JUNCO – Journal of UNiversities and international development COoperation
n. 1/2021

ISSN: 2531-8772

UNIVERSITY TEACHING AND POTENTIAL OF GEOGRAPHIC INFORMATION SYSTEMS IN PROJECT CYCLE MANAGEMENT CYCLE IN INTERNATIONAL DEVELOPMENT FOR COOPERATION

Silvia Grandi*, Cristina Brasili*, Giuseppe Vico**, Aurora Circhetta°°

*Department of Statistical Science "P. Fortunati", University of Bologna, s.grandi@unibo.it
** Department of Earth Science, University of Rome "La Sapienza", Department of Environment, Land and Infrastructure Engineering, Polytechnic University of Turin, giuseppe.vico@uniroma1.it
°° Department of Historical and Geographic Sciences and the Ancient World, University of Padua, Department of Statistical Science "P. Fortunati", University of Bologna, aurora.circhetta@studenti.unipd.it

Abstract
This paper presents the first results of a pilot project tackling the nexus among Gis and spatial analysis, international cooperation and higher education. This experience shows that it seems appropriate to use a dialectical approach between theory and practice to develop knowledge, competences and operational skills to be used potentially in all project cycle management phases. The teaching pilot project held at the University of Bologna within the undergraduate curriculum in Development and International Cooperation (Svic) has led to develop a syllabus and a methodological framework for a full laboratory-course allowing students to be professionally ready to apply Gis in practice.

Keywords
Gis, international cooperation, university teaching, Gis training, spatial analysis

Introduction

The growing importance and the application potential of spatial analysis has been following the works of geographers and all actors since their involvement in discoveries, explorations, 'territorialisations' and sustainable development projects. In this perspective, Alexander Von Humboldt's (1769-1959) works can be considered a seminal scholar (Wulf, 2015; Pausas and Bond 2019) setting the basis of this correlational science, i.e. methodological data collection by measurement of environmental variables, by observation of places in their natural and social aspects and then describing, modeling and visualizing them.

In the late 1960s, the significant growth of Information and communication technologies (Ict) started in parallel to the international cooperation processes and, as of the 1970s, by combining the potential of cartography, Ict, relational databases and digitization processes, Geographical information systems (Gis) have been developed turning into a powerful tool to support spatial analysis, monitoring and

ISSN: 2531-8772

decision-making in policies and projects (Dallari e Grandi, 2005; Pesaresi, 2017). The power of visualization, inherent in cartography, is enhanced with Gis, which also became a significant communication tool to be used in field participatory project (Conti, 2011; Burini, 2016), in crisis management (Grandi and Bernasconi, 2021a), in monitoring programs, in designing new sustainable development infrastructures (Kraak *et al*., 2020), etc.

However, in the field of international development cooperation, Gis are still not sufficiently widespread in project practices and, therefore, there is a need for accelerating cross fertilization processes in disciplinary practices. Towards this goal, education and training can play an important role.

A complex mosaic emerges between opportunities, contamination and the complexity of interdisciplinarity that is necessary for the use of technologies in a conscious manner in order to simultaneously comply with the necessary analytical capacity of the territory, the technical-cartographic knowledge, the variability and uncertainty of cooperation and the informatic-technological aspects, as well as possible costs for appropriating or constructing data, cartographies and visual representations of the territory in areas where Ict technologies languish.

In this perspective, this paper is focusing on the experiences in university teaching of Gis for local development and international cooperation held at the University of Bologna. In particular, this paper presents the first results of a pilot project tackling the nexus among Gis and spatial analysis, international cooperation and higher education. This experience is a laboratory aiming at setting the basis for a didactical approach to spatial analysis and Gis for social sciences, especially those into political science and development studies.

The rise of computer-based spatial analysis

Throughout the last century, spatial analysis has found wide interest among scholars from different backgrounds of social sciences such as sociologists, geographers, economists, anthropologists, epidemiologists, and psychologists. The former have exploited the potential by analyzing the size, density and homogeneity of spatially situated social processes (Martinotti, 1993; Mela et al, 2000; Nuvolati, 2002; 2007); human geographers have focused their studies on the distribution of phenomena over the territory (Wirth, 1945); economic geographers and economists have analyzed production patterns distributed over a specific area, their employment structure and prevailing consumption (Lynd and Lynd, 1970; Dicken and Lloyd, 1993); anthropologists have introduced the

ISSN: 2531-8772

variables of tradition and culture as key elements of the analysis, analyzing the historical features of experience that make social reality a unit with a distinct demographic and spatial structure (Banfield, 1976); epidemiologists have analyzed the natural and anthropic characteristics of the physical environment (Snow, 1854); psychologists have focused their attention on the behavioral variable and on the system of social interactions distributed over a given space (Logan and Collver, 1983).

As defined by Janelle and Goodchild (2011), relatively to Spatially Integrated Social Science (Siss) are analysis techniques that make it possible to study local and global social groups, spatial diversities, and the clustering of spatial entities without these analyses being delimited within well-defined physical or political boundaries. Moreover, they can also be traced back to perceptions of the entities to which these analyses are applied.

The study of problems involving precisely the concept of 'space' in the narrow sense is fundamental in spatial statistical analysis and Gis, since any type of phenomenon, be it social, economic, demographic, environmental or other, will always be linked to the distribution and territorial conformation of the given study area. This goes to define the so-called 'spatial dependence', due to the spatial relationship between the data present in a given territorial unit and what happens elsewhere. Consequently, the 'unidirectional' dependence of statistical analyses characterized by the variable 'time' becomes a 'multidirectional' dependence when the spatial dimension is considered.

The application of this analysis consists, first of all, in georeferencing the available data, i.e. locating an event by associating it with a pair of coordinates (whether flat or geographical) such that it can be unambiguously identified in real space or on a map, by means of a Gis system, whatever it may be. In this way, the events being analyzed are linked and connected to the territory through a system of coordinates. Multi-temporal analyses then are those that can reveal how the phenomenon under study has changed (or not changed) over time in a given territory. In fact, by analyzing the types of change, it is possible to establish a legend of the transformations in order to associate colors and dithers to highlight the phenomenon in its aspects.

One of the main functions of Gis analysis is to explain the non-uniform nature of the distributions of phenomena in space. Indeed, tools are sought to better analyze the typical forms and situations of spatial aggregations of social phenomena (Anderson et al., 1999, La Greca 2011).

The so-called Spatial Multicriteria Analysis (Sma) constitutes an analysis and evaluation tool that has recently been developed in the international field but is still scarcely experimented at a national level (Malczewski, 1999). A Sma model can be defined as a procedure aimed at identifying and comparing solutions to a semi-structured spatial decision-making problem, based on a combination of factors that can be, at least partially, represented by maps (Malczewski, 2006) and it represents one of the

ISSN: 2531-8772

most recent developments in evaluation procedures in the sphere of spatial transformation interventions. Multicriteria analysis makes it possible to combine environmental data with economic and social information, to compare them, and to represent the outcome according to specific thematic maps, so that Sma guarantees significant support in the development of decision-making processes that can be central in international cooperation programmes and projects. Nowadays, geographic information and its use in spatial planning is a well-established practice, thanks also to Spatial Data Infrastructures (Sdi) for sharing and circulating information. To these practices, the potential related to the analysis and interpretation of Geographic Information derived from Social Media have been added (Zupi, 2017).

The main functionality of Gis is the possibility of associating one or more attributes, i.e. descriptions concerning one or more phenomena, with a spatial datum. In this way, the georeferencing of information that can be derived from a wide range of sources, not necessarily statistical in nature, can lead to the spatial analysis of the data considered. Consequently, by tracing and mapping the areal distribution of phenomena through the associated data, thematic distribution maps can be obtained, and the overlapping of the same, by intersecting several pieces of information, leading to the formation of classes of categories that can be both the starting point and the result of research and discussions on environmental and social effects and their monitoring.

At a practical level, operations commonly used for spatial analysis also in the context of development cooperation can be:

- "queries": to extract information from the database to be displayed on maps;
- zone creations or "buffers": to create a buffer area around elements in the database;
- superimpositions or "overlays": to superimpose several maps in order to obtain a map that gathers more information;
- spatial interpolations: to produce a statistical surface representing the variation of a quantity in space, even where it has not been measured;
- dashboards: to monitor & communicate (see Grandi & Bernasconi, 2020);
- infographics & stories: to communicate (Grandi and Bernasconi, 2021b).

This is also accompanied by the INSPIRE directive (INfrastructure for SPatial InfoRmation in Europe), which is a European directive establishing an infrastructure for spatial information in the

ISSN: 2531-8772

European Community[1] , which came into force on 15 May 2007. A directive that intends to create a common infrastructure that makes the spatial information of the various states compatible and usable in a cross-border context, so as to overcome problems regarding the availability, quality, organization and accessibility of data, in order to be able to correlate also data on an international scale, which are already provided according to the standards dictated by the directive itself. Once operational, it enables cross-border data to be seamlessly combined between Member States and shared with applications and between users providing a common framework to better cooperate and develop policies.

The case study of the Svic course at University of Bologna

The Undergraduate curriculum in Development and International Cooperation (Svic)

Given the high potential of Gis in social sciences, the context in which a teaching of Gis has been experienced is that of the "Development and International Cooperation (SVIC)" program, a three-year undergraduate degree course at the University of Bologna that belongs to the course class 'Social Sciences for Cooperation, Development and Peace' (L-37). It has been considered mature to experiment a dedicated Gis laboratory as the course provides a versatile and multi-purpose training that enables students to acquire the necessary skills to understand and analyses globalization processes from various social, legal, political and cultural aspects, particularly in the fields of international development, social and peace policies[2]. The course devotes special attention to developing countries in order to promote a comparative analysis, both qualitative and quantitative, aimed at highlighting the weight of structural and sectoral differences in the various local systems and at identifying key factors for adopting pro-development policy measures.

The course consists of two years with core courses and a third year in which specific in-depth courses are offered in the various areas, including geography, statistics, economics, etc. The degree course also places great emphasis on internationalization and encourages its students to gain experience abroad. There are also many opportunities for direct encounters with the main working realities in the sector, through work placements, which allow students to gain initial experience in the world of work, and also through workshops, some of which are in English, which allow students to delve into development and cooperation issues in order to put the skills acquired into practice.

[1] https://inspire.ec.europa.eu/

[2] https://corsi.unibo.it/laurea/SviluppoCooperazioneInternazionale/studiare

ISSN: 2531-8772

Optional courses have recently been included to further promote quantitative knowledge, to address development issues in multidimensional terms and to support the growing focus on emerging global issues related to the environment and climate change.

On the occasion of the Cyclical Review of the course of studies (in early 2022), a consultation with social partners that focused on the validity of the educational objectives and the management system used by the course of studies was held. It emerged from the focus group that the specific training objectives of the degree course are appreciated for their validity and relevance and in particular the importance of the cross- and inter-disciplinary nature of the teaching offering is recognized. The combination of theoretical teaching and laboratory activities are considered good, but the more operational and professionalizing skills should be further enhanced in order to better meet the needs of the world of work. In terms of transversal skills, those relating to the ability to analyze data and databases, design, teamwork, argumentation, communication and interpersonal skills are in greatest demand. It is precisely with this in mind that the proposal has been made to activate a "Gis and spatial analysis for international cooperation and local development". The model used is a laboratory-course of four European credits (in the 2020/2021 academic year), in order to strengthen the proposal of an educational offer that allows for the acquisition of more operational and professionalizing skills by supplementing the theoretical knowledge that is provided in some courses.

Gis where considered useful advanced tools of analysis that Svic students should acquire in this area, as they will be useful in facing the challenges that continually arise as experts in 'development' according to a contemporary, multifaceted and multidimensional, sustainable and universal conception (Sen 2000, Tulumello S. 2022).

The ability to thematically geo-localize is a prerequisite for analyzing and deepening the context under study in order to identify the consequent policy measures to be taken; complex thinking and multicriteria decision making can be strongly supported by Gis.

Development in its current vision must, in fact, be approached with a set of instruments and competences that allows for multidimensionality. Thematic maps of indicators are useful for the spatial analysis of global and local phenomena, cartography for the preparation and evaluation of local development and international cooperation projects can be a critical support system (Tulumello Foderà Pipitone 2007). Moreover, cartographic representation could become an important interpretation tool and a powerful form of visual communication to support decision makers in cooperation programs and projects. Students who become familiar with Gis tools will be able to "visualize" the interconnections between the phenomena studied by superimposing images of the

ISSN: 2531-8772

economic, social and political context in order to gain an insight into the complexity of the territory so as to support decision-makers in taking action with the ultimate goal of "development".

From Gis basic introduction to a course in "Spatial Analysis and Gis for local development and international cooperation

As part of the lectures of the course in "Geography and sociology of the territory", for three academic years, a growing number of lecture hours have been dedicated to the introduction of the basic elements of Gis-based cartography and digital cartography. This has been a pilot project, experimenting both traditional frontal lecturing as well as digital one, even before Covid-19. The aim of this sub-module was to provide students with the elements of spatial analysis and Gis to be used as support for the analysis of spatial phenomena and spatial planning. At the end of the course, it was expected that students acquired the foundations of cartography and digital representation using basic Gis features autonomously and thanks to the growing diffusion of open-source systems such as QGis. Students were expected to develop the ability to produce thematic maps relating to elements and indicators useful both for the spatial analysis targeting global phenomena, local development, and international cooperation projects. Furthermore, they were expected to improve awareness and the ability to carry out the basic operations of spatial analysis of phenomena, basic Sma and create a cartographic project.

Thanks to the students' review system of the University of Bologna, yearly fine-tuning and improvements have been made according to table 1. Moreover, the Covid-19 pandemic accelerated digitalization and online lecturing, adding new technological opportunities in the pedagogy of the course.

Table 1 - Summary table of the evolution of the piloting of the introduction of GIS in the SVIC course

Academic Year	Content of the course	n. lecture hours and expected working time for students	Review of the experience & Improvements
2018/2019 (before Covid-19)	1. Elements of classical cartography (definitions, properties, scale, projections, reference systems, symbology, types of maps, etc.).	Two hours, traditional lecture	This part of the course was particularly appreciated by about one third of the students as it aimed to provide practical skills and

ISSN: 2531-8772

Total hours	2. Spatial data in the Gis environment (shapefiles and rasters) and basic use of QGis for constructing a geodatabase to design a thematic map using QGis. 3. Self exercise at home in designing a world thematic map using the Human Development Index or other indicators of the UNDP statistical online statistical database	Two hours, lecture with a simple introductory guided exercise in computer science lab Four hours of independent practice work with the support of video-tutorials (not compulsory, rewarded with extra-points at the exams)	a methodology for the development of autonomous skills in the production of digital maps. A group of students (approx. 10%) used this competence in the application of the project work in the sociology part. One-third of the students complained that the necessary computer skills were too high or that they could not easily produce the required map because a sufficiently similar exercise had not been done in class. One third of the students considered this methodology not particularly interesting because it tended to be too practical and quantitative compared to the theoretical framework of the degree course and their expectations.
2019/2020 (before Covid-19)	1. As in the previous year 2. Introduction to Gis and Spatial data (shapefiles and rasters) and main operations (overlaying, buffer, visual analysis, etc). Basic elements of relational database management. Databases and georeferencing. Building simple databases with spatial data and Join operations 3. Basic use of QGis, retrieving data and structuring a database for spatial analysis in projects for international cooperation and local development using HDI indicator of the UNDP online statistical database 4. As in the previous year	Two hours, traditional lecture Two hours, traditional lecture Two hours, lecture with a full guided exercise in computer science lab to prepare a world thematic map on HDI Four hours of independent project work (alone or in	In order to meet requests for more practical support, the operational part was further strengthened by running an extra two hours, including elements of theory on relational databases and a computer room exercise that accompanied step-by-step procedures and commands to be used to build the thematic map. Extended the possibility to work in pairs in order to

ISSN: 2531-8772

		couples) with the support of video-tutorials (not compulsory, rewarded with extra-points at the exams)	improve peer-to-peer learning processes.
2020/2021 (during Covid-19)	1. As in the previous year 2. As in the previous year + examples of applications. 3. As in the previous year 4. As in the previous year + a page on spatial analysis description based on the results 5. Problem solving tutoring extra-time lecture	Two-hour lecture, online only Two hours lecture, online only Two hours lecture online with a full guided exercise online with full sharing screen of the lecturer to prepare a world thematic map on HDI Five hours of independent project work (alone or in couples) with the support of video-tutorials (not compulsory, rewarded with extra-points at the exams) Two extra-hours of rehearsal, question and answer session, and problem solving to students that requested help	Lectures where fully recorded and shared in the Moodle platform. To provide a more practical insight, some examples of application of spatial analysis and GIS applications in international cooperation and local development practices have been presented. Shape files and the .xls file were provided in the Moodle platform, to ensure everybody would finish the exercise. On top of the map, students were requested to add a short one-page report to demonstrate understanding of main concepts of spatial analysis. To support students that had practical problems, this extra open session acted as a simulation of a helpdesk service to solve problems that could halt the conducting of project work

In a few years, this submodule moved from a minor part of the geography course to 25 per cent of it, and some final dissertations have significantly foreseen the use of Gis in their case study applications. The number of students involved was about 100 each years. This experiment has led to the design of an autonomous laboratory-course of 24-teaching-hours that could expand the objectives, competences acquired by students and the span of knowledge in Gis technologies as well as on

ISSN: 2531-8772

practices, case studies and critical analysis capabilities. In particular, the laboratory course has been composed of theoretical parts and a practical part aimed at developing a final complex project work. The content of the theory, held in traditional and digital blended fashion, part of the course could be then summarized as follows:

1. Introduction to cartography: from the first forms of spatial representation to Gis, Gps and other satellite geo-technologies;
2. Basic elements of classical cartography (definitions, properties, scale, projections, reference systems, symbology, types of maps, etc.).
3. Basic elements on relational database systems for constructing a geodatabase. Databases and georeferencing. Building simple databases with spatial data and Join operations.
4. Gis. The format of spatial data in the Gis environment (*shapefiles* and *rasters*). Retrieving data and structuring a database for spatial analysis in projects for international cooperation and local development.
5. Building cartograms with Qgis and overlaying operations.
6. Gis and digital cartography for participatory mapping: case studies.
7. Cartographic representation as a form of visual communication and decision support in cooperation programs and projects: maps in infographics, geo-dashboards, geo-visualization systems. Get a critical analysis on which technology and software select.

Lectures where organized in two parts, the first covering theoretical elements while in the second part direct practices thought with a full guided exercises involving tutorial covering these operations and features, i.e. those presented in paragraph 2 (Data collection and management; Orientation between software; Performing queries; Use of the "buffer" functions; Performing "overlays" and Spatial interpolations). Tutorials performed in class where fully recorded and shared in the Moodle platform and were dedicated to (a) Introduction to QGis and tutorials; (b) Creating a world thematic map with QGis using HDI data, (c) Exercise on Italian region cartography; (d) Crating a route with GPS data using application for smartphone and QGis; (e) data visualization with Flourish; (f) using Geoportals to retrieve geodata via Web map and web feature services; (g) Use of plugins (use of OpenstreetMaps cartography in QGis).

Peer-to-peer & expert involvement

ISSN: 2531-8772

Two former students, leveraging on peer-to-peer pedagogy approach, were participating to a brief, 30-minute seminar to present their case studies respectively applied into international cooperation realm (i.e. the use of Gis to monitor a project progress in rural areas of Niger) and into local development (i.e. the use of Gis to analyze spatial pattern of sustainable agricultural practices in the Salento area). This latter case was chosen because it can be considered a good example of application of practical skills in research of undergraduate level when referring to local development projects. The peer-to-peer lecturer provided first a theoretical part, aimed at teaching the students on the possible methodological steps to follow (data collection, data analysis, and data presentation) when implementing a spatial analysis in a final dissertation research, hence a reporting in the cooperation field. Some insights were also given on how to organise semi-structured interviews, as a tool to complement the Gis analysis. This theoretical part was followed by an exercise on how to retrieve statistical data from reliable sources and how to use the collected data to implement a joint function in QGis: the shapefile of the Italian regions was downloaded from ISTAT (Italian National Institute of Statistics), and uploaded as a vector file in QGis; a .csv was uploaded in QGis; the joint function was applied; the set of symbols for the newly created layer and final layout was created, including a legend and scale. The above-described seminar helped to understand the possible benefits stemming from a peer-to-peer approach. Moreover, this approach can contribute to increasing the acquisition of more professionalising skills (see paragraph 3.1) to be operationalised in the cooperation field. The particular attention on maintaining an interdisciplinary approach leads students to better face the multidimensional and multifaceted aspects of development in their future career.

Finally, a seminar was organized with an expert to transfer the sense of the more complex scientific and technological horizon of digital cartography, GIS, and spatial analysis.

Conclusions

The analysis of the application potential on the creation of professional skills entangling spatial analysis and international cooperation are increasingly possible thanks to a new diffusion in the application field that has reached in recent years, also thanks to open-source software and open-data. The sphere of action of development cooperation in its various components and phases creates a significant interest in young students. Therefore, a framework of work can be constructed to identify the most important phases of Gis applications in development and learning needs. In particular, the teaching pilot project presented has led to develop a methodological framework in order to explore

ISSN: 2531-8772

the cases for the use of Gis in support of international development cooperation. To further develop this work, it seems appropriate to use a dialectical approach between practice and university teaching, i.e. between potential applications in project cycle management, competences and the skills developed or to be developed in existing university courses. For instance, the following phases the project and programme cycle could be considered:

1. The identification and study phase of the territory under investigation or construction of a project;
2. The data collection phase, especially when potentially geo-referenced and thanks to the use of Gps;
3. The support phase for the design of a programme or feasibility project also in remoteness conditions thanks to the processing of satellite raster images;
4. The operational planning phase by exploiting both the potential of spatial analysis and forecast modelling of Gis systems and in its potential for Sma, as well as applications in bottom-up participatory processes;
5. The external and internal communication phase thanks to the visualization tools;
6. The project progress monitoring phase to maintain a strong geospatial data connection and linkage;
7. The evaluation phase, both *in itinere* on the progress made and *ex post* on the impacts of a more or less complex project or programme.

Each of these should be accompanied by a spatial analysis technology and methodology that the knowledge and critical analysis of professional shall select appropriately. Hence, the role of education in preparing these competences is strategic to strengthen application of Gis. Research to further develop the nexus among Gis and spatial analysis, international cooperation and higher education pedagogy could be a future evolution of this work.

Acknowledgements

This paper is the result of a common work, however paragraph 1 and 3.2 and has been edited by S. Grandi, paragraph 2 has been edited by G. Vico, 3.1 by C. Brasili and 3.3 by A. Circhetta. Conclusions are indistinctively written together.

References

Anderson B.S., Butts C.T., Carley K.M. (1999). “The interaction of size and density with graph-level indices”, Social Networks, 21(3), pp. 239-267.

ISSN: 2531-8772

Banfield E.C. (1976). Le basi morali di una società arretrata, Il Mulino, Bologna.

Burini F. (2016), "Cartografia Partecipativa. Mapping per la *governance* ambientale ed urbana". Franco Angeli, Milano.

Conti E. (2011), "Dal NIMBY al consenso: il caso concreto di una centrale termoelettrica", in Santini L. (a cura di). Partecipazione nei processi decisionali e di governo del territorio, Pisa Universiy Press, Pisa, pp. 113-126.

Dallari F., Grandi S., (2005). Economia e geografia del turismo. L'occasione dei Geographical Information System. Patron, Bologna.

Dicken P., Lloyd P. (1993), Location in space. Theoretical Perspectives in Economic Geography, Harper Collins Publisher, New York.

Foderà R. (2022), La costruzione sociale del dato. In Tulumello S., Verso una geografia del cambiamento, MIMES EDIZIONI (Milano-Udine), p. 91 - 100.

Geraghty E., Kerski J. (2020), "The Impact of COVID-19 on Geography, GIS, and Education", Journal of Research and Didactics in Geography (J-READING), 2, 9, pp. 53-66, DOI: 10.4458/3617-06.

Grandi S., Bernasconi A. (2020), "Convergenza di web design e informazione spaziale, statistica, genomica ed epidemiologica: il caso delle geo-dashboard nella crisi COVID-19", Documenti Geografici, p. 463-476, DOI: 10.19246/DOCUGEO2281-7549/202001_29.

Grandi, S., Bernasconi, A. (2021a), "Geo-online explanatory data visualization tools as crisis management and communication instruments". In International Cartographic Conference, Copernicus Publications, 41(4), pp. 1-8, https://doi.org/10.5194/ica-proc-4-41-2021.

Kraak MJ, Roth RE, Ricker B, Kagawa A, Le Sourd G. (2020). Mapping for a Sustainable World. United Nations: New York, NY (USA).

Janelle D.G., Goodchild M.F. (2011), Concepts, principles, tools, and challenges in spatially integrated social science. In T.L. Nyerges, H. Couclelis, and R. McMaster, The SAGE Handbook of GIS and Society, SAGE, Thousand Oaks, pp. 27–45.;

Logan J., Collver A. (1983), "Residents' Perception of Suburban Community Differences", American Sociological Review, 48 (3).

Lynd R.S., Lynd, H.M. (1970), Middletown, vol. I, Edizioni di Comunità, Milano.

Martinotti, G. (1993), Metropoli. La nuova morfologia sociale della città, Il Mulino, Bologna.

Mela, A., Davico, L., Conforti, L. (2000). La città, una molte. Torino e le sue dimensioni spaziali, Liguori, Napoli.

Malczewski J. (1999). GIS and Multicriteria Decision Analysis, John Wiley and Sons, New York.

Malczewski J. (2006), "GIS-based multicriteria decision analysis: a survey of the literature", International Journal of Geographical Information Science, 20(7), pp. 703-726.

ISSN: 2531-8772

Nuvolati G. (2002), Popolazioni in movimento città in trasformazione. Abitanti, pendolari, *city users*, uomini d'affari e f*laneurs*, Il Mulino, Bologna.

Nuvolati, G. (2007), Mobilità quotidiana e complessità urbana, Firenze University Press, Firenze;

Pausas J. G., Bond W. J. (2019), "Humboldt and the reinvention of nature", Journal of Ecology, 107, pp. 1031-1037, DOI: 10.1111/1365-2745.13109.

Pesaresi C. (2017). Applicazioni GIS. Principi metodologici e linee di ricerca. Esercitazioni ed esemplificazioni guida. UTET, Torino.

Sen A. (2000), Development as freedom, Anchor Books, New York.

Snow J. (1854), "The cholera near golden-square and at Depford". Medical Times Gazette, 9, pp. 321-322.

Stoltman J.P. (2012), "Perspective on geographical education in the 21st century", Journal of Research and Didactics in Geography (J-READING), 1 (0), pp. 17-24, DOI: 10.4458/1005-03.

Tulumello A., Foderà R., Pipitone V., (2007). La misura dello sviluppo locale, Bruno Mondadori editore, Milano.

Wulf A. (2015), *The invention of nature: Alexander von Humboldt's new world*. New York, NY: Knopf Doubleday Publishing Group.

Web Sites

https://corsi.unibo.it/laurea/SviluppoCooperazioneInternazionale/studiare - Insegnamenti: piano didattico (accessed September 14, 2022)

http://inspire.ec.europa.eu/ - Inspire Knowledge Base – Infrastracture for spatial information in Europe (accessed September 13, 2022)

Acronyms

Svic – Development and international cooperation undergraduate degree
Gis – Geographical snformation system
Gps – Global positioning systems
Hdi – Human development index
Ict – Information and communication technology
Istat – Italian National office of statistics
Inspire – INfrastructure for SPatial InfoRmation in Europe
Qgis – Quantum Gis
Sdi – Spatial Data Infrastructures
Siss – Spatially integrated social science
Sma – Spatial multicriteria analysis