POLITECNICO DI MILANO

PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 39th cycle

PNRR 118 PA Research Field: EARTH OBSERVATION AND GEOGRAPHIC DATA TO SUPPORT REGIONAL LAND PLANNING

Monthly net income of PhDscholarship (max 36 months)
€ 1275.0 In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	The regional administrations have in charge the coordination of land planning projects and monitoring, in cooperation with local administrations. Geospatial data are the background for any operations, to be integrated with related information. This PhD project will be developed in cooperation with the Administration of Lombardia Region (RL) and would like to focus on the development of tools for planning and monitoring actions related to the regional land planning. The focus is given to three main tasks, which are strictly correlated: •to limit the 'land take' and promote land regeneration; •to limit the 'soil sealing'; and •to develop a Regional Green Infrastructure connecting territories providing Ecosystem Services and promoting Biodiversity. These goals are fostered by the United Nations (SDGs), EU (e.g., COM-2011 no. 571, Green Deal: Biodiversity strategy to 2030) and important in the **PNRR** (mainly **Mission M2C4**, but with other goals spread out in other missions). RL has targeted their achievement and has ruled out some regional laws, which are supposed to

	control related processes. Since in recent years we have learnt about several unprecedented new factors that affected regional policies (e.g, pandemic, energy crisis, etc.) the implementation of these objectives requires a flexible approach and then a dynamic action to monitor quick evolution. The topic of the proposed PhD project is then to help RL to activate new methodologies to deal with planning and monitoring of projects related to the abovementioned goals. While standard geographical data (e.g., geo-databases, orthoimages, thematic maps) have been already exploited to this purpose, open data from space obtained by European Earth Observation (EO) missions (e.g., Copernicus and forthcoming IRIDE) may add potential new knowledge on the way the territory changes within time, with a time frequency higher (in terms of a few month) than the one that is currently available (years). The application of new satellite data (optical and radar) will allow to detect major changes due to the low spatial resolution. But with the advent of new constellations providing data at high resolution (IRIDE mission will provide optical data at 3 m ground resolution), this approach will be useful to understand minor changes as well. Data from space will be integrated with standard digital maps and other types of geospatial data. If the use of new EO data is the first key-point of this PhD project, the second is **the service to the administration of RL, which will take advantage of the outcomes of this research which will consist in innovative methods, guidelines and procedures to support Public Administration**.
Methods and techniques that will be developed and used to carry out the research	The focus of this PhD research is to develop operational workflows and guidelines to help regional land/urban planning. Handling different types of geospatial data with GIS (Geographic Information System) tools is the core of this project. Digital data such as the Regional Geospatial Database, orthophotos, maps of land coverage and use, plans for land government (PGT), cadastral maps, risk maps, and online maps from commercial geoportals will be used for the analysis as well as to understand the changes within time.

	Techniques for map comparison based on vector-to-raster and topological analysis will be applied and developed. On the other side, open satellite data available from EO services (mainly Copernicus and in the future IRIDE missions) will be used to retrieve information about changes within time. Processing remote-sensing data will be a methodology to be applied, from standard procedure for pre-processing and georeferencing, up to classification procedures. The research will consist in three main phases, to be modulated (and also changed) depending on the results and data availability: 1. definition of goals and applications to develop; 2. data mining and focus on the methodology to be applied; and 3. tentative automation of procedures defined at points 1 and 2, with application of machine learning techniques. This project is focused to provide to the **Integrated GIS Structure of Lombardy Regional Administration (Regione Lombardia - DG Territorio e Protezione civile - Struttura Sistema Informativo Territoriale Integrato)** the chance for an important step forward in this direction. The ABC department has signed a cooperation agreement with this institution, making easy the collaboration framework. This will imply: •**an internship for a total period of 6 months** (also non continuous) in their offices in Milano; •their support for the entire PhD in terms of available data and priorities of the Regional Administration; •the result of this project should be focused to become operational workflows, procedures and guidelines, not mere theoretical and technical developments. To support this research by adding value from experiences carried out on other countries, **a period abroad in a public administration, a facility management or a data provider company, or a university, will be scheduled. This period abroad will last 6 months**.

Educational objectives	•The educational objectives will be supported by internal/external courses to improve the PhD candidate?s skills on processing geographic data in GIS environment, and to handle and process EO data. •Machine learning techniques will be also included in training. •More generally, the candidate is suppose to become able to analyze and compare data related to the development of application for land planning and management, topics that will be also included in the educational objectives.
Job opportunities	•Public administration and private companies (e.g., in the facility management sector) which adopts geographical and EO data for their business. •Research centres dealing with data infrastructures and land use analysis. •Software developer companies in the field of EO.
Composition of the research group	2 Full Professors 2 Associated Professors 1 Assistant Professors 2 PhD Students
Name of the research directors	Profs. M. Scaioni, F. Guzzetti, M Gianinetto

Contacts
Prof. Marco Scaioni marco.scaioni@polimi.it

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	637.5 €
By number of months	6

National Operational Program for Research and Innovation

Company where the candidate will attend the stage (name and brief description)	Regione Lombardia - DG Territorio e Protezione civile - Struttura Sistema Informativo Territoriale Integrato
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	To be defined
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Additional support:
Budget for the research activity (only for positions supported by scholarship): total amount Euro 5197.60 per student.
In detail:
- 1st year Euro 1732.53
- 2nd year Euro 1732.53
- 3rd year Euro 1732.53

Additional information about the organization and regulations of ABC-PhD programme can be found in the Regulations for the 39th Cycle of ABC-PhD: download is available at link: https://www.dottorato.polimi.it/corsi-di-dottorato/architettura/architettura-ingegneria-delle-costruzioni-e-ambiente-costruito

Additional information about ABC department and ABC-PhD programme: available at link: https://www.dabc.polimi.it/
Desk availability: The ABC department provides non-permanent desks to be temporarily booked in common PhD rooms.

This scholarship is funded by the PNRR national programme under the research line on "Public Administration" in D.M. 118. This means that the owner of the position will be obliged to submit periodical reports about her/his activity.