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SOCIO-ECONOMIC RESPONSES TO THE ENVIRONMENT AND ECOSYSTEM SERVICES IN REGIONAL DEVELOPMENT

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Abstract: With environmental conditions coming to play an ever-greater role in regional development, this paper has sought to determine how multi-functionality of the environment relates to the formation of regions' development potential, by way of attractor gravity and increased regional viscosity. The attendant analysis has addressed both the theoretical foundations for the modelling of reality and of presentation of the potential for ecological-economic models to be used in the devising of development policies. The proposals made in consequence offer a new perspective on the environment and the role it is playing in socio-economic development, particularly where responses to ecosystem services are concerned.

Key words: environment, ecological-economic models, socio-economic development, ecosystem services

INTRODUCTION

The interrelations between the natural environmental and socio-economic systems have become subjects for study in several different scientific disciplines, this above all reflecting the multi-functionality of the natural environment within the mega-system of the geographical environment. Worth mentioning as of fundamental significance are functions that are: (1) ontological one, in that the environment is a place of habitation for species (not least human beings) or groups of species; (2) a landscape-forming, since there is an objectivised visualisation of the (*i.a.* natural) processes and phenomena ongoing in the mega-system of the geographical environment; (3) ecological, arising as a function of the presence of living space and resources, and resulting from the flow of energy and cycling and retention of matter (natural resources); and (4) sozological (or regulatory), reflecting the natural environment's contribution to the neutralising of harmful exogenous (above all anthropogenic) influences.

The multi-functionality of the natural environment and its close association with the socio-economic sphere are such as to ensure regular mention of its resources (e.g. by Degórski 2007, 2008; Faludi 2009) among factors underpinning regional development—alongside human, material, financial and social capital, as well as innovation (Churski 2008; Churski and Perdał 2008). The European Commission's Third (2004) *Cohesion Report* presents, as the main factors behind regional development, technical infrastructure, human capital and so-called soft factors that shape conditions for the generation of growth and transformation processes. The potential of the natural environment falls within the latter group, has and is also accounted for among EU policy priorities. In fact, two out of the four priorities invoke the concept of sustainable development directly, as well as the protection and management of natural resources.

In the light of changing social perceptions of the natural environment's role in regional development processes, evolution is also taking place when it comes to perspectives on optimum use of resources of the natural environment, the protection of its most valuable fragments, and—more generally—the geographical environment as a complex ecological-social-economic system (Kuznets 1955; Dinda 2004). It is that complexity that has motivated a search for, and attempt at the definition of, loci for the generation of development trajectories reflecting regional potentiality, not least conditioning as regards the environment and landscape. The search in question was initiated for points of concentration of trajectories in space that have become known as attractors (Domański 2007, 2008; Degórski 2010). Attractors, or attraction locations along development trajectories, are decisive determinants of particular regions' viscosity, i.e. their gravity potentials capable of generating attractiveness as regards investment capital, but also the enhancement of the potential for human quality of life, and hence attractiveness as a destination for settlement-related migration.

The work described in this paper has thus sought to determine how the multi-functionality of natural space relates to the formation of regions' development potential, by means of the aforesaid gravity of attractors and increased viscosity. Relevant analysis offered both the theoretical foundations to the modelling of reality and a presentation of the capacity for ecological-economic models to be used in elaborating development policies. The proposals this article makes refer to a new perspective on the environment, and the role it is playing in socio-economic development, particularly as regards responses to ecosystem services.

THEORETICAL FOUNDATIONS FOR THE MODELLING OF REALITY

Reality modelling based on chaos theory and using rules relating to the dynamics of non-linear systems, makes it clear that the same initial data, for the very same system of mathematical equations, may give rise to different results. Such procedures reflect the theory of deterministic chaos, using the properties of equations or systems thereof to reveal the sensitivity of solutions to arbitrarily small perturbations in the parameters describing a dynamic system. Even insignificant differences in initial data may then give rise to a different sequence of solutions of the nonlinear equations over a sufficiently long period of time called the characteristic time. So, amplification of small changes in the initial conditions over a sufficiently long time period may cause an entirely different final outcome. In line with this assumption, we can expect that the very same qualities of the environment may, but not necessarily will, lead to the same degree of success in regional development and investment-wise attractiveness, resulting from the use of ecosystem services. Many researchers also note that forecasting of systems unstable over time is very difficult if a reliable result is sought (Życzkowski and Łoziński 2003). Nevertheless, the search for robust attractors constitutes an important direction of study in many domains of science. An attractor is a hidden, hardly observable, ordering of a process. Acquaintance with one provides for the making of predictions and may influence the course of the respective processes, including also those leading to the development of whole rural-urban regions or fragments thereof.

In adopting, in line with the prerequisites of the Lorenz model, an emergent order wherein immeasurable and nonlinear reality becomes understandable, we must conclude that the direction of development of a given area also becomes foreseeable. Chaos turns into order, not only in the manner describable by reference to Lorenz attractors, but also through such forms as solitons, bifurcations or fractals, which might be considered mathematical models of the emergence of order in nature.

OUTLAYS ON THE ENVIRONMENT AND THEIR ECONOMIC EFFECTS

The nonlinearity of the relations between society and nature constitutes a factor that may, in given circumstances, give rise to systems characterised by meta-stability (Domański 2008). However, under disturbance, such systems may pass over into a dynamic mode. One external stimulus generating impulses that set the development process in train is the economic situation of a region. Where economic phenomena and processes are highly dynamic (as for instance during business crises), there is a manifold increase in the potential for such impulses to appear, while the directions being taken by development trajectories are characterised by significant inertia. Under such circumstances, the potential of the natural environment is an essential element strengthening the ecological-social system (Glasson 2000; Morris and Therivel 2000; Degórska and Degórski 2003). It is therefore common for this to be a triggering element as regards regional development, providing possibilities for measurable and definable economic effects to be achieved in multidimensional geographical space (Degórski 2003, 2007).

There are currently a range of views within environmental economics as to the economic effects of ecologically-oriented investments, especially those associated with environmental and landscape protection with a view to a given area's attractiveness being enhanced. According to the model for the achievement of economic success using outlays on the protection and optimal use of environmental resources elaborated by S. Schaltegger and T. Synnestvedt (2002), there are three options for the possible development of relations between the said outlays and the economic effect achieved (Degórski 2009). It should of course be emphasised that increased outlays on integrated protection of environment and landscape do not always yield the expected economic benefits. It may happen that, despite increased outlays, the ultimate effect remains the same, with the location on the respective curve still being at the starting point for economic success. However, it is much more frequent for ecologically-oriented investments to bring the expected economic success and to generate measurable benefits. Some environmental economists even assume that overall benefits are proportional to outlays on optimising the protection and use of the environment's potential. Alas, as was noted above, this is not always the case, leaving the assumption in question as much too sweeping a generalisation.

There is certainly no simple transmission of outlays into benefits in the context of the protection and use of the environment. Engagement in a host of related activities requires that a given spatial unit fulfils three basic conditions, regarding:

- the existence of a very detailed assessment of environmental potential, related above all to natural resources and the landscape, and allowing for clearly-defined protection of the most valuable fragments;
- the existence of a definite development strategy that provides for optimal use of natural potential in line with the sustainable development concept allowing for rational management of the natural space;
- account for sectoral policies in overall regional development policy, with the incorporation of such an environmental policy as will allow assumed economic objectives to be achieved, while ecologically-oriented solutions impacting on the local community's quality of life are kept in place.

In highly-developed countries, increasing attention is being paid to society's actual or perceived quality of life, *inter alia* in the context of both a quality of the environment and aesthetic qualities of the landscape that are as high as possible, in the perspective of tourist and residential functions, and in the context of quality of food produced and drinking water available, as well as the purity of the air. The pursuit and attainment of ever-higher living standards requires that decisionmakers pay increasing attention to the spatial order and to appropriate care for and management of the natural connections between rural and urban areas. Also of major importance is quality of life within intensively urbanised areas, where the natural environment is either very much transformed or simply created conceptually and technologically by people. The green-space infrastructure of urban units also very often constitutes a structural-spatial element to urban ecological networks, and ought therefore to be connected strongly with the external network of open spaces, this strengthens the role, not only in terms of nature itself, but also, and perhaps above all, as a factor influencing people's quality of life. The quality of the environment in which people live determines their health status in both physical and psychological terms. In turn, these types of conditioning are decisive for the living standards of all of us (Fig. 1).

As models of outlays on the environment and the achievement of economic success are constructed, account should also be taken of, and a definition supplied for, the so-called maximum incremental social tolerance to irreversible costs (MISTIC). This indicator should allow for an assessment of the degree to which society is ready to forego certain benefits to attain definite development objectives, including costs related to the introduction of pro-environmental solutions, very often high. Let us note, though, that the contribution of the

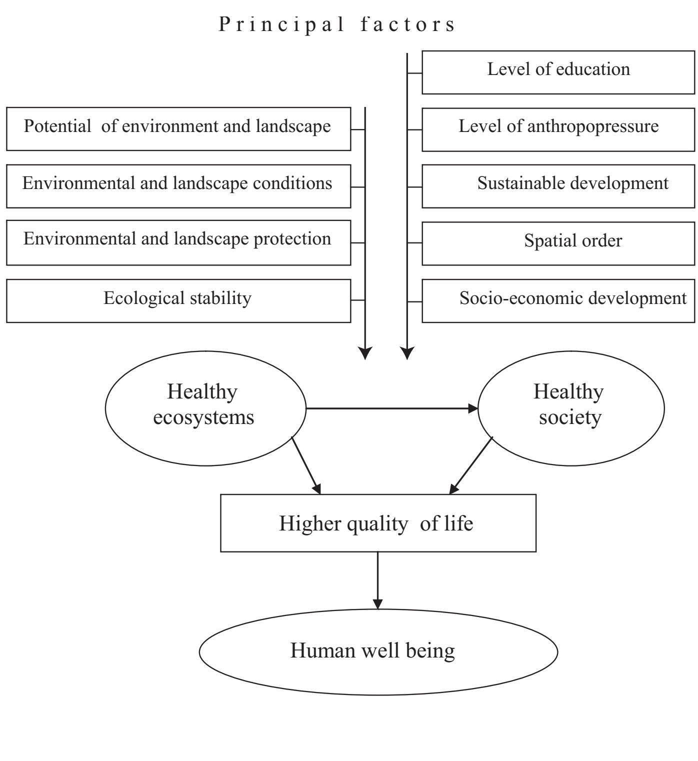

Figure 1. Influence of some factors on the ecosystem and society conditions in relation to human well being

environment to the development of regions is not only limited to the aspect of direct protection of its most valuable assets, but also includes construction of an entire infrastructural system, with the aim of success acceptable to society being attained. A perfect example is provided by CEECs, which—before the period of accessions to the European Union—had been characterised by generally very liberal policies with respect to care for the quality of the natural environment, especially as regards the limitation (minimisation) of the negative impact due to human pressure on the functioning of natural systems. One ought however to underline that in Poland the very essential diminution of anthropopressure on the environment followed already in the first decade of the transformation (Bernaciak 2009; Degórska, Degórski 2010). Nevertheless, it was only the inclusion of these countries into the structures of the European Community that forced them to adopt regulations valid in EU Member States, including as regards the protection and management of the environment in conformity with the principles of sustainable development. Adjustment of the basic standards in the domain of environmental quality, resulting from the so-called "environmental acquis", required that enormous financial costs be borne, between 12% of the GDP generated by Lithuania and Slovenia and as much as 71% of that generated in Estonia (Degórski 2007).

ECONOMIC-ECOLOGICAL MODELS

One way to determine the true interrelationships pertaining between the economic domain and conditions in the natural environment of regions (including rural-urban areas) entails the construction of economic-ecological models. The starting point for the simple study of causal relations is an elaboration of single-discipline models. Yet, in multi-factor analyses of regional development, it is multidisciplinary or so-called holistic models that are being applied. As opposed to detailed models being linked up into increasingly complex formulae, holistic models involve an attempt to construct just one model, this encompassing the respective entirety, and making possible a cognizance of interactions between the system of the natural environment and the socio-economic system. To be mentioned among those applied most often are input-output models, in extended form also, intended for the management of environmental quality and energy policy.

Input-output models constitute an effective instrument for describing regions, allowing for the determination of the flows of goods between the economic system and the physical-geographical system, also referred to as the ecological system (Berbeka 2005). One of the basic objectives of these models being applied is that optimum solutions should be obtained where policy on the extraction and use of raw materials is concerned. This is true of models optimising the materials-intensiveness of the economy, which, on the basis of interrelations between increased GDP and total resource consumption (TRC), make it possible for solutions sought to be found, including via the determination of magnitudes for the use of particular resources (goods) of the environment where the generation of the assumed value of GDP is concerned, and with indications of directions to the development of policies as regards materials, innovation and the implementation of new technologies. These studies use various measures and indicators for particular groups of raw materials, and their overriding objective is the rational management of natural resources of the environment within particular physico-geographical regions.

Models of energy policy are mainly applied for optimisation, or for simulation of the functioning of the entire energy system of a region and its impact on the environment. As noted by R. Domański (2006), embedded energy can be a common denominator for the ecological and economic formulae. The goal of constructing energy policy models is to assess energy consumption in relation to cost intensity of its generation, as well as the level of economic development of a region. The interest in the use of these models to shape regions' socio-economic policy increased markedly after the energy crisis of the 1970s, when, on the one hand, societies became aware of the real problems of non-renewable energy resources being exhausted, with energy prices prone to increase unpredictably, and, on the other hand, the negative impact on the quality of natural environment of burning fossil fuels (mainly the solid ones) was determined and proven scientifically. Hence, optimisation of the use of energy resources was commenced with, and efforts made to lower the rate of increase of energy consumption in relation to the increase in GDP. Thus, for instance, in the EU 15 in the years 1995–2004, GDP grew by 17%, while energy consumption increased by just 5%. In the years preceding this particular period, the nominal increase in energy consumption had actually been greater than the increase in GDP (Environmental Signals, 2004). However, the energy-intensiveness of the economies of the new EU Member States differs from (is higher than in) the EU 15. The lowest indicator for energy-intensiveness in 2004, expressed as the ratio of total energy consumed, given in oil equivalent units (TOE), to GDP, was observed for Denmark (at around 100). The average value of the TOE/GDP indicator for the EU 15 was at around 200. By comparison, the value of this indicator for Poland was 460, while the average for all ten new Member States joining the EU in 2004 was c. 700. This situation has improved recently, of course, if mainly thanks to the restructuring of industry and the economic crisis, as will be commented upon further below.

Alongside environmental and economic components, models for the environmental quality management contain modules of objective functions, formulated within the concepts of regional development, especially in the situation of their multiplicity. These models are in particular used to assess the value of space as regards location attractiveness, especially for housing construction, and notably the building of family housing and villa quarters (Łaguna and Witkowska-Dąbrowska 2005). The evaluation, whose result is expressed via an indicator of ecological value of a given spatial unit (V_{EFP}), is carried out on the basis of a ranking of particular evaluated elements of natural space, before point scores (m), defined for the analysed area (P), are calculated. Thus, for instance, with respect to particular categories of land cover the following scoring is used: old forest—10 points, pasture—4 points, arable land—1 point. Then, on the basis of the adopted intervals for the summed value of point scores, the ecological value of a given area is determined from the point of view of assumed investment projects (Degórski 2008a).

The extended models, that is—the so-called economic models with an ecological component, are constructed to assess the economic consequences of environmental policies (Hicks 1975, 1979). In their theoretical prerequisites they refer to the state of a general spatial equilibrium resulting from the equilibrium among subjects constituted by producers and consumers who in particular have at their disposal environmental resources, means of production and the institutions responsible for the quality of the natural environment. On the basis of concepts from Walras and Pareto (McLure 2001), these models are being developed continuously, one example involving models for cost optimisation in air-quality protection (Łaguna and Witkowska-Dąbrowska 2005). These models are developed by reference to the interrelations between the maximum admissible costs of pollution reduction (MAC) and the maximum social cost (MSC). They allow for determination, and then for implementation, of technical solutions, providing for both a mitigation of pollution and a lowering of social costs.

All of the types of ecological-economic models presented here illustrate how application to relations between the natural environment and the socio-economic sphere is possible, notwithstanding the fact that examples quoted here represent nothing more than a glance at a subject that has been developing quite intensively in recent years. Despite the reference to just a couple of examples of models applied, and their domains of application, it is clear that the ecological-economic models constitute a highly valuable tool in identifying functional mechanisms underpinning the ecological-social system, as well as the latter's optimisation. They therefore represent one of the methods for the integrated study of the geographical environment, facilitating understanding of the numerous processes and phenomena (both natural and socio-economic) that are ongoing within the mega-system of the geographical environment.

ENVIRONMENTAL POTENTIAL AND ECOLOGICAL SERVICES

Precise cognition of the relationships pertaining between nature and the economy also allows for a search for benefits, be they economic or social, accruing from environmental resources and the services rendered by the environment with respect to the functioning of the entire geographical mega-system. These benefits, referred to as "ecosystem services", concern the strengthening or functional improvement of numerous fundamental processes occurring in the geographical system and exerting an influence on the quality of water and air, on the fertility of soils, and on the alleviation of climate change (Zhang *et al.*, 2007; Degórski 2010a).

Irrespective of the development of civilisation and conceptualisations of the causal relationships between human development and the potential of the natural environment, this potential has always played, and will always play an extremely important role in the context of the socio-economic, cultural or existential development of individual countries, regions or local communities. In the Millennium Ecosystems report (2005), which addresses ecosystem assessment from the point of view of the betterment of human living conditions in particular, attention is paid to the definite services rendered to people by ecosystems, these being categorised as:

- existential, i.e. of a fundamental nature, including the circulation of matter and energy, emergence of soil cover, respiration, photosynthesis, etc., in other words the processes essential to the persistence of life on Earth;
- alimentary, i.e. connected intimately with the capacity of the planet to supply people with food, water and raw materials;
- regulatory, i.e. associated with influences exerted on the quality and dynamics of climatic conditions, water conditions (droughts, floods), or else the buffering of the spread of epidemics and pandemics;
- cultural, yielding recreational, spiritual, educational, etc. opportunities and benefits.

Recently, in view of the rapidly intensifying anthropopressure being exerted on the environment, as well as the use of the properties of ecosystems in socio-economic development, the role of ecosystem services has been even more visible (Holdren and Ehrlich 1974; Ehrlich and Ehrlich 1991; Wallace 2007). They are taken advantage of in numerous aspects of social and economic life, and in particular for:

- the purification of air and water,
- the generation and preservation of soils and renewal of their fertility,
- the mitigation of droughts and floods,
- the detoxification and decomposition of wastes,
- the pollination of crops and natural vegetation,
- the dispersal of seeds,
- the cycling and movement of nutrients,
- the control of the vast majority of potential agricultural pests,
- the maintenance of biodiversity,
- the protection of shores from erosion by waves,
- protection from the sun's harmful ultraviolet rays,
- the partial stabilization of climate,
- the moderation of weather extremes and their impacts,

• the provision of aesthetic beauty and intellectual stimulation uplifting of the human spirit.

The benefits accruing from environmental potential, as expressed through ecological services, are not only of existential significance to human beings—having definite and perhaps decisive significance for the further fate of the human species, but they are also characterisable in terms of economic value, which can be translated into concrete business successes (Mizgajski and Stępniewska 2009; Degórski 2010b; Mizgajski 2010). It is common for the attainment of high environmental standards to be associated with the gaining of synergetic effects that result in increased value of land within an area, its attractiveness in tourist terms, or a lowering of wastewater management costs. However, in many cases, these effects prove hard to measure, since there are no perfect yardsticks against which to set the value of ecosystem services (VES). Proposals forwarded in this domain to date do not account for parameters so significant to the functioning of the geographical megasystem as attainment of ecological equilibrium, or the possibility of goods of nature being made use of by a larger group of members of local communities, allowing also for the reaping of personal benefits (Howarth and Farber 2002).

Estimations of the value of ecosystem services in conditions of a market economy are most often made by reference to the difference between potential and actual costs, the latter considered decreased by the use of the services in question; or else on the basis of profits generated through the use of these services in the economy of the region. The subject literature points to there being six main groups of measure for the value of ecosystem services, intended to estimate the socio-economic benefits resulting from the implemented use of the services in question (Farber *et al.* 2002; Degórski 2010). The groups entail:

• magnitude of costs avoided—providing for the determination of costs that would have had to be borne where, for example, ecosystem services were not available for water purification processes (as when wastewater passes through swampy land and vegetation), and also accounting for healthcare costs;

• reduced purpose-oriented costs—for instance, through replacement of systemic solutions generated by people with strengthened or reinstated natural conditioning (e.g. natural watershed functions within urban areas, rather than the construction of water treatment plants),

• increased commercial revenue—through improvement in the quality of ecosystems, as where improved water quality entails increases the potential for fish production, and thereby puts in place a 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. a willingness to pay travel and accommodation costs in order to be at a location characterised by high natural qualities, or else to make use of ecosystem services, primarily during weekends),

• profits generated from people's hedonistic behaviour—the demand for ecosystem services being, for example, reflected in the price people would pay for a definite group of goods, resulting from a hedonistic 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 of limited attractiveness where natural conditions are concerned),

• profits from the propensity of societies to make use of ecosystem services in a well preserved natural environment—through construction of hypothetical scenarios by which the alternative profits from access to these services can be estimated (e.g. the price visitors would be willing to pay for—and hence the potential revenue available from—entering National Parks, cultural-landscape parks and other areas of high natural value situated in rural-urban regions).

In line with the argumentation pursued by J. Boyd and S. Banzahaf (2007), ecosystem services should be considered within a much broader perspective than only as a final effect of service for the beneficiary. The assumed ultimate effect of activities associated with the use of water resources in a region might, for instance, be the regulation of the water economy, this, however, exerting a number of indirect effects of great significance to the economy, like the provision of high-quality drinking water, the possibility of water being retained for irrigation purposes, or an increased hydrological potential for power generation. Some of the services by themselves generate other kinds of service that remain within a causal chain leading towards economic success, see Wallace (2007), Fisher and Turner (2008). Practical use of such solutions gives rise to situations in which economic success is also ecological success, and the environment, through the intermediation of ecosystem services, becomes a significant player in the general economic system, as well as the social system (Haughton and Hunter 1994; Bolund and Hunhammar 1999).

The very same degree of success from the point of view of the quality of human life is, of course, to be attained in a different manner within urbanised or rural areas. In the urban system, the ecosystems of green space and surface waters (street greenery, urban parks and woods, meadows, lakes, water flows) provide essential services to the community of the given urbanised area. These services include purification of the air, regulation of microclimatic conditions, reduction of noise, storage of precipitation waters, purification of wastewaters, and creation of conditions for recreation and leisure (Haughton and Hunter 1994). Ecosystem services are perceived otherwise in rural areas. Agricultural ecosystems are actively transformed by humans with a view to their being maximum production of alimentary, pseudo-alimentary, non-alimentary and indirectly-alimentary crops. However, the attention of the Millennium Ecosystem Assessment (2005) did nevertheless turn to the multi-functionality of agricultural ecosystems and their provisioning of ecological services. Among these services, improvement of water conditions in general and of water supply in rural areas have been mentioned (Zhang *et al.* 2007). Still, the most important service provided by farming ecosystems is the flow of matter and energy allowing for the production of food, and therefore ensuring satisfaction of the most basic existential needs of people. Thus, irrespective of the spatial scale of the analysis of the value of services provided by ecosystems, from the local through to the supra-regional, this value is an important agent in general economic, as well as social, systems.

RELATIONS BETWEEN THE NATURAL ENVIRONMENT AND SOCIO-ECONOMIC SYSTEMS DEPENDING UPON THE BUSINESS CLIMATE

Considerations of relationships pertaining between the system of the natural environment and the socio-economic system in a period of economic crisis relate, not only to a decreasing human impact in particular due to reduced intensity of production or lesser instability of society (Chung and Beamish 2005; Okumus *et al.* 2005; Wang 2009), but also to procedures that would allow for better use of environmental potential as a factor in regional development at times that are hard from the point of view of capital flows and the generation of investment. It is beyond doubt that the most recent economic slump did result in a decrease in emissions of greenhouse gases, including carbon dioxide, this fact having had a positive impact on the sanitary state of the environment, and hence also on the living conditions for communities in different regions of Europe. According to data from the Point Carbon company headquartered in Oslo—which monitors emissions of carbon dioxide in the countries of the European Union—the total emissions were 6% lower in 2008 than in the preceding year. A similar, more generalised decrease in emissions of greenhouse gases has also been observed. In 2008, the

27 countries participating in the European system of emissions trading produced 2.11 bn tonnes of greenhouse gases, as compared with 2.24 bn tonnes a year before. This effect is also perceived to result from recession in European countries, which entails lower levels of industrial production and a reduced demand for energy. The most pronounced drop in emissions took place in the branches of cement-making (by roughly 9%), and pulp and paper (roughly 7%), this potentially also indicating these as the sectors hit most painfully by the crisis. At the same time, due to reduced travel to "exotic" locations, many regions of Europe have seen an activation of tourist traffic, along with increased use of the potential the environment and landscape manifest for the development of tourism. This has especially been true of seaside areas of Belgium, Germany or Poland.

It is very frequent for economic calculations related to regional economic development not to account for costs resulting from elementary catastrophes arising out of a divested environment (e.g. of forest, water or swamp ecosystems); nor is consideration given to outlays on the medication of people whose illnesses result directly or indirectly from a disturbed biological equilibrium of ecosystems and/or their poisoning. Among the most spectacular examples of negative consequences resulting from the disturbance of the said equilibrium in the natural system was the heat wave of 2003 affecting western and southern Europe. The number of victims of this heat wave is estimated at 35,000, putting this phenomenon at the top of the most tragic natural catastrophes in Europe over the last 50 years (Kosatsky 2005). Increasing losses relating to extreme phenomena are also being noted in Poland. Of the greatest ecological catastrophes of the last two decades in Poland one should mention those of 1997, 2002 and 2010. The first of these was associated with a flood that had the greatest spatial reach of any in the 20th century, with material losses exceeding 9.7 billion Polish zlotys (Degórski, M. Kuchcik 2008). Losses last year were at virtually the same level.

SUMMARY

Unpredictability of chaotic phenomena results from the divergence of closely neighbouring trajectories and simultaneous sensitivity of the respective systems to very small disturbances (fluctuations), which bring about a change in the trajectory that allows the state of the system, though very similar to another state, to evolve in quite another manner. That is why qualities of the natural environment can be considered very important factors in regional development, albeit with the reservation that local communities are aware of the value of its potential, and consciously strengthen the system by which development trajectories are generated, in such a way that the desired positions are assumed by attractors, i.e. loci of concentration of development trajectories. This can be achieved through a strengthening of remaining factors underpinning regional development, as well as the neighbourhood of the natural environmental system. In countries that for years neglected the problems associated with protecting environmental quality (with the result that a proper perception of the potential of the environment and landscape as assets significantly contributing to the quality of human life is absent), there remain very broad possibilities for natural resources of the environment to be taken advantage of in the generation of regional development trajectories.

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