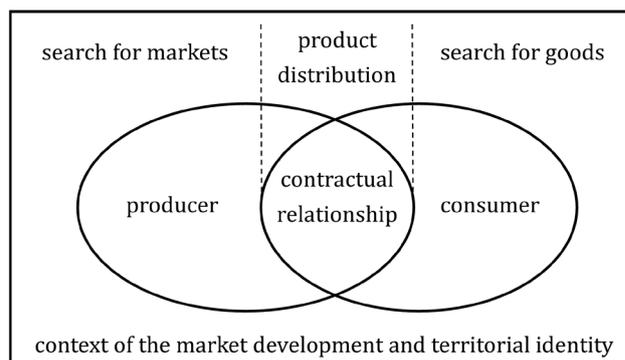


Fig. 1 Schematic representation of the dynamic relationship between producer and consumer.

2. Hierarchy – the brewery aims to seize the largest markets.
3. Avoidance – the brewery focuses on more peripheral territories with weaker competition.
4. Collusion – breweries divide the market up amongst themselves.
5. Acquisition – the brewery purchases, takes over or connects with the existing network of another brewery.
6. Segmentation – the brewery aims to take over a specific market segment.

Distribution networks of final products are highly variable in the brewing industry and correspond to many factors, among which is the size of the producer and their position within the industry (Pulec 2016). The strategy usually chosen by new or small producers is Contagion due to its relative financial and logistical simplicity. They create a foundation for further expansion to more distant locations (Hasman et al. 2016) which may depend on the level of market development and the associated saturation with beer products (Hána et al. 2020). In markets with hard competition, the main barrier to the wider expansion of regional breweries is difficult access to distribution networks, which are controlled by larger breweries (Mason and McNally 1997) often with exclusive dealing contracts (Chen and Shieh 2016). In addition, small breweries oppose canned and durable production by selling fresh draft beer for fast consumption (Naylor 2000) which promotes sales at the production site or nearby without long-distance transport. The advantage of such a contagion strategy is not only cheaper and easier distribution, but also a focus on the familiar and loyal environment of local customers who are increasingly looking for local products (Reid and Gatrell 2017) in response to neolocal tendencies directed against the standardization of intensifying globalization (Flack 1997; Schnell and Reese 2003; Schnell 2013, Taylor and DiPietro 2020). Local producers offer a product that has the advantage of speciality and originality of the production location, which could be supported by the impression that only a particular location has the conditions suitable

for the production process (Harvey 2010; Reid and Gatrell 2015). When expanding to farther locations, they must choose a different marketing strategy or convince the more distant customers of the territorial uniqueness of their production (Hasman et al. 2021).

Why does a consumer in a certain region decide to choose a specific product? In addition to the characteristics of individuals that are not the subject of this article (see instead, e.g., Aquilani et al. 2015), it depends on contextual factors and several factors of supply. It may be affected by exclusive dealing, i.e., a contract with a big producer which excludes any other suppliers (Chen and Shieh 2016). Therefore, the customer with this contract is excluded from considering products from smaller breweries. The customer, who is free with his demand, then looks for a suitable offer. The final decision depends on its relationship to the chosen product (depends on the context of identity, e.g., Materna et al. 2019) and on the market development (breadth of supply, economic power, etc., e.g., Hána et al. 2020). Market development is also related to the presence of transnational corporations with their standardised production (Hána et al. 2020), which can direct customers to original local products (Materna et al. 2019).

With a growing negative view of the standardised global consumption culture in advanced markets (Holt et al. 2004; Ozsomer 2012), we are witnessing a taste

for beer diversity (Sustersic and Sustersic 2013) and a turn to consumer's local region, manifested by a preference in diverse local food, developing local traditions and lifestyles, and supporting the local economy, which is known as neocalism (Schnell and Reese 2003). Therefore, consumers prefer locally owned diverse beer produced independent of big breweries or transnational companies (Hart 2018). For some consumers, there is even a kind of moral obligation to favour local brands which can contribute to their local identity (Siemieniako et al. 2011). However, the customer can also choose a local product due to the greater emphasis on quality (Winter 2003; Aquilani et al. 2015) or on reducing environmental impacts by consuming local products (Barnett et al. 2005; Hoalst-Pullen et al. 2014; Holtkamp et al. 2016) with a short distance between stages of its locally embedded production (Bowen 2010, 2011), although such local embeddedness varies according to the size of its home town, the rural/urban dichotomy and the type of town and location within it (Courtney et al. 2008). Customers may appreciate the local production of the final product rather than the production of raw materials (like hops, barley etc.), for which they do not express such a strong local preference (Atallah et al. 2021). In addition to origin, favourite type of beer and price can also play a role in a specific consumer's beer selection (Meyerding et al. 2019). Based on this

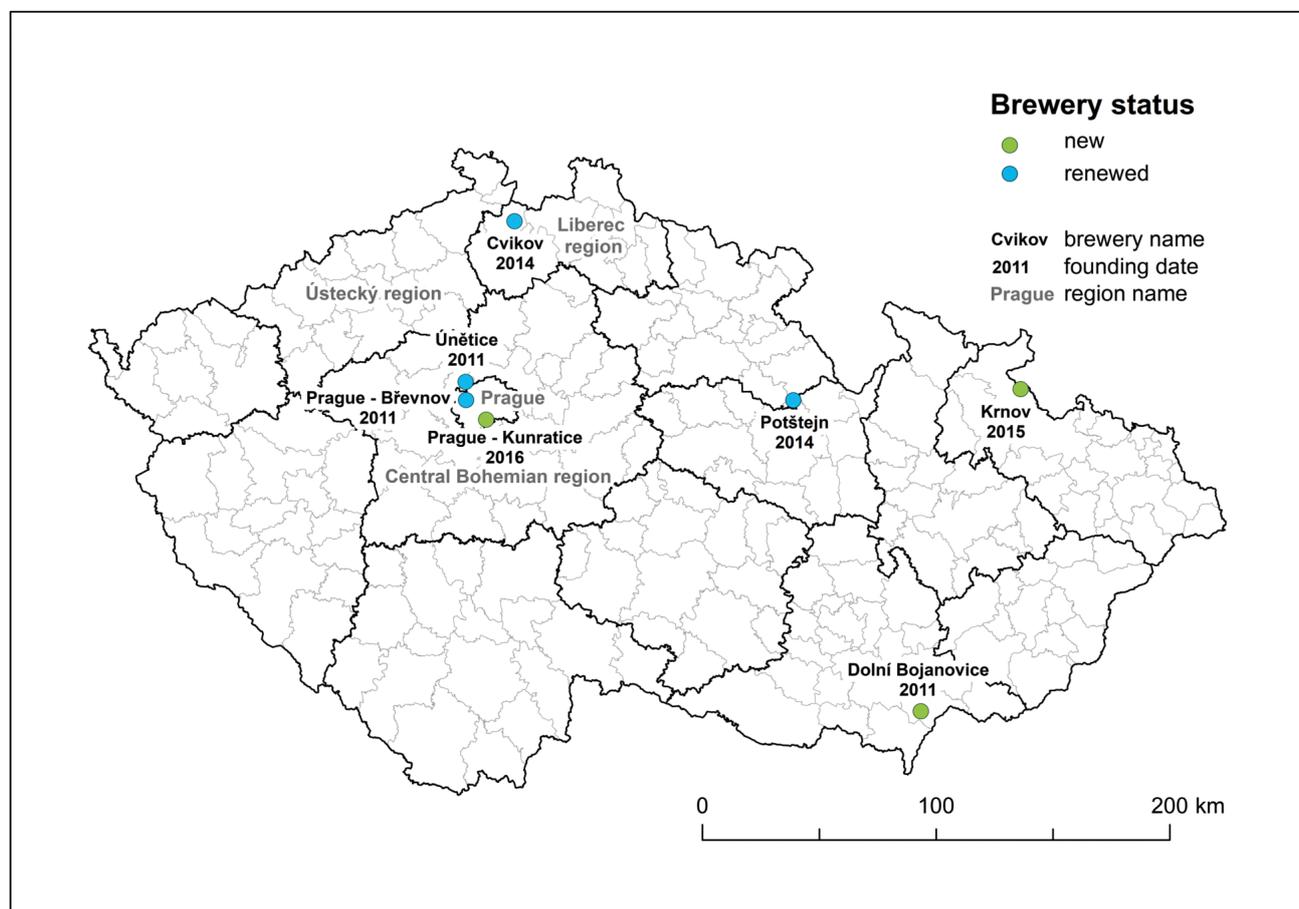


Fig. 2 Breweries included in the research.

presumption, we may also interpret a rising cultural position of more expensive local beer consumption as a marker of higher social status (Thurnell-Read 2018).

3. Methods

The empirical part combines quantitative and qualitative research. The quantitative part includes mapping the distribution regions of breweries at the level of 6,268 Czech municipalities and districts of Prague. First, longitudinal research was conducted on breweries that had the potential to establish new distribution regions at the start of this study (2015). For that purpose, newly established breweries had to be selected, whose output was growing rapidly and was likely to reach the 10,000 hl mark in the near future. These conditions were met by two breweries, which were thus included in the longitudinal research: Únětice (founded 2011) and Cvikov (2014). Both were restored breweries at their historical production sites.

The longitudinal research consisted of collecting data annually (2015–2020) on all outlets of both breweries in order to map how the breweries' distribution regions have evolved over time. The key data here were lists of all the breweries' outlets, including their addresses, which were available on both breweries' websites. However, as the data on the breweries' websites were not always completely up-to-date and accurate, they were further verified and supplemented by comparison with the websites of outlets and with databases beerborec.cz, pivnidenicek.cz, and untappd.com (for more about these databases see Hasman et al. 2016). The market share of the brewery

in a municipality was then calculated as the number of outlets offering its beers to the number of all outlets in the municipality according to the beerborec.cz (2021) database. Since a substantial part of the distribution region of the Únětice brewery is the nearby capital city of Prague, all outlets in Prague were also mapped using their exact geographical coordinates.

Second, our data was supplemented by cross-sectional research on other newly established breweries that were able to develop relevant distribution regions. Inclusion criteria were therefore 1) an operating period of no more than ten years (i.e., a foundation year later than 2010) and 2) brewery size defined in terms of yearly production above 2,500 hl (according to the latest data as of 2018, see RIBM 2019) and supplying at least 100 different outlets (data for 2021; beerborec.cz 2021). The third criterion was willingness to participate in the second, qualitative part of the research. Out of the fifteen breweries that met the first two criteria, five responded positively (Figure 2); their distribution regions were subsequently identified based on data for 2021 from beerborec.cz (2021).

The qualitative part of the research was conducted to support and expand previous quantitative findings mainly in terms of the explanation of distribution strategies and thinking about the factors of these strategies. This part of research was inspired by methodological approach of Kuehn and Parker (2021). We intended to interview all 7 mentioned breweries. However, Krnov and Potštejn withdrew from the interviews due to time constraints; the information needed was then, when possible, replaced by secondary data from their websites and other public sources. The interviews were conducted in-person (or by

Tab. 1 Questions for structured interviews

Search for markets and product distribution
1) How much of your production do you sell in your brewery restaurant? Does that share tend to increase or decrease? 2) How do you obtain contracts with nearby outlets (your own activity, sales representative, distributor)? 3) What portion of your production do you sell at nearby outlets? Does this proportion tend to grow or decline? 4) How do you obtain contracts with distant outlets (your own activity, sales representative, distributor)? 5) What proportion of your production do you sell in remote outlets? Does this proportion tend to increase or decrease? 6) What proportion of your production do you sell in other ways (festivals, bottled beer...)? 7) Which outlets do you choose? And why? 8) Do you brew different beer styles? Do your outlets differ according to the beer styles you brew? 9) Which outlets do you not pursue and why? 10) Where and how do you find new outlets for your beers? 11) Do you plan to increase your brewery capacity and further expand your market? 12) Are you considering changing your current strategy for finding outlets for your beers?
The context of territorial identity
13) Does the fact that you are a local brewery have any influence on customers (outlet owners) from your region? 14) Do they mention it when ordering your beer? (and in what context, if any) 15) Are they also interested in the origin of the ingredients? 16) Do you communicate with customers (innkeepers) from your region in a different way than with customers (innkeepers) from other regions? 17) Do you use local symbols/names/labels to promote your beers?
The context of the market development
18) In terms of competition, do you consider large breweries (and multinational groups) a negative phenomenon (occupying distribution networks, enforcing exclusive contracts, offering cheap products, etc.), or a positive phenomenon (consumers are overwhelmed by standardised beers and prefer to look for something local, specific, and of high quality, which opens the door to success for regional breweries)?

Note: For an explanation of the categories and questions, see Figure 1 and the related text.

telephone, in the case of the Dolní Bojanovice brewery) with the breweries' owners or co-owners and lasted about 30 minutes. The questions (Table 1) covered three areas comes from the theoretical discussion in section 2. The most vital were (1) questions on the breweries' strategies for establishing distribution regions, which could provide a verification and explanation of our quantitative findings. We can consider the breweries' strategies as our dependent variable which were followed by questions on the characteristics associated with the two wide explanatory factors: (2) territorial identity and (3) market development.

4. Results

At the beginning of the observed period in 2015, the Cvikov and Únětice breweries achieved almost identical results in terms of beer production and number of outlets (see Figure 3). However, their further development was quite different. The Cvikov brewery, founded at the end of 2014, had a very strong entry into the market and was already present in 180 outlets after two years. However, it reached its peak and then it slightly declined in terms of production and number of outlets. In contrast, the Únětice brewery, founded in 2011, has been growing slowly but steadily throughout its existence.

The other researched breweries also performed well during the 2015-2018 period, either holding their production at a stable level or steadily increasing it (see Figure 4). However, the production of these breweries is not yet close to industry parameters and have not even exceeded 5,000 hl per year. However, for the newest breweries (Krnov and Praha – Kunratic, which did not exist in 2015), the sharp increase in production suggests that they could be classified as industrial breweries in the coming years.

4.1 Cvikov brewery

The sharp increase in the number of Cvikov's outlets in the first two years after the brewery's establishment (which, however, was not associated with production increase) illustrates its strategy at the time – there was a clear objective to gain brand awareness in the home region of the Lusatian Mountains (see Figure 5). The names of its beers also demonstrate the exclusive focus on this region – Sklář (“Glassblower”) refers to the centuries-old tradition of the glass industry for this region in history, while Hvozd, Luž, and Klíč are the names of the highest peaks of the Lusatian Mountains.

This strategy, typical for emerging small breweries (Hasman et al. 2016) seeking to target a loyal local population with strong brand awareness and relationships (Reid and Gatrell 2017), was initially very successful. In 2015 and 2016, we observed a strong presence of the Cvikov Brewery throughout the northern

part of the Česká Lípa district – it is commonly present in more than 25% of outlets of a given municipality, and in some areas more than 50% – these are excellent results for a new brewery competing with established industrial breweries. By contrast, at the beginning of its existence, Cvikov was virtually non-existent outside the Česká Lípa district.

The brewery is using this strategy to lay the groundwork for further expansion into more distant regions (see Hasman et al. 2016) such as the neighbouring districts of Děčín and Liberec, as well as in the direction of and in the country's capital, Prague. In these new outlets, however, the desire to gain a wide presence is already overwhelmed by the desire to gain permanent and lucrative outlets in larger cities where there is more competition but also a higher concentration of affluent customers demanding beer diversity (Sustersic and Sustersic 2013) and seeking local specialities (Holt et al. 2004; Ozsomer 2012; Hart 2018), even if these are not produced directly in the region of consumption. Thus, as time has passed, the brewery has partly relied on a relatively distant and challenging expansion, which has caused a slightly weakened presence in its own home region.

During the entire observed period, the number of outlets in Cvikov's immediate vicinity has thus decreased (in the towns of Cvikov, Nový Bor, Jablonné v Podještědí, and Česká Lípa from 35 outlets in 2015 to 11 in 2020), but at the same time, the number of outlets in the larger towns of neighbouring regions (Ústí nad Labem, Děčín, Liberec, and Jablonec nad Nisou) has increased from 3 outlets to 16. The number in the capital city of Prague has also increased from 21 outlets to 33.

Thus, the brewery changes the originally clearly dominant “contagion” strategy to some extent (cf. Hasman et al. 2021) and expands it with elements of the “hierarchy” strategy, targeting both nearby and distant larger cities and outlets with larger beer sales, at the expense of nearby rural outlets with smaller sales. However, the distance factor remains significant and sets the limit for expansion – in the more distant, larger cities (Brno, Ostrava and Plzeň), Cvikov was present only sporadically, and, if so, it was in multi-tap restaurants, especially in the early part of the observed period.

A representative of brewery management confirmed that the above-described transformation of the distribution region is the result of a targeted strategy. The brewery has two sales representatives, with one actively seeking new locations in its home region, and the other in the direction of Prague (these more distant outlets for cask beer now account for about 30% of the brewery's sales). He further states that it is logistically unprofitable for the brewery to ship beer to outlets more than 150 km away and that they are therefore not currently pursuing these outlets (with the exception of deliveries of bottled beer to retail chains, which account for about 20% of the sales but

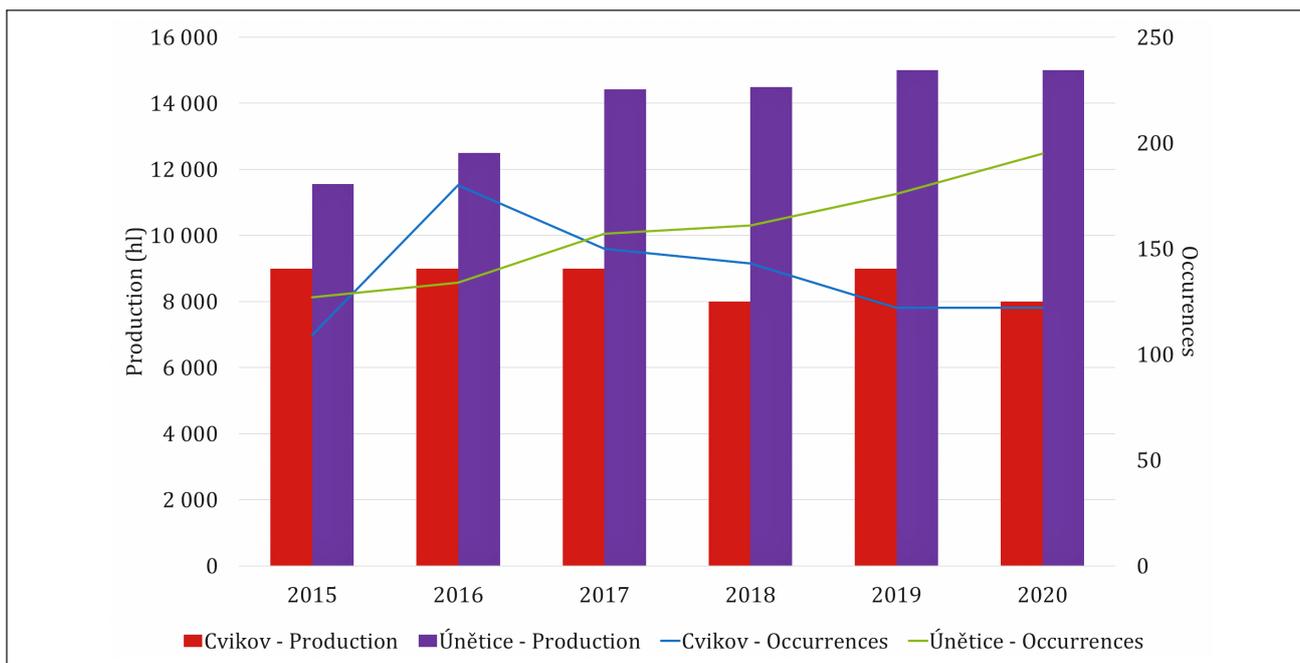


Fig. 3 Cvikov and Únětice occurrences and production (2015–2020). Sources: RIBM 2019, interviews with breweries

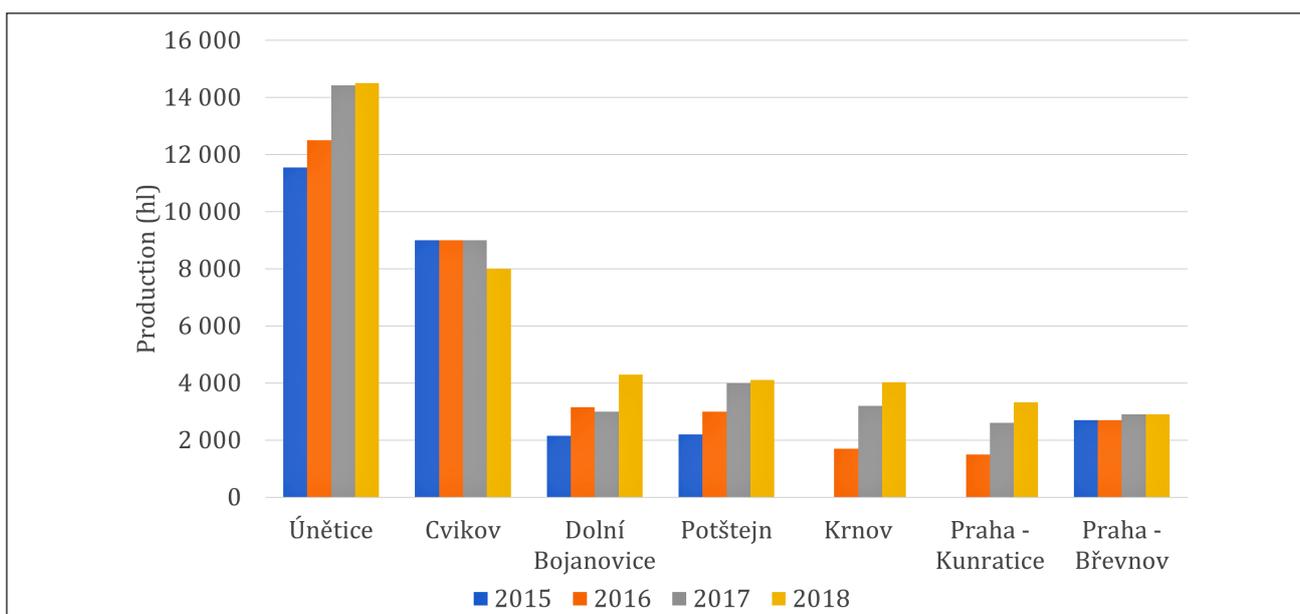


Fig. 4 Breweries production development (2015–2018). Source: RIBM 2019

generally have a completely different distribution and sales strategy).

However, local presence in the nearby region remains important – sales of cask beer directly at the brewery’s restaurant account for about 20% of sales and about 30% at other nearby outlets. The brewery benefits from its appearance and the regionally well-known story of the restored historic brewery building, which becomes part of the brewery’s story and the identity of its local customers (see Schnell and Reese 2003; Reid and Gatrell 2017; Materna et al. 2019). Outside the region, it is not as well known, yet it still benefits from its regional embeddedness and relies on

personal visits to the brewery by potential beer buyers, as they often express their surprise at how the building looks. Thus, for the Czech consumer, regional breweries can also have an important role as restorers and custodians of historic buildings of the brewing heritage, which is a strong aspect of the Czech national identity (Materna et al. 2019).

In the case of very close outlets in smaller villages, the brewery offered samples, but this often did not lead to long-term cooperation. Cvikov states that “you need to get the innkeeper on your side to actively offer your beer”, otherwise visitors continue to prefer the established brands of the large industrial breweries.

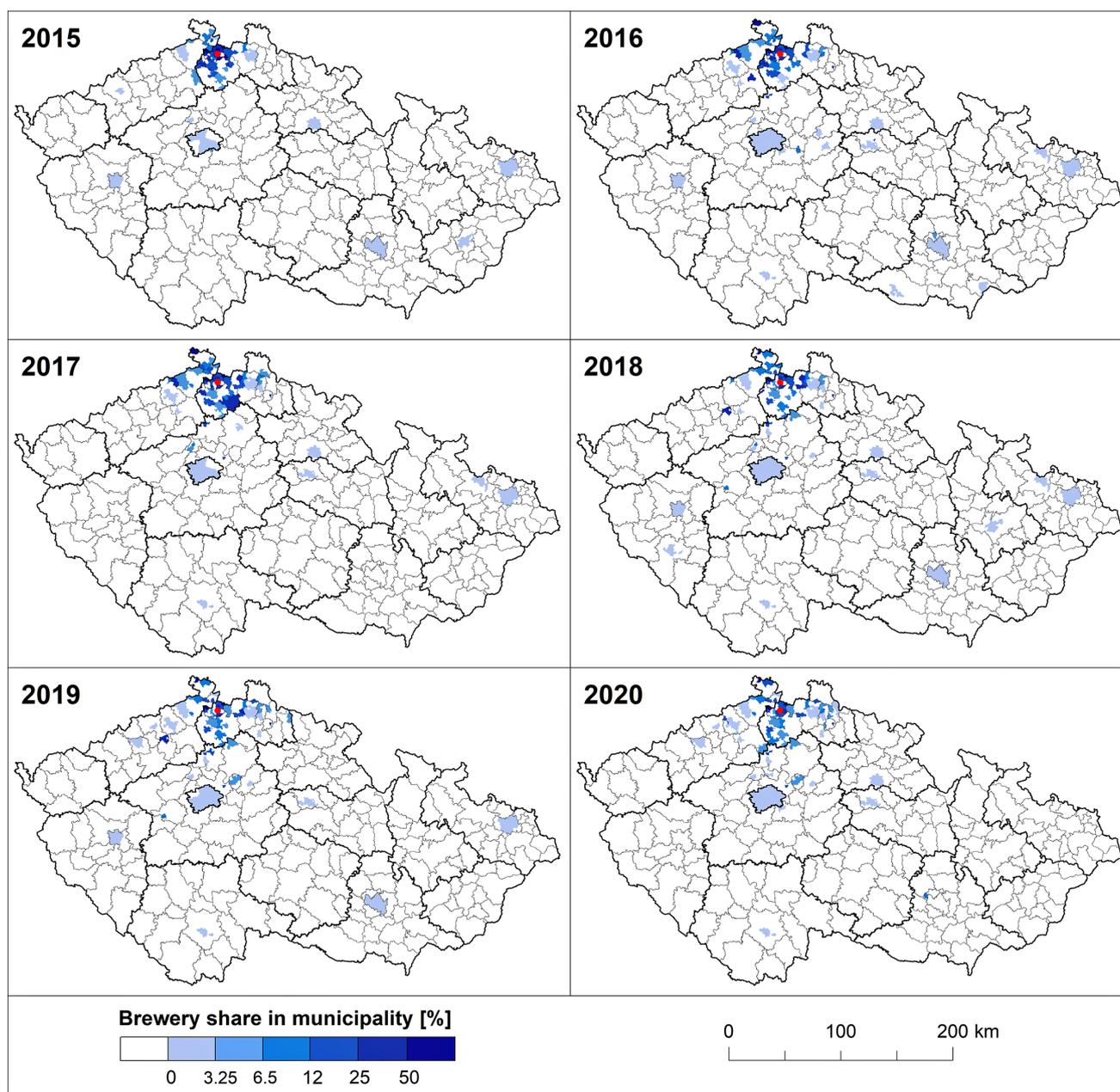


Fig. 5 The Cvikov share in Czech municipalities (2015–2020).
Sources: Beerborec.cz 2021, own research

This is consistent with the view that a local producer needs to convince customers of the uniqueness of its locally embedded production (Harvey 2010; Reid and Gatrell 2015), and in turn contradicts previous findings of customers preferring local specialities, which tends to be quite natural in response to global standardisation (see Flack 1997; Schnell and Reese 2003; Schnell 2013; Taylor and DiPietro 2020), often as a matter of moral commitment (Siemieniako et al. 2011) rather than systematic action by the brewery. In addition, the brewery mentions that there is often a problem with the outlets' quality assurance of the beer in more remote outlets with smaller taps, which then leads to a deterioration of the brewery's reputation. In some cases, Cvikov has therefore actively terminated cooperation (the brewery representative

literally says: "some innkeepers are just dirty slob, we don't have to be everywhere").

In 2020, Cvikov opened its second brewery restaurant at an exclusive address in Prague centre, where it expects significant sales in the future. The brewery is thus counting on the fact that the wealthier Prague clientele will be more in favour of the "local" brand than consumers in the production region itself. The long-term decline in the number of outlets is thus offset by an overall increase in their attractiveness, and total production remains just below 10,000 hl per year in the long term (according to the brewery, also in 2019 and 2020, for which official data are not yet available). After the expected decline caused by the covid-19 pandemic, the brewery plans to increase production to a target of between 15,000 and 20,000 hl per year in the future.

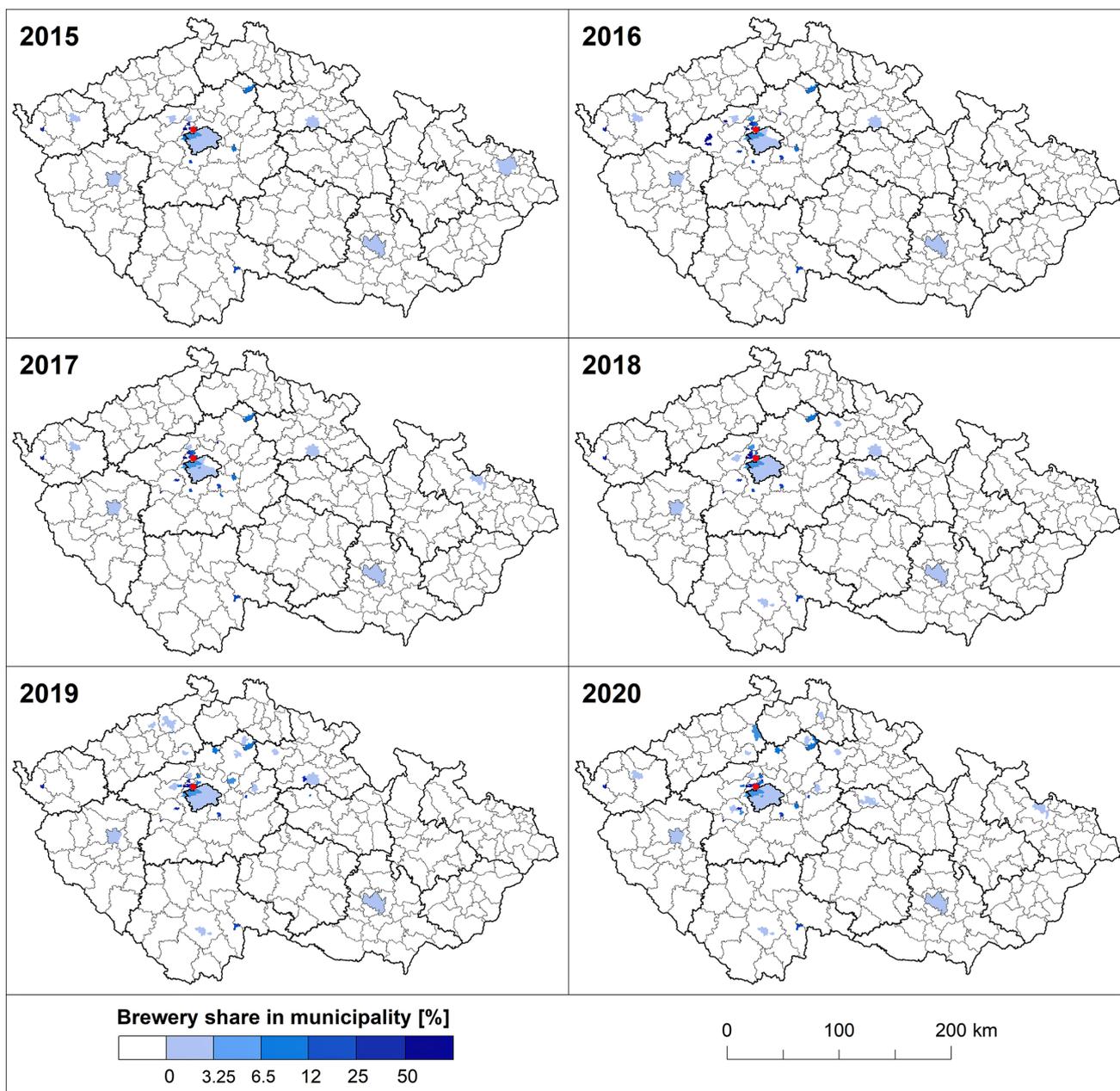


Fig. 6 The Únětice share in Czech municipalities (2015–2020).
Sources: Beerborec.cz 2021, own research

4.2 Únětice brewery

The Únětice brewery benefits from its very advantageous geographical location in the close vicinity of the capital city, Prague, and it is surrounded by attractive nature in the Únětický potok valley. Thus, it has a plethora of potential nearby outlets, while it can also be a destination for a large number of Prague day-trippers, who form a relationship with the local brewery through its association with a popular afternoon excursion location (see Williams 2009 for the connection between neolocalism and tourism). In terms of its diffusion, the brewery orientation towards “contagion” and “hierarchy” strategies, therefore, needs to be carefully distinguished, as in their spatial expression the two strategies may overlap to a large extent – the most hierarchically

attractive Prague outlets are in fact located in the brewery neighbourhood.

Indeed, Prague makes up the vast majority of the brewery outlets, with only a slight decrease from 77% in 2015 to 73% in 2020, but the absolute number of outlets in Prague increased from 98 to 143 in the same period. However, a closer look at its distribution maps (see Figures 6, 7) still shows the crucial importance of neighbourhood distribution – it is particularly dominant in the small municipalities surrounding it and also has a strong presence in the immediate neighbourhoods on the north-western outskirts of Prague. Únětice maintains a permanent but marginal presence in several multi-tap restaurants in Brno and Plzeň. Otherwise, outlets beyond the Central Bohemian Region are virtually non-existent. Thus, it is also

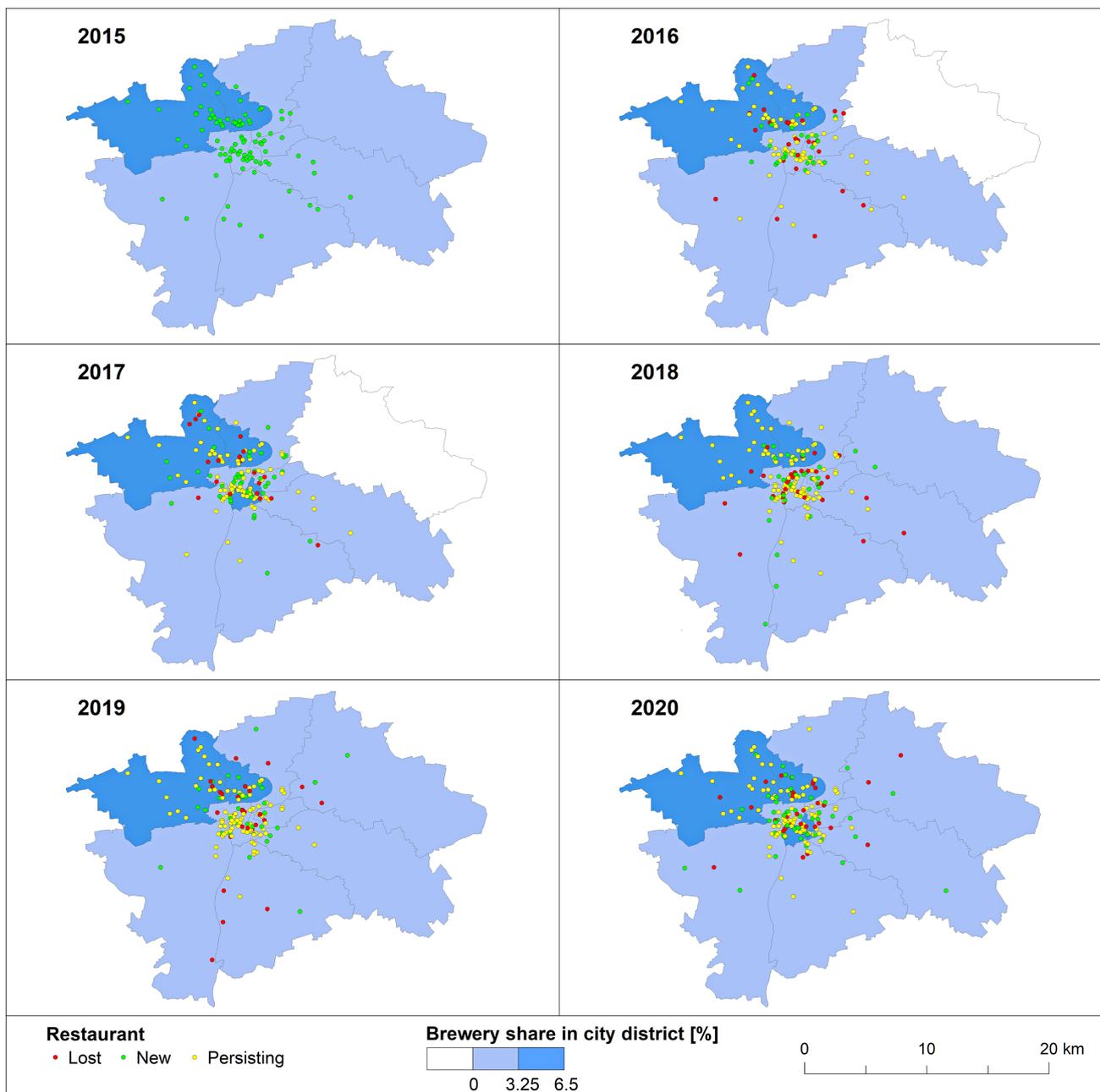


Fig. 7 The Únětice share in Prague districts (2015–2020)
 Sources: Beerborec.cz 2021, own research

confirmed that the regional brewery uses primarily a contagion strategy to build its distribution region (see Hasman et al. 2016). However, it seems that in contrast to Cvikov, it does not need to abandon it, as it is already using this strategy to build a base in the hierarchically most interesting market.

In a more detailed view of Prague (Figure 7), we find that the Únětice brewery is also undergoing some changes in its strategy of dissemination. Since the beginning of the observed period, the brewery has maintained a stronger presence (in more than 3.25% of the outlets) in the nearest districts of Prague 6 and Prague 7 (see Figure 7), in which we can see the manifestation of a contagion strategy. In 2020, however, representation in Prague 2 (the lucrative part of the

historical centre of Prague) increased. This shift can be seen as utilising the nearby neighbourhoods as a basis for gaining a good reputation among Prague citizens and expanding into the city centre, i.e. a manifestation of hierarchy strategy (see Hasman et al. 2016).

This shift can also be observed when comparing the share of individual Prague districts within the total number of all Prague outlets (see Figure 8). While the share of outlets in Prague 6 and 7 near the brewery has dropped from 40% to less than 30%, the share of outlets in the city centre (Prague 1 and 2), as well as in other more distant parts of Prague, has been growing in the long term. It is also interesting to look at the qualitative structure of the outlets: the brewery’s current, strong orientation towards more

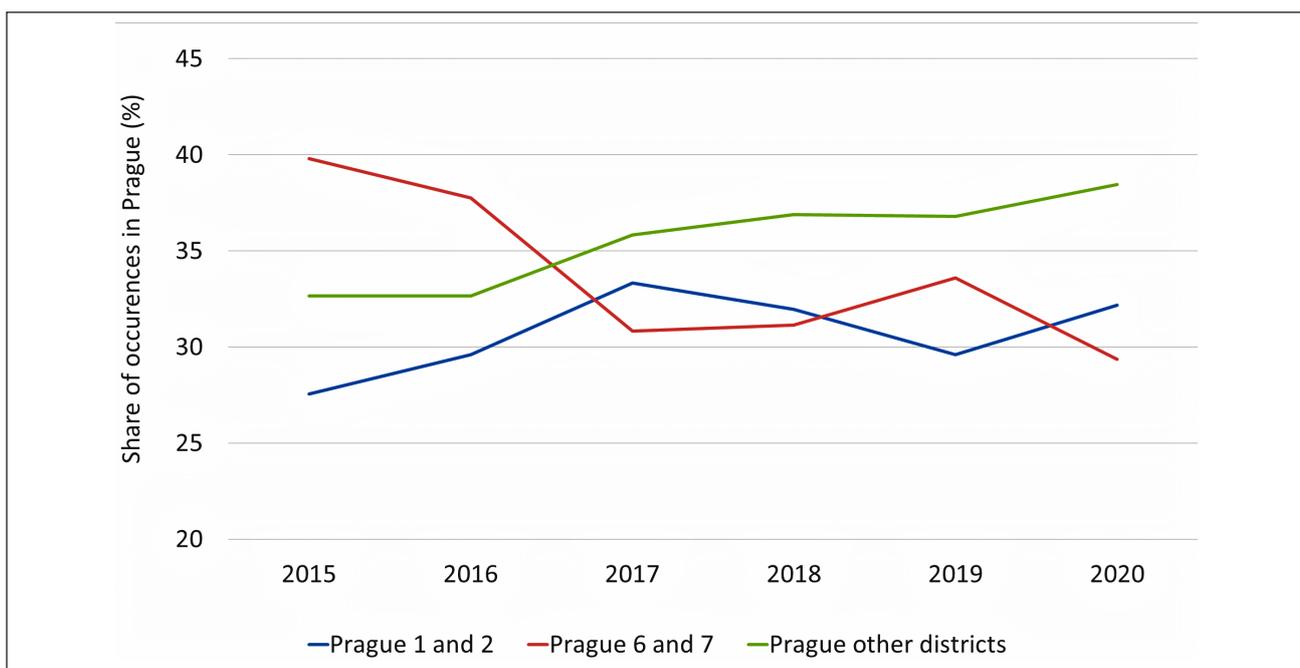


Fig. 8 Únětice brewery in Prague districts.
Sources: Beerborec.cz 2021, own research

luxurious outlets in hotels, cafés and theatre restaurants is evident, enabling the sale of popular beer at premium prices. This focus is a consequence of the fact that Únětice beer has a reputation as a very high-quality product in Prague. This may be largely linked to the fact that it is a local product, which is generally perceived as of higher quality (see Winter 2003; Aquilani et al. 2015).

The co-owner of the brewery confirmed a clear orientation towards nearby markets, with Prague and the municipalities beyond its northwestern border accounting for more than 90% of sales of cask beer (including around 10% in the brewery's own restaurant in Únětice), corresponding to a clear orientation towards the brewery's immediate surroundings. Although the brewery has two sales representatives, it is in a favourable situation where demand outweighs supply. Around 80% of the newly acquired outlets contacted the brewery on their own, and only around 20% of the new outlets are actively acquired by Únětice brewery on its own initiative. The brewery does not explicitly avoid distant outlets (for example, it exports beer to four restaurants in Malmö thanks to a contact from a person with a difficult-to-obtain licence for importing alcohol into Sweden), but merely states that the beer volume that is worth exporting increases with distance due to transport costs, so they only accept larger orders. Conversely, they deliver any quantity of beer to nearby outlets. Logistical and financial simplicity are the reasons that regional breweries prefer the contagion distribution strategy (see Hasman et al. 2016).

But even this strategy is not without problems. According to a brewery co-owner, contagious distribution is surprisingly hitting limits in terms of

consumer interest. The brewery perceives a clear difference between its non-Prague and Prague clientele. While consumers in nearby rustic outlets consider local beer "boring" and prefer more "worldwide" brands from more distant, large Czech industrial breweries (often owned by multinational companies), in Prague outlets, a beer from a regional brewery associated with a particular (not necessarily nearby) location is more often perceived as a positive beer offer diversification. Therefore, there is a clear distinction between the more affluent clientele of larger cities, who have a taste for beer diversity (Sustersic and Sustersic 2013), and focus on the production of regional breweries, which they consider exceptional (see Harvey 2010; Reid and Gatrell 2015). In this context, however, it should not be forgotten that the higher price of the local products may also play a role, which may bias rural populations towards the cheaper standardised production of large breweries (see Meyerding et al. 2019) and may affect perception of special and expensive local production as marker of social status among the urban population (Thurnell-Read 2018).

At present, the Únětice brewery is not planning to change its current business strategy or to expand the brewery's capacity, because its annual production of around 15,000 hectolitres has already reached the desired volume. Also, the brewery building does not allow for further expansion of the production capacity. However, there has been a partial shift in the production structure towards bottled beer, which used to account for around 15% of sales, but this share (even excluding the temporary effect of the lockdown caused by the covid-19 pandemic) has risen to around 25%.

4.3 Other breweries

The diffusion strategies of the five other breweries (Břevnovský pivovar and Kunratice brewery in Prague, Potštejn brewery, Krnov brewery, and Dolní Bojanovice brewery) are largely determined by their geographical location – the two Prague breweries, similarly to the Únětice brewery, naturally focus almost exclusively on the capital city market, while the others, like Cvikov, are in their early stages and focus on a more coherent region of operation in their wider hinterland (see Figure 9). This, again, indicates that new regional breweries tend to focus on their own region in their distribution strategy (see Hasman et al. 2016).

At a closer look, however, the strategies of these breweries differ considerably. For example, the Kunratice and Dolní Bojanovice breweries do not operate their own brewery restaurants at all, while the Břevnov brewery, located in the tourist-attractive grounds of the Břevnov monastery near the centre of Prague, sells a full 35% of its output in its home restaurant. All breweries uniformly state that they do not seek out more distant locations, which are generally not worth supplying. Břevnov is more focused on restaurants, where it will be offered as the main beer. It is therefore another brewery that is perceived as high quality (see Winter 2003; Aquilani et al. 2015) and can set more strict terms in the local consumption

area. The fact that it is the restored brewery of the oldest Czech monastery from the 10th century may also play a role, considering the historically strong position of its beer in the Czech national identity.

However, these breweries do not focus only on contagion strategy. All of these breweries are clearly seeking to sell in lucrative locations that allow sales at premium prices to wealthier customers. In practice, however, there are only two Czech cities with a sufficient number of multi-tap restaurants and other more expensive outlets to which it is worthwhile to transport beer from a greater distance – Prague and, to a lesser extent, Brno. Breweries located in Bohemia focus their hierarchy strategy almost exclusively on Prague, while breweries located in Moravia divide their hierarchy strategy roughly equally between nearby Brno and more distant but more lucrative Prague.

Compared to Cvikov and Únětice, the other researched breweries have a different composition of beer offer. While Cvikov and Únětice focus on the classic Czech style of bottom-fermented lagers, the other breweries focus much more on special styles (for example, Krnov and Dolní Bojanovice produce up to dozens of beer styles brewed annually). In these cases, we can thus speak of a partial application of a “segmentation” strategy, where the brewery attempts to occupy a certain free market segment (Hasman et al. 2016).

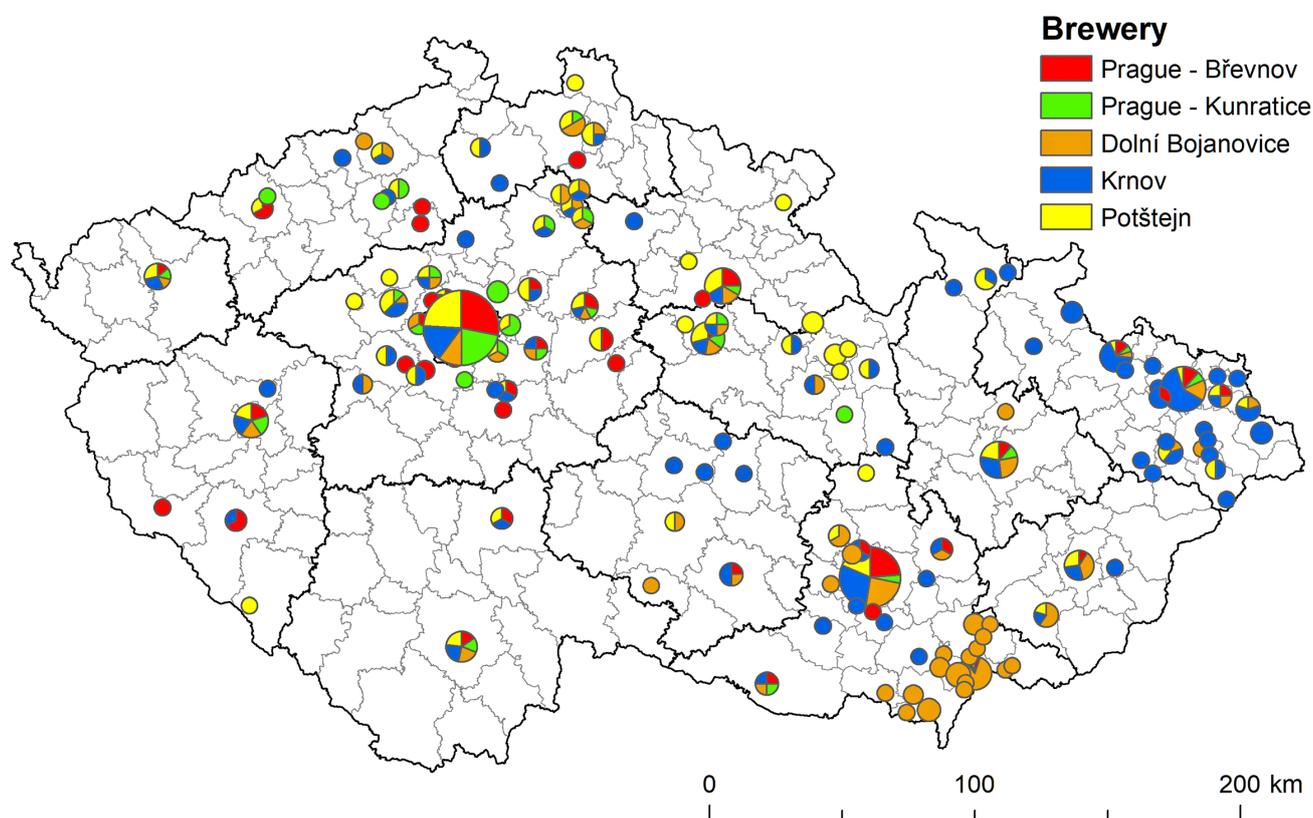


Fig. 9 Břevnov, Kunratice, Potštejn, Krnov, and Dolní Bojanovice breweries occurrence in Czech municipalities (2021). Source: Beerborec.cz 2021

All breweries, (except for Břevnov, which is fully utilised in terms of capacity), are striving to acquire other outlets in the future. The Kunratice brewery, which is part of the “Czech Brewmasters” brewing technology manufacturer, has been expanding its activities in an original way. Dozens of novice brewers have brewed beer there for a short time as part of their training and then setting up their own microbreweries. Often, the Kunratice brewery then enters these new breweries of its ‘graduates’ into ownership, so that even at the level of regional breweries, there is partial use of the “acquisition” strategy typical of the segment of larger breweries and the entry of multinational corporations into the saturated beer market (see Materna et al. 2019; Hána et al. 2020). If this strategy also appears in the microbrewery segment, we can see signs of this new brewing sector moving into the next stages of its development (Hána et al. 2020), which has been happening in the US for at least a decade (Reid and Gatrell 2015).

None of the breweries reported using “avoidance” and “collusion” strategies (see Hasman et al. 2016). Regional breweries are practically not in competition with each other due to their limited distribution regions, and they also do not consider large industrial breweries as direct competitors, but as a different segment of the beer market that relies on low prices enabled by economies of scale (Materna et al. 2019). Regional breweries rely either on the diversity of their beer offer (see Sustersic and Sustersic 2013; Hart 2018), the quality of their product (Winter 2003; Aquilani et al. 2015), or on their regional embeddedness (see Schnell and Reese 2003).

5. Discussion and conclusions

The first research objective was to find out which strategies of establishing a distribution region are selected by new Czech breweries. The importance of contagion strategy (Bennison et al. 1995; Hasman et al. 2016) was confirmed for the breweries researched, especially in the first phase of their market presence. The logistically simple and inexpensive targeting of nearby outlets allows breweries to offer their product quickly to numerous potential customers and, thus, creates a stable base. If the product does not catch on in some outlets, it does not yet cause a major problem for the brewery. Interestingly, large breweries are not seen by local producers as direct competitors (cf. Mason and McNally 1997; Chen and Shieh 2016) but rather as a different segment of the beer market with low-priced, mass production. After establishing sufficient bases, breweries proceed to the second phase of expansion using the hierarchy strategy (Bennison et al. 1995; Hasman et al. 2016) where they target lucrative outlets that allow selling their products at premium prices and achieving higher profits. They usually focus on larger cities and tourist areas with

a more affluent clientele, but also more competition. Hence, they need to invest more effort and resources to acquire such outlets. This strategy is already riskier, and distribution costs are higher. As distance increases, brewers are more concerned with the size and lucrativeness of the outlets to which it is worthwhile to sell their beer.

The second objective was to investigate which factors influence the breweries’ distribution strategies. The theoretical part of the article introduced two main groups of possible factors: territorial identity (e.g., Schnell and Reese 2003; Materna et al. 2019) and the level of market development (e.g., Hána et al. 2020). However, our research has shown that these two groups of factors cannot be evaluated separately, but rather the interaction between them should be considered. The advantage of regional breweries is undoubtedly their local or regional embeddedness (e.g., Reid and Gatrell 2015). Conversely to Courtney et al. (2008), in our sample Únětice brewery from urban and popular tourist hinterland of Prague is more embedded than those from smaller rural towns. On the other side, our data support claim of Courtney et al. (2008) that breweries from larger towns are more embedded than those from smaller towns. The more affluent consumers living in cities are more willing to pay for more expensive and better quality products (Winter 2003; Aquilani et al. 2015; Thurnell-Read 2018; Meyerding et al. 2019), more inclined to buy local products in the spirit of neolocalism (Schnell and Reese 2003; Siemieniako et al. 2011; Hart 2018), and more appreciative of diversity of beer offer (Sustersic and Sustersic 2013).⁴ In practice, this leads to a paradoxical phenomenon where breweries encounter better evaluations of their local products in cities than in their own rural surroundings, where they instead have to actively persuade potential customers. As a result, it is relatively easy for a brewery to gain outlets in a nearby area with little competition, but the problem is to retain them, whereas the opposite is true in cities with a saturated market. Thus, neolocalism, understood as an interest in local products (Flack 1997; Schnell and Reese 2003; Schnell 2013; Taylor and DiPietro 2020), is observed more in cities than in the actual localities to which it applies. Thus, we not only see differences between markets in their perceptions of global standardisation and neolocal responses depending on their advance (Holt et al. 2004; Ozsomer 2012), but also between regions of a single country.

Specifically, restored breweries have an indisputable competitive advantage in the Czech environment in the form of a long tradition and a well-preserved

⁴ Probably less important for the customers of the interviewed breweries are the lower environmental impacts of local production, which were not mentioned by any of them (cf. Barnett et al. 2005; Hoalst-Pullen et al. 2014; Holtkamp et al. 2016).

brewery building. These breweries were usually built to a wider production capacity, have a locally known brand, and also often still have a number of living witnesses of their former beers in the area, for whom this is part of their local identity (e.g. Materna et al. 2019). In contrast to newly established breweries, they do not acquire or build new locations “from scratch” but have the spreading to some extent “in the genes” and often merely return to where they used to operate. In terms of expansion, they are the most dynamic part of the otherwise stable Czech beer market. A large part of their customer base may also be people who are impressed by the restoration and maintenance of historic brewery buildings, which are part of the industrial heritage and, thus, an important aspect of the Czech national identity (e.g. Materna et al. 2019).

Our research has shown that there are a lot of factors that may have a notable influence on the distribution strategies of new regional breweries in developed and saturated beer markets. The important ones are interconnected with a neolocalism concept which tells us an important story about changing consumers behaviour from orientation toward standardised industrial beer to locally or regionally embedded production. This behaviour is influenced by the history of the brewing industry in particular countries and by the market development of countries or regions. Therefore, it is actually a question of cities rather than of the countryside where the beer is often produced. The predominantly extra-regional neolocalism of consumers described above is thus rather an expression of their fashionable consumer culture than of local or regional patriotism.

Finally, it is necessary to state the limitations of the research in this article. These were mainly due to the restrictions associated with the covid-19 pandemic. The pandemic period was difficult for all breweries, which reduced their interest in participating in the research. Our sample size is therefore relatively limited and the results may be biased by which breweries were willing to participate in the research. Crucially, however, representatives of the two key breweries, Cvikov and Únětice, expressed interest in the research. More impact on our research was caused by the fact, that the long-term closure of all Czech restaurants prevented us from conducting the originally planned qualitative research, which would have been based on interviews with representatives of outlets tapping beers from the sampled breweries and their customers. This would have provided insight into (1) why the outlets themselves decided to switch to these brands and (2) why (and if at all) customers favour beer from brands in question, or, more generally, which factors influence potential customers' preference of new beer brands. This, along with the consumer interviews, leaves room for future research that can further contribute to understanding the emergence of the region by the new breweries' operations.

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From geopolitics to anti-geopolitics: The story of Cameroonian bilingualism

Josef Kučera*

University of Ostrava, Faculty of Science, Department of Human Geography and Regional Development at the University of Ostrava, Czechia

* Corresponding author: josef.kucera@amo.cz

ABSTRACT

The aim of the article is to examine how Cameroonian bilingualism was portrayed in academic literature and how it fit into the ongoing geopolitical dynamics. The article considers two time periods for the geopolitical narrativization of African states (1960–1990 and 1990–2020). These two periods differ not only in geopolitical narrativization, but also in the shift in academic paradigms. This article employs geopolitical and anti-geopolitical approaches to show how the state's narrative of bilingualism has been filling into the globally accepted narratives. Cameroon was chosen as the extreme case, where the two former colonial languages (English and French) share the same status, defining Cameroon as a bilingual country. The conclusion of the article is that Cameroon's bilingual status has the ability to fit into the current geopolitical narratives. Beside the dominant narrative, there was present at least one important narrative.

KEYWORDS

anti-geopolitics; bilingualism; Cameroon; geopolitics; language policy

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1. Introduction

It should come as no surprise that representations of Africa have been frequently descriptive and foreign-sourced given that geopolitics is a tool of the powerful. Political centres were usually responsible for shaping the global perception of peripheral areas. The narratives about Africa have undergone substantial change over the past 60 years, and these stories frequently have an impact on how the continent and its individual nations are perceived. Cameroon in this situation is not an exception and this article researches the academic representation of this central African country that is usually labelled as “African in miniature”.

This article is focused on the academic representation of the bilingualism in Cameroon and how its description was (or was not) aligned the global narratives significant for chosen periods. There should be no doubt that language has various functions. For political scientists, one of the most important *raisons d'être* of a language is, among others, the symbolism of group identity that creates the feeling of belongingness (Simpson 2008: 1). On the other hand, descriptive and ascriptive attributes of the language as an identity creator may differ, as Simpson demonstrated, in various countries within the continent. Cameroon may be perceived as an extreme case, where bilingual nature of the state with two former colonial languages (English and French) has huge potential to be examined to fill contemporary geopolitical narratives.

Article strives to answer the question *whether (and how) the academic understanding of Cameroonian bilingualism fits into the globally accepted geopolitical narratives describing Africa*. The article uses the approach of critical geopolitics, namely, the post-colonial geopolitics and the antigeopolitical perspective with the aim to evaluate stories behind the bilingual state. The article starts with description of methods and approaches used for analysis, continue with the review of Cameroonian bilingualism. The last part of the article uses academic literature to critically evaluate whether the description of Cameroon bilingualism fitted into the globally accepted dominant narratives.

2. Post-colonial geopolitics and anti-geopolitics

This article uses two approaches: critical geopolitics, namely post-colonial geopolitics and anti-geopolitics. Those two perspectives approach geopolitical narrations from different angles. The article identified dominant geopolitical narratives about Africa in two selected periods 1) 1960–1990 as the period of independence and the Cold War and 2) 1990–2020 as the period with significant culturalist shift from structuralist perspective. Those periods were framed by

different dominant narratives. Language policy and Cameroonian bilingualism were selected as examples to demonstrate whether those narratives were the most significant for selected periods and how they were used to frame Cameroonian bilingualism.

To define the approaches, let us start with finding the meaning of geopolitics – for instance, S. Moiso (2015: 220) highlighted two main meanings of geopolitics. While the first one interprets geopolitics as a scholarly practice and as a subfield of political geography, the second one accentuates political practices connecting power, place, and subjects usually understood as a practice of international relations. In this article, the term geopolitics means a subfield of political geography bearing in mind the interaction between power and place.

As the term critical may suggest, the branch of critical geopolitics originates from the criticism of geopolitics (which is nowadays called classical geopolitics). P. Kelly (2006) identified nine essential differences between these two fields of geopolitics. Shortly to conclude, the critical geopolitics assumes that the world is created and perceived by observers. For this reason, two subfields of critical geopolitics were chosen – post-colonial geopolitics and anti-geopolitics. To understand post-colonial geopolitics as research tool, we can use the work of J. Sharp (2009: 7), who states: “[o]ne of the goals of postcolonialism is to include voices that have been previously excluded from academic discussions. Postcolonial writers tend to challenge the presentation of singular narratives and instead seek to include multiple voices in their work.”

The anti-geopolitics was classified (Routhledge 1997) as “geopolitics from below”, and as the power that is opposing the central power regardless of the holder. From that perspective, anti-geopolitics is a way to react to dominant geopolitical tendencies and it can only exist in the interaction with them. For the research of geopolitical narratives, anti-geopolitics can be called a *counter-narrative* (Dwyer, Davis, and emerald 2017: 10) The advantage of using anti-geopolitics come with the possibility to see, what is not said. Because being overwhelmed by a geopolitical narration, one must adapt to the framework of the public space that might not be created by someone else. How to deal with space that is created by someone else is shown by Scott (1985) in his research about resistance. He found out that those with power are establishing the public space and creating the ideal types of subordinates – those who are hardworking, never complaining, and loyal. Meanwhile, those without power tools create ideal attributes of masters. However, those attributes are not openly communicated in the public space and those powerless have different tools to dominate other types of spaces which are invisible and anonymous. Scott shows that private space and anonymity create an important power instrument with tools,

such as gossip, jokes, and secret symbols. From this perspective, the anti-geopolitics can be defined as private gossips, which are challenging the dominant public power narratives, and which has the potential to be transformed into the dominant narrative.

3. Multi-scalar perspective

To use geopolitical approach in this study, the author identified three crucial dichotomies that can be applied to examine the research question. The first will be referred to in this article *Global*. It shows up as the Anglophone and Francophone cleavage. The second one will be called the *State's*. Its focus is on the unity against distinction, division, and external influence. This approach supports the official state centred line of bilingualism and country's indivisibility. The third dichotomy will be called *Local*, where the dichotomy is represented by interplay between indigenous languages and European post-colonial languages.

The article works with the hypothesis that Cameroon as a model country in Africa should be fitting into the narrativization of the continent. This means that in the first period, the global perspective should prevail while in the second period the state's perspective should be the dominant one. The hypothesis will be tested by identification of how the Cameroonian bilingualism was perceived and how this perception fits into the crucial identified narratives. It is expected that the geopolitical narrativization of Cameroon usually creates a competing line between the *Global* and *State's* cleavage, while the *Local* cleavage is more or less present, but never dominant. As the side product of the article, the awareness of the underestimated *Local* binarity should be raised. Thanks to critical geopolitical approaches, we should be able to identify this binarity and incorporate it into the narrativization of Cameroon bilingualism, though never as the dominant one and typically as the supporting one for the dominant narrative, which is either the *Global* or the *State's*. This binarity arises from the distinction between European and indigenous languages.

As it is significant for postcolonial geopolitics, meanwhile, the public sphere may be dominated by the *Global* or the *State's* narrative about the *Official bilingualism* and/or *Anglo-Francophone* cleavage, while the private life and private values might be influenced by the narration which was labelled as the *Local*. This can be demonstrated in the language of regional radio broadcasting which has a certain amount of time reserved for local languages used in the region (Kouega 2007: 63–67). As it may be clear, these local language broadcasts will be present mainly in cars or in homes, where they compose safe private space. The divergence between public space and private space has a significant impact on the power structure in every society and the post-colonial state is no exception.

Those spheres can serve as common tools for creating an idea of danger coming from the outsiders, that pose threat for the natives who belong to the political communities, as mentioned Mbembe (2001: 70):

[D]iscourse on land and 'indigenouness' were common coin, and the logics of territorialization went hand in hand with those controlling 'insiders' and excluding 'outsiders.' But territory was not the exclusive underpinning of political communities, the sole mark of sovereignty, or the sole basis of civil obedience. Space was represented and used in many ways, especially when those representations and uses were closely tied to the definition of principles of belonging and exclusion.

In the context of the situation in Cameroon, we may say that the geopolitical *State's* narrative of national unity was becoming challenged by the anti-geopolitical Anglo-Francophone division with the end of the Cold war narrativization and the change of the paradigm in the social sciences. This cleavage posed a significant threat to the narrative of unity by having a binary structure. Thus, the aim of the *State's* narrative was to exclude it from the public space, which should have resulted into various upheavals and oppressions. While the indigenous languages have stayed present in private space and tolerated under the umbrella of the *State's* narrative, dominant *lingua francas*, such as the *Pidgin English* or *Camfrenglish* stayed excluded from the *State's* narration. The main aspect of how they challenge the *State's* narrative is that they have an identity-creating character that could incorporate significant parts of Cameroonian society that should stay *bilingual* with the official ideology of bilingualism, that expects mastering both English and French. On the other hand, the *State's* narrative maintains and tolerates the private language described in the argument while operating with public unity.

The aim might be to keep the distinction as wide as possible to ensure that the possible indigenous languages' counter-narrative does not challenge the Cameroonian unity, which is the crucial part of the *State's* narrative. It means that keeping indigenous languages within the debate may ensure that the Anglo-Francophone cleavage will be seen just as one of many and thus, not the crucial one. Moreover, the article aims to identify other non-dominant narratives within the academic literature. This is done by a narrative research analysis of selected books, that fit into the main geopolitical narratives.

4. The geopolitical framing of language policy in Africa

Sense of belongingness based on language identity can be created within different types of communities, but the states should have an exclusive role among

them. In line with this claim, the state may be perceived as an exclusive case of a shared political identity. When we are referring to the language policy of states in Africa, they have been usually perceived as some anomalies without a long-term identity reason. This approach used to be dominant for the French political scientists from 60s to 80s starting from R. Aron. From the M. Foucher's interpretation, those postcolonial states perceived the language policies as a tool for short-term aims "on the horizon and as a goal to reach", instead of a tool for a long-term goal of creating unity, based on shared values within a certain territory, in other words not as "united for the action of political unity and internal sovereignty within the borders traces on the map" (Foucher 1988: 12–13). Thus, African states were usually perceived as tools for immediate action, with a lower value than those *united states*, which were viewed as having a shared identity as their final objective. Those uniting characteristics of states were common in the 1960s, 1970s, and 1980s (Cheeseman and Fisher 2020). Since the 1990s, there has been a new wave of publications and academic works that discuss Cameroonian bilingualism as an identity aspect. This time it is characterized by the change of paradigm towards ethnicity and belongings as produced and situational aspects. Hence, main identified narratives in the text are labelled *unifying* over the first thirty years and *coercive* for the next thirty years. The research works with the question how selected academic text filled Cameroonian bilingualism into those two narratives. The question of why geopolitical instruments are used to study Cameroonian bilingualism may now be raised. It is because the language policy has all necessary power aspect of *postcolonial* state's power building processes described by A. Mbembe. He wrote that, the processes in those *postcolonial* states may be defined by something called *commandment* as a tool for domination. Such a *commandment* has three crucial characteristics of dominance: 1) creative or establishing, 2) legitimating as a one-sided relationship, 3) ensuring or maintaining (Mbembe 2001: 28). As this perspective suggests, even languages might be used as tools of dominance, when the ability to master the language of the former colonists has excluding character (power relations) rather than of an inclusive one (nation-building) and thus it may be studied and evaluated by geopolitical research approaches. During the transition period between former colonial empires and new national states, languages had all three characteristics crucial for a *commandment*, as a way to create, legitimate, and maintain dominance over those whose language proficiency was not at an acceptable level. The good knowledge of the official language of a newly independent state was essential for individuals and groups' well-being and opportunities within the state apparatus (Simpson 2008: 3). The case of Cameroon in this context might be seen as an extreme case, where the mastering of two European

languages becomes a powerful tool of the new elites. Thus, using bilingualism in the context of Cameroon might be an ideal tool for both excluding those who were not willing or able to master both languages on the required level, as well as for cementing and uniting the national identity. However, as contemporary research shows, this policy of two equal languages is not perceived as successful, where two languages serve to polarize, instead of incorporating the society (Bilola and Echu 2008: 213).

As proclaimed by the state's official policy, the public space in Cameroon has been dominated by bilingualism since 1961, when the modern Cameroonian state was established. (Achimbe 2013; Ayafor 2005; Bilola and Echu 2008; Fon 2019; Konings and Nyamnjoh 2003) Nevertheless, the meaning of bilingualism has never been clearly defined and as a result, speculations on this matter were source for many misunderstandings. The multilingual status of the country and the mobility within the state blur the strict lines between Anglophones and Francophones in everyday reality. Certain authors even insist that bilingualism should not mean just an ability to master both English and French, but the state's bilingualism should also include indigenous bilingualism with one of the European languages (Fon 2019: 56).

By geopolitical narration about countries in Africa usually views them as either Anglophone or Francophone – Lusophone. Apart from some exceptions, this is based on the language of the former European colonist. The language label of the country may create certain unfulfilled expectations. Such misinterpretation of language labelling within the state borders is a focal point of a narrativization called by D. Bach a *pioneering front* (Bach 2013: 11–13). From this geopolitical narration, the language may be perceived as a clearly understandable tool if not directly for domination, then at least as a sign of crucial geopolitical dependency. In short, when it is said that a certain language is used in a certain country, it can easily create an impression of strong ties between the group of countries using the same language. For instance, the presence of the French language as the main communication tool within the Sahel countries gives an indisputable impression of French influence on the one hand, and significant shared ties among Sahel countries on the second. Nevertheless, such domination of a European language is usually not accepted internally; therefore, these language labels are usually ascriptive, which are given externally by the outsiders as the easiest mark connected to potential geopolitical domination. Senegal is a case to demonstrate how global and internal perception may differ. In this case, the knowledge of French creates opportunities for domination of the state's service, while the situation on the ground favours a local *lingua franca* – Wolof. In short, whilst Wolof became accepted as society's *lingua franca* in almost the whole country, Senegal is globally perceived as a Francophone country. Thus,

classifying something as a language: 1) structure (linguistic), and 2) socio-political factors. It is commonly stated that Cameroon has between 250 and 300 languages (Bilola and Echu 2008).

Myers-Scotton, a linguist, then proposes four socio-political factors, for differentiating various situations connected to the similarity of languages, including 1) national borders, 2) cultural borders, 3) religious borders, and 4) unifying linguistic variety into one language (2006: 19–22). In the first case (national borders), she highlights the artificiality of borders as a denominator for creating different languages. Using this factor, she defines *receptive bilingualism* as the first case, where the languages are so similar that speakers of those languages can understand a speaker of the other language, although they cannot speak their language. The second case is the *dialectal continuum*, where speakers on both sides of national borders understand each other and the mutual understanding declines with growing physical distance from the borders. The second factor of political delimitation of languages (cultural borders) defines two similar languages, but different in terms of cultural circumstances (by font per example). The third factor (religious borders) refers to the situation where there is one language that is divided into two different subtypes due to the religious cleavages. As can be seen, the first, second, and third socio-political factors are not suitable for the case of Cameroon. The last factor (uniting linguistic variety into one language) describes the situation where there is one language that differs according to the location, speakers etc., but it is understood as one language. This may be the case of former colonial languages, which is the category of languages where both English and French should belong.

Thus, even though the French language used in Cameroon may differ from the French language used in Canada, it is globally seen as the same French language. As a result, Cameroon may share geopolitical (global) belonging with both the Francophonie and the Commonwealth. Achimbe (2013) for example used the terms Cameroonian French and Cameroonian English, although it is usual to use the term standard French. These standardised dialects of languages have the potential to create something which is called a *symbolic capital* which represents the way the educated people talk (Myers-Scotton 2006: 25). This *symbolic capital*, sometimes called *Good taste*, has a significant impact on the majority-minority dynamic, as pointed out by Eriksen: “For this reason, many minority members may be disqualified in the labour market and other contexts where their skills are not valued” (Eriksen 2015: 357).

By the term *bilingualism* in Cameroon usually means the mastering of standardised versions of English and French. This type of *bilingualism* is anchored in the Constitution and is based on historical processes and in the academic literature called *official*

bilingualism. However, some minor voices sometimes point out that bilingualism should also take into account the minority languages and at least one European (Fon 2019: 56). In spite of the standardized version of both English and French which is required for the right *bilingualism*, it needs to be mentioned that the usual *lingua francas*, originating from either English or French by their *pidginization* (of both English and French), receives lower status in the society and its speakers are discriminated (Bilola and Echu 2008: 206). Simpson (2008: 18–22) defines four types of postcolonial language policy within the continent, namely: 1) promotion of one dominant indigenous language; 2) the European language becoming the dominant national language; 3) promotion of multilingualism as the state’s added value; 4) something in between those types. Simpson ranks the case of Cameroon in the second category as a somehow deviant case, where two European languages were promoted with a significant prevalence of one of them. As a result, we can identify the Anglo-Francophone cleavage as the dominant approach that occupies the public space. However, in a case study mentioned later in Simpson’s book, the case of Cameroon is labelled as *Official bilingualism in multilingual states*. Thus, multilingualism has a significant place within the study and this dichotomy is a supplement of the Cameroonian language policy. Why Simpson puts Cameroon into this category might not be clear, but at least he tried to explain that: “English and French have thus become linguistic beacons which serve to polarize and separate the population, and the uneven implementation of official bilingualism is creating serious problems for national integration” (Simpson 2008: 20).

The success of Cameroonian bilingual policy is usually rated as low level. Achimbe (2013: 8) for instance, it is highlighting that “the bilingual policy has been heavily criticised by almost all the studies on language planning.” Above mentioned authors of the chapter in Simpson’s book (Bilola and Echu 2008: 212) came to a conclusion that the language identity of Cameroonian bilingualism did not help to create one nation, but rather created two language identities as a symbol of allegiance. However, they highlighted some positive trends in the language identity building (Bilola and Echu 2008: 212) such as urban *lingua francas* as ascriptive identity tools. Thus, this situation shown the well-known truth that “it is not Cameroon, but Cameroonians who are bilingual” (Fon 2019: 58).

The most famous one among the identity tools eliminated from official bilingualism could be described either as *Cameroonian Pidgin English* or as *Camfranglais* being the French-based Pidgin. We can see on this pidginization of both English and French that the official bilingualism in a multilingual country faces significant challenges that may help to cement the Cameroonian national identity. For example, Achimbe (2013: 10) comes with the word *Youthspeak*, which is based on both pidginized English and French.

However, these artificial languages with identity-creating potential are usually not respected by the state, reversely to the native languages that have certain degree of autonomy and privileges – for instance in local radio broadcasting (Kouega 2007).

5. Textual analysis

5.1 Methods

The following part of this article will be divided into two chapters to answer the question about language policy as fitting into the prevailing narratives within the chosen time periods. It will focus on two equally long periods of 30 years. The first one attempts to analyse texts published between 1960 and 1990, the second examines the texts from 1990 to 2020. These two periods were chosen based on the paradigm shift in social sciences and above-mentioned prevailing narratives within the geopolitical framing identified by Cheeseman and Fisher as *unifying* up until 1990 and *coercive* since till now. As authors wrote:

Indeed, during the 1960s and 1970s, many authoritarian African regimes came to depict multiparty politics as fundamentally divisive and disruptive, and used this argument to legitimate creating other kinds of political systems that they said would be better placed to promote national unity. (Cheeseman and Fisher 2020: 30)

Later on, in the 90s: “In some respects, this transformation was sweeping and profound. Between 1989 and the end of 1990s, almost all African states that were not in conflict committed themselves to holding multiparty elections of one form or another.” Thus, it is expected, that Cameroon should not be an exception and academic literature might follow those narratives. The political sciences texts chosen for research are the following: C. Welch’s *Dream of Unity* (1966), J. F. Bayart’s *L’État au Cameroun* (1979), and *Negotiating an Anglophone identity* by P. Konings and F. Nyamnjoh (2003) as most evident for the chosen time periods. The author also used as a demonstration of the last period the study of IFRI, *Education et pouvoir dans le conflit anglophone au Cameroun* (2020), written by C. Petrih. The text identified three levels of analysis (Global, State’s and Local) and evaluate how they fit into two temporal narratives. This was done by detailed reading of selected works with the aim to identify how dominant narratives (for the chosen period) were used in each of researched level. Moreover, another aim was to find the non-dominant narratives that were present. The books (or chapters) that might be chosen with expected similar results should be David E. Gardinier’s *Cameroon: United Nations Challenge to French Policy* (1963), *Politique du ventre* of Jean-Francois Bayart (1989), *Itinéraires d’accumulation au Cameroun* (1993) written under Peter

Geschiere, Piet Konings or the above-mentioned chapter concerning Cameroonian bilingualism from Biloa and Echu (2008). The author is fully aware that the chosen books have their limits in being representants of the chosen periods. However, the author expects that chosen books outline the main ideas of the chosen periods and describe the evolution of the *official state bilingualism*, which changed from a source of pride to an identity tool for leverage. Even though these books may be seen as fully fitting into the above-mentioned narratives, the main aim of using them is to critically evaluate the prevailing narratives in those books and try to find others narratives that were not less significant in selected academic literature.

5.2 The Dreams of unity and accumulation

Starting with an analysis of the texts from the 60s, the literature viewed Cameroon as an example of possible pan-African unity after independence. Thus, the narrativization of the period of the 60s was based on a geopolitical narration of independence against the post-colonial powers. Despite the European languages creating a crucial framework, they were more or less a uniting tool for achieving the same aim. The key text chosen as defining the period was C. Welsch’s *The Dream of Unity*, where Cameroon appears in several crucial narrative stories.

The first one treats the *Kamerun Idea*, which is based on the unity of German historical Cameroon and the idea of the future federation as a possible accommodation of two different systems. What can give us a clue about the general narrativization of K. Welsch are the last pre-independence elections in Southern Cameroon in 1959. Those elections are presented as a victory of the Kamerun National Democratic Party (K.N.D.P.). Firstly, the name of the party refers to the united German Cameroon. Secondly, there was a pamphlet issued before the elections, titled “The Secession Charter of the Kamerun National Democratic Party”. The document consisted of four arguments and cited fourteen advantages of secession (Welsch 1966: 200–201). The first story which appears in the text works with the narrative of Cameroon unity – it says that after fifty years under the German administration, “we developed a sense of oneness in all aspects of life” from “conglomeration of ethnic communities” (Welsch 1966: 200). The second narrative was about the unsatisfying and inequitable financial arrangements coming from abroad. In this case Nigeria was responsible for making the Southern Cameroons suffer (Welsch 1966: 200). The last story behind the declaration may be labelled as a dividing one, as the main division is between Cameroonians and Nigerians where “we differ in culture, tradition, and in our entire general outlook” (Welsch 1966: 200). Thus, these three narratives can be 1) *the unifying* stories of Cameroonian unity, 2) the tale of *neglected* administration by the external rulers, and 3) the narrative of

difference mainly in the cultural matters used against Nigerians and particularly against Ibos. Thus, here we can see that the geopolitical narrativization was mainly state-based, ensuring the unity of a post-colonial state against Great Britain as a colonial power. However, the Brits were actually represented by Nigerians or Ibos.

On the other side of the border, in French Cameroon, Ahidjo took power in 1958. In his speech from February 1958, he stated that reunification is “the dream of all Cameroonians” (Welsch 1966: 210). The main goal of his new government, to be accomplished in the shortest time possible, was to gain independence. However, he proclaimed that the problem of division “must receive a solution before the proclamation of our independence” (Welsch 1966: 211). From this perspective, there were only two narratives in French Cameroon, concretely 1) *unification* as a permanent dream and 2) *independence* from Paris. However, as Welsch mentioned, the situation in French Cameroon was violent even before independence. The brutality of both *maquisards* as well as of the government-supported by the French spread even to Southern Cameroon and was a significant tool for pro-British politicians who were opposing reunification (Welsch 1966: 232). This whole time period was later labelled as a taboo topic in Cameroon which reappeared only at the end of the millennium. (Deltombe, Domergue, and Tatsitsa 2011)

If we look closer at the development of the situation before the plebiscite and on the 1961 plebiscite itself, the crucial part for the politicians from Southern Cameroons, who were also talking about the reconstruction of “Kamerun”, was creating Cameroon on “the basis of equality between the partners, thus protecting the distinctive backgrounds of the English-speaking and French-speaking sectors” (Welsch 1966; 228). However, the essential question in this context is what was meant by the quotes of “equality” and “protecting backgrounds”. These two terms definitely meant something different for authors in the 60s, when Welsch’s book was written, than for authors in the following years. Welsch also shows an interesting fact about the campaign itself, where he presupposed an inability of people to understand what they would be actually voting for, as can be shown by the following quotation:

In low-literacy society such as the Southern Cameroons, complex explanations of constitutional guarantees had little impact. The issues were too abstract, unrelated to the realities of daily life. The campaign was conducted rather on more familiar issues, in particular Nigerian immigration, terrorism in the Cameroun Republic, vague sentiment of Cameroonian ‘brotherhood’, the economic development undertaken by the Germans and the stagnation under the British, the desire to maintain the existing way of life, and ethnic solidarity behind a particular party. (Welsch 1966: 231)

To sum up, the situation in the 60s was perceived in a way that the most important thing was the uniting of Cameroon as a single, united, and federal country with two languages. The geopolitical division was stressing the post-colonial dimension of united Cameroon, and geopolitical narratives which were centring the unity against European colonists and their proxies prevailed in both federal parts. During the following years, the subject of Anglo-Francophone cleavage disappeared from the academic narrativization.

Cameroon enters into the 70s with a crucial narrative of post-colonial states which are different from the Western states. This period of the Cold war may be framed as *non-western exotism*, where there was a search for finding their differences from the ideal Western states. Significant for this period was something that Mbembe (2001: 3) later described as the narrativization of Africa: “pretext for a comment about something else, some other place, some other people.” Thus, the period of the 70s and the 80s can be characterized as mostly being about what Africa, African states, and societies are not, instead of being about what they actually are. The academic literature suffered by “dogmatic assertions, cavalier interpretations, and shallow rehearse” (Mbembe 2001: 9). As a significant book for this period about the Cameroonian state, it was chosen J. F. Bayart’s *L’État au Cameroun*. In the preface of the book, the Anglo-Francophone axis is mentioned as an existing cleavage, but the multi-ethnic character of Cameroonian society is highlighted in the previous paragraphs. Moreover, bilingualism is perceived as some added value for Cameroon, instead of some sort of disadvantage or a root of a potential conflict (Bayart 1979: 9). Referendum concerning the unitary state is again perceived as “inevitable political progress with centralisation ensuring Francophone dominance” and a “presidential system ensuring great stability” (Bayart 1979: 10). The whole narrative within the book works on the assimilation of ancient and post-colonial elites (Bayart 1979: 19). The absence of a chapter about the language policy signifies how inessential this topic was valued. Thus, Bayart claimed that Cameroonians were benefiting from the existence of a state which is able to ensure political stability and participation in the global economy. This narrative was copying the world’s approach, as the book was published in the year when Margaret Thatcher was elected the British Prime Minister for the first time and only two years before the election of Ronald Regan. The whole global narrative of the First World was focused on the ongoing *Cold War* with significant *laissez-faire* and free-market approaches. Thus, Bayart’s book might serve as another brick in the wall and it can help us understand that for the situation until the 90s, the language/identity policy was not as important as the unity promotion. Meanwhile, the economic issues in the light of the oil crisis were emphasised. Alongside such prevalent narratives, the description additionally

functioned as what could be described as non-western exotism.

5.3 Coercive multipartism

The change of perception of Cameroon (viewing it as a united and stable country) started to appear at the beginning of the 90s, because of two historical events and changing and paradigm from structuralist approach. The first one was the end of the Cold War, but the more significant one was the genocide in Rwanda in 1994 and the Yugoslavian war. Thus, the 90s in Africa were framed by the fear of *Balkanisation* on the one hand, and the threat of another *genocide* on the second. The events in Rwanda, but also an influential book by R. Kaplan had an indisputable impact on how countries in Africa started to be perceived. Short period of global focus on the continent allowed the promotion of existing cleavages, based on different identity characteristics, yet respecting the established borders. The book that has been chosen for framing this period is Konings and Nyamnjoh's *Negotiating an Anglophone Identity: A Study of the Politics of Recognition and Representation in Cameroon* (2003).

In the first part of the book, the authors highlight that despite the building of a nation, "the primary concern had been to integrate the diverse ethno-regional groups into the state and place them under the centralised authority" (Konings and Nyamnjoh 2003). This was followed by the political disregard of this issue in spite of various identities. Nevertheless, the post-colonial state used any opportunity to foster conflict and to "deconstruct the Anglophone identity" (Konings and Nyamnjoh 2003: 2). The book adopts the existence of various identities which were not taken into account during the previous period, and it states that there should be at least three strong identity-based power elites in Cameroon, namely: 1) Muslim-Fulbe with the power-centre in Garoua, 2) Beti surrounding the capital of Yaounde, and 3) the Francophone Bamilikele in the West region. According to Konings and Nyamnjoh, the first two ethnics were creating the political-administrative power axis, while the third one was responsible for the development of entrepreneurship. Talking about the Anglophone identity and other identities, another aspect which needed to be mentioned was another axis based on coastal and hinterland division. Concerning the economic issues, the text mentioned the economic growth thanks to the petrol, and later the economic fall from 1986–1993, which resulted into the popular discontent. According to the text, the first opposition party, Social Democratic Front (SDF), took "advantage of widespread Anglophone resentment to their allegedly second-rate citizenship, in the Francophone-dominated unitary state" (Konings and Nyamnjoh 2003: 8). In essence, the book's preface refers to both as either geopolitical or anti-geopolitical cleavages.

However, it might be mentioned that the *Local* cleavage and *State's* perspective should promote and even highlight the *Global* division of the structure of Cameroonian society. Within the text, Konings and Nyamnjoh clearly distinguish the Anglophone and the Francophone aims. For instance, in the chapter concerning the Federation, they wrote that, "Francophone elite was never in favour of federalism," or that, "hegemonic tendencies of the Francophone-dominated state and even of the Francophone population as a whole, which would invariably lead to a further 'marginalisation, exploitation and assimilation' of the Anglophone region" (Konings and Nyamnjoh 2003: 66–67). The narrative of national unity was strongly supported in the 80s and lasted till the beginning of the 90s, when the anti-geopolitical narrative was introduced, as "Anglophone Cameroonians were termed 'Biafrans'" (Konings and Nyamnjoh 2003: 77) – a foreign aspect within the country (Konings and Nyamnjoh 2003: 88).

Concerning the bilingual and multilingual status of the country, Konings and Nyamnjoh noted that Biya's regime was trying to deconstruct Anglophone identity by highlighting the bilingual and multilingual status of the state (Konings and Nyamnjoh 2003: 109). They called this approach 'divide and rule', and in this context the author understood the *State's* geopolitical narrative of bilingualism as a coercive tool. From the *State's* perspective, both (*Global and Local*) divisions would be considered as anti-geopolitical and opposing the state's bilingual narrative by

trivialisation and demonization of the Anglophone problem, the establishment of the control over the state media, the punishing of any journalist and/or public intellectual who has dared to propagate Anglophone identity and solidarity, and encouragement of the ethnic-regional print media, as well as outright repression. (Konings and Nyamnjoh 2003: 136)

Based on previous evidence, they claim that "the idea of reunification appears to have been much more popular among the Francophone population than among Anglophones in the southern quadrant" (Konings and Nyamnjoh 2003: 194). Moreover, later appeared studies criticising the *official bilingualism* as an unsuccessful policy (Ayafor 2005: 140) and thus, this systematic prevalence of *Global* narrative preserved the Anglo-Francophone cleavage as a core of Cameroonian policy for the future.

If we move to the second decade of the 21st century, we can document that it was determined by the rebellion of the Anglophone teachers and judges. These rebellions later became violent, and in English-speaking global press (Guardian, BBC) they were presented as "Anglophone rebellion against marginalisation later evolved into a violent fight of separatists" (Kučera 2020). The labelling of the conflict on the cleavage of Anglophone people against Francophone government appeared to be crucial for this period, but

such narration creates an impression of a people-centred movement against the political elites, which was a globally common narrative. In her study, Petright (2020: 6) focuses only on the Anglophone regions which she calls NoSO (Northwest and Southwest region). This name later became a neutral label for these two Anglophone regions. She suggested that the ongoing conflict was based on symbolism, where the fight against the school system is a proxy tool for fighting the state and its institutions. She highlighted that the aims of a state within the context of the language policy were two – to promote unity, and to assimilate the different (Petright 2020: 8). Thus, we can conclude that even though the *State's* narrative and approach have not changed, yet the global trends have undergone evolution and subsequently the changed global narrative pushed *State's* perception into the category of the anti-geopolitical narrative. Petright notes that the language policy was not the core of the conflict but served more as an understandable proxy to show dissatisfaction with the poor government (Petright 2020: 13). This claim may be one of proofs which shows that the Anglo-Francophone cleavage narrative might have been exploited, based on the globally prevailing geopolitical narration of *the pioneering fronts*.

However, the economic fall in 2016 connected with Naira devaluation and economic consequences for NoSo is almost missing from the perspective of the contemporary texts. From these texts, it seems that, in contrast to the narration from the 70s to the 90s, the economic issue did not play any role in political mobilisation based on the language policy. Unluckily, such narration creates a space for misinterpretation of the ongoing processes as purely linguistic and identity based, meanwhile one may assume that the economic issues have played a significant role just like at the beginning of the 90s.

6. Conclusion

This article used the approach of post-colonial geopolitics and anti-geopolitics to answer the question *whether (and how) the academic description of Cameroonian bilingualism fits into the globally accepted geopolitical narratives describing Africa*. It analysed significant academic texts about the Cameroonian political system in the temporal context. Its conclusion is that even though Cameroon fits into the narratives significant for certain periods, there was always present at least one another narrative that was also strong, but it did not have the force to become a label of the period (Tab. 1).

The text concludes that the period between 1960 and 1990 mentioned the language policy and the question of bilingualism rarely. Beside the ongoing Cold war narrative, the texts were focused on independence (on colonial powers), unity (Cameroonian), centralisation, accumulation, and integration. The used text from 1966 put the general narration of the potential conflict between Cameroonians and foreigners not only cultural but also economic and administrative. Within the context, the situation after 1975 favoured the economic narration, and the possibility of a strong government was viewed as a required pretext for economic development, while the language policy and the questions of English and French were perceived as a comparative advantage for economic development.

The fear of genocide and promotion of language identity on the one hand was accompanied with the global fear of possible balkanization of African continent since 1990s. Even, though this period is globally labelled as a period of democracy promotion, selected books were underlying different topics connected with culturalist shift. As it was demonstrated in the chosen texts, the focus was not only on the contemporary geopolitical narratives, but also on cultural identities and inequalities in general. This was happening whilst the state was trying to ensure the dominance of the bilingual and uniting narratives. As it was demonstrated, the texts in the 90s were also dealing with the economic and public life inequalities, where the identity cleavage played a significant role. The focus on those inequalities in later texts became slightly less apparent, which led towards the acceptance of the contemporary geopolitical cleavage as the Anglo-Francophone, which consequently turned into the dominant label. This also copies the dominant narratives since 2014, when the geopolitics became more competitive and less liberal democracy dominant.

Last but not least, the author of this text would encourage greater caution when we present previous issues in the optic of a contemporary perspective. For instance, the narrativization of Anglo-Francophone cleavage, which arose in 2016, should not be labelled as more than 50 years of political marginalisation of Anglophones as it should rather be labelled as 30 years of language policy ignorance or as a state-building with the following years of political Anglophone mobilisation. During the process of Cameroonian state building, there were various identity groups that were marginalised under the umbrella of political unity. The Anglo-Francophone cleavage grew in importance within the global narrative of *the Scramble for Africa*, thanks to the global perception

Tab. 1 Prevailing narratives.

	Global	State's	Local
1960–1990	Against foreigners (British/French; Nigerians)	Centralisation as an advantage (Economic/Politic)	Integration and accumulation
1990–2020	Language policy as cleavage	Coercive (and repressive) state (Divide and rule)	Ethnicity as cleavage

that such cleavages received a wider space for being exploited. As a result, the author came to the conclusion that even though Cheeseman and Fisher's narratives are valid and important, they do not serve itself for describing the situation, at least in the case of Cameroon.

Moreover, the author would like to highlight the lack of economical description of the situation of Anglophone regions in the second decade of the 21st century. The modern texts about the upheaval in NoSo do not mention this part which was significant for the political processes of previous periods. From this perspective, the description of the economic situation and its impact on Anglophone's mobilization would be helpful for understanding Cameroonian politics in its complexity and not just from the perspective of language and identity mobilisation. Therefore, some research about the economic situation and its impact on Anglophone mobilisation would be beneficial.

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The expansion and migration of small mammals in the Makalu Barun region induced by changes of the Himalayan environment during the Quaternary

Milan Daniel¹, Jan Kalvoda^{2,*}

¹ National Institute of Public Health, Prague, Czechia

² Charles University, Faculty of Science, Department of Physical Geography and Geoecology, Prague, Czechia

* Corresponding author: kalvoda@natur.cuni.cz

ABSTRACT

This paper describes the course of migration and expansion of small mammals in the Makalu Barun region influenced by the orogenic uplift of the East Nepal Himalaya and climatically conditioned changes in the extent of morphogenetic zones from the Upper Pleistocene up to the present. The results of zoological and parasitological research are compounded with the knowledge of the dynamic development of landforms, which testifies to significant changes in the high-mountain environment during the Quaternary. The migration of Palearctic species of small mammals across the gradually emerging orographical barrier during the orogenesis of the High Himalaya was completely interrupted by the glaciation in the Upper Pleistocene. This extensive glaciation also excluded occurrence and survival of small mammals in the high-mountain valleys of the Makalu Barun region. Migration routes and the extension of the territory of small mammals remained open only in the periglacial zone of the Arun and Barun Khola valleys. Following the interstadial period of warmer and humid climate conditions were changed by the Late Glacial Maximum when small mammals were again pushed away from heavily glaciated valleys to the lower altitude periglacial zone. During the Holocene interglacial, the occurrence of fauna and flora in the high-mountain valleys depended on repeated spatial changes of periglacial and glacial morphoclimatic zones. Current biogeographical hazards are accentuated due to the rapid retreat of glaciers, the expansion of the periglacial morphoclimatic zone and the increased human impact in the High Himalaya.

KEYWORDS

small mammals; the Quaternary environment; landform evolution; the Makalu Barun region; the Himalaya

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1. Aims and methods of the study

A remarkable endeavour of pioneering mountaineering expeditions to the highest eight thousand peaks was also to gain knowledge about the natural environment of the mountains of High Asia. Half a century ago, Czechoslovak mountaineering expeditions to Makalu (8,475 m) in the East Nepal Himalaya also contributed to this effort. As a reminder of the anniversary of these Czechoslovak expeditions in 1973 and 1976, we present a regional study on a current topic that requires a systematic linking of the results of zoological, parasitological, geomorphological and geological knowledge. From a general point of view, this is a contribution to the knowledge of the exciting history of fauna expansion in the climatically harsh and variable glacial and periglacial zones of the East Nepal Himalaya from the Upper Pleistocene up to the present.

This study emphasizes the migration of small mammals and principal features of their distribution as an important biogeographic phenomenon in the Makalu Barun region (Fig. 1), which reflects the tectonic uplift, origin and oscillations of the mountain glaciation and morphoclimatic zones during the Quaternary period of collisional orogeny. The results of the zoological investigation of the present-day distribution of small mammals are integrated with the palaeogeographical and geomorphic evidence on the landform development during the Quaternary.



Fig. 1 Morphostructural and climate-morphogenetic differentiation of the Himalayan landscape between the Chomolongma and Makalu Massifs and the Barun Khola valley is conspicuous. The canyon-like valley (ca 3,000–4,000 m a.s.l.) with lateral hanging valleys is incised into crystalline rocks of the basement of the High Himalaya nappe. On the horizon, strongly glaciated mountain massifs are situated: to the left, the Peak IV (6,720 m), Nuptse (7,879 m), Lhotse (8,501 m), Lhotse Shar (8,383 m) and Sagarmatha (Mount Everest, 8,847 m; entirely in the background); to the right, Peak III (6,825 m), the southern summit (8,010 m) and the main summit of Makalu (8,475 m). Photograph by Jan Kalvoda (April, 2006).

We pursued zoological and geomorphological research in the Himalayan terrains during the years 1971, 1973, 1976, 1979, 2002 and 2006, and related laboratory works were almost completed in 2021. This long-term inquiry allowed us to make also a comprehensive interpretation of significant changes in the natural environment and human activities in the Makalu Barun region. Colonization of areas exposed by a retreat of glaciers represents a serious ecological process in high-mountain biocenoses. Because of the increasing intensity of the reduction of glacial zone owing to changes in climate during the last decades, former findings are valuable as a comparative source for the present.

The alpine fauna of the Makalu Barun region occurred in the foreland and on nunataks of the Barun glaciers. Nowadays it comprises Palearctic species as well as species of the oriental region, which, because of their wide ecological adaptability, extend up to this area from lower altitudes (Daniel et al. 1985). Typical representatives of the oriental region are birds *Tetraogallus tibetanus aquilonifer*, *Pyrrhocorax graculus digitatus*, *Corvus corax*, *Corvus macrorhynchos* and *Ithaginis cruentus cruentus*. In the pilot study Daniel and Kalvoda (1985) determined that the psychrophile faunal elements of Palearctic origin, for example *Alticola stoliczkanus*, *Ochotona roylei* and *Neodon sikimensis*, became isolated in the Barun valley by the gradually rising main crest of the High Himalaya during the Quaternary. This orographical barrier, owing to its cold climate and continuous glacial cover, has been insurmountable since the Upper Pleistocene. The southward advance of the Palearctic fauna was stopped by the bioclimatic boundary modified to the environmental adaptability of the individual species.

The presented study focused on the occurrence and migration of small terrestrial mammals tightly linked with a particular habitat in the Makalu Barun region. Their ectoparasites, which have particular zoogeographical affiliations, were also considered. Expansion of animals and their haematophagous parasites (mainly ixodid ticks; Daniel 1979) in newly exposed areas introduces the risk of vector-borne diseases caused by viral and bacterial pathogens circulating among vertebrates by means of vectors-haematophagous ectoparasites. Under particular circumstances, they are transmissible to humans and can cause severe and even fatal disease (Daniel 2015, 2017).

Our intention is also to determine changes in the altitudinal limit of risk of the vector-borne diseases occurrence based on the analysis of environmental conditions required for the survival of small terrestrial mammals and their parasites. Therefore, zoological and parasitological findings are compound with knowledge of the dynamic development of landforms, which testifies to significant changes in the high-mountain environment of the Makalu Barun region during the late Quaternary. The complex interpretation made it possible to determine the course of

expansion and migration of small mammals in harmony with the orogenetic uplift of the High Himalaya and climatically conditioned changes in the extent of morphogenetic zones from the Upper Pleistocene up to the present.

Research of the Makalu Barun region was aimed especially at geology (e.g., Bordet and Latreille 1955a, b; Bordet 1961; Krummenacher 1961, 1966; Schärer 1984; Lombardo and Bortolami 1998), geomorphology and geocology (Byers 1987a, b, 1996; Carpenter and Zomer 1996) as well as the dynamics of changes of the Himalayan environment during the late Quaternary (Chhetri and Cairns 2015; Chhetri et al. 2017; Byers et al. 2019), including natural hazards and risks. Publications concerning this environment have been evaluated by Kalvoda (1992, 2020). The largely glaciated part of the East Nepal Himalaya is an area exceeding 400 km² comprising complicated systems of hanging and valley glaciers, which flow from the extremely high crests. Therefore, other topics examined during the research in the Makalu Barun region have been the dynamics of glaciers and, especially, the Quaternary glacial history. Geomorphological research of landform patterns in the Chomolangma and Makalu Massifs and the Barun Khola valley regions has been undertaken by Kalvoda (1978, 1979a, b, 1982, 1984a, b, 1992, 2004, 2007 and 2020). The observation of landforms provides evidence of very dynamic landscape evolution and indicates the extraordinary features of natural hazards in the East Nepal Himalaya (Kalvoda and Emmer 2021).

In the context of environmental aspects and geocology of the Makalu Barun region, previous articles have dealt with human disturbance (Byers 1996), forest ecology (Carpenter and Zomer 1996) and landscape analyses using satellite data (Zomer et al. 2001a, b, 2002). Zoological studies in the Barun Valley have been sporadic. Gregori and Petrov (1976) reported small terrestrial mammals collected during the Yugoslav Himalayan expedition to Makalu in 1972. Our collections of small terrestrial mammals and their ectoparasites (chigger mites and ixodid ticks) in the Makalu Barun region are discussed in papers by Daniel (2015, 2016 and 2017). Other publications concern birds (Daniel and Hanzák 1993), fleas of small mammals (Smit and Rosický 1976), chigger mites (Daniel and Stekolnikov 2009), mites (Dusbábek and Daniel 1975; Samšínák and Daniel 1978), parasitic helminths (Baruš et al. 1975; Baruš and Daniel 1976; Moravec and Daniel 1976) and synanthropic flies (Gregor and Daniel 1976). Soil micro-mycetes in samples collected up to 4,900 m have also been described (Janečková et al. 1977).

The Makalu Barun National Park (1,500 km²) with a buffer zone (830 km²) was established in 1992. Therefore, our principal zoological data and field documents were obtained twenty years before the nature conservation in this territory. It has been designated as a *Strict Nature Reserve* (Carpenter and Zomer

1996) in order to protect natural ecosystems and processes in an undisturbed state for scientific study, environmental monitoring and the maintenance of genetic resources.

The structure of presented paper involves necessary review and original parts. The first section (2nd–4th chapter) is based on condensed survey of the high-mountain environment, recent geomorphic processes and occurrence of small mammals in the Makalu Barun region. New results of the study are presented in the 5th and 6th chapter. This original section concerns the origin, expansion and migration of small terrestrial mammals in the studied area determined by a correlation and integration of geomorphological and zoological data. Discussion takes an interest especially in current biogeographical hazards associated with rapid changes of the environment in the Himalaya.

2. A concise survey of the high-mountain environment

A comprehensive interpretation of the analysis of zoological and geomorphic materials from the Makalu Barun region assumes the use of basic knowledge about the current natural environment of the East Nepal Himalaya. The Makalu Massif represents the uppermost orographical and structural unit of the High Himalaya (Fig. 2). In the lowest part of this mountain group occur zones with geomorphic signatures of the structural unconformity overlying the lower topographic levels of the Peak III, Peak IV and Baruntse Massifs. The elevations of the Makalu crests between the Japanese Col and the Chago La are still some 1,500–1,700 m higher than these mountain groups, being comparable with the summits of the Chomolangma Massif (Odell 1925, 1948; Bordet 1961, 1970). The Makalu and Chomolangma Massifs have excellent patterns of geological structure on steep walls (see e.g. Searle et al. 2002, 2003). The great broken georelief (Fig. 3) stimulate effectiveness of cryogenic and glacial modelling. Ice masses whose bedrock dips steeply and rapidly move downhill into periglacial morphoclimatic zone where they remain stagnant and mostly abrade the earlier glacial deposits of the valley floors.

The main representatives of the High Himalayan nappes in the Makalu Barun region are the metamorphic rock complexes of the Barun nappe (Bordet and Latreille 1955a, b, c; Krummenacher 1961, 1966). Tectonically located higher is the Makalu nappe, containing rocks of both the Barun group and the Makalu Formation. These rocks form the main ridge of the High Himalaya, together with the Chomolangma nappe, in which the Chomolangma group rocks overlie the upper portion of the Makalu Formation (Kalvoda 1978, 1992). In the Makalu Massif area (Fig. 2

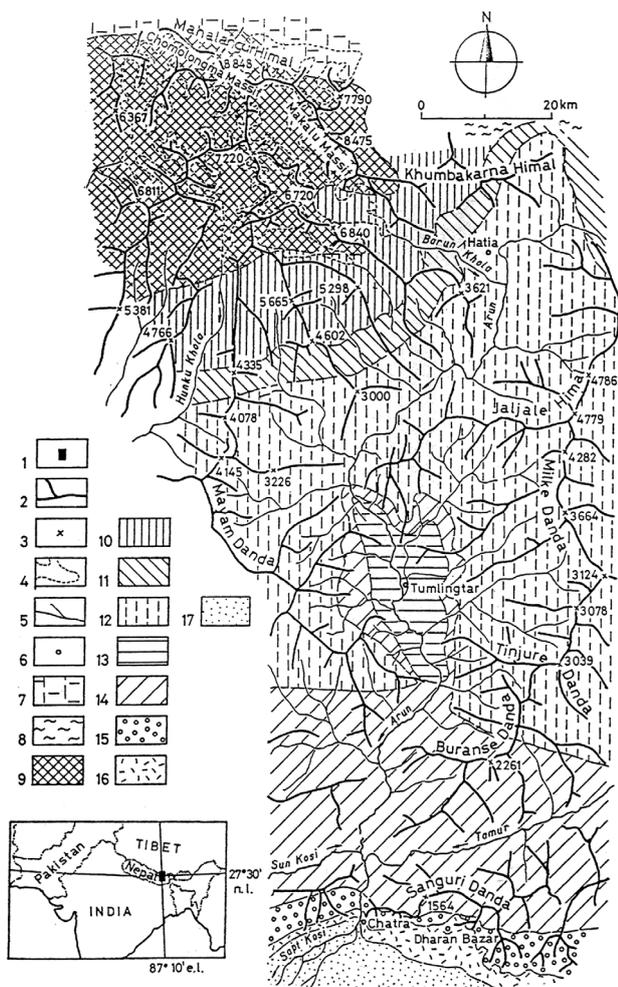


Fig. 2 Orographical patterns and geomorphological units of the East Nepal Himalaya between the Chomolongma and Makalu Massifs and Sapt Kosi lowland (Kalvoda 1992, 2020). Key: 1 – studied area, 2 – main mountain ridges, 3 – elevation points (in meters above sea level), 4 – glaciers, 5 – rivers, 6 – villages; 7–17 geomorphological units: 7–8 high-mountain relief on the sedimentary formations and crystalline rocks of the Trans-Himalaya: 7 – with alpine-type (arête) landforms, 8 – with predominance of periglacial, structural-denudation and erosion landforms in a semi-arid cold climate; 9–11 high-mountain relief on crystalline rocks of the High Himalaya: 9 – with alpine-type (arête) landforms, 10 – with predominance of periglacial, erosion and structural-denudation landforms in a humid cold climate, 11 – structural-denudation landforms of frontal parts of the High Himalayan nappe (Main Central Thrust); 12 – 14 mountainous relief on the crystalline rocks of the Lesser Himalaya: 12 – deeply eroded and highly dissected relief of the Tinjure nappe, 13 – Tumlingtar intermountain basin, 14 – dissected hilly reliefs of the Tumlingtar, Sanguri and Buranse Formations; 15 – 17 polygenetic reliefs on the Pliocene to Recent sediments of the Sub-Himalaya: 15 – dissected relief of the Siwalik hills, 16 – Late Quaternary accumulation landforms at the foot of the Siwalik, 17 – Sapt Kosi lowland.

and 4), the Chomolongma Group occurs only near the unnamed peak of 7,502 m elevation, where its lower part consists of pelitic, slightly metamorphosed rocks of Palaeozoic age.

The Makalu Formation consists of a number of Miocene granite bodies (Bordet 1961, 1970; Kalvoda 1979a, b) associated with extensive contact injection zones intruded into the lower part of the Chomolongma

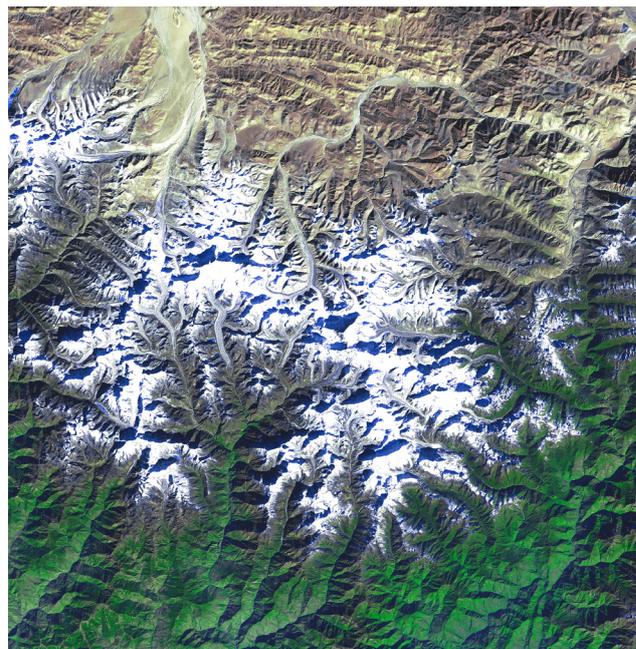


Fig. 3 Visible diversity of landscapes in the Nepal Himalaya and Trans-Himalaya recorded by satellite image on 5 January 2002 by Landsat 5. The High Himalaya range between the Cho Oyu, Chomolongma and Makalu Massifs (from the west to the east) with extensive glaciation is situated in central part of the image. Tibetan semi-arid landscape in the north and Nepalese humid monsoonal landscape in the south of the High Himalaya are striking. These landscape types are interconnected by the antecedent valley of the Arun river (situated in right part of the image) flowing from the north towards the south.

Group and the upper part of the Barun Group. The later consists mostly of biotite gneisses, originally of Precambrian age. At lower elevations, in the Barun valley below the Shershon site towards the Main Central Thrust, the Barun Group consists of an up to 5,000 m thick formation of banded biotite gneisses (Fig. 1) with garnet, kyanite and silimanite with interlayered garnetiferous amphibolites, pyroxenite lenses and granulites. Compact bedrock relief is developed on black paragneisses along the lower parts of the eastern cliffs of Peak IV Massif, below elevation points 5,860 and 6,260 m, in the foreland of the southwestern wall of the Makalu Massif and the crests near the Col Sherpani.

The biotite-sillimanite gneisses in the upper part of the High Himalayan series were intruded by tourmaline leucogranites of the Makalu Massif in the period 24.4–21.7 Ma ago (Schärer 1984; Lombardo and Bertolami 1998; Visona and Lombardo 2002). The bedrock relief on the yellowish-white granites is developed especially on the ridges and walls of the Peak IV, Baruntse, Chago and Makalu Massifs. The largest area of this bedrock relief is occupied by the slopes and cliffs on the zones of granites injected into paragneisses. Rocky slopes are highly dissected with frequent ledges and troughs, and often displaying block disintegration of rocks with corresponding autochthonous slope debris.

The Upper Barun glacier (Fig. 4) and its older moraines lie between 27°47' to 27°58' N and

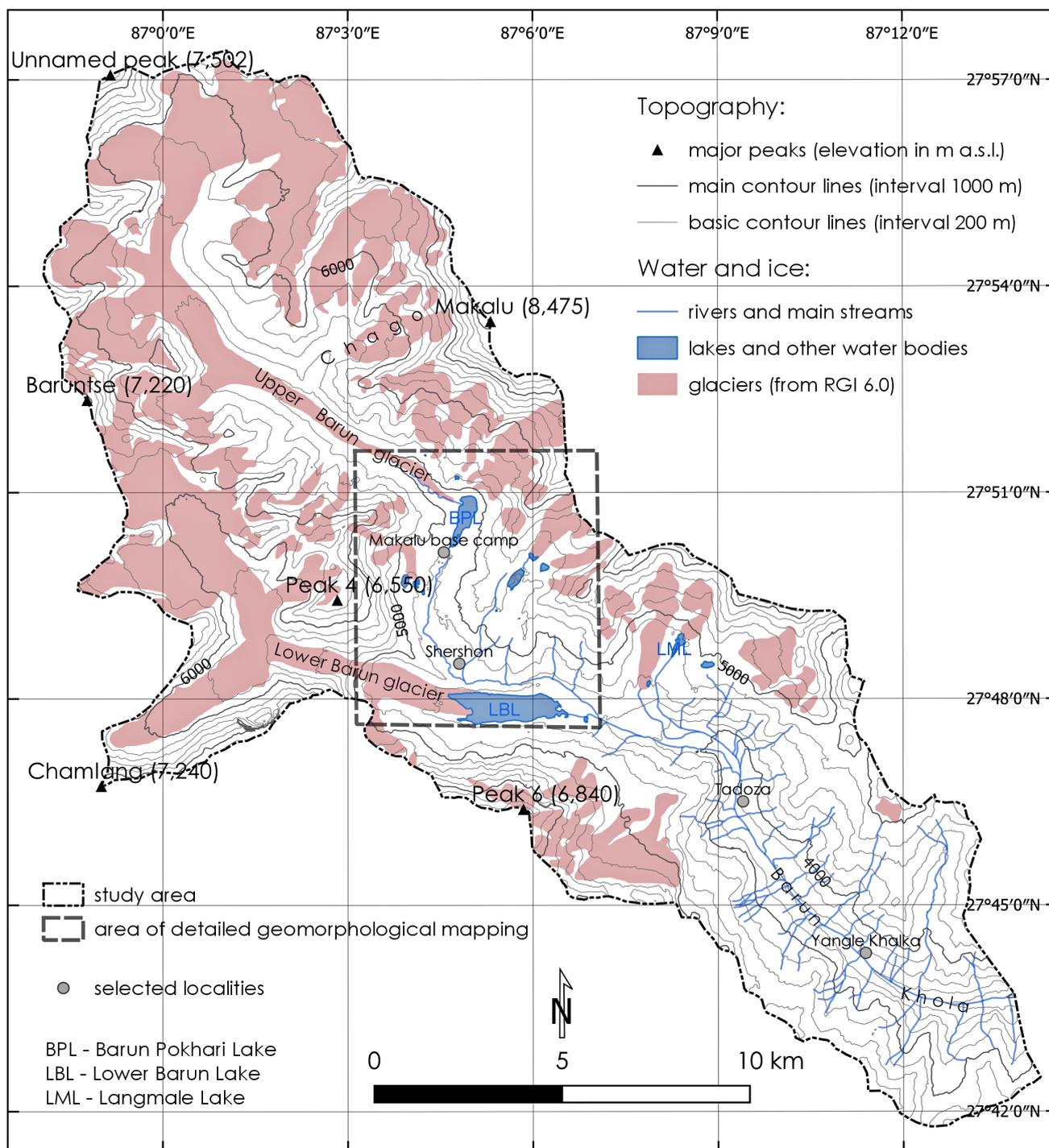


Fig. 4 Geographical position, orography and varied terrain in the central part of the Makalu Barun area (Kalvoda and Emmer 2021).

86°58' to 87°08' E at the western foot of the Makalu (8,475 m a.s.l.). The altitudes of the crests surrounding the Barun glacier basin are above than 6,000 m. The present-day Upper Barun glacier is 23 km long, with its' difference in altitude being 1,370 m over this distance. The Upper Barun glacier basin adjoins the valleys of the Lower Barun glacier and the Hunku glaciers in the southwest, and the Imja and Kangshung valleys further to the northeast. In the north, the upper part of the Barun area is bounded by the unnamed peak of 7,502 m elevation which forms the eastern limit of the Chomolungma Massif. Towards the west, the Upper

Barun glacier is connected with the Baruntse Massif (7,220 m) across the Cho Polu (6,734 m) by a north-south trending series of crests. Further south, three lateral glacial valleys occur. Above these the main connecting ridge adjoins the extensive Peak IV Massif (6,720 m). The opposite eastern side of the Upper Barun glacier valley is formed by crests between the Pethangtse (6,710 m) and the Chago (6,860 m), which continues to the southeast as the dominant orographic feature of the Makalu Barun region, i.e. the Makalu Massif (8,475 m). In addition to the main peak, the southeastern summit (8,010 m) of the Makalu, the

Chomo Lönzo (7,790 m) and Kangshungtse (7,640 m) also form parts of the Makalu Massif.

Continuation of the Lower Barun glacier valley represents the Barun Khola river valley, which at 1,350 m a.s.l. enters the antecedent canyon of the Arun river (Wager 1937). The total length of both joint-controlled Barun valleys from the main Himalayan ridge to the Arun river canyon exceeds 54 km. Below the confluence with the Barun Khola river, the Arun canyon is incised as deeply as 1,050 m a.s.l., and after a further 12 km, near the village of Num, it is at 850 m a.s.l. The deep dissection of the mountain relief has also been preserved in the Lesser Himalaya from the intermountain Tumlingtar basin to the structurally controlled denudational slopes of the Main Boundary Fault at the southern margin of the mountain range (Kalvoda 1978; Brunsten et al. 1981).

Described orographical section across the East Nepal Himalaya encompasses a series of altitudinal-controlled climatic zones each characterised by corresponding types of geomorphic exogenous processes and vegetation conditions. The georelief configuration and altitudinal peculiarities of the mountain belts are responsible for the remarkable variations of climate within the Himalayan regions (Fig. 2).

The altitude-dependent distribution of temperature in the East Nepal Himalaya may be characterised by the following average temperatures of the warmest month (July or August) in the main climatic zones of the region (Troll 1967; Daniel et al. 1985; Pratt-Sitaula 2004): very cold (above 5,200 m a.s.l.) less than 0 °C, cold (5,200–4,100 m) 0–10 °C, moderately cold (4,100–3,100 m) 10–18 °C, moderate (3,100–1,800 m) 18–25 °C, moderately warm (1,800–1,200 m) 25–30 °C and subtropical (below 1,200 m a.s.l.) more than 30 °C. These climatic zones vary somewhat with the boundaries increasing from west to east, as well as from south to north.

The perpetual snowline rises from altitudes of 5,400–5,500 m in the southern Khumbu Himal area to 5,600–5,700 m at the foot of the Chomolongma Massif and further to the north of the main crest up to 5,900 m a.s.l. (Odell 1925; Kalvoda 1978; Fushimi 1977, 1978). From recent observations, it follows that the perpetual snowline on the southern slopes of the Makalu, Lhotse, Khumbutse and Cho Oyu Massifs oscillates between 5,400 and 5,600 m, and on the northern slopes of the Sagarmatha and the Cho Oyu between 5,800 and 5,900 m a.s.l.

In the periglacial area south of the Chomolongma and Makalu Massifs alpine meadows with *Juniperus squamata* and *Rhododendron nivalis* occur. This biogeographical zone is separated from the treeline (Fig. 3), which south of the main ridge of the High Himalaya represents the treeline of the semi-arid continental zone (Chhetri and Cairns 2015), by a zone of humid alpine meadows with *Rhododendron spp.*, *Lonicera spp.* and *Juniperus recurva*. Alpine shrubs and meadows occur abundantly at 4,100–5,200 m (Troll 1967;

Chhetri and Cairns 2015), the continuous vegetation cover ending at 5,200 m a.s.l. In the Barun Khola valley (Fig. 4), the treeline runs on the sheltered slopes at 3,800 m a.s.l., and on the more humid shaded slopes at 4,200 m a.s.l., which are roughly 1,500–1,700 m below the snowline. The vicinity of the treeline represents a habitat characterised by *Betula utilis*, *Abies spectabilis* and shrubs of *Rhododendron campanulatum*; in drier places, *Abies* is replaced by *Juniperus recurva*. A sub-alpine forest between 3,100–4,100 m a.s.l. is occupied by *Betula utilis*, *Abies densa*, *Rhododendron arboreum* and other rhododendron species. In the range of 1,800–3,100 m a.s.l. is remarkable a subtropical evergreen mountain mist forest with *Pinus khasya*, *Quercus lamellosa* and other oak species, *Tsuga dumosa* and *Abies densa*. Between 800 m and 1,800 m a.s.l., a tropical evergreen forest predominates with *Betula alnoides*, *Lyonia ovalifolia*, *Toona ciliata* and *Phoebe lanceolata*. At altitudes below 800 m a.s.l., the hills are covered by a near-tropical deciduous forest dominated by the species *Shorea robusta* and *Terminalia tomentosa*.

The East Nepal forests abound in a wide variety of animals of which the most famous are snow leopard (*Panthera uncia*), black bear (*Selenarctos tibetanus*), musk deer (*Moschus moschiferus*) and Himalayan tahr (*Hemitragus jemlahicus*) in the higher mountain zones. In the middle mountains are found bharal (*Pseudois nayaur*), ghural (*Nemorhaedus goral goral*) and kankar (*Muntiacus muntjak vaginalis*), whilst the Siwalik Hills are colonised by elephants, tigers, panthers and rhinoceros. All the Himalayan regions are also remarkable for their hundreds of species of birds (Mehta and Kellert 1998; Khanal et al. 2014).

3. Recent geomorphic processes and phenomena

Landforms in the East Nepal Himalaya and neighbouring regions provide evidence for the nature of very dynamic landscape evolution, including extensive tectonic movements, extremely high rates of denudation, sediment transfer and deposition (Kalvoda 1978, 1992). We present our observation of recent geomorphic processes in the Makalu Barun region in four main morphoclimatic areas (Fig. 5 and 6): 1) Extreme glacial zone; 2) Glacial zone; 3) Periglacial zone; and 4) Seasonally cold / warm humid zone. We have been dealing this current topic since 1971 (Kalvoda 1976; Daniel and Kalvoda 1978), while we emphasized the significant changes of the high-mountain environment particularly in recent works by Kalvoda (2020) and Kalvoda and Emmer (2021). Recent geomorphic processes and related phenomena represent key features of the environment, which control current expansion and migration of small mammals in the Himalaya.

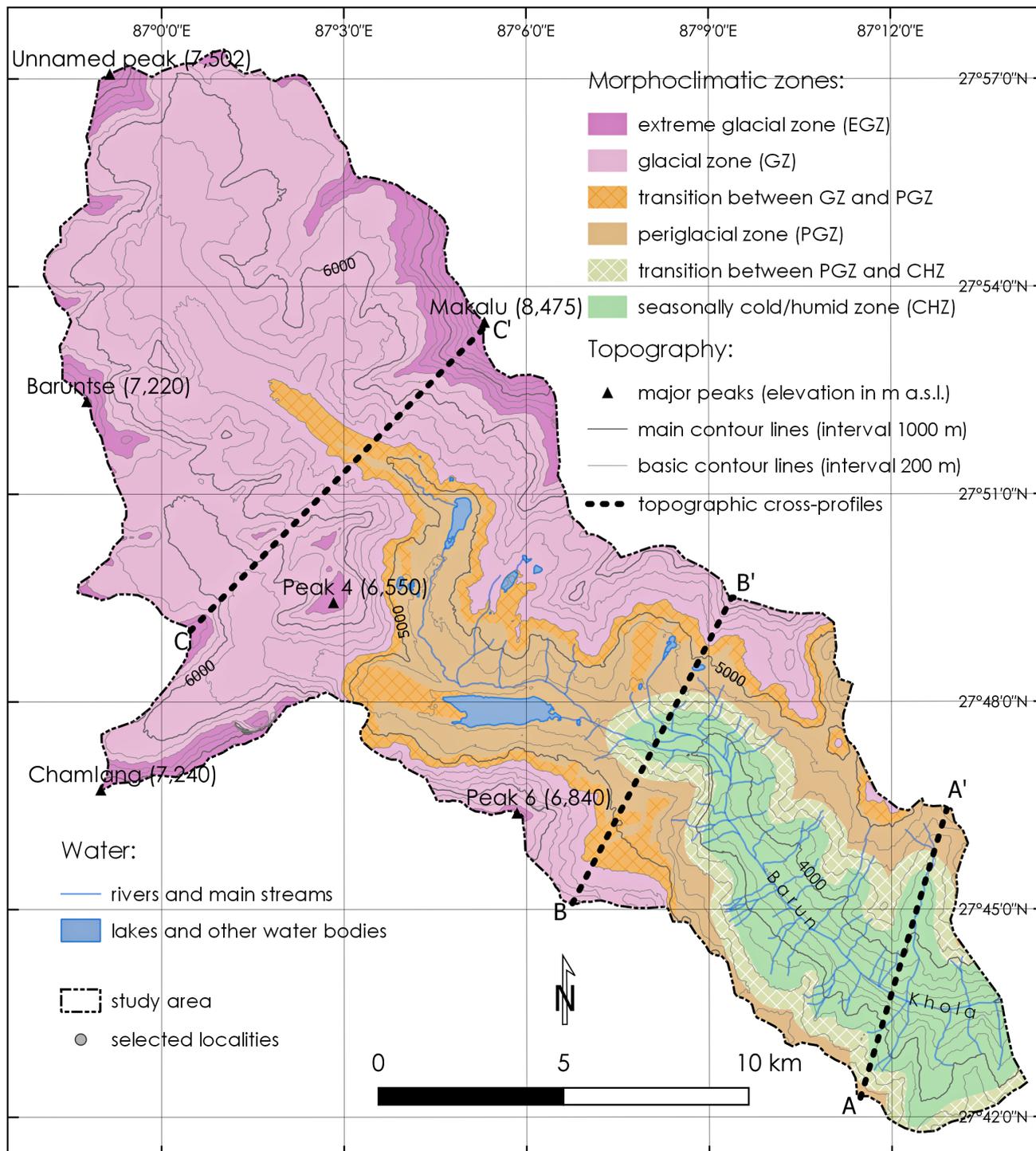


Fig. 5 Delimitation of studied morphoclimatic zones in the Makalu Barun region of the East Nepal Himalaya. Cross-profiles A–A', B–B', C–C' are presented at Figure 6. Definition of four morphoclimatic zones and two transitional zones (modified after Kalvoda and Emmer 2021):

Morphoclimatic zone	Definition
Seasonally cold/humid zone (CHZ)	delimited on a basis of the presence of compact vegetation cover (trees and rhododendron shrubs)
Transition zone between CHZ and PGZ	500 m upstream distance buffer from the limit of the Seasonally cold/humid area
Periglacial zone (PGZ)	located between transition buffer area of CHZ and transition area between PGZ and glacial zone (GZ)
Transition zone between PGZ and GZ	250 m downstream distance buffer from the 5,200 m a.s.l. overlaid and combined with glacial tongues reaching downstream this buffer
Glacial zone (GZ)	between 5,200 m a.s.l. and 6,400 m a.s.l.
Extreme glacial zone (EGZ)	above 6,400 m a.s.l.

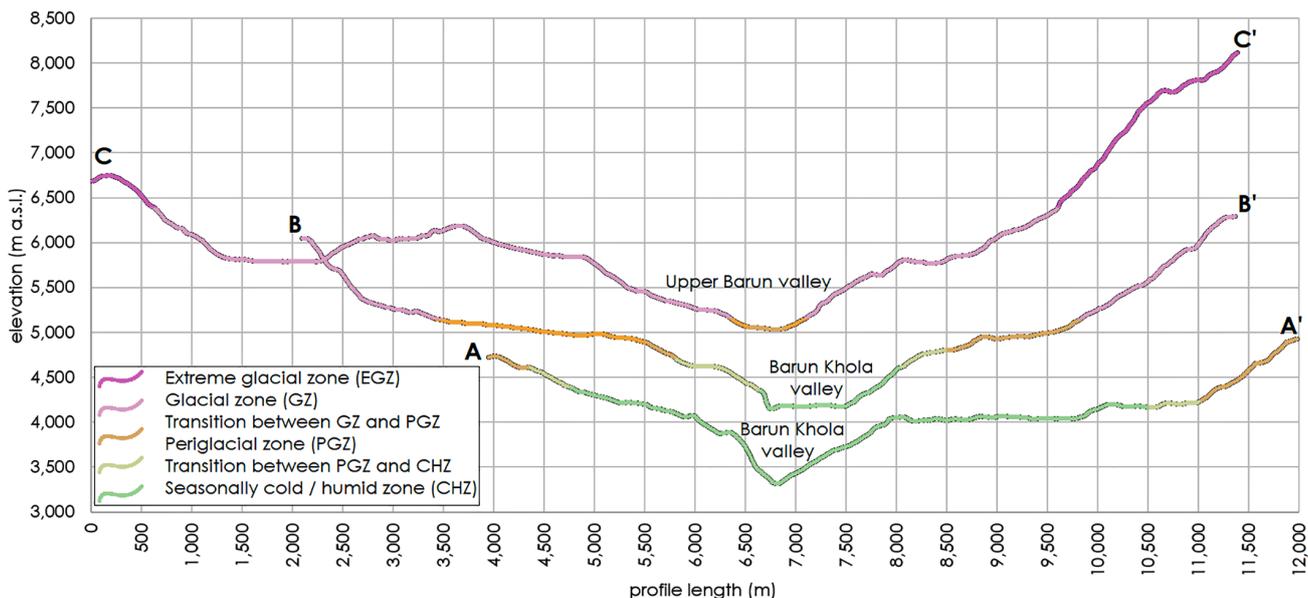


Fig. 6 Extension of morphoclimatic zones in the three cross-profiles throughout the Makalu Barun area (for the location of cross-profiles see Figure 5; after Kalvoda and Emmer 2021).



Fig. 7 Southeastern area of the Chomolungma Massif near the head of Upper Barun valley. The steep cliffs behind the Cho Polu ice dome (6,734 m) rise up to the Lhotse (8,501 m) and Lhotse Shar (8,383 m) and pass into the crest of unnamed peaks with heights 7,596 and 7,502 m. Clouds and snow hide the catchment area of the Kangshung glacier situated below the eastern face of the Sagarmatha (8,847 m). Photograph by Jan Kalvoda (May, 1973).

3.1 Extreme glacial zone

The extreme glacial area with a remarkable landscape of alpine-type (arête) ridges displays an effective combination of deep cryogenic weathering with a complex of glacial and nival morphogenetic processes in the very cold and semi-arid environment (Fig. 7). The intensity and duration of temperatures below freezing point have led to deep rock disintegration and macrogelivation (Kalvoda 2007). The largest areas of glaciation are concentrated in the upper end of the Upper Barun glacier valley, which cuts between the Chomolungma and Makalu Massifs into the main ridge of the High Himalaya. The steep cliffs lacking

permanent snow and ice cover, underwent deep cryogenic disintegration, and were subjected to aeolian corrasion; the harder rocks and dykes being selectively carved out. Field observations during the period 1971–2006 as well as later, together with present remote sensing data (Kalvoda and Emmer 2021), have shown that conspicuous recent changes in the rock slope patterns and volume of ice masses accompanied by a recession of the frontal parts of hanging glaciers, are only in the lower parts of the mountain walls.

3.2 Glacial zone

The present-day glaciation of the Makalu Barun region displays regression signatures due to the small amount of precipitation and the expansion of the periglacial zone by recent warming of monsoonal climatic conditions. The perpetual snowline oscillates on the southern slopes between 5,400–5,600 m, and on the northern slopes between 5,700–5,800 m. The spreading of the periglacial zone to the detriment of lower areas of the cold glacial zone is striking (Kalvoda 1992, 2020; Kalvoda and Emmer 2021). The valleys and ridges are fully filled with glacier masses at high altitudes above ca 6,000 m. A remarkable phenomenon is also the occurrence of the relics of glacial and related sediments of Upper Pleistocene and Holocene age.

The valley glaciers in the Makalu Barun region arose by the retreat of a large glacier (Fig. 8) and it is splitting up into smaller flows. The largest slope glaciers are developed on broad ridges in the vicinity of the 6,250 m and 6,170 m peaks and below the southern Makalu face. Here hanging glaciers form the main feeding source for the lower-lying slope and



Fig. 8 Landforms in the foreland of the Upper Barun glacier situated between 4,900 and 4,700 m a.s.l. and the Barun Pokhari lake. Relics of Upper Pleistocene to modern moraines as well as Holocene to Sub-recent lacustrine sediments and outwash fan deposits have been preserved (see also Figure 9). The oldest conserved glacial sediments of the Upper Barun glacier originated during the Late Glacial Maximum. Rock glaciers and recent landslide deposits are also remarkable. Photograph by Jan Kalvoda (April, 1973).

valley glaciers and avalanche masses (Kalvoda 1978, 1979a, b). Remarkable geomorphic signatures of substantial loss in the volume of glaciers during the late Holocene are expressed by a variety of landforms (Fig. 7 and 8). Gravitational landforms include active talus fans developed at the foot of huge rock faces as well as older talus fans of great areal extent, and accumulation piles resulting from avalanches, rockfalls and landslides.

3.3 Periglacial zone

High rates of erosion and denudation have been observed in the periglacial environment around the lower part of glaciated area (Fig. 5 and 6). Intense freeze-thaw activity of water is the basis of periglacial processes and related landforms. A remarkable enlargement of the active periglacial zone increases the volume of transported products of erosion and denudation and the level of geomorphological hazards, including frequent mass movements (triggered also by earthquakes; compare e.g. Fort 2000; Avauac 2003; Bilham 2019), avalanches, landslides and flash as well as outburst floods (Byers et al. 2019; Kalvoda and Emmer 2021). The current decrease in the distribution of permafrost has implications for landscape stability, which is reflected in solifluction movements, rock-glacier evolution and sediment release into streams and rivers.

In the foreland of glaciers in the Barun valley a system of slope, glaciofluvial, lacustrine and fluvial

accumulation landforms have developed (e.g. Fig. 8). The Late Holocene to modern terraces and cones of outwash sediments represent the earlier of two generations of glaciofluvial landforms which occur in the depressions between individual moraine ridges. They occur on the floor of the valley between the Holocene frontal moraines of the Upper Barun glacier and the left lateral sub-recent moraine of the Lower Barun glacier near the Shershon site (Fig. 9). From the Lower Barun icefall south of the Peak IV Massif to the Tadosa site, the valley floor is filled with ridges of fossilised oscillation moraines, rockfalls, talus fans and the retreating glacier tongue.

In the periglacial area of the Barun Khola valley between the present-day end of the Lower Barun glacier and Yanle Khalka locality are conspicuous features of rapid nival and fluvial erosion, active exfoliation sculptures on the rock walls and varied slope processes (Fig. 10). Remarkable are products of recent flash floods, landslides and related mass movements. Mass-wasting processes are intensified and slopes are deeply denuded (Kalvoda and Emmer 2021). Very marked periglacial landforms are rock glaciers that have been situated on steep slopes above glacier basins and in zones from which glaciers have retreated but a cold climate still persists.

The presence of recent and former lakes of glacial origin on the Barun valley floors is indicated by three terraces of lacustrine sediment up to 6 m thick, lying between the fronts of the tongues of the Upper Barun glacier and the Shershon site, surrounded throughout by fossil moraines. The middle of these is the largest, situated at 4,850 m a.s.l. between the sub-recent frontal moraines of the Upper Barun glacier and the glacier of the eastern faced of Peak IV. Minor relics of lacustrine terraces lie on the banks of the Barun Pokhari lakes at two levels; the higher of the terraces corresponds to the level of the filled lake before the collapse of the morainic dam.

In the periglacial morphoclimatic zone extends a vegetation belt of alpine shrubs and meadows with typical representatives of *Rhododendron* species, *Juniperus* and *Lonicera*. Sporadic flowering plants appear in protected places on steep scree-covered slopes even in the vicinity of the snowline. The upper boundary of the alpine steppe is in some places modified by rock outcrops. At altitudes of 4,500–5,000 m, the granular character and occasional movements of sub-recent to modern lacustrine and glaciofluvial sediments hinder and retard the establishment of vegetation over large areas.

The contact of the sub-recent moraines of the Upper Barun and Chago glaciers at 5,450 m a.s.l. (Fig. 11), covered relatively continuously with grass and moss, is the uppermost locality at which plants occur. Above 5,200 m, the zone of alpine shrubs and meadows passes into an extremely cold semi-arid zone with moss and lichen assemblages. Organic landforms include rocky outcrop surfaces and detritus affected by

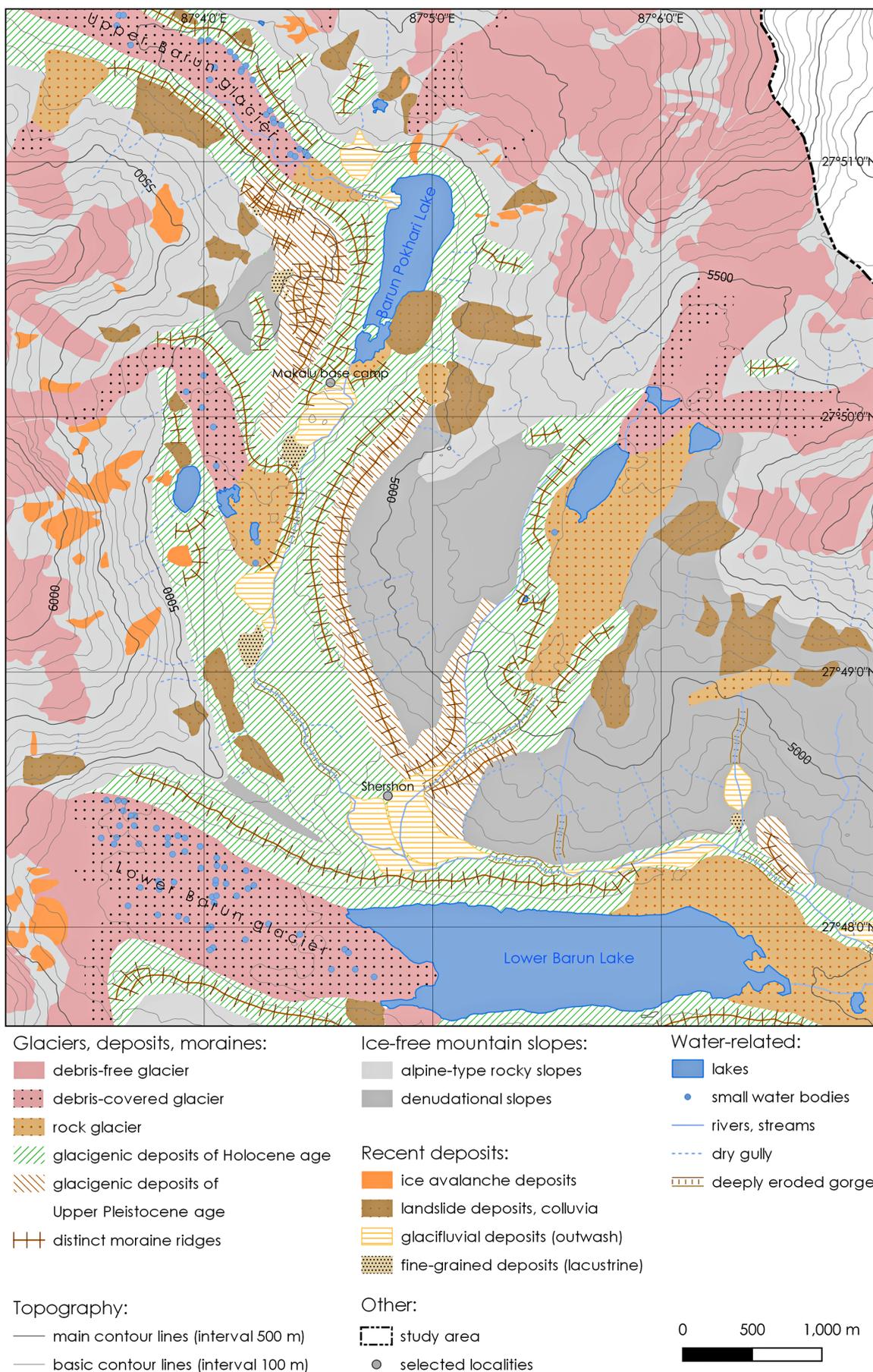


Fig. 9 Geomorphological map of the area between the southern face of the Makalu Massif and the Lower Barun glacier (Kalvoda and Emmer 2021).



Fig. 10 Landscape around the Lower Barun glacier between the icefall above Shershon site (4,752 m a.s.l., in the background) and Phematan (3,483 m) in the Barun Khola valley developed in the paragneisses of High Himalaya nappe. Remarkable are detachment planes of rockfalls, glacial and glacialfluvial deposits as well as accumulation landforms of landslides and related mass movements. Photograph by Jan Kalvoda (May, 1971).



Fig. 11 High-mountain landscape above the permanent snow line (5,500–5,600 m a.s.l.) west of the Makalu Massif gives remarkable evidence for retreating of glaciers, extremely high intensity of weathering processes and varied mass movements in very cold and semi-arid climatic conditions. The hill of glacial and slope deposits (5,450 m a.s.l.) in the central part of figure was the highest site where *Alticola stoliczkanus* was found. Photograph by Jan Kalvoda (April, 2006).

biogenic weathering above the upper boundary of the alpine steppe (at 4,950–5,100 m a.s.l.), which is irregularly covered with mosses and especially lichens.

3.4 Seasonally cold/warm humid zone

The Barun Khola canyon-like valley has a strongly U-shaped form and it is primarily of glacial origin with the main stages of its landform evolution during the Middle and Late Pleistocene. The periglacial

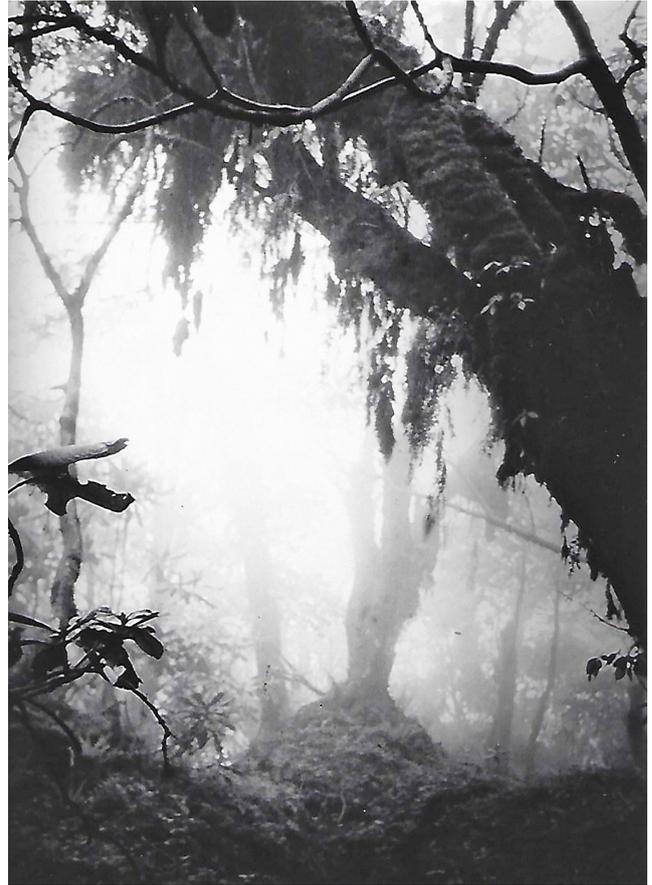


Fig. 12 Vegetation zone of the subtropical evergreen mountain mist forest occurs in the lower part of the Barun Khola valley up to 3,100 m a.s.l. Epiphytic plants, receiving water from air humidity, cover the trunks and branches of trees and shrubs. Photograph by Milan Daniel (March, 1973).

weathering features of the marginal ridges of the Barun Khola valley disappear even before this valley enters the rocky cliffs of the High Himalayan nappe in the evergreen monsoon mountain forest zone. The Barun Khola valley floor, at up to 2,800 m a.s.l., is covered by thick deposits of glaciofluvial and slope sediments of Holocene age cut by vertical erosion from the Phematan site to as low as the paragneisses and granulites bedrock of the lower part of the High Himalayan nappe. At altitudes in the range of 1,800–3,100 m is remarkable a subtropical evergreen mountain mist forest (Fig. 12) with *Pinus khasya*, *Quercus lamellosa* and other oak species, *Tsuga dumosa* and *Abies densa*.

The Barun Khola and Arun canyon-like valleys are areas of frequent natural disasters with high risks involved to all types of human activities (Kalvoda 1984a, b, 2007; Byers 1996; Chhetri et al. 2017). A large number of rockfall accumulations has been found in the lower part of the Barun Khola valley. The erosion and denudation of rock massifs is driven by tectonic activity and the humidity of the summer monsoons. Makalu Barun National Park and Conservation area protects a broad range of Himalayan forest types, ranging from near-tropical dipterocarp monsoon forest (up to 400 m a.s.l.) to subalpine conifer stands (4,000 m a.s.l.). Below ca 2,000 m a.s.l. forests

are strongly affected by subsistence agricultures (Carpenter and Zomer 1996) and above 2,000 m a.s.l., a cool, humid climate suppresses agricultural activity.

4. The occurrence of small terrestrial mammals in the Makalu Barun region

Small terrestrial mammals and birds were collected by Milan Daniel in the complex of Barun valleys (Fig. 9), which are formed by the Upper Barun and Lower Barun glaciers from which the Barun Khola river is rising as the right tributary of the Arun river. There were selected seven main localities (in a span of 3,450–5,950 m a.s.l.) of differing landform patterns, the current environmental conditions, and geomorphological history. At these sites the collection was carried out in all habitats (biotopes) allowing the occurrence of small terrestrial mammals (Tab. 1).

Landscape patterns of the zoological sample sites were as follows:

1. *Phematan* (27°44'20.86"N, 87°11'15.04"E; 3,483 m a.s.l.): 1A – Glacio-fluvial deposits on the valley floor, on the right bank of the Barun Khola river (running from NWW to SEE), comprised coarse sandy or gravel material overgrown with turf. These deposits were bordered by a humid coniferous forest mixed with rhododendrons. In summer, the glacio-fluvial terrace serves as pasture and an occasional camping site for shepherds. 1B – Fluvio-glacial deposits on the left bank of the Barun Khola river, densely overgrown with low creeping shrubs and partly covered with large rock fragments, devoid of any traces of human activity. 1C – Accumulation of a rockfall with coarse sandy material, covered with turf and moss, on the left bank of river. 1D – Forest margin near the preceding biotope with numerous uprooted trees situated on the left bank of river.

2. *Yanle Khalka* (27°46'21.31"N, 87°09'15.72"E; 3,743 m a.s.l.): 2A – Upper Holocene river accumulation terrace is composed of coarse sand, gravel and boulders, with the vegetation strongly modified by grazing, when shepherds inhabit the surface of river terrace. 2B – Edge of fir-tree forest (*Abies spectabilis* and rhododendrons) situated on glacio-fluvial deposits. 2C – Fluvio-glacial terrace with chaotic piles of rocky blocks, covered with boulders and scattered areas of turf. The uneven surface of the terrace is a result of intensive periglacial processes. 2D – Fir-tree forest on the end of a large talus slope. 2E – Edge of a fir-tree forest with numerous uprooted trees located on slope deposits.

3. *Tadosa* (27°47'59.25"N, 87°06'26.43"E; 4,555 m a.s.l.): 3A – Loamy screes under walls built by crystalline rocks exposed at the eastern side of the valley. The slope material consists of a sandy deposits accumulated by perennial melt water from snow fields, and is overgrown with *Lonicera* sp. 3B – recent

aluvium of the river and moraines with willow shrubs in front of the Lower Barun glacier. 3C – Sandy-debris talus fixed by vegetation (rhododendrons, tsuga, willows, developed herb layer) serving as a summer pasture.

4. *Shershon* (27°48'29.00"N, 87°04'40.07"E; 4,752 m a.s.l.): 4A – Paraglacial depression situated between the Upper Holocene moraine of the Lower Barun glacier and the right side of valley covered with debris and sandy material. Turfs and creeping rhododendrons are present. 4B – Dissected surface of the washed out fluvio-glacial cone on the valley floor where a stone enclosure for round up of sheep and goats had been built at the highest level of the valley which was utilized as pasture. 4C – Southern edge of the recent frontal moraine of a slope glacier situated below the eastern face of Peak IV near the plateau of lacustrine deposits.

5. *Front of the Upper Barun glacier* (27°50'40.01"N, 87°05'16.08"E; 4,930 m a.s.l.): 5A – The base camp of the expedition at the base of Upper Pleistocene moraine. 5B – Boulders scattered at the base of a large Holocene moraine. 5C – Recent moraine of a slope glacier of the eastern face of Peak IV. 5D – The hill part of a side Holocene moraine of the Upper Barun glacier. The moraine surface is remodelled by periglacial processes and is covered with initial polygonal soils. 5E – the Holocene moraine situated along the left side of the Upper Barun glacier.

6. *Junction of the Upper Barun and Chago glaciers* (27°52'49.80"N, 87°02'14.32"E; 5,490 m a.s.l.): 6A – Rampart of the Upper Holocene moraine above the junction of the glaciers, formed by chaotic block accumulations. In this site, Camp 1 of the French climbing expeditions was situated in 1954, 1955 and 1971. 6B – NW of the preceding biotope, about 500 m away, there are large rocky slopes covered by strongly weathered blocks and scree of paragneises and granites.

7. *The top of the rock tower in the lower part of the SW face of Makalu* (27°51'47.50"N, 87°05'16.08"E; 5,950 m a.s.l.): It is situated at the end of a rocky ridge between hanging glaciers. Camp 1 of the Czechoslovak climbing expedition was situated at a small platform of cryogenically weathered black gneisses with dykes of granites. The only ice-free way leading to this site is crossing precipitous rocky outcrops and steep slopes covered by debris of crystalline rocks.

Altogether 139 small terrestrial mammals were collected and evaluated taxonomically (Daniel and Hanzák 1985). They comprised 11 *Soriculus nigrescens centralis* (Hinton 1922), 8 *Episoriculus caudatus soluensis* (Gruber 1969) (Soricomorpha, Soricidae), 10 *Ochotona roylei roylei* (Ogilby 1839) (Lagomorpha, Ochotonidae), 98 *Neodon sikimensis sikimensis* (Hodgson 1849), 10 *Alticola stoliczkanus* (Blanford 1875) (Rodentia, Cricetidae), and 2 *Niviventer eha* (Wroughton 1916) (Rodentia, Muridae); see Table 1. Birds were collected in the same localities as small mammals. Most of them were shot by gun and

Tab. 1 Distribution of small terrestrial mammals by locality found in the Barun valley during the year 1973 (Daniel 2015, 2017).

	Date	Species	Number
Phematan 3,450 m a.s.l.	25/03–4/04	<i>Episoriculus caudatus soluensis</i>	4
		<i>Soriculus nigrescens centralis</i>	7
		<i>Neodon sikimensis sikimensis</i>	44
		<i>Niviventer eha</i>	2
		<i>Ochotona roylei roylei</i>	7
Yanle Khalka 3,600 m a.s.l.	4–9/04	<i>Episoriculus caudatus soluensis</i>	3
		<i>Soriculus nigrescens centralis</i>	4
		<i>Neodon sikimensis sikimensis</i>	35
		<i>Ochotona roylei roylei</i>	1
Tadosa 3,900–4,000 m a.s.l.	12–19/04	<i>Neodon sikimensis sikimensis</i>	17
Shershon 4,600 m a.s.l.	26/04–2/05	<i>Neodon sikimensis sikimensis</i>	3
Front of the Barun Glacier 4,900 m a.s.l.	21/04–14/05	<i>Alticola stoliczkanus</i>	9
		<i>Ochotona roylei roylei</i>	1
Junction of Barun and Chago glaciers 5,450 m a.s.l.	8/05	<i>Alticola stoliczkanus</i>	1
Top of the rock tower SW face of Makalu 5,950 m a.s.l.	8/05	<i>Ochotona roylei roylei</i>	1
Total			139

only a few were caught in nets. A total of 94 birds of 28 species were collected (Daniel and Hanzák 1993): Galliformes (three species), Charadriiformes (one), Columbiformes (one), Coraciiformes (one) and Passeriformes (22 species).

Representatives of the Soricidae (*Soriculus nigrescens* and *Episoriculus caudatus*) were found only in the first two valley zones described (Phematan and Yanle Khalka). Soricidae have not extended their range to higher altitudes, although suitable biotopes (primarily the forest composed of *Abies spectabilis*, drained by rivulets and with humid sparsely overgrown places) exist at Tadosa locality. Similar observations apply to *Niviventer eha*.

Neodon sikimensis is the most abundant small terrestrial mammal in the Barun valley penetrating (Table 1), ranging from the lowest zone to the level of the lacustrine terrace in the front of recent moraine of the Barun glacier. The great ecological adaptability of this species enables it to occupy all biotopes with favorable vegetation cover in the lower part of the valley, irrespective of their ages and origins. In the higher part of the valley, this species inhabits the fossil moraines stabilized by present-day vegetation, which are primarily rhododendrons. The upper boundary line of its observed distribution represents the Holocene moraine of a hanging glacier tongue at foot of the eastern face of Peak IV, which formerly also participated as a dike of the middle glacial lake.

The occurrence of *Alticola stoliczkanus* follows the upper range of *N. sikimensis* (Table 1). The glacial landforms designated as the upper limit of the distribution of *N. sikimensis*, demarcate the lower limit

of the distribution of *A. stoliczkanus*. This species is a distinct hypsobiont in a landscape otherwise devoid of small terrestrial mammals. Despite the fact that *Ochotona roylei* was found at the highest altitude, its distribution is concentrated in much lower elevations, primarily in the section between Yanle Khalka and Tadosa sites (Fig. 10). This is in line with the overall distribution of *O. roylei* in Nepal, published by Thapa et al. (2018). These authors consider the occurrence of this species at an altitude above 5000 m a.s.l. to be rather exceptional and cite our find as the highest in Nepal so far. It is evidence of the high potential of adaptability of this pika to the environment of the high mountains. In doing so, an important factor in this herbivorous species is the consumption of fresh and dry plant material of a wide species spectrum, including mosses and lichens. Cercophagy (eating one's own droppings) is a supplement to the ability to make maximum use of the food.

Neodon sikimensis showed a clear preference for open spaces, but also readily inhabits both the forest edges (locality 1D; 2B, 2E) and the interior of dense forest (1B; 2D), where it was always the most abundant small terrestrial mammal. *N. sikimensis* is the only species among the small terrestrial mammals, which ranges from the lowest altitudinal zone of the Barun Khola valley into places high above the 4,900 m a.s.l., confirming the striking ecological adaptability of this species. Grassy open spaces inhabited by *N. sikimensis* (localities 1A, 1B; 2A, 2C; 3C) display characteristic piles of displaced soil and traces of burrowing. The greatest concentration of such signs of vole activity was observed in spaces, which serve



Fig. 13 Conifers grade of mountain forest with rhododendrons and *Abies spectabilis* fir is substantially destroyed above Phematan site in the Barun Khola valley (at 3,500 m a.s.l.) by human activities especially at summer pasturelands near the treeline. Photograph by Milan Daniel (May, 1973).

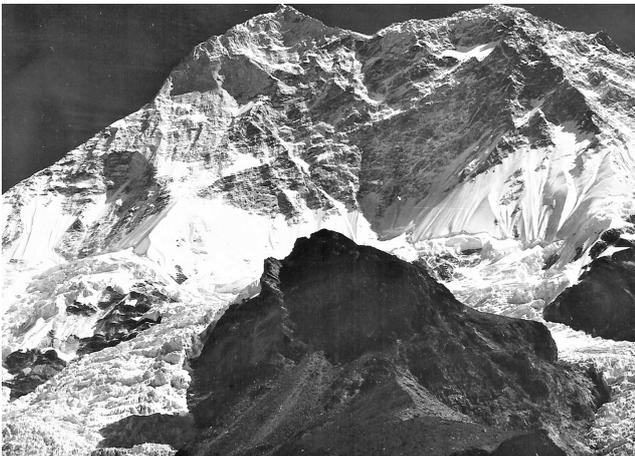


Fig. 14 Beyond the top of black gneisses tower (5,950 m a.s.l.) in the lower part of the south-western Makalu wall originated blocky fields of cryogenically weathered crystalline rocks. It was the highest site where *Ochotona roylei roylei* was found. Photograph by Milan Daniel (May, 1973).

as temporary round-up areas for pastured animals (Fig. 13).

Comparison of the results obtained in all localities where *N. sikimensis* occurred reveals how the presence of humans and pastured sheep flocks as well as economic activities producing heaps of organic waste in otherwise sterile landscape, can affect the occurrence of this species, which is showing a tendency towards synanthropy. Association of *A. stoliczkanus* was also influenced by human activities. The base camp of mountaineering expeditions, with stored foodstuffs and concentrated garbage, attracts *A. stoliczkanus*. The animals concentrated in locality 5A within three weeks of the base camp being established. The highest altitude at which *A. stoliczkanus* was found (5,450 m; locality 6A; Fig. 11) topographically coincides with an islet of Alpine tundra vegetation. Even in this case, however, the survival of local population may have been affected by human activities because in this

locality the camps of French expeditions were pitched in 1954, 1955 and 1971. A considerable amount of garbage (primarily tin cans and other packaging) suggests that in those years there was an unusual supply of food for small terrestrial mammals.

Our finding of the pika *Ochotona roylei* at 5,950 m a.s.l. (Table 1) is also evidence of human influence on the Alpine fauna. This pika was found at the site of camp 1 of the Czechoslovak mountaineering expedition (Fig. 14), and in the previous year (in the autumn post-monsoon period 1972) a camp of the Yugoslav expedition to Makalu was pitched there. It is situated above the permanent snowline and is devoid of any vegetation except for lichens on rocks. The animal, in order to reach this place, had to overcome rocky slopes and of unconsolidated debris. This camp 1 was supplied with foodstuffs, which attracted the animal. Tracks in the fresh snow indicated that the pika first sought garbage outside the tents, later entering the tents and finally accessing the boxes containing food supplies, chocolate being the most attractive to the animal.

5. The origin of small terrestrial mammals

The High Himalaya functions as an almost impenetrable divide between the Palearctic (Tibetan) and Oriental (Indo-Malayan) biogeographical regions. At least since the Upper Pleistocene, life has been maintained at the forefront of the Himalayan glaciers, pushed back by them into lower elevations during repeated advances only to migrate again closer to the ridges during retreat of glaciation. These environmental processes took place during long-term orogenic uplift of mountain ranges by about 4,000–5,000 m in the East Nepal Himalaya during the Quaternary. The dynamics of landform evolution of the High Himalaya in the Quaternary have become a decisive factor in species distribution and in the direction of migratory routes of small terrestrial mammals.

The present state of the distribution and living conditions of small terrestrial mammals in the Barun region is controlled by the processes causing the colonization of these high-mountain areas. Two aspects are particular here in comparison and linking of biological and geomorphic data. All detected representatives of the Barun fauna are of Palearctic origin, while the only open contemporary aspect of the Barun valley is southwards in the direction of the Oriental biogeographic region. Weigel (1969) designates the species *Soriculus nigrescens*, *Episoriculus caudatus* and *Niviventer eha* as faunistic elements with Palearctic-arboreal Nepalese distribution (sensu De Lattin 1967); *Neodon sikimensis* as Palearctic-arboreal (Sino-Tibetan) element and *Alticola stoliczkanus* as Palearctic (Tibetan-eremic) species.

The Barun Khola river empties at 1,350 m a.s.l. into the canyon-like valley of the Arun river (Fig. 3),



Fig. 15 The deforested structural denudational slopes above the Barun Khola and Arun river valleys around the Sedoa village ($27^{\circ}35'N$, $87^{\circ}16'E$; ca 3,400 m a.s.l.) are affected by strong precipitation and associated erosion processes of soils. The broken slopes are reshaped by forest burning, clearing and agricultural terrace fields up to altitudes of 3,200 m. Photograph by Jan Kalvoda (April, 2006).

which rise from the glaciers of the northern slopes of the main Himalayan ridge and join the semi-arid cold zone of the Trans-Himalaya. It is remarkable difference between the semi-arid cold climate of Tibetan region in the north and Nepalese humid monsoonal climatic conditions in the south (e.g., Wager 1937; Bordet 1961; Kalvoda 1978, 2021; Chowdhury et al. 2022). The Arun river valley transects antecedently the rock assemblages of the High Himalaya, Lower Himalaya and Siwalik in the meridian direction, and opens into the Ganges Plain. This transverse suture through the High Himalaya, representing one of the most ancient relicts of the pre-Quaternary drainage pattern, might have been a corridor for the exchange of faunistic elements between the northern Tibetan Plateau and southern Indian sub-continent during the Quaternary. Today the confluence area of the Arun and Barun Khola rivers occurs in the zone of the warm and humid montane climate of the sub-tropical evergreen forest (Fig. 12). Extensive steep erosion and denudation slopes above the confluence of both rivers are situated in the seasonally cold/warm humid morphoclimatic zone (Fig. 15). Expansion of small mammals into the Barun valley is possible for species that can survive in these environments.

Climate change affects all Earth surface systems but with the greatest impact in high-altitude cold environments, especially through its impact on frost penetration and duration within the ground surface layers and by altering vegetation cover. We take into account the rapid uplift of the High Himalaya (Fig. 3) and substantial changes of its glaciation during the Quaternary. It is the period when small terrestrial mammals might have been differentiated to the level of today genera. The most interesting are the representatives of species and genera currently found at the highest elevations: *Alticola stoliczkanus*, representing



Fig. 16 Pika *Ochotona roylei roylei* was found in the Barun valley at the altitudes of 3,450–5,950 m (after Daniel 1973; see also Figure 14). Photograph by Milan Daniel (April, 1973).

the genus known in the Asian region since the Pleistocene, and *Ochotona roylei* (Fig. 16), belonging to the genus known (after Simpson 1945) also since the Pleistocene.

Analysis of the results obtained in our collecting sites (Table 1) shows that even the present state of georelief, climatic and vegetational conditions in the bottom part of the Barun valley would not prevent colonization by *Neodon sikimensis*, *Niviventer eha* and the two shrew species. Of these, only *N. sikimensis* is found above the timberline. The occurrence of pikas in the lowest zones of the Barun valley is not confirmed. Their presence in the Shipton Pass ($27^{\circ}41'01''N$, $87^{\circ}12'16''E$; 4,216 m a.s.l.) indicates that their migration might have taken place through tributary hanging valleys. In contrast, the present distribution of *A. stoliczkanus*, which forms sharply limited and isolated population, has the upper occurrence close to the forefront and glaciated area of the Upper Barun glacier as high as the permanent snow line.

The High Himalayan ranges, preventing the migration of fauna and flora, were not an invincible barrier up to the Middle Pleistocene. There were favourable conditions for the southward spread of psychrophilic fauna, including representatives of the genus *Alticola*. During the Pleistocene, in the period of culminated collision orogeny, the Chomolongma, Makalu and Chamlang Massifs were uplifted. The faunistic connection between the deeply continental Tibetan Plateau and the Indian sub-continent was consequently interrupted both by the rising mountain vault and the beginning of its continuous glaciation. Only transverse morphotectonic sutures of the antecedent valleys in the High Himalaya, e.g. of the Arun river, remained open to the penetration of faunistic elements, namely during interglacial periods.

Small terrestrial mammals had to immigrated exclusively through the Arun river valley either from the area of contemporary Sibrung ($27^{\circ}41'31''N$, $87^{\circ}22'31''E$; 1,800 m a.s.l.) at the mountain stream

Barun Khola mouth of the river Arun directly upward into the Barun valley, or indirectly through the Shipton Pass (27°41'01"N, 87°12'16"E; 4,216 m a.s.l.) continuing along the crest of the contemporary pasture-settlement Mumbuk (27°42'58"N, 87°12'38"E; 3,700 m a.s.l.). Migration through the Shipton Pass could have been a) through the Kasuwa Khola valley (Fig. 15) flowing into the Arun river near the contemporary settlement Num (27°32'25"N, 87°17'29"E; 1,340 m a.s.l.) continuing northward directly to the Shipton Pass, or a parallel way b) through the Isuwa Khola valley situated further west. These migration paths followed the changes and vegetation ascent of Rhododendron-coniferous forest (the upper belt of tropical evergreen montane forest) and moist alpine scrub and meadows. Any alternative migration route for small terrestrial mammals from the north was excluded owing to the inconvenient orographic and glacial conditions (Daniel and Kalvoda 1978; Daniel et al. 1985; Kuhle 1991, 2006a, b).

The psychrophilic fauna of northern origin in the southern Nepalese valleys of the Himalaya are consequently restricted by two boundaries: in the north by an orographic barrier with a strictly unsurpassable zone of continuous glaciation effective since the Upper Pleistocene, and in the south by a bioclimatic boundary. Representatives of the genus *Alticola* found on the late Quaternary moraines of the Barun glacier and in its close foreland are the remains of the population separated from the northern Tibetan populations during the Upper Pleistocene by extensive glaciation of the highest ranges of the High Himalaya. The initial migration route of *Alticola* spp. was most probably from the north directly through the gradually rising mountain ranges and not through the Arun river valley and then along the Barun Khola valley. This interpretation agrees with the systematic classification of the east-Nepalese representatives of the genus *Alticola*, which were listed by Biswas and Khajuria (1955). These authors were the first to describe *Alticola bhatnagari* based on specimens from the Khumbu Himal region. Gregori and Petrov (1976) consider this taxon to be a subspecies of *Alticola stoliczkanus bhatnagari*. They point out that the representatives of the *A. stoliczkanus* populations from the southern slopes of the Himalaya are distinctly smaller than those from the northern Tibetan elevations as already reported by Hinton (1926).

A similar history of migration also may account for the distribution of pikas (Table 1), which extended as high as the forest zone owing to their greater ecological adaptability. For *N. sikimensis*, initial colonization of the Barun valley may have been by offspring of the original migrants penetrating directly from the north together with representatives of the genus *Alticola*. These species can migrate since the Upper Pleistocene along slopes near the mouth of the Barun Khola from the Trans-Himalayan and High Himalayan part of the Arun river valley.

6. Colonization of the Makalu Barun region by small terrestrial mammals

Comparison of the present occurrence of fauna and flora and geomorphological patterns of the Makalu Barun area, primarily in the key sector between the southern part of the Makalu Massif and the tongue of the Lower Barun glacier near Shershon (Fig. 9), facilitates a reconstruction of relations between advance and retreat of mountain glaciation and the spread of small terrestrial mammals since the Late Glacial Maximum in the Upper Pleistocene up to the present time.

Natural features significant for the spread of small terrestrial mammals in the Barun glacier area are characterised by landform patterns as abiotic elements of the environment. The alpine-type (arête) relief of predominantly gneiss and granite rocks, characteristic of highly rugged ridges, peaks and cols and precipitous walls (Fig. 1 and 14), is inaccessible to migrating fauna both in the glacial zone above the permanent snow line (at present ca 5,600–5,700 m a.s.l.) and in the foreland of the glaciers. Denudational slopes with block debris deluvium form extensive areas above the contact between the Upper Barun and Chago glaciers in the Pethangtse Mt. direction (Fig. 11) and in some places also form the foot of faces of Peak IV and Makalu Massifs. The glacier bulks and permanent snowfields furrowed by systems of crevasses and avalanche scars represent extremely unfavourable ecological conditions.

Relatively favourable environment for small mammals are late Quaternary deposits of glacial, glacio-fluvial, lacustrine and eolian origin, together with current slope debris and talus cones. Some of these accumulation landforms in the periglacial morphoclimatic zone of the Makalu Barun region are covered with vegetation of Alpine tundra. The thickness and position of glacier tongues during the Late Glacial Maximum as well as their retreats and advances in the Holocene created a barrier against the spread of fauna. The course of expansion of fauna also depends on local landforms and microclimatic conditions, including glaciological and hydrological features. In the periglacial zone (Fig. 5 and 6) are in progress intensive regelation processes of repeated freezing and thawing of water in weathered deposits, solifluction and related phenomena of mass movements.

In some places the continuous sheet of ice tongues through the debris of surface moraines indicates the possible direction of migration of psychrophilic species of small terrestrial mammals across the ice-covered valley. The still preserved as well as extinct lake surfaces, together with the rapid glacier torrents represent unsurpassable obstacles. The great distance between the individual sites suggests the possible spread of small terrestrial mammals, as described above. Apart from direct evidence of small mammals, indirect evidence was provided by the long lasting,

Tab. 2 The expansion of small terrestrial mammals associated with essential changes of glacial and periglacial morphoclimatic processes in the Makalu Barun region from the Upper Pleistocene up to the present day.

Stratigraphical divisions of the Quaternary (<i>MIS = Marine isotope stages</i>)	Main glacial stages in the East Nepal Himalaya and their approximate dating (Kalvoda 2007, 2020)	Extension and migration of small terrestrial mammals in the Makalu Barun region and its neighbouring Himalayan areas
----- 0.00 Ma Holocene Epoch ~MIS 1 (<i>warm period</i>)	Rapid retreat of glaciers and increasing human influence on the high-mountain environment. Little Ice Age (Historical, Recent, ca 1,000–850 years ago) Lobuche (2,000–1,000 years ago; Lingten-type moraines) Retreat of glaciers (3,000–2,000 years ago) Thukhla (Mid-Holocene, ca 4,900–3,600 years ago; Khumbu-type moraines) Retreat of glaciers (8,000–4,000 years ago) Chhukung (Early Holocene, 10,000–8,000 years ago; Changri-type moraines)	Opening of migration routes of <i>Alticola stoliczkanus</i> and <i>Ochotona roylei</i> to the ice-free sites above 5,000 m a.s.l. Small mammals survived during the colder periods in the periglacial zone (pushed down) and/or on the higher situated former moraines and other types of deposits with isolated thawing surface layers of permafrost up to the altitudes of ca 4,600 m. The extension of small mammals depends during the Holocene on spatial changes of periglacial and glacial climate-morphogenetic zones. The occurrence of fauna and flora in the high-mountain valleys is proportional to changes in the extent of seasonally thawing surface layers of permafrost on glacial, glacio-fluvial, slope, lacustrine and aeolian deposits.
----- 0.0117 Ma Pleistocene Epoch: Upper Pleistocene (MIS 2 – <i>maximum of cold period</i>) (MIS 3 – <i>cold period</i>) (MIS 4 – <i>cold period</i>)	Retreat of glaciers (13,000–10,000 years ago) Pheriche II (13,600 years ago) Pheriche I (Late Glacial Maximum, 25,000–16,000 years ago; Dusa-type moraines) Thyangboche II (36,000–25,000 years ago; the development of well-preserved glacial valleys) Thyangboche I (Late MIS4–Early MIS3, 74,000–(top 57,600)–36,000 years ago; it is the maximum extent of glaciation in the Upper Pleistocene during which the oldest U-shaped valleys and high situated flat glacial valleys originated.	Gradual return of small mammals to the Barun and related valleys by their migration on glacial and slope deposits was enabled by the expansion of periglacial zone. Small mammals were again pushed away from heavily glaciated valleys to the lower situated periglacial zone. Migration route and extension territory of small mammals remains open in the periglacial zone of the Arun valley. The extensive glaciation excluded occurrence and survival of small mammals in the mountain valleys. The migration of Palearctic species of small mammals across the gradually emerging orographical barrier during the orogenesis of the High Himalaya was completely interrupted by the development of glaciation in the Thyangboche stages (relics of related glacial deposits are not preserved).
----- 0.126 Ma Middle Pleistocene (<i>MIS 5, warm oscillation</i>) ----- 0.781 Ma (<i>MIS 19, warm oscillation</i>)	Later morphogenetic processes could destroy landforms of glacial origin, which would be evidence of the Middle Pleistocene glaciations.	Palearctic fauna and flora were widespread throughout the gradually evolving Himalayan mountain ranges until the early period of the Upper Pleistocene.

repeated flights of a pair of eagles above denuded debris slopes in the Barun valley head. These raptors prey upon small mammals.

Preceding particular considerations about the origin of the mammalian fauna in the varied environment of the Makalu Barun region are composed with knowledge of landform evolution since the Upper Pleistocene (see Table 2). During the Late Glacial Maximum (25,000–16,000 years ago), proved by the considerable advance of glaciers, the fauna of the upper part of the Barun valley was pushed by ice masses at minimum to the Yanle Khalka locality, that is to altitudes below 3,600 m. Advanced tongues of the Upper Barun and Lower Barun glaciers were joined together and they also developed conspicuous Dusa-type moraines. The upper part of the Barun valley was lifeless during the Late Glacial Maximum (Table 2). This extremely cold environment was characterised by strong action of cryogenic, nival and glacial processes.

During the Late Glacial Maximum, the width, position and thickness of glaciers and the abrasive action of their ice masses in the Makalu Barun region were influenced by changes of climatic conditions as well

as morphotectonic activity with developing extreme dissection of mountain massifs. The largest areas of glaciation in the Upper Pleistocene were concentrated in the upper end of the Upper Barun glacier valley, which cuts between the Chomolongma and Makalu Massifs into the main ridge of the High Himalaya. This strongly glaciated area passes with a wide transfluence of ice masses into the Kangshung valley to the east of Sagarmatha. The glacial polish on the groups of roches moutonnées, exposed 1.5 km from the peak of elevation point 6,260 m, in the vicinity of the 6,540 m peak below the northwestern face of the Makalu and above the Barun Pokhari lake towards the Japanese Col, provide evidence of the considerable extent of the Upper Pleistocene period of glaciation.

In the Late Glacial Maximum, the tongues of both Barun glaciers joined, but during the later glacier regression, they already became separated. The lateral glacial valleys and crests protruding from the Peak III Massif constitute a remarkable denudation level with alpine-type modelling in a progressive stage of destruction. The relatively considerable width of the Lower Barun valley is striking, being

preserved to the southern foot of the Makalu Massif and to the south up to the prism-shaped Peak VI Massif. The western crest of the Peak VI (6,840 m) passes into the strongly glaciated group of peaks in the Chamlang Massif (7,290 m) with a huge system of hanging glaciers.

Beginning of the interglacial period at the end of the Pleistocene and early Holocene (Table 2) was the main cause that the valley glaciers lost almost half of their volume and retreated by several kilometres. The front of the Upper Barun glacier tongue retreated as far as below the southern face of Makalu. Extensive areas of the periglacial morphoclimatic zone were thus uncovered for the upward migration of fauna and flora not only along the valley floor, but also on the late Quaternary deposits free from ice. The exposed virginal space was gradually colonized up to the front of valley glaciers, where presumably a biocenosis very similar to the present one was created. Together with other hypsobionts these periglacial areas elevations were also colonized by representatives of the genera *Ochotona* and *Alticola*. Likewise the genus *Neodon* most likely migrated to higher localities, possibly as far as the close vicinity of the front of retreated glaciers.

The earliest Holocene advance of glaciers in the Makalu Barun region dates back to 10,000–8,000 years ago (Table 2). Preserved Changri-type moraines indicate that the ice masses at that time filled the main valley almost to the Shershon site. This advance of glaciers pushed again the vegetation and animal communities down to lower parts of the Barun valley. However, the valley glaciers did not reach the dimensions of the preceding advance, so that the huge right-sided Upper Pleistocene lateral moraine below the eastern face of Peak IV was laid bare. Its considerable extent (the biotopes described in preceding chapter as 5B, C, D) facilitated the survival of those communities which can endure the environmental conditions at the boundary between glacial and periglacial morphoclimatic zones. The possibility of an “island” survival of small mammals at this boundary can be indicated, for example, by the seasonal melting of the upper layer of permafrost and the degradation of the ice fill in weathered deposits of glacial and slope origin. On the basis of data on the present environmental requirements, these conditions were agreeable to pikas (Fig. 16) and species of the genus *Alticola*. If these moraines and slope sediments were ever inhabited by *Neodon* in the previous interstadial period, they must have descended at that colder time to periglacial morphoclimatic zone below the front of advancing glaciers.

The subsequent warming up and rise of humidity in the Early Holocene ca 8,000–4,000 years ago (Table 2) forced again the front of the valley glacier to retreat below the southern face of Makalu. Conditions in the ice-free space were restored to those similar to the preceding period of glacier retreat. Colonization

of repeatedly exposed areas continued faster than in the preceding interstadial period. Namely, the first migrants of small mammals comprised members of surviving populations that had been isolated on relics of the Upper Pleistocene moraines below the eastern face of Peak IV. On the contrary, during this regression the lateral valley and hanging glaciers in the upper part of the Barun valley still reached as far as the main glacier tongue, so that the migration routes of small mammals in these areas continued to be blocked.

During the following Middle Holocene advance of glaciers, evidenced by the development of Khumbu-type moraines, the fauna and flora retreated again to lower zones of periglacial conditions, but some isolated populations can survive on the exposed fossil moraines. Not only the Upper and Lower Barun glaciers, but also the hanging glaciers descending from the Japanese Col of the Makalu Massif as well as the eastern faces of Peak IV advanced considerably. A terminal moraine was created which later blocked the present-day Barun Pokhari lake and push moraines of short tongues hanging glaciers (Fig. 8 and 9). The later retreat of glaciers ca 3,000–2,000 years ago (Table 2) produced development of (at least) three lakes from the thawing waters beyond above mentioned dams. These lakes blocked the migration routes of small mammals leading through the valley floor upwards in the wake of a retreating glacier. The newly created biotopes suitable for the existence of small terrestrial mammals near the present front of a glacier were therefore colonized mainly by pikas and mice from autochthonous populations surviving the Holocene advances of glaciers on fossil moraines and slope deposits.

The advancement of small terrestrial mammals from lower elevations was partly blocked by existence of lakes which prolonged during the Upper Holocene the isolation of populations living higher above them. The two lower lakes were later emptied after the terminal moraine of the hanging glacier and the chaotic moraine ramparts above Shershon site had been broken through by erosion, leaving several striking plateaus with prevailingly lacustrine sediments. The discontinuity in distribution of mammalian fauna caused by long-term existence of these Upper Holocene glacial lakes and related landform patterns is apparent up to the present day. The moraine of the hanging glacier of the Peak IV eastern face, contacting the left lateral moraine on the opposite side of the valley, remains as a marked dividing line between the distribution of *Neodon sikimensis* extending to it from the south and of *Alticola stoliczkanus* which colonized the moraine from the north.

The recent retreat of valley glaciers has brought about significant changes in higher parts of their tongues and also in their catchment areas (Table 2). For example, above the confluence of the Upper Barun and Chago glaciers, the structural denudational slopes with block debris were laid bare and some lateral

glacial trains were separated from the main tongue of the Upper Barun glacier. Volume of ice masses around the Hillary's Nunatak (27°55'43"N, 87°01'23"E; 6,140 m a.s.l.) is reduced which is connected above all with the onset of a significant increase of aridity in the extremely cold climatic conditions northwest of the Peak IV – Makalu line. By this means, new areas were created suitable for the colonization by small terrestrial mammals and new migratory routes appeared facilitating the colonization of these islet-like sites. The pronounced increase in aridity of the extremely cold climate northwest of the Peak IV and Makalu Massifs and the substantial decrease in the volume of the glaciers and the lengths of the glacier tongues have persisted up to the present day (Fig. 7 and 11).

The periglacial zone and varied accumulation landforms which facilitate the spread of small terrestrial mammals are rapidly expanding. The areal extent and volume of the glacial, glacio-fluvial and fluvial deposits appear to be remarkably limited when compared to the huge cliffs and slopes being eroded. Slope sediments, especially block eluvia and deluvia, talus cones and foot-of-slope debris are most frequent. On the denudational slopes of gneisses and migmatites and their connecting ridges, block deluvia form continuous fields rimming the foot of isolated rocky outcrops. They also form the substantial part of rockfalls and ice-stone avalanches.

7. Discussion

The mode by which small terrestrial mammals spread is specific for the Makalu Barun region. It probably applies to the entire periglacial zone of the Nepal Himalaya. Large areas of the permafrost domain are ice-rich terrains affected by thermokarst processes. Permafrost is a major factor influencing cold-region hydrology, soil carbon storage and ecosystems. Key feedbacks from permafrost degradation in the context of climate change include transformation in geomorphic and ecosystem processes.

Predictions can be made about the future spread of small terrestrial mammals in the Makalu Barun region. It is most likely that *N. sikimensis* will advance to places close to the present fronts of valley glaciers. For this, there are sufficient biocenotic as well as morphoclimatic conditions in the substantially enlarged periglacial zone. The extensive summer pasturing of sheep as high as these elevations may further accelerate this process. We can observe by the increased burrowing activity of *N. sikimensis* how the presence of man and pastured animals affect the occurrence of this vole species. Anthropogenic disturbances in a dynamic environment, including the possibility of regular burning in a presumed attempt to increase pasture area (Byers 1996), could have significant roles in modifying the Barun valley landscapes. Corridors of disturbance related to contemporary indigenous and

turist use, e.g. tree harvesting, burning and grazing, was observed along the main valley trail, and impacts appeared to be growing in frequency and magnitude.

The substantial changes in the colonization of landscape by small mammals may be anticipated in the highest part of the Barun valley. In newly exposed places near the permanent snow line, the semi-arid climate is more severe than more humid climatic conditions along the front of valley glaciers. It can be endured only by representatives of distinct psychrophilic hypsobionts, such as are *A. stoliczkanus* and *O. roylei* (Fig. 16). Their population will gradually increase and the islet-like character of their distribution will be preserved according to local climatic and geomorphic conditions. Increasing human activities may play a relevant role. This is indicated by the concentration of *A. stoliczkanus* in and around the Makalu base camps at 4,800–4,900 m a.s.l. and by the penetration of *O. roylei* even into much higher located camp I (5,900 m a.s.l.) in the lower part of the southwestern face of the Makalu Massif.

All the trapped animals were examined for the presence of ecto- and endoparasitic infestation (Daniel 1974). This work was carried out while respecting the safety conditions for working with potentially infectious material, which in itself was a problem to carry out in a tent in the harsh Himalayan climate. Such a set has not been (and still is not) collected, analyzed and evaluated in the Himalaya before. Some of the results provided important information supplementing knowledge of the migratory routes of small mammals in the Barun valley during retreat of glaciers and of the role of human activity. Among the parasites that can be bioindicators of change are two groups of external parasitic mites (chigger mites and ticks), which undergo an important part of their life cycle exposed to environmental conditions during their non-parasitic phases of development. Infestations of Ixodid ticks, Trombiculid chigger mites and fleas were tightly linked to the local habitat where these ectoparasites must survive during their non-parasitic phase. An indicator of anthropogenic impact was the occurrence of synantropic flies. Results of parasitological research in the studied area are presented in detail by Daniel (2015, 2016 and 2017). In view of the Palearctic origin of small mammals in higher areas of the Makalu Barun region, one can assume the primary possibility of occurrence of pathogens circulating to the north of the High Himalayan ridge. It is possible to assume an occurrence of arboviruses transmitted by ticks and also rickettsioses transmitted by ticks and chigger mites. Bacteriological infections including plague could be occurred.

Human activity can influence secondary formation of natural foci of vector-borne diseases in several respects. An extensive form of pasturage provides a blood source for adult ticks necessary for the existence of local populations. Arrival of pastured cattle in summer alpine pasturelands (Fig. 13) can repeatedly

introduce ticks, give rise to local populations and thus increase the species spectrum of local fauna. The introduction of an infected tick can, by means of transovarial and transstadial transmission, form a local infected filial generation; in this respect, *Haemaphysalis aponomoides* (Warburton 1913) is potentially dangerous. In addition, the arrival of infected domestic animals can infect local tick populations. Accumulation of organic rubbish positively influences the local population density of small mammals, concentrates them and thus increases their mutual contact and the transmission of infections and of vectors.

The zoological and parasitological research was carried out 20 years before the designation of the Barun-Makalu National Park, i.e. before the application of regulatory measures of nature conservation. It is thus an important comparative material for the evaluation of changes in the biosphere that took place in the next three decades under the influence of observed changes in climate and human activities, as well as for the prediction of the further possible course of these processes. This also fully applies to the spread of diseases transmissible from the wild to humans and possible changes in landscape epidemiology caused by climate change and human activities not only in the Himalaya, but more broadly also in other mountain systems of the Palearctic.

8. Conclusions

Principal regularities of expansion and migration of small mammals caused by the late Quaternary geomorphological history of the Makalu Barun region are explored. The study is based on collection of 139 small terrestrial mammals (Table 1) and 94 birds collected in the Makalu Barun region at altitudes of 3,450–5,950 m a.s.l. in the pre-monsoon period of 1973. Further author's primary data are earlier published results of geomorphological analysis, including a set of geomorphic maps and collection of rocks, and physical-geographical observations from the years 1971–2006. Zoological and parasitological findings are correlated with the landform patterns and their evolution. The correlation testifies to significant changes in the high-mountain environment of the Makalu Barun region during the late Quaternary. It was determined the course of expansion and migration of small mammals related both to the orogenic uplift of the East Nepal Himalaya and climatically conditioned changes in the extent of mountain glaciation and periglacial morphoclimatic zone from the Upper Pleistocene up to the present day.

Palearctic fauna and flora were widespread throughout the evolving Himalayan mountain ranges until the early period of the Upper Pleistocene (Table 2). The migration of Palearctic species of small mammals across the gradually emerging orographical barrier during the orogenesis of the High Himalaya was

completely interrupted by the Thyangboche stages of glaciation in the Upper Pleistocene. This extensive glaciation also excluded occurrence and survival of small mammals in the high-mountain valleys of the Makalu Barun region. Migration routes and the extension of the territory of small mammals remained open only in the periglacial zone of the Arun and Barun Khola valleys. Following the interstadial period of warmer and humid climatic conditions were changed by the Late Glacial Maximum (25,000–16,000 years ago) when small mammals were again pushed away from heavily glaciated valleys to the lower altitude periglacial zone.

During the Holocene interglacial (Table 2), the occurrence of fauna and flora in the high-mountain valleys depended on repeated spatial changes of periglacial and glacial morphoclimatic zones. Gradual return of small mammals to the Barun and neighbouring valleys by their migration on former glacial and slope deposits was enabled by the expansion of periglacial zone. They retreated to lower zones of periglacial conditions during colder periods. In the Upper Holocene, isolated populations of small mammals could survive on the exposed former moraines and other types of weathered and/or transported deposits with seasonally thawing layers of permafrost. Conspicuous reduction of the volume and length of glaciers observed in the last hundred years opened migration routes of *Alticola stoliczkanus* and *Ochotona roylei* to ice-free sites situated even at the altitudes above 5,000 m a.s.l.

Current biogeographical hazards in the Nepal Himalaya are associated with rapid retreat of glaciers, the expansion of the periglacial morphoclimatic zone and the increased human impact in the High Himalaya. The cause-and-effect relationship between active morphotectonic processes, landform evolution, climate changes and faunal/vegetation patterns of the biosphere could result cumulatively from the responses of individual species, affecting the dynamics of communities to the extent and mode of dispersion of mankind.

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Trajectories of forest cover change in Chakrashila Wildlife Sanctuary (India) between 2000 and 2020 using Landsat imagery

Sanswrang Basumatary*

Gauhati University, Department of Geography, India

* Corresponding author: sanswrangbty896@gmail.com

ABSTRACT

Forest cover changes in the Chakrashila Wildlife Sanctuary, in the north eastern Indian state of Assam between 2000 and 2020 were assessed using Landsat 5 TM (2000 and 2010) and Landsat 8 OLI (2020) satellite data. The objective of the study was to examine the temporal variations, if any, of forest cover in the Sanctuary. The satellite images of 2000, 2010 and 2020 were classified using supervised classification into three different categories viz: dense forest, open forest, and barren land. Based on a maximum likelihood classifier and using standard accuracy assessments, the results indicated that the area covered by barren land and open forest increased between 2000 and 2010 but decreased between 2010 and 2020. Similarly, dense forest had decreased by 22.32% between 2000 and 2010 but increased by 15.19% between 2010 and 2020. These changes occurred reflecting the positive results emanating from conservation policies and afforestation efforts by the primary stakeholder, the state forest department, in recent years. Such efforts were linked to the enhanced institutional status of the protected area, which had been upgraded from a Reserved Forest in 1966 to that of a Wildlife Sanctuary in 1994.

KEYWORDS

forest cover change; Chakrashila Wildlife Sanctuary; satellite imageries; supervised classification

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1. Introduction

Undisturbed tropical forests provide numerous benefits, ranging from being carbon sinks to fulfilling several social, economic and ecological functions (Rashid, Bhat, and Romshoo 2017; Sharma et al. 2022). They are, however, unfortunately being destroyed and degraded at unsustainable rates emanating from agricultural extensification and/or urbanisation expansion (Doyle, Beach, and Luzzadder-Beach 2021). Recent decades have witnessed deforestation rates to the tune of above 3 million hectares annually (FAO 2016). Deforestation is problematic, but tropical deforestation is far more worrying considering that the latter are storehouses of rich biodiversity (Phillips et al. 2017). A forest can be defined as a large tract of land covered with trees and undergrowth which provide an ecosystem for the habitat of different kinds of plants and animal species.

According to the United Nations Framework Convention on Climate Change (UNFCCC), 2001, “a forest is defined as an area of land between 0.05 and 1.0 hectares with a tree crown cover of more than 10–30% and trees with the ability to attain a minimum height of 2–5 meters at maturity in situ.”

The study of forest cover change is one of the most important constituents of land use and land cover (LUCC) change (Lele, Joshi 2009). Land use can be defined as the changes that accrue as a result of human activities on land which are influenced at multiple scales by economic, cultural, political, historical, and land-tenure relations (Brown 2003). Deforestation and desertification are often the main outcomes of LUCC change taking place and bringing about alterations from naturally occurring land cover to anthropogenic or man-made land use categories (Foster 1992; Lele and Joshi 2009). The detection of land-use change and changes in forest cover enables the observation and evaluation of spectral and temporal variations that are happening within various environments (Mouat et al. 1993; Panuju et al. 2020).

Land-use induced land cover change can be classified into two types: ‘modification’ which indicates an alteration in condition within a cover type and ‘conversion’ which refers to the transition from one cover type to another (FAO 1995b). Forest changes can be either negative (deforestation) or positive (reforestation/afforestation) (Fig. 1).

“Deforestation is defined as a long-term or permanent removal of forest cover and conversion to non-forested land use” (Lund 1999). According to the United Nations Food and Agriculture Organization (FAO 2001), if the tree canopy cover falls below 10% or the forest is transformed into some another land cover then it can be termed as deforestation.

The drivers of deforestation are variously biophysical, location and socio-economic (Chowdhury 2006), and include illegal cutting and extending of agricultural land (Indrabudi et al. 1998), particularly

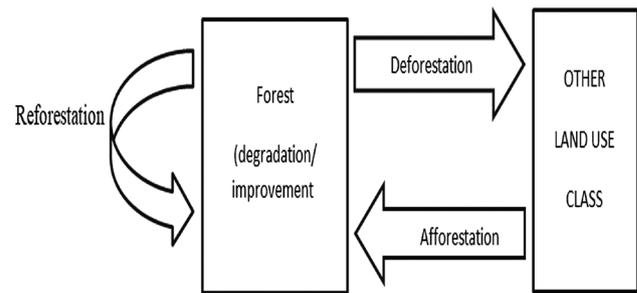


Fig. 1 Change in forest land (FRA 2000).

smallholder agriculturalists. Since 1990 the world has lost 178 million ha of forest, at a rate of net forest loss of 4.7 million ha per year in 2010–2020 (FAO 2020). Conversion in forest class, such as from dense to open forest, is referred to as forest degradation because they entails detrimental impact on the site and reduce the production capacity (Dutca and Abrudan 2010). Ecological and social problems such as an increase in global warming, soil erosion, and biodiversity loss are caused by depletion in forest cover (Kaliraj et al. 2012). Forest cover mapping helps in providing a constant delineation of land cover (Kumar 2011). In India, forest cover assessment for the entire country is carried out every two years by the Forest Survey of India (FSI).

For formulating various management strategies a precise database relating to forest cover, forest types, species composition as well as information of temporal changes in forest cover is required (Kaliraj et al. 2012; Karia et al. 2001; Kumar 2011). A regular observation of forest cover conditions is essential for detection and modeling of forest cover disturbances (Estreguil and Lambin 1996). For effective conservation management, it is crucial to ascertain the maximum amount of forest cover change that can be tolerated by wildlife communities (Corkery et al. 2020). Analysis of the cumulative impacts of changes in a landscape is vital for conserving sensitive habitats and environmental quality (Estreguil and Lambin 1996).

In recent years the use of remote sensing datasets has become indispensable to assess and monitor forest cover dynamics at regular intervals (Forkuo and Frimpong 2012; Sharma and Joshi 2013; Kaliraj et al. 2012; Lele and Joshi 2009). In remote sensing, the process of identifying differences over a geographical area by observing them at different times using multi-temporal data sets is known as change detection (Panuju et al. 2020; Singh 1989). Spatial distribution of forest resources, diversity conditions, and temporal changes can be analyzed and monitored using remote sensing and geographical information system (GIS) by combining spatial data with the other attribute databases (Kaliraj et al. 2012).

Deforestation due to anthropogenic activities is a major cause of forest cover change. This has been negatively affecting the natural ecosystem, biodiversity, and climate. Deforestation represents one of the largest issues in the present world. Forests have

been converted to land used for other purposes for a very long period of time. Agricultural expansion, wood extraction for domestic fuel usage particularly in rural areas adversely affects the biomass (Sharma et al. 2022), and expansion of infrastructural facilities (Ahmed et al. 2022) are drivers of forest loss and degradation. North east India is a biodiversity hotspot and has several important protected areas (PAs) such as wildlife sanctuaries and national parks within it. Considering that population pressures are rather intense in India, PAs do not always mean that conservation goals are realized. This analysis makes an assessment of the trajectories of forest cover and its dynamics in Chakrashila Wildlife Sanctuary in Assam, India between 2000–2020 using remote sensing and GIS.

2. Study Area

The Chakrashila Wildlife Sanctuary (CWS) in India is spread over undulating topography covered with dense semi-evergreen and deciduous forest with strips of grasslands and scattered scrubs. Chakrashila Wildlife Sanctuary is situated in the Kokrajhar and Dhubri districts of the north east Indian province of Assam ($26^{\circ}15'–26^{\circ}26'N$, $90^{\circ}15'–90^{\circ}20'E$). The total area of the sanctuary is around 45 sq. km enclosed by green hills and two lakes, viz Dheer Beel (a *beel*

is a local term signifying a lake) and Diplai Beel on the periphery (Fig. 2). The sanctuary represents the southern-most distribution of the endangered golden langur, which is endemic to western Assam and parts of Bhutan and is the flagship species of the Sanctuary (Talukdar and Gupta 2018).

The forest tract of Chakrashila was given the status of a Reserved Forest (RF) in 1966. Deforestation and hunting were rampant, causing severe degradation of the forest, prompting Nature's Beckon, a local non-governmental organization (NGO), to launch several programs aimed at raising awareness among the local population, which eventually led to the creation of Chakrashila Wildlife Sanctuary (CWS) in 1994 (Talukdar and Gupta 2018). Wildlife Sanctuaries (WLS) are accorded far better protection and conservation than RFs. The financial resources available to WLSs and monitoring and conservation efforts are also better and more streamlined. In India protected areas (PA) are organized into RFs, WLFs and National Parks (NP). Within this 'hierarchy' of PAs, conservation measures tend to be the most stringent in the NPs and least so in RFs. The CWS hosts 33 mammal, 273 bird, 24 reptilian and amphibian species (Talukdar and Gupta 2018). Several of these bird species are endangered according to the IUCN Red Data List. The two lakes, Dheer Beel and Diplai Beel, also contribute to the sanctuary's significant bird diversity.

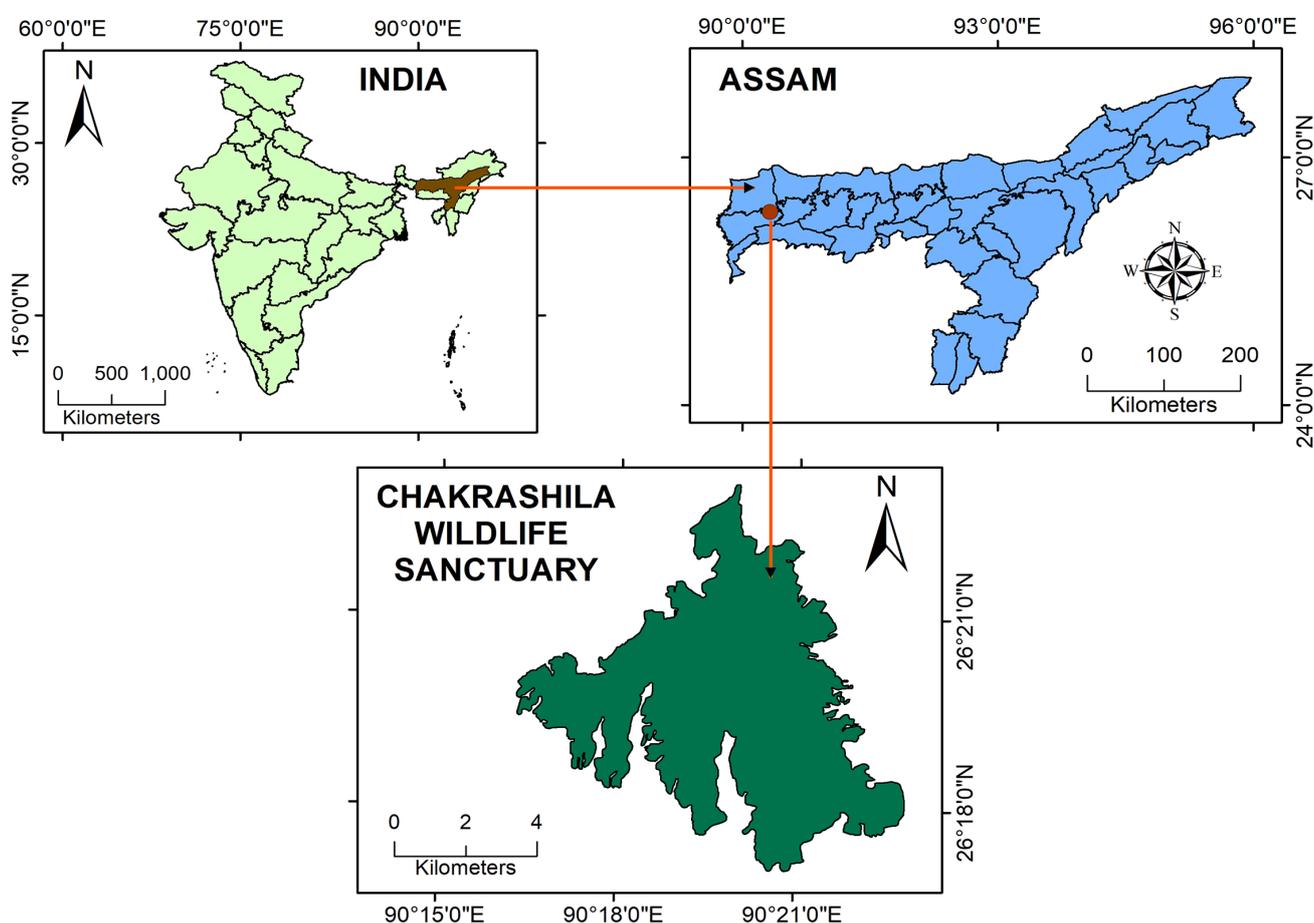


Fig. 2 Location of study area.

3. Methodology

Landsat 5 TM images of 25 October 2000 and 21 November 2010 and Landsat 8 OLI images of 16 November 2020, with almost zero percent cloud cover over the study area were used. All images with comparable calendar dates were chosen to reduce the seasonal effects on forest cover. The study made use of the combination of different bands (Band 1, 2, 3, 4 and 5). This study used the maximum likelihood classification (MLC) algorithm to run the classification, since this is known to give good results (Ahmed et al. 2022). Training samples were collected for each determined class (dense forest, open forest, and barren land) and the spectral features of each class were examined. Following recent studies (Sharma et al. 2022) Google Earth was used to select training and testing sites during the process of running the classifications for 2000, 2010 and 2020 as well as during the accuracy assessment stage of the analyses.

As a result, the study area is divided into three categories: dense forest, open forest, and barren land by locating a specific place in remotely sensed data that represent homogeneous instances of these land cover types (Fig. 3).

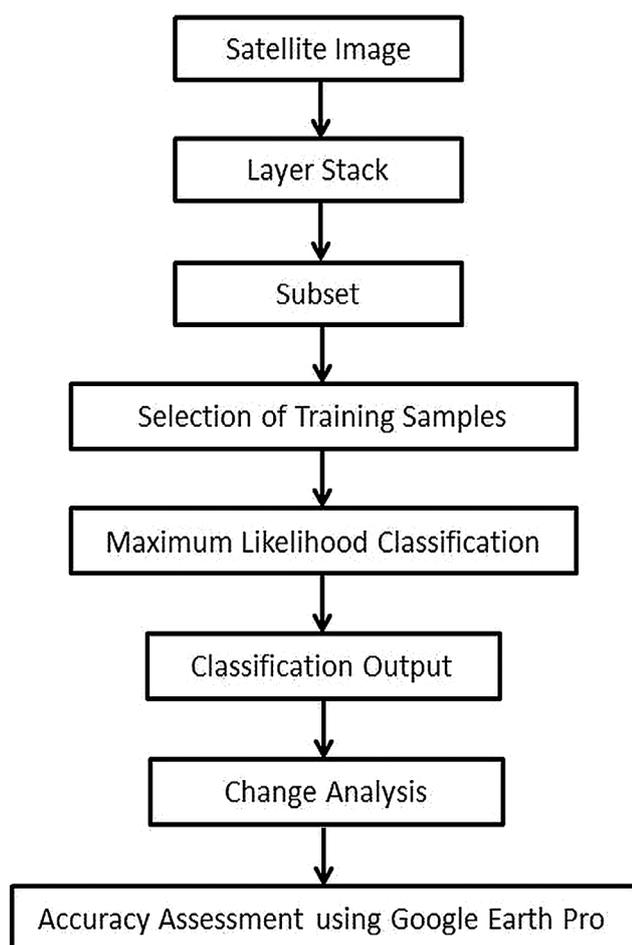


Fig. 3 Flow chart of methodology.

4. Results and discussion

4.1 Forest cover change between 2000 and 2010

Forest cover changes in the CWS from 2000–2010 showed that the most significant changes occurred in dense forest and barren land. In the year 2000, the total area covered by dense forest was 29.36 sq. km (64.85%) of the study area. During 2010, dense forest declined to 19.26 sq. km (42.53%). Overall loss of dense forest from 2000–2010 was 10.1 sq. km (22.32%) with an annual loss of 2.23 percent. Barren land showed a growth of 7.53 sq. km (16.62%) from 0.85sq. km (1.88%) in 2000 to 8.38 sq. km (18.5%) in 2010. During this decade, barren land increased with an annual growth of 1.6 percent, while open forest increased by a marginal rate of growth of 0.57 percent per year. Open forest increased from 15.06 sq. km (33.27%) in 2000 to 17.65 sq. km (38.97%) in 2010 (Tab. 1 and Fig. 4).

From Fig. 5 and Tab. 2, we find that during 2000–2010, maximum change occurred between dense and open forest with 10.51 sq. km of CWS being converted from dense forest to open forest, while 1.37 sq. km of dense forest was converted to barren land. Another change was 5.97 sq. km area of open forest being converted to barren land and 1.67 sq. km area was converted from open forest to dense forest. Marginal change in forest cover from barren land to dense forest (0.005 sq. km) and barren land to open forest (0.03 sq. km) took place from the year 2000–2010.

4.2 Forest cover changes between 2010 and 2020

The dense forest in CWS in 2020 accounted for 26.14 sq. km (57.72%) of the total geographical area which showed an increase of over 6.88 sq. km (15%) from 2010. Open forest which covered 17.65 sq. km (38.97%) in 2010 decreased to 14.52 sq. km (32.06%) in 2020. Barren land also showed a perceptible decrease in area from 8.38 sq. km (18.5%) in 2010 to 4.38 sq. km (10.22%) in 2020. The area under dense forest increased by 6.88 sq. km (15.19%), while open forest decreased by 3.13 sq. km (6.91%) and barren land by 3.75sq. km (8.28%) (Table 3). Thus some improvement in the quality of forests seems to have set in, as a transition from open forest to dense forests seems to have occurred. This is a healthy trend since dense forests are known to be superior habitat for various flagship species including Asian elephants (*Elephas maximus*) (Ahmed et al. 2022). The positive changes that accrued were a result of improved conservation and afforestation efforts associated with the protection accorded since 1994. Once it was designated as a wildlife sanctuary in 1994, better protection was given to it and conservation efforts by the state forest departments were set in motion. The results of such efforts slowly began to bear fruit and became

Tab. 1 Change of forest cover during 2000–2010.

Forest Categories	2000 (%)	2000 (sq. km)	2010 (%)	2010 (sq. km)	Change (in %)	Change (sq. km)	Annual Change (%)
Dense Forest	64.85	29.36	42.53	19.26	(-) 22.32	10.1	(-) 2.23
Open Forest	33.27	15.06	38.97	17.65	(+) 5.7	2.59	(+) 0.57
Barren Land	1.88	0.85	18.5	8.38	(+) 16.62	7.53	(+) 1.66

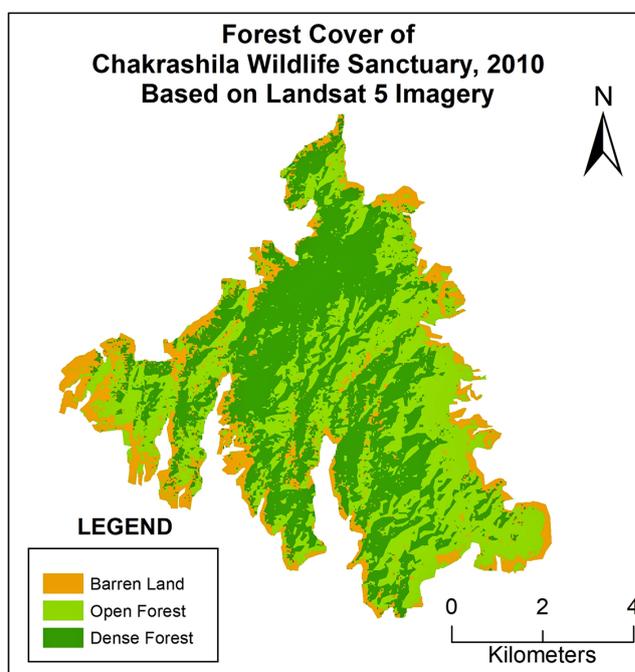
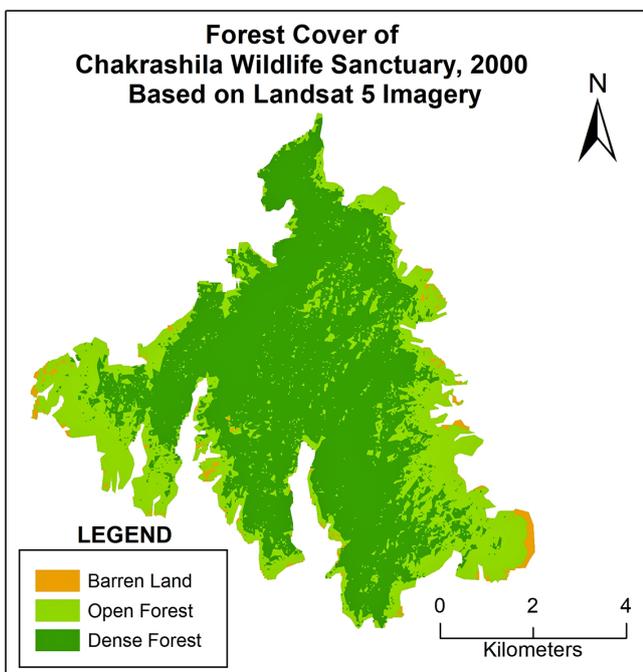


Fig. 4 Forest cover of 2000 and 2010.

Tab. 2 Change in forest cover categories from 2000–2010.

Change (2000- 2010)	Area Change (sq. km)
Barren Land – Dense Forest	0.005
Barren Land – Open Forest	0.03
Dense Forest – Barren Land	1.37
Dense Forest – Open Forest	10.51
Open Forest – Barren Land	5.97
Open Forest – Dense Forest	1.67

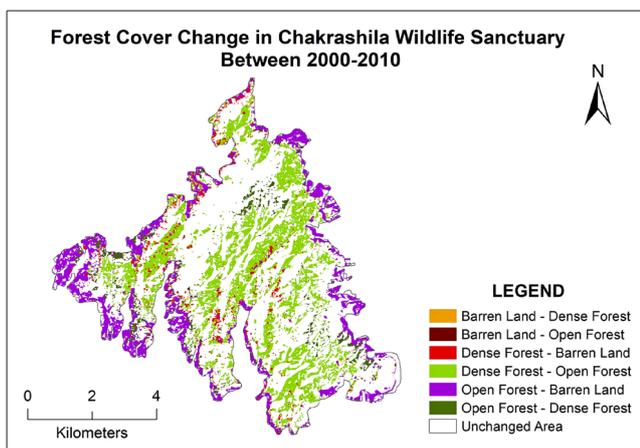


Fig. 5 Forest cover change between 2000 and 2010.

evident by the 2010–2020 period. The results of conservation efforts were probably not apparent during the 2000–2010 period since this was most likely too short a span of time since 1994 to be evident. Along with these efforts by the state forest department, were the positive role played by the local tribal communities that reside in this area, namely Bodo, Rabha, Adivasi and Garo. These tribal communities are dependent on the forest for a variety of resources including fuelwood resources. However, they attach a high priority to biodiversity conservation and maintaining the aesthetic beauty of the forest (Talukdar and Gupta 2017) and were supportive of the conservation efforts (Fig. 6).

Fig. 7 and Tab. 4 show that 1.67 sq. km and 2.44 sq. km area of barren land had got transformed into dense and open forest respectively. Similarly, 0.18 sq. km and 3.11 sq. km area of dense forest were transformed to barren land and open forest respectively. 8.81 sq. km area of open forest was converted to dense forest and 0.36 sq. km was converted from open forest to barren land. Thus it can be seen that the changes were a mixed bag of results: certain positives accrued in the shift from open to dense forests, along with some losses as well. The latter were those changes that saw open forest being degraded to barren land, bereft of forest cover. These changes reveal the results

Tab. 3: Change in forest cover during 2010-2020.

Forest Categories	2010 (%)	2010(sq. km)	2020 (%)	2020 (sq. km)	Change (%)	Change (sq. km)	Annual Change (%)
Dense Forest	42.53	19.26	57.72	26.14	(+) 15.19	6.88	(+) 1.52
Open Forest	38.97	17.65	32.06	14.52	(-) 6.91	3.13	(-) 0.57
Barren Land	18.5	8.38	10.22	4.38	(-) 8.28	3.75	(-) 0.83

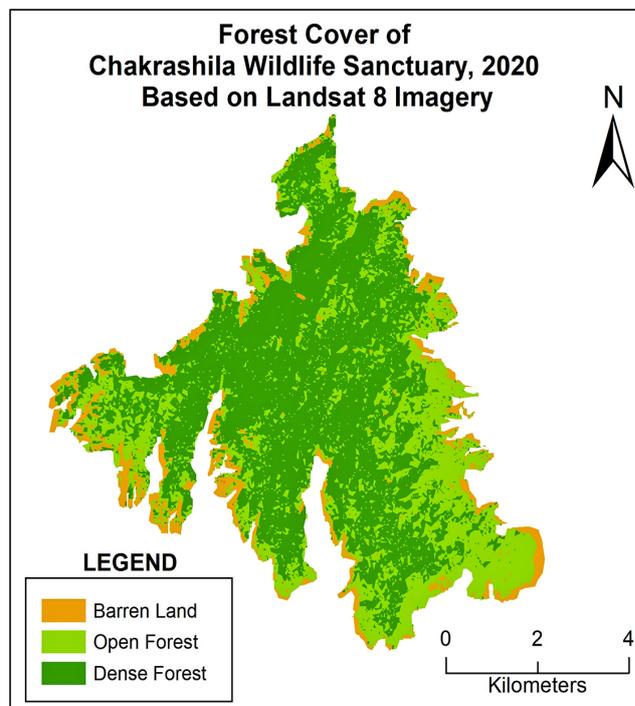
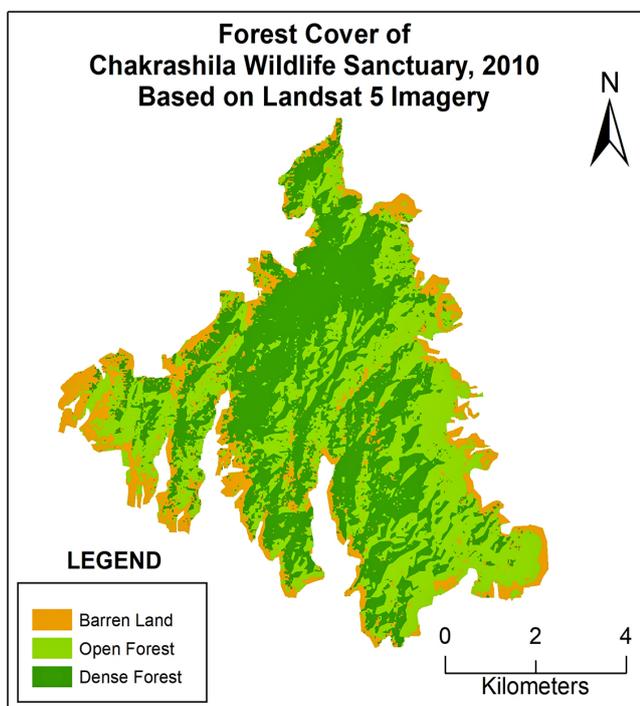


Fig. 6 Forest cover of 2010 and 2020.

Tab. 4 Change in forest cover categories from 2010–2020.

Change (2010–2020)	Area Change (sq. km)
Barren Land – Dense Forest	1.67
Barren Land – Open Forest	2.44
Dense Forest – Barren Land	0.18
Dense Forest – Open Forest	3.11
Open Forest – Barren Land	0.36
Open Forest – Dense Forest	8.81

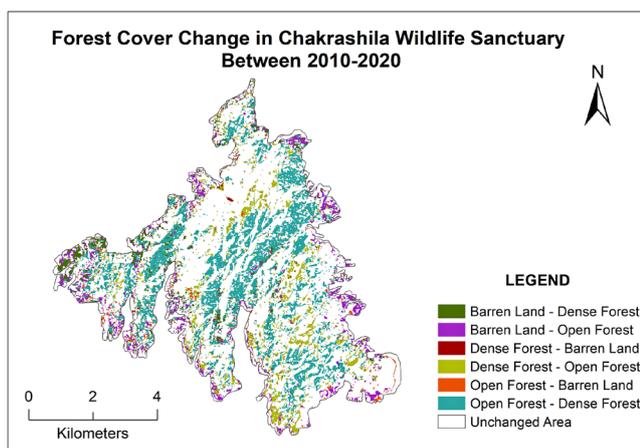


Fig. 7 Forest cover change between 2010 and 2020

of afforestation efforts by stakeholders, primarily the Forest Department of the Government of Assam. At the same time, the loss of open forest to barren land is emblematic of the stresses stemming from anthropogenic pressures of smallholder agriculturalists coupled with the sheer population pressures that exist in a densely populated country like India. Indeed, India is set to overtake China as the most populous country in the world by 2023 according to UN estimates (Hegarty 2022) and rural pressures on limited land resources are a constant threat.

5. Accuracy assessment

Because of the complexity of digital image categorization and the introduction of increasingly advanced digital satellite remote sensing systems, the need for accuracy evaluation has risen (Congalton 1991). The Kappa Coefficient of Agreement was first proposed in the early 1980s as a measure to quantify the accuracy of an image classification used to create a thematic map (Congalton 1991; Foody 2020).

For this study, the image classification of the year 2010 and 2020 has been used for accuracy assessment applying the method of kappa coefficient (k).

$$\text{Kappa Coefficient } (\hat{k}) = \frac{N \sum_{i=1}^r x_{ii} - \sum_{i=1}^r (x_{i+} \times x_{+i})}{N^2 - \sum_{i=1}^r (x_{i+} \times x_{+i})}$$

where

- r = number of rows in error matrix,
- x_{ii} = number of observations in row i and column i (on the major diagonal),
- x_{i+} = total observations in row i (shown as marginal total to right of the matrix),
- x_{+i} = total of observation in column i (shown as marginal total at bottom of the matrix),
- N = total number of observations included in matrix.

The overall accuracy of image classification for the year 2010 was 90.62% and overall kappa accuracy was 0.85.

The overall Accuracy and Kappa accuracy assessment of image classification for the year 2020 is 90% and 0.84. Generally accuracy assessments above 80 percent are considered acceptable in remote sensing assessments (Anderson et al. 1976).

6. Conclusion

The process of forest cover change in the CWS over a 20 year period from 2000 to 2020 was measured using Landsat satellite images at an interval of 10 years. The various forest cover categories showed both gains and losses. In the year 2000, dense forest covered 64.85% of the study area; by 2010, it had dropped to 42.53%, a substantial loss of 22.32%. However, dense forest registered an increase of 15.19% over 2010, and by 2020 it covered 57.72% of the total area of the wildlife sanctuary. Between 2000 to 2020, a total of 7.13% of dense forest area was lost.

During the early period of this analysis, forests showed more losses than gains. Along with loss in the dense forest category, barren land increased during 2000–2010. These were the result of encroachments continuing during the early years of the forest

tract’s conversion from an RF to a WLS. However, as the years progressed, the health of the CWS forest ecosystem gradually improved. The most evident and important gain that accrued was in the dense forest category. The proportion of dense forest increased during the latter half of the period 2000–2020. Additionally open forest transitioned into dense forest. This is a healthy trend and is indicative of the improved conservation efforts by the state forest department as well as the support of local tribal population groups that inhabit the fringe areas of the CWS (Fig. 8).

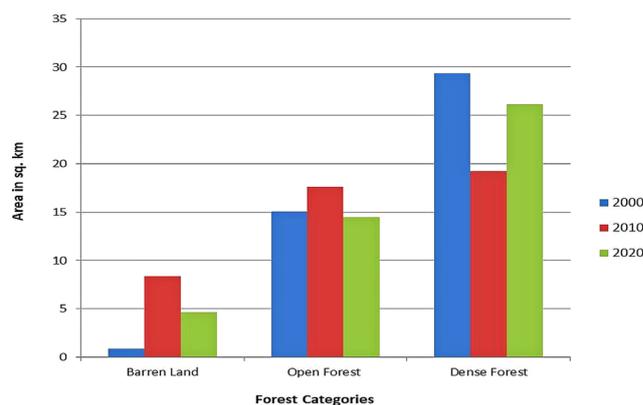


Fig. 8 Forest cover of 2000–2020.

Certain steps could be taken to improve forest conservation and minimize the extraction of forest resources and forest degradation in the WLS. These would entail greater community participation in forest management efforts. Forest resource evaluation and a periodic forest inventory using remote sensing and other tools, including high resolution photographs using unmanned aerial vehicles (UAV) would be an advisable effective strategy. State forest agencies elsewhere in India are using UAV aided forest monitoring and these are fairly affordable technologies that the CWS authorities could take up as well.

Tab. 5 Error matrix of image classification for the year 2010.

	Barren Land	Open Forest	Dense Forest	Row Total	User’s Accuracy (%)	Producer’s Accuracy (%)
Barren Land	9	0	0	9	100	81.81
Open Forest	2	8	0	10	80	88.89
Dense Forest	0	1	12	13	92.3	100
Column Total	11	9	12	32		

Tab. 6 Error matrix of image classification for the year 2020.

	Barren Land	Open Forest	Dense Forest	Row Total	User’s Accuracy (%)	Producer’s Accuracy (%)
Barren Land	11	0	0	11	100	100
Open Forest	0	7	1	8	87.5	77.78
Dense Forest	0	2	9	11	81.82	90
Column Total	11	9	10	30		

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Mapping MNEs in Cuba and barriers to their growth

Petr Šmelc, Jana Vlčková*

Prague University of Economics and Business, Faculty of International Relations, Department of International Economic Relations, Czechia

* Corresponding author: jana.vlckova@vse.cz

ABSTRACT

Very little is known about the investment climate and operations of MNEs in Cuba due to limited data provided by the Cuban government. In this paper, we explore the investment climate in Cuba and identify factors that limit the activities of MNEs. We also assess the impact of the COVID-19 pandemic and the future prospects for MNEs in Cuba. Our research is based on questionnaires and semi-structured interviews in MNEs operating in Cuba. MNEs consider low macroeconomic stability, the impossibility of acquiring real estate, access to financing and the movement of capital, and profit repatriation as the most problematic factors for their business activities. On the other hand, IPR protection, corruption, the skills and education of the available workforce and the availability of electricity were assessed as the least problematic. Less than half of the MNEs interviewed found positive changes concerning the investment climate in Cuba during recent years. This implies limited prospects for economic growth in the near future.

KEYWORDS

investment climate; MNEs; Cuba; foreign direct investment

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1. Introduction

The role of multinational enterprises (MNEs) and foreign direct investment (FDI) has increased significantly in recent decades due to the finer division of labor and more complex location decisions of MNEs (Dicken 2015). FDI has thus become an important source of foreign capital and technology for emerging markets (Lall 2000; Dunning and Lundan 2008). At the same time, negative impacts are also widespread, such as the crowding out effect for domestic companies, layoffs and negative impacts on the environment (Aitken and Harrison 1999; Hardy 1998; Doytch and Uctum 2016). Most developing and emerging countries are trying to attract MNEs to promote their economic growth. The scope of MNEs operations and the impact of FDI depends on the economic, financial and socio-political conditions of host countries, referred to as the investment climate (Aisedu 2006; Bayraktar 2013) and also on host countries' income levels (Borensztein, De Gregorio, and Lee 1998; Alvarado, Inguez, and Ponce 2017).

Since the revolution in 1959, Cuba has been a predominantly closed country with a centrally planned economy and a significant role played by state-owned companies. However, to address its deepening economic problems, Cuba has partially opened to multinational companies, particularly since the 1990s. MNEs have been allowed to operate in the country under limited conditions. Due to the absence or unreliability of official data (see e.g. Feinberg 2016 or Vidal 2020), we have very little information about their activities, the conditions under which they operate and the impact of their activities on the Cuban economy as a whole.

FDI represents an important source of foreign capital as Cuba has limited access to foreign loans (Travieso-Diaz and Tumbull 2002; Luis 2017), restrictions on remittances from the US (Mesa-Lago and Vidal 2019) and a decrease in international tourism due to the COVID-19 pandemic. At the same time, only a few studies have explored the operations of MNEs in Cuba in the last decade (Walsh 2017; Rottig, Muscarella, and de Oliveira 2019). Furthermore, researchers mainly focused on US companies. This paper thus aims to assess the conditions under which MNEs operate in Cuba. We focus especially on these research questions: What are the major barriers to MNEs operations in terms of the Cuban investment climate? Is there space to increase MNEs' activities in Cuba? Attention is given to the development of the investment climate, the impact of COVID-19, and future prospects. Given the limited number of studies devoted to MNEs and the investment climate in Cuba, this paper contributes to extending the knowledge about Cuba's investment climate and considers the latest events. This paper is based on questionnaires and follow-up semi-structured interviews conducted with executives of companies operating in Cuba,

allowing for a comparison with studies focused mainly on US firms.

The paper is structured as follows. First, a literature review on MNEs, the investment climate, and the Cuban economy and policies are analyzed. We then describe the applied methodology related to questionnaires and semi-structured interviews. In the third chapter, the results from the qualitative research are presented, including the discussion. Conclusions summarize the main findings of the paper.

2. Literature review

In this literature review first, we summarize the theoretical and empirical findings regarding the role of MNEs in host economies and the assessment of different aspects of the investment climate in developing countries. Second, we describe the development of the Cuban economy with a focus on its investment climate and the role of MNEs and we review empirical literature that evaluates the Cuban investment climate.

2.1 MNEs and the investment climate

In recent decades, globalization has led to a significant increase in the number of MNEs i. e. companies that have established branches or subsidiaries in countries other than their countries of origin (OECD 2018). The importance of MNEs in the world economy can be demonstrated, for example, by their share of world GDP estimated at 32%, or by their percentage of global exports, reaching 64% in 2016 (De Backer, Miroudot, and Rigo 2019). Activities of MNEs are closely related to increasing global FDI flows. These have expanded substantially since the 1970s, despite relative stagnation in the recent decade (UNCTAD 2021).

MNEs can play an essential role in host economies. Many theoretical and empirical studies highlight their positive impact on the economic growth of host countries through the inflow of capital, more advanced technologies or more advanced management skills, and other knowledge that contribute to increasing productivity in the economy (Lall 2000; OECD 2002; Moran, Graham, and Blomström 2005; Dunning and Lundan 2008). The operations of MNEs often also intensify the competitive environment, which can increase the efficiency of the use of resources by the host country (Blomstrom and Kokko 1998; Marlevede and Schoors 2005; Dunning and Lundan 2008). On the other hand, negative impacts are also mentioned, such as excessive displacement and/or crowding out of local companies that cannot compete with MNEs – the so-called crowding out effect (Lall 2000; Dunning and Lundan 2008; Aitken and Harrison 1999). Furthermore, downsizing of production and labor layoffs (Hardy 1998) and negative impacts on

the environment (Doytch and Uctum 2016) are also recorded. Last but not least, FDI contributes to uneven development across different geographic scales (Pavlínek 2022).

The impacts of FDI on the host country/region are dependent on many factors ranging from the type of investment, mode of entry and attributes (e.g. industry type, scale of operations) to the nature of the local economy and the length of investment (Dicken 2015). The positive relationship between FDI inflows and economic growth in host economies was confirmed, for example, by data from 15 developing countries (Desbordes and Franssen 2019), West Asian countries (Suliman, Elian, and Ali 2018) and India (Choi and Baek 2017). At the same time, several studies have not confirmed this relationship at all or only to a limited extent (e.g. Carkovic and Levine 2002; Choe 2003; Li and Tanna 2019). In general, more positive effects of FDI are observed in high income countries where horizontal FDI prevails compared to emerging and developing countries with predominant vertical FDI (Borensztein, De Gregorio, and Lee 1998, Alvarado, Inguez, and Ponce 2017).

In this paper, we focus mainly on the perspectives of MNEs operating in Cuba. The main challenges and obstacles to the further development of the activities of MNEs, assessment of host country conditions and their impact on MNEs, etc., are reflected in the investment climate of the host country. The investment climate is understood as the sum of all external factors that affect MNEs in the host country (Silvia-Leander 2005). The World Bank (2013) defines the term investment climate as the policy, institutional and behavioral environment, both present and expected, that affects the returns and risks associated with investments. Several institutions provide various investment climate rankings such as the Global Competitiveness Index (GCI) of the World Economic Forum and the World Bank's Ease of Doing Business (the issuance of the report was ended in 2021). Other rankings cover sub-areas of the investment climate, such as corruption (e.g. Transparency International's Corruption Perception Index), the quality of governance (e.g. World Bank Governance Indicators) and human development (e.g. UNDP's Human Development Index). These rankings usually work with data from several sources including surveys and public/private/NGO experts' views. The assessment of the investment environment for MNEs can further be found in the Business Environment and Enterprise Performance Survey (BEEPS) and the Economist Intelligence Unit.

The level of both tangible and intangible aspects of the investment climate may also boost the development impact on the host countries (Lin 2011; Horneberger, Battat, and Kusek 2011). Lin argues that the quality of infrastructure determines the transaction costs of individual firms and plays an important role in facilitating the allocation of resources in

accordance with the country's comparative advantage. To support the country's industrial development, Lin highlights the role of the state in the improvement of tangible and intangible infrastructure rather than any intervention in the functioning of markets by protectionist measures (import tariffs to protect infant industries), rigid exchange-rate policies or the creation of state-owned enterprises. Moreover, the quality of the investment climate also impacts the size of benefits from spillover effects that the host country receives from MNEs activities (Amin 1999; Blalock and Gertler 2008).

Categorizations of particular aspects of the investment climate, and procedures for their evaluation are also widespread in academic literature. Among the first ones belongs Stobaugh (1969), who addressed the issue of the complexity of the investment climate and its impact on decisions by MNEs, and highlighted the need to decide on a multi-factor rating scale covering criteria such as the repatriation of capital, the maximum possible share of foreign ownership of a company, etc. Li and Li (1999) divide the individual factors of the investment climate into hard ones (natural resources, infrastructure and telecommunications equipment) and soft ones (e.g. economic, political, legal, managerial factors). Ng and Tuan (2002) use 48 variables divided into seven categories: socio-economic factors, the availability and costs of inputs, infrastructure, government policies on FDI, restrictions on business operations, government administration and living conditions to assess the investment climate in China. Human capital, the availability of natural resources, the quality of infrastructure, and the administrative and legal environment are the four main categories of factors of the investment climate applied by Abushhewa and Zarook (2016). Institutional theory has been widely employed to study emerging or low-income countries (e.g. Kostova 1997; Trevino, Thomas and Cullen 2007; Rottig, Muscarella, and de Oliveira 2018). Most of these researchers follow the theory introduced by Scott (1995). He divides the factors influencing the decision-making of organizations into three categories – regulatory (e.g. legislation), normative (societal norms, values, etc.), and cognitive (cultural aspects).

Several studies assess the investment climate in developing countries and its impact on FDI. Based on firm-level evidence Kinda (2010) showed that constraints related to the investment climate hamper FDI in developing countries. Accordingly, Bayraktar (2013) found that developing countries ranking higher in the World Bank's Doing Business attract more FDI, and an upward shift in the ranking is associated with higher FDI flows. Furthermore, research focused on the evolution of the investment climate. For example, Bhaumik, Bhandari, and Gokarn (2003) have shown improvements in the Indian investment climate in the areas of managerial and skilled non-managerial workforce qualifications and the quality of

local resources needed for business (especially IT services), with stagnation or deterioration in the institutional environment and the legal framework for business. In Kosovo, improvements in the area of taxes and labor have been recorded despite negative development in terms of competition and the political situation (Hajrizi and Hasani 2013). On the other hand, in the Georgian investment climate the hindering of the development of MNEs was related particularly to the unavailability of a skilled workforce and an insufficiently credible legal system (Gürsoy and Kurşun 2008). Ershova (2017) identified problems in the regulatory environment (especially regarding employment and immigration) and customs clearance as the main obstacles to the development of Japanese MNEs doing business in Russia. Overall, the rule of law (Li and Resnick 2003; Jensen 2008; Alexander 2014; Staats and Biglaiser 2012), corruption (Wei 2000), political uncertainty (Trevino, Thomas, and Cullen 2007), the quality of physical infrastructure (Kinda 2010) and economic aspects such as macroeconomic stability, the quality of the banking system, market size and structure, etc. (Dunning 2004; Asiedu 2006; Khachoo and Khan 2012) have been identified as the most important ones for the activities of MNEs in host countries.

2.2 The Investment Climate in Cuba

Cuba is one of the last countries with a predominantly centrally planned economy. After the revolution in 1959, the United States imposed a trade embargo against Cuba, which despite some softening, still exists today. Cuba's more economically successful periods were thus associated with the support of foreign partners. Initially, the support stemmed from the Soviet Union (1962–1990), since the year 2000 from Venezuela. In 2014, the support from Venezuela started to decline following Venezuela's economic downturn. In the intervening periods, Cuba had constantly plunged into economic crises. It confirms the considerable failure of the Cuban economic model, which is unable to achieve long-term sustainable growth without significant foreign support (Feinberg 2016). According to the Cuban statistical office, Cuba's GDP per capita in 2020 was at the level of \$9,601 USD (ONEI: Anuario Estadístico de Cuba 2020; Cuentas nacionales, Edición

2021). However, Vidal (2020) draws attention to the considerable unreliability of the official data and estimates the real level of GDP at around one-third of that amount. The developments of the main macroeconomic indicators can be seen in Tab. 1.

Cuba has very limited access to foreign loans, thus an important source of foreign capital is foreign direct investment (Travieso-Diaz and Trumbull 2002; Luis 2017). Therefore, during the periods without foreign aid, which resulted in deepening economic problems, Cuba had to adjust its policies. For example, between 1991 and 1993 Cuba's GDP declined by more than 10% year on year and trade by 80% (Benzing 2005; World Bank 2021). Thus, in the 1990s, Cuba opened up limited opportunities for foreign investment in tourism, mining, energy, and telecommunications. Several MNEs took advantage of this, and the level of foreign direct investment reached almost 2% of GDP in 1994 (Spadoni 2014 – Fig. 1). Nevertheless, in the late 1990s, after Hugo Chávez came to power in Venezuela and established close economic cooperation with Cuba, the conditions for MNEs deteriorated again, for example by not renewing licenses of many MNEs (Romero 2017). Horizontal FDI is the major type of investment in Cuba as companies want to capture the Cuban market, resource-seeking investment is also present to some extent (Feinberg 2016).

Although Venezuelan economic support, consisting mainly of supplying cheap oil to Cuba and hiring Cuban state employees (particularly doctors) in Venezuela at high prices, represented a significant boost for the Cuban economy, many weaknesses remained. Cuba was still dealing with lagging industrial and agricultural production, insufficient savings and investment rates, sluggish exports and a chronic deficit in merchandise trade (Feinberg 2016). To address these issues in 2011, the Sixth Congress of the Communist Party approved the document entitled “Guidelines for the Party's Economic and Social Policies and Revolutions,” which contained reform proposals aimed at some economic decentralization and support for private enterprises (Lineamientos de la Política Económica y Social del Partido y la Revolución 2011). This document launched another wave of economic opening. In 2013, the government expanded the possibilities for private business (in particular, the number of companies that can be conducted privately was

Tab. 1 The main macroeconomic indicators for Cuba.

	2015	2016	2017	2018	2019	2020	2021
GDP Growth	4%	1%	2%	2%	0%	-11%	1%
Inflation (GDP deflator)	3%	4%	4%	1%	4%	17%	
Unemployment	2%	2%	2%	2%	1%	1%	
Government debt to GDP	18.2%	19.9%	18.3%	18.4%	19.0%		
Budget deficit to GDP	5.8%	6.6%	8.6%	8.1%	6.2%	17.7%	11.7%

Source: World Bank (2022); Trading Economics (2022); ONEI (2021)

increased), and Law No. 313 was passed, which regulated the conditions for foreign investors in the Mariel Free Trade Zone. The Mariel Free Trade Zone, located approximately 50 km west of Havana, allows MNEs to be licensed for up to 50 years and offers them additional tax benefits. Further, in this zone, it is possible to pay employees higher wages than in other parts of Cuba (Spadoni 2014).

In 2014, a new law on Foreign Direct Investment, Law No. 118, was approved (Ley No. 118, 2014). It guarantees foreign investors protection against expropriation (except in the public interest, investors should be fully compensated). National courts should settle any litigation between MNEs and Cuban state-owned companies. All sectors of the economy are accessible to MNEs, except health services, education, the financial sector, and defense (though military-owned companies are not excluded). MNEs are also guaranteed many tax benefits. Profits and dividends should be fully convertible into foreign currency. Nonetheless, MNEs can only hire employees through a state agency. Further, Law No. 118 requires the approval of each MNE capital injection by the Cuban government.

The resumption of diplomatic relations with the US in 2015 led to some easing of barriers and a change in the overall atmosphere. It led to an inflow of new capital, especially in tourism, energy, and biotechnology (Feinberg 2016). Another significant step by the Cuban government towards creating a more open economy occurred in 2021 when Cuban citizens living in Cuba were allowed to set up small and medium-sized companies (The Economist 2021). Decree No. 32 of the Council of Ministers was also issued, further easing the conditions for establishing MNEs representations and branches in Cuba. The MNEs are no longer required to have had a previous business relationship with Cuban companies when applying for registration in Cuba (Andersen 2021). At the beginning of 2021, to, among other things, clarify the system for foreign investors, Cuba unified its two currencies. However, it resulted in a significant increase in inflation in the short term (Mesa-Lago 2021). In 2014 US president Barack Obama initiated a more friendly US approach to Cuba, leading, for example, to some easing of the rules for traveling between the two countries and sending remittances from Cubans living in the US to their relatives in Cuba. His successor Donald Trump terminated this initiative, and after 2017, the US administration repealed most of the previous liberalization measures (Vidal 2019). The approach of US president Joseph Biden, elected in 2020, seems to be slowly returning back to the more friendly approach of President Obama. As a first step, in May 2022 he announced the easing of restrictions on remittances and travel of US citizens to Cuba (Financial Times 2022).

Diplomatic relations with the European Union (EU) improved in 2017, when the EU and Cuba concluded the Political Dialogue and Cooperation Agreement

(PDCA). This Dialogue ended more than 20 years of limited cooperation framed with the so-called Common Position, under which the EU conditioned any strengthening of mutual relations by progress in the field of human rights. The PDCA mainly focuses on strengthening the development cooperation and does not contain any concrete measures regarding trade liberalization or investment protection. Nevertheless, it is expected that the improved diplomatic ties and broadened mutual dialogue will contribute to a more attractive and predictable economic environment (Tvevad 2017).

The operation of MNEs in Cuba can currently take several forms. MNEs may establish a legal entity in Cuba in the form of branches (owned 100% by foreign companies) and subsidiaries (less than 100% owned by foreign companies) under Law No. 118 of 2014 or a branch without the need for capital input under Decree No. 32 of 2021. However, implementing a subsidiary (a so-called joint-venture) is possible only if formed with a state-owned enterprise. Another possible way for foreign companies to enter Cuba is to conclude a hotel management contract. Foreign companies can manage a hotel owned by a Cuban state-owned enterprise under agreed-upon conditions. By completing a hotel management contract, the foreign entity does not acquire a share of the company's capital (Spadoni 2014).

Estimates of FDI flows and their relation to GDP have been presented in several studies and are visualized in Fig. 1. More significant stages in which the volume of incoming FDI was above 1% of GDP were during the 1990s and in 2018-2020 (newer data are not available). The data for 2018-2020 were announced by the government but are questioned by international analysts. The data seem to be surprisingly high, given sanctions applied by the US and complications caused by the COVID-19 crisis (EIU, 2021). In Fig. 2 comparison of Cuba's FDI inflows with several Central American and Caribbean countries of similar size can be seen. Until 2015 the inflows of FDI to Cuba were among the lowest compared to the other countries in the figure. The amount of incoming FDI in 2018-2020 as announced by the Cuban government would put Cuba significantly closer to the best performers in the selection.

Regarding the number of MNEs operating in Cuba, according to official data, in 2020 there were 50 companies fully owned by foreign companies, 103 companies operating in the form of a branch jointly owned with a Cuban state-owned enterprise (i.e. a joint-venture), and 165 companies operating in the format allowed through the use of a hotel management agreement (ONEI 2021). More detailed information regarding the names of the companies or their representation in different sectors of the economy was not published. Further, the information on branches of foreign companies without capital participation is also not available.

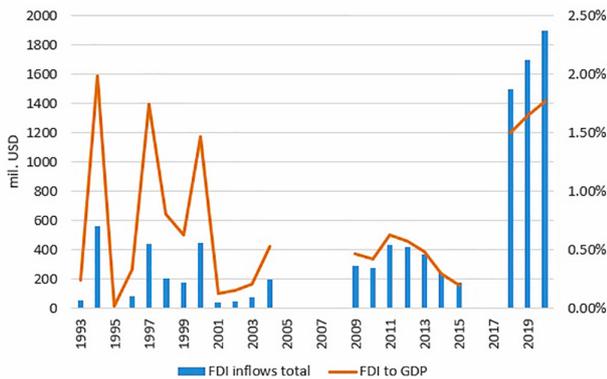


Fig. 1 The Development of FDI in Cuba.

Source: Spadoni (2014) for 1993–2004; Luis (2017) for 2009–2015; Reuters (2020) for 2018–2020

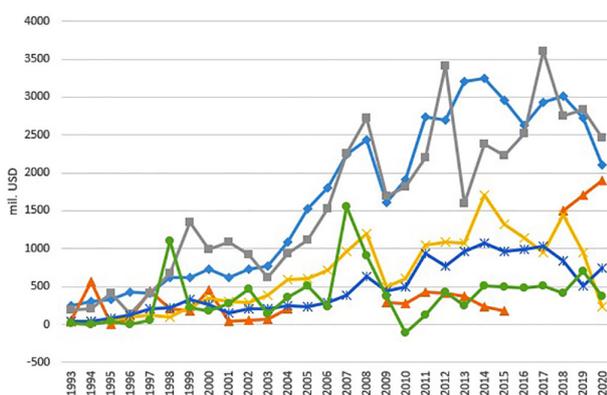


Fig. 2 The comparison of FDI inflows among selected countries from the Central American and Caribbean region.

Source: for Cuba: Spadoni (2014) for 1993–2004; Luis (2017) for 2009–2015; Reuters (2020) for 2018–2020; for other countries: World Bank (2022)

Most reports assessing the quality of the investment climate do not include Cuba (Cuba has not been evaluated in the World Bank's Ease of Doing Business, World Economic Forum's Global Competitiveness Index or the International Institute for Management Development's World Competitiveness Scoreboard). The Economist Intelligence Unit ranked Cuba 77th out of 82 countries evaluated in the 2016–2020 period (EIU 2020). In the 2020 World Bank's Worldwide Governance Index (WGI 2021), Cuba performed worst in the areas of regulatory quality (assessed at the 6th percentile of the countries evaluated) and government accountability (this category refers mainly to the extent to which the country's citizens are able to participate in selecting their governments, as well as freedom of expression, association and media) (at the 11th percentile). Cuba fared slightly better in the areas of political stability (at the 65th percentile), government effectiveness (at the 45th percentile), the rule of law (at the 43rd percentile) and control of corruption (at the 49th percentile). In the 2021 Transparency International's Corruption Perceptions Index Cuba ranked 64th out of 108 countries.

There are several older studies on the Cuban economy (e.g. Benzing 2005; Corrales 2007). In most cases, they do not focus on FDI and the investment climate and do not reflect the current situation. Because of the communist political regime, Cuba differs significantly from other emerging markets. Their unique institutional environment is thus unique and poses a big challenge for MNEs. In order to analyze the main challenges associated with the entry and operation of MNEs particularly in tourism in Cuba Walsh (2017) interviewed representatives of 18 MNEs from the USA, Canada, Australia and Spain. She identified the US trade embargo and local financing, the existence of a dual currency, property ownership and excessive operating costs as the crucial obstacles. Respondents mentioned the need to build strong informal relationships with local partners, thorough consideration of the potential target group and the need to significantly adapt the business strategy to the Cuban environment as key to a successful business in Cuba. On the other hand, corruption, issues of taxation, labor law and security were not identified as being problematic. Rottig, Muscarella, and de Oliveira (2019) with the use of Scott's institutional theory evaluated the challenges that US-based MNEs face in various areas of the Cuban institutional environment. The authors conducted 34 interviews with MNEs executives, US government officials and diplomats, identifying challenges most often related to the non-existence or insufficient degree of development of some formal institutions and in the area of gaining local legitimacy by foreign companies. More specifically, these were challenges related to infrastructure, the lack of integration of payment systems between the US and Cuba, the impossibility of local financing for the purchasing of consumer goods, the obligation to hire Cuban workers only through a state agency, and law enforcement and the protection of investments. Vidal and Alonso (2021) found that the changes in the institutional environment in Cuba over recent years have only been marginal. The main obstacles to the development of MNEs identified in the questionnaire surveys, are in particular, the US trade embargo, excessive bureaucracy and regulation, the inefficiency of state-owned companies and problems associated with legal proceedings.

3. Methodology

The investment climate of individual countries and its impact on the activities of MNEs can be identified by quantitative methods (questionnaires) or qualitative interviews. Often mixed methods are applied, such as quantitative questionnaires with follow-up semi-structured interviews (Mendoza and Woolcock 2014; Walsh 2017). Further, econometric methods are used to evaluate investment climates in several countries, and their impact on FDI flows and activities of MNEs (Quazi 2007; Hayakawa, Kimura and Lee 2013).

Due to the very limited, non-transparent and often outdated data the Cuban Statistical Office provides, such an analysis is not possible in the case of Cuba. Therefore, in this paper, we applied the mixed method.

The open-ended questions are recommended for exploratory questions and/or for analyzing novel phenomena (e.g. Eisenhardt and Graebner 2007). Furthermore, it allows additional data to be obtained beyond pre-prepared questions and can provide a better understanding of the specific features of the Cuban economy. With more rigidly structured questioning techniques the researcher could shape the interview with their own ideas and the answers of the respondents could be determined by a set of operationalized fragments (Hendl 2016). The respondents were guaranteed anonymity and offered the option of not answering any particular question to achieve a higher rate of return of the questionnaires and a higher degree of truthfulness of the answers given (Javorcik and Spatareanu 2005). Further, we controlled the primary data with secondary data from academic literature and Cuban policies to avoid biases (Ghauri 2004).

To answer our research questions, we compiled a questionnaire (Appendix 1) through which MNEs evaluated various aspects of the Cuban investment climate according to how problematic these aspects were for their activities: respondents were asked to describe the main challenges to their operation in Cuba. The set of questions in the questionnaire was compiled based on previous research focused on the evaluation of the investment climate and the identification of its major barriers for MNEs. In the first part of the questionnaire, MNEs evaluated the selected 21 investment climate factors on a scale of 1–5 according to the extent to which MNEs consider them problematic for their business activities in Cuba. The evaluated factors included the areas of regulation, governance, economics and infrastructure, following the BEEPS business limits survey, supplemented by several selected factors used in the Ease of Doing Business (World Bank 2022), Global Competitiveness Index (World Economic Forum 2019) and by the authors' Ng and Tuan (2002). We included both tangible and intangible factors of the investment environment. The number of evaluated factors was reduced in comparison to the above-mentioned reports in order to keep the questionnaire acceptably long. MNEs were also offered the opportunity to add additional factors if they considered any significant factor missing from the selection. In the second part, the questionnaire contained open questions about the main obstacles to the development of MNEs business activities and the most significant changes from the perspective of MNEs, which were formulated similarly to the works of Bhaumik, Bhandari, and Gokarn (2003), Gürsoy and Kurşun (2008) or Ershová (2017). We added a question about the effects of the COVID-19 pandemic on the activities of MNEs. The follow-up semi-structured interviews focused on further explanations of the

reasons behind MNEs' evaluations of different investment climate aspects from the questionnaire. They helped to deepen and better understand the specifics of operations in Cuba.

It is not easy to identify firms operating in Cuba. The Cuban statistical office only publishes data on the number of companies wholly or partially owned by foreign companies and also foreign companies operating in Cuba through hotel management agreements, but no detailed information on these companies could be found. In addition, apart from these MNEs, several foreign companies established branches in Cuba (sometimes with many local employees and significant economic turnover) without direct capital participation and also without any official information regarding them. Thus, it is difficult to estimate the number of MNEs operating in Cuba and collect further detailed information regarding their operations.

Considering the reachability for in-person interviews, in our research we focus on European MNEs. They are also less covered in previous research. We only identified 22 European companies with subsidiaries in Cuba which were listed in the Orbis database. These included very large MNEs such as Nestle, Unilever and Bayer as well as smaller companies. Five of these MNEs were from Spain (Bureau van Dijk 2022). Therefore, we used Internet searches, articles from trade fairs and the websites of various export promotion agencies to identify companies operating in Cuba. We also asked several export promotion agencies from different countries for a list of companies operating in Cuba but obtained no answer. Some of them state on their websites that they don't provide any information regarding companies with which they cooperate. A beneficial source was the database of the Spanish state export promotion agency ICEX España Exportación e Inversiones, which contains a list of Spanish companies registered in Cuba. Of the 241 listed companies, 56 have information regarding the existence of a local representation in Cuba on their websites and these were subsequently contacted. Further, we identified 6 Czech companies mainly during events focused on investment possibilities in Cuba organized by the Czech Ministry of Industry and Trade. Czech companies have historically strong relations with Cuba that follow the mutual cooperation of both countries during the Czechoslovak communist era. The representatives of MNEs further recommended two companies from Slovakia and Belgium during the interviews with MNEs. In the end, 64 MNEs operating in Cuba were contacted, mainly by email. Due to the initial very low response rate, we also contacted all companies by telephone.

Seventeen companies completed the questionnaire. The interviews were conducted with eight company directors or executives responsible for managing the company's activities in Cuba. The interviews took place in Madrid in December 2021 and Prague in February 2022. The entire research took place from July 2021 to March 2022. All of the respondents travel to

Cuba regularly. The surveyed companies are engaged in the production of medical supplies, the distribution of communication technologies, the purchase and sale of food products, the supply of technical solutions to refineries, and the construction sector. Thirteen of the companies are Spanish, two are Czech, one is Slovak, and one is Belgian. The vast majority of companies have been operating in Cuba for a long time, mainly since the 1990s. The most frequent motivation for the companies' entry was the business opportunities in the unsaturated Cuban market with a shortage of products in many areas. Fifteen of the companies have active branches in Cuba. One company temporarily suspended its Cuban activities in 2021, and one company temporarily closed its branch as it was managing its business activities remotely. The companies operating branches in Cuba employ Cuban citizens (from two to 280). Twelve of the companies have a branch of a foreign parent company established in Cuba according to the Decree No. 32 of the Council of Ministers (before Decree No. 206), three companies have a branch with capital participation according to Law No. 118 and two companies established a subsidiary in Cuba with a 49% share in the share capital (a Cuban state-owned enterprise owned 51%) also according to Law No. 118.

4. Results

4.1 Evaluation of the investment climate

We asked the companies to evaluate selected factors of the investment climate regarding the problematic nature of their business activities in Cuba in the questionnaire and during the structured interviews.

Individual factors were rated on a scale of 1 to 5 (1 for "not problematic at all" to 5 for "very problematic"). The average evaluation of individual factors is visualized in Fig. 3.

According to the questionnaires, the most problematic factor for doing business in Cuba is low macroeconomic stability with a rating of 4.4 (Fig. 3). During the interviews, respondents complained in particular about the unpredictability and significant fluctuations in economic development and the instability of the Cuban economic system. They also stressed that the Cuban economy is very sensitive to the development of relations between the USA and Cuba. The Cuban economy has been negatively affected by the reduction in remittances from the United States, whose flows increased after US President Obama eased restrictions on them in 2015 but they were tightened again by his successor President Trump (Vidal 2019). The decreased economic support from Venezuela is also having a negative effect. Venezuelan support has been gradually reduced since 2014 due to the economic crisis in Venezuela (Mesa-Lago and Vidal 2019). Furthermore, the respondents mentioned the high dependence of the Cuban economy on foreign tourism as a source of foreign currency. They complained, that any fluctuations in the number of tourists are immediately reflected in the state of the economy, which was particularly evident during the COVID-19 pandemic. According to the respondents, any drop in the state budget revenues is rapidly mirrored in the purchasing power of state-owned enterprises, which are the main (in most cases the only) business partners of MNEs.

The second most problematic factor (evaluated with an identical average mark of 3.8) identified by respondents was real estate acquisition and access to

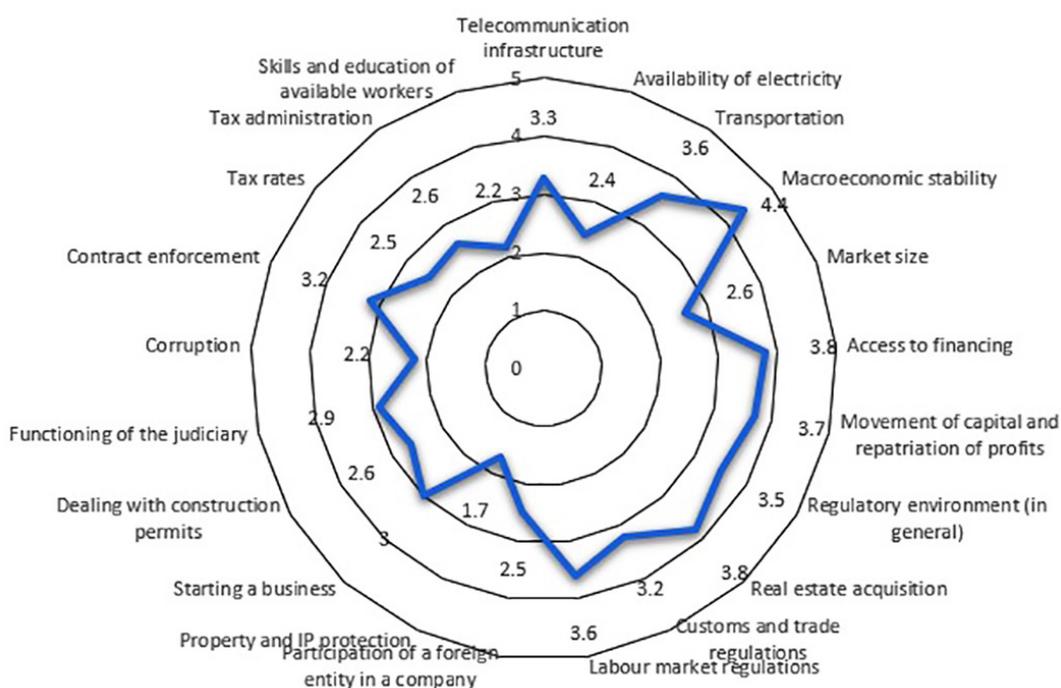


Fig. 3 Problematic factors of the Cuban investment climate.

Source: Original research done by the authors

financing. The acquisition of real estate is not allowed for foreign entities and thus, MNEs are dependent on renting the necessary premises. MNEs mentioned that this ban is sometimes circumvented by fictitiously registering the property acquired by an MNE to Cuban citizens, for example, the company employees. This option was used by one of the interviewed MNEs. However, this company highlighted that this solution is far from ideal and a high amount of trust and long-term relationship with the local employees is necessary. In the case of access to finance, the MNEs find very limiting the impossibility of obtaining a loan from a Cuban bank and rely only on financing from outside of Cuba. One Czech company mentioned the limited possibility to obtain loans for operations in Cuba via Spanish banks, which they had been granted for some Cuban projects in the past. However, this option was surprisingly evaluated as very difficult by the interviewed Spanish companies.

The movement of capital and profit repatriation was identified as the third most problematic factor (with an average rating of 3.7). MNEs perceive the transfer of profits into euros and their sending to bank accounts outside Cuba as the most problematic. Due to the regular shortage of foreign currency in the Cuban financial system, these transactions are regularly delayed by several months and repeated demands for payment are needed to complete them. Two other factors that were more adversely evaluated with an average rating of 3.6 were the labour market regulations and transportation. MNEs consider the impossibility of directly hiring Cuban workers and setting the employment conditions as very problematic. According to the criteria received from MNEs, employees are selected by a state agency, which also determines their remuneration. The salary determined by the state agency is usually very low and insufficient to keep employees motivated. MNEs often have to increase it by a certain amount paid unofficially above the normal salary to keep the motivation high. Nearly all interviewed MNEs mentioned this practice. Regarding transportation, MNEs mentioned that they have to face several obstacles when moving around Cuba. The main one is the real impossibility of purchasing a car. Cars are only available in Cuba at prices several times higher than that typical in Western markets. Some MNEs bring cars from Europe, but they have problems with their maintenance and finding spare parts in Cuba. The unavailability of cars makes the MNEs dependent on public transportation, which they claim to be very unreliable and slow. The respondents had the opportunity to add other problematic factors to the questionnaire. In eight cases, the companies stated the payment morale of Cuban state-owned enterprises. Except for one company, all the interviewed companies have outstanding claims in Cuba ranging up to millions of euros, up to several years overdue. MNEs mentioned that they tend to obtain the majority of their claims at some point, but the

constant debt recovery is time and resource-consuming. MNEs try to reduce the risk associated with the poor payment morale of Cuban companies through, for example, insurance in their home countries. They also seek to recover payments on claims through the courts or representatives of their countries during official visits. However, according to MNEs, these tools are only effective to a limited extent. In five cases, the companies mentioned the trade embargo imposed by the USA, which was not included among the evaluated factors, given that it is an external factor. In particular, the interviewed MNEs mentioned that many companies operating in the US are concerned about cooperating with them (as suppliers, for example) for fear of possible embargo violations and the imposition of sanctions.

In most cases, the identified problematic factors align with previous research (Walsh 2017; Rottig, Muscarella, and de Oliveira 2019; Vidal and Alonso 2021). However, we also identified financing, property ownership and the US embargo among the most limiting, although the emphasis on the US embargo was lower than in Walsh (2017) and Vidal and Alonso (2021). It can be explained by the high representation of US companies in the samples used in those studies, which naturally are more exposed to sanctions, while the European companies are affected somewhat indirectly. Unlike previous research, we found that macro-economic stability seems to be the most problematic factor for MNEs. It might be due to the recent deterioration in Cuba's economic relations with the US and Venezuela and the COVID-19 pandemic. In contrast to previous studies, we also identified the payment morale of Cuban companies and problems with the repatriation of profits among the problematic factors.

In terms of the least problematic factors for their business, MNEs identified intellectual property rights protection (the average rating was 1.7), corruption and the skills and education of the available workforce (both 2.2) and the availability of electricity (2.4). During the structured interviews, the MNEs mentioned that they had not experienced any problems with protecting property rights. MNEs evaluated the development in the area of corruption positively, which is at a significantly lower level than it was during the 1990s. MNEs recognized the Cuban government's pressure to reduce corruption. In several cases, many Cuban executives, for example, currently even refuse to accept any gift out of fear of possible punishment. Respondents expressed satisfaction, especially with the level of skills of Cuban employees occupying both skilled and unskilled positions. The interviewed MNEs mentioned that the electricity supply has improved noticeably during recent years and nowadays, they face electricity shortages very rarely. The results are generally in line with previous studies. Like Walsh (2017), corruption and tax issues were not identified as problematic factors. Beyond the findings of other studies, we have

identified property and intellectual rights protection as the least challenging factor, which doesn't indicate different perceptions between EU and US companies.

4.2 The impact of the COVID-19 pandemic

The pandemic affected the activities of all respondents very negatively, except for one Spanish medical company supplying material for the production of the Cuban vaccine against COVID-19, which had the most successful year in 2021 throughout its 15 years of operation in Cuba. The other respondents mentioned a significant decline in revenues leading in most cases to losses in 2020 and 2021. According to the respondents, the decline in revenues was caused by a reduction in expenditures (especially for investments) by state-owned enterprises, which in most cases are the only customers of these MNEs. The decrease in expenses by state-owned enterprises was mainly due to a decline in revenue from tourism, which is one of the primary sources of foreign currency and a significant contributor to Cuban GDP. The interviewed MNEs reported a further deterioration in the payment morale of Cuban state-owned enterprises during the pandemic. In three cases, the companies mentioned the possibility of leaving the Cuban market if the situation did not improve. One company did temporarily suspend its business activities in Cuba. There were also problems in logistics, with companies noting significant transport delays. The issue of maintaining personal contacts, which according to the respondents, are crucial for a business to be successful in Cuba, was also mentioned repeatedly.

4.3 The development of the investment climate in the last five years

In the questionnaire, the MNEs were asked to evaluate the development of the Cuban investment climate over the last five years concerning their business. Nine of the companies surveyed stated that they had not seen any positive changes. During the structured interviews, three companies mentioned that they had not noticed any changes in the regulatory environment that would affect their operations in Cuba. Naturally, these companies have seen and experienced adverse economic developments in recent years, caused in particular by the COVID-19 pandemic, the reduction of economic support for the Cuban regime from Venezuela, and the evolution of relations between Cuba and the United States.

Five companies stated they had a positive view of some aspects of the opening up of the private sector in Cuba, notably a new law in August 2021 that allows Cuban residents to set up small and medium-sized businesses. This change has not yet had a direct impact on the interviewed MNEs, given that the ban on cooperation between MNEs and the Cuban private sector is still in force. However, the interviewed MNEs

recognized a certain amount of effort by the Cuban government to gradually relax this ban in the future, which could expand their business opportunities.

Two respondents stated that they had seen the benefits of unifying the two Cuban currencies in January 2021. Despite the rising inflation, primarily due to monetary reform, they welcome greater transparency in the monetary system. One company surveyed cited the development of a special Mariel Free Trade Zone in which investors can operate on more favorable terms.

4.4 The main obstacles to further development of MNEs

The companies were also asked about three main obstacles to further expanding their activities in Cuba. Therefore, if there were improvements in the areas concerned, this would probably lead to an increase in the business activities of MNEs. To a large extent, the mentioned obstacles logically overlap with the problematic factors described in the previous subchapters.

The most frequently mentioned obstacle (in eight cases) was, as with problematic factors, the payment morale of Cuban state-owned enterprises and the difficult recovery of old claims. The second most frequently mentioned obstacle (in seven cases) was the real impossibility of obtaining local funding in Cuba and the problem of converting profits in the Cuban currency into euros. The third most frequently mentioned obstacle (in five cases) was the problem with local transport, especially the fundamental impossibility of purchasing a car and the complications this created in terms of the movement of its employees in the country. Another obstacle mentioned again was the trade embargo imposed by the USA.

4.5 Implications for the development of the Cuban economy

The average evaluation of selected factors of the investment climate was 3.0. Similar levels of evaluation were received by both tangible (average 3.1) and intangible (average 3.0) factors. This indicates a certain general discontent of the surveyed MNEs with the Cuban investment climate. Apart from the implications for the MNEs activity, this could also indicate a significant limit to the market allocation process, which would be hindering the development of the Cuban economy. Lin (2011) suggests that regarding the development process, the state should focus mainly on improving infrastructure and leave the allocation of resources predominantly to market forces. Otherwise, the investments and other business decisions of firms will not be consistent with the country's comparative advantage which could harm the country's competitiveness. Cuba, as seen from the answers of surveyed MNEs, still focuses much more

on state intervention in key sectors of the economy and invests insufficiently in the infrastructure.

In addition to this, since the ties of MNEs to the Cuban private sector are limited by law, the extent of spillover effects from MNEs to local private companies is expected to be rather low. On the other hand, considering that in Cuba horizontal FDI prevails over vertical FDI, the Cuban economy should be able to gain certain benefits from MNEs activity (Dicken 2015). Nevertheless, to evaluate this, more research focused on the size of the spillover effects would be needed. Thus, to boost Cuba's development process it is important that the Cuban authorities systematically focus on the identified problematic institutional aspects.

5. Conclusion

The Cuban investment climate is unique and differs from the investment environment of Western economies and other emerging countries. Cuba is one of the few countries with a predominantly centrally planned economy, and its stance on MNEs and foreign capital has been rather negative in the last few decades. However, specific opportunities for MNEs to enter the Cuban market have been possible since the 1990s, and several took advantage of this situation and now operate in many areas in Cuba. Their activities are primarily based on horizontal FDI with market-seeking motivation. Despite their long-term operations, MNEs' activities in Cuba remain relatively small. It is evident, for example, from the estimates of the volume of incoming FDI. There is a minimal amount of aggregated information on the business activities of MNEs in Cuba. Official data (e.g. on FDI volumes) are not published, or the data are delayed by several years (Feinberg 2016). In addition, many analysts find the provided data unreliable (Vidal 2020).

We evaluated the conditions for MNEs operations and the barriers for their activity and future growth based on a questionnaire survey and follow-up semi-structured interviews with MNEs. We focused on the development of the investment climate in Cuba over the last five years. We found that MNEs consider low macroeconomic stability, the impossibility of acquiring real estate, access to financing, and movement of capital and profit repatriation as the most problematic factors for their business activities in Cuba. During the semi-structured interviews, the companies also most often mentioned the poor payment morale of Cuban state-owned enterprises and the trade embargo imposed by the USA (as an external factor). On the other hand, MNEs executives view the protection of property rights and intellectual property, corruption, the skills and education of the available workforce, and the availability of electricity as the least problematic.

In terms of the development of the investment climate, over half of the MNEs have not seen any positive

changes concerning their business activities. Six companies have a positive view of some of the aspects of the opening up of the private sector that took place in 2021, which could create new opportunities for MNEs in the future.

Many of the findings are consistent with the results of previous research. Problems identified as very problematic factors were related to financing and property ownership as found by Walsh (2017) or issues related to transport infrastructure and labor market regulation as described by Rotting, Muscarella and de Oliveira (2018). Several companies (5 out of 17) mentioned the US embargo as a limiting factor. Still, they did not emphasize its limiting significance to the same extent as Walsh (2017) or Alejadro and Alonso (2021), partly because all companies were of European origin, thus not affected by the US embargo directly. As with Walsh (2017), we did not identify either corruption or tax issues as problematic factors. In contrast to previous research, the research identified macroeconomic stability as the most challenging factor, which may be due to the deteriorating economic situation in the last few years due to the reduction in Venezuelan support, the deterioration of relations between Cuba and the United States and the COVID-19 pandemic.

The MNEs' positive evaluations regarding property and intellectual rights protection, corruption and also contract enforcement can be seen as rather surprising, given the perception of Cuba in terms of governance (according to WGI and Corruption Perception Index or Walsh (2017)) it is not very satisfactory. These findings would thus not be in line with the view that the governance/rule of law factors are major determinants of MNEs activities as stated for example by Li and Resnick (2003).

Our results regarding the perception of the regulatory environment are fairly consistent with the WGI, as both WGI (in 2020 Cuba ranked among the worst countries – at the 6th percentile) and our respondents (Regulatory environment was rated 3,5 out of 5) have rated it very negatively. Some differences are also obvious in the evaluation of corruption perception. While our respondents have rated the corruption level rather positively (2,2 out of 5), in WGI Cuba ranked at the 55th percentile and also scored poorly in Transparency International's Corruption Perception Index with a score of 46/100.

The research conducted thus identifies the problematic factors in the regulatory and macroeconomic areas that limit the activities of MNEs and have further implications for the process of the Cuban development process. Should the Cuban government be interested in making MNEs a more active presence in the Cuban economy and benefit more from their presence, significant progress must be made, especially in these identified areas. MNEs considering entering Cuba must take into account the identified factors in their market entry strategies and consider

possible ways of hedging against the risks arising from them, for example, various types of insurance policies.

Some of our findings prompt further investigation. One of them is the issue of corruption, where we obtained slightly better results than the WGI and Corruption Perception Index. Also, it would be interesting to investigate, why some of the rules of law issues (contract enforcement or property and intellectual rights protection) were not marked as significantly problematic for the examined MNEs. Perhaps one of the reasons could be that the risks are sufficiently compensated by higher profits, but it would be beneficial to further investigate this issue. Additionally, we only researched companies that are already active in Cuba and thus only investigated how the operations of these companies would develop if certain changes in different investment environment aspects occurred. However, these changes might also attract the attention of other companies that until now were not active in Cuba. Therefore, future research should also include companies that are considering entering the Cuban market, these could possibly be reached at various fairs or Cuba-related events.

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Appendix 1: The questionnaire

1) What is the focus of your company's activities in Cuba?

2) For how many years has your company been operating in Cuba? _____

3) Does your company have permanent representation in Cuba? () yes () no

If yes:

- How many employees does your company have in Cuba? _____
- What is the proportion of foreign employees among all your employees in Cuba? _____
- What is the legal form of your business in Cuba (e.g. branch, joint venture etc.)? _____

4) What was the motivation for your company to start doing business in Cuba?

5) How problematic are the following factors for the activities and growth of your company in Cuba?

(Please rate the different factors from 1 to 5, 1 meaning "not problematic at all" and 5 meaning "very problematic". If possible, please add a short comment.)

- telecommunication infrastructure (Internet access, mobile data, mobile network, etc.):
- availability of electricity:
- transportation (roads, public transportation, etc.):
- real estate acquisition:
- tax rates:
- tax administration:
- customs and trade regulations:
- labour market regulations:
- skills and education of available workers:
- regulatory environment (in general):
- macroeconomic instability (inflation, exchange rate, etc.):
- functioning of the judiciary:
- corruption:
- access to financing:
- market size:
- movement of capital and repatriation of profits:
- limitations regarding the maximum participation of a foreign entity in a Cuban company:
- property and intellectual rights protection:
- contract enforcement:
- starting a business:
- dealing with construction permits:

6) Are there any other factors that significantly affect your business company in Cuba? If so, what are they and what is their impact?

7) What are the three main obstacles to the development of your company in Cuba?

8) What changes in the business environment in the last 5 years have been the most significant for your operations in Cuba?

9) How has Covid-19 affected the activities of your company in Cuba?

Historical geography of the pastoral system in Samtskhe-Javakheti, Georgia

Roman Maisuradze^{1,*}, Tamar Khardziani²

¹ Ivane Javakhishvili Tbilisi State University, Department of Geography, Georgia

² Ivane Javakhishvili Tbilisi State University, Vakhushti Bagrationi Institute of Geography, Georgia

* Corresponding author: romani.maisuradze@tsu.ge

ABSTRACT

The Georgian region, Samtskhe-Javakheti, has a long tradition of pastoralism. Our research focused on the study of pastoral agriculture across XVI–XX centuries. The study is based on census documents, which provide information on the number of sheep and their distribution, statistical and modern field-based materials. The research goal was to study the pastoral systems and related socio-economic sectors and analyze their spatial and temporal dimensions. The paper presents thematic maps prepared by the authors, which reflect the state of pastoralism in the sixteenth to twentieth centuries and the present situation. The tabular and cartographic material presented allows to assess the changes that have taken place over a long time and to analyze modern conditions.

KEYWORDS

pastoralism; sheep; pastures; Samtskhe-Javakheti; Georgia

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1. Introduction

The paper discusses the spatial and temporal aspects of the pastoral economy in the Samtskhe-Javakheti region. Pastoral farming is an important agricultural sector with a long development tradition and represents a “deep structure” (Braudel and Wallerstein 2009) of socio-economic activity. Like in Asia Minor and regions of the Caucasus, pastoralism in Georgia dates back to the Neolithic period, when the domestication of sheep, goats, and cattle entered an active phase (Chessa et al. 2009). The importance of sheep husbandry is high in the local economy and international trade. Sheep exports from Georgia to neighbouring countries repeat traditional trade relations and show a growing trend. The leading importers are Middle East countries (Gabriadze et al. 2019; Kandashvili et al. 2020). The low price of Georgian sheep is one of the attractive factors for exporters. Sheep and related products also serve the local market. In addition to meat and dairy products, wool and leather production was of great importance in the study area.

The economic and political challenges of the late Middle Ages were linked to changes in the natural environment and geopolitical shifts, and military interventions. The study region experienced Ottoman invasions in the 16-19th centuries (Svanidze 1971). The region was also threatened by the so-called “Lekianoba”, which meant kidnapping and trafficking in captives (Alimbarashvili 2013). During the Middle Ages, the northern hemisphere was characterized by a drop in annual air temperature that often lasted for decades (Mann 2002; Matthews and Briffa 2005). Cold weather naturally increased the demand for warm clothing and wool production, which became a precondition for the growth of the agro-pastoral system in the study area. The same factor may have been one of the reasons why the number of sheep in Europe and the Middle East increased significantly during the Middle Ages, followed by increasing wool production. Sheep growth for this period is also observed on the Iberian Peninsula (Butzer 1988). In Britain, from the middle of the thirteenth century, there was a significant increase in the role of sheep economy. Thus, swampy areas were also used apart from the existing pastures for grazing (Mate 1987). The number of sheep decreased during the Black Plague pandemic in the mid-fourteenth century, and by the 16th century, its sharp increase was again observed (Oldland 2014). The importance of sheep farming was very high, and in international trade, this sector expanded its area significantly in the Middle Ages. The Caucasus, including the territory of Georgia, where the long tradition of pastoral farming was formed, should not be an exception.

Georgia has different sheep farming forms, including sedentary and transhumance. Samtskhe-Javakheti region has a mixed type, which implies both local

sheep farming when pastures are used by local farmers and seasonal use of pastures by pastoralists from other regions of Georgia. This type of mixed sheep-herding has existed for at least several centuries, evidenced by the sixteenth-century census document, *The Great Book of Gurjistan Vilayet*, which was the primary source of our research. The document prepared by the officials of the Ottoman Empire dates back to 1595. The census had its political and economic preconditions and was carried out to collect taxes related to the expansion of the Ottoman Empire towards the Caucasus (Maisuradze et al. 2020). This description is the earliest and most well-documented source that has reached the present day. Until 1490, Georgia was united as one kingdom, later divided into Kartli, Kakheti and Imereti kingdoms, and Samtskhe-Saatabago. In 1490, the Kingdom Hall in Tbilisi officially confirmed the disintegration of Georgia into the kingdoms mentioned above. No earlier census documents have been preserved for the territory of Georgia, although such descriptive work had to be carried out as the centralized state needed to collect taxes in an orderly manner. The results of the census conducted by the Mongols in 1254 to collect taxes are also lost (Javakhishvili 1982). Foreign officials described the Kingdom of Georgia in 1254, Samtskhe-Saatabago in 1595 and the Kingdom of Kartli in 1728. After the formation of the USSR, another important document was prepared, based on the 1923 census of population and agriculture (Central Division of Statistics 1925). By the resolution of January 5, 1930, the Central Committee of the CPSU set 1933 as the date of complete collectivization of Georgia. This period began transferring most of the property owned by private households to collective farms. The 1923 agricultural census became the base of confiscating land and livestock from private owners and the subsequent commencement of the collectivization process, and unfortunately, this document was used for mass expropriation and infringement of private property. The agricultural censuses of 1254, 1595, 1728 and 1923, on the one hand, served one purpose – collecting monetary taxes from the population. In all these cases, the process was carried out due to the regime established after the external intervention and had no positive outcomes.

The censuses of 1595 and 1923 allowed us to determine the location of the main centres of the pastoral economy and the distribution of pastures by settlements or administrative units. Our interest was in studying the intensity of pastoral farming and the changes that have taken place in the fields related to sheep husbandry, as shown in the census materials. For comparison, we took three periods significantly different from each other, reflecting the changes and trends that have taken place. According to the census results, it was essential to assess the supply of sheep products to the population of Samtskhe-Javakheti, including wool. The analysis showed how vital pastoral farming was for the local population.

2. Study area

Samtskhe-Javakheti is located in the southern part of Georgia and unites six administrative units – Akhaltsikhe, Adigeni, Aspindza, Akhalkalaki, Ninotsminda and Borjomi municipalities. The region’s area is

about 6.4 thousand square kilometres, and its population comprises 160.5 thousand people (National Statistics Office of Georgia 2022). Part of the territory of modern Samtskhe-Javakheti, namely the gorge of the river Jamjama, a tributary of the river Ktsia, was not included in the so-called Gurjistan

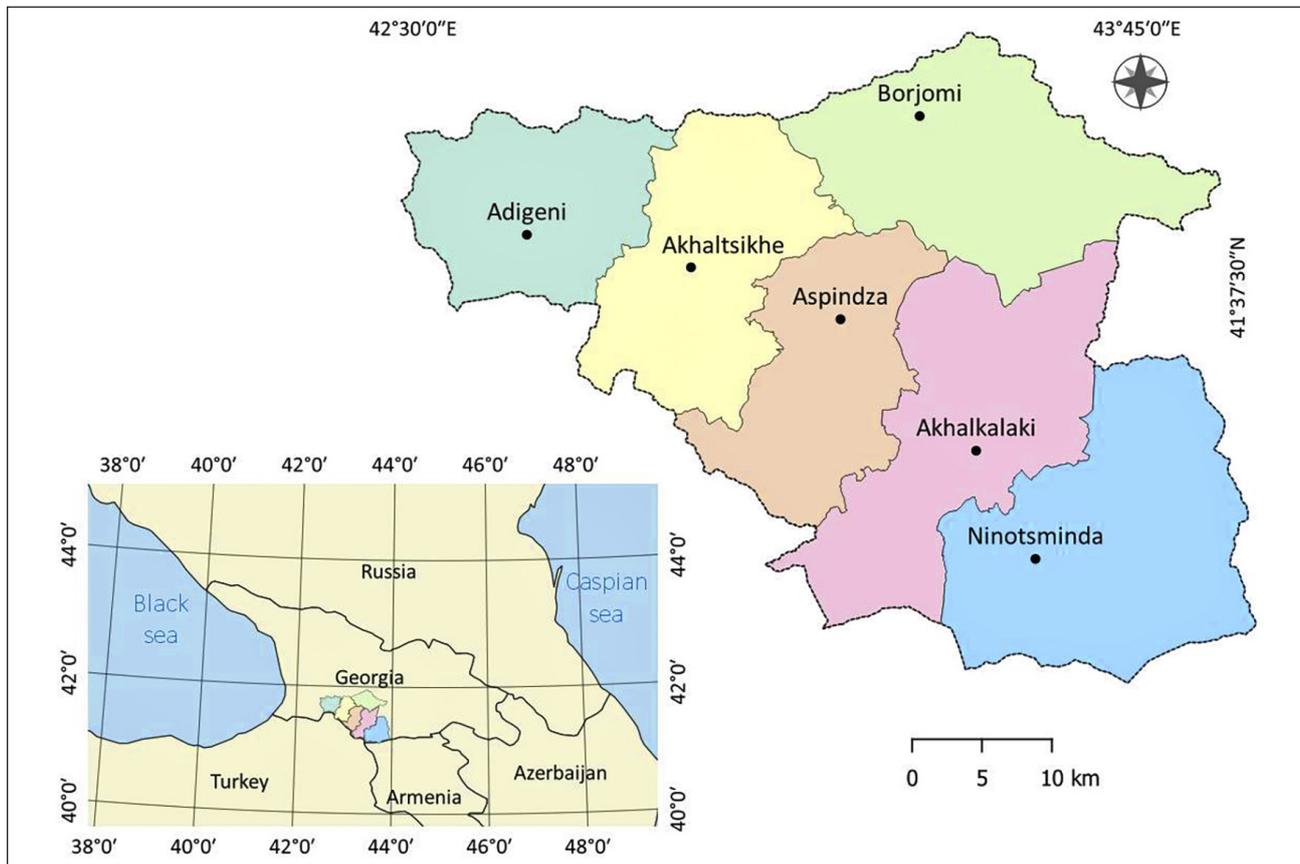


Fig. 1 Study area.
Source: Elaborated by the authors.

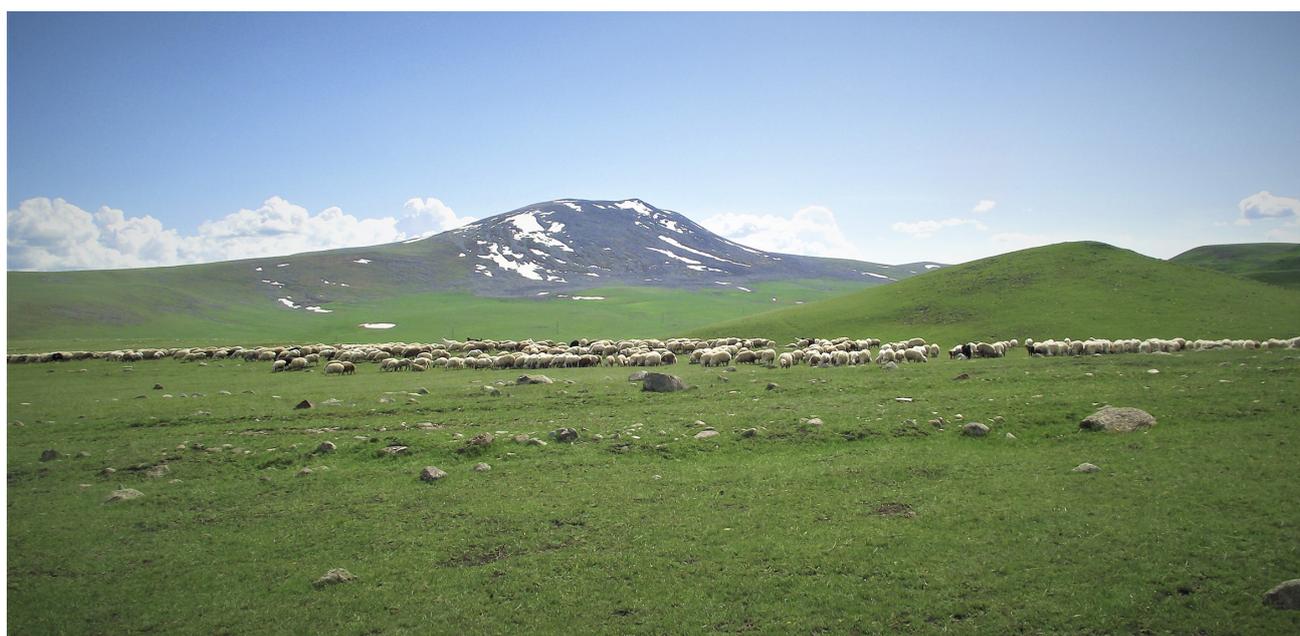


Fig. 2 Sheep grazing on Samsari Ridge, Javakheti.
Source: Photo by Roman Maisuradze, 2018.

Vilayet. Another clarification: the village of Kvishkheti, which was included in Gurjistan Vilayet in 1595, today belongs to the Shida Kartli region. Besides, the village Kikibo and the upper reaches of the river Kvabliani are located outside the Samtskhe-Javakheti, which were part of the Gurjistan Vilayet. Samtskhe-Javakheti is a mountainous region. The extreme low point lies near the village of Akhaldaba at about 740 m a.s.l., while the highest point is Mt. Didi Abuli (3301 m a.s.l.) (Maisuradze and Khardziani 2021). The region is characterized by vertical zoning of ecosystems and climate diversity. Quaternary volcanism and its remnants play an important role in landscape formation and different relief forms (Fig. 1).

The following large orographic units are distinguished in the region: 1. The Lesser Caucasus system, including Arsiani, Adjara-Imereti and Trialeti ridges; 2. Akhaltsikhe Valley, the lower and middle reaches of the river Kvabliani, the Mtkvari Gorge in the Atskuri-Aspindza section and the lower reaches of the Uraeli and Potskhovi gorges; 3. Volcanic canyon, Aspindza-Mirashkhani section in Mtkvari gorge and Khertvisi-Akhalkalaki section in Paravanistskali gorge; 4. Volcanic plateaus: in the form of Javakheti, Niali, Fersati, Bakuriani, Borjomi plateaus; 5. Ridges of volcanic origin, with cones and volcanic lakes, in the form of Abul-Samsar and Javakheti ridges (Maisuradze et al. 2021).

3. Materials and methods

3.1 Materials

We used the following materials in the study: 1. The Great Book of Gurjistan Vilayet is a document that describes the condition of the population and agriculture in the study region (Jikia 1941). For settlements, payment was recorded in monetary units (Akhche), although their respective natural units were also indicated, corresponding to the weight/volume of Akhche in the units of weight and volume at that time (Kila, Mani / Batman); 2. The agricultural census of Georgia was conducted in 1923, so-called community sums, where the local population, land fund, crops and livestock are described (Central Division of Statistics 1925); 3. The National Statistics Office conducted the 2004 and 2014 Georgian censuses. However, their differentiation by spatial units is much more general, and in public access documents, they are grouped by the municipalities (National Statistics Office of Georgia 2004, 2014); 4. Large-scale topographic maps were compiled during the Soviet period at a scale of 1 : 25,000, which we used to identify settlements and determine locations; 5. Google Earth satellite imagery (2018–2019); and 6. The sample plots were described during the field trips (2017–2018) to study the types of ecosystems, the main floristic composition, and the pastures' productivity.

3.2 Methods

The study focused on the main types of ecosystems typical in the region and conducted research activities to determine their species composition and grassland productivity (Braun-Blanquet 1932; Schils and Coppejans 2003). We took one square meter as a model plot, on which we determined the species composition and the scale of their coverage. We also summarized the grass cover mass that helped determine phytomass productivity (Beruchashvili 1983). Finally, we mapped the samples from the field and extrapolated the data by landscape units, for which we used a landscape map compiled by us during 2009–2012 at a scale of 1 : 200,000.

Quantitative analysis method: The exact number of sheep is not mentioned in the Great Book of Gurjistan Vilayet in contrast to the mentioned document, the number of sheep in the 1923 census was calculated accurately. The census document of 1595 had another advantage – the description was given according to the settlements. However, the levied taxes were clearly stated, including the taxes on sheep, allowing us to evaluate the number of sheep, which includes the number of sheep raised on both sedentary and seasonal summer pastures. Sedentary – when the sheep were owned by local residents and they were housed on site during the cold period of the year, and seasonal when the sheep were owned by residents of other regions and they were brought here only for summer pastures. The tax levied on one sheep was one Akhcha. The total tax had been levied for both adult sheep and lamb. For sheep grazing on summer pastures from other regions, there was a so-called Yataghi tax. Yataghi was levied on the entire flock. Typically, a flock of sheep consisted of an average of 150–250 sheep (Svanidze 1984).

Therefore, took the arithmetic mean number was applied 200 sheep, as the quantity of a separate flock of sheep. Yataghi tax on one flock comprised 25 Akhche; therefore, we assumed that 25 Akhche were collected on average out of every 200 sheep. For the administrative units, attribute tables were prepared, which included information on sheep by settlements. Finally, the number of local and external sheep was summarized and then compared them by administrative units (Liva, Nahia) they would graze. In addition to the 1595 census, we prepared tables in Excel format to calculate 1923 census spreadsheets and estimate the number of sheep in each administrative unit and their distribution by pastures and local households. The cartographic method involved using large-scale topographic maps and satellite imagery to identify and map the settlements described in the 1595 document. Determining their location was complicated because some settlements no longer exists today (Jikia 1958). We checked their location during the field works in 2017–2018. As a result, determined the location of the settlements on the maps and satellite images, which have disappeared.

Vector layers were created using a geoinformation system. A database was prepared to enter the calculated information according to the imposed tax on sheep. In addition to the large-scale map of administrative units (1 : 25,000), We digitized and created vector layers from satellite images (2018–2019) depicting the distribution of the land fund used for grazing and pasture and divided them into two categories: 1. Pastures suitable for mowing; and 2. Pastures, which were non-suitable for mowing. The second category included lands that could not be used for mowing due to the steep slope and thus were used for extensive husbandry. Based on the census documents (1595, 1923), created maps showing the distribution of pastures by administrative units for two periods, the end of the sixteenth century and the beginning of the twentieth century. In addition, conducted a sheep husbandry analysis according to the administrative units. The maps presented in the article were prepared using the QGIS program. Research also implied a method of comparative analysis that reflects the distribution of sheep and pastures for the sixteenth, twentieth, and twenty-first centuries. Because these are the only documents for the entire region from the few existing census documents that are available. Accordingly, the following has been conducted: 1. Comparative analysis of the structure of the land fund and the provision of population with pastures; 2. Comparative analysis of the sheep and sheep products provision.

4. Results

Of the sites named in the historical source, 644 were settlements, while 29 described units were croplands or hydrographic units. Only part of the described settlements is inhabited today. Many of them are uninhabited, and some of them are extinct and is difficult to determine their location. The settlements were united in administrative units called Nahia, referred to as regions (Jikia 1941). Each Nahia was united into a larger administrative unit, the Liva (Sanjak). There were nineteen Nahias in total, which were united in six Livas. Twenty-two settlements had the status of Castle Rabat (A settlement where residential buildings were located around the fortress), and in addition to them, Vardzia was a town carved into the rock. Besides, Baraleti and Gokia were referred to as small trading type towns. The rest of the settlements were villages, and their surroundings were also used for grazing.

Judging by the sample data taken in the field, the meadow used for grazing should have mixed species composition. Among the species forming meadows, there are formations suitable for feeding sheep.

Sample plot #1: It is located near the village Shalosheti (E 43°11'795"; N 41°26'168"), at 2051 m a.s.l. Dry surface phytomass equals 4.32 t/ha. The distribution of plant formations by tier, height, and projection coverage was tabulated to give a better idea of

which species were the dominant meadow-forming formations to be used as sheep feed (Tab. 1). The field data shows that meadow productivity is close to the average (3.7 t/ha) calculated for highland meadow landscapes from surveys conducted in the last century (Beruchashvili 1995). In addition, the condition of the described meadow is relatively well maintained as cattle grazing is less observed here.

Tab. 1 Meadow species composition by the sample plot #1. Source: Authors' own processing.

Species	Tier	Height (m)
<i>Poa alpina</i> L.	I	1.1
<i>Phleum pratense</i> L.	I	0.9
<i>Trifolium pratense</i> L.	III	0.3
<i>Malva sylvestris</i> L.	IV	0.2
<i>Vicia tenuifolia</i> Roth	II	0.5
<i>Agrostis capillaris</i> L.	II	0.4
<i>Cirsium vulgare</i> (Savi) Ten.	III	0.3
<i>Taraxacum officinale</i> Weber ex Wiggins	III	0.3
<i>Achillea millefolium</i> L.	IV	0.2
<i>Scabiosa bipinnata</i> C. Koch	III	0.3

Sample plot #2: The meadow near Lake Paravani (E 43°50'479"; N 41°26'122") at 2091 m a.s.l. (Tab. 2). Here, the meadow-forming species are almost evenly distributed, and the floristic composition is relatively poor. As a result, the productivity of the meadow in this plot was lower than the average – 2.1 t/ha.

Tab. 2 Meadow species composition by the sample plot #2. Source: Authors' own processing.

Species	Tier	Height (m)
<i>Trifolium pratense</i> L.	I	0.3
<i>Ranunculus repens</i> L.	I	0.3
<i>Potentilla recta</i> L.	I	0.3
<i>Achillea millefolium</i> L.	II	0.2

The number of plants common in Samtskhe-Javakheti is relatively high and includes 1652 species (Shetekauri and Chelidze 2016). These include formations that are suitable for feeding sheep. Therefore, sheep husbandry in the region should have a good precondition. The total area of pastures exceeds 2.5 thousand square kilometres, which is about 40% of the study area. Our study does not cover forest landscapes because the forest area was not used for sheep grazing newer.

In order to assess the areas used for pasture at the end of the sixteenth century, we summarized the meadow areas. These areas were consistent with the data mentioned in the census document, which showed the tax imposed on sheep and goats. Research results showed that the pastures were quite unequally distributed across administrative units of that time (Tab. 3).

Tab. 3 Pasture areas in Samtskhe-Javakheti according to the administrative units as of 1595. Source: Authors' own processing.

Liva (Sanjaq)	Pastures suitable for mowing (ha)	Pastures non-suitable for mowing (ha)	Total (ha)
Akhaltzikhe	28,621.44	50,484.08	79,105.52
Kertvisi	23,469.84	19,877.62	43,347.46
Akhalkalaki	64,405.07	38,917.17	103,322.25
Childiri	11,397.99	4,004.64	15,402.63
Fotskhovi	1,859.34	1,095.98	2,955.32
Petre	5,422.81	7,191.85	12,614.66
Total	135,176.50	121,571.34	256,747.83

As shown from the table above (Tab. 3), Akhalkalaki Liva is primarily distinguished by pastures. However, among the internal administrative units, Akhalkalaki Nahia stands out, meaning better pasture provision (Fig. 3).

The number of sheep in Akhalkalaki Nahia, distinguished by its grazing area, is high. However, it should be noted that the Tq̄e-Javakheti district is almost equal in quantity to Akhalkalaki (Fig. 4). Apart from them, Chacharaki, Khertvisi, Atsquri and Ude regions were distinguished by sheep numbers, and Aspindza district was slightly behind them. It is noteworthy that both local and external sheep grazed here, which means there was no lack of grazing land in these

areas, and the locals allowed flocks brought from other regions to graze here. If we observe the numbers of external sheep, Chacharaki and Tq̄e-Javakheti regions were in the foreground. The same indicator is also high for Akhalkalaki, Khertvisi and Atsquri regions. The numbers of local sheep still distinguish Akhalkalaki Nahia, but it is notable that Ude and Tq̄e-Javakheti regions do not lag far behind. Today's Borjomi gorge, which mainly occupies the area of former Petre Liva, lags far behind other administrative units in the number of sheep. Moreover, sheep were not observed in Kashveti Nahia.

Although the number of sheep was high, the pastures could handle the pressure from grazing, indicating that sheep husbandry in the region was relatively stable. On land used for grazing suitable for mowing, the average pressure was 0.66 sheep per hectare, and on land used only for grazing, this indicator comprised 1.4 sheep per hectare. In the pasture category, which was suitable for mowing, the average number of sheep per hectare was 0.93. As for the total amount, there were 1.97 sheep per hectare, which means that the pressure on the pasture was not high in the region. This fact indicates the following: no shortage of pastures was observed in the region and a relatively low pressure allowed them to avoid pasture degradation.

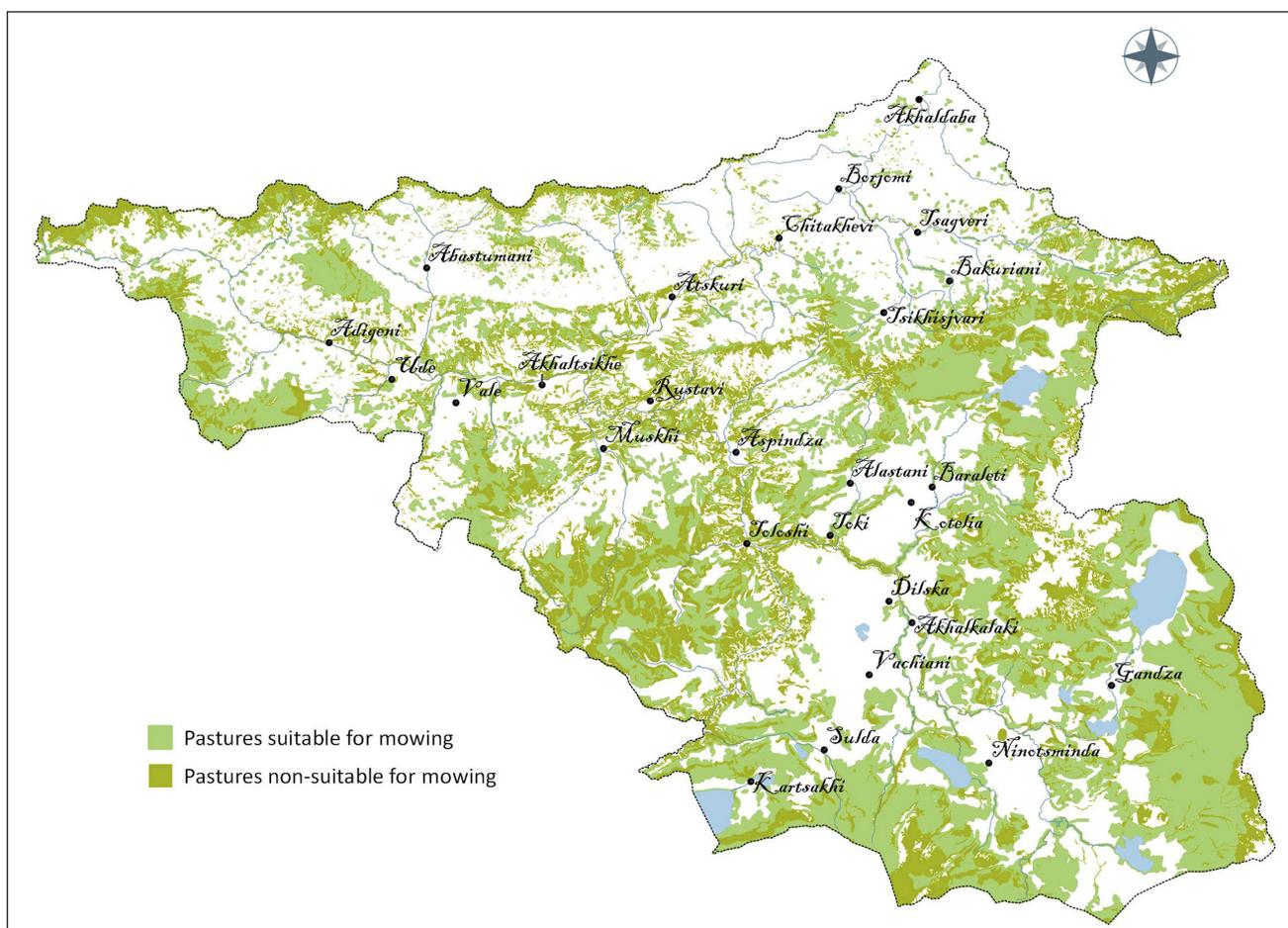


Fig. 3 Samtskhe-Javakheti pastures. Source: Elaborated by the authors.

The sheep per hectare varied between 2.5 and 4 in Atsquri, Chrdili (Potskhovi Liva), Ude, Khertvisi and Tqe-Javakheti regions. The territory of Khertvisi is characterized by steep, rocky slopes, where the grass of the mountain steppe and meadow is spread, and the slopes must have been under relatively high pressure. According to local narratives, the lack of forest and shrubs on the slopes could be not excessively grazed but fires during the wars across the fifteenth-sixteenth century were common. In the Atsquri area, where landslides are frequent and slope are dominated by soft rocks, washed slopes should be partly the result of sheep grazing. In addition to grazing, deforestation, fires, and other events that frequently altered the landscape were common (Maisuradze et al. 2018). In addition, the effect of the mountain valley climate is observed in the Atsquri district, which is manifested in increased dryness and hot, dry summers.

From the second half of the sixteenth century until 1829, most of the territory of Samtskhe-Javakheti was part of the Ottoman Empire and became a place of military confrontations. From the seventeenth century, the kings of Kartli were able to return the Borjomi gorge to the village of Dviri and made part of the Kingdom of Kartli again (Makalatia 1957). After that, a detailed census to collect the taxes is not

confirmed. A census document was made for only some part of Samtskhe-Javakheti in 1728, and this section was incorporated in the so-called Tiflisi Vilayet in 1723. In particular, only Petre Liva entered the Tiflisi Vilayet from the territory of Samtskhe-Javakheti, while the rest remained part of Akhaltsikhe Eyalet. However, the Tiflisi Vilayet existed for only twelve years (1723–1735), and this document was less used in governance.

In the 1923 census, the amount of sheep was described with high accuracy. Community farms were to become the basis of collective farms. The territorial arrangement was based on the administrative division of 1897, which united the administrative units – the so-called Mazra and their communities. The territory of Samtskhe-Javakheti united three Mazras, twenty-five communities and three self-governing towns. Part of the territorial units was united in Akhalkalaki and Akhaltsikhe Mazra, while six communities and one self-governing town in the Borjomi gorge were united in Gori Mazra. Sheep farming was still practised in the region. However, unlike the second half of the sixteenth century, the population changed, the ethnic and religious structure and the spatial distribution also varied.

The number of sheep has decreased in the seven-teenth-nineteenth centuries, significantly compared to

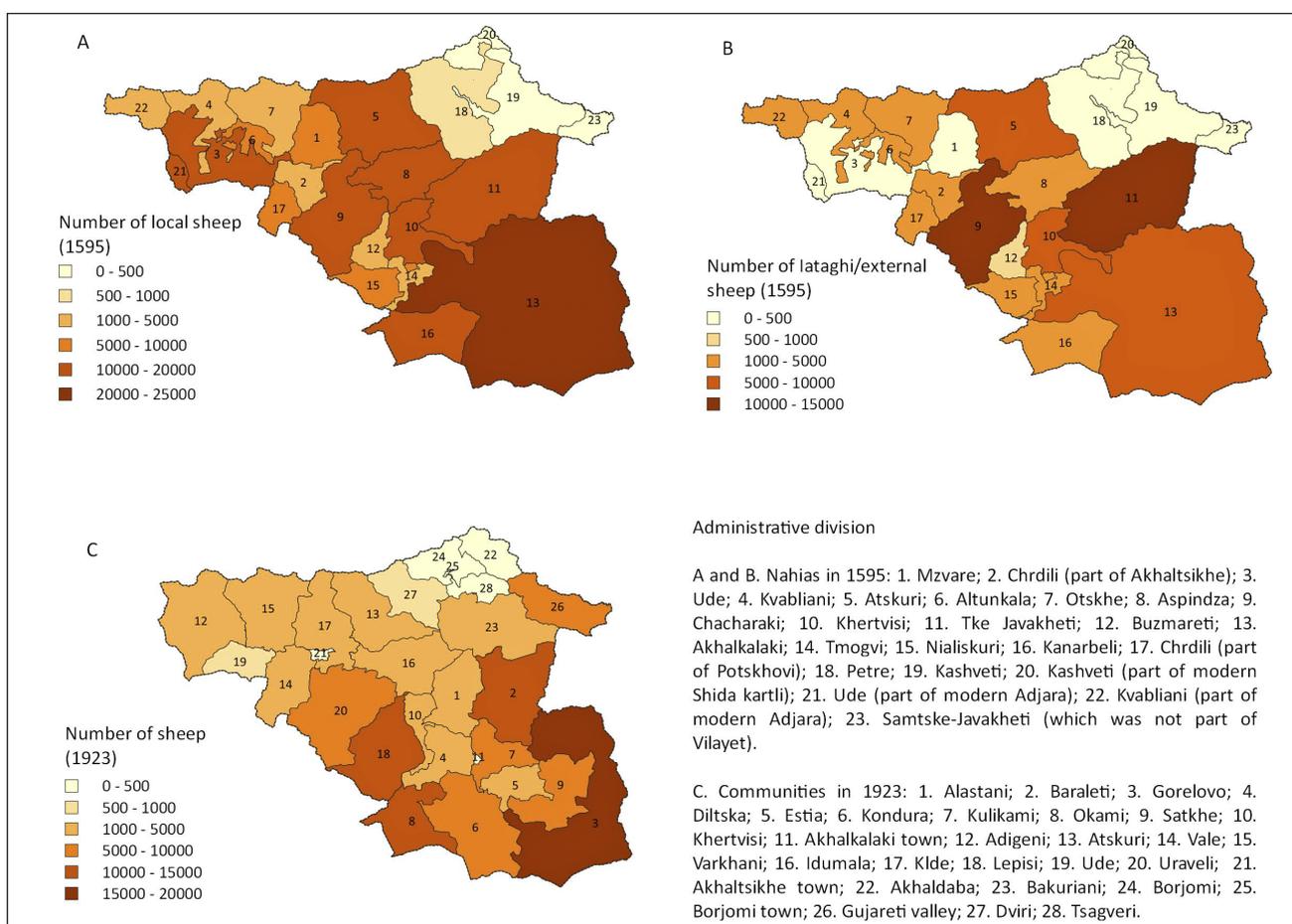


Fig. 4 Number of sheep by administrative units, state of 1595 and 1923. Source: Elaborated by the authors.

the second half of the sixteenth century. The number of local sheep is reduced by 26.73%, indicating that sheep farming has lost its position as an agricultural sector. At the end of the sixteenth century, the number of sheep in the territory of present-day Borjomi Municipality and the south-eastern part of the Javakheti Plateau was meagre, which changed at the beginning of the twentieth century. This indicates that herding was not recorded due to depopulation, and after the population returned here, they again started grazing sheep. The table below (Tab. 4) allows to understand pastoralism at the beginning of the twentieth century; namely, sheep number, their distribution by communities, and the pressure on the pastures.

Amid the decline in the total sheep number in the entire study area, its number in the territory of Borjomi Municipality has almost doubled. Furthermore, in the Khanjali-Madatapa section, shepherding has regained its role, and the Gorelovo community is most distinctive in this respect. The role of sheep farming in the Samtskhe Valley has reduced; not even a third of the sheep are left compared to the 1595 census. The pressure on the pasture is further reduced. It should be noted that, unlike the 1595 census, while calculating the pressure on pastures, we could not consider the number of external sheep, as they were recorded within the region where their owners lived permanently. However, pressure on pastures is reduced here, especially in the Adigeni-Varkhani section, where pastures were busiest in the second half of the sixteenth century (Tab. 5).

Gorelovo community were located in the upper course of the river Paravani and was distinguished by pastures suitable for mowing. Gorelovo grasslands accounted for two-thirds of the pastureland within the entire Mazra (Fig. 5 B.), while pasture non-suitable for mowing more occupied a quarter of the Akhalkalaki Mazra and 13.6% of the whole study area (Fig. 5 C). Pasturelands (Fig. 5 B.) with more than 1000 ha had only four communities, three united in Akhalkalaki Mazra and covered the Javakheti plateau

area. Apart from them, only the Bakuriani community owned more than 1000 ha of the same category pastures, including Bakuriani, Tsikhisjvari, Tori plateaus and Trialeti ridge. The second category of pastures (Fig. 5 C), in total, based on the GIS layer, is evident that, apart from Gorelovo, only three communities owned more than 20,000 hectares of pastures: Kondura, Lepis and Uraeli. The pastures of more than 10,000 ha were owned by three communities in the Akhalkalaki Mazra, two communities in the Akhaltsikhe Mazra and two communities in the Gori Mazra. In Gori Mazra (Borjomi district), more than 10000 ha of pasture lands were owned by Gujareti and Bakuriani communities, using grazing land on the Tori-Tsikhisjvari-Bakuriani-Mitarbi plateaus and summer pastures of Trialeti ridge. The Tsagveri, Akhaldaba and Borjomi communities, and the Akhaltsikhe, had a minimal pasture area. The towns of Borjomi and Akhalkalaki did not have own pastures at all. The pastures of the Akhaltsikhe Mazra communities was bordered by, on the one hand, the Arsiani ridge, on the other hand, the Fersati plateau, the highland zone of the Adjara-Imereti ridge and the slopes of the Trialeti ridge, which is characterized by highland pastures.

The number of sheep in the study area increased significantly during the Soviet period. However, a declining trend began again in the 1990s. As a result, sheep number dropped to 85,000 at the 2004 census. This trend continued into the following period.

As can be seen (Tab. 6), a decreasing trend is observed everywhere except for Ninotsminda and Borjomi municipalities. The reasons for the reduction are as follows: difficult conditions for sheep care, which is directly related to infrastructural malfunctions: roads, necessary resting areas for sheep on trails, drinking water, facilities for washing and grooming sheep, wool and care facilities and equipment for the processing and difficult living or working conditions for shepherds. Massive sheep disease and frequent predator (Wolf, lynx, Jackal) attacks have not been reported, but

Tab. 4 Number of sheep and pressure on pastures on the territory of Samtskhe-Javakheti in 1923. Source: Authors' own processing.

Mazra/Administrative unit	Sheep number	Sheep per ha of pasture suitable for mowing	Sheep per ha of pasture non-suitable for mowing
Akhalkalaki	69,941	4.32	0.60
Akhalsikhe	38,242	19.60	0.39
Gori (Modern Borjomi municipality)	9,382	4.51	0.37
Total	117,565	5.82	1.36

Tab. 5 Pasture areas in Samtskhe-Javakheti (ha) by communities and regions (1923 census). Source: Authors' own processing.

Mazra/Administrative unit	Pastures (ha)/Census data	Pastures suitable for mowing (ha)/GIS-based calculations	Pastures non-suitable for mowing (ha)/GIS-based calculations
Akhalkalaki	16,173.92	86,948.88	45,735.76
Akhalsikhe	1,951.31	36,417.75	63,389.02
Gori (Modern Borjomi municipality)	2,078.92	11,207.28	16,064.09
Total	20204.15	134,573.90	125,188.87

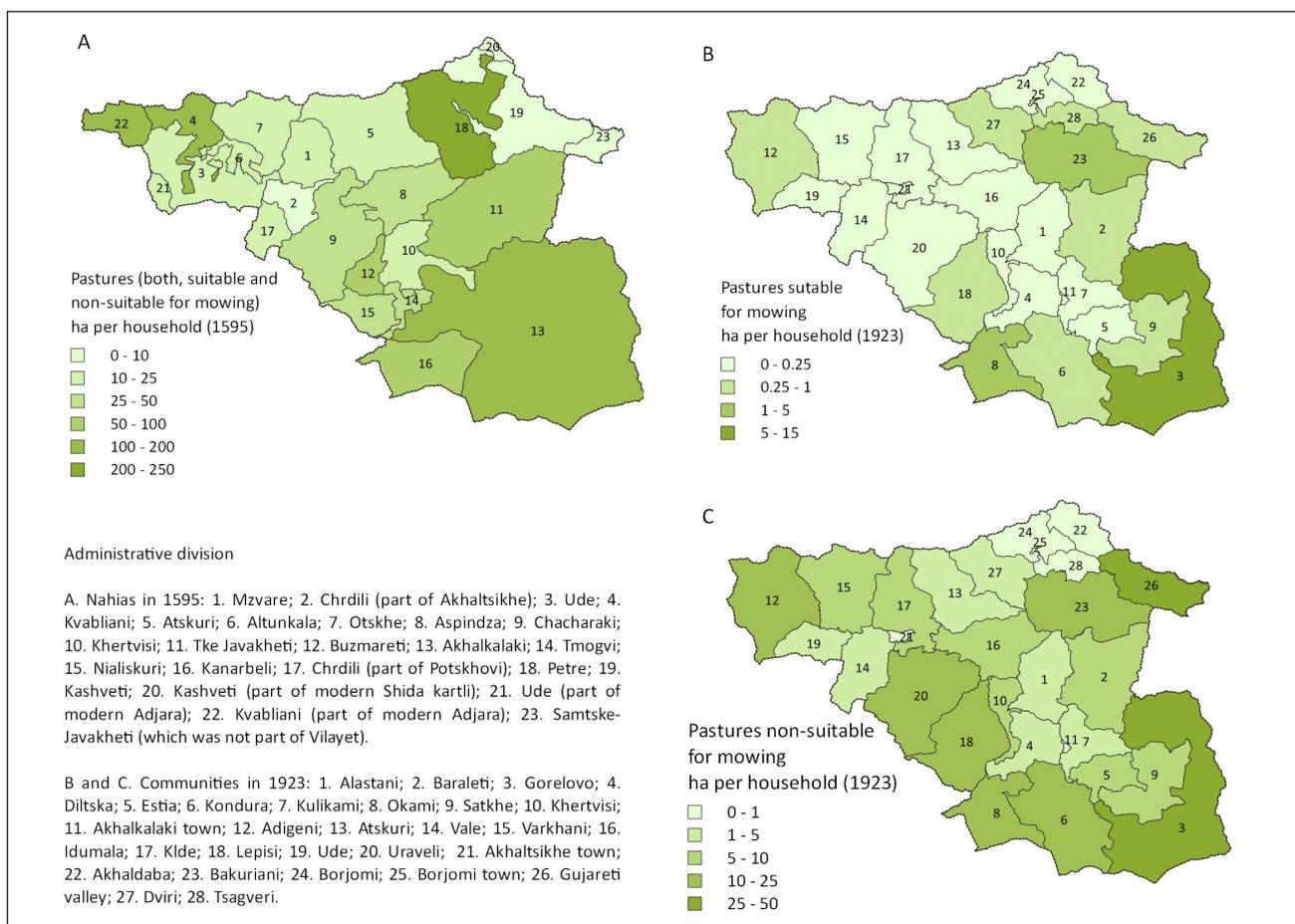


Fig. 5 Pastures per household, as of 1595 and 1923. Source: Elaborated by the authors.

shepherds talk a lot about the problematic conditions of keeping sheep. In addition, the problem is that the price of mutton is relatively low in the local market. Demand for local leather and wool is also negligible. In the region and the country, the lack of leather and wool processing production and demand for the products harms the sector. The case could not be improved either by the start of sheep exports to Middle Eastern countries, as sheep husbandry could not take the form appropriate to modern standards. Consequently, the problem is not with the lack of pastures but with the malfunction of the sector in general.

Tab. 6 Number of sheep in Samtskhe-Javakheti region, according to the administrative municipalities based on the 2004 and 2014 censuses. Source: Authors' own processing.

Municipality	Number of Sheep	
	2004	2014
Adigeni	2,324	1,262
Aspindza	13,008	5,402
Akhalkalaki	27,718	16,694
Akhaltsikhe	4 343	3,675
Borjomi	4,365	8,116
Ninotsminda	30,577	32,250
Total/Samtskhe-Javakheti	82,335	67,399

In the second half of the sixteenth century, the population of modern Samtskhe-Javakheti was smaller than it is today. The small population distinguished Petre Liva, respectively Petre and Kashveti districts. This area covers most of the territory of present-day Borjomi Municipality, and the reason for its depopulation should have been increased war and forced migration.

If sheep farming had not been profitable, it would not have had such intensity in the region, although it required a lot of hard work and care. So it is evident that not all families pursued sheep farming, or some pursued it more for meat and wool than for dairy products. Nevertheless, on average, each family owned more than 25 sheep. Since not everyone followed sheep breeding, this figure is averaged over the population and is still high.

Sheep farming was pursued with little intensity in the Chrdili and Otskhe districts, where each family owned less than ten sheep. Therefore, a relatively small number of sheep is indicated in the Mzvare Nahia. This must be explained on the one hand by the extended forest cover of the Otskhe Nahia. But, in addition, in the Mzvare and Chrdili Nahias, grain crops, viticulture and fruit growing were relatively large, and consequently, pastures covered smaller areas. When we compared the number of sheep in

these Nahias to the pasture area per household. It was found that the pasture area here was smaller per household than in regions with high sheep numbers. In Tmogvi, Chacharak, Chrdili (Potskhovi), Khertvisi, Ude, Nialisquri and Kanarbeli regions, the number of sheep per household was close to the average of the study area. It should also be noted that the population in Petre Liva and Kvabliani region was significantly reduced. There was also a large share of abandoned villages in the Buzmareti region. Consequently, these districts have a high rate of pastures per household at the expense of the small population size.

Buzmareti was the most distinguished by the number of sheep per household. This can be explained by the fact that highland meadows distinguish Buzmareti, it is rich in pastures, and the area is focused on livestock, including sheep farming. Therefore, the rate per capita is relatively high in the Akhalkalaki district, where the provision of pastures is high. However, the number of sheep per household in the Akhalkalaki is lower than in the Tqe-Javakheti, where the climatic and relief conditions were identical. It is also noteworthy that the Akhalkalaki is almost three times more provided with pastures than the Tqe-Javakheti. This seemingly strange difference must have been caused by the following fact: Akhalkalaki, at first glance, was characterized by a relatively high population – 605 households. There were many deserted villages here and in the Tqe-Javakheti, but in one part of Akhalkalaki Nahia, the lands around Khanjali-Madapata Lake were wholly deserted, and the settlements

located here were abandoned decades before the census.

Keeping sheep was quite difficult. However, in the second half of the sixteenth century, sheep farming was an important sector in the economy and activities of the region. It was also interesting to know how the development trend of this ancient agricultural sector run and what path it took in the following centuries.

By 1923 census, compared to the second half of the sixteenth century, the population increased significantly and, consequently, pasture use intensity (sheep/area) should have been higher. On the contrary, sheep number decreased, and the number of sheep per capita was less than at the end of the sixteenth century. This indicator was twice as high in Akhalkalaki Mazra as Gori and Akhaltsikhe. At the expense of the number of sheep in Akhalkalaki Mazra, sheep per household was high for the entire study region. At the same time, the average data in Akhaltsikhe and Gori regions were almost equal and a little behind the average of the whole region. The communities of Gorelovo and Gujareti had an exceptionally high rate of sheep per household, which can be explained by the fact that the land fund in these communities was used more as grazing land than arable. The number of sheep per household is also high in Okami and Lepisi communities due to the abundance of highland pastures, and the Javakheti and Erusheti plateaus were in the best condition in this regard. The picture is similar in terms of pasture provision. Per household, it seems that there are two peaks in the cases of Gorelovo and

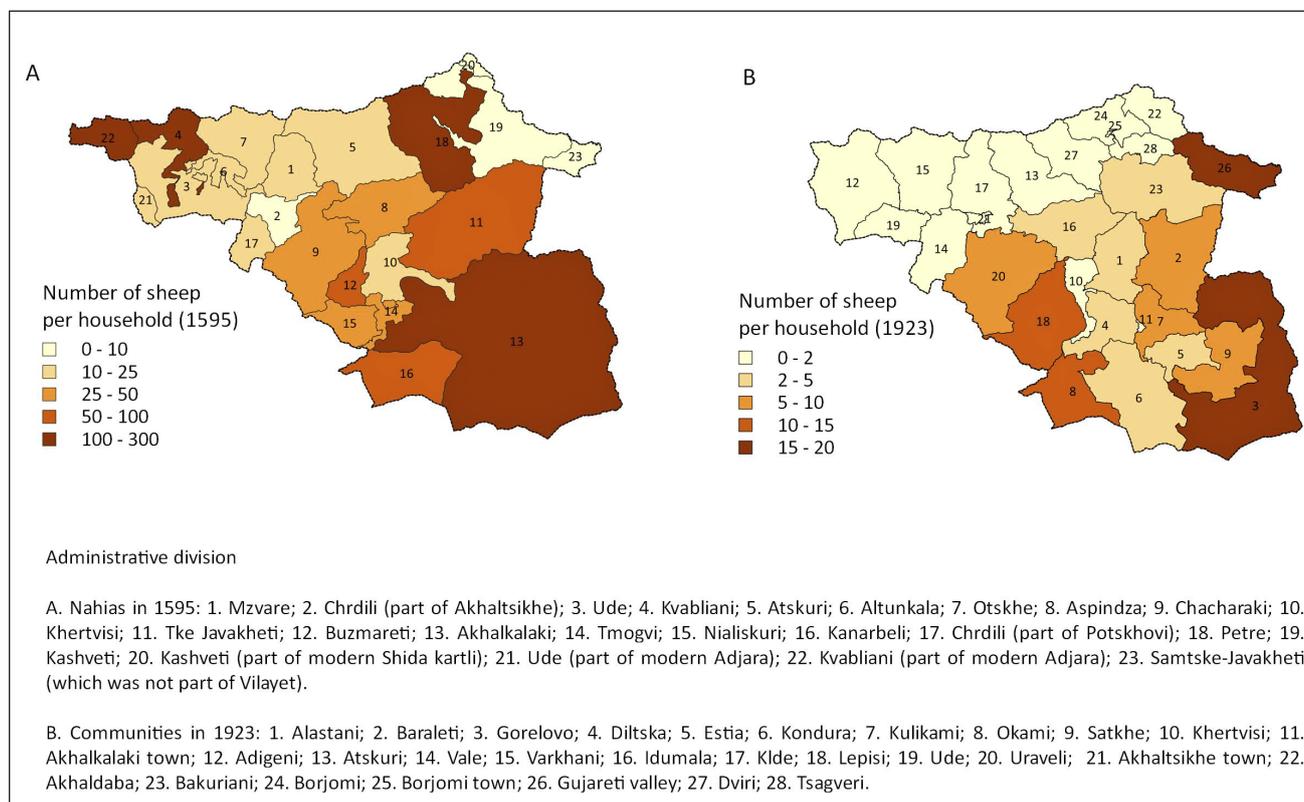


Fig. 6 The number of sheep per household. Comparison of the 1595 and 1923 conditions. Source: Elaborated by the authors.

Gujarati communities. The communities of Bakuriani, Uraveli and Lepisi are also distinguished by the high rate of pastures per household and the communities of Adigeni, Okami, and Kondura repeated similar patterns. Some communities, such as Dilska, Ude, Tsaghveri and Akhaldaba, experienced significant shortages in pastures due to various reasons. Dilska, as in the case of Ude, included mainly arable lands within the boundaries of the community. Tsaghveri and Akhaldaba communities were characterized by an abundance of forested areas with little land suitable for grazing.

Gorelovo community had 13.2 ha of pasture per household, which means that the residents of the upper part of the Paravanistsqali River and the surroundings of Paravani Lake were much better provided with grazing land than the residents of other communities. The provision of pasture to the population of the Borjomi was almost equal to the average. At

the same time, one household in Akhaltsikhe Mazra received nearly five times less pasture land than the average for the region. This can be explained by the fact that most of the lands in Akhaltsikhe Mazra were used as arable, and it had a much larger population than the communities in Gori, Borjomi.

The decrease in the number of sheep was probably due to changes in the population's livelihood and economic factors. Samtskhe-Javakheti region during the Soviet period was not considered an important region in terms of wool production. The Soviet economy was characterized by a centralized character, which denied the development of local, relatively less productive but quality products. Furthermore, the mountains of southern Georgia did not occupy large areas against the background of other territories of the USSR, where a vast number of sheep were raised on collective farms. It was impossible to set up farms

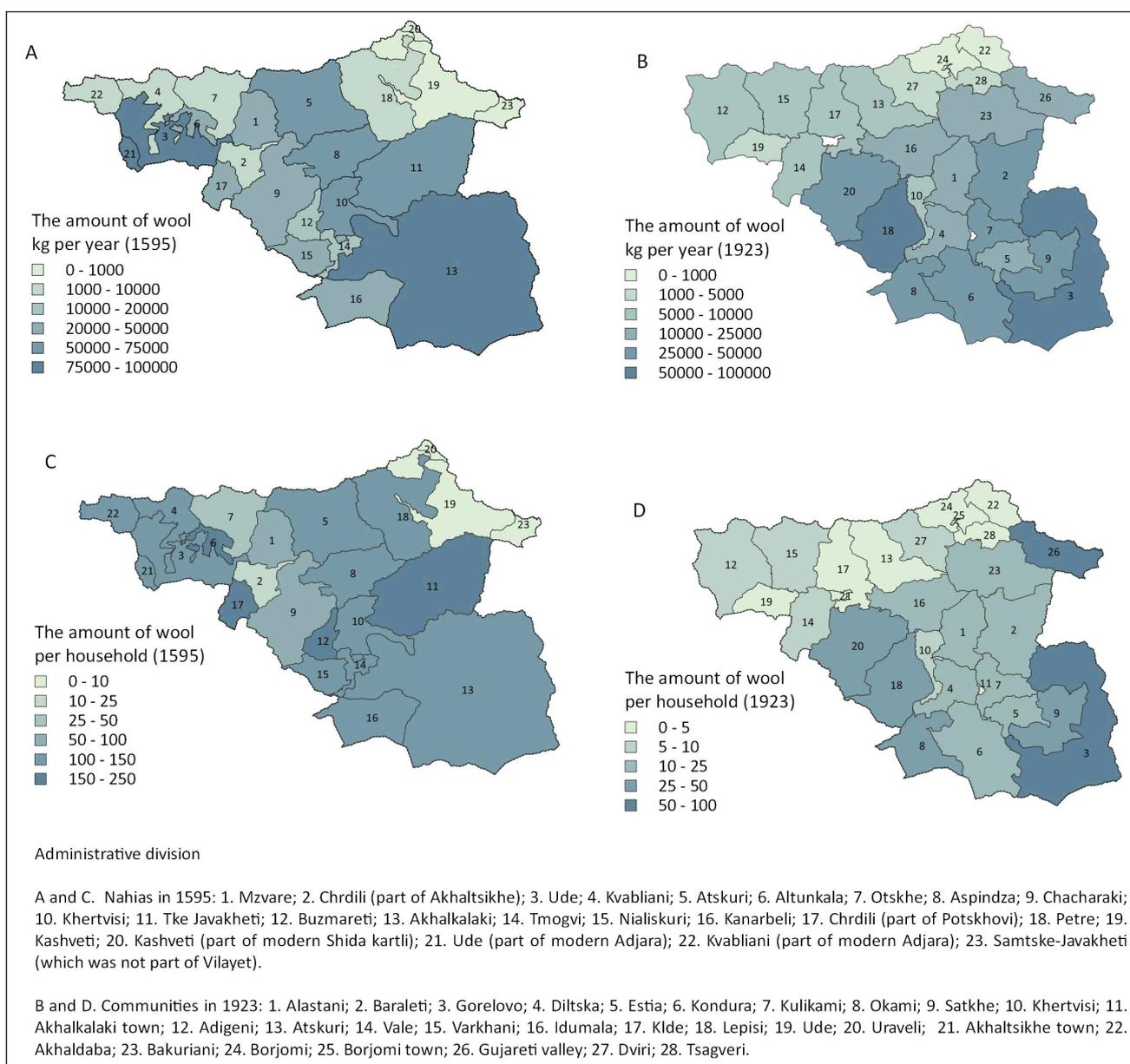


Fig. 7 The amount of wool in total and per household. Comparison of the 1959 and 1923 conditions. Source: Elaborated by the authors.

that would combine tens of thousands of sheep into one farm and could not accommodate several million sheep in one space. Therefore, Georgian sheep breeds, such as Georgian semi-coarse, Imeretian and Tushetian sheep, were not considered competitive in wool production. Consequently, there was an established opinion about the wool product here that it was only suitable for producing poor quality shawls (Fig. 6, Fig. 7).

The total amount of wool collected in the region in 1595 was several thousand tons, and its amount was exceptionally high in the cooler areas, where there would be greater demand for warm clothing. As for the amount of wool produced per household, the areas with a cool climate were also distinguished here, where a kind of orientation towards the production of shawls is especially noticeable. For example, Buzmareti is characterized by highland settlements. Most of the villages in the 16th century were located above 2000 m, as well as the Tqe-Javakheti and Akhalkalaki districts. Altunkala (Golden castle), is an exception in this respect. However, the location of Altunkala itself and the roads passing through it provided an additional opportunity for better sales of sheep and wool.

By the beginning of the twentieth century, the situation had changed somewhat. The amount of wool produced by 1923 was reduced by almost one and a half times. The amount of produced wool per household here was reduced by about seven times, indicating that the interest in the production of shawl and maud has decreased. The decrease in the Samtskhe basin is even more noticeable. For example, at the end of the sixteenth century, more than 195 kilograms of wool per household were produced in the Altunkala region, at the beginning of the twentieth century in Adigeni and Varkhani bordering Altunkala, it was 6–7 kilograms in total. The population was mainly concentrated in the villages, the number of towns was small, and besides, the textile industry and manufactories were not developed here. Only the required amount of wool was produced for domestic consumption.

At present, wool is produced in small quantities only for domestic consumption. The list of products obtained is currently much more minor, mainly used for mattresses and blankets. Rarely used to spin yarn, this is done mainly by middle-aged women who weave by hand and use a local product for knitted garments. Pastoral farming is undergoing significant changes around the world. Technologies are evolving, the industry is becoming more knowledge-intensive, and it is intertwined with many contiguous areas, as competitive product reception and the well-being of citizens involved in the sheep industry are linked to maintaining a high level of industrial technology. The problem of the development of pastoralism in the study region is the issue because sheep breeding is maintained in sharply primitive forms. There are no wool enterprises in the region, including even small ones, which will develop shale products under

modern standards and try to establish themselves in the market. Shepherd conditions and pastoralism infrastructure are poor. These and other reasons affect the weakening of local wool production, which does not positively impact pastoralism. However pastoralism here has a very high potential and could become an economically successful branch in case of support.

5. Conclusion

Pastoral farming is a traditional field in the study area. Its development during the Middle Ages was related to the demands of the local production and trade market. By the end of the sixteenth century, the field was well developed, and the role of the sheep in the economy was significant. From the second half of the sixteenth century, the population began to migrate to other regions of Georgia. Due to the difficult geopolitical situation, the role of towns was weakened, and the production of wool, which was one of the essential areas of capital accumulation in the late Middle Ages, could not find ways of development here. In the nineteenth century, the population increased, but the role of towns and the importance of manufacturing did not increase. As a result, sheep farming became an less important agricultural sector solely to meet domestic needs. Consequently, the number of sheep decreased, and its importance in the local economy gradually diminished. During the Soviet period, the number of sheep here increased. The region, however, was not considered a primary sheep-breeding zone, and the focus here was on potato growing, which stemmed from a planned economy. During the Soviet era, the focus was on mobile pastoralism, for which the lower reaches of the Mtkvari and the Kizlar Valley in the North Caucasus which is located in the Russian Federation, were used as winter pastures, which is currently inaccessible due to its location in another state. After gaining Georgia independence, the number of sheep began to decrease gradually. Production efficiency became a problem, which was manifested both in the production of wool and leather and dairy products. Difficulties were created in production technologies and in meeting the market standard, which is a necessary prerequisite for establishment in the international market. The problem of infrastructure development still remains an unresolved issue. Because the infrastructure necessary for housing, hygienic-sanitary and processing is still unorganized. Currently, Georgian sheep are of interest mainly to Middle Eastern countries. In the case of support, proper funding and governance, the sector's importance will increase and positively impact the local economy. It is necessary to consider the centuries-old pressure on the pastures to promote the development of pastoralism. However, it is essential to improve pasture quality and maintain productivity in the long run.

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