

CARTOGRAPHY TARGETS FOR SHAPING SUSTAINABLE REGIONS

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Abstract: *Regional sustainability was recognized as one key issue connecting urban to national sustainability. The developments have however emphasized that beside wanted effects of technological progress, undesired negative effects can appear. Some scenarios for the future regional development estimate that by 2050 regions will gain more self-administration and development competence in the context of the own countries. In this regard technical and economic fields should be taken into account in connection to the social one, where special attention has to be paid to the field of cartography. This is becoming more relevant regarding assuring regional sustainability because of the need of land property clarifications. Without maps, people would hardly be space oriented and the knowledge about spatial relations and objects locations in space is a first condition for assuring a successful economic development. In the last time the scientific level in cartography has been strongly developed, so that maps can be currently automatically derived from geo-data acquisition methods and presented in a range of forms, from maps on mobile phones to augmented reality presentations. In this paper some cartography targets will be debated for getting sustainable regions.*

Keywords: *Cartography, Sustainable Regions, Land Property, Maps, Interdisciplinary Approach*

1. About Cartography

Cartography is the study and practice of making *maps*, as mentioned in Wikipedia [15]. Combining science, aesthetics, and technique, cartography builds on the premise that reality can be modeled in ways that communicate spatial information, as presented in Figure 1.

It becomes clear that the field of cartography has gained more relevancy than ever. Without maps, people would be spatially blind. As stated by the International Cartographic Association, ICA, the knowledge about spatial relations and the locations of objects is extremely important in order to assure several human activities [4]. In this regard it is to be mentioned its role for enabling proper economic development, for managing and administrating land use as well as for handling disaster and crisis situations [1, 14]. Not to neglect is its role for simply showing interested people how to get from one place to another [3]. A lot of progress has been made in the field of cartography in the last time thanks to innovative information and communication based technologies.

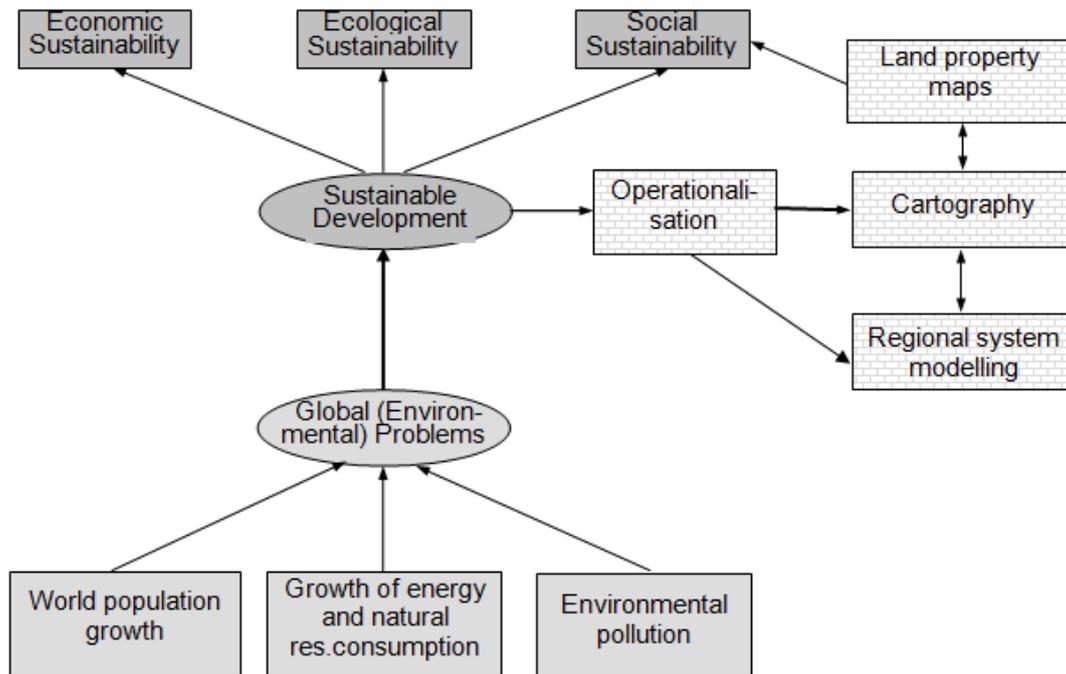


Figure 1: The concept of sustainable development and the role of cartography for its operationalisation

Maps can now be automatically derived from geo-data acquisition methods such as laser scanning, remote sensing, and sensor networks. Smart models of geo-data can be built, which allows in-depth analysis of structures and patterns. In addition to that, maps can now be presented in a range of forms, from maps on mobile phones to augmented reality presentations. These let viewers see live, real-world environments with amplified features using computer-generated sensory data [3, 13].

In order to emphasize the made progress in this field, it has to be mentioned the International Cartographic Conference (ICC) in Rio de Janeiro in 2015. In the context of this conference several ideas of modern cartography did converge and *cartography for sustainable development* has been debated [6]. With this occasion it has been pointed out the relevance, attractiveness, and contemporaneity of maps and cartography. With this occasion it became clear that supporting sustainable development with proper geo-information management and with modern maps is representing a thing which has to be hardly considered in the future developments of cartography for getting sustainable settlements [6, 8].

By educating a new generation of engineers in the field of sustainable cartography with interdisciplinary skills the contribution to the sustainability of our human society will be assured by respecting several conditions [13]. Some of these conditions are using an interdisciplinary approach especially related to clarifying the causal relationship between population and their land property, materialized in land property maps [3].

This proposed interdisciplinary objective will strengthen the role of cartography in getting regional sustainability and will probably challenge its possible contribution in this direction [5, 7, 8].

2. Sustainability Background

Beside technical field, the environmental and socio-economic fields are simultaneously playing an important role in matters of assuring the sustainability of our human society [7]. The field of *cartography* needs special attention in the context of different aspects from the technical field in connection with the social one. In order to succeed assuring the regional sustainability the field of cartography is becoming pretty relevant because of the necessity for land property clarifications. It is well known that without maps, people would not be space oriented, would be blind. The knowledge about spatial relations and the locations of objects in space is a first condition for assuring a successful economic development and human prosperity. Other activities can be mentioned connected to this one, as land administration and management, land-use planning, handling disaster and crisis situations, and even clarifying people how to reach certain unknown places [1, 13].

A lot of progress has been made in the last years in the field of *cartography*, becoming more modern, because of applying and using new innovative ICT based techniques. In the last time the scientific level in cartography has been strongly developed, so that maps can be currently automatically derived from geo-data acquisition methods such as laser scanning, as well as remote sensing [1]. Smart models of geo-data can be built, which are enabling in-depth analysis of structures and patterns. On the other side maps can be presented in a range of forms, from maps on mobile phones to augmented reality presentations that let viewers see real-world environments with amplified features using computer-generated sensory data [3, 8].

The concept of *sustainable development* has been defined first time in the Brundtland Report 1987 and accepted as a possible solution for the global complex ecological, economic and social problems [2]. The wish is to find an equilibrium state between the technological progress, which did assure in the past the desire of the humanity to increase its quality of life and the assurance of sustainability of our human society. The developments did however emphasize that beside wanted effects of technological progress, undesired and even unthinkable negative effects can appear [7]. Currently humanity is confronted with a series of global problems, not only environmental ones, their complexity is basing on the interconnectedness as well as on the fast changes taken place in technological field. In order to find solutions for the identified problems debates on scientific, political and social levels have started worldwide some time ago [7, 11, 12].

3. Cartography Role in Getting Sustainability on Regional Level

The Sustainable Development Goals (SDGs), adopted by the United Nations in 2015 [10], have as a main goal to end poverty, to protect the planet, and to ensure prosperity for everyone. To make this happen, UN encourages everyone to do their part, not only governments, private sector, and civil society but also each of us as individuals [7, 10].

In this regard, as each institution or company, also the International Cartographic Association, ICA can contribute to meeting the SDGs by 2030 [5]. The 17 SDGs are listed below and some of them are clearly connected to relevant cartographic aspects [10]:

1. No Poverty
2. Zero Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean energy
8. Decent Work and Economic Growth
9. Industry, Innovation and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life below Water
15. Life on Land
16. Peace, Justice and Strong Institutions
17. Partnerships for the Goals

These goals are materialized by more than 300 indicators [10]. For instance, Goal 4, which seeks to ensure quality education for everyone and encourage lifelong learning includes 10 targets, one of which is to ensure that all children receive free and good primary and secondary education. The success of this target is measured by two indicators: the percentage of children who are proficient in reading and mathematics and the rate of students who complete primary and secondary schools [10].

In order to reach these targets, the role of cartography is pretty significant. First contribution is represented by mapping the indicators. It is known that well-crafted maps can effectively exhibit known facts in a visual way. Online mapping technology can disseminate these facts globally to increase awareness of the current situation. On the other side interactive map dashboards, connected to geographic databases at multiple scales and with space-time analytical functions, allow decision-makers at various levels to view as well as to compare indicators for policy development. The discipline of cartography can put a stone in realizing these diverse maps for showing certain developments and cartography really can convey all sorts of metrics, insight, and relationships with regard to the SDGs [5].

The International Cartographic Association’s poster about the Sustainable Development Goals is trying to teach the principles of cartography while educating viewers about the sustainable development goals [5, 10]. Additionally, in the spirit of Goal 4, mentioned before, the ICA’s activity is allowing to educate people on the importance of the SDGs while also informing about the role of maps. ICA’s commissions, which address a wide range of topics that cover nearly the entire discipline of cartography, each adopted one of the goals. As a starting point, the commissions selected a target of their chosen SDG, along with its indicators. Then each commission expressed its topic cartographically, through the lens of that commission’s objectives [5]. For example, the poster for protecting life on land, made by the Commission on Map Projections, tells the story of how certain map projections can be good or bad depending on how the mapmaker wants to display all the earth’s land. The ending poverty poster, made by the Commission on Topographic Mapping, encapsulates how to use topographic maps to better understand what causes poverty. Other posters acquaint

viewers with open-source technologies, the relevance of selecting the correct level of detail for administrative units, and the effects of using color in map design. Taken together, all the posters tell a story of mapping options, and of multiple map perspectives [4, 5, 6].

Maps that matter and are well designed, are engaging, instantly understandable, and relevant to society. They should raise human interest for understanding these sustainable development goals [5, 10]. In this regard the creation of an *Atlas of Good Practices for Mapping the SDGs* is for ICA the way to bring its contribution for “making the world a better place with maps” [4]. Actually ICA is stating that its aim is to ensure that cartography is employed to maximum effect and full potential for the benefit of society and science through a global promotion of the disciplines of cartography [4].

As mentioned in the report regarding the Cadastral System in Romania, presented in 2009 from ANCPI, in the Overview on the Cadastral Systems of the E.U. member States [16] the links between cadaster and land registry have been already followed in Romania by developing and implementing a unified cadaster and land registration system at national level in Romania. This system is administered in compliance with the European and international standards in the field of cadaster and land registration. The system performs the efficient and secure registration of real estates, ensuring a much improved coordination between the technical and legal components [16]. The developed system is based on several principles as for instance: inscribing a single real estate in a land book, having a single entry register, for the cadaster and the land book, called “General Entry Register”, introducing new cadastral numbering and an integrated work flow, that ensures the solving of an application requiring cadaster as well as land registration services [16].

The Romanian Geoportal called INSPIRE has started to be developed in 2010 and is assuring access to metadata and spatial data sets being in the meantime connected to the European Geoportal, <http://geoportal.ancpi.ro/geoportal> [18]. The INSPIRE Directive has been transcribed in the national legislation by the government Act No. 4/2010 regarding the establishment of the National Infrastructure for Spatial Information, INIS in Romania and the development of INIS legal functioning framework as well as the coordination structure of the all processes [18]. The goal of INIS is to assure the unified framework for a common operating procedure with the Romanian spatial data and to assure the public access to them as well as to assure the needed support for developing national and European policies in this field [17]. On the other side it is to be mentioned that by using the INIS infrastructure the quality of the geographical information is improved and the corresponding costs are reduced. The INIS infrastructure is operating after the principle “unique collection, multiple use [17].

4. Cartography Research Goal for Achieving Sustainable Development

The recent cartographic research agenda, as debated in the context of the ICA Commission for Sustainability, is emphasizing some actual and potential directions in the field of scientific research carried out for the global society [5]. Its own strategic mission is to ensure that geospatial information is employed to maximum effect for the benefit of science and society in order to assure its sustainability [4].

Therefore the research agenda is covering several relevant fields and topics with the common goal of assuring the sustainability of our human society [8]. This agenda documents current research activity in these fields, suggests areas where more intensive or renewed effort

is required, and also discusses the methods by which some of this research can be undertaken within the ICA Commission for Sustainability, but not only [5]. A very important role is given to the international collaboration with other related societies, and under suggested programs of integrated research stimulated in an appropriate way. In this regard the scope of the research agenda is including specific cartographic issues.

It is to be mentioned that it is impossible to create a non-overlapping hierarchy of research topics. Relevant keywords are accompanying the cartography research topics for sustainability, which fall within the accepted extent of Cartography. On the other side synergies with closely related fields can be recognized, especially in spatial data collection and handling [5]. These relevant *keywords* are the following [4]:

1. Geographic information;
2. Metadata and Spatial Data Infrastructures (SDIs);
3. Geospatial analysis and modelling;
4. Usability;
5. Geovisualization, visual analytics;
6. Map production, from atlases to Internet maps;
7. Cartographic theory;
8. History of cartography and GI science;
9. Education;
10. Society.

All keywords of the cartography research topics are oriented to achieve the sustainability of our human society, with differences from one region to another on a global level, but especially the last two ones being very much connected to this idea. Producing a *map on the cartographic basis of sustainable development* in order to point out territories with a good situation regarding sustainability and others with big challenges connected to achieving sustainability will be in the future the most important contribution in this regard, just to create a basis for scientific and political discussions on different levels.

5. Conclusions

The potential cartography contribution to sustainable development has been debated in the present paper. An adequate land property map is actually indispensable for an appropriate economic, social and environmental development on a local, regional as well as on a national level. It is also vital for good governance, assuring in this way the sustainability of our human society.

The possible cartography contribution to meeting the sustainable development goals has been presented as seen by the International Cartographic Association. Local decision makers have to strongly recognize in the future the advantages of clarified land property maps enabling a good land administration and management, in order to take proper decisions in the direction of assuring the sustainability of rural and urban development. On the other side there is a need to take responsibilities for inappropriate land property maps, because this issue can really compromise the sustainability of our human society.

The general conclusion that can be drawn regarding these aspects is that the existing possibilities of assuring clear land property maps not only in our country but also world-wide,

have to be better explored by cartography in the efforts of establishing the sustainable development of our society. By taking into account the Romanian Geoportal, INSPIRE it would be a major step forward in delivering a kind of *thematic map on a cartographic basis of regional sustainability*. This action could efficiently complete the already made cartography contributions in getting sustainability on a local, regional, national as well as on a global level.

6. References

1. *Enemark, S., 2007: Integrated Land-Use Management for Sustainable Development, International Federation of Surveyors;*
2. *HAUFF, V., (Ed), 1987: Our Common Future. The Brundtland Report of the World Commission on Environment and Development. Oxford Univ. Press, Oxford ;*
3. *Hennermann, K., Woltering, M., 2014: Kartographie und GIS – Eine Einführung. 2. Auflage, WBG.*
4. *International Cartographic Association, ICA, <http://icaci.org/>*
5. *ICA, Commission on GI for Sustainability, WG – GIS and Sustainable Development, <http://SusGIS.net>*
6. *The 27th International Cartographic Conference, “Maps Connecting the World”, August 23-28, 2015, Rio de Janeiro, Brazil, <http://www.icc2015.org/>*
7. *Jischa, M. F., 2005: Herausforderung Zukunft, second edition, Elsevier, Spektrum Akademischer Verlag, Heidelberg.*
8. *Kraak, M.-J., 2016: Cartography Contributes to Meeting Sustainable Development Goals. ArcNews Fall 2016, Vol. 38, Nr. 4, 2016, <https://www.esri.com/~media/Files/Pdfs/news/arcnews/fall2016/fall-2016.pdf>*
9. *Palamariu, M., Tulbure, I., Dreghici, A., 2017: Cartography Task for Achieving Sustainable Development. Proceedings of the 17th International Multidisciplinary Scientific Geoconference, SGEM2017, Section “Cartography and GIS”, Albena, Bulgaria*
10. *Sustainable Development Goals, 2015, <http://www.undp.org/content/undp/en/home/sustainable-development-goals.html>*
11. *Tulbure, I., Palamariu, M., 2010: Environmental Assessment of Some Mining based Industrial Activities. Proceedings of the 10th International Multidisciplinary Scientific Geoconference SGEM2010, Vol. 2, Albena, Bulgaria, 2010, pp 237-244*
12. *Tulbure, I., 2016: Sustainable City in Romania – from Vision to Reality, Albiez, M., Banse, G., Lindeman, K., C., Quint, A. (Eds.): Designing Sustainable Urban Futures – Concepts and Practices from Different Countries. KIT Scientific Publishing, Karlsruhe, 2016, pp. 73 – 84*
13. *Virrantaus, K., Fairbairn, D., Kraak, M.-J., 2009: ICA Research Agenda on Cartography and GI Science. In: The Cartographic Journal, Vol. 46, No. 2, pp. 63–75, May 2009, http://icaci.org/files/documents/reference_docs/2009_ICA_ResearchAgenda.pdf;*
14. *Williamson, I., Grant, D., 2002: United Nations – FIG Bathurst Declaration on Land Administration for Sustainable Development: Development and Impact. FIG XXII International Congress, Land Administration for the New Millennium, Washington, D.C. USA, April 19-26 2002*
15. *Wikipedia: <https://en.wikipedia.org/wiki/Cartography>.*
16. *Permanent Committee on Cadaster in the European Union, 2009: Cadastral Information System - a resource for the E.U. policies. Overview on the Cadastral*

- Systems of the E.U. member states;*
17. *INSPIRE - Infrastructure for Spatial Information in Europe. Raport Stat Membru: România, 2013;*
 18. *Romanian Geoportal INSPIRE, <http://geoportal.ancpi.ro/geoportal>.*