

PART IV
LOCAL ASPECTS OF DEVELOPMENT

QUALITY OF LIFE AND ECOSYSTEM SERVICES IN RURAL-URBAN REGIONS¹

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Abstract. The study here presented concerns the possibility of making use of the natural environmental potential, expressed through ecosystem services, in the establishment of foundations for and the direction of development of the rural-urban areas. The purpose of the study is to show the potentialities of using ecosystem services in governance, directed towards the economic and social development of the rural-urban regions, with consideration of improvement in quality of human life and preservation of the most valuable resources of nature as well as landscape qualities. Ecosystem services, being the nature-provided good, play an increasingly important role in the shaping of social and economic policies within the peri-urban areas, and thereby also their direct influence on the standard of living of the inhabitants increases. The scope of analysis that is presented in the report encompasses the problems of using the potential of the environment in the development of regions on the basis of modelling of reality with due account of the level of social awareness in the context of pro-ecological behaviour patterns. Assumption was adopted that even small differences in the initial parameters or a disturbance of the trajectory of regional development may have an essential impact on the ultimate effect, that is – on the role played by ecosystem services in this process.

Keywords: ecosystem services, perception of nature, attractors, trajectory of rural-urban regions development

INTRODUCTION

In conditions of the increasing pro-ecological awareness of the societies of many countries, especially the highly developed ones, the role of natural environment as an integral part of the mega-system of geographical environment, encompassing the socio-economic and the physical systems, is also increasingly highly appraised. The systems mentioned, mutually interconnected through interactions, are with respect to each other, respectively, the subject and the systemic environment (Degórski, 2004). In the context of the structure and functioning of geographical space the multi-functional character and the significant contribution that this space has towards the shaping of human life quality and health, are also being perceived (Degórski, 2003; Meyer, Degórski, 2005). In view of the fact that

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these functions are not only of the generally nature-related or ecological character, but also of the socio-economic one (in particular, as the reserves of natural and mineral resources, as sinks for the emissions of pollutants and for the accumulation of waste, as well as the pool of habitat and landscape potential for human relaxation), they are increasingly frequently perceived as elements conducive to the development of regions (Łaguna, 2004; Degórski, 2007), especially of the rural-urban regions, as the areas featuring highly intensive spatial, natural, social and economic transformations.

In connection with the thus strong mutual impact of the economic, social and natural processes and phenomena, rural-urban regions become the place of numerous conflicts, mainly of spatial character, whose resolution depends largely upon the appropriate governance of the region, based on skilful use of all of its potentials, including the natural ones. Currently, governance is being defined as the rules of the political system for solving conflicts between actors and adopting decisions (legality). It has also been used to describe the “proper functioning of institutions and their acceptance by the public” (legitimacy). Further, it has been used, as well, to invoke the efficacy of government and the achievement of consensus by democratic means (participation).

In the procedures of planning and management of the peri-urban regions, especially in the countries with well-developed mechanisms of the free market, the natural environment becomes, thereby, a significant player in the processes of economic and social development of these regions. The macro-economic processes generate, in these conditions, definite directions of social behaviours and preferences, while natural environment, by virtue of the non-renewable character of its natural and landscape resources, and the utilitarian multiple functionality constitutes a product, whose value constantly increases. Societies are increasingly aware of its essence in the axiological aspect, as well as in the ontological (existential) one. It is namely so that the environmental qualities are more and more often decisive for the preferences as to the location of residence and leisure, for the choice of lifestyle, and so on. Multi-functionality of natural space is also perceived as an opportunity for increasing the development potential of the rural-urban regions through gravity produced by respective attractors and generation of the increase in their viscosity (Degórski, 2010). Areas, where air is purer due to increased forest share, or areas with good quality of waters, become highly attractive from the point of view of location and investment making. This, however, brings also very often definite negative consequences in the form of urban sprawl over the open spaces and the increase of anthropogenic pressure, whose effects are constituted by the fragmentation of the environment, destruction of ecological linkages, and, thereby, disappearance of the green belts, surrounding large cities.

In this context particular significance is gained by the controlled growth of urbanisation within the suburban areas, as well as by the proper use of the environmental potential in the process of management of space. One of the approaches of operational character, involving environment in the processes of managing space is associated with ecosystem services.

The purpose of the present study is to demonstrate the potential capabilities related to the use of ecosystem services in governance, oriented at economic and social development of the rural-urban regions, with consideration of the improvement of human life quality and preservation of the most valuable natural assets as well as landscape qualities.

PERCEPTION OF NATURE AND HUMAN CONSCIOUSNESS

Within the quickly developing rural-urban zones of the European countries, the potential of nature, expressed, in particular, through its multiple functionality, is – despite the increasing social awareness – still not sufficiently highly appraised by many decision makers and by plain citizens. The

problem lies primarily in the fact that the functions of the products of nature are poorly defined and insufficiently promoted among the local communities, which, in a democratic system, are capable of deciding of the directions of development of their respective regions. People often do not understand fully the kinds of services that nature provides. They very often are not aware that the pure water that they drink or the decomposition of waste in their gardens under the influence of microbiological life constitute exactly such goods or services, provided by nature, representing enormous existential value and obtained without any significant financial outlays. People are sometimes also not aware of the fact that the metabolism of ecosystems, taking place under very strong anthropogenic pressure, leads in many cases to their deformation, which, ultimately, may end up with their disappearance. Disappearance of numerous populations of animals or plants shall undoubtedly disturb the biotic equilibrium state, and hence hinder a lot of natural processes, taking place nowadays in the system of natural environment, with not fully predictable consequences.

Urban sprawl, and, more generally, settlement sprawl, and the increasingly intensive human penetration of the suburban green areas bring about the increasingly stronger impact of local communities on the environment. Raising income levels of the population, expressed through raising standard of living and changing preferences, resulting from the state of awareness, shaped largely due to the processes of education, cause the human pressure on the suburban areas to increase further, while the rural-urban areas, until now mutually functionally and spatially connected, shall undergo increasing mutual integration and disappearance of the functions typical for them (Fig. 1). Hence, they will be forming a multi-functional space, unified in terms of its functional character.

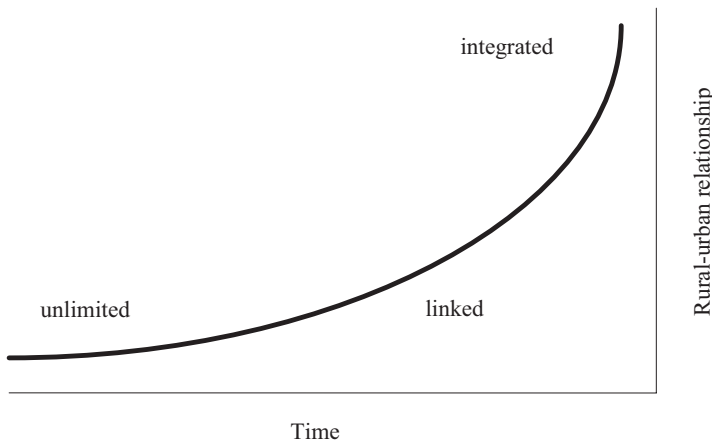


Fig. 1. Changes over time in the character of relations within the rural-urban areas

The fundamental problem in the integration of rural and urban areas, as seen from the point of view of quality of life is, therefore, the preservation of their natural elements, and of the entire system of environment, in a possibly good condition. Contemporary societies pay definitely more attention – when compared to the periods of the 19th and 20th centuries – to the harmonious co-existence of man and nature, making reference to the behavioural attitudes of people from the beginnings of civilisation. In those ancient times nature constituted for humans a shelter, a source of alimentation, and the environment of life and activity. Natural environment had for people ontological, epistemological, and oftentimes also sacral meaning. With the development of civilisation, though, the functions of natural environment underwent a change in evaluation in the context of social life. People, while

developing an own anthropogenic system, concentrated primarily on its improvement, and treated natural environment as increasingly distant external world. The natural hierarchy of values, resulting from the immanent, inborn and instinctively felt existential conditions, underwent a deeper evolution in the direction of depreciation of the significance of natural environment in the life of individuals and of the entire societies. The increasingly often adopted nihilist attitudes with respect to nature were associated with the image of *homo sapiens* as a tamer of nature, who is capable of transforming and adapting the environment to own needs, according to own visions and developed aspirations.

Nowadays, the majority of people, in the perspective of quality of life, wish to live and work in the environment characterised by the landscape possibly free of anthropogenic deformations, featuring spatial order, and the environment with good sanitary conditions. The pro-ecological awareness of the societies is again on the increase, and is one of the reasons why people migrate from the strongly urbanised areas to the rural-urban areas. People start to treat natural environment as not just solely a natural entity, within which they live and grow, but also as a good, which can and should be taken advantage of in the local and regional development. Yet, irrespective of the actual reasons, the increase in the ecological awareness of the societies is more and more visible (Fig. 2). This proposition ought to be adopted, though, with a reservation, perhaps paradoxical, that the increase of the pro-ecological awareness is associated with the state of the environment and the level of economic development of a given society. In distinction from the primitive consciousness, resulting from the instinctive premises, the currently developing human perception of nature, of secondary character, is a learned precaution and care for the future generations of the societies, and is increasingly burdened with economic calculus. It should, however, be emphasised that in both the case of the pro-ecological primitive consciousness, and of the learned one, they have very strong existential bases.

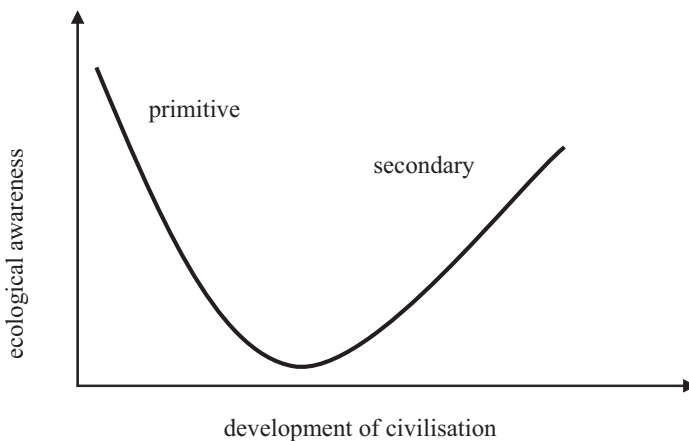


Fig. 2. Interrelation between the development of civilisation of the societies and their ecological awareness

ENVIRONMENTAL POTENTIAL IN THE RURAL-URBAN AREAS AND ECOSYSTEM SERVICES

Irrespective of the level of development of civilisation and the human perception of its causal relations to the potential of natural environment, the latter has played, plays now and shall continue to play an enormous role in the context of the socio-economic, cultural and existential development,

especially with respect to local communities. Very frequently in the rural-urban regions, taking shape under the influence of a rapid inflow of population, differentiated as to the perspectives on the problems of the environment, local communities of these areas form their preferences and adopt behaviour patterns that are different from those typical for both the urban and rural areas. In the urban system the ecosystems of greenery and surface waters (street greenery, parks, urban woods, meadows, lakes, water flows) provide very important services for the local resident community. Among such services we can mention purification of the air, regulation of the micro-climatic conditions, reduction of noise levels, retaining of precipitation, purification of wastewater, formation of proper conditions for recreation and leisure. Ecosystem services are perceived somewhat differently within the rural areas. Agricultural ecosystems are being actively transformed by people with the aim of maximising or optimising the production of alimentary, pseudo-alimentary, non-alimentary and indirectly alimentary plants. Yet, the multi-functionality of the agricultural ecosystems and provision by them of the ecological services, are essential for the improvement of water regime and water supply, as well as for the alleviation of climate changes (Zhang et al., 2007; Degórski, 2010). Still, the most important service, rendered by the agricultural ecosystems is the circulation of matter and energy, allowing for production of food, that is – for the satisfaction of the basic existential needs of people.

The already mentioned multi-functionality of rural-urban areas and disappearance of the leading functions cause that a specific perception develops within these areas of the ecosystem services. This might be partly attributed to the development of areas featuring high natural potential. The behaviour patterns evolving make very clearly apparent the care for the quality of life of all inhabitants, as well as of the entire local community. This local community frequently sees the improvement of their standard of living in the raising of quality of the environment and landscape (Fig. 3).

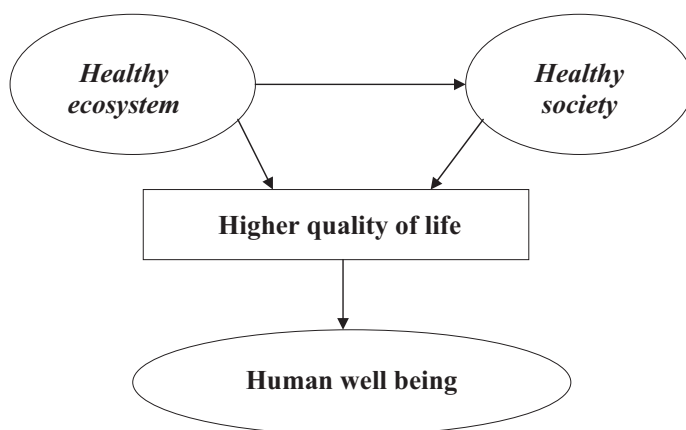


Fig. 3. Relationship between healthy ecosystems and human well being

Multi-functionality of the environment with respect to human life is also being registered in an increasing number of documents of the European Union. In the Millennium Ecosystems (2005), a report concerning the assessment of ecosystems in terms of, in particular, betterment of human living conditions, attention is paid to four basic functions that the ecosystems fulfil in our lives, providing definite services for people:

- the existential ones, of fundamental character, among which the circulation of matter and energy is mentioned, emergence of the soil cover, respiration, photosynthesis, etc., that is – the essential processes, decisive for life on the Earth;
- the alimentary ones, that is – decisive for the supply of food, water and raw materials for people;
- the regulatory ones, influencing the quality and the dynamics of climatic conditions, water conditions (droughts, floods), or forming the buffer conditions with respect to the spread of epidemics or pandemics;
- the cultural ones, yielding recreation, spiritual, educational etc. benefits.

In the rural-urban zones, in view of the quickly increasing human pressure on the environment and the use of the properties of ecosystems in the socio-economic development, the role of the ecosystem services is even more pronounced (Holdren and Ehrlich, 1974; Ehrlich and Ehrlich, 1991; Wallace, 2007). They are taken advantage of in numerous aspects of social and economic life, in particular for:

- purification of air and water,
- formation and protection of the soil cover and its renewal, as well as quality improvement, and thereby also soil fertility,
- alleviation of droughts and floods,
- detoxication and decomposition of waste,
- pollination of crops and increase of yields,
- dispersion of the seeds and causing the natural succession of plants,
- circulation of the nutrient substances,
- natural protection against a vast majority of potential agricultural pests,
- maintenance of biodiversity,
- protection of the seashore against the abrasion erosion, caused by waves, in the seacoast agglomerations,
- protection of the shores of inland flows from fluvial erosion,
- protection of people against the damaging ultraviolet radiation from the sun,
- stabilisation of weather conditions, and hence also partial stabilisation of the topo-climate,
- limitation of the extreme phenomena and their influence on the living conditions of people,
- provision of aesthetic impressions, beauty and “spiritual feast” for people, elevating for the personality and the aesthetic feelings.

Frequently, through achievement of high environmental standards in the rural-urban areas, synergetic effects are obtained, entailing the increase of land value, its attractiveness in tourist terms, or lowering of costs associated with wastewater management. Such effects, though, are often difficult to measure. There do not exist, namely, perfect yardsticks for measuring the value of ecosystem services (VES). Proposals forwarded in this domain to date do not account for the parameters so significant for the functioning of the geographical megasystem as attainment of ecological equilibrium, or the possibility of making use of goods of nature by a larger group of members of the local communities, allowing for the realisation of personal benefits (Howarth and Farber, 2002).

Estimation of the value of ecosystem services in conditions of market economy takes place most often on the basis of the difference of potential and actual costs, the latter decreased by the use of ecosystem services, or on the basis of profits generated through the use of these services in the economy of the region. Literature of the subject points out six main groups of measures for the value of ecosystem services, meant to estimate the socio-economic benefits resulting from the implementation

of use of these services (Farber et al., 2002; Degórski, 2010). In the rural-urban regions these measures include:

- magnitude of costs avoided – enabling determination of costs that would have to be borne in case, for instance, of lack of use of ecosystem services in water purification processes (e.g. through the use for purification of wastewater of the swampy land and vegetation), accounting also for the health care costs;
- decrease of the purpose-oriented costs – for instance, through replacement of the systemic solutions, produced by people, by strengthening or reconstruction of the natural conditioning (e.g. reinstating the natural watershed functions within the urban areas, rather than constructing water treatment plants),
- increase of the commercial revenue – through improvement in the quality of ecosystems, for instance – improvement of water quality entails increased fish production potential, and thereby establishes the basis for increased direct and indirect (downstream and upstream) revenues,
- travel-related profits – demand for participation in the use of ecosystem services may require movement of the population (e.g. willingness to pay the travel and accommodation costs in order to come to locations characterised by high natural qualities and to make use of ecosystem services, primarily during weekends),
- profits generated from hedonist behaviour of people – demand for ecosystem services may get reflected in the price that people would pay for a definite group of goods, resulting from the hedonist attitude to lifestyle (thus, in particular, houses located in places attractive from the point of view of environmental and landscape quality have much higher prices than houses situated in areas little attractive in terms of natural conditions),
- profits from the propensity of the societies to making use of ecosystem services in a well preserved natural environment – through construction of hypothetical scenarios for estimating the alternative profits from the access to these services (e.g. estimation of the price – and hence the revenue – that the visitors would be willing to pay for entering the national parks, the cultural-landscape parks and other areas of high natural value, situated in the rural-urban regions).

Ecosystem services, conform to argumentation of Boyd and Banzahaf (2007) should be considered within a much broader perspective than only as a final effect of service for the beneficiary. Authors of this proposition indicate that the assumed ultimate effect of the activities associated with the use of water resources of the region might, for instance, be the regulation of water economy, which, however, brings a number of indirect effects, very significant for the economy, like provision of high quality drinking water, possibility of retaining water for irrigation purposes, or an increased hydrological potential for power generation. Some of the services generate by themselves other kinds of service, remaining in causal chain leading towards economic success, see Wallace (2007), Fisher and Turner (2008). Practical use of such solutions brings about the situations, in which economic success is also an ecological success, and the environment, through the intermediary of ecosystem services, becomes a significant player in the general economic as well as social system (Haughton and Hunter, 1994; Bolund and Hunhammar, 1999).

MODELLING OF DEVELOPMENT OF RURAL-URBAN REGIONS AND ECOSYSTEM SERVICES

The procedures of economic assessment of the value of ecosystem services incorporate also social communication and information on social preferences, especially at the level of local solutions, which are typical for the rural-urban areas. They allow for a better identification of social expectations in the context of use of ecosystem services for the improvement of life quality and economic development of a given territory. In respective studies assumption ought to be adopted, though, that not everywhere the same kind of solution is capable of yielding similar benefits and providing the same final effect. One of the methods of predicting the final effect consists in the use of modelling instruments and the search for optimum directions of development. This is of special importance in the areas, where an intensive growth of the periurban zone is taking place now. An instance of such an area is provided by the metropolitan area of Warsaw, which, on the one hand, features still quite a low degree of urbanisation, but also, on the other hand – a high absorption capacity of urban type investments, estimated at the level of 7-8 million inhabitants, and an equally strong urban sprawl (Degórska, 2008).

Modelling of reality, based on theory of chaos, using the regularities of dynamics of nonlinear systems, demonstrates that the same initial data, for the very same system of mathematical equations, bring different results. Such procedures refer to the theory of deterministic chaos, in which the property of equations or systems of equations is made use of, consisting in a high sensitivity of solutions to arbitrarily small perturbations in parameters, describing the dynamic systems. Hence, even insignificant differences in the initial data bring about a different sequence of solutions of the nonlinear equations. This property of nonlinear equations makes apparent the sensitivity of the final results with respect to very small differences in the initial conditions over a sufficiently long period of time, called characteristic time. So, amplification of the small changes in the initial conditions over a sufficiently long time period may cause an entirely different final outcome. Conform to this assumption we can expect that the very same qualities of the environment may, but not necessarily so, lead to the same degree of success in regional development and investment-wise attractiveness, resulting from the use of ecosystem services. Many scholars note also that forecasting of the systems unstable in time is very difficult if one wishes to achieve a reliable result (Życzkowski and Łoziński, 2003). Yet, search for robust attractors constitutes an important direction of study in many domains of science. An attractor is a hidden, hardly observable, ordering of the process. If we knew it, we could perform predictions and influence the course of the respective processes, including also the processes of development of rural-urban regions in their entirety or their fragments.

Adopting, conform to the prerequisites of the Lorenz model, the emergent order, whereby the immeasurable and nonlinear reality becomes understandable, one must conclude that the direction of development of a given area also becomes thereby foreseeable. Chaos turns into order not only in the way, described by the Lorenz attractors, but also through such forms as solitons, bifurcations or fractals, which might be considered as mathematical models of emergence of order in nature. Analysis of changes in the landscape of the metropolitan area of Warsaw, carried out for the years 1998-2005, demonstrated that in the entire periurban zone the areas featuring the highest attractiveness from the point of view of development of the settlement system were those attractive in terms of nature and landscape (Degórska, 2008). The development of these areas is strengthened currently by the use of ecosystem services, and hence a spatial structure arises, characterised by a specific, internally diversified setting of units, differing as to the human potential.

Environment, therefore, constitutes a factor that is capable of generating a trajectory of development, which may get denser, forming locations exerting attraction – exactly the attractors – each with an own basin of attraction, which is also, among other factors, contributing to the viscosity of the area. This property of every region, including the rural-urban areas, is responsible for the drainage of human and economic capital from the surrounding region, and then the retention (rooting) of this capital, allowing for the achievement of an instantaneous state of socio-economic equilibrium. This state can be or become stable, or, under the influence of endo- and exogenous factors may undergo further development processes. Attractors, being equilibrium points, attracting all (local) trajectories of a given dynamic system, owing to the nonlinear character of the socio-natural relations, constitute a factor forming in definite conditions systems featuring meta-stability (Domański, 2007; Degórski, 2010).

It must be recalled, though, that in accordance with the general system theory of Ludwig von Bertalanffy (1928), an attractor is an area or a point in a certain state space, towards which the system may converge, and around which this system may remain over an arbitrarily long scale of time, undergoing evolution in terms of chaotic dynamics. A system is considered chaotic, when its state space map contains saddle points, homoclinic crossing points (crossings of inflows and outflows of the very same trajectory), as well as heteroclinic crossing points (crossings of inflow and outflow of different trajectories). Exactly these properties of the map of trajectories cause that the qualities of the natural environment, expressed, in particular, through ecosystem services, do not have to always decide with the same force of the attractiveness of a region. As mentioned already before, even slight differences in the initial conditions related to the potential of the environment, may bring about a completely different final effect, and, in addition, the active economic surroundings of the natural environmental system exerts a strong influence on the course of developmental trajectories. The level of investments made into the transport and tourist infrastructure, human capital and economic potential, belong among the most significant factors, modifying the trajectories of regional development. When constructing the models of outlays into the environment and achievement of economic success, one should also account for and define the so-called maximum incremental social tolerance to irreversible costs (MISTIC). This indicator should allow for the assessment of the degree of readiness of a society to forego certain benefits for the sake of attainment of definite development objectives, including the costs related to introduction of pro-ecological solutions, very often entailing high costs. Let us note, though, that the contribution of the environment to the development of regions is not only limited to the aspect of direct protection of its most valuable assets, but includes also construction of the entire infrastructural system, with the aim of attaining the success that would be accepted by the society.

One of the ways to determine the true interrelations that take place between the economic domain and the conditions pertaining to natural environment in the regions, including rural-urban areas, is constituted by construction of economic-ecological models. The starting point for the simple study of causal relations consists in elaboration of the single-discipline models. Yet, in the multi-factor analyses of regional development, the multidisciplinary or the so-called holistic models are being applied. Instead of linking the detailed models into the increasingly complex formulas, in holistic models it is attempted to construct one model, encompassing the respective entirety, and giving the possibility of cognising the interactions that take place between the system of natural environment and the socio-economic system. Among the most often applied models let us mention the input-output models, also in an extended form, meant for management of environmental quality and energy policy (Degórski, 2007). They make up, one of the methods of integrated study of geographic environment,

facilitating the understanding of numerous processes and phenomena, of both natural and socio-economic character, taking place within the mega-system of geographic environment.

CONCLUSIONS

Fast development of civilisation and changes, taking place in the lifestyles of the enriching societies, exert undoubtedly an impact on the state and the evolution of the noosphere. In the highly developed countries the societies devote more and more time to leisure and an increasing role in their life is played by the care for the quality of this life. The frequently egocentric perspective on the conditions of life of the individuals yields an intended or unintended coincidence effect, which gains already a social dimension. At the level of the societies, care for a high standard of living must also be based on the environmental conditions, treated as one of factors of development of a given rural-urban region.

Such a way of thinking, even though, alas, not very common, as yet, gains an increasingly broad acceptance, both among the decision makers and in the direct reception of the societies of the respective regions. Inhabitants understand the best what is the most important for them and what ought to be implemented in the development of their regions. It can be proposed that actual pragmatic consideration of ecosystem services shall become more and more common. The development of human awareness shall evolve in the direction of thinking about the necessity of using the environmental assets and the potential of ecosystems as the factor of economic and social development, not only in the existential aspect, but also in view of the provision of a very tangible economic effect.

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