# NATURAL HERITAGE MANAGEMENT AND PROMOTION THROUGH FREE AND OPEN SOURCE SOFTWARE: A PRELIMINARY SYSTEM DESIGN FOR THE INSUBRIPARKS PROJECT

D. Oxoli[1]*, M. Cannata[2], V. Terza[3], M. A. Brovelli[1]

[1] Department of Civil and Environmental Engineering, Politecnico di Milano, Como Campus, Como, Italy - (maria.brovelli, daniele.oxoli)@polimi.it
[2] IST-SUPSI, Institute of Earth Sciences, Canobbio, Switzerland - massimiliano.cannata@supsi.ch
[3] Parco Regionale Spina Verde, Como, Italy - vittorioterza@spinaverde.it

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**ABSTRACT:**

Nowadays, sustainable development and preservation of territories poses a number of challenges requiring innovative and robust technological tools to fully accomplish them. According to this, the design of an integrated tourism management system is here discussed. The tourism management system is developed for the Insubria Region within the INSUBRIPARKS project, funded by the Interreg program of the European Union. The Insubria is a historical-geographical area stretches between Northern Italy and Southern Switzerland embedding a valuable historical and natural heritage. Nevertheless, the tourism potential of the region is not fully exploited due to a fragmented political context within the geographical area that extends across different local and national jurisdictions. The final goal of the project to increase tourism attractiveness of the Insubria Region through the provision of physical infrastructure, the development and promotion of new tourism experiences, and the deployment of a standardized Information Technology infrastructure to support cross-border land management and marketing operations. Central to this paper is the preliminary design of this infrastructure that will provide tools for supporting information generating and consuming among project partners and external stakeholders. The design phase leverages exclusively Free and Open Source Software. Alongside the preliminary architecture, both use cases and user requirements are discussed together with the expected benefits deriving from the co-creation of best tourism management practices by means of open and shared software platforms.

## 1. INTRODUCTION

The management and promotion of peculiar territories such as protected areas and natural parks have emerged as critical tasks to unpin their tourism potential while ensuring sustainable exploitation of their landscape and environmental resources. These tasks are often hindered by fragmented political contexts to which each protected area may be subjected. This may prevent optimal management due to competitive actions as well as weak cooperation among the decision makers (Holden, 2016).

In this context, the implementation of smart Information Technology (IT) applications that support sharing of management-related information as well as fostering of tourism experiences across territories has led to countless benefits to the tourism market (Gretzel et al., 2015, Antonovic et al., 2015, Li et al., 2017). Indeed, modern Web technologies are key to aid co-ordination across the organizational boundaries, by reducing technological barriers and costs of decision making that are relevant to geographically distributed organizations (Buhalis, 2003, Chon, 2013, Masron et al., 2016).

With this in mind, we introduce here the INSUBRIPARKS project, an Interreg funded project aiming at the harmonisation of management and promotion practices of natural parks along the cross-border area between Italy and Switzerland. The Interreg program is an initiative of the European Union aiming at promoting investments, innovation and implementation effort

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*Corresponding author

to boost cooperation among regional and local governments across the continent to ensure sustainable impacts for people and territories (http://www.interreg-italiasvizzera.eu). According to this, the INSUBRIPARKS project objective is to develop a network of tourism experiences and facilities through the co-operation among project partners.

The project encompasses multiple actions including the provision of physical infrastructures, mainly dedicated to pedestrian mobility, and the development of a standardized IT infrastructure. The latter is conceived to improve information generating and consuming among project partners and stakeholders. The target content ranges from geospatial datasets - including tourism landmarks and facilities - to information from the crowd such as social media posts and reviews. Environmental sensor observations, namely visitor counts, are also considered. The IT infrastructure is designed to include exclusively Free and Open Source Software (FOSS) components and it will provide a unified data endpoint for the park managers as well as a dedicated Web client application for visitors to enhance the virtual exploration of natural parks attractions. Alongside the preliminary design of the system architecture, both use cases and user requirements are briefly discussed. Issues connected to critical data collection and harmonization are outlined. The assets provided by the use of FOSS for the development of the standardized IT infrastructure of the INSUBRIPARKS project is discussed together with the underlying benefits deriving from the co-creation of best management practices by means of open and shared software platform.

The paper continues as follows. Section 2 includes an overview of the project partners, activities, and objectives. In Section 3, the preliminary design of the IT infrastructure is discussed. Expected results and conclusions are reported respectively in Section 4 and Section 5.

## 2. THE INSUBRIPARKS PROJECT

The INSUBRIPARKS is an Interreg project funded within the transnational cooperation program between Italy and Switzerland 2014-2020. The project proposal was conceived by some of the Lombardy Region (Northern Italy) natural parks belonging to the Insubria Region (Figure 1), from which the project inherits its name. The Insubria is a historical-geographical region stretching approximately between the Adda river (East) and the Sesia river (West), and between the St. Gotthard Pass (Southern Switzerland) in the north and the Po Valley in the south.

This region encompasses a number of interconnected landscapes ranging from the plain to the Alpine environment, crossing the world-wide famous region of sub-alpine lakes, such as the Como Lake, and including many urban centres which are among the major commercial and cultural hubs of both the Lombardy Region and the Canton of Ticino (Southern Switzerland).

### 2.1 Motivations and Partnership

The INSUBRIPARKS project aims at overcoming the qualificatory role of ”green islands” that is often entitled to natural parks located along heavily urbanized regions, such as the Insubria Region. This by designing and implementing strategies to integrate the common natural, cultural and historical heritage characterizing the project area and - at the same time - to leverage the local peculiarities of each natural park and surrounding territories.

In view of the above, the project team is composed primarily by the natural parks (Figure 1) of the Insubria Region. These are for the Italian side namely Spina Verde (https://www.spinaverde.it), Campo dei Fiori (http://www.parcocampodeifiori.it), and Pineta (http://www.parcopineta.org). For the Swiss side, two parks are involved namely Gole della Breggia (https://tinyurl.com/y243ryft) and Bosco del Penz which is legally represented by the municipality of Chiasso (https://www.chiasso.ch). Parks are also identified as primary stakeholders of the project that is expected to unpin the actual tourism potential of this cross-border area by creating better physical as well as virtual connections among the local tourist attractions.

The no-profit organization Pro Val Mulini ONLUS (http://www.provalmulini.eu) is involved for concerning of the historical and cultural aspects of the project. The Swiss Regional Tourism Office (OTR) Mendrisiotto Turismo (https://www.mendrisiottoturismo.ch) participates to the project to provide the know-how on best tourism management practices.

Finally, the scientific partners Politecnico di Milano (https://www.polimi.it) from the Italian side, and The University of Applied Sciences and Arts of Southern Switzerland (SUPSI, http://www.supsi.ch) from the Swiss side, are in charge of the technological component of the project that encompasses the digital data collection and analysis as well the development of the standardized IT infrastructure.
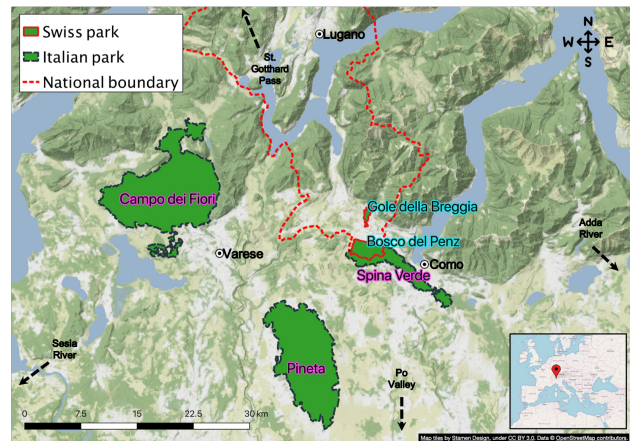


Figure 1. Project area and the natural parks involved in the INSUBRIPARKS project

### 2.2 Objectives and Activities

According to the assets and expertise provided by each partner and the number of common cultural and environmental heritage characterizing the project area, the main objectives of INSUBRIPARKS is to better connect and promote all those peculiarities to allow exploiting the real tourism potential of the Insubria Region.
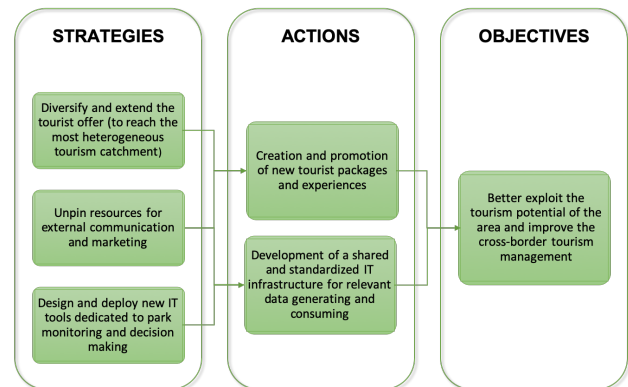


Figure 2. Summary of the INSUBRIPARKS project strategies, actions, and objective

To achieve the above, three main strategies are considered (Figure 2). The first one is to leverage and extend the available touristic experiences offered by the parks. A number of touristic packages, intended here as new or upgraded thematic itineraries, will be designed and empowered with new infrastructures as well as extended in terms of cultural content. The second strategy consists of the development of a unified communication and marketing office for the promotion of the project outcomes aiming at reaching the largest external audience through the extensive use of emerging Web and social media as well as to the coordination of public events and congresses. In parallel, a central management office will be set up that will guarantee coordination among partners activities as well as control over both the administrative and technical edges of the project.

Finally, the whole system will take advantage of a standardized IT infrastructure that is designed to cope with data collection, analysis, and access needs connected to both the integrated

management of the parks and the virtual exploration of the project area by the tourists. The preliminary design of the standardized IT infrastructure, including both functionalities and the software architecture, is discussed in the next section.

The whole project activities are organized into nine dedicated Working Packages (WP). The WP activities are summarized in the project work breakdown structure included in Figure 3.
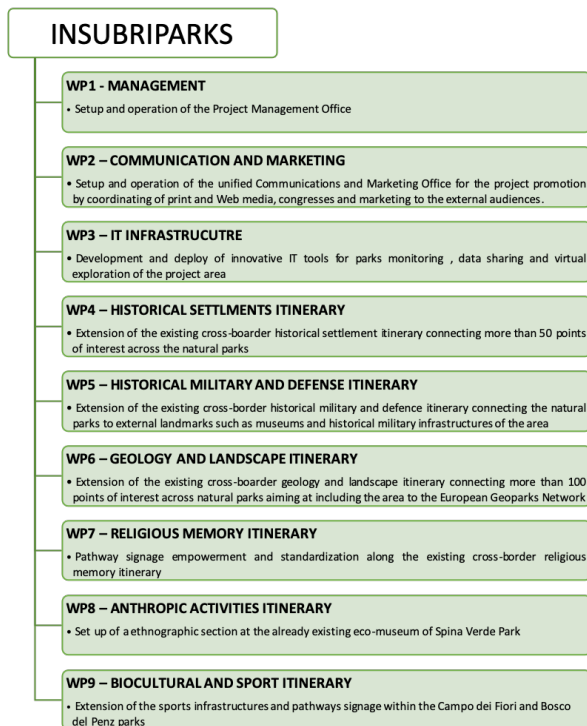


## INSUBRIPARKS

**WP1 - MANAGEMENT**
• Setup and operation of the Project Management Office

**WP2 – COMMUNICATION AND MARKETING**
• Setup and operation of the unified Communications and Marketing Office for the project promotion by coordinating of print and Web media, congresses and marketing to the external audiences.

**WP3 – IT INFRASTRUCUTRE**
• Development and deploy of innovative IT tools for parks monitoring , data sharing and virtual exploration of the project area

**WP4 – HISTORICAL SETTLMENTS ITINERARY**
• Extension of the existing cross-boarder historical settlement itinerary connecting more than 50 points of interest across the natural parks

**WP5 – HISTORICAL MILITARY AND DEFENSE ITINERARY**
• Extension of the existing cross-border historical military and defence itinerary connecting the natural parks to external landmarks such as museums and historical military infrastructures of the area

**WP6 – GEOLOGY AND LANDSCAPE ITINERARY**
• Extension of the existing cross-boarder geology and landscape itinerary connecting more than 100 points of interest across natural parks aiming at including the area to the European Geoparks Network

**WP7 – RELIGIOUS MEMORY ITINERARY**
• Pathway signage empowerment and standardization along the existing cross-border religious memory itinerary

**WP8 – ANTHROPIC ACTIVITIES ITINERARY**
• Set up of a ethnographic section at the already existing eco-museum of Spina Verde Park

**WP9 – BIOCULTURAL AND SPORT ITINERARY**
• Extension of the sports infrastructures and pathways signage within the Campo dei Fiori and Bosco del Penz parks

Figure 3. Schematic of the INSUBRIPARKS project work breakdown structure

## 3. IT INFRASTRUCTURE DESIGN FOR NATURAL HERITAGE AND TOURISM PROMOTION

The success of any tourism system is determined by the availability of robust and innovative tools for monitoring, planning and marketing operations (Jovanović, 2016). Therefore, the adoption of cutting-edge technologies to support each project activity has been recognized as a key point by the INSUBRIPARKS project partners. Indeed, the development of a standardized IT infrastructure for relevant information collecting, sharing, and consuming among project stakeholders has been included among the project core activities.

The main goal of the IT infrastructure is to empower all the cross-cutting management and promotion operations - involving data - with a comprehensive suite of IT tools. These operations include monitoring of the environment and the tourism fluxes within the parks by the parks managers, the coordination and design of promotional activities and the virtual exploration of the park attractions by the tourists, among others. With this in mind, the target data that will be systematically integrated into the infrastructure include base cartographic information regarding transport, accommodation facilities, services, point of interest and infrastructure located in the project area. Data from the crowd such as videos, pictures, online reviews and social media posts produced by the visitors will be selectively crawled and stored in the system to foster a new sight of the territory.

Finally, a physical sensors network will be deployed at the principal tourist hot spots of the area. The sensors will deliver visitor counts observations to the IT infrastructure. This observations, together with the crowdsourced data, will be exploited to better understand tourism fluxes features and better design both planning and marketing activities. Finally, the IT infrastructure will be enriched with the installation of some smart IT stations that will provide visitors with access to scientific and cultural content directly on the field, with the aim of augmenting their tourism experiences within the parks.

Most of the target data have a strong geographical trait that suggests the use of Geographic Information Systems (GIS) technologies as the most logical pattern for the development of the IT infrastructure. In general terms, GIS play a critical rule in any modern management practice. Accordingly, the combination of multimedia content and Web technology with GIS provided in a number of cases with substantial enhancement to the attractiveness also of tourism systems (Wei, 2012).

A parallel concern in conceiving the IT infrastructure is about the technology costs and the long term sustainability of the system. Considering the very diverse technological and institutional background among partners, the IT infrastructure design focuses on leveraging already existing and stable technologies to deploy innovative solutions. In particular, FOSS technologies offer capable and reliable software to contribute to the creation of the IT infrastructure by ensuring equitable access to the system functionalities to each partner that is not bounded by any license or purchase constraint (Brovelli et al., 2017). Moreover, the maturity reached by most of FOSS solutions guarantees usability as well as provide the system with a potential to be empowered, replicated and customized with reduced development and economic efforts (Cannata et al., 2015).
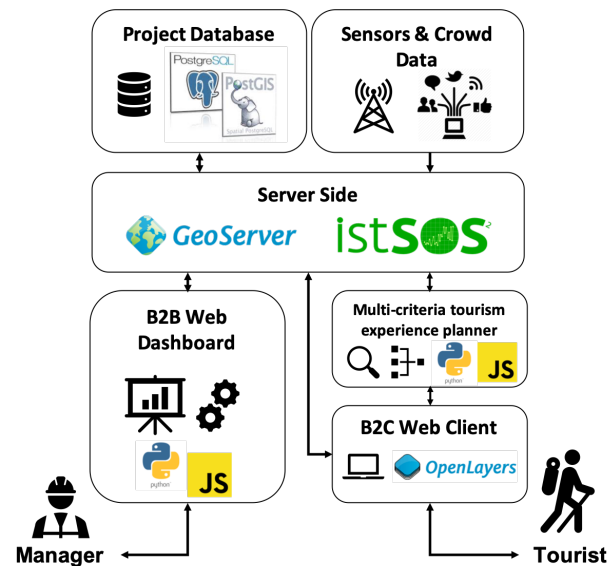


Figure 4. Preliminary architecture of the INSUBRIPARKS IT infrastructure

In view of the above, the INSUBRIPARKS IT infrastructure will include the following main components (Figure 4). The server-side will be implemented to dynamically store, organize, and expose both geospatial data and non-spatial content. The data endpoint will be implemented considering cutting-edge FOSS solutions such as PostgreSQL-PostGIS (https://postgis.net), GeoServer (http://geoserver.org) and istSOS

(http://istsos.org). While PostgreSQL-PostGIS is the database where the structured geospatial information is stored, Geoserver and istSOS will expose the relative data through Web services compliant with the Open Geospatial Consortium (OGC) standards. In particular, Geoserver will offer a dedicated Web Mapping Service (WMS), Web Feature Service (WFS) and Web Coverage Service (WCS) to distribute geographical data while istSOS will offer a Sensor Observation Service (SOS) to collect and dispatch time series observations collected by sensors or citizens. The usage of international standard foster the interoperability and the decoupling of back-end development from the front-end since the communication and data exchange occurs following well defined and commonly accepted protocols and formats. This permits the reuse of technical components and the optimization of costs and efforts, for example the OpenLayers JavaScript library (https://openlayers.org) that support WMS, WFS and WCS can be used to implement dynamic maps in the browser to illustrate the territory of interest and the available itineraries.

Upon this component, a custom Web dashboard enabling data management and processing will be created to provide a Business-to-Business (B2B) platform to project partners with a focus on park managers. Finally, a map-based Web client will provide users with Business-to-Customer (B2C) functionalities such as interaction with the information layers as well as access to smart tools for tourism experience planning. The latter will allow users getting suggestions and insight into the most suitable tourism packages or itineraries according to their expressed preferences and needs.

The client will integrate common operations such as query with the unique visualization benefits offered by maps. The client will take advantage of standard FOSS Web mapping libraries such as OpenLayers. Custom modules will be developed ad-hoc allowing a dynamic interaction with the data endpoint. A graphical schema of the architecture is included in Figure 4.

## 4.  EXPECTED RESULTS

The tourism management system that the INSUBRIPARKS project aims at developing is expected to deliver a number of benefits to the tourism promotion of the Insubria Region.

On one side, the provision of new of infrastructure and facilities, as well as the extension of tourism packages and - in turn - of the tourism offer will pose as the main tangible outcome from the visitors perspective. Indeed, visitors will finally have the possibility of enjoying multiple thematic itineraries within a park and/or following an analogous theme across multiple parks. This enabled possibility is critical to the underlying project goal that consists of producing a positive economic impact along the project area by facilitating visitors circulation between the Lombardy Region and the Canton of Ticino. On the other side, the deployment of the standardized IT infrastructure aims at providing a unified hub of tourism information for the area. Indeed, this wealth of information is currently underexploited or partially fragmented into the partner Websites. Afterwards, the conceived IT exploration tools such as the multi-criteria tourism experience planning module will take advantage of the hub, thus providing an immersive virtual experience to potential visitors which will be allowed to interact with their data of interest improving their connection and involvement with the INSUBRIPARKS.

In parallel, the availability of open and shared IT tools for data managing - such as the B2B Web Dashboard - promises to fill both communication and coordination gaps among partners throughout any the management and promotion tasks. Especially, those tasks affecting not only their inner area but also neighbouring territories that require timely and structured access to any strategic and contextual information.

Finally, the availability of ordered and accessible records through the data endpoint may benefit also the monitoring of progress and impacts of the project itself by allowing for measuring of Key Performance Indicators (KPI). These may involve both real-time and historical analysis e.g. of sensor and crowd-sourced data to assess the global and local performances of the tourism systems providing valuable insight to planners and decision makers.

## 5.  CONCLUSIONS

To conclude, in this paper the general features of the INSUBRI-PARKS Interreg project were spelt out. The potential benefits of introducing a FOSS-based IT infrastructure into a geographically extended tourism management system were discussed. Target data of the project were mentioned by highlighting the strong geographical component of the information required. A preliminary architecture of the IT infrastructure was presented by leveraging some of the most mature and flexible FOSS and FOSS GIS (FOSS4G) Web technologies.

The INSIBRIPARKS project is currently in its start-up phase. Part of the project strategies as well as components of the preliminary system architecture might be re-designed or adjusted according to the project intermediate outcomes.

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