SMARTLAGOON

DELIVERABLE 7.4

Joint Collaboration Task Work Plan

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017861.

SMARTLAGOON

Innovative modelling approaches for predicting Socio-environMentAl evolution in highly anthRopized coasTal LAGOONs

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Abstract

SMARTLAGOON Project benefits from the support of the Horizon 2020 programme of the European Union within the framework of an Innovation Action. To ensure the development of their activities to achieve the expected results the eight organizations members of the consortium will release some deliverables during the timeline of the project (48 months in total).
These deliverables are numbered and depend on each Work Package.
The present deliverable D7.4 named “Joint Collaboration Task Work Plan” is the first draft of the Collaboration Plan following the development of an inter-project Collaboration Agreement between the FET projects (see Annex). The deliverable is jointly prepared by the projects funded under the H2020 FET Environmental Intelligence call: I-Seed, SMARTLAGOON, WatchPlant, RAMONES and Re-SET.

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Introduction

This deliverable is the first draft of the Collaboration Plan following the development of an inter-project Collaboration Agreement between the FET projects (see Annex). The deliverable is jointly prepared by the projects funded under the H2020 FET Environmental Intelligence call: I-Seed, SMARTLAGOON, WatchPlant, RAMONES and ReSET.

The overall goals of the Environmental Intelligence (EI) cross-project collaboration are (1) to define a joint vision and blueprint for Environmental Intelligence, and (2) to foster discussion and knowledge sharing between the interdisciplinary communities involved in the five projects and (3) improving visibility and outreach of the concept of Environmental Intelligence for all key stakeholders across the projects.

The collaboration will be fostered through a series of activities that have been outlined in the Collaboration Agreement, and further elaborated in this deliverable as a proposal for actions going forward.

Plan for preparation of the BluePrint for Environmental Intelligence

The first version of the Blueprint for Environmental Intelligence will be released at M12. The contents of the document will be defined in detail by the project coordinators and their consortia via exchange of emails and meetings. A first in-person meeting is envisioned to take place on the occasion of the special track on Environmental Intelligence in the 2021 ACM International Conference on Information Technology for Social Good (GoodIT 2021; September 9 – 11, 2021; Rome, Italy). The representatives of the five funded FET PROACTIVE projects will all join this Conference depending on prevailing COVID-19 guidance.

Preliminary discussions have been held during a range of on-line joint meetings (including the project's kick-off meetings) and some ideas for content of the first version of the Blueprint for Environmental Intelligence (EI) have been stated, including:

Proposed overall lead(s) [preliminary and subject to change]. First deliverable: Mark Mulligan and Theo Mertzimekis. Second deliverable: Laura García Carmona and Javier Senent Aparicio. Third deliverable: Barbara Mazzolai and Laura García Carmona. Fourth Deliverable: to be defined. We envisage the blueprint including a range of sections such as:

- Definition of Environmental Intelligence: envisioning a new approach to understand and help identify solutions to environmental problems by adopting a multi-disciplinary, technology led approach including robotics, advanced sensors, actuators, and engineering, AI, nature-based solutions, chemistry, material science, models, mathematics and environmental policy. A relevant reference is available here:

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- A guide on current technologies and best practices for Environmental Intelligence: insights from active projects (e.g. from I-Seed enabling technologies: what can bio-inspired robotics offer to EI? What is the state of the art? What is needed?...)
- EU and global initiatives relevant to EI
- relevant communities and networks in EI-related fields
- High-level rules and best practices as indications for future EI projects
- Actions and needs for governments and agencies as suggestions for next work-programmes

This brief report (max 20 pages) will be further developed in future iterations

Joint activities

Joint publications

Joint publications pave the way to maximize the awareness of the topic by scientists in several related areas in the multidisciplinary context covered by EI. In this sense, Special Issues in specialized journals dedicated to a chosen topic will provide the latest work and the state of the art in a unique and valuable reference source for every researcher interested in that area.

A proposal for a Special Issue on Environmental Intelligence has been prepared already and submitted to the IEEE Internet of Things (IoT) journal at the end of M3. The Special Issue focuses on new techniques for modeling and predicting socio-environmental evolution across different temporal and spatial scales by the design of radically novel approaches to resilient, reliable, and environmentally responsible in-situ monitoring. The submitted proposal is listed in Annex 2.

Other possibilities:

In the event that the EI proposal is rejected for publication in the IEEE IoT journal, other journals such as the following will be considered:

- Journal of Environmental Management
- Nature Machine Intelligence
- Technology in Society
- Frontiers in Robotics and AI
- IEEE Robotics and Automation Magazine
- Science Robotics
- Scientific reports

Joint conferences and events

Joint conferences and events will maximize visibility of the topic such as opportunities for enabling technologies in related areas to benefit social good. Additionally, it provides a chance for face-to-face meetings of the EI projects to establish working sessions for collaborative activities.

1. **GoodIT September 2021: Lead: José M. Cecilia**

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A special track on IT for Environmental Intelligence will be organised annually at the GoodIT conference where representatives of I-Seed, SMARTLAGOON, WatchPlant, RAMONES and ReSET will be present and will allow the exchange of ideas for the annually updated blueprint document (M12).

- Papers submitted include (drafts):
  - Mulligan et al. (2021) Environmental Intelligence for more Sustainable Infrastructure Investment. Submitted GOOD-IT.
  - Cecilia et al. (2021) SMARTLAGOON: Innovative modelling approaches for predicting socio-environmental evolution in highly anthropized coastal lagoons. Submitted GOOD-IT.
  - García-Carmoma et al. (2021). Alife biohybrid systems for environmental intelligence: WatchPlant project.GoodIT_WatchPlant_concept-paper. Submitted GOOD-IT.
  - Mazzolai et al. (2021). Towards new frontiers for distributed environmental monitoring based on an ecosystem of plant seed-like soft robots. Submitted GOOD-IT.

2. Possibilities for other scientific conferences:

Below we discuss other possible conferences where joint sessions on Environmental Intelligence can be developed.

- A possible forthcoming event to propose a joint initiative is the 2022 IEEE International Conference on Soft Robotics, RoboSoft 2022 (https://softroboticsconference.org/). Barbara Mazzolai is General Chair and the event will be held on 4-8 April, 2022, in Edinburgh. The Conference theme is: “Soft Robot for the Planet”. Programme contents are currently under definition and there are a few options that we can propose together:
  - (I) joint round table session on EI;
  - (II) a Science Café on E.I. (similar to round table, but open to the general public too and moderated by a scientific journalist); to promote citizens' awareness and participation in E.I. topic.
  - (III) a workshop on Environmental Intelligence (workshops will be held on the 4th, and the indicative deadline for proposals is mid/end of October 2021)

For 2022, 2023 or 2024 we could evaluate also a proposal for a workshop at:

- ICRA (https://www.ieee-ras.org/conferences-workshops/fully-sponsored/icra)
- IROS (https://www.ieee-ras.org/conferences-workshops/financially-co-sponsored/iros)
- RSS (https://roboticsconference.org/)

3. Possible communication initiatives for students and the general public

Communication activities for the general public (in science fairs, etc.) could be organized under joint conferences and events to promote citizens' awareness and participation in Environmental Intelligence. Additionally, a series of lectures (virtual) on EI from various consortium partners on specific topics and relevant external experts for PhD students and young researchers of the various teams, to be published on EI projects websites.

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Joint summer schools

The objective of the summer schools is to introduce the Environmental Intelligence topic to the new generation of scientists by the transference of knowledge generated in the latest advances in environmental intelligence project technologies.

Two Summer Schools are planned during the course of the projects, during the Summers of 2023 and 2024:

First Environmental Intelligence Summer School

Organised by: RAMONES (Theo J. Mertzimekis) and I-Seed (Barbara Mazzolai) projects

Scheduled for: Summer 2023

The school will be organized mainly for graduate students and early career scientists, with an expected number of participants of about 40 to 60 students.

The school will involve students participating in the EI projects but it will be also open to students outside the projects consortia.

Lectures will be held by researchers from the different EI projects, as well as from external experts. Topics will cover scientific and technological advances deriving from cross-disciplinary synergies among environmental science, advanced sensor research, robotics and Artificial Intelligence, biology, material science, social aspects associated with climate change and environmental monitoring.

Summer school 2 Lead: WatchPlant (Laura García Carmona) / SMARTLAGOON (Javier Senent Aparicio)

A second summer school will be jointly organized in summer 2024 (M42-43) (ReSET would participate only informally through attendance of the ReSET PI if funds allow, as ReSET finishes January 2024) by the SMARTLAGOON and WATCHPLANT projects in Valencia, Spain. This summer school will be designed for MSc students, PhD and early career scientists interested in Environmental Intelligence research covering the distant and multidisciplinary disciplines of the topic.

The summer school is open to about 40-60 people including participants from all project consortium and outsiders: Master and PhD students enrolled in environmental intelligence fields, passionate about biotechnology, engineering, informatics, and climate science area, with passion to learn and for driving change in their field. Additionally, it could be also open to young professionals within university incubators startups in a devoted session to knowledge transference involving companies and or platforms participation.

Capacity sharing webinars and training sessions

Knowledge sharing sessions with policymakers and other relevant stakeholders. Lead: ReSET (Leads: Mark Mulligan and Arnout van Soesbergen)

Online training sessions on the theory and practice of Environmental Intelligence will be delivered, focused on the following key groups (up to 75 per session). Bringing in contributions from the different projects, these would focus on Environmental Intelligence more broadly, beyond the specifics

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of the individual projects and would be focused on providing training rather than summarizing project activities.

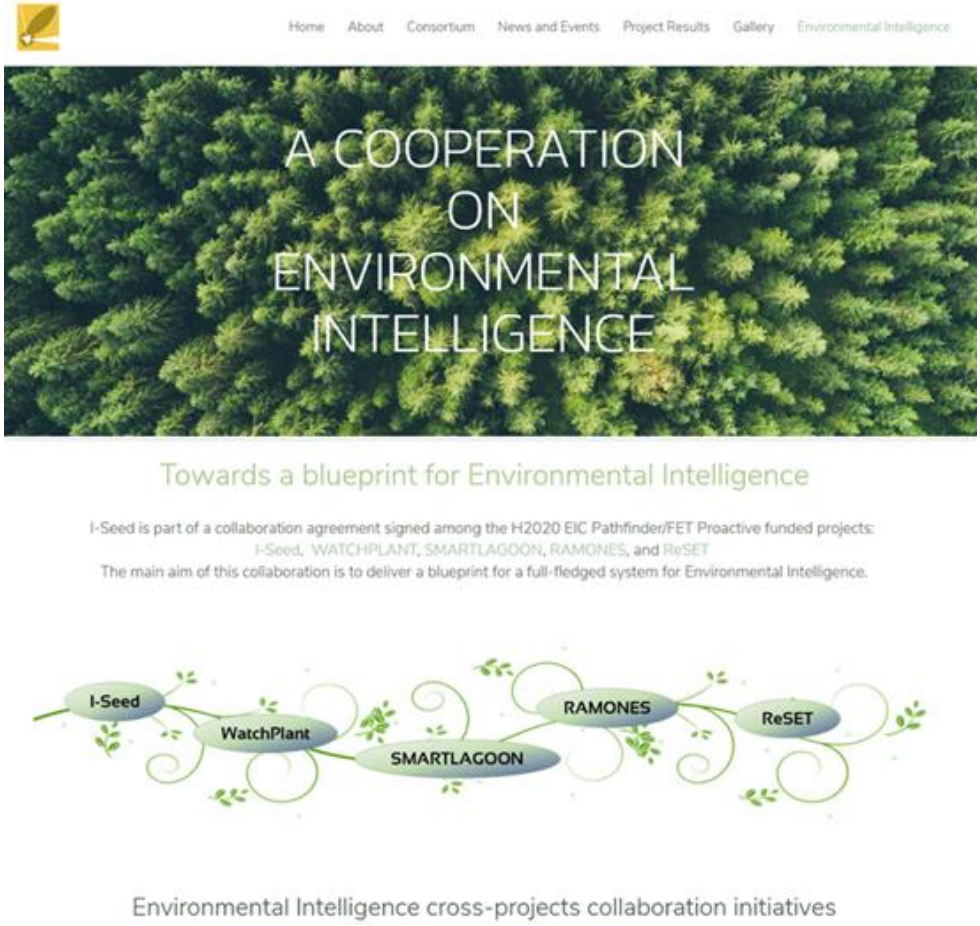
- Teachers (school and university level) (M12-18). Title: New technologies for low cost environmental monitoring for educators
- Farmers and land managers (M18-24). Title: The role of environmental intelligence in nature-friendly, environmentally sustainable farming.
- Businesses (insurance, investment, corporate Environmental and Social Governance) (M24-30). Title: Environmental intelligence to manage environmental and reputational risk
- Local, regional and national government (M32-35). Title: Environmental intelligence supporting water, climate and biodiversity sustainability

These will bring together relevant expertise from the five projects. They will be live-online and recorded for later use.

Press releases, website and social media

Dissemination actions of the joint collaborative activities will be maximized towards social media under the hashtag #EnvironmentalIntelligence, and updates in the websites of the projects where specific sections for the collaborative activities are envisioned for each project.

- I-Seed: https://www.iseedproject.eu/environmental-intelligence
  Twitter: @iSeed_project / https://twitter.com/iSeed_project



Environmental Intelligence cross-projects collaboration initiatives

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- WatchPlant: https://watchplantproject.eu/collaboration-agreement-environmental-intelligence/
  - Twitter: @WatchplantP / https://twitter.com/WatchplantP
  - Linkedin: @WatchPlant EU Project / https://www.linkedin.com/company/watchplant-eu-project
  - #WatchPlant

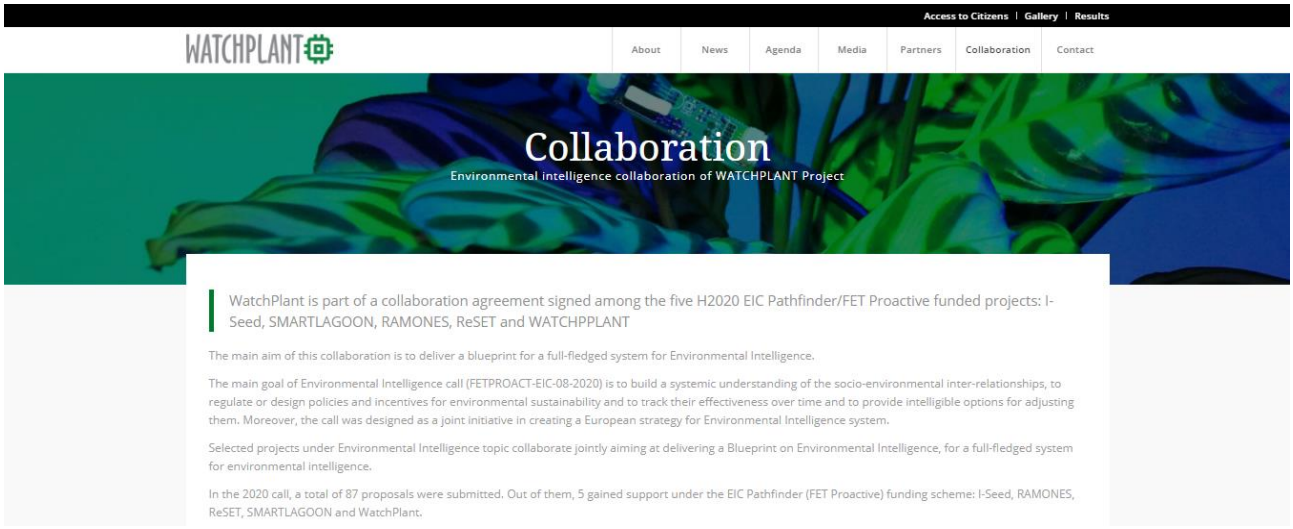

Figure 1: WATCHPLANT website

- RAMONES
  - Twitter: @ramones_eu / https://twitter.com/ramones_eu
  - LinkedIn: https://www.linkedin.com/in/ramones-eu/
  - Instagram: @ramones_eu / https://www.instagram.com/ramones_eu/
  - Facebook: https://www.facebook.com/RAMONES-EU-100320495404908/
  - Youtube: https://www.youtube.com/channel/UCd-QJLQSukH3h6jREDrGJYw
  - Website: https://ramones-project.eu/
  - Hashtags:
    #ramones_eu #horizoneurope #radioactivity #marine #robotics #naturalhazards #environmentalintelligence #FET_eu #eicPathfinder #EUeic #geohazards #artificialintelligence
    #EnvironmentalModeling #marineengineering #policy #monitoring #innovation #Open #FAIR

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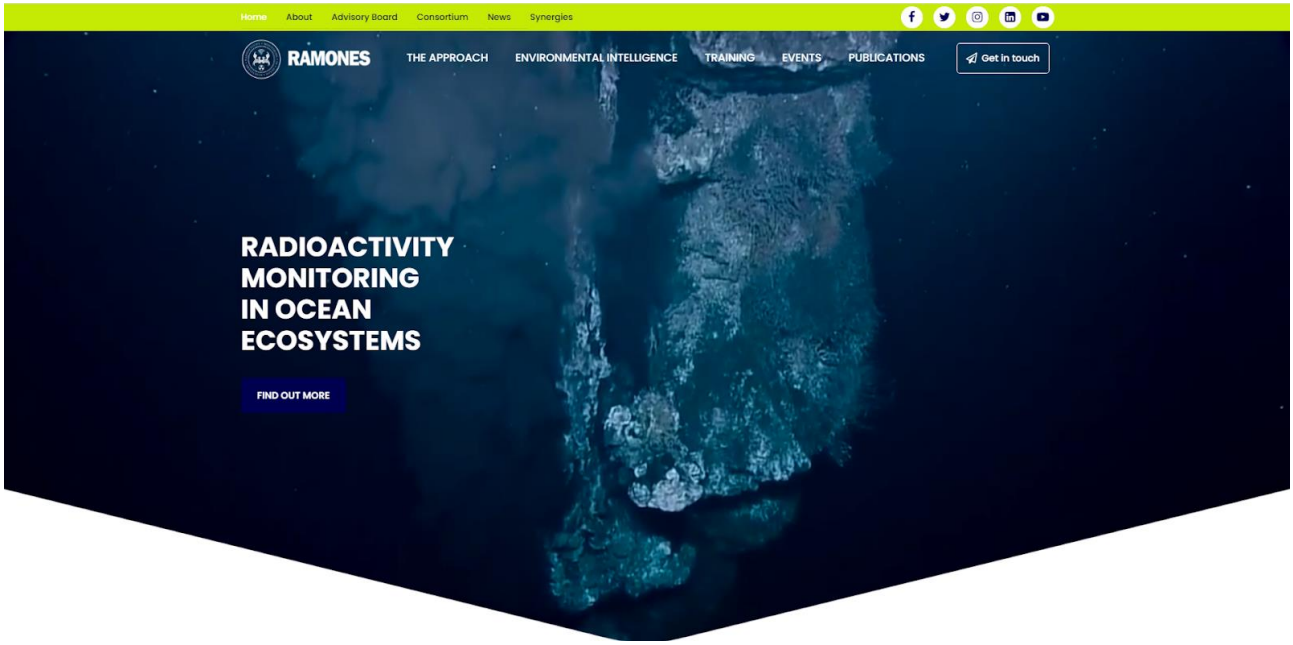
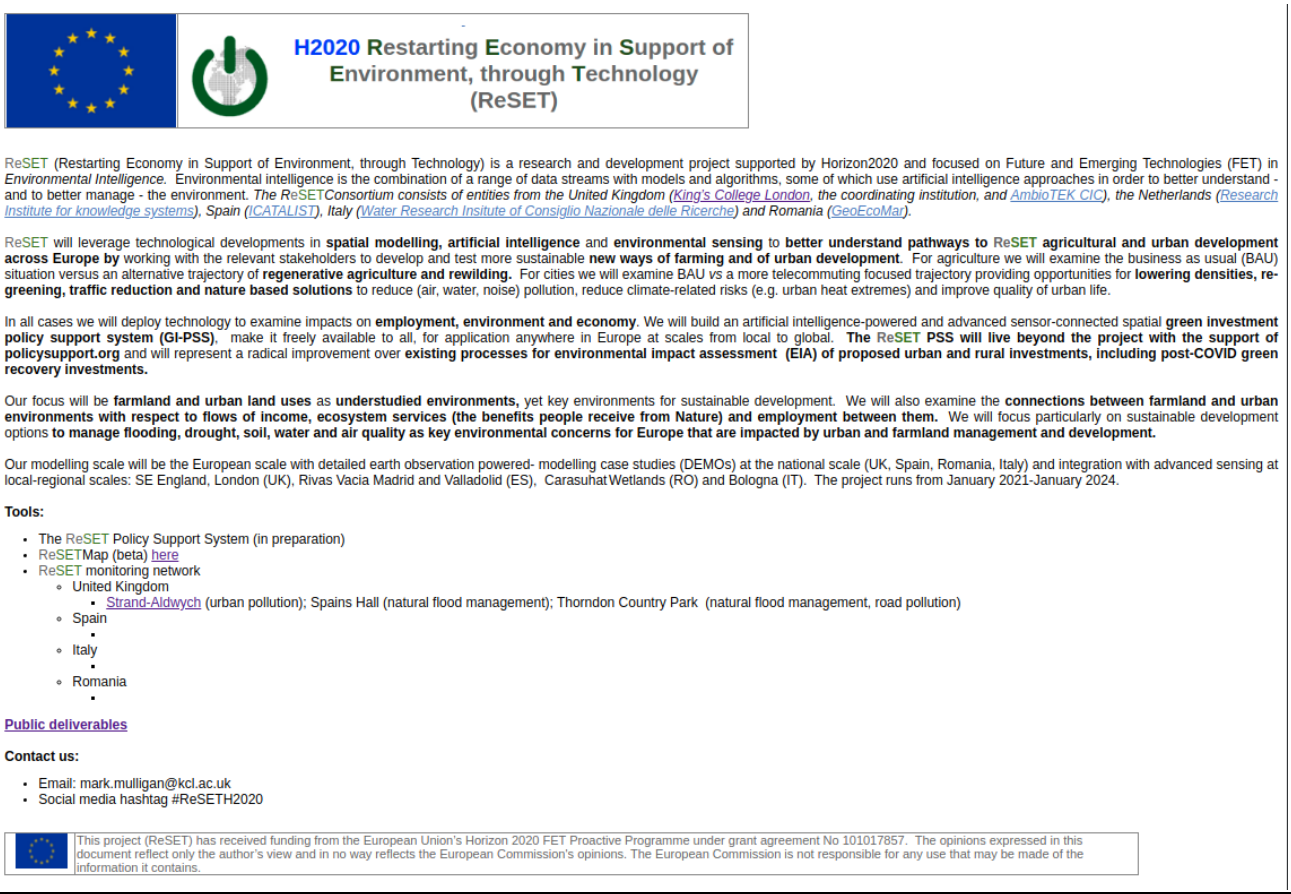


Figure 2: RAMONES website

- ReSET http://www.policysupport.org/reset
  - Twitter: @markmulligan @policysupport #ReSETH2020



H2020 Restarting Economy in Support of Environment, through Technology (ReSET)

ReSET (Restarting Economy in Support of Environment, through Technology) is a research and development project supported by Horizon2020 and focused on Future and Emerging Technologies (FET) in *Environmental Intelligence*. Environmental intelligence is the combination of a range of data streams with models and algorithms, some of which use artificial intelligence approaches in order to better understand - and to better manage - the environment. *The ReSETConsortium consists of entities from the United Kingdom (King's College London, the coordinating institution, and AmbioTEK CIC), the Netherlands (Research Institute for knowledge systems), Spain (ICATALIST), Italy (Water Research Insitute of Consiglio Nazionale delle Ricerche) and Romania (GeoEcoMar).*

ReSET will leverage technological developments in **spatial modelling, artificial intelligence** and **environmental sensing** to **better understand pathways to ReSET agricultural and urban development across Europe by** working with the relevant stakeholders to develop and test more sustainable **new ways of farming and of urban development**. For agriculture we will examine the business as usual (BAU) situation versus an alternative trajectory of **regenerative agriculture and rewilding.** For cities we will examine BAU *vs* a more telecommuting focused trajectory providing opportunities for **lowering densities, re-greening, traffic reduction and nature based solutions** to reduce (air, water, noise) pollution, reduce climate-related risks (e.g. urban heat extremes) and improve quality of urban life.

In all cases we will deploy technology to examine impacts on **employment, environment and economy**. We will build an artificial intelligence-powered and advanced sensor-connected spatial **green investment policy support system (GI-PSS)**, make it freely available to all, for application anywhere in Europe at scales from local to global. **The ReSET PSS will live beyond the project with the support of policysupport.org** and will represent a radical improvement over **existing processes for environmental impact assessment (EIA) of proposed urban and rural investments, including post-COVID green recovery investments.**

Our focus will be **farmland and urban land uses** as **understudied environments,** yet key environments for sustainable development. We will also examine the **connections between farmland and urban environments with respect to flows of income, ecosystem services (the benefits people receive from Nature) and employment between them.** We will focus particularly on sustainable development options **to manage flooding, drought, soil, water and air quality as key environmental concerns for Europe that are impacted by urban and farmland management and development.**

Our modelling scale will be the European scale with detailed earth observation powered- modelling case studies (DEMOs) at the national scale (UK, Spain, Romania, Italy) and integration with advanced sensing at local-regional scales: SE England, London (UK), Rivas Vacia Madrid and Valladolid (ES), Carasuhat Wetlands (RO) and Bologna (IT). The project runs from January 2021-January 2024.

Tools:

- The ReSET Policy Support System (in preparation)
- ReSETMap (beta) here
- ReSET monitoring network
  - United Kingdom
    - Strand-Aldwych (urban pollution); Spains Hall (natural flood management); Thorndon Country Park (natural flood management, road pollution)
  - Spain
    -
  - Italy
    -
  - Romania
    -

Public deliverables

Contact us:

- Email: mark.mulligan@kcl.ac.uk
- Social media hashtag #ReSETH2020

This project (ReSET) has received funding from the European Union's Horizon 2020 FET Proactive Programme under grant agreement No 101017857. The opinions expressed in this document reflect only the author's view and in no way reflects the European Commission's opinions. The European Commission is not responsible for any use that may be made of the information it contains.

Figure 3: ReSET website

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- SMARTLAGOON
  - Twitter: @SMARTLAGOON / https://twitter.com/SMARTLAGOON
  - LinkedIn: https://www.linkedin.com/company/smartlagoon/
  - Facebook: https://www.facebook.com/Smartlagoon-102880865222877

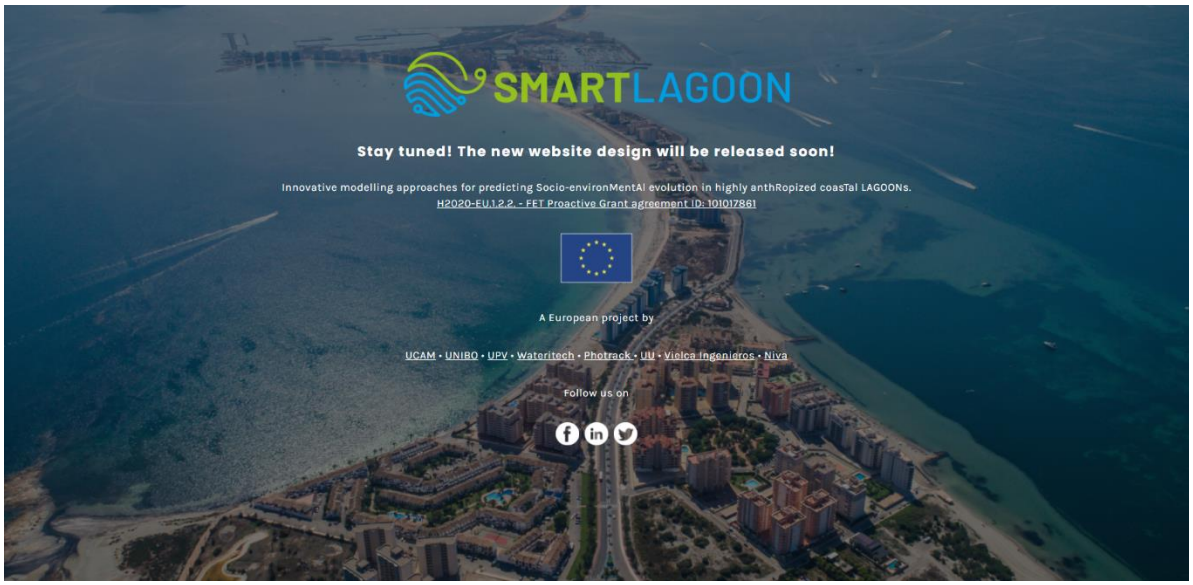

Figure 4: SMARTLAGOON website

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Annex 1. Collaboration agreement for Environmental Intelligence set of projects

The 5 projects funded under the Environmental Intelligence call need to collaborate to avoid duplication and ensure impact greater than the sum of the individual projects. This agreement sets out the manner of that collaboration.

Funded projects

I-Seed: Towards New Frontiers for Distributed Environmental Monitoring Based on an Ecosystem of Plant Seed-Like Soft Robots

Purpose: I-Seed aims at developing a new generation of self-deployable and biodegradable soft miniaturized robots, inspired by the morphology and dispersion abilities of plant seeds, to perform a low-cost, environmentally responsible, in-situ detection of key environmental parameters in air and topsoil. Seeds dispersal strategies are driven by the spontaneous, often reversible, anisotropic deformation of their tissues upon swelling or drying of cell walls, and do not require any control or internal energy supply. Following a bioinspired design, these skills will be implemented into seed-like robots by using multi-functional biodegradable materials and natural morphological features, which endow them with the ability to fly and disperse via natural vector mediated diffusion in air, or to respond to humidity variations to move on terrain surface and self-penetrate in topsoil. Sensing will be based on diffusion, absorption, and structural changes of parts of the robots made from sensor materials with a chemical transduction mechanism and fluorescence-based optical readout. Recordings of temperature, humidity, CO2 and mercury (Hg2+) will be executed at air-soil interface. Deployment of the I-Seed robots and reading of the acquired measurements will be performed using drones. Seed-drone communication will rely on optical signaling and fluorescence based on Light Detection and Ranging technology (fLiDAR), and using photonic "tags" to impart different type of sensors and robots a unique response. Algorithms will be developed such that drones can map the robots in air and on the ground. By merging bioinspired soft robotics, material science, nanocomposite technologies, and environmental science, I-Seed will address the specific challenge by building a radically new dynamic scenario for analyzing and monitoring air and topsoil environments and their interface, extending environmental sensor networks and filling existing gaps of data analysis systems.

Innovative modelling approaches for predicting socio-environmental evolution in highly anthropized coastal lagoons (SMARTLAGOON)

Purpose: Coastal lagoons are ecosystems with great environmental and socioeconomic value. However, these natural systems are especially vulnerable to climatic and anthropogenic pressures, such as intensive agriculture and extensive urbanization as a consequence of the tourist development. Despite the vulnerability and complexity of these ecosystems, there has been limited development of novel techniques which can provide real-time monitoring, analysis and management of these

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critical resources. Beyond being useful for policy-making procedures at multiple levels of granularity, these tools can increase local and citizen awareness of environmental impacts. SMARTLAGOON project intends to develop a digital twin to build a systemic understanding of the socio-environmental inter-relationships affecting coastal lagoons and their ecosystem. It will digitally replicate the policy-making procedure of these complex socio-environmental systems by combining, analyzing and interpreting data from different sources; including efficient in-situ IoT infrastructures with edge computing capabilities that reduce the overall system's carbon footprint, remote sensing technologies, social media sensing, open-data repositories and data from human behavior, economics and the social sciences, by making recourse to advanced AI, NLP, physically-based and citizen science models. As a case study, SMARTLAGOON focuses on Europe's largest saltwater coastal lagoon, i.e., Mar Menor (Murcia, Spain), which has suffered serious environmental degradation due to several socio/environmental reasons. We will jointly develop our tool with citizens, stakeholders and policy-makers of this area to address their needs and requirements, following an agile methodology to ensure practical and useful results for this particular scenario in the first instance and extend to other coastal lagoons in the second instance.

WatchPlant (101017899) SMART BIOHYBRID PHYTO-ORGANISMS FOR ENVIRONMENTAL IN SITU MONITORING

Purpose: WatchPlant will develop a new biohybrid system technology, a wireless wearable self-powered sensor for in-situ monitoring of urban environments. This system equips urban biological organisms -plants- with Artificial Intelligence (AI) to create a smart sensor for measuring both, environmental parameters and the responding physiological state of plants, in a very early stage by the use of a barely explored fluid, phloem sap, in combination with chemical, and physical sensors. It will be integrated into complex networks that allow performing distributed information processing, decision making, modeling and data fitting, paving the way for the self-awareness or self-adaptation. Additionally, it will constitute a clean energy self-powered device due to the novel use of sap, not only for transforming plants into living sensors, but also for clean energy generation. A consortium of EU research, technology centers and ambitious high-tech SMEs will stretch and combine the limits of plant physiology and bioelectronics with microtechnology, multiphysics modelling, sensor engineering, AI and environmental modelling, to transform plant into living autonomous and self-powered sensors. The project has the ambition to solve how to extract sufficient sap volume in a healthy plant, how to make long-lasting bioelectronics, and how create a smart self-powered wearable phyto-sensor in a single device. It also has the challenge of modelling urban environments using novel combinations of exiting parameters and explores the future role of sap in this sense. Thus, it is a promising tool to carry out weather/pollution/pandemics development forecasting systems up to social networks for proving an ecological/environmental feedback to citizens. Thus it will be possible to perform specific actions and apply efficient use of resources and correct policies, which can have a great impact not only in urban monitoring but a huge range of plant related sectors such as agro-food industry or forestry.

RAMONES RadioActivity Monitoring in OceaN EcosystemS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017861.

Natural radioactivity in the marine environment has been present since the Earth's formation, while artificial radionuclides were introduced into the oceans in 1944. More recent direct sources exist that feed the oceans, such as low-level liquid discharges from reprocessing plants, large-scale releases due to disasters (e.g. Fukushima hit by the tsunami in 2011), and smaller-scale radiological events. Exploration of submarine environments should consider the existence of radioactivity in terms of its short- and long-term impact on marine and coastal ecosystems, also in correlation to natural hazards, such as seismic activity over submarine faults. Significantly undersampled in oceans, radioactivity poses real risks to marine ecosystems and human population, urging for detailed, data-driven modelling.

RAMONES aims to offer new and efficient solutions for in situ, continuous, long-term monitoring of radioactivity in harsh subsea environments. A new generation of submarine radiation-sensing instruments, assisted by SoA robotic and artificial intelligence (AI) will be developed towards understanding radiation related risks near and far from coastal areas, while providing data towards shaping new policies and guidelines for environmental sustainability, economic growth and human health.

The main ambition is to lay a radical new path to close the existing marine radioactivity under-sampling gap and foster new interdisciplinary research in threatened natural deep-sea ecosystems. RAMONES will invest a significant effort to provide tools for long-term, rapid deployments, propose new AI-driven and supported methodologies, and offer scaled-up solutions to researchers, policy makers and communities. RAMONES will combine SoA equipment from various disciplines and advanced modelling
in fine synergy, and design new and effective approaches for the marine environment to provide efficient response to natural and man-made hazards, shaping future policies for the global population.

Restarting Economy in Support of Environment, through Technology (ReSET)

ReSET aims to leverage technological developments in spatial modelling, artificial intelligence and interoperable environmental sensing to better understand pathways to ReSET agricultural and urban development across Europe by working with the relevant stakeholders to develop and test more sustainable new ways of farming and of urban development. For agriculture we will examine the business as usual (BAU) situation versus an alternative trajectory of regenerative agriculture and rewilding. For cities we will examine BAU vs a more telecommuting focused trajectory providing opportunities for lowering densities, re-greening, traffic reduction and nature based solutions to reduce (air, water, noise) pollution, reduce climate-related risks (e.g. urban heat extremes) and improve quality of urban life. In all cases we will deploy technology to examine impacts on employment, environment and economy. We will build the AI-powered and advanced sensor-connected spatial green investment policy support system (GI-PSS) necessary to achieve this aim and will, as our previous PSSs, make it freely available to all, for application anywhere in Europe at scales from

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local to global (see KCL#1). The ReSET PSS will live beyond the project with the support of policysupport.org and will represent a radical improvement over existing processes for environmental impact assessment (EIA) of proposed investments.

Our focus will be farmland and urban land uses as understudied environments, yet key environments for sustainable development. We will also examine the connections between farmland and urban environments with respect to flows of income, ecosystem services and employment between them. We will focus particularly on sustainable development options to manage flooding, drought, soil, water and air quality as key environmental concerns for Europe that are impacted by urban and farmland management and development. Our modelling scale will be at the European scale also with detailed earth observation powered modelling case studies (DEMOs) at the national scale (UK, Spain, Romania, Italy) and integration with advanced sensing at local-regional scales: SE England, London (UK), Rivas Vacia Madrid and Valladolid (ES), Carasuhat Wetlands (RO) and Bologna (IT).

Purpose of collaboration

The purpose of collaboration between these projects is to:

a) Minimise duplication of effort
b) Share best practice and technology, where appropriate
c) Ensure the sum of the funded projects is greater than the parts
d) Work towards a blueprint for an Environmental Intelligence system of systems

The collaboration will be fostered through a series of collaboration activities outlined below. A precise plan for the timing, resource allocation and precise responsibilities for these activities will be documented in a rolling planning document, the first version of which will be ready at 6 months into the projects.

Collaboration activities

- A series of annually updated blueprint documents that bring the key technical advances of the projects together to propose a blueprint identifying the characteristics of an environmental intelligence system
- Submission of a special issue in a multi-disciplinary journal related to environmental issues: Environmental Modelling & Software, Science of the Total Environment in which this blueprint becomes the first, integrative paper, developed collaboratively by the projects alongside individual papers that are specific to the project developments
- Knowledge transfer sessions with policymakers and relevant stakeholders. The main objective of the Knowledge Transfer Session in addition to the dissemination and exploitation of specific results, is to share the knowledge, experience and best practices obtained between the 5 projects with high level key stakeholders in a roundtable format. This sharing will be done under the usual scientific conventions (citation and acknowledgement of others'

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work). For unpublished work any methods/technologies/data/results are provided for internal use only and are not to be published until the originator of those works has published them so they can be cited.

- These include two collaboratively organised summer schools bringing together dissemination and training activity of the individual projects with a session on integration and environmental intelligence more broadly.
- Each project will devote a minimum of 2% of total budget, including person-months and other costs (publication costs, cost contributions for the summer school) to this collaboration
- Collaboration will be managed by a steering committee comprising the lead for each project and all participants in each project will have some role in collaboration activities

Each PI signs on behalf of their project as an indicator of intention to collaborate. The legal aspects of this collaboration are specified in the projects' contracts with the EC.

Signed

Mark Mulligan (for ReSET)

Javier Senent Aparicio (for SMARTLAGOON)

Barbara Mazzolai (for I-SEED)

Laura García Carmona (for WatchPlant)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017861.

Theodoros J. Mertzimekis (for RAMONES)

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Annex 2. Special issue proposal on environmental intelligence

Background and motivation

Climate change is one of the main challenges facing modern societies. Its impact, often associated with extreme events, has dramatic consequences worldwide with the loss of natural ecosystems and high economic losses, having moreover a significant impact on health. Other anthropic activities add further stress in the environment (e.g., pollution, erosion). Preventing and reducing the impact of climate change and anthropic effects involves understanding risks, strengthening disaster management policies, increasing investments to reduce the impacts of these events and improving preparedness for effective disaster response.

There is a growing interest in this area. For example, within the umbrella of the "Environmental Intelligence EU Horizon 2020 framework program, five high-quality projects (i.e. RAMONES, SMARTLAGOON, I-Seed, ReSET, WATCHPLANT) have been funded under this topic. This includes up to 35 participants from academia and high-tech industries that are promoting research lines in different fields related to environmental intelligence. Selected projects under this topic are expected to collaborate, jointly aiming at delivering a blueprint for a full-fledged system for environmental intelligence.

New synergies between the distant disciplines of environmental modelling, advanced sensor research, social sciences, environmental and Earth sciences, robotics and Artificial Intelligence can lead to radically new approaches for creating and using dynamic models of the environment, including predictive modelling, scenario testing and real-time tracking. The ultimate goal is to build a systemic understanding of the socio-environmental inter-relationships, for instance to regulate or design policies and incentives for environmental sustainability and to track their effectiveness over time and to provide intelligible options for adjusting them.

This special issue seeks high-quality articles that will lay the technological groundwork for environmental intelligence, presenting novel results or new lines of research, as well review articles, clearly describing the state of the art in some specific related topic.

Technical scope of the proposal

We devise two main technical directions for research to provide contributions to the development of environmental intelligent solutions. They are

a. new techniques for modelling and predicting socio/environmental evolution across different temporal and spatial scales. These will combine, analyse and interpret data from in-situ and remote (e.g., satellite) sensing technologies, other public data sources (e.g., historical data, planning documents, legislation), and data or models/theories from human behaviour (including gender differences), economics and the social sciences by making recourse to advanced artificial intelligence techniques, if/as needed. The focus is on modelling and tracking of the interplay between natural and societal systems, for example on how policies and economics modelling predict human behaviours' impact on the environment, how explicit or implicit incentives and social norms interact with

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the environment's evolution and exploitation, how real-time environmental awareness and intelligence can improve behaviour towards more sustainability, or how the decisions based on changes in the environment in turn affect the state of the natural environment.

b. radically novel approaches to resilient, reliable and environmentally responsible in-situ monitoring. In-situ sensing technologies (physical, chemical, biological, behavioural) for environmental monitoring, in particular favouring sensors for parameters and environments that are currently under-sampled but at the same time critical for improving predictive models for understanding environmental processes. Proposals should look for ground-breaking concepts of affordable sensor design and deployment, maintenance, retrieval and/or recycling, based on concepts such as self-deployment, self-awareness, adaptation, artificial evolution, self-repair and controlled decomposition; or using edge computing, distributed Artificial Intelligence or new concepts from micro-robotics to optimise sensing or monitoring frequency, and field demonstrations of these new sensing approaches.

Significance and relevance to this journal

The IEEE Internet of Things Journal is clearly a proper fit for this special issue since IoT gives the perfect framework to propose solutions related to system architecture, enabling technologies, communication and networking protocols, services and applications, and their social implications. Moreover, the two main technical directions for research we propose are already very active and could be used to open new opportunities for the design of environmental intelligence solutions and to connect IoT to the climate change movement.

A plan for attracting quality papers

Beside the classical diffusion through the available mailing lists, social networks, etc. the five funded projects indicated in the "Background and Motivation" section, are actively participating in the organization of this special issue. Each project will promote articles on the topics related to the special issue and, in addition, will search its network of contacts for high quality articles on the topic. Moreover, we will contact directly the people involved in the organization of recent events related with the topic, like for example:

- http://www.ict4s.org/
- https://ictd2020.org/organizers/
- https://computingwithinlimits.org/2020/
- http://www.smart-objects.org/#organizers
- https://ictd2020.org/organizers/
- https://www.cfia.nl/home
- https://www.neanias.eu

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Tentative schedule

Submission Deadline: April 15, 2022
First Round Review Due: September 1, 2022
Revision Due: October 1, 2022
Acceptance Notification: December 1, 2022
Final Manuscript Due: January 1, 2023
Publication Date: 2023

Potential overlaps with published issues

We couldn't find any potential overlaps with other published issues in the IEEE IoT-J according to this: https://ieee-iotj.org/special-issues-list/ and, to the best of our knowledge with other special issues of other technical journals.

LIST OF GUEST EDITORS AND THEIR SHORT BIOGRAPHIES:

José M. Cecilia is a Ramón y Cajal research fellow at the Computer Engineering Department, Universitat Politècnica de València (Spain). He received his B.S. degree in Computer Science from Universidad de Murcia (Spain, 2005), M.S. degree in Computational Software Techniques in Engineering from Cranfield University (United Kingdom, 2007), and PhD degree in Computer Science from the Universidad de Murcia (Spain, 2011). Dr. Cecilia is a well-established researcher in the high-performance computing (HPC) area, specifically for the applications he has developed. His publication portfolio is composed of more than 100 research papers in JCR-Ranked journals and high-quality international conferences in the area. Dr. Cecilia's research career has been focused on bridging the gaps between hardware and software by developing novel applications that overcome current technological barriers. Particularly, he has developed applications within the convergence between emergent HPC and Artificial Intelligence, following an application-driven approach where hardware and algorithmic innovations have been always considered to offer novel solutions to real problems.

Mark Mulligan is Professor of Physical and Environmental Geography at King's College London and Honorary Fellow of UN Environment - World Conservation Monitoring Centre. He works with a large team of PhD students on a variety of topics in the areas of environmental spatial policy support, ecosystem service modelling and understanding environmental change. This research is at scales from local to global and with a particular emphasis on tropical (montane cloud) forests in Latin America and semi-arid drylands in the Mediterranean and Africa. He is developer of a range of open datasets at geodata.policysupport.org and free web-based spatial policy support systems at www.policysupport.org. These include hydroclimatic and land cover datasets and the WaterWorld hydrological and Co$ting Nature ecosystem services modelling tools. His research involves fieldwork around the world and he is also developer of a range of open source, web-connected, instruments for environmental monitoring through the FreeStation and FreeSensor projects.

Heiko Hamann is professor for service robotics at the University of Lübeck, Germany since 2017. He was assistant professor at the University of Paderborn, Germany and did his postdoctoral training

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at the Zoology department of the University of Graz, Austria. Hamann received a doctoral degree in engineering from the University of Karlsruhe, Germany in 2008. He coordinated the EU-funded H2020 FET project flora robotica (2015-2019) that developed and investigated closely linked symbiotic relationships between robots and natural plants to explore the potentials of a plant-robot society able to produce architectural artifacts and living spaces. Since 2021, he is a PI within the EU-funded H2020 FET project WatchPlant that develops and investigates smart bio-hybrid photo-organisms for environmental in-situ monitoring. His main research interests are bio-hybrid systems, swarm robotics, and evolutionary robotics, especially collective decision-making and the emergence of swarm behaviors triggered by intrinsic motivation.

Barbara Mazzolai, is Associate Director for Robotics at the Istituto Italiano di Tecnologia (IIT), Principal Investigator of the Bioinspired Soft Robotics (BSR) Research Line and Senior Researcher Tenured. She graduated in Biology at the University of Pisa (Italy) in 1995, obtained an International Master Diploma in Eco-Management in 1998 at the Scuola Superiore Sant'Anna, and in 2011 the Ph.D. in Microsystems Engineering from the University of Rome Tor Vergata. Her research activities are in the areas of biologically-inspired robotics and soft robotics. She has a long experience as researcher and project manager of European projects in the topics of biorobotics, soft robotics and environmental robotics. From 2012 to 2015 she was the Coordinator of the EU-funded FET-Open PLANTOID project (FP7-293431), and developed the world-first plant-inspired robot, “Plantoid”. Since January 2019, she is the Coordinator of the EU-funded FET-Proactive GrowBot Project (H2020-824074), which proposes a disruptively new paradigm of movement in robotics inspired by the moving-by-growing abilities of climbing plants. Since January 2021, Dr. Mazzolai is also coordinator of the EU H2020 FET Environmental Intelligence project I-Seed, which aims at developing self-deployable and biodegradable soft miniaturized robots, inspired by the morphology and dispersion abilities of plant seeds, to perform a low-cost, environmentally responsible, in-situ detection of key environmental parameters in air and topsoil.
She is author and co-author of more than 260 papers appeared in international journals, books, and conference proceedings; and she is member of the editorial board of various International journals. She is member of the Scientific Advisory Board of the Max Planck Institute for Intelligent Systems (Tübingen and Stuttgart, Germany), since 2016; and member of the Advisory Committee of the Cluster on Living Adaptive and Energy-autonomous Materials Systems - livMatS (Freiburg, Germany), since 2019.

Theo J. Mertzimekis is an Associate Professor of Experimental Nuclear Physics in the Department of Physics of the National and Kapodistrian University of Athens and an Academy of Athens Laureate in Experimental Physics. He holds a PhD in Physics from Rutgers, The State University of New Jersey (2002) and has worked as a Research Associate at NCSL/Michigan State University (NSF fellow), the University of Ioannina at NCSR “Demokritos” performing research in universities and institutions around the world (Berkeley Lab, Yale WNSL, CERN/ISOLDE, FAIR GSI, Australian National University and more). His main focus is on experimental studies of nuclear structure involving large laboratory infrastructures and state-of-the-art instrumentation in radiation detection and imaging. He currently leads the Nuclear Structure, Reactions and Applications Research Group (NuSTRAP) with

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more than 15 members. He has participated with various roles in several EU and National funded projects supporting infrastructure and research mobility (EURONS, ENSAR and ENSAR2, REGPOT LIBRA). He is currently the Coordinator of the EU-funded FET "RAMONES" project (2021-2024), which proposes a radically new approach of in-situ monitoring radioactivity in deep-sea ocean ecosystems in an autonomous, continuous, AI-based fashion. RAMONES aims at redefining the state of the art in Environmental Intelligence by combining radiation instrumentation with advanced marine robotics and machine learning, performing large-scale environmental modeling and proposing new policies towards improving the resilience of human communities and ecosystems against natural and man-made hazards. His publication record includes more than 300 papers in international journals, books, and conference proceedings (https://bit.do/tmertzi). He is a member of International Scientific Communities (EPS, iXAS, EPS, HNPS) and an editorial board member in International journals, the Chief Editor in HNPS Advances in Nuclear Physics and a Section Editor in Nuclear Energy and Technology (NUCET).

Pietro Manzoni is currently a full professor of computer engineering at the "Universitat Politècnica de València", Spain. He is the coordinator of the Computer Networks Research Group (GRC) and a senior member of the IEEE. He received the master's degree in computer science from the "Università degli Studi" of Milan, Italy, in 1989, and the PhD degree in Computer Science from the "Politecnico di Milano", Italy, in 1995. From November 1992 to February 1993, he did an internship at the Bellcore Labs, Red Bank, New Jersey, USA, and from February 1994 to November 1994 he was a visiting researcher at the ICSI (International Computer Science Institute) Berkeley, California, USA.
His research activity is related to the use of Mobile Wireless Networks to the design of dynamic systems. He is currently working on solutions for the Internet of Things focusing on LPWAN-based networks, and Pub/Sub systems. The overall focus is on the design of sustainable solutions that is, solutions that try to consider at least one of sustainability's three main pillars: the economy, society, and the environment. He published more than 200 scientific papers in conferences and more than 90 papers in international journals; his h-index is 34 (in Scopus). He is a senior member of the IEEE. He recently was co-chair of the IEEE Globecom 2019 SAC symposium track "Internet of Things", General co-chair of ACM/EAI GOODTECHS 2019, and General chair of IEEE CCNC 2019. He is part of the editorial board member of various International journals.

AUTHORSHIP FOR THE PROPOSED ISSUE:
We are proposing this special issue with the main goal to provide an alternative forum for the researchers in the environmental intelligence solutions area and to help creating a community around this topic. None of the guest editors has, currently, any material ready to be submitted to the proposed special issue.

Call for papers

This special issue aims at gathering the recent advances and novel contributions from academic researchers and industry practitioners in the novel area of environmental intelligence, in order to fully leverage the potential capabilities and opportunities brought by this area.

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Topics

- Big data and predictive analysis for enabling environmental intelligence.
- Modelling and predicting socio/environmental evolution based on IoT data.
- Novel approaches to resilient, reliable and environmentally responsible in-situ monitoring.
- Enabling new approaches to monitoring, analysis and management of critical resources.
- Obtention of reliable data and models at multiple levels of granularity for environmental policy making.
- Reduced environmental footprint for environmental IoT.
- Machine Learning Accelerators for environmental IoT.
- Robotics technologies for environmental IoT
- IoT architectures for environmental intelligence.
- IoT enabling technologies and systematic integration of environmental-related data.
- IoT services, applications, and test-beds for environmental intelligence.

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SMARTLAGOON

End of Deliverable 7.4

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