

Capacity-building as an instrument to foster the implementation of nature-based solutions

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Abstract

This article presents teaching and learning material from three strategically designed ReNature Horizon 2020 project training activities. A total of twelve presentations covering different aspects of NbS implementation are presented with this article. Additionally, this article also includes materials produced by learners, throughout their work within self-organised groups carried out during the Second ReNature Training School. This is the second article publishing teaching and learning material arising from the ReNature project.

Keywords

nature-based solutions, urban agenda, urban green space, urban ecosystems, sustainable development, socio-environmental justice

Introduction

A New Urban Agenda which promotes sustainable and inclusive urban economies and environmental sustainability was adopted at the United Nations Conference on Housing and Sustainable Urban Development (UN-Habitat 2016) in Quito, 2016. This agenda aims to leverage the benefits of well-planned urbanisation, where sustainable use of land and resources, mitigation and adaption to climate change go hand in hand and are mutually reinforcing. As pointed out in the Quito Declaration on Sustainable Cities and Human Settlements for All, rapid urbanisation increases climate risk and vulnerability to the adverse impacts of climate change and other natural and man-made hazards and particularly affects coastal areas, delta regions and small island States (UN-Habitat 2016). The New Urban Agenda notes that sustainable urban development is crucial for achieving the Sustainable Development Goals (SDGs) of the 2030 Agenda, because the degree of urbanisation (percentage of urban population in total population) worldwide was at around 56% (75% in Europe) in mid-2020 (Statista 2021) and it is expected that nearly 7 in 10 people will live in cities by 2050 (The World Bank 2020).

The concept of sustainability is gaining more and more traction as an indispensable part of development and economic progress, creating an opportunity to integrate environmental plans and policies into economic and social agendas. Such integration has the potential to transform SDGs into powerful tools that operate in urban settings to enhance economic growth, social inclusion and environmental sustainability. Within this context, a set of the 17 Sustainable Development Goals (SDGs) identified by Agenda 2030 is crucial for achieving regional, national and global sustainability in a balanced and integrated manner through a three-dimensional sustainable development concept. SDGs can only become practical tools for problem-solving with the assumption of full integration of the long-term transformation agenda and the mobilisation of strategic drivers of change (governments, research institutions, business) (UNEP 2015, Timmermans 2015). To monitor continuous progress in achieving SDGs by 2030, the Bertelsmann Stiftung and the Sustainable Development Solutions Network (SDSN) released the updated assessment of the annual country trends, titled "The Sustainable Development Goals and Covid-19" in 2020 (Sachs et al. 2020). The report contains detailed regional dashboards to help determine implementation priorities. The available data show that there is a high potential risk that no country will achieve the SDGs by 2030, even though many countries are making progress.

The integration of nature-based solutions (NbS) into urban planning and decision-making supports societies to deal with urban challenges by enhancing (or preserving) the provision of multiple benefits and co-benefits to biodiversity, human well-being and economic development. NbS are defined by IUCN as "*actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*" (Cohen-Shacham et al. 2016). New solutions are required in coping with current societal challenges, and nature-based innovation can play a significant role in fostering mitigation, but also resilience and adaptation, to climate and environmental stressors.

Within this context, it is important to foster trans-disciplinary, bottom-up processes and the creation of a continuous, creative dialogue between and within key stakeholders and communities. This dialogue can lead to the collaborative production of knowledge and the collaborative creation of ideas and solutions to develop and implement NbS as part of a strategy for the attainment of sustainable development.

The Horizon 2020 project ReNature (Promoting research excellence in nature-based solutions for innovation, economic growth and human well-being in Malta) is aimed at raising the research and innovation profile of the Malta College of Arts, Science and Technology (MCAST) by developing a scientific strategy for setting up and stimulating scientific excellence and innovation capacity in the field of nature-based solutions (NbS). Three important components of this strategy are:

1. training and capacity-building,
2. networking, clustering and knowledge co-creation, and
3. the development of policy-oriented initiatives, tools and methodologies.

ReNature brings together knowledge-holders, i.e. people and organisations possessing relevant knowledge in various areas of expertise, through networking and clustering to co-create knowledge as part of a strategy for the identification of effective nature-based solutions to tackle societal challenges. The main objective of ReNature training events is to create a space for open and inspiring discussion among project partners, academics, practitioners and stakeholders.

Three training activities, directed towards fostering capacity-building and research excellence, were delivered during the second half of the project. These trainings have focussed on the current policy context promoting NbS interventions, NbS design, implementation, and effectiveness in providing co-benefits to biodiversity and ecosystem service flows, leading to an improvement in human well-being, and methods for effective communication and collaboration across the science-policy interface.

Learners had the opportunity to interact and share experiences and activities with experts from the research and practitioners' community, from Europe and beyond, during the practical and theoretical sessions that were carried out within these capacity-building events. All training modules were delivered in English.

A selection of the training material - developed for Renature capacity-building and networking events for mainstreaming nature-based solutions during the first 18 months of the project - has been published within the ReNature-established Research Ideas and Outcomes (RIO) collection (Tomaskinova et al. 2020). The purpose of this paper is to complement the key outputs of the ReNature training activities that took place during the second project period, following the first published article titled 'Capacity-building and networking events for Nature-Based Solutions & Re-Naturing Malta'.

Aim of the training events

Knowledge exchange and capacity-building to promote research excellence for the implementation of nature-based solutions.

Date and place

A total of three capacity-building events were held between March 2020 and the August 2021:

- **1st ReNature Webinar: Mainstreaming nature-based solutions to address sustainability challenges** was held online via Zoom 26th June 2020;
- **ReNature Training Course 5: Nature-based solutions and the science-policy interface** was converted to a virtual event due to the COVID-19 emergency and held online via Zoom between 14th – 16th September 2020;
- **Second Interdisciplinary Training School: Planning Nature-based Solutions in Cities** was converted to a virtual event due to the COVID-19 emergency and held online via Zoom between 15th March – 18th March 2021.

List of Keynote Speakers and Panellists

For these training and networking events, we brought together 15 panellists and keynote speakers from 10 countries (Table 1). Fig. 1 presents the gender diversity distribution of the panellists and keynote speakers.

Table 1.

Keynote speakers and panellists delivering training sessions during the training events (name and organisation).

Name	Organization
Albert, Christian	Buhr University Bochum, Germany
Balzan, Mario V.	Malta College of Arts, Science and Technology, Malta
Collier, Marcus	Trinity College Dublin, Ireland
Connop, Stuart	University of East London, United Kingdom
Dicks, Lynn V.	University of Cambridge, United Kingdom
Frantzeskaki, Niki	Swinburne University of Technology, Australia
Geneletti, Davide	University of Trento, Italy
Grace, Miriam	University of Cambridge, United Kingdom
Haase, Dagmar	Humboldt University of Berlin, Germany
Kabisch, Nadja	Humboldt University of Berlin, Germany
Longato, Davide	University of Trento, Italy

Name	Organization
McPhearson, Timon	New York New School Nature, USA
Raymond, Chris	Helsinki Institute of Sustainability Science, Finland
Sapundzhieva, Anna	Pensoft Publishers, Bulgaria
Stout, Jane	Trinity College Dublin, Ireland

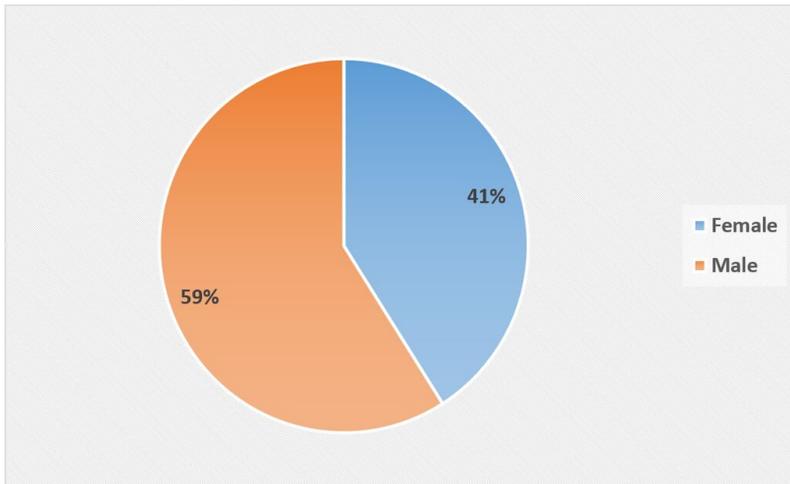


Figure 1. [doi](#)

Pie chart showing the gender diversity distribution of keynote speakers and panellists.

Event attendance

Over 70 participants participated in the online meeting during the 1st ReNature Webinar, which was held as an additional activity to disseminate the ReNature work and keep the stakeholders engaged also in a virtual environment.

The fifth ReNature Training Course was held online via Zoom and live-streamed on YouTube. In all, there were a total of 314 registrations, and up to 131 unique viewers on the same day (the maximum number allowed was 100 attendees) whilst the YouTube live stream was watched >300 times until the last day of the training course. Our audience hailed from Malta (34%), the EU and the UK (52%) and the rest of the world (14%, including the USA, Australia, and others), and their spheres of activity were industry (60%) and research/academia (40%) (Figs 2, 3). Maltese attendees were also predominant during the following days (27% on 15th September 2020; 29% on 16th September) (Figs 4, 5).

The Second ReNature Interdisciplinary Training School involved the participation of 38 attendees from 23 countries (Fig. 6), including early-career practitioners, postgraduates, MCAST staff and relevant Maltese stakeholders. Gender Diversity distribution of the attendees is presented in Fig. 7.

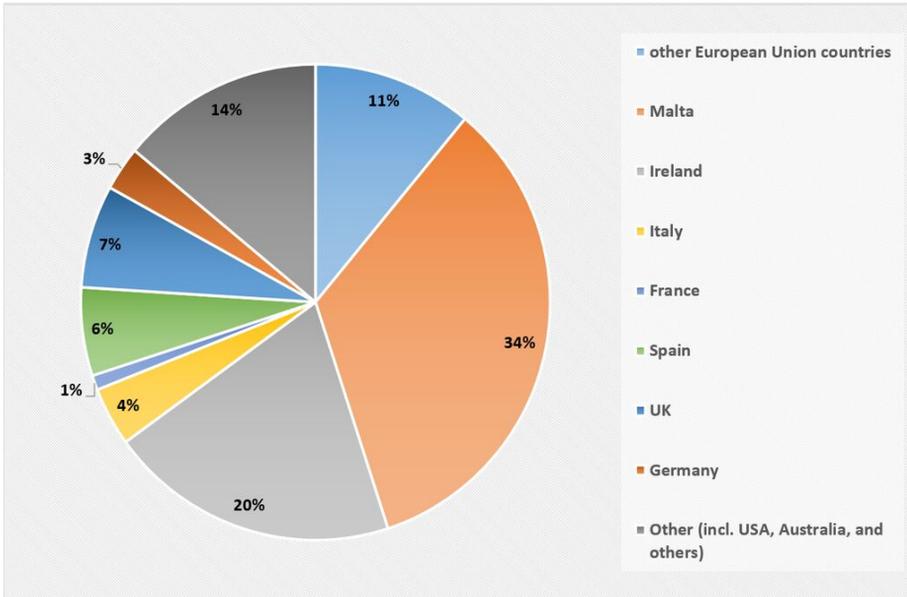


Figure 2. [doi](#)

Pie chart showing the attendees of the fifth training course, grouped by country of affiliation, during the first day (14th September 2020).

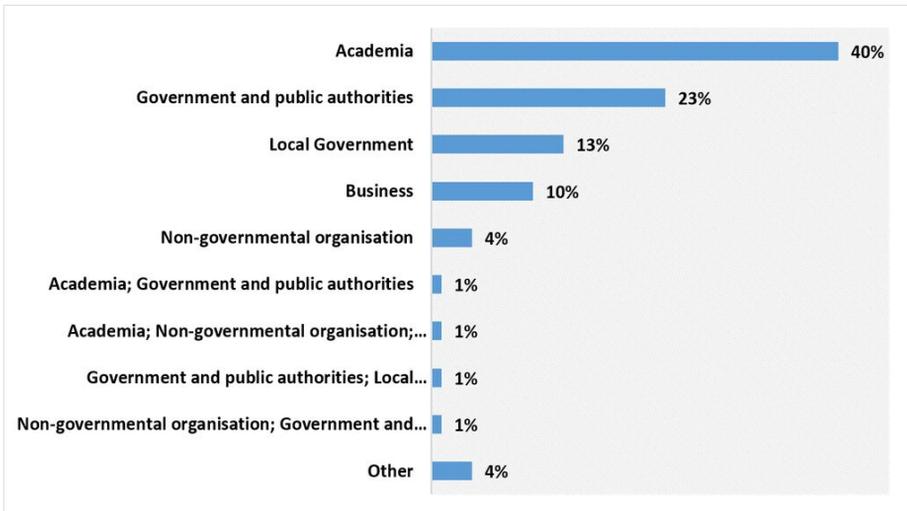


Figure 3. [doi](#)

Bar chart showing the attendees of the fifth training course, grouped by sector of affiliation, during the first day (14th September 2020).

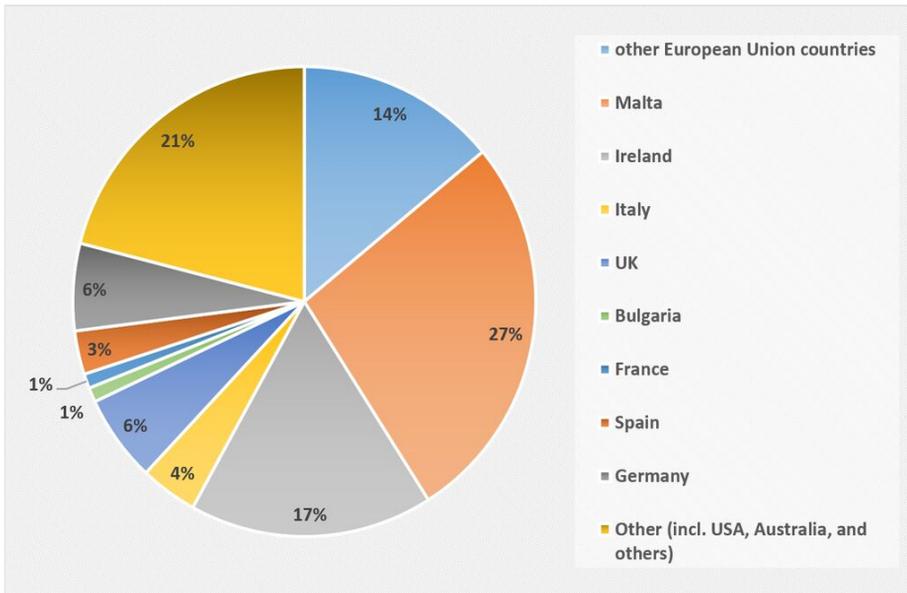


Figure 4. [doi](#)

Pie chart showing the attendees of the fifth training course, grouped by country of affiliation, during the second day (15th September 2020).

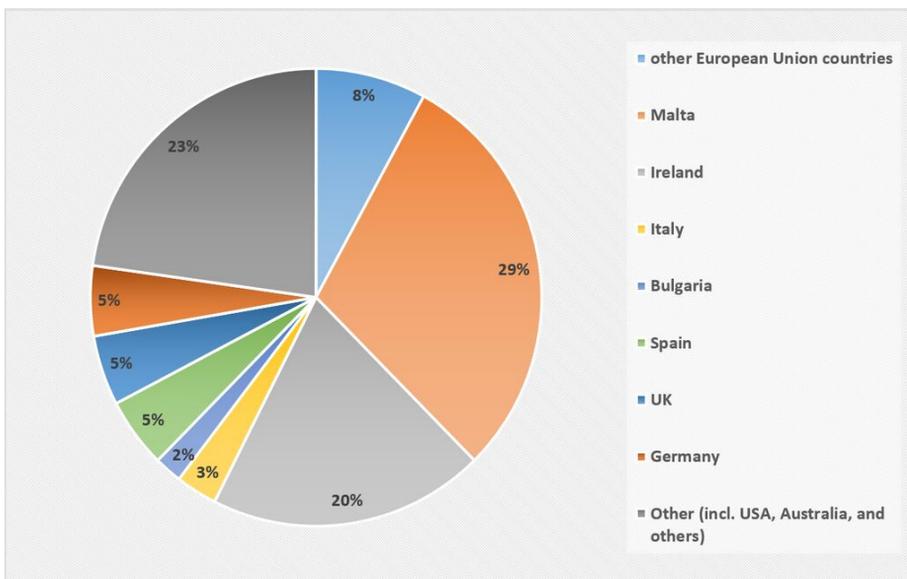


Figure 5. [doi](#)

Pie chart showing the attendees of the fifth training course, grouped by country of affiliation, during the last day (16th September 2020).

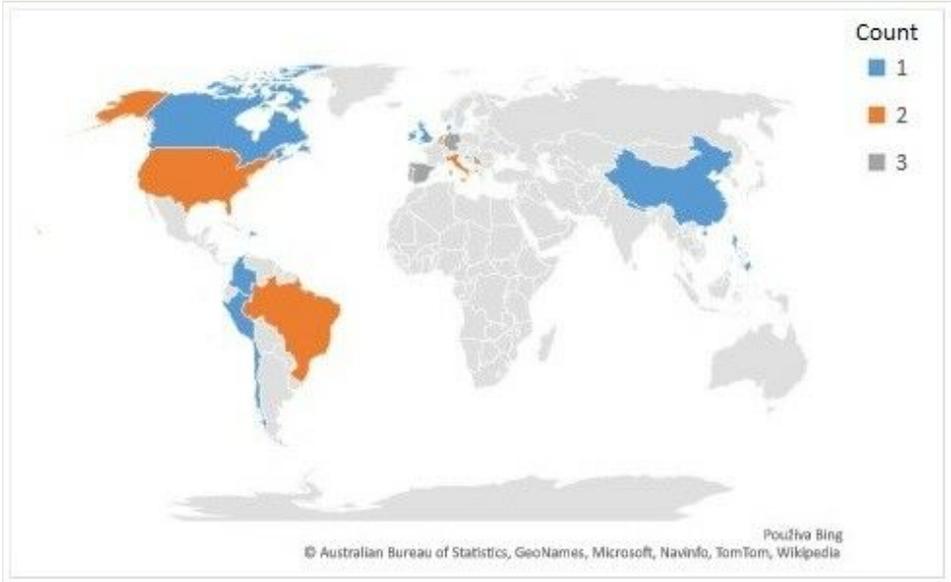


Figure 6. [doi](#)
Nationality of attendees of the Second Training School.

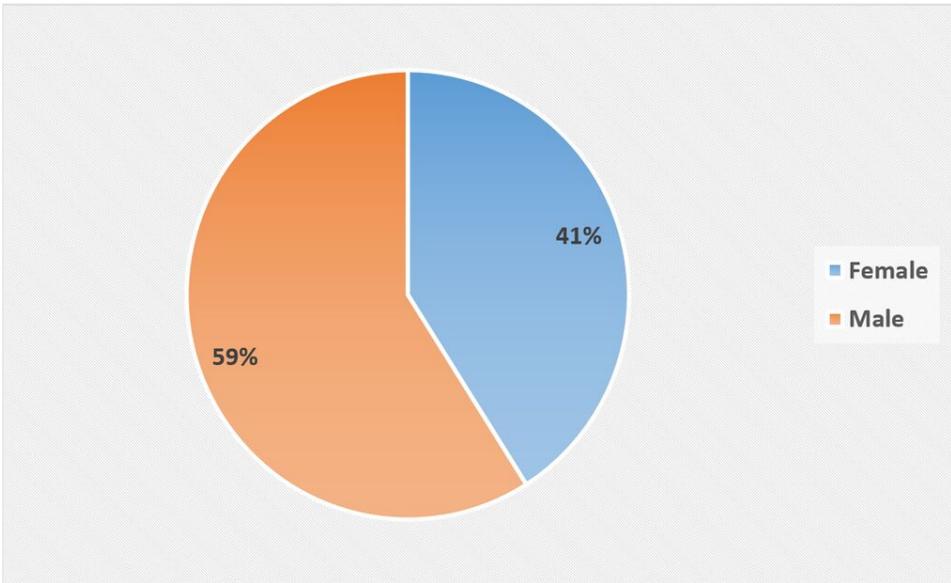


Figure 7. [doi](#)
Gender Diversity distribution of Training School attendees.

Key outcomes and discussions

Training key outcomes were geared towards enabling the research team from the coordinating institution (MCAST) to upscale its capacity to the level of performance of the supporting twinned institutions, in order to facilitate future collaborations and networking during the project and after its termination. The main learning outcome of the training events was related to the ability gained by the participants to understand the basic concepts and the tools for mapping and assessing biodiversity, green infrastructure and ecosystem services. Additionally, they enhanced the ability to discern the opportunities and restrictions in mainstreaming NbS in an urban and rural context. All the courses have included a strong practical element, with group work to facilitate interactions and (virtual) field visits.

- The 1st ReNature Webinar has been developed and designed to: (1) address the need for an effective implementation of nature-based solutions, (2) identify existing knowledge gaps, and (3) present the approach adopted in the ReNature project in bringing experts together to discuss and share knowledge and experiences. The main objective of this online meeting, which was also livestreamed on YouTube, was to provide attendees with training on how to identify solutions to concrete societal challenges, based on exploring real-life examples from Malta, Trento (Italy) and Dublin (Ireland). During the webinar, speakers and mentors from the ReNature consortium (MCAST, TCD, UNITN and University of Cambridge) described the idea, purpose and impact of NbS, stressing that nature can be seen as a solution to different problems besides meriting protection for its own intrinsic value. Researchers described how to achieve urban regeneration through NbS in cities. The programme included sessions on the use of indicators to identify the most effective NbS that may be applied in different urban environments, the identification of the different typologies of NbS and an associated impact evaluation framework of urban NbS (Fig. 8). In addition, the ReNature team presented results, from recent collaborative research with practitioners, that identified knowledge gaps limiting the uptake of NbS in the Mediterranean region. A Q&A session was beneficial to all participants, as questions could be asked in front of the panel and answered publicly during the meeting.
- The process of delivery of the 5th ReNature Training Course included 11 learning sessions and a virtual fieldwork session based on NbS types via Google Earth (Fig. 9). During the training course attendees explored the current policy context promoting NbS interventions, discussed NBS design, implementation and effectiveness in providing co-benefits, and evaluated methods for effective communication and collaboration across the science-policy interface. The fifth ReNature Training Course shared positive experiences, from Europe and beyond, of effective collaboration at the science-policy interface (Fig. 10).
- The Second ReNature Interdisciplinary Training School was carried out through 6 learning sessions, 4 keynote lectures and a Q&A. The process of delivery of the Training School included learning sessions and self-organised group work - group practical exercises relating to three case-studies (Ta' Qali commercial area, Hal-

Ferri area and Marsa Sports Complex - Fig. 11), group discussions and group presentations. The objective of the Training School was to provide participants with an understanding of opportunities to mainstream NbS in urban planning, and of how the design of NbS can provide co-benefits to biodiversity and ecosystem service flows, leading to an improvement in human well-being. Through a problem-based learning approach, learners were asked to work in multi-disciplinary groups, identify context-adapted NbS, assess ecosystem services and the benefits arising from the implementation of NbS (Figs 12, 13, 14), and then present the outcomes to practitioners and policy-makers and receive their feedback. The project proposals developed by trainees were related to three real case-studies that have recently undergone public consultation in Malta, and which provide an opportunity to implement nature-based solutions that address key societal challenges, including air and noise pollution, stormwater management, and access to nature and opportunities for recreation and nature-based tourism. The outcomes presented by student groups were highly valued by the school trainers and are included in the supplementary files.

As regards the main learning outcomes, upon completing the training school, attendees were expected to:

- Identify appropriate context-adapted nature-based solutions to address specific societal challenges in development projects;

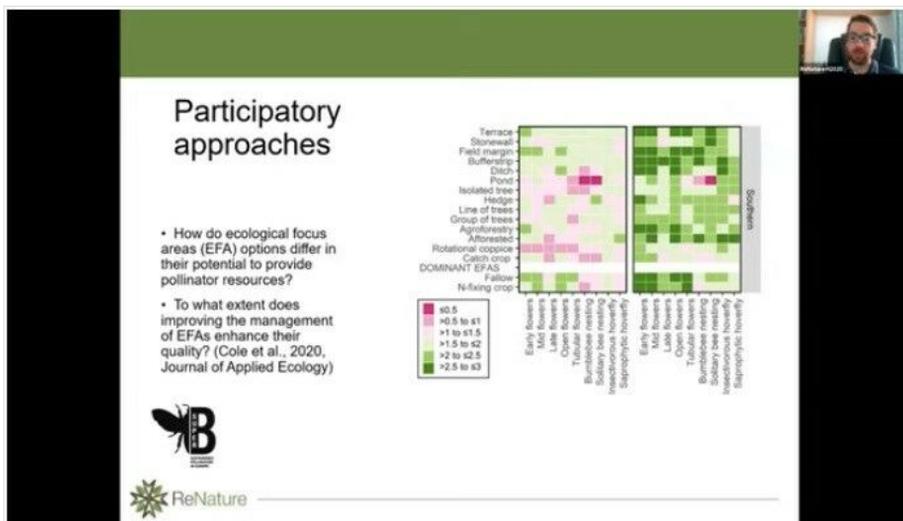


Figure 8. [doi](#)

Slide from the 1st ReNature Webinar on mainstreaming nature-based solutions to address sustainability challenges.

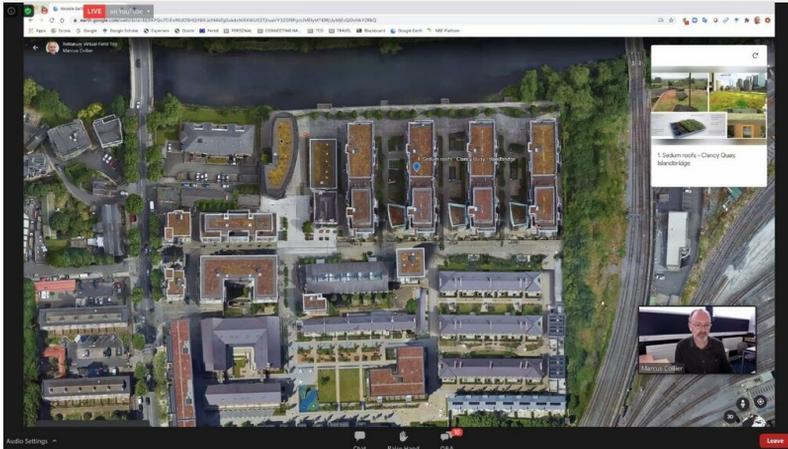


Figure 9. [doi](#)

As an alternative for a live fieldtrip, we took trainees on a virtual field trip looking at nature-based solutions in Dublin using a combination of Google Earth and images taken during the ReNature project. This was then exported as a KML file so that trainees can import it into their own Google Earth file for use in their work and research.

ReNature 5th Training Course September 14-16 2020

Nature-based solutions and the science-policy interface [REGISTER HERE](#)

September 14th L1 10:00-10:30 L2 10:30-11:00 L3 11:30-12:15 L4 12:15-13:00

Welcome note and introduction to the ReNature project
L1 Dr Mario Balzan, MCAST

Nature-based solutions in urban planning
L3 Dr Davide Gavaletti, Davide Longatte, University of Toronto

The policy context of Nature-Based Solutions
L2 Dr Tiago Freitas, DG Research and Innovation, European Commission

Breakout groups: Nature-based solutions in cities – what solutions are out there (virtual fieldwork)?
L4 Dr Marcus Collier, Trinity College Dublin

September 15th L1 10:00-10:45 L2 10:45-11:15 L3 11:30-12:15 L4 12:15-13:00

Designing nature-based solutions for multifunctionality
L1 Dr Stuart Connop, University of East London

Planning nature-based solutions in metropolitan landscapes
L3 Prof Christian Albert, Ruhr University Bochum

Assessing the effectiveness of urban ecosystems to prioritise nature-based interventions in a high-density urban agglomeration
L2 Dr Mario Balzan, MCAST

Establishing nature-based solutions for urban resilience
L4 Prof Timon McPherson, New York University

September 16th L1 10:00-10:40 L2 10:40-11:15 L3 11:30-12:15 L4 12:15-13:00

How to interact with policy makers and influence policy
L1 Dr Lynn Dicks, University of Cambridge

Science and policy for pollinator protection: The All-Ireland Pollinator Plan
L3 Prof Jane Stout, Trinity College Dublin

Communication – How to communicate key messages about NBS - benefits and risks?
L2 Anna Sapundzhieva, Pernsoft

Feedback and closing
L4 Dr Mario Balzan, MCAST

This project receives funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 809096.

Figure 10. [doi](#)

Keynote speakers and lecturers of the fifth ReNature training course on nature-based solutions and science-policy interface.

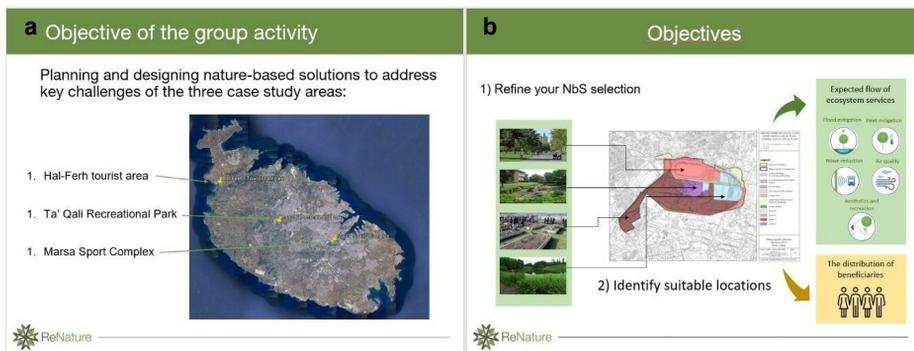


Figure 11. Introduction to self-organised group work based on three actual case studies.

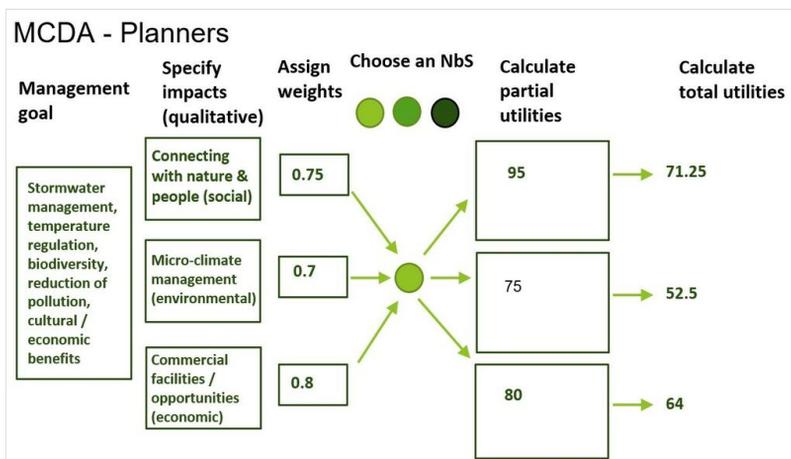


Figure 12. [doi](#) Group work on planning and designing NbS in the Ta'Qali case study, using multi-criteria decision analysis to compare NbS options. Can we add a statement somewhere, maybe at the beginning of the section, saying that these screenshots of group work are shared by permission of the students?

- Plan context-adapted NbS that lead to co-benefits to biodiversity and ecosystem services, and well-being;
- Understand, through case-study applications, how NbS can be mainstreamed into urban planning and environmental decision-making;
- Identify methods that can be used to assess the performance of NbS;
- Evaluate different stakeholder perceptions of nature-based solutions;
- Identify future opportunities for the implementation and co-creation of context-adapted NbS.

Figure 13. [doi](#)

Group work on planning and designing NbS in the Hal-Ferh case study.

NbS selection, beneficiaries, suitable locations and policy instruments

Policy goal	NbS	Beneficiaries	Suitable location	Policy Instrument (mainly regulatory)
Reduction of impacts on hydrology and promotion of groundwater safeguard	Vegetation cover ditches Porous pavements Green Roots 	<ul style="list-style-type: none"> Users of the sport area Citizens of Marsa Local authority - flood prevention unit Water and wastewater management companies 	Along the road next to the channel	Performance based planning approach (guidelines & targets exist) Regulatory: development exaction of Funding from EU projects
Greening of the area (among other goals)	Tarrased Linear park 	<ul style="list-style-type: none"> Citizens (walking from center to harbor) Users of sport area Private facilities located along the green area Tourists 	Existing storm water channel - extended from harbor (south east extension) to the Marsa city center	Compensation measure (other areas will be build up) Preferential tax treatments
Restore degraded habitats and Protect old trees	Planting local native plants (wildflowers, scrubs) Mosaic of long and short grass beneficial to pollinators Building and placing birdhouses 	<ul style="list-style-type: none"> Ornithological societies Tourists (birdwatching) Researchers/citizen scientists Local schools ("outdoor classrooms") 	All the sports complex	Conservation zones & protected areas (area of scientific importance for birds) Preferential tax treatments

Provisioning services  Regulating services  Support services  Cultural services 

11

Figure 14. [doi](#)

Group work on planning and designing NbS in the Marsa Sports Complex case study.

Learning outputs

Attached to this article, there is a set of key training materials resulting from the above-listed capacity-building and training events.

List of presentations:

1. Designing nature-based solutions for multifunctionality (Keynote Speaker: Stuart Connop, University of East London, UK) Suppl. material 1;

2. Assessing the effectiveness of urban ecosystems to prioritise nature-based interventions in a high-density urban area (Panellist: Mario V. Balzan, MCAST, Malta) Suppl. material 2;
3. Establishing nature-based solutions for urban climate resilience (Keynote Speaker: Timon McPhearson, New York New School Nature, USA) Suppl. material 3;
4. Science and policy for pollinator protection: The All-Ireland Pollinator Plan (Keynote Speaker: Jane Stout, Trinity College Dublin, Ireland) Suppl. material 4;
5. Introduction to nature-based solutions (Panellist: Marcus Collier, Trinity College Dublin, Ireland) Suppl. material 5;
6. Ecological succession and vegetation assemblages in a Mediterranean climate (Panellist: Mario V. Balzan, MCAST, Malta) Suppl. material 6;
7. Urban green spaces, health and socio-environmental justice in cities (Keynote Speaker: Nadja Kabisch, Humboldt Universität zu Berlin, Germany) Suppl. material 7;
8. NbS and performance-based planning (Panellist: Davide Geneletti, University of Trento, Italy) Suppl. material 8;
9. Instruments for NbS design (Panellists: Davide Longato, University of Trento, Italy) Suppl. material 9.

Learners' group-work outputs

Attached to this article as supplementary files, there is also a set of materials produced by learners during the work in self-organised groups, carried out as part of the Second ReNature Training School.

- Group 1: Ta' Qali Commercial Area: Final proposal (Authors: Alan Scarry, Esmee Kooijman, Jelena Dunjić, Pradilla Gonzalo, Martina Kičić, Sean Goodwin, Tomas Brage) Suppl. material 10;
- Group 2's materials have not been provided by students.
- Group 3: Marsa Sports Complex: Final proposal (Authors: Cristina Matos, Greta Dekker, Kejt Dhrami, Naty Pantaleón, Snezana Popov) Suppl. material 11;
- Group 4: Ta' Qali Commercial Area: Final proposal (Authors: Daniel Rozas, Sally Fernanda Torres Mallma, Laura Costadone, Hana Brunhoferova, Sheryl Rose Reyes, Judita Tomaskinova) Suppl. material 12;
- Group 5: Hal-Ferħ area: Final proposal (Authors: Elena Di Pirro, Maria Isabel Bastos, Hafiz Khan, Niklas Weins, Shahryar Sarabi, Tannya Pico) Suppl. material 13;
- Group 6: Marsa Sports Complex: Final proposal (Authors: Maria del Carmen Redondo Bermudez, Erica Bruno, Prabhat Joshi, Sara Justino, Steven Calascione, Bruno Flório Lessi) Suppl. material 14.

Conclusions

The training events carried out in the second half of the project, even if organized in a virtual format due to the Covid-19 pandemic, have strengthened the partnership among project partners, academics, practitioners and relevant stakeholders created during the previous capacity building events for the establishment of a national NbS research and innovation cluster and the development of the scientific, technical and research capacities to implement NbS in practice.

In total, the ReNature project delivered nine training and capacity building events, including one workshop with stakeholders, five training courses (four in person and one virtual), one virtual webinar, and two training schools (one in person and one virtual). The process of delivery of the events included learning sessions with experts and keynotes, workshops, fieldwork sessions, individual or group class exercises, group practical exercises on case-studies, group discussions and group presentations. Participants were trained in different topics concerning nature-based solutions in different contexts during practical and theoretical sessions, and had the possibility to learn from and discuss with international experts. As a final remark, the online format of the fifth training course and the second training school facilitated the participation of attendees, particularly from outside the EU.

Acknowledgements

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Supplementary materials

Suppl. material 1: Designing nature-based solutions for multifunctionality [doi](#)

Authors: Stuart Connop

Data type: Presentation

[Download file](#) (8.88 MB)

Suppl. material 2: Assessing the effectiveness of urban ecosystems to prioritise nature-based interventions in a high-density urban area [doi](#)

Authors: Mario V Balzan

Data type: Presentation

[Download file](#) (5.22 MB)

Suppl. material 3: Nature-based solutions for urban climate resilience [doi](#)

Authors: Timon McPhearson

Data type: Presentation

[Download file](#) (35.44 MB)

Suppl. material 4: Science and policy for pollinator protection: The All-Ireland Pollinator Plan [doi](#)

Authors: Jane Stout

Data type: Presentation

[Download file](#) (5.44 MB)

Suppl. material 5: Introduction to nature-based solutions [doi](#)

Authors: Marcus Collier

Data type: Presentation

[Download file](#) (3.02 MB)

Suppl. material 6: Ecological succession and vegetation assemblages in a Mediterranean climate [doi](#)

Authors: Mario V Balzan

Data type: Presentation

[Download file](#) (1.33 MB)

Suppl. material 7: Urban green spaces, health and socio-environmental justice in cities [doi](#)

Authors: Nadja Kabisch

Data type: Presentation

[Download file](#) (3.12 MB)

Suppl. material 8: NbS and performance-based planning [doi](#)

Authors: Davide Geneletti

Data type: Presentation

[Download file](#) (3.12 MB)

Suppl. material 9: Instruments for NbS design [doi](#)

Authors: Davide Longato

Data type: Presentation

[Download file](#) (1.33 MB)

Suppl. material 10: Group 1: Ta' Qali Commercial Area [doi](#)

Authors: Alan Scarry , Esmee Kooijman, Jelena Dunjić, Pradilla Gonzalo, Martina Kičić, Sean Goodwin, Tomas Brage

Data type: Presentation

[Download file](#) (1.04 MB)

Suppl. material 11: Group 3: Marsa Sports Complex [doi](#)

Authors: Cristina Matos, Snežana Popov, Greta Dekker, Kejt Dhrami, Natividad Pantaleón

Data type: Presentation

[Download file](#) (1006.10 kb)

Suppl. material 12: Group 4: Ta' Qali Commercial Area [doi](#)

Authors: Daniel Rozas, Sally Fernanda Torres Mallma, Laura Costadone, Hana Brunhoferova, Sheryl Rose Reyes, Judita Tomaskinova

Data type: Presentation

[Download file](#) (1.06 MB)

Suppl. material 13: Group 5: Hal-Ferħ area [doi](#)

Authors: Elena Di Pirro, Niklas Weins, Maria Isabel Bastos, Tannya Pico, Hafiz Khan, Shahryar Sarabi

Data type: Presentation

[Download file](#) (732.99 kb)

Suppl. material 14: Group 6: Marsa Sports Complex [doi](#)

Authors: Maria del Carmen Redondo Bermudez, Erica Bruno, Prabhat Joshi, Sara Justino, Steven Calascione, Bruno Flório Lessi

Data type: Presentation

[Download file](#) (1.01 MB)