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Daniele La Rosa
Riccardo Privitera *Editors*

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Daniele La Rosa · Riccardo Privitera
Editors

Innovation in Urban and Regional Planning

Proceedings of the 11th INPUT Conference—
Volume 1

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Preface

The 11th Edition of the International Conference focuses on how to integrate nature-based solutions in urban and regional planning processes and science. Previously planned for September 2020, due to the COVID-19 pandemic the INPUT 2020 Conference will be hosted in 8–10 September 2021 by the University of Catania (Italy).

The overarching theme of INPUT 2021 edition is “Integrating Nature-Based Solutions in Planning Science and Practice”. There is growing evidence that nature-based solutions (NBS) are strategic instruments to restore or improve the functionality of urban ecosystems towards more livable, healthier and resilient cities. Despite their many advantages, NBS are not widely implemented because the evidence of their effectiveness is not yet sufficiently diffused among policy-makers, city-planners and residents and because NBS are often overlooked due to the complexity of their design and lack of normative instruments supporting planning choices. In order to permanently incorporate NBS into planning instruments, more research and international discussion are required to consolidate the fragmented evidence that NBS can significantly improve the overall degree of environmental sustainability of contemporary cities.

INPUT 2020 gathers international scholars in the fields of planning, civil engineering and architecture, ecology and social science, to build and consolidate the knowledge and evidence on NBS and to help an efficient implementation and replication of solutions.

The INPUT 2020 Conference hosts 14 thematic sessions, namely:

- Enhancing the use of nature-based solutions in urban planning
- Modelling to innovate planning solutions for socio-ecological systems
- Input visions: new technologies, data and hybrid models for spatial planning
- Urban metabolism and simulation for decision-making in spatial planning
- Performance-based planning
- Computational planning
- Geodesign for informed collaborative spatial decision-making

- Planning and design of ecosystems services: assessment frameworks, models, mapping and implications
- Green infrastructure for planning healthy urban environments
- The mitigation of peripheralization risk in urban and regional planning
- Strategies and actions for climate change adaptation and mitigation in mediterranean regions
- Analysis and planning of rural landscapes
- Accessibility in urban planning: moving towards innovative approaches
- Maintenance, upgrading and innovation in cultural heritage

This book presents the first collection of 69 contributions submitted to the INPUT 2020 Conference, following the first call for paper launched in Winter 2020. The accepted articles, after a blind-review process, are here organized in 5 topical parts, which group together the 14 thematic sessions of the conference:

- Nature and Ecosystems for Urban Systems
- Models and Technologies for Spatial Planning
- Climate Change and Spatial Planning
- Peripheries, Rural and Cultural Landscapes
- Accessibility in Urban Planning

INPUT 2020 proceedings explores empirical as well as theoretical frameworks for NBS, their attitude to provide ecosystem services, to deal with climate change effects and to support mitigation and adaptation planning strategies. Integration of NBS in planning science and practice is investigated across different contexts and scales, from urban cores to peripheries as well as from rural to cultural landscapes. Above all, this collection presents the state of the art of modelling approaches and innovations employed in urban and spatial planning, with a trans-disciplinary, boundary-less character to face the complexity of contemporary socio-ecological systems and following a practice-oriented approach aimed to problem solving.

INPUT is a group of Italian academic researchers and academics working in different fields related to the exploitation of innovation for urban and regional planning, with particular reference to geo-informatics and socio-ecological aspects of spatial planning. INPUT Conference is held every two years in Italy, with last editions been hosted in Viterbo (2018), Torino (2016), Cagliari (2014) and Potenza (2012).

INPUT 2020 Conference is organized by [LAPTA](#), a research laboratory of Department of Civil Engineering and Architecture of the University of Catania (Italy), working on sustainable urban and landscape planning.

Catania, Italy
December 2020

Daniele La Rosa
Riccardo Privitera

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Workshop of Geodesign: Geology as the Basis for Planning Alternatives Futures for the Quadrilátero Ferrífero



Pedro Benedito Casagrande  and Ana Clara Mourão Moura 

Abstract Geology has always been present in the process of transformation of the anthropic landscape. However, the role of Geology in landscape planning is still incipient and has not been the subject of an integrated policy. Linked to this and to the need of professionals related to Geology and Mining to participate actively in planning, the Geodesign technique was chosen to elaborate an alternative future plan for the Iron Quadrangle region, in Minas Gerais, Brazil, using Geology as base. In this way, a Geodesign Workshop was held with several professionals related to Mining and obtained a territorial plan for the region. This result generated the Decision Model, which is consistent with the study area and showed that the method used is assertive for landscape and territory planning

Keywords Territorial planning · Geodesign · Landscape planning

1 Introduction

The present work approaches a field of research that is shortly explored by geology: the studies of transformation of the mined landscape, the co-creation of alternatives of future for a landscape of mining interest, and the collective project that considers different aspects that are part of the variables of consideration of the approach from the point of view of the geologists. Mining industries develop proposals for the use and transformation of the territory, aiming at the best locational choice for development, maintenance and protection actions. However, the use of Geodesign logic and methodology is still an innovation for this sector, especially for the propositional stage of the landscape and future uses.

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The Geodesign methodology contributes to the co-creation of ideas, in which different perspectives and values are placed on the same table of proposals, sharing opinions. There is the possibility of collective construction of projects with groups and different participants of society, in a process in which different opinions are compared and a conclusion or consensus is reached.

The Quadrilátero Ferrífero area, in Minas Gerais, Brazil, was chosen as the study area, mainly because of its symbolic and representative role for the geological sector. The study aims to investigate the potential of Geodesign for the management of the area with geological interest—whether they are production, landscape or environmental protection. The Quadrilátero Ferrífero is the heart of mineral exploration and production in Minas Gerais, in which significant conflicts of interest arise, as it is an area of important natural and environmental resources, landscape values and a great economic value related to mining and significant urban expansion. From this perspective, the case study, for its complexity, provides a broad discussion about the potential of Geodesign for the mining landscape, aiming at shared decisions on where to promote the expansion of the economy, where to preserve, where to recover, where to promote maintenance.

The geological processes are related with great importance among the mapped systems, as they explain the forms of occupation of the territory since its inception, influencing its evolution and the processes of landscape transformation.

The region became a mining province due to the exuberant amount of mineral commodities present in the area and thus the occupation of a network of cities began. The beginning of the urbanization of Brazil was conducted and influenced by geological formations and their geomorphological consequences, for economic reasons and strategic position in the landscape. Thus, the beginning of the history of interiorization of Brazil has embryonic links to Geology and Geomorphology. This relationship can be observed in the reflection of Paraizo (2004, p. 12), “a knowledge about the formation processes of our planet and its evolution in time”, which has served as a guide for man since the beginning of its history.

The most diverse conflicts of interest, by the juxtaposition of economic and environmental values, are generated by the changes made by man in the territory. Thus, it is worth testing the Geodesign procedure to create possibilities for alternative futures in relation to the area of study

Understanding the values of the Quadrilátero Ferrífero is not an easy task, given the presence of occupation and urban expansion conflicting with the conservation of the landscape, and the actions of mining companies. In parallel to the economic interest, there is also environmental interest and interest in urban sprawl, as it corresponds to the southern vector of the Metropolitan Region of Belo Horizonte (RMBH) (Tonucci Filho 2012). Environmental and territorial events in the area, related to the different interests of the use of the territory and its evolution, linked to hegemonic agents, characterize the dynamics of the place (Silva 2007; Souza 2007).

2 Area of Study

The Quadrilátero Ferrífero (Fig. 1) is in the South-Central state of Minas Gerais, Brazil, covering an area of approximately 7,000 km², which occupies a region surrounded by mountains arranged almost orthogonally, hence the name “quad-range”. The mountain elevations are around 1,000 m and there are points with a elevation of more than 2,000 m above sea level. The municipalities of Itabira, Mariana, Congonhas and Itaúna delimit the extremes of the area, which are geographically arranged in a quadrangular way in the territory (Ruchkys 2007). It is bounded by the mountains from west to east and from north to south: Serra Azul, Rola Moça, Curral and Piedade (northflank, west-east bound); Caraça and Gandarela (east-south, flank), Ouro Branco and Outro Preto (south flank, east-west) and Moeda (westflank, south-north bound); (Dorr 1969). The taxonomic origin of the region was named by Gonzaga de Campos due to the iron ore deposits found there (Ruchkys 2007; Scliar 1992).

As a workshop of thematic interest, the mining system was dismembered to contemplate the most diverse approaches from the geographical point of view. The themes of economic, tourist, urban, cavity, groundwater and environmental areas were taken into account. Workshop with Geological Base for Planning became possible because of the plurality of the axes that Geology has, which requires deepening in different issues and verifying where there are conflicts with environmental and urbanization issues.

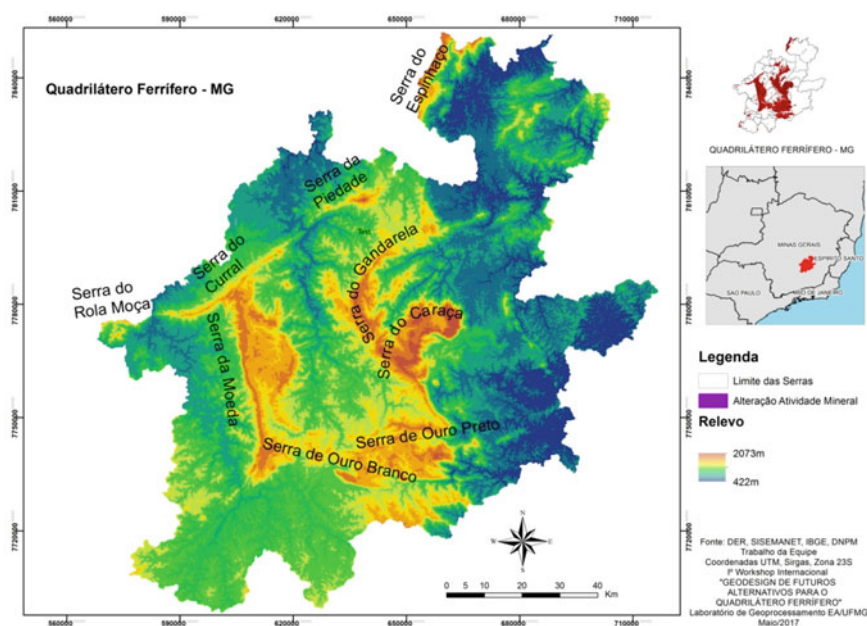


Fig. 1 Location of the study area. Source EA-UFMG Geoprocessing Laboratory

3 Methodology

The methodology is based on the definition of specific variables for the approach of geological interest, both for the definition of economic interests, as well as of acting in preservation, maintenance, and recovery of transformed areas. It also presents how to analyse the variables so that they represent the territorial reality, and how to make judgments to identify potentialities, restrictions, specific needs (Fig. 2).

The investigation began with the questioning of how geology could influence urban planning and, from this point, the stage of assembling information for the case study was structured. This initial investigation was based on geological issues related to the management of the territory.

For the creation of new information, it is important that the Multicriteria Analysis procedure is widely used. In the case of the option for the integration of variables by Weights of Evidence and the analysis is made by attribution of weights and notes, indicated by a specialist in the phenomenon under study or in the variable in question (Malczewski 1999; Malczewski 2006). The Multicriteria Analysis allows the crossing of variables in spatial analyses, according to a Decision Tree, from which the weighted average can be applied to integrate the variables, or simply as a process of combinatory analysis (Moura 2014). The decision by this Decision Tree requires understanding on how variables relate.

4 Case Study

By analyzing the main characteristics that represent the *Quadrilátero Ferrífero* in its geological context, it is possible to understand the choice of the systems that served as a reference in the workshop process. All these characteristics should contribute to obtaining information about potentialities and limitations, dynamics, demands and conflicts, and all this should be expressed in cartographic models. According to Moura (2014), the use of geographic information system is directly related to the generation of a heuristic space, since there is the possibility of selective extraction of variables.

In the methodology of Geodesign the systems include the set of themes selected and evaluated within a given context of research or spatial clipping of study. The systems defined were:

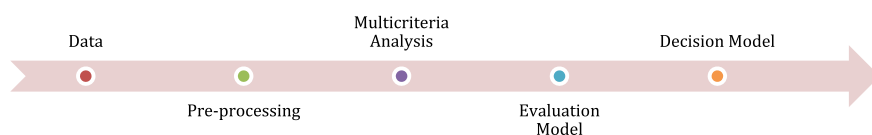


Fig. 2 Methodological flowchart. *Source* The authors

- Tourist attractiveness due to geology.
- Mineral attractiveness.
- Vulnerability of Vegetation Cover and Conservation Unit.
- Speleological Vulnerability.
- Hydrogeological Vulnerability Associated with Porosity.
- Vulnerability by Urban Anthropization in a Geological and Geomorphological Bias.
- Other ideas (open system to receive ideas that were eventually not contemplated in the chosen systems.)

4.1 Representation, Process and Evaluation Models

After the study on the area were defined the main characteristics that could represent the issues that relate to the context of the landscape of the *Quadrilátero Ferrífero*. They are presented here in their representation process and evaluation models. The set of evaluation models presents results that indicate the conditions of suitability to project and policy proposals, by classes (feasible, suitable, capable, not appropriate and existing, according to the legend proposed by Steinitz 2012) (Fig. 3).

5 The Geodesign Workshop

The moment of presentation of the design (composed of the sum of policy projects for all systems) had debates with great value, especially since each group represented an interest in a sector of society (social, environmental and economic).

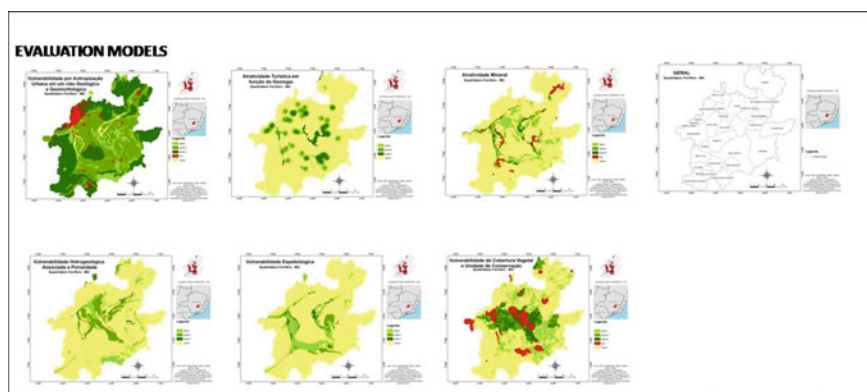


Fig. 3 Evaluation models used in the workshop. *Source* The authors

After the presentations and compared the ideas, the workshop conductor realized that it was already possible to notice expressive similarity between the proposals of the groups, as shown in Fig. 4.

The Final Proposal (final design) is the stage of Decision Model, when by approximations and consensus, by negotiation processes and evaluation of assertiveness levels, a collective decision is reached. The final negotiation began to be composed of diagrams already chosen three groups, considered consensus. Some

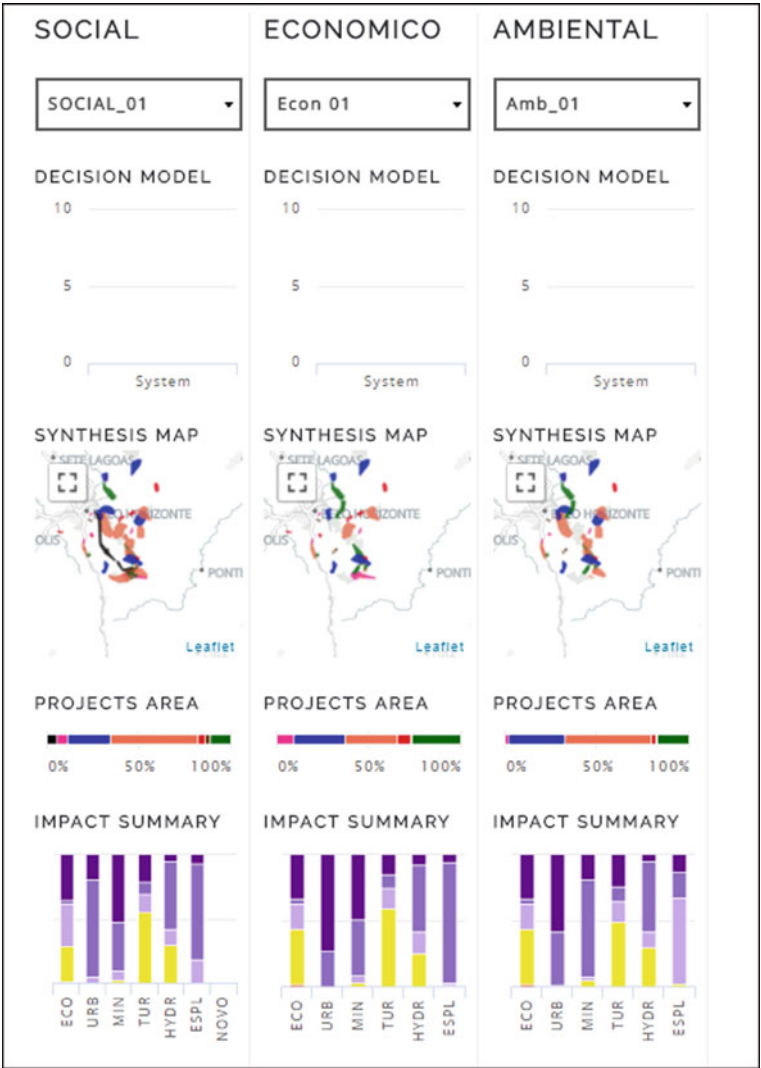


Fig. 4 First project of each of the groups and impact analysis of each system. *Source* Casagrande (2018), from the workshop, view of the GeodesignHub platform (2017)

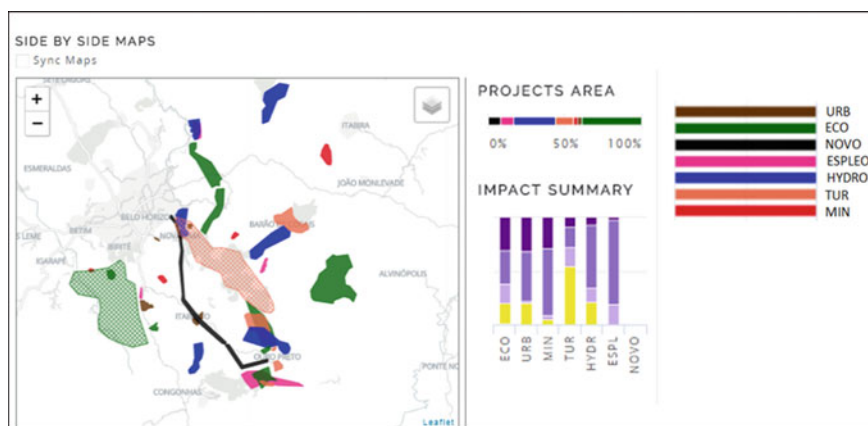


Fig. 5 Decision Model of the Workshop. *Source* Casagrande (2018), from the workshop, view of the GeodesignHub (2017)

diagrams were changed from frequency two to three, and others were discarded, from the negotiation between the participants. It would also be possible to negotiate small adjustments so that the diagram was accepted by all, which means placement, discussion, and possible acceptance of constraints.

Then, the same process was performed for the diagrams with frequency equal to one, a process in which the only candidate needed to defend his idea and convince the two other groups that they had not indicated the diagram. As a result, the final product was obtained for the workshop, as shown in Fig. 5.

6 Conclusion

It was possible to verify the benefits generated by the Geodesign method approach to territorial planning through the final results of workshop, with emphasis on the clear understanding obtained by all about the importance of geological bias in the study of territorial planning.

From the first project carried out by each of the three groups (environmental, social, and economic), it was already possible to verify the similarity between the ideas. And more than that, the workshop's final proposal (Decision Model) was remarkably similar to the initial ideas, only refined to avoid possible impacts or conflicts. As the negotiation progressed, or where there was some conflicting overlap the diagrams were redesigned so that there was no conflict of interest.

The process was greatly optimized due to the competencies of the participants, because they were specialists in topics related to earth sciences and interesse in Geology, and who knew very well the territory under study, the Quadrilátero Ferrífero. As a result, there was quality in the co-creation of proposals, which were in themselves harmonized and conscious from the beginning.

The Final Decision Model achieved coherence with the reality of the Quadrilátero Ferrífero, besides being easily used by the Government as guideline for mining and urban planning of the region. This makes us believe that traditional Brazilian approaches to territorial planning can be reviewed and altered in order to fill existing gaps. Territorial management can very well be guided by this method, thus facilitating the resolution of various conflicts.

Geology is the basis of society, since practically everything that is built by man is allocated on the continents and these are supported by the rocks, being this science the pillar for the support of anthropic activities.

Practically all aspects of the studied territory have strong links with geological issues, conforming the essence of what is understood as the Quadrilátero Ferrífero. Geology strongly conditions the landscape and its values to be preserved, environmental and economic riches, anthropization expansions by mineral explorations and expressive urban growth and the essence of the place's *genius loci*, which is the mining landscape.

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