

УДК 504.03+502.6

A. A. KLIESHCH

V. N. Karazin Kharkiv National University
Svobody Sq. 4, 61022, Kharkiv, Ukraine
e-mail: klieshch@karazin.ua

THE EFFECTS OF URBANIZATION ON THE ENVIRONMENT

Our synthesis of the published scientific literature shows complexity and diversity of environmental effects of urbanization on the natural components and ecological systems: excessive loads on the lithosphere of the city and its surface manifest; The consequences of water use in the city; consequences of atmospheric pool pollution by city transport and plants there are acid precipitation; «heat islands»; dust content of the atmosphere and climate change; impact associated with the load on the landscape; alienation of land for waste dumps; the effects of electromagnetic radiation, noise, vibration, light and information pollution of the environment.

Keywords: urbanization, environmental impacts, mechanism of the impact, negative effects

Клещ А. А., Харківський національний університет імені В. Н. Каразіна

ВПЛИВ ПРОЦЕСУ УРБАНІЗАЦІЇ НА НАВКОЛИЦЬНЕ СЕРЕДОВИЩЕ

На основі огляду опублікованих наукових праць проаналізовано екологічні наслідки впливу процесу урбанізації на компоненти і комплекси довкілля: надмірних навантажень на атмосферу міста і його поверхні; надмірну експлуатацію водних ресурсів забруднення атмосферного басейну міським транспортом і рослин - кислотні опади; «Острова тепла»; запиленість атмосфери і зміна клімату; зміна природного ландшафту міста, деградація природних ландшафтів в приміських районах; відведення землі для звалищ; ефекти електромагнітного випромінювання, шуму, вібрації та ін.

Ключові слова: урбанізація, вплив на довкілля, механізми впливу, негативні ефекти

Клещ А. А., Харьковский национальный университет имени В. Н. Каразина

ВЛИЯНИЕ ПРОЦЕССА УРБАНИЗАЦИИ НА ОКРУЖАЮЩУЮ СРЕДУ

На основе обзора опубликованных научных работ выделены экологические последствия влияния процесса урбанизации на компоненты и комплексы окружающей среды: чрезмерных нагрузок на литосферу города и его поверхности; чрезмерную эксплуатацию водных ресурсов загрязнение атмосферного бассейна городским транспортом и растений – кислотные осадки; «острова тепла»; запыленность атмосферы и изменение климата; изменение природного ландшафта города, деградация природных ландшафтов в пригородных районах; отведение земли для свалок; эффекты электромагнитного излучения, шума, вибрации и др.

Ключевые слова: урбанизация, воздействие на окружающую среду, механизмы воздействия, негативные эффекты

Introduction

Today, we can state that urbanization is a global trend. More people live in urban areas than in rural areas, with 54 per cent of the world's population residing in urban areas in 2014 (UNPD, 2014). Total urban area will continue to expand, driven by urban population growth in developing nations and low population density of newly urbanized areas in the developed world (Angel et al, 2005, Cohen, 2006, Mertes et al, 2015).

Urbanization is a phenomenon that has many different aspects. This is the reason for the existence of several different theoretical bases to determine the concept. The scientists use different definitions of the urbanization content, but the most commonly used definitions are those describing urbanization as a

process (Tisdale, 1942). For example, Encyclopedia Britannica defines urbanization as a «process by which large numbers of people become permanently concentrated in relatively small areas, forming cities» (Urbanization, 2015).

How does urbanization change the world around us? Simple answer to this rhetorical question is not possible. With a convention, the effects of urbanization can be divided into negative and positive. The positive effects are often attributed as the economic results (e.g, reduction of expenses associated with the transport costs, rational allocation of natural resources in production), and social changes: growth of the level of education among the population, a high level of consumer needs satisfaction, giving people an opportunity not available in the countryside and, in general,

improving living standards. However, the list of the negative effects of urbanization is also impressive. These include: the extraordinary level of employment and unemployment, overcrowding, an acute shortage of housing, pov-

erty, healthcare problems and deviant behavior of the urban population (crime, violence, alcoholism, drug addiction, etc.), and, last but not least, the problem of environmental impact.

Results and discussion

The public in general is inclined to believe that urbanization negatively affects the environment (Stiling, 2012). There exists a firm opinion that massive and rapid increase in the number of cities is one of the main factors of the planet's global ecosystem's environmental degradation (Bornkamm, Lee and Seaward, 1982; O'Brien and Western, 1976; Gaston, 2010).

However, before unambiguously negative assessment of all environmental impacts of urbanization, let's try to understand the mechanism of the impact of this process on the environmental components and systems.

The consequences of **excessive loads on the lithosphere of the city** and its surface manifest in the processes such as changes in the relief, structure of watersheds, changing the properties of the lithosphere, breach of the geological foundation integrity, etc. The negative consequences of the lithospheric dislocation and the relief of the city are complex environmental problems.

Nowadays, such most environmentally adverse impacts compromising the integrity of the geological foundation as land subsidence in the cities are of a local and not general character. As a rule, they occur because lithospheric and relief properties are neglected in the planning of economic activity in cities (Parcerisa, 1989).

The consequences of water use in the city include the over-exploitation of water resources and associated changes in hydrological and hydrogeological conditions; the environmental impact of artificial reservoirs; the impact of economic activity on pollution of surface drinking water sources; mutual influence of surface and groundwater (Haapala, 2002).

One example of increasing urbanization negative impact and related to it industrialization on objects of the hydrosphere is excessive pumping of groundwater. This leads to subsidence and loss of shallow aquifers. As a result, we lose access to the water supply and soil resources (Kasarda, 1991).

Among the negative **consequences of atmospheric pool pollution by city transport and plants** there are acid precipitation; "heat islands"; dust content of the atmosphere and climate change.

Some researchers argue that the urban areas along with agriculture are the largest emitters of greenhouse gases, and therefore implicated in global climate change (Kalnay et al, 2003). However, another group of scientists takes the opposite view, believing that the volume of the greenhouse gases emission from natural sources is much higher than the anthropogenic emissions (Dodman, D., 2009). Thus, the impact of industrial enterprises emissions in city-millionaires on global warming is not solved yet.

Environmental **impact associated with the load on the landscape** is also quite complex and varied (Antrop, 2004). The most important consequences are such things as changing the natural landscape of the city, degradation of the natural landscape in suburban areas due to excessive visits of forest and recreation areas, disposal of land for landfills, cottage settlements and highways; lack of green areas and recreational facilities; plant diseases caused by changes in the composition of soils, pollution of atmosphere and hydrosphere, the need to establish an optimal "urban" species composition of the vegetation, the problem of flora and fauna habitat loss.

In the process of urbanization cities increase their area due to the "absorption" of natural ecosystems and habitats with extensive forms of land use that significantly changes the pattern of the natural landscape (Deng et al). Many studies prove that the occupied territories of the city lose their properties of natural habitats, which ultimately leads to impoverishment and "homogenization" effect of biota (Friesen, 1998; McKinney, 2008).

One of the most pressing environmental problems, caused by the influence of urbanization is **a problem of waste formation and recycling**. Solid waste, i.e. large-tonnage waste, worn out in everyday life articles and

items, as well as human waste products or residues generated in the system of housing and public services occupies a special place in the composition of municipal waste. The classical approach to the disposal of municipal solid waste (MSW) is the fight against windmills: alienation of land for waste dumps and at best bed waterproofing is carried out. Landfill sites laid 40-50 years ago, are already overflowing and cannot cope with the volume of waste produced by the population. Filling the newly created ones is at an alarming rate, and there are fewer and fewer territories to create additional landfills. It is obvious that the existing methods of disposal, reduced to primitive burrowing into the ground, are unable to cope with the growing wall of solid waste.

Management of solid waste is going through a critical phase due to the lack of suitable methods for the management of large amounts of waste generated every day in big

cities. One of the consequences of this situation is the adverse effect on the environment and on human health. Particularly acute is the problem in the countries of China, India and Africa (Rathi, 2006; Ray et al, 2005; Dong, 2010; Parrot, 2009).

Also, the effects of urbanization can be selected into a separate group comprising the effects of **electromagnetic radiation, noise, vibration, light and information pollution of the environment**. (Poulton, 1985). As an example, let's consider the impact of noise pollution caused by urbanization. Here, we have to admit that the city is a continuous source of noise. One of the main sources of urban noise is motor transport and Industry (Kihlman and Kropp, 2001). The mechanisms of noise impact on the environment are rather indirect, mainly its negative impact is directly exposed to the man himself, as well as the fauna of the urban environment.

Concluding remarks

Summing up, we can answer the question asked at the beginning of our discourse. Urbanization affects all natural components and systems, the mechanisms of this effect are rather complex and diverse. Thus, it should be recognized that the phenomenon of urbanization has strong implications on the ecological environment. However, not all effects of ur-

banization can be called negative. We'd like to believe that despite the pessimistic predictions of some scientists, the cities of our time will leave a positive environmental footprint. After all, XXI century is called the century of the cities, and we still hope that after many a century the name will sound proudly

References

1. UNPD, 2015. World Urbanization Prospects: The 2014 Revision. United Nations Population Division, New York.
2. Angel, S., Sheppard, S., Civco, D., Buckley, R., Chabaeva, A., Gitlin, L., Kraley, A., Parent, J., Perlin, M., (2005). The Dynamics of Global Urban Expansion. Transport and Urban Development Department, The World Bank, Washington, DC.
3. Cohen B. (2006). Urbanization in developing countries: Current trends, future projections, and key challenges for sustainability. *Technology in Society*, 28, pp.63-80.
4. Mertes C .M., Schneider A., Sulla-Menashe D., Tatem A.J., Tan B.(2015). Detecting change in urban areas at continental scales with MODIS data. *Remote Sensing of Environment.*, 158, pp.331-347
5. Urbanization, (2015). In Encyclopaedia Britannica Online [online] Retrieved from <http://www.britannica.com> [26 October, 2015].
6. Tisdale Hope, (1942). The Process of Urbanization. *Social Forces*. Vol. 20, No. 3, 311-316.
7. Gaston, K. (2010). *Urban ecology*. Cambridge: Cambridge University Press.
8. Stiling, P. (2012). *Ecology*. New York: McGraw-Hill
9. Bornkamm, R., Lee, J. and Seaward, M. (1982). *Urban ecology*. Oxford: Blackwell Scientific.
10. O'Brien, K. and Western, J. (1976). *Urbanization*. St. Lucia, Qld.: University of Queensland Press.
11. Kasarda, J. (1991). Third World Urbanization: Dimensions, Theories, And Determinants. *Annual Review of Sociology*, 17(1), pp.467-501.
12. Dodman, D. (2009). Blaming cities for climate change? An analysis of urban greenhouse gas emissions inventories. *Environment and Urbanization*, 21(1), pp.185-201.
13. Kalnay, E. and Cai, M. (2003). Impact of urbanization and land-use change on climate. *Nature*, 423(6939), pp.528-531
14. Friesen, L. (1998). Impacts of urbanization on plant and bird communities in forest ecosystems. *The Forestry Chronicle*, 74(6), pp.855-860.

15. McKinney, M. (2008). Effects of urbanization on species richness: A review of plants and animals. *Urban Ecosystems*, 11(2), pp.161-176.
16. Deng, J., Wang, K., Hong, Y. and Qi, J. (2009). Spatio-temporal dynamics and evolution of land use change and landscape pattern in response to rapid urbanization. *Landscape and Urban Planning*, 92(3-4), pp.187-198.
17. Antrop, M. (2004). Landscape change and the urbanization process in Europe. *Landscape and Urban Planning*, 67(1-4), pp.9-26.
18. Haapala, U.(2002). Urbanization and Water: The Stages of Development in Latin America, South-East Asia and West Africa, Master's Thesis.p.106
19. Rathi, S., (2006). Alternative approaches for better municipal solid waste management in Mumbai, India. *Journal of Waste Management* 26 (10), 1192–1200.
20. Ray, M.R., Roychoudhury, S., Mukherjee, G., Roy, S., Lahiri, T. (2005.) Respiratory and general health impairments of workers employed in a municipal solid waste disposal at open landfill site in Delhi. *International Journal of Hygiene and Environmental Health* 108 (4), 255–262.
21. Dong Qing Zhanga, Soon Keat Tanb, Richard M. Gersbergc (2010) Municipal solid waste management in China: Status, problems and challenges *Journal of Environmental Management* Volume 91, Issue 8, pp. 1623–1633.
22. Parrot Laurent, Sotamenou Joel, Kamgnia Dia Bernadette (2009) Municipal solid waste management in Africa: Strategies and livelihoods in Yaoundé, Cameroon *Waste Management*, 29, pp. 986–995.
23. Poulton, M. (1985). The urban environment. *Urban Ecology*, 9 (1), pp.83-86.
24. Kihlman, T. and Kropp, W. (2001). City traffic noise - a local or global problem?. *Noise Control Eng. J.*, 49(4), p.165.
25. Parcerisa, J. (1989). The Relief of the City. *Perspecta*, 25, p.26.

Надійшла до редколегії 29.10.2015