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“SEASONAL SUBURBANIZATION” IN MOSCOW OBLAST’: CHALLENGES OF HOUSEHOLD WASTE MANAGEMENT

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Abstract

Second homes used for recreation are widespread, in Russia they are located mainly in the suburbs. Our research is aimed at contributing to the debate on environmental impact of second homes. We focus on the issue of household waste management drawing empirical evidence from Moscow *oblast’*. The paper proposes a spatial analysis of remote sensing data concerning the number and localization of illegal landfills and tests the spatial relation between illegal landfills and second home settlements. The significant number of identified illegal landfills and their location reflect the inefficiency of region’s waste management system and population’s low environmental awareness.

Key words

second homes • suburban development • illegal landfills • Moscow *oblast’* • Russia

Introduction

The leisure-related mobility lifestyles of second home owners is a widespread phenomenon in many parts of the world (Müller 2002; Hall & Müller 2004; Hall et al. 2009; Roca 2013; Treivish 2014; Hall 2015; Visser & Hoogendoorn 2015). For second home owners it is an opportunity to escape the busy urban life; therefore, they greatly value the features associated with the natural environment (Müller 2002; Huhtala & Lanka 2012; Long & Hoogendoorn 2013). Due to owners’ pursuit to the comfort second homes become

increasingly modernized, the current trends indicate that there is an increase of consumerism and housing standards (Hiltunen et al. 2015). Thus, it is no surprise that second home owners which seasonally multiply the local population themselves have negative impact on the environment (Hiltunen 2007; Long & Hoogendoorn 2013; Hiltunen et al. 2015). In some countries, e.g. Finland, the awareness of the increasingly harmful environmental impacts of second homes is leading towards a movement promoting more sustainable options and a better governance of the processes (Hiltunen et al. 2015). The impacts

posed by second homes and the response to the challenge are place-based, largely dependent on the specificity of second homes and personal attitudes of their owners (Kondo et al. 2012; Long & Hoogendoorn 2013; Hiltunen et al. 2015) as well as the overall national, regional, and local environmental discourses. Russian second homes (*dacha*) are usually grouped into small settlements which are located mainly in the suburbs of large cities (Nefedova 2012). They were in the Soviet times and still remain an important part of the desired residential model for urban residents (Leetmaa et al. 2012) which offers an opportunity to enjoy the suburban green environment (Lovell 2003). Moscow *oblast'*¹ is covered with a more or less dense network of second home settlements which begins at the borders of Moscow City and extends up to the neighboring regions (Nefedova 2012). However, these second home settlements do not have an official settlement status. They are 'invisible' to the statistics and are neglected by the municipal authorities (Nefedova 2011).

With the present paper we investigate the issues related to the environmental impacts of second home settlements in Moscow *oblast'* (here and after may be referred as MO). Researching their region-specific features the focus is on the issues concerning household waste management. Household waste management is an important issue for the contemporary society due to the large volumes produced, its hazardous impact on the environment and human health (Silvestri & Omri 2008). Nowadays, the latter is a major environmental challenge for the region under study. While MO is a home to about 5% of Russia's population (*Regiony Rossii* 2012), the territory accounts for a significant share of the overall household waste production in Russia – more than 20% (Gosudarstvennyy doklad 2013).

¹ The border between Moscow City and Moscow *oblast'* in our study is delimited by the Moscow Ring Road. Even though the south-western part of Moscow *oblast'* was annexed during a controversial administrative-territorial reform in favor of in the early 2010s (Argenbright, 2011), the change has little relevance for our study while the concrete physical boundary delimitation permits to carry out similar research in the future.

Out of all produced household waste in MO, about 90% is stored in landfills (Gosudarstvennyy doklad 2013). In addition to the authorized landfills a large amount of illegal landfills is formed here every year. Illegal landfills may be found in many developed and developing countries (Silvestri & Omri 2008; Biotto et al. 2009; Apostol & Mihai 2011; Jorda-Borrell et al. 2014); however, their features and spatial patterns may vary due to regional peculiarities (Mihai et al. 2012). Our research hypothesis is that the seasonal increase of population in the second home settlements of MO is a factor contributing to the formation of illegal landfills; in other words, the spatial patterns of second home settlements associate with those of illegal landfills. Thus, with the empirical evidence from Russia we aim to contribute both to the debates on environmental impacts of second homes and to those concerning the distribution of illegal landfills.

Various data sources are used in the study, primary spatial data, e.g. remote sensing data (satellite and aerial images), online cadastral maps, and freely distributed data from web sources. Integrated into a geographic information system (GIS) these data are used to identify spatial patterns of second home settlements and illegal landfills over a large area of Moscow *oblast'* allowing to conduct a comprehensive spatial analysis.

The paper is structured as follows: the first section concerns the context of second home settlements in Moscow *oblast'*; the second section is about the environmental issues related to the second home development; the third section specifies the data, their collection, verification, and interpretation; the fourth one provides results, and finally the discussion ensures to overview the issues at hand.

The phenomenon of “seasonal suburbanization” in Moscow *oblast'*

After the collapse of state socialism in Russia as well as in East European countries the social context of their spatial development changed

(Smith & Timar 2010). Studies focused on post-socialist countries demonstrate an activation of the residential suburbanization process in their metropolitan regions (Hirt 2007; Leetmaa et al. 2009; Leetmaa et al. 2012). In Russia newly built elite settlements around Moscow City partly reflect the early beginning of this process. The construction of new housing is a visible spatial change, but there is also an abundance of pre-existing housing in the suburban areas of many post-socialist metropolises (Brade et al. 2009; Leetmaa et al. 2012; Mamonova & Sutherland 2015; Nuga et al. 2015). The ownership of such housing is very widespread (Leetmaa et al. 2012; Nefedova & Pallot 2013). The affection of Moscow's residents towards their suburban housing is demonstrated by opinion polls, which show that 88% of respondents have had positive feeling towards suburban housing; however, only 27% of them were ready to use it for permanent residence (Makhrova 2014a). This phenomenon was called "seasonal suburbanization" (Nefedova 2011; Nefedova 2013). According to Nefedova (2012) there are several reasons for 'seasonal' suburban development. First of all, there are still strict residential registration laws coupled with the rapid urban housing prices growth in the major cities, especially in Moscow. People are reluctant to sell their apartments in the city and move to the countryside, as there will probably be no way back. Secondly, most second home settlements have poor amenities, while commuting is time-consuming due to severe traffic jams. Thirdly, permanent housing requires high investments due to a harsh climate, while the mean income of Russians' is not sufficient for the purpose. The above reasons are reinforced by the mentality, the culture of "central living" in Russia is very strong among urban dwellers (Alden et al. 1998). Living close to the city center is considered highly prestigious (Vendina 1997). Generally, only housing in elite settlements is used as permanent (Makhrova 2014b; Makhrova & Kirillov 2015). Thus, suburban housing in MO is not a manifestation of a Western-type suburbanization, Lovell (2003) argues that this housing is something

in between a classical second home and an ordinary housing stock in the suburbs. *Dacha* is 'a dream' to combine the advantages of urban and rural life in the specific historical and geographical conditions of Russia (Nefedova 2012). Although, the mostly temporal usage brings *dacha* closer to a second home used for recreation. Keeping this in mind in the course of the paper we use second home theories rather than theories of suburbanization to describe spatial development in MO. However, an important difference should be noted. While in Western countries second homes and second home settlements are only perceived as places for relaxation (Pitkänen et al. 2011; Long & Hoogendoorn 2013; Hall 2015), in Russia they are interfaced with the dual heritage of pre-revolutionary *dacha* used by the elites for recreational purposes and the Soviet-era tradition to utilize small plots of land in suburban areas for farming in times of food shortages (Mamonova & Sutherland 2015). These plots may be located in areas with already disturbed natural environment, e.g. vicinities of railroads and highways. As noted by Long and Hoogendoorn (2013) the disturbed environment reduces the aesthetics of the area, thus, the enjoyment gained from owning and visiting the second home. Under such circumstances one of the main factors influencing the value of a second home to its owner is undermined. The dissatisfying experience may result in a careless attitude towards the place and the surrounding environment (Proshansky et al. 1983).

Environmental impacts of second homes: the role of societal perceptions and management

A second home ownership exists in an intersection of tourism and migration (Williams & Hall 2000). The interests of second home owners in the area are generally stronger than those of tourists, while their formal position is weaker than that of permanent residents (Farstad 2015). Despite their humble formal position, the large and increasing multitude of second

home owners in Russia, as in the Western countries (Treivish 2014), influences social, economic, and environmental development of territories. Although, the precise influence of this temporal population is yet not fully understood (Hall 2015), in Russia partly due to the lack of official data. Experiencing nature and enjoying natural amenities have been identified as key motives for second home ownership (Hiltunen et al. 2015). Studies on Western second homes reveal that valuing the leisure and natural environment second home owners are often being identified as 'eco-minded' tourists (Kaltenborn et al. 2008). However, the mere mobility of second home owners as a wider part of tourism is interconnected with environmental changes of ecosystems at various scales (Hall & Lew 2009; Scott et al. 2013; Hiltunen et al. 2015). Living in multiple dwellings besides the overall disturbance of the environment, generates a rise of energy consumption and non-renewable resources, with the production of household waste (Hiltunen 2007; Hiltunen et al. 2015).

In general, there are two important components that to some degree shape the impact on the environment at a given place and time: culture and values of the community on the one hand, and the official control on the other. Second homes tie people to the area and these ties are based on the ownership, sometimes for several generations, and form a strong bond with a place (Wildish et al. 2015). Forming an effective bond with a place is a necessary prerequisite for a personal responsibility for territorial development (Raagmaa 2002), but it is not a sufficient one. The social meanings, beliefs, values, and behavioral patterns of the community largely influence individual variables (Proshansky et al. 1983). Thus, the responsibility for the place may be reinforced or reduced by the communities' collective discourse. Gudkov et al. (2008) argue that people in the post-Soviet society are characterized by a specific individual irresponsibility in most aspects of life. Their tendency to blame third parties for the surrounding negative phenomenon is coupled with a passive belief that the future life will somehow improve on its own.

With the deepening economic problems, the majority of the population is more concerned with the personal wellbeing than with solving abstract environmental problems (Bauman 2003). The 2000s in Russia may be characterized by the process of ecological science collapse, the deinstitutionalization of the state environmental policy (Larin et al. 2003), and the political marginalization of the civic environmental movement (Yanitsky 2005). All the above named features serve as a poor base for the formation of an environmentally concerned society.

Besides generally irresponsible attitude towards the environment, there are challenges posed by the management of second home settlement which reinforce the negative impacts on the environment. As was said above, the majority of the second home settlements which occupy a significant area and concentrate numerous amounts of people in summer (Nefedova 2011; Nefedova 2013) do not have an official settlement status. Thus, the official norms and rules of settlement development are not applied to them. Describing the issues related to second homes in different countries Hall (2015) argues that there are difficulties determining exactly who is responsible for second home settlement development as they are managed in different institutional fields, and a comprehensive idea is not usually formed. The above statement fully reflects the situation in Russia in general and in MO in particular. As for the organization of waste management, the waste management system is monopolized in most second home settlements by the government of the municipality where the second home settlement is located. Because of lack of an official status these settlements are not of primary interest to the municipality; therefore, their waste management system is organized poorly. There is of course no separate waste collection, since it is not introduced in Russia on a regular basis. Waste management in second home settlements is characterized by a high level of centralization and inflexibility; it has no place-specific features and is unable to adapt quickly in case of unforeseen circumstances (Gosudarstvennyy

doklad 2013). All in all, the lack of communities' responsible attitude towards the environment reinforced by the problems of management may well be prerequisites for the emergence of illegal landfills in the vicinity of second home settlements.

Data and methodological approach

The main challenge of our research is the lack of sources of official open data on the distribution of both second home settlements and illegal landfills. As for second home settlements, the most detailed information is contained in the National agricultural census of 2006 (Russian National Agricultural Census 2006). However, only aggregated data of regional level is in open access. The information for municipalities may be accessed via direct requests to regional offices of Federal statistics. Since such requests are not free of charge and not all are approved, such statistics may be used only for a limited number of municipalities. Thus, the available data are not always accurate, detailed, and up-to-date.

To overcome the challenge remote sensing data were used. Remote sensing has often been used for monitoring large areas (Silvestri & Omri 2008). Their use is justified by their basic properties – the objective presentation of information, large spatial coverage, and easy integration into GIS. The initial data for the research were seamless mosaics of space images with a high and ultra-high spatial resolution provided by the web map services Yandex.Maps, GoogleMaps, BingMaps (Microsoft), ArcGIS.Imagery (ESRI), and Geoport 'Roscosmos'. Multiple data sources were used since the presented mosaics may consist of images taken in different time periods. The use of 5 seamless mosaics from different sources makes it possible to some degree to avoid errors of temporal uncertainty. Basic spatial data (roads, hydrological features, settlements) were downloaded from OpenStreetMap and verified on a basis of an online cadastral map, available from the web

site of the Russian Federal Service for State Registration, Cadastre, and Cartography (<http://maps.rosreestr.ru/PortalOnline/>). Following the preparation and uploading of data to ArcGIS software (version 9.3) was a semi-automatic interpretation of remote sensing data. Unfortunately, the quality of data and the phenomenon under study hinder an automatic interpretation. Visual interpretation was found to have a number of advantages, primarily due to the importance of the indirect interpretive signs which help to obtain a more accurate result.

Identification of second home settlements

In order to separate second home settlements from other types of settlements we used an online cadastral map as the main free source of official data. The online map has an open code which allows loading the data into GIS software. Cadastral boundaries and the designated type of land use were used as components for analysis. Large-scale topographic maps provided by the Federal Center for Geodesy and Cartography were also used for a more accurate digitizing of the boundaries of second home settlements. However, both the online cadastral map and the topographic maps cannot serve as sole sources of data. This is because map updates are often not in pace with the rapidly changing territorial development of MO. All obtained information was verified with remote sensing data.

Identification of illegal landfills

While the data on the second home settlements can be found in official sources, with illegal landfills this is not the case. Space images of ultra-high resolution as well as data from population participation maps were used in the analysis. Spatial analysis with the use of GIS technologies was also very helpful. Illegal landfills are not located randomly, the spatial criteria for their distribution were identified by Silvestri and Omri (2008), Biotto et al. (2009), and Jorda-Borrell et al. (2014).

These criteria include the proximity of roads, as landfills are always reached by roads and paths, and specific geomorphologic characteristics of the territory (e.g. presence of former quarries). We also included our test parameters – vicinities of different settlement types (second home settlements, cities, and villages) – as an additional spatial criterion. Overall, these criteria allowed to determine the location of illegal landfills with a high probability. Basing on empirically obtained results we used a ‘buffer’ type proximity analysis to reduce the area for detailed analysis (Jorda-Borrell et al. 2014). The areas with a high probability of landfills’ location were then analyzed in detail. Basing on the research by Timofeev et al. (2012 – quoted in Lipilin 2014) and Silvestri and Omri (2008) we identified illegal landfills by one or a combination of the following features: areas with bare soils and degraded vegetation, irregular shaped patches, and fine-grained texture. The used remote sensing data of ultra-high resolution allowed to localize illegal landfills sized up to 10m². However, since illegal landfills are usually quite small (compared to authorized landfills) and localities close to them are heavily polluted it was hard to identify their boundaries precisely.

In order to identify the morphological composition of waste in illegal landfills we conducted field research in several key sites. Aerial images from an unmanned air vehicle (UAV) were used for the purpose. The hardware included RC 690S Tarot hexacopter with a Sony Alpha NEX-5 camera attached to it. UAV aerial images were processed with digital photogrammetric software – Agisoft Photoscan and Pix4Dmapper.

Results

Spatial patterns of second home settlements’ in Moscow oblast’

The comparison of available statistical data with the results of remote sensing data allowed to allocate more than 7 thousand second home settlements outside the official boundaries of cities and villages (Fig. 1). The obtained figure is 20% higher than the total

number of official rural settlements in MO. Second home settlements are located unevenly within the territory forming a specific spatial pattern. Their highest density is near the borders of Moscow City. Center-periphery gradient is apparent in the density; however, not in the absolute number of second home settlements.

Second home settlements are largely present in the western sector of MO. It accounts for about 30% of their total amount. This part of MO has a long history of second home development, in the post-Soviet period it has become the main area of new suburban housing construction (Makhrova 2014b). Different type of housing construction here proceeds despite the important nature conservation functions performed by nature reserves situated here and leads to land use conflicts (Makhrova 2014b).

Illegal landfills in Moscow oblast’ and their spatial association with second home settlements

The limitations of spatial resolution of satellite images which are the main source of information, contributed to the number of illegal landfills that could not be identified. However, the obtained number is still significant and demonstrates a worrying reality. Overall we identified 4790 illegal landfills within MO. The data on them were digitized and organized into a spatial layer containing attribute information. The location of settlements influences the disposal of waste (Mihai et al. 2012); therefore, most of illegal landfills are located in their outskirts or in proximity of their borders. Overall we identified four main spatial regularities of illegal landfill allocation in the region²: within the borders, but in the outskirts of settlements (3924); outside the borders but in proximity of settlements (2093 illegal landfills within the range of 2km from second home settlements; 805 within the range of 2km from cities and villages); near recreational areas (277 – within the range of 150m from water bodies, e.g. rivers, lakes, and ponds; 405 - in forests and parks);

² Some landfills follow more than one regularity.

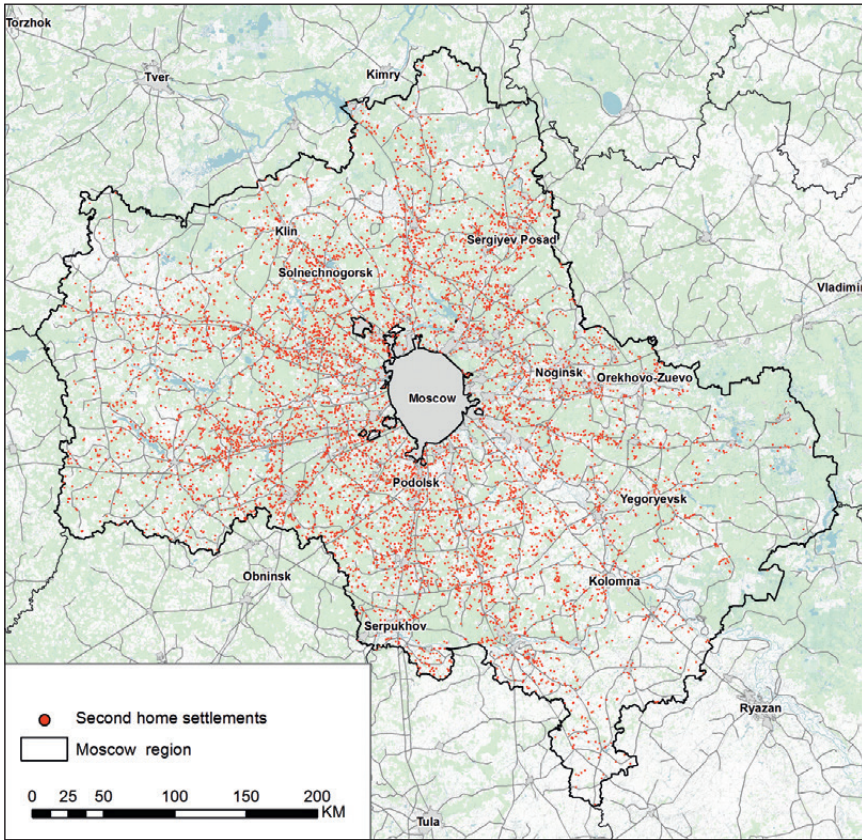


Figure 1. The spatial distribution of second home settlements in Moscow oblast' (Draft and design: A. Medvedev)

in the proximity of roads (157 illegal landfills - within the range of 200m from major roads; 303 - within the range of 100m from rural roads). The results clearly show that the highest density of illegal landfills is near the borders of Moscow (Fig. 2) alike the density of second home settlements. Further spatial analysis supports our research hypothesis suggesting that there is a statistically significant association between the localization of second home settlements and illegal landfills in MO (at a significance level $p = 0,05$).

Even though most of identified illegal landfills are quite small ranging from 10 to 15m², they are harmful to the environment and the health of the population. As suggested in Gosudarstvenny doklad (2013) the areas in close proximity of illegal landfills experience

significant pressure, sometimes natural self-purification capabilities of the environment. The morphological composition of disposed waste was found to be heterogeneous. Both rapidly and slowly decomposing materials were present: plastics (e.g. bottles, packaging, disposable tableware), glass, paper, cardboard, textile, and food (Fig. 3). Such composition of waste contributes to the pollution of ground and surface waters, soil and vegetation as well as atmospheric air, as well as directly or indirectly affects the health of second home residents; moreover, rodents, e.g. rats and mice, which are potential carriers of dangerous infectious diseases are largely present near landfills. Furthermore, illegal landfills reduce the aesthetic appeal of the landscape and its value (Bouvier et al. 2000).

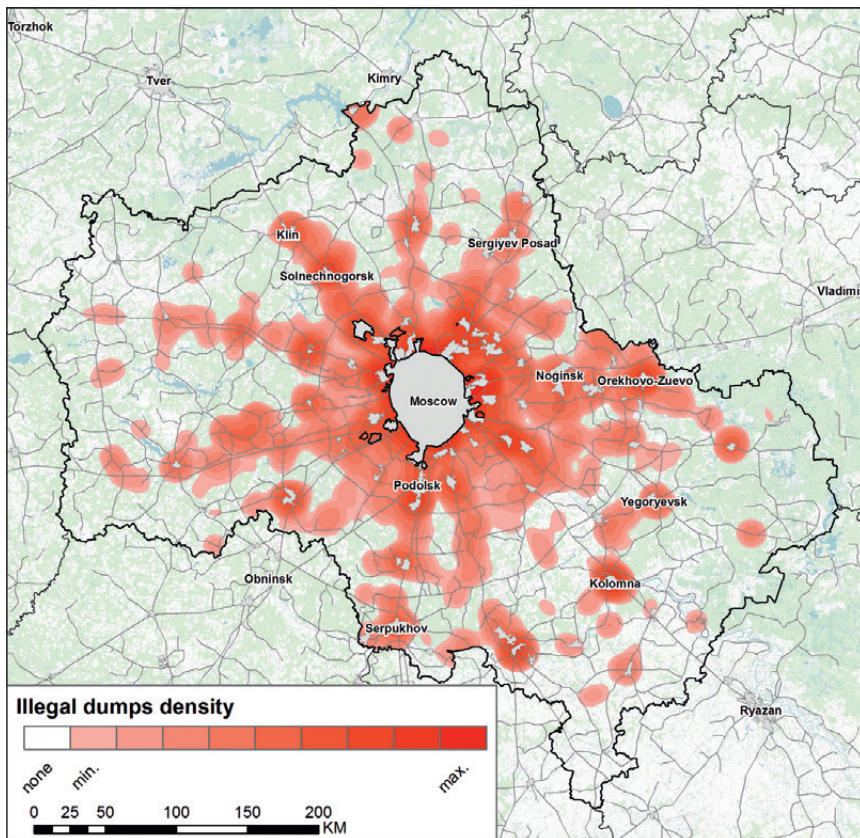


Figure 2. The density of illegal landfills (dumps) in Moscow oblast' (Draft and design: A. Medvedev)



Figure 3. Aerial image of an illegal landfill taken with RC 690S Tarot hexacopter, July 2015. Lyuberetskiy rayon (municipality), Moscow oblast' (Photo A. Medvedev)



Figure 4. Littering around waste containers, June 2014. Ramenskiy rayon (municipality), Moscow oblast' (Photo M. Gunko)

The official norms (SanPin 2.1.7.1322-33 2003) state that territories of municipalities should regularly be cleaned of waste in accordance with environmental, sanitary, and other requirements. Household waste should be collected, transported and disposed in a way that is safe for public health and the environment. The area where waste is disposed should be remote from settlement boundaries corresponding to the sanitary rules and norms. However, the cross reference of our research results with official norms shows that out of 29 main requirements of waste disposal 18 are being violated. Field observations reveal that waste management system is poorly developed in second home settlements: there is an insufficient number of waste collecting containers and those available are inconveniently located. Waste collection is irregular and so leads to the littering of the areas near waste containers. This is especially evident during holidays (Fig. 4).

The obtained results of spatial analysis and field observations indicate that the violation of sanitary norms in the sphere of waste disposal in MO seem to be mutual in terms of relations between the general population and authorities; while municipal authorities still struggle to introduce an efficient and user friendly waste management system the environmentally unconcerned population disposes waste in unauthorized, but convenient locations. Under such conditions second home settlements become areas of significant negative environmental impact.

Conclusion and discussions

The mobility of second home owners is influenced by the desire to relax from the stresses of urban life; thus, they value a high quality of environment and nature around their second homes (Long & Hoogendoorn 2013; Hiltunen et al. 2015). However, the analysis of spatial data shows a statistically significant association between illegal landfills and second home settlements. It is highly unlikely that these illegal landfills emerged without a direct participation of local second home owners. In line with the arguments of Hiltunen et al. (2015), our results indicate indirectly that second home owners themselves are the ones least worried about the harmful impact which their activities have on the environment. It seems that second home owners in MO generally hold a place-based view of own environmental impact (Hiltunen et al. 2015), lacking a broader understanding that their actions have a direct negative influence on their own wellbeing.

Though the vicinity of second home settlements is the main factor of the emergence of illegal landfills, they are also widespread in other recreational areas, alongside roads, inside the boundaries of cities and villages. There is a general increase of illegal landfills due to the increase of settlements' and road density. The areas that are less 'visible' and because of that receive less attention from the authorities, e.g. the outskirts of settlements,

'unofficial' settlements (second home settlements), remote recreational areas, are the ones that suffer the most from illegally disposed waste. Thus, the issue has a more universal nature, and confirms the findings of Yanitsky (2005) about the low environmental awareness and culture of the contemporary Russian society. The activities of both general public and regional/ municipal authorities contribute to generation and regeneration of vicious practices of waste management leading to the deterioration of environmental situation in the region.

The results of our research indicate that there is a sharp need for a comprehensive policy aimed at various aspects of waste management as well as societal perceptions. Primary actions should be towards formation of a visible and user friendly waste disposal infrastructure. There should be also a promotion of recycling in cooperation with enterprises using recycled materials. Further

research should be carried out for the better understanding of population awareness and attitude towards waste management, including surveys of the general public and interviews with stakeholders in Russia in general and in MO in particular. This future study would not only enrich theoretical knowledge but may serve as a starting point in developing efficient policy and particular measures aimed at promoting responsible attitude towards the environment.

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Unless otherwise stated, the sources of tables and figures are the authors', on the basis of their own research.

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