

TOURISM CLUSTER LOCATION ANALYSIS IN THE SOUTHERN PART OF PRIMORSKY KRAI

Tatiana K. MUZYCHENKO 

FSBIS Pacific Geographical Institute FEB RAS, Information and Cartographic Centre, Vladivostok, Russia, e-mail: muzychenko.tk@gmail.com

Vladimir N. BOCHARNIKOV 

FSBIS Pacific Geographical Institute FEB RAS, Laboratory of Ecology and Wildlife Conservation, Vladivostok, Russia, e-mail: vbocharnikov@mail.ru

Anna A. MIKHAYLOVA 

Immanuel Kant Baltic Federal University, Center of Geopolitical Research in Baltic Region, Kaliningrad, Russia, e-mail: annatikhonova@kantiana.ru

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Abstract: Tourism industry operations are affected by many overarching issues, such as maintaining the balance between the under-visited and the over-visited attractions. Tourism is among the most important sources of income in Primorsky Krai regional budget. This study is aimed at proposing a scientific approach to recreational zoning of coastal areas based on the assessment of urbanization, digitalization and availability of touristic infrastructure. Several municipalities located in the southern part of Primorsky Krai have been selected for the analysis. It was found that touristic infrastructure favors heavily urbanized and densely populated areas, usually in close proximity to the shoreline. It was concluded that the results of tourism cluster analysis do not always coincide with the territorial planning documentation. The relationship between the tourism industry operations and the possibility for adoption of information and communication technologies in the study area was assessed using the cellular network coverages. The results presented indicate that the tourism industry potential in Primorsky Krai is unevenly distributed across the study region, thus challenging the balance of overtourism and undertourism. However, the more disadvantaged areas are potentially able to expand upon the existing infrastructure and attract more tourist traffic. Therefore, the tourism sector in the study area indeed has the possibility to create several attractive tourist clusters to evenly distribute the tourist flows.

Keywords: touristic infrastructure, cellular network coverage, geographic detector tool, southern Primorsky krai, spatial analysis

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INTRODUCTION

The tourism industry is considered an essential part of a modern sustainable economy (Serrano-Barquín et al., 2012) that drives the infrastructural and economic development, especially in the rural areas (Wijijayanti et al., 2020). It can be a positive force for the preservation of the local heritage and natural conservation, while creating new jobs with few negative environmental impacts (Anup, 2018). However, tourism industry operations can be affected by many overarching issues – overtourism and undertourism (Barač–Miftarević, 2023; Gowreesunkar and Vo Thanh, 2020). Overtourism is a situation when too many tourists visit the same destination at the same time, in some cases even overwhelming the qualities that originally drew the travelers in. Undertourism implies that the destination receives very little to no attention from tourists. Provided that destinations compete for the same visitors, it can be said that these phenomena are interwoven with each other (Gowreesunkar and Vo-Thanh, 2020). Therefore, decisionmakers must maintain the balance of tourist flows between over-visited and under-visited attractions. Cluster policymaking can alleviate the issue by improving the efficacy of resource allocation and identifying the areas that require more attention than others. However, this planning approach requires a thorough assessment of the existing touristic infrastructure and amenities.

Over recent years, the smartphone and other “smart” devices have become intermediaries in day-to-day activities (Dickinson et al., 2014), increasing the tourism industry’s reliance on information and communication technology (ICT) infrastructure, such as cellular network services (Gretzel et al., 2015). Sun et al. (2024) noted the positive impact of ICT growth on the increase in the tourism development index, using data from 130 countries from 1995–2019. Another study by Seetanah and Fauzel (2023), based on the example of island economies, substantiates the direct cause-and-effect relationships between digitalization and tourism development. Therefore, the inclusion of ICT infrastructure was deemed a necessary supplement to the analysis of overtourism and undertourism phenomenon.

Possibly the strongest divergence in the development of tourism is found in coastal areas. Moreover, seaside tourism is a major source of pressure on the coastal and marine ecosystems. Therefore, it is of utmost importance to identify the necessary conditions for ensuring both the sustainability and competitiveness of tourism in seaside areas (Liu et al.,

* Corresponding author

2024). For example, Leka et al. (2022) assert the importance of measuring and monitoring the pressure tourism causes on the coastal areas in the form of the Tourism Carrying Capacity Index. Jurkus et al. (2021) carried out a geoinformational benchmarking of the sustainability and competitiveness of coastal tourism in several South Baltic resorts, identifying existing and potential conflicts, assisting future planning and decision-making.

A study by Mikhaylova et al. (2023) performed a functional delimitation of the coastal zone based on tourism activity. It was found that the most promising areas for tourism extend no further than 10 km from the coastline, with the most attractions concentrated in very close proximity to the coast and favoring urban areas. Studies by Adeola and Evans (2019), Ciacci et al. (2021) demonstrate the positive relationship between the tourism development of coastal areas, social and economic conditions of the area, the infrastructure availability, and the access to information and communication technologies via statistical analysis, thus explaining the concentration of tourist attractions in highly urbanized areas. Therefore, there are numerous factors that have to be considered and measured to identify the exact locations that have to be considered by policymakers when developing tourism development strategies and zoning. Tourism sector accounts for a considerable portion of income in Primorsky Krai, especially in the southern part of the region. In recent years, it has become one of Russia's leading tourist destinations.

Historically, Primorsky Krai has always experienced sufficient tourist attention (Martyshenko, 2011), driving the development of solid touristic infrastructure (Volivok, 2018). The primary focus of this attention has always been directed to southern Primorye – Khasansky, Nadezhdinsky, Partizansky and Shkotovsky districts, as well as Vladivostoksky, Artemovsky, Nakhodkinsky and Partizansky urban districts, which make up our study region.

As a result, the area is able to accommodate ecotourism (Maslovskaya et al., 2020), recreational, cultural, gastronomic (Den and Shemetova, 2020), and many other prominent types of tourism. These developments are further supported by recent government-initiated investments, infrastructure renewal projects, and exploration of tourism exchange opportunities with neighbouring countries, namely North Korea and China. However, the study region faces several challenges, such as harsh restrictions on nature management imposed by conservation lands (specifically IUCN category I and II protected areas) and rugged mountainous terrain (Bocharnikov et al., 2004) that lead to stark land development disparities, negatively affecting the touristic infrastructure development and even distribution of tourist flows.

Expansion of ICT infrastructure networks to remote area significantly improve the quality of data and insights used by the industry to respond to the current needs and better predict future trends. Therefore, widespread adoption of digital tools, along with the cluster policy implementation, will increase the attractiveness of the study area as a tourist destination and significantly improve the efficacy of the industry operations. However, a solid framework is required to integrate the newly acquired analytics and tools into a cohesive product that can be used by the decisionmakers. The aim of this study is to propose a scientifically based approach to recreational zoning in coastal areas by assessing the availability of touristic infrastructure and the accessibility of ICT. To achieve the goals outlined above, the authors have constructed a 3x3 km grid, each cell containing information on several touristic infrastructure types and population estimates. A Geographic Detector statistic has been calculated for each data type, denoting its significance in tourism processes. The grid has been overlaid with cellular network coverage map, to represent the potential for ICT implementation in tourism industry operations.

MATERIALS AND METHODS

Geospatial analysis has been employed to analyze the suitability of the local touristic infrastructure for cluster formation, having been previously used in tourism-related research (Xia et al., 2018; Gao et al., 2022). Within this approach, cell-based models are commonly used as an abstract representation of the spatial environment. Grid cells act as a uniformly proportioned unit that integrates heterogeneous data on a scale finer than the administrative division. As 1:300 000 map scale is suitable for regional planning purposes, a 3x3km grid was proposed by the authors. Additionally, the choice of cell size was made to ensure that every point of interest can be potentially reachable by walking in each cell. Studies have shown that in Europe, the average distance to the nearest daily amenity in metropolitan areas is 3.2 km, or approximately a 45-minute walk (Kompil et al., 2019). Walkability properties of the area play a significant part in driving visitors to the area on a smaller scale (Hall and Ram, 2019), also promoting the creation of sustainable tourism spaces (Bartzokas-Tsiompras and Bakogiannis, 2023). Tourist attractions and accommodations are known to be the defining factors of tourist appeal, determining the image of destination (Sharpley, 2000; Haneef et al., 2019). During the creation of the indicator list for the analysis of touristic infrastructure location impact on the study area, we relied on the findings outlined in previous studies. This has allowed us to justify the selection of indicators used for characterizing various infrastructure types, in accordance to their significance and sufficiency for the current research purposes. The authors understand that the indicators used can be altered to better suit the features of other regions: the list can be shortened or expanded, thus improving the zoning efficacy. However, the authors believe that the list, as described below, can be used as a base for conducting similar research in coastal tourist regions.

To form an arbitrary spatial representation of the touristic infrastructure (such as road networks, accommodation, shops, beaches, and other points of interest) the relevant information on a set of indicators presented in Table 1 has been gathered from several sources. Tourism development is spatially focused on the coastal areas, especially so in the study area (Mikhaylova et al., 2023), which necessitates including the beaches in the analysis. Protected areas and parks play a prominent role in tourism by providing cultural ecosystem services, raising awareness and driving investment in nature conservation (Zhang et al., 2022). Roads are an important component of the tourism package, enabling the tourists to move freely around the destination. A lack of proper transportation connectivity can impede tourism (Odeku, 2020). Shopping is among the most prominent and pervasive tourism activities (Chen, 2013), during which goods are purchased

and sometimes taken home by the participants (Jin et al., 2017). Shopping can affect the destination choice for the tourists (Moscardo, 2004), and it can be a major revenue source for destinations (Murphy et al., 2011). Foodservice was also included in the analysis, as it is closely linked with gastronomy tourism, agritourism, and several other types of tourism (Seddighi and Theocharous, 2002). Tourists are intrinsically subject to many risks, such as psychological, social, cultural, temporal and financial (Dayour et al., 2020). It has been proven that potential risk concerns affect tourism participation (Lin et al., 2023). Overall, insurance services bring more comfort and satisfaction to the travel experience (Bentley and Page, 2001), justifying the inclusion of the insurance offices into the analysis. Banks have also been included, as access to banking services for tourism creates investment expansion opportunities and generates local employment (Van Tran et al., 2023). Even though the importance of travel agencies has been significantly diminished by the rapid advent of the digital age (van Rensburg, 2014), they still can provide specialized services. Such establishments are found only in areas where the tourism industry is already highly developed.

The data for touristic infrastructure types has been obtained from OpenStreetMap. To form an arbitrary spatial representation of the touristic infrastructure (such as road networks, accommodation, shops, beaches, and other points of interest) the relevant information on a set of indicators presented in Table 1 has been gathered from several sources.

Table 1. Indicators used for tourism cluster suitability analysis.

Variable	Parameter
Protected Areas	Binary value (0 – not present, 1 – present)
Beaches	Binary value (0 – not present, 1 – present)
Pedestrian Paths	Total length in a cell (m)
Unpaved Roads	Total length in a cell (m)
Tourist Attractions	Total count in a cell
Population	Total count in a cell
Paved Roads	Total length in a cell (m)
Shops	Total count in a cell
Railroads	Total length in a cell (m)
Parks	Binary value (0 – not present, 1 – present)
Foodservice	Total count in a cell
Banks	Total count in a cell
Accommodation	Total count in a cell
Insurance Offices	Total count in a cell
Travel Agencies	Total count in a cell

Tourism industry operations require human capital, which usually draws from the local population pool (Baum et al., 2016), to provide goods and services (Li et al., 2022). Thus, population counts for each cell were roughly estimated using the information provided by a LandScan HD dataset. Cellular network coverages and land zoning maps were chosen as ancillary data. Cellular network coverage extent as of 2023 was collected and combined from official sources of four largest Russian telecom operators – MegaFon, Beeline, Tele2, and MTS. The combined extent of cellular network coverage in the study area was divided into two categories: cellular networks of all standards, and 4G cellular networks. Contours of lands zoned for recreation and tourism purposes have been extracted from territorial planning documents obtained via FGIS TP service (<https://fgistp.economy.gov.ru>). The analysis results were compared to cellular network coverages and land zoning maps available for each district. However, considering different municipalities approach land zoning for recreation differently, a complete match with the analysis results should not be expected.

The authors have used GeogDetector plugin for QGIS with the tourist infrastructure spatial data to determine how meaningful each amenity type would be for the tourism industry in the local context. GeogDetector is grounded on the Power of Determinant (PD), which generates four detectors using the Equation 1 below (Wang et al., 2010b):

$$PD = 1 - \frac{1}{N\sigma^2} \sum_{i=1}^L N_i \sigma_i^2 \quad (1),$$

N and σ^2 denote the area and the variance of phenomena prevalence of the study area respectively. The study area is stratified into L stratum, denoted by $i = 1, \dots, L$ (Wang et al., 2010a), according to spatial heterogeneity of a suspected determinant or its proxy of the phenomenon. PD values can range from 1 (if the determinant completely controls the phenomenon) to 0 (if the determinant is completely unrelated to it). Thus, the PD reflects the degree to which a determinant explains the prevalence of the phenomenon, producing the Q value (Wang, 2012). Administrative boundaries play the role of an explainer value in the analysis, as they denote the areas of jurisdictional responsibility (Landres et al., 1998) in accordance to which the tourism industry operates.

RESULTS AND DISCUSSION

The geographic distribution of tourism infrastructure in Primorsky Krai's municipalities, along with some land zoning data provided by the regional authorities, is reflected in Figure 1. As a result of GeogDetector calculations, each data type has received a corresponding Q-value, denoting their significance in the spatial patterns of tourism industry operations. The Q-value ranking of the indicators is provided in Figure 2. It was established that the most prominent drivers of tourism are protected areas and beaches, with pedestrian roads coming in third place.

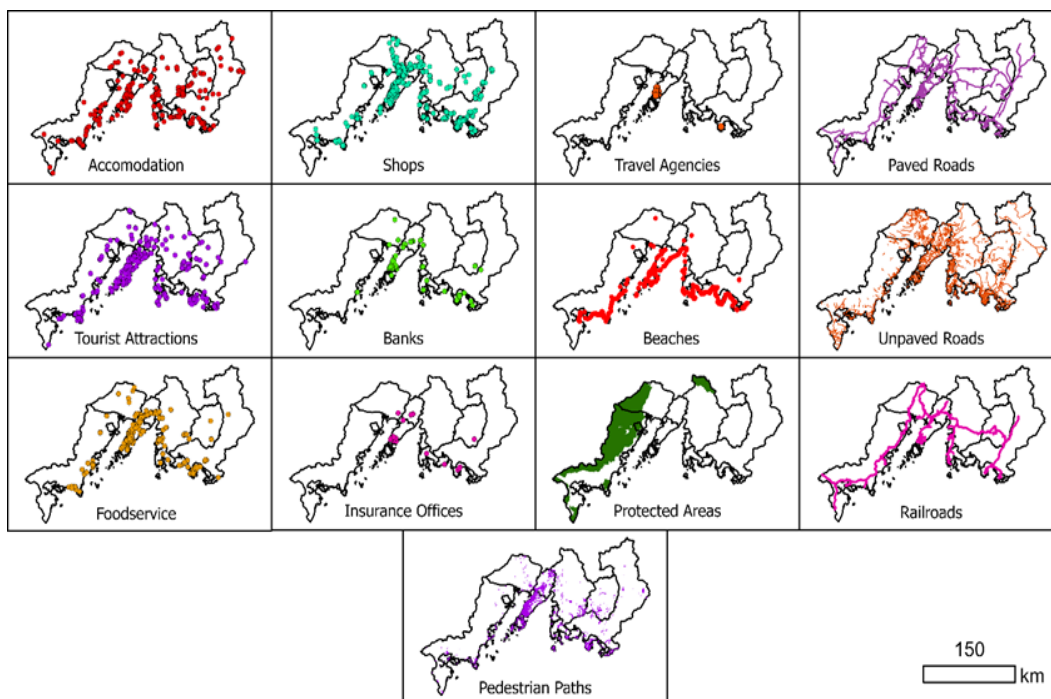


Figure 1. Spatial representation of data types employed in cluster analysis (Source: all data depicted in the figure was sourced from OpenStreetMap)

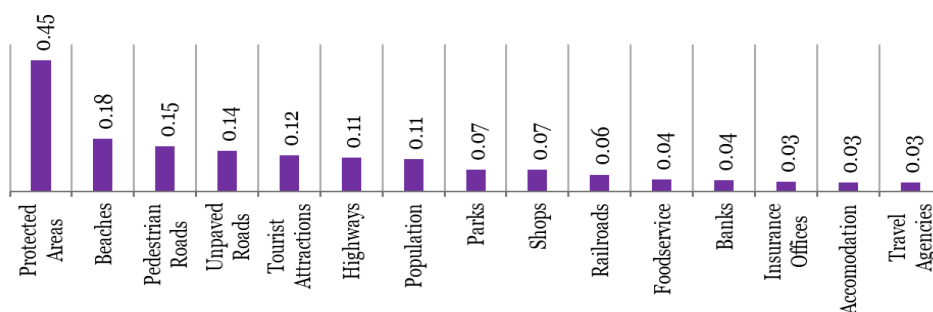


Figure 2. Q-value ranking of variables reviewed in the analysis (p-value is 0 for all parameters)

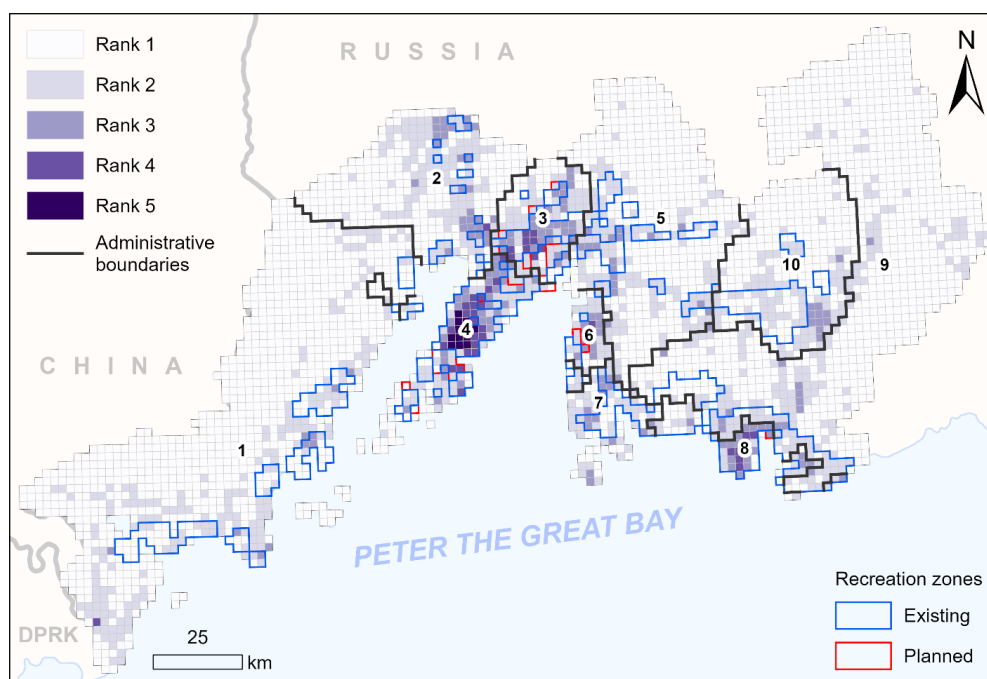


Figure 3. Tourism cluster suitability ranking in juxtaposition to recreation zoning data. 1 – Khasansky District; 2 – Nadezhdinsky District; 3 - Artemovskiy Urban District; 4 - Vladivostokskiy Urban District; 5 - Shkotovskiy District; 6 - Bolshoy Kamen Urban District, 7 – Fokino, 8 - Nakhodkinsky Urban District; 9 – Partizansky District, 10 – Partizansky Urban District. (Source: existing and planned recreational zones are allocated based on the territorial zoning plans developed by the regional and municipal government of Primorsky Krai)

However, the lowest-ranked categories – accommodation, insurance offices and travel agencies – seem to occur only as a result of tourism industry operations. Each cell has been assigned an individual score based on a sum of all indicators multiplied by their respective Q-values, and the total scores were divided into five ranks, as demonstrated in Figure 3.

Ranks 4 to 5, as shown in Figure 3, represent good conditions for tourism cluster development. As a rule, cells of this type congregate in coastal, highly urbanized, and densely populated areas with solid road infrastructure. Inland parts of the study area are less populous on the average, potentially explaining the steep decline in the amount of the infrastructure. The total amount of cells within each rank and administrative division was counted. Based on the prevalence of higher-ranking cells, it was determined that tourism clusters are more likely to occur in Vladivostoksky, Nakhodkinsky, and Artemovskiy Urban Districts, the most urbanized and populous divisions of the study area.

To assess how well tourist infrastructure coincides with the land zoning data, the count of cells within two highest ranks in the district was compared to count of cells which contain the recreational zones. It was found that Vladivostoksky and Artemovskiy Urban Districts have demonstrated the highest analysis result and recreational zoning compatibility. Technically speaking, Nakhodkinsky Urban District has demonstrated full overlap within the two categories. However, it has been disqualified from the rating due to local land zoning peculiarities. According to the municipal land zoning data, most of the district area is considered recreational land. The lowest overlap percentages between the two categories are observed in Partizanskyy Urban District and Nadezhdinskyy District, with only about 20% of potential recreational lands being zoned as such. On average, only just below 50% of highest-ranking cells appear to be used or considered for tourism purposes.

An assessment of mobile Internet coverage, including the high-speed 4G networks, was conducted for the study area, the results of which are demonstrated in Figures 4a and 4b and juxtaposed with the spatial distribution of tourism infrastructure in Figures 4c and 4d. Cellular networks services a significant part of the study area, excluding the remote areas located at the far west and north. However, high-speed 4G cellular networks are primarily available in the urbanized areas, as well as along the coasts and major highways. Vladivostoksky, Nakhodkinsky and Artemovskiy Urban Districts receive the best cellular network coverage in recreational areas thus far. Additionally, high-speed Internet is available in the coastal areas of Khasanskyy District, which are considered extremely promising tourism zones.

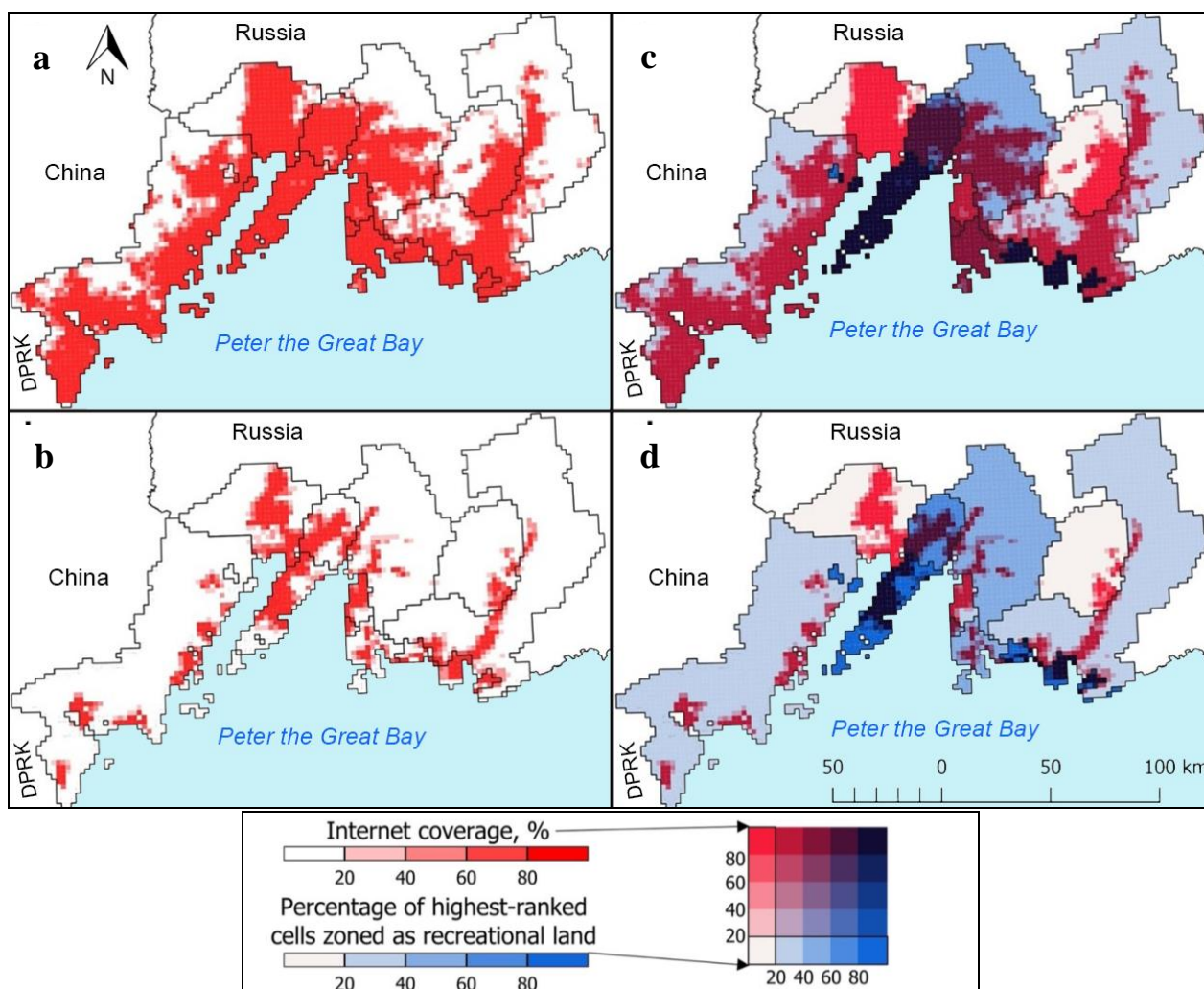


Figure 4. Cellular network coverage in the study area in comparison to the spatial distribution of recreation areas:
 a – cellular networks (all standards) from all telecom operators; b – 4G cellular network coverage from all operators;
 c – cellular networks (all standards) coverage overlaid with the percentage of recreation areas by municipality;
 d – 4G cellular network coverage overlaid with the share of recreation areas by municipality.

The author-proposed index reflects the amount of existing tourist infrastructure in absolute values. Both the existing tourist infrastructure, as well as recreational land zoning patterns, seem to favour highly urbanized and densely populated areas, which are usually located on the coasts. An earlier study by Mikhaylova et al. (2023) supports this. Thus, it was established that Vladivostoksky Urban District, Nakhodkinsky Urban District, Artemovskiy Urban District, as well as Khasansky District contain the most tourist amenities, while Partizansky District, Khasansky District, and Shkotovskiy District appear to have the least amount of tourist-gear infrastructure out of all study municipalities. A tourist flow assessment, conducted over 2021–2023 by the telecom operator MegaFon, has confirmed that the main point of attraction is indeed Vladivostok and its surrounding areas.

However, the authors do not suggest that lower-rated districts are unsuitable for tourism. Rather, the study is also meant to reflect the yet-unused tourism development potential that these territories possess and the value this potential provides in redirecting the tourists from the over-visited attractions. The authors have found that the presence of tourist infrastructure is not fully coincident with the land zoning data. However, it should be noted that different municipalities in the study area seem to approach recreational land zoning differently. Generally, it appears to not have been based on the presence of already-present tourist infrastructure. The analysis results indicated that the tourism industry in Primorsky Krai indeed has room to grow, which requires further investigation. Ecotourism is considered a promising avenue of tourism development for the study region, as it is home to several prominent protected areas: Land of the Leopard and Call of the Tiger National Parks. The land zoning plans need to ensure the interests of the tourism industry meet nature conservation goals and to sustainability principles, among several other considerations.

CONCLUSION

This study proposes a scientifically based approach to coastal and seaside area zoning, which can be used for different regions to avoid the negative consequences of overtourism. The study has assessed the impact of urbanization, digitalization potential (in the form of an analysis of the degree of cellular network coverage) and the location of various tourism infrastructure types on the tourist attractiveness of the coastal regions. Locations of existing tourism infrastructure were compared to existing and planned recreational areas, by referencing the land zoning documentation. The spatial distribution of tourism infrastructure has been compared to both existing and planned recreational areas. The use of GIS technologies has made it possible to carry out a more detailed zoning of the territory without being limited by the municipal boundaries. This approach has made it possible to identify potentially attractive tourism zones, which are currently experiencing the effects of undertourism, since they have not yet received institutional support and recognition as a viable tourist destination. This work has contributed towards a theoretical understanding of delimiting and managing the tourist flows in the coastal tourist areas, in a manner that maintains the balance between meeting the environmental sustainability goals and maximizing the economic benefits provided by the industry.

Since the study area encompasses ten municipalities in Primorsky Krai, Russia, it holds practical significance for the regional policymaking toolsets utilized in territorial planning. It was found that the most promising areas for tourism cluster formation are located in Vladivostoksky, Nakhodkinsky and Artemovskiy Urban Districts. Coastal settlements in Khasansky District are reported to possess a tremendous recreational potential as well, which was confirmed in an earlier study (Mikhaylova et al., 2023). Based on the cellular network coverage assessment results, it was concluded that high-speed mobile internet is already accessible in the most attractive tourist areas. ICT adoption allows the tourism industry to better address the feedback provided by the customers, thus improving the operations efficacy. It should be noted that telecom operators are working to ensure 4G service at natural tourist attractions, such as remote beaches and mountaintops.

As the study results have demonstrated, tourist sites are primarily concentrated in urban areas. To avoid the negative consequences of over-tourism in these well-established hotspots, recreational potential of the rural sections of the study regions needs to be improved. As ICT tools can assist with managing the customer expectations and responding to feedback in a timely manner, we conclude that expanding the cellular network coverage, as the most accessible form of Internet connection, is paramount to the goals outlined above.

The study is mainly limited by the size of the study area. Further work will focus on expanding the area of interest and implementing comprehensive functional zoning for tourism development in Primorsky Krai. Additionally, further investigation into the topic is required to assess the qualitative properties of tourism infrastructure. Different objects may have different levels of attraction for the tourists, which should be accounted for in the land zoning documentation. Future avenues of research should be focused on expanding the area of interest, and further refining the proposed recreational zones identification approach. Tourist attraction points must be identified, a map of tourist flows made, and a ratio of tourism objects concentration and diversity measured.

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