

Review

PPGIS applied to environmental communication and hazards for a community-based approach: a dualism in the Southern Italy “calanchi” landscape

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Abstract: The need of protection of the territory is a priority for the society, which is an integral part of it (unfortunately, this coincidence is often forgotten): the new environmental issues require the development of innovative management strategies and of appropriate knowledge and models. The balanced use of resources, essential for the survival and well-being of society, can be optimised through the promotion of the territory. The identification and the sustainable development of local resources can only be achieved by directing development policies towards a path of integration between ecological needs, protection of the landscape and socio-economic and cultural needs. The landscape, read as a result of the interaction between human and natural processes, is a rich heritage to safeguard, enhance and promote. The key requirement underlying each cultural and environmental enhancement project is the knowledge of the territory in its manifold aspects; knowledge that can be properly synthesised through cartographic representation: maps are tools to make data easily accessible and meaningful. In this contribution, after having carried out a review of the literature on GIS technologies and having provided some work examples, we analyse some proposals about the application of PPGIS on communication of environmental promotion initiatives; PPGIS, in fact, are effective in risk communication and information and in the consequent prevention of disasters. The mediated and participatory use of PPGIS technologies, furthermore, allows a community-based approach, fundamental for reducing the disaster risk.

Keywords: “Calanchi”; Landscape; PPGIS; disaster risk reduction; society; communication

1. Introduction

The geological history of Italy explains the amazing landscapes which characterise the whole country. Dynamic phenomena are still active, and the sempiternal contrast between continuously acting endogenous and exogenous strengths gives our country an extraordinary abundance of land settings, and at the same time, a high level of fragility.

We would like to focus on two fundamental concepts in the new systemic approach aimed at studying, knowing and managing our planet: resource and risk, which are the two “poles” of a continuum that embraces all the interactions between mankind and the earth. In particular, the main object of this work is Landscape, which, in Italy, is undoubtedly one of the most important resources both in tangible and intangible terms. Landscape can be defined as the result of the interaction of the physic, biotic and anthropic components, acting in a spatial/temporal scale. Moreover, following the statements of the European Landscape Convention [1], landscape impinges on the quality of human life, and the society is responsible for the landform’s protection. On the other side of the dualism, risk is a situation involving exposure to hazard; the concept of exposure entails a personal choice, in avoiding or not the hazard.

Individual/community/society (a trinomial well describing the complexity of the term “people”), is the common factor connecting the previous expressions. So, the main issue is how to make people aware of what risk is; of where, why and when a hazard may threaten lives and infrastructures, and above all, how a hazard becomes risk.

On the basis of these reflections, we strongly believe that the often-dramatic problems affecting the delicate balance typical of the relationship between environment and society require a holistic approach: multiscalarly, multidisciplinary, integration; such a perspective includes all of the disciplines regarding both the planet and the society living on it. In parallel, it is mandatory to have an effective involvement of the society, making people understand the territory’s status and aware of the direct or indirect effects of their behaviour on it. A proper way to reach such a complex objective is to empower individuals/communities/society to participate in territorial management, through intensive information and awareness campaigns.

Moreover, an integrated approach reveals how deep the link is between knowledge, consciousness and sustainability. The significance of the latter term is often forgotten, or misunderstood. The concept of sustainability is made of awareness, responsibility, sharing of experiences. In other words, it is the natural fruit of a concrete participatory democracy, dynamically extended in space and time.

Today, society must recover the consequences of the improvident territorial management performed up until now: this is mandatory and cannot be postponed if we really want to leave an alive planet and renewable resources to the next generations. Sustainable development *vs* territorial exploitation: this is one of the most problematic dualisms of the present times. The postmodern period we are living in is classified as the Anthropocene Era, as the first geological era in which human activities have been able to influence the atmosphere and alter the planet’s equilibrium. Humankind has no more time to waste in restoring environmental balances. To this aim it is essential to experience new effective ways to share knowledge, find educational programmes, and communicate [2,3].

Prevention is made up of knowledge, conscience, and action. Until it is assimilated and transformed into behaviour, it is essential to work on many fronts. Information is the first and most vital step [4]. In this paper we will focus on the role of communication referring to prevention.

It is dramatically evident that the current styles in scientific communication are not effective enough. Both referring to the natural hazards and to the pandemic, there is no shared consciousness of the common effects of natural hazards, as well as of public health problems. Despite the global diffusion of information tools, the contents of the “scientific communication” are too often misunderstood, and refused as “official communication”. The old tradition in the “mainstream” communication styles testifies the habit of using spectacularisation and fatalism [4]. Moreover, the highly differentiated availability of a lot of channels causes a fragmentation of the audiences. The users can choose, and it is their right, but the side effect is the lack of plurality in the fruition, and the unsure accuracy of the information. Of course, there are neither magic formulas, nor determined algorithms: rather, new ways in communicating are necessary. Finally, the research world has started to consider the importance of unconventional communication, aimed at involving individual/community/society in an effective dialogue, devoted to risks prevention, as well as sustainability.

Communication of those scientific topics that have been shared with the society must be comprehensible, proposed through a simple language, yet not simplifying the fundamental concepts. At the same time, communication must reach the widest and most varied range of the public; it must be interesting, intriguing, appealing; if we reflect on this, that is how advertisements work. There is no scandal in proposing such an approach: after all, we have to induce a behaviour, although in the field of environmental risk prevention rather than in marketing. Experience teaches us that talking about risks “tout court”, causes a form of removal effect by the listener. So, it is mandatory to debate the topic by resorting to a reciprocal one: the resource. From environmental, geological or hydraulic risks to the pandemic, it is always more effective when people are invited to follow proactive behaviours, rather than being scared.

In this contribution, after having carried out a brief literature review on GIS, WebGIS, PPGIS technologies and having provided some work examples, we analyse some proposals about the application of PPGIS on environmental communication in the context of some initiatives to promote the natural and cultural resources. Finally, we will demonstrate how PPGIS are also effective in risk communication and in the consequent disaster prevention.

2. Reference framework and tools

2.1. Cartography and landscape geology

Conceptually, in Earth Sciences and Geography, as well as in many other disciplines involving the study of territory, the representation does not follow the action, but is a component of it [5]. Themes and phenomena are oriented and emerge according to the scale of analysis and the point of view. In this context, Earth Sciences offers a vast and complex heritage of knowledge and positively integrates with a relatively new science: Landscape Ecology.

Thematic maps can be considered as a complete toolset to provide clear and comprehensive knowledge of the territory, from the general to a particular level of detail, and are therefore an indispensable basis for spatial planning actions. The representation of an area on a map is a complex process that encompasses a lot of work on data, from their collection to integration and rendering as

graphic images. Thanks to a geographic information system (GIS) the output maps are meaningful, providing the users with information about the focused topics.

Moreover, a GIS architecture is continuously updatable, and allows a diachronic analysis of phenomena: nowadays digital cartography is the best tool that offers the most complete information on the studied areas, providing us with the related information and constituting an essential basis for the evaluation of its state [6].

Perception of the landscape is a fundamental step that humanity must take towards the knowledge of nature. The form, according to Aristotle, is the synthesis of the endogenous and exogenous processes that shape the earth's surface [7]. The integration of different disciplines for a scientifically significant result, which can be used in land management policies, requires a methodology that overcomes differentiation, based instead on a holistic approach.

The different knowledge needs suggest new dialogic strategies and procedures of interaction between the operator and the technology [8]. A perspective able to interpret the landscape as the result of all processes, human and natural, occurring in a complex mosaic of ecosystems will guide the planning and management of the territory to the creation of places of collective identification. The basis of a proper planning should be the intent to protect the aesthetic and cultural resources of the territory and the creation of opportunities for social and economic promotion, in a harmonious relationship with the concept of protection of natural resources [9].

The most appropriate methodology, in a perspective of a cognitive survey of the area under study, is based on the approach of Landscape Ecology, which considers the characteristics of natural and artificial ecosystems as parts of a diversified system [10–14].

2.2. *Knowledge of the territory and its cartography: GIS and WebGIS*

Integration of data, elaboration of indexes, multi-scale and multi-thematic analysis, representation of georeferenced information: these are the main function of GIS. Moreover, the possibility to recover and update a large amount of data, to synthesise the information according to the thematic subject, and the differentiated processes according to the user needs, confirms the scientific impact and the technological relevance of GIS tools [15,16]. Further values are the friendly usability both for operators and users: in particular, WebGIS technology and platforms allow us to visualise and query on line georeferenced information and associated maps, without needing additional software, therefore providing a valuable tool for almost each and every field of interest of individuals and groups. For the topics addressed in this paper, GIS tools are the most proper ones to be used in order to assess social-ecological resilience and how its functionality can be improved; these tools also help reach and preserve the desirable balances between such systems by evaluating and mitigating the effect of the various pressures acting on them [17,18].

In parallel, PPGIS (Public Participation Geographic Information Systems) are a relevant evolution of GIS. This kind of tool confirms the role of GIS technology in involving a wider participation of individual/community/society in a common action for environmental protection, risk prevention and sustainable development. At the moment, the high potential of PPGIS has not yet been developed to the best level, despite technological progress, especially referring to shared knowledge, induction of social awareness, involvement of the whole society [19,20].

It is therefore mandatory to keep on extending the right of participation to everyone, entering the broader and more engaging concept of participatory democracy. There are many fields of application:

considering the network of links between environment and society, the potentially strategic and revolutionary importance of the PPGIS is evident: from the monitoring of hydro-geological hazards, to the function of “spread observatory” on the territory. Nevertheless, public participation in GIS data collection implies a knowledge, however basic, of the tool and some analytical skills, therefore a social involvement in educational paths is required, which are to be integrated into the action itself of participation in the GIS, through inductive and deductive processes [21].

3. Examples of map-based land management support projects

In this section we will briefly introduce two Italian projects that have used GIS as a means to present a lot of meaningful data in a concise fashion.

3.1. Landslide risk in Italy: the “IFFI” project

As previously stated, the extreme fragility of the Italian territory is mostly due to the geomorphological settings of the country. Landslides can be considered the most important natural hazard in Italy, where they are very widespread, too often resulting in serious consequences. The main objectives in the field of landslides risk prevention are: to provide a comprehensive survey of local morphologies and dynamics of landslides; to forecast potential future landslides’ activations based upon their evolutionary processes, in order to evaluate hazard and risks to human activities, possibly applying the method to all the areas which has a similar geological and morpho-climatic characteristics; to share scientific information with society, aiming at involving citizens in a new and sustainable territorial management.

The Italian Landslide Inventory (IFFI) Project aims at identifying and mapping landslides over the whole of the Italian territory, following standardised criteria. It constitutes an essential tool to assess the landslide hazard territorial planning, preventive and mitigative actions, and Emergency Plans (Figure 1) [22]. Started in 1999, and coordinated by The Geological Survey of Italy, IFFI currently reports 620,808 landslides have occurred in the Italian territory: the information is organised in a national geo-database. The homogeneity and completeness of the IFFI database have been tested by analysing the area-frequency distribution of the landslides, the proximity to urban areas and the variation of the landslides. The quality indices permit recognition of those areas whose indicators are accurate, and the critical ones, whose information is incomplete. The reliability of the IFFI database is a fundamental requisite, referring to the main objective of this tool: landslide modelling and consequent territorial management. The use of GIS technology allows the integration of data and the rendering of thematic maps: in particular, landslide susceptibility maps are key tools for land use planning, management and risk prevention. The Landslide Susceptibility Map of Italy, at 1:1,000,000 scale, is implemented by integrating DEM (20 m resolution) and lithological maps of Italy (scale 1:500,000), with the IFFI Database [23].

Thanks to the integration and the comparison of these data, the assessment of those areas suitable to be used as a reference for the implementation of a landslide susceptibility model has been performed. To this aim, physiographic domains have been identified as a basis to classify landslides into three main categories characterised by areas of homogeneous geology and geomorphology: rockfalls; rock-avalanches; slow mass flow. The modelling tests were performed with different techniques, as described in [24,25].

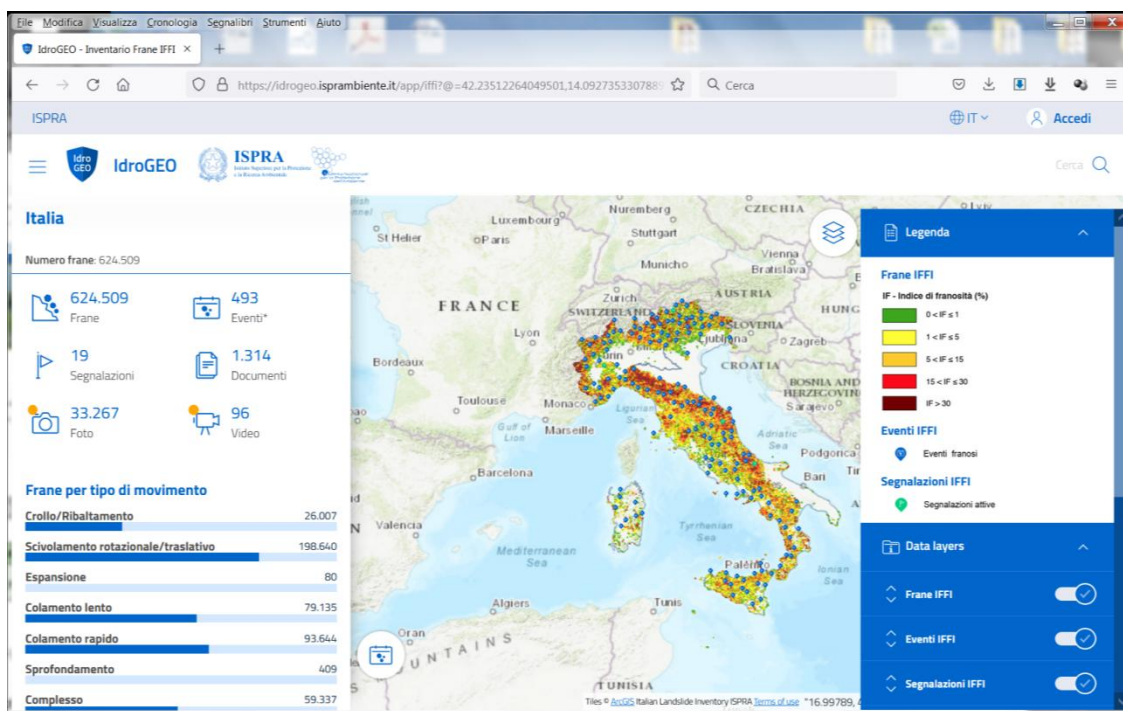


Figure 1. Italian Landslide Inventory (IFFI) Project WebGIS. The colour scale shows the index of susceptibility to landslide.

3.2. Map of nature

The “Carta della Natura” (Map of Nature) project analyses the Italian Landscape at the scale 1:250.000 and the habitats at the scale 1:50.000 [26–28]. The objective is to recognise and evaluate the conditions of the territory of the whole country: the study allows us to identify the physiographic units at a synthetic scale. The methodology is based on the Landscape Ecology theories, that integrate all the components of the landscape following a holistic approach, implemented in a GIS environment, whose setting is aimed at processing a lot of data, and rendering maps clearly representative of those themes that have been selected for specific needs.

The territorial analysis and related cartography, realised at the “regional” scale 1:250.000 allows for the interpretation of territorial settings in a dynamic sense, by monitoring landform evolutions in space and time (Figure 2).

In parallel, the detailed study, at 1:50.000 scale, reveals the habitat’s functionality and its exposure to hazards. Special attention is paid to the GIS and related databases, created both to perform thematic studies on specific areas, and to give territorial planners a powerful instrument, which would be essential in pursuing sustainable development and risk prevention. All of the above, is implemented in a Web-GIS environment, in order to make the information readily available to the public, with the possibility to be used in a personalised way [29].

In particular, the multi-scale approach allows us to select the best scale for any specific theme; moreover, it permits integration and comparison between different maps, although realised at different scales, nevertheless respecting the significance of each representation at its respective scale of analysis. A further, fundamental function of the Map of Nature GIS is in the field of divulgation. This tool is user-friendly and potentially very useful in educational and didactic programmes as data

and information can be easily visualised in the personalised GIS projects. Furthermore, thanks to PPGIS, manifold activities in distance learning can be performed: an essential contribution in these times of pandemic.

Both of the described WebGIS are able to express the results of the territorial evaluation in indexes that allow for the representation of the studied themes by classes of values. The resulting maps are generated by the integration of meaningful data, the most significant function of the multiscale and multi-disciplinary approach.

In this sense they are effective tools for the management of the territory, especially in identifying those sites characterised by fragility and exposed to natural hazards and/or are under special protection, as representative of land settings of geomorphological and environmental value: a proper way to reach a balance between use and respect of the land, risk prevention and sustainable development. Again, a wide social involvement is essential for this aim: WebGIS and PPGIS have an extremely high potential in the field of communication, dissemination, education.

4. Objectives and examples

This paper can be considered halfway between an opinion piece and a scientific paper: it is based on scientific foundation and concerns concrete experiences. At the same time, it is a vision, a wide-ranging idea: in this sense, as well as having the proposed contents it could also be considered as unconventional. We chose to emphasise the set of ideas, their originality, the potential of the informative campaign, especially considering the other cultural topics.

As already stated, the new challenge for the whole research world is the undelayable progress needed in sharing knowledge with society, aiming at activating an increasingly conscious behaviour. Some experiences have been realised during the last few years, within a fruitful cooperation between ISPRA (Institute for Environmental Protection and Research) and the University of Camerino. New approaches have been proposed, trying to integrate the complex aspects of the landscape's geomorphological settings, and the historical development of some areas of special interest. All of the above has been achieved by using unconventional topics: movies, sport, wine production. Such a kind of twinning revealed an interesting potential, which can be seen as an expression of storytelling, a new style in scientific communication, and one which is often misunderstood, (confusing science communication and science fiction, natural and supernatural). This is a new way of suggesting an integrated form of information, which is an indispensable component in a contemporary, intergenerational education, especially in a country like Italy, so full of different land settings and breath-taking panoramas. Communication begins from the shape and position of the so-called "Boot" (a nickname due to the silhouette of Italy) that encompasses a wide variety of types of landscape, natural and cultural. The above mentioned WebGIS and the related Maps, representing Landscapes, its characteristics, its hazards and resources, allows wide access to the information by the public. In particular, we would like to present three experiences, focusing on some land settings well describing the link between risk and resource as two poles of a continuum.

The objective here is to demonstrate how GIS can be effectively used to transfer information in an unexpected and profitable manner using one particular area as the experimental context.

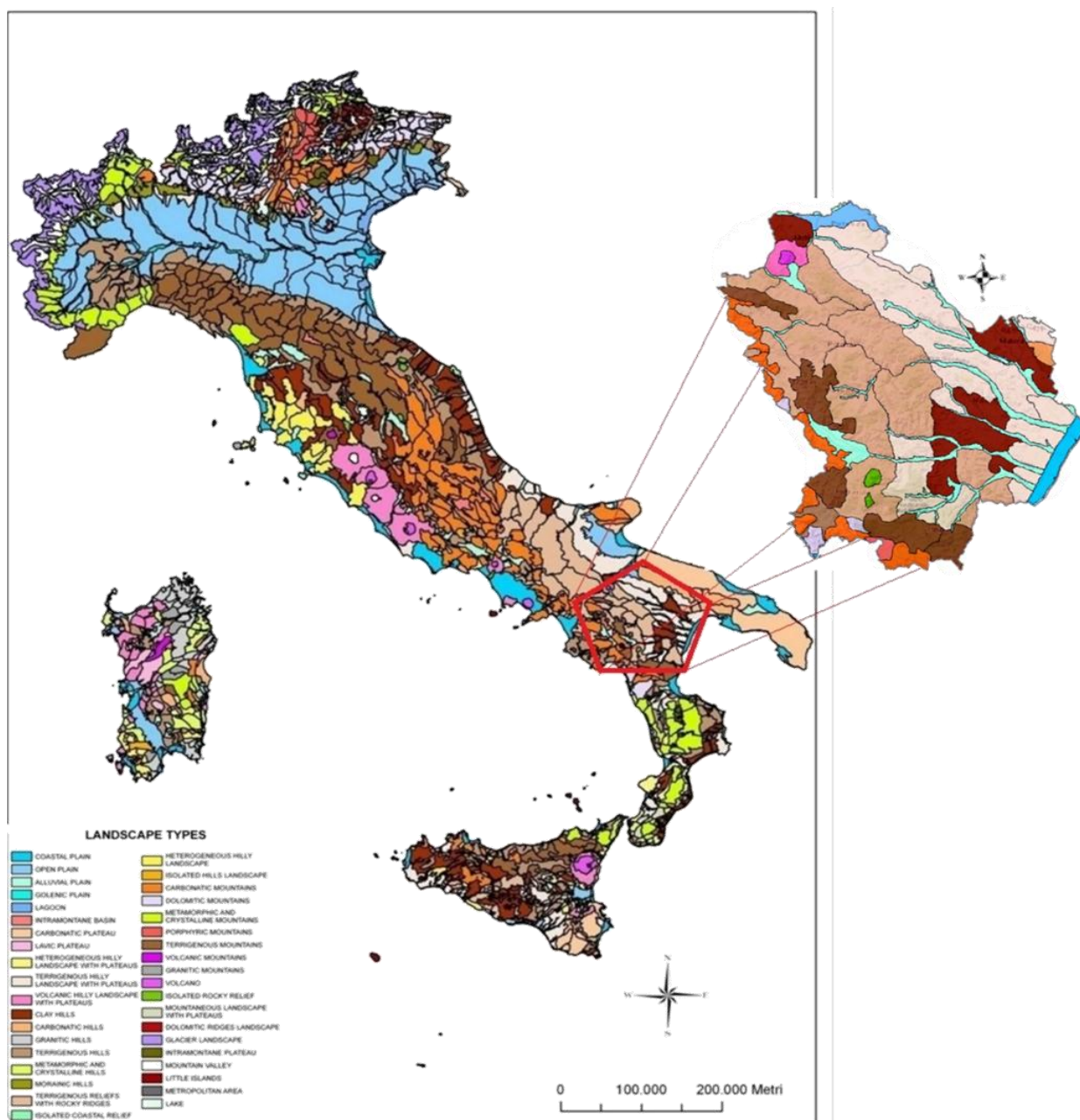


Figure 2. Italian Map of Landscapes Units scale 1:250,000; the Units of the Basilicata Region are highlighted.

4.1. Study area

We will focus on an area in Southern Italy; the Basilicata region (province of Matera). The whole region is about 10,000 sq km wide; following the “Map of Nature” Physiographic Units classification, the landscape of the region is mainly characterised by three landscape types: “Terrigenous Hilly Landscape with Plateaus”, “Terrigenous Hilly Landscape with rock ridges” and “Clay Hills”. Within the latter type, the characteristic morphologies in the area are the “calanchive” fronts, developed along the supporting slopes (Figure 3). Such a morphology is mainly set on the Subappenninic Clays, at altitudes between 150 m and 400 m asl., along with the south facing, anti-dip slopes. Their spectacular shapes are due to the erosion processes. The “calanchi” are therefore

shapes of erosion that mould those anti-dip slopes which are steep and resistant to the deterioration of mass movements, thus subject to fast linear erosion [30]. The southern exposure promotes hydro-meteoric erosion due to the accentuated temperature variations [31]. The “calanchi” shapes are due to weathering on the slope’s surface, when the already altered ground is removed by landslides. Its denudation favours the erosive process which is at the origin of the particular geometry of the studied forms [32,33]. The dry and hot climate favours the removal of certain kinds of clay minerals constituting the surface lithologies. On the contrary, during the wet periods, clay minerals are hydrated, so increasing their size: this succession of phenomena causes a surface cracking, that makes erosion occur faster. The lithological-structural characteristics and the microclimatic conditions linked to exposure [34] control the genesis and distribution of the gullies, while the anthropic factors, mainly deforestation, directly influences the rapidity of the gullies’ evolution. A further special shape can be observed at a more detailed scale: the so called “popcorn” surfaces, due to the rainfall energy that moulds small pyramidal shapes whose top is covered by gravels and fossils [35,36]. The resulting morphology testifies both territorial fragilities, in terms of landslide hazard, and the landscape’s resources as the “moon shaped” breath-taking panorama is actually precious to local communities. Many initiatives aimed at divulging those scientific concepts useful to guide people towards consciousness of the “calanchi” area in Basilicata region have been realised, by framing scientific information into a wide cultural context.

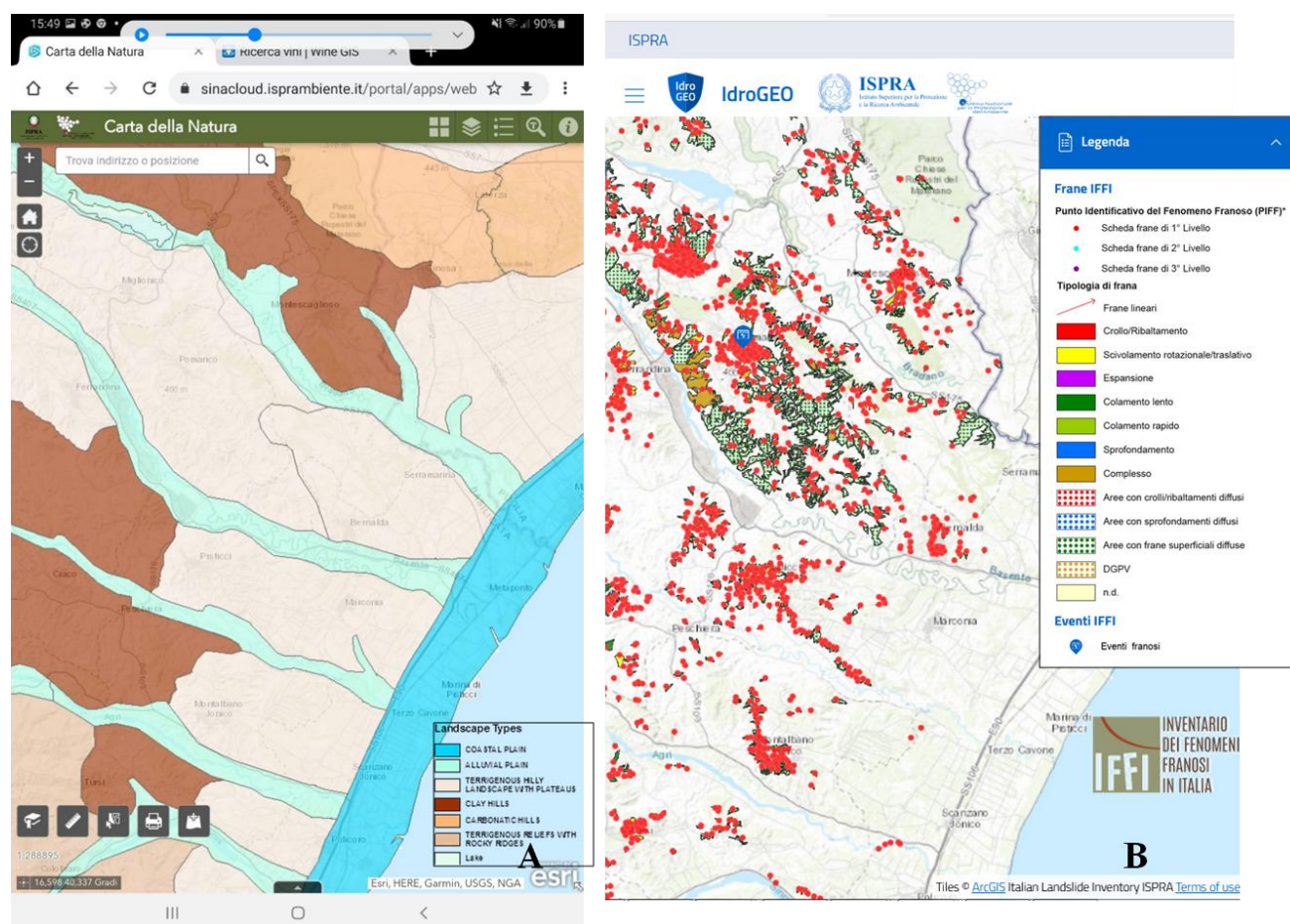


Figure 3. Italian Map of Landscapes Units scale 1:250,000 (A), showing the Landscape units of the “Calanchi” area, in the SE portion of Basilicata Region and (B) the corresponding Landslide inventory records, showing the high fragility of the landscape.



Figure 4. The “Calanchi” Landscape in Montalbano Jonico.

4.2. Examples

As noted before, GIS also have the function of sharing information about environmental issues with the whole society, by using unconventional (and appealing) topics, among which movies, sports and wine production. Initiatives such as the ones described below aim at explaining the natural and cultural Italian heritage, by referring to its wonderful landscapes, as it is a social heritage. It is essential to make the information available and comprehensible to the widest and more differentiated audience, especially referring to those social segments not yet involved in sustainable and preventive practices.

The use of topics more accessible to the public with the mediation of GIS technologies is fundamental to start an innovative process of effective communication. We believe that it is mandatory, and possible, to attract the public’s attention to the areas and, at the same time, allow people to access information to the risks related to the territory. All this, should be implemented by GIS maps and applications, superimposing the information on the specific event or topic and all of the territorial data which to be divulged, first of all those concerning the natural hazards pending on the area. The knowledge of the landsettings and their evolution, proposed through themes more appealing to the public, is an effective and unconventional way to inspire people’s awareness and trigger virtuous behaviours towards risk reduction.

The following examples have been partially realized in an experimental way, reaching an encouraging involvement of the local communities. A desirable outcome would be that the project achieve an institutional support to be implemented.

The following examples propose, through a thematic analysis [37], possible experiences of the use of GIS technologies in communicating environmental and cultural issues. The main objective is to identify similar concepts in the research data, exploring the relationships of meaning. These relationships can be used to further develop and corroborate the interpretation of theories addressing

the phenomena under study [38]. We summarise, through key points, the main aspects related to the selected examples:

In the field of outdoor sports, cycling is particularly linked to the geomorphological settings of the landscape. A lot of popular races are continuously organised, open to the non-professional cyclists: these competitions have both regional and national importance, involving not only local communities: families, friends, reporters, amateurs, talent-scouts; all of these people follow these events, and it is always a chance for organising social events, ideal to promote the territory and its culture.

1. We want to highlight one of these initiatives, located in a very special area, particularly suitable to give a concrete example of the potential of such unusual contexts: the “Calanchi bike Marathon”, which is organised in Montalbano Jonico. Its special location offers the riders and the public a spectacular tour through the most picturesque “Calanchi” extension in Southern Italy (Figure 4) and in the past few years, the chance has been taken to promote the knowledge of earth sciences and awareness of the positive potential, as well as of the fragility, of the territory [39].

2. In parallel, the communication of the natural scenario in movies and tv series, can be an engaging tool for the knowledge and the enhancement of the territorial resources [8]. The core of this idea is to integrate the characteristics of the landscape that give the story a particular significance, with the intent of unveiling the natural history on the screen. For example, “Imma Tataranni”, based on the novels written by Mariolina Venezia, produced by Rai fiction, is located in the province of Matera, and the most important scenes were filmed in the ghost village of Craco, near Pisticci (Figure 5), abandoned after a great landslide in the 80’s. The same location is the scenography of the final scenes of the famous movie “The Passion of the Christ” by Mel Gibson. The landscapes characterising some scenes in the film are spectacular, and take on meaning in the representation of the story. The episodes of the series and the scenes of the movies, shot in special places which were very interesting in terms of landscape and environmental value, are the starting point for an analysis of the relationship between society and territorial structures, aiming at addressing the problems related to territorial management and risk prevention.

3. Last but not least, the geo-environmental characterisation of the wine production areas offers an effective chance to enhance the “natural-agricultural” landscape, so typical in the Italian countryside: the “calanchi” areas, due to the geo-chemical components of soils and substrate, are surrounded by crops, orchards, and of course vineyards. Although the most famous is the Aglianico del Vulture (from a volcanic area), other interesting wines are produced in the clay hills we are focusing on, such as: the red Aglianico di Matera and Aglianico di Ferrandina: both composed mostly from Aglianico grapes. There are also the red and sparkling Lambrusco del Basento, which are produced in the province of Matera from Lambrusco Maestri grapes. On occasion of “Open Cellars”, an appointment widely appreciated by wine lovers from all over Italy, many wineries in Basilicata allow the public to taste the wines of the area by entering the cellars to discover the secrets of winemaking and aging. Many initiatives are similar to this and are aimed at allowing people to enjoy the gastronomic and artistic culture of the region, and the natural history of the sites as well. Some experiences were born during the International Year of Planet Earth (2006–2009) [40], furtherly relaunched in 2019, when Matera was designated as the European Capital of Culture.



Figure 5. Craco, the ghost village near Pisticci (province of Matera).

5. Discussion and conclusions

There are a lot of interesting situations used to divulge scientific information, which can be deemed an essential basis upon which to create a social consciousness of territory, its resources and hazards. To this aim, some products of scientific research, such as GIS, PPGIS and general cartography, become tools for involving people in an awareness-raising campaign for the general public and local authorities. It is mandatory to promote and develop a culture of prevention, and—in our opinion—it is necessary to act employing unusual methods (because the usual ones have failed). It is necessary to change perspective, focusing on long-term results, surveying many components in social behaviour, extending the inquiry to a wide and varied range of public. GIS technologies, through their potential and correct use, can play a fundamental role in reducing the risk of disasters. GIS applied to these three examples are disaster risk oriented and aim to impact practical skills on how to use GIS technologies to overcome the major challenges faced in pre-disasters, during disaster, and post-disaster management such as during early warning, hazard, vulnerability and risk assessment, as well as in the implementation of risk reduction strategies. In the use of GIS, PPGIS and cartography several factors can be important: it will be useful to utilise spatial data in disaster risk assessment and management; follow existing sources of historical disaster information; apply GIS, PPGIS in hazard, vulnerability and risk assessment and environmental communication; employ risk information and communication in emergency preparedness planning; visualise hazard and risk information; apply GIS and PPGIS to post-disaster damage assessment. Community-based analysis [41] helps decrease community exposure to hazards and increase their resilience and coping capacity. The consideration of communities within disaster risk reduction frameworks can be traced back to early works that acknowledged the importance of considering social perception and human processes in the context of risk [42]. More recently, these perspectives have expanded in depth and scope and have reverberated in literature addressing the experiences of local communities facing natural and human-made hazards [43,44]. This body of knowledge recognises that communities have always played an important role in disaster recovery and preparedness [45–47]. In this context, a PPGIS that includes a participatory methodology represents an important tool for environmental

communication and for disaster risk reduction. Indeed, a PPGIS is easy to use, thanks to its user-friendly components (webGIS, VGI, smartphone access); it can open up to multimedia contents (2D and 3D images, tags, streaming) and must represent not only the point of view (and therefore the vision of the world) of its creators or designers, but also the more heterogeneous ones of citizens [48]. PPGIS applied to environmental communication develop citizens' preparedness through the risk awareness promotion, using a community-based approach to reduce the potential impacts of natural and human-made hazards, but also informing about the importance of enhancing the natural and cultural resources of the territory as in the case of the proposed examples.

The recent, dramatic occurrences that hit the whole society, all over the world, highlighted how difficult is to share new way of thinking, and new behaviours aimed at preventing risks. A lot of people tend to deny even the most obvious scientific evidence. A simple mechanism, made up of superficiality, ignorance, unconsciousness, makes people feel invincible: expressed as "not now, not to me".

The only effective way to counter this trend is to make the population aware of what risk is, and the responsibility of the individual/community/society in exposing themselves to hazards, which, in turn, converts it into risk. It is mandatory to share information and to make it understandable, also by means of modern GIS cartography, as we wanted to show in this contribution. The public participation geographic information systems (PPGIS) represent a further evolution of GIS. The appellation was coined to explain the high potential of GIS in both supporting policy making and in involving marginalised communities in enhancing their own culture.

Specifically, cycling, communication of the natural scenario in movies and tv series and promotion of geo-environmental characterisation of the wine production areas are important examples in which the communication of risk, related to the importance of the link between nature and culture that characterises these places, can be spread among citizens with the help of PPGIS technologies. Film productions have become, for the purposes of promoting the area, a fundamental tool through which to represent and exalt the natural scenery of an area. This is demonstrated by the flourishing, outside and inside Italy, of film festivals, including small and independent ones, and of film commissions that aim to attract film productions.

Even cycling immerses people in the spirit of the places that the cyclist passes through, in their traditions and aspirations, in their "load of humanity". Through cycling we cross the major tourist destinations, favouring the routes between one and the other, the experienced landscapes, the infinite possible divagations, the encounters along the way. It is a "human" tour, because nowadays almost all landscapes are cultural, therefore shaped by human beings, which aims to show the link between nature and culture.

Finally, wine tourism is a journey aimed at discovering the wine offer of a territory and through which tourists can experience the local culture and acquire a sense of the place and is one of the best opportunities for sustainable rural development in many regions around the world [49].

In these contexts, citizens can become recipients, but also the main actors who contribute to the creation of useful information for the tourist promotion of these places and also for an educational use through PPGIS tools. In fact, PPGIS are actually a "social" development of GIS, as an instrument in the "bottom-up" approaches, referring to participatory democracy. The community-based approach is originally aimed at people targeted for humanitarian assistance, in order to provide them with "the right to participate in making decisions that affect their lives" as well as "a right to information and transparency" by the aid's supporters. But in the face of the situation that characterises the worrying relationship between us, Humankind, and the planet in which we live, we

can extend the right of taking an active part in public affairs, so stepping ahead, towards the main goal of a concrete participatory democracy. The European Union is developing programmes to make citizens able to participate in policy making, by offering society adequate instruments.

It is necessary to go on, being aware that behavioural changes in society require more than a generation, to become part of the cultural heritage. It is also essential to resort to intergenerational communication, aiming at filling those gaps—due to distraction, superficiality, lack of time—characterising the interaction between decision-makers, voters, and society. Science is fast moving forward, with the support of increasingly effective technology. Paradoxically, a growing gap is created with the so-called ordinary people (actually ourselves). Indeed, nobody likes to think that the planet we live on is undergoing changes towards a point of no return. Systems, functions and dynamics that allow the Earth to live, are progressively deteriorating, and resilience does not have infinite possibilities. It is therefore necessary to reach a shared change of mind, to create new liveable balances, based on sustainability. Science and dialogue are at the same time starting points, paths and objectives in the challenge for life in the Anthropocene.

Authorship contribution statement

Francesca Romana Lugeri: Conceptualization, Methodology, Writing—original draft, Writing—review & editing. Nicola Lugeri: Conceptualization, Methodology, Writing—review & editing. Piero Farabollini: Conceptualization, Methodology, Writing—review & editing, Supervision. Francesco De Pascale: Methodology, Writing—review & editing and Results Discussion.

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Conflict of interest

The authors declare no conflict of interest.

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