Nature-based Solutions to address climate and societal challenges in small and medium-sized islands

AUTHORS

Mark D.C. Mansoldo, Elisa Serra, Erika Igondová, Aristides Moustakas, Abdullah Hüseyin Dönmez, Alexandra Tsatsou, Berre Kumuk, Christos Zoumides, Elli Tzirkalli, Emine Keleş Özgenç, Erich Wolff, Francesco Sica, Franziska Paul, George Zittis, Giuseppe Fenu, Hai-Ying Liu, Ioannis P. Kokkoris, Ioannis Vogiatzakis, Irene Christoforidi, Jean-José Filippi, Katerina Boucoyannis, Ligorini Viviana, Marilena Stamatiou, Marina Antic, Osman Kumuk, Paraskevi Manolaki, Periklis Kleitou, Peter Davids, Rocío Pineda-Martos, Savvas Zotos, Senka Ždero, Shiri Zemah Shamir, Tanya Trenkova, Yael Shaked Mandelberg, Ziv Zemah Shamir, Zorica Srđević, Mario V Balzan

AFFILIATIONS

[1]Ecostack Innovations Limited, KBIC, Kordin, Paola, PLA 3000, Malta. [2]International Marine Centre (IMC), Italy. [3]Natural History Museum of Crete, University of Crete, Heraklion, Crete, Greece. [4]Duzce University, Türkiye. [5]National Technical University of Athens. [6]Gazi University, Turkiye. [7] Cyprus Institute. [8]Faculty of Pure and Applied Sciences, Open University of Cyprus, Nicosia, Cyprus. [9]Trakya University, Türkiye. [10]Utrecht University, Netherlands. [11]La Sapienza - Università di Roma, Italy. [12]Ensphere, Hamburg, Germany. [13]Climate and Atmosphere Research Center (CARE-C), The Cyprus Institute, Nicosia, Cyprus. [14]University of Cagliari, Italy. [15]Department of Environmental Impacts and Sustainability, NILU – The Climate and Environmental Research Institute NILU, Kjeller, Norway. [16]Department of Sustainable Agriculture, University of Patras, 30131 Agrinio, Greece. [17]Department of Soil, Plant and Food Sciences, University of Bari Aldo Moro, Bari, Italy. [18]Department of Agriculture, Hellenic Mediterranean University, 71410 Heraklion, Greece. [19]Unité d'Appui et de Recherche 3514 Stella Mare, Université de Corse Pascal Paoli - CNRS, 20620 Biguglia, France. [20]Ecolise, Silversquare Central, Cantersteen 47, 1000 Brussels, Belgium. [21]Université de Corse Pascal Paoli, Campus Grimaldi, Corte, BP52, 20250, France. [22]Institute of Genetic Resources University of Banja Luka, Banja Luka, Bosnia and Herzegovina. [23]Iskenderun Vocational School of Higher Education, Iskenderun Technical University, Hatay, Turkiye. [24]Department of Spatial Planning, TU Dortmund University, Germany. [25]Departamento de Ingeniería Aeroespacial y Mecánica de Fluidos, Escuela Técnica Superior de Ingeniería Agronómica, Universidad de Sevilla, Ctra. de Utrera, km. 1, Sevilla 41005, Spain. [26]University of Novi Sad, Faculty of Agriculture, Department of Water Management, Trg D. Obradovića 8, 21 000 Novi Sad, Serbia. [27]School of Sustainability, Interdisciplinary Center (IDC), Reichman University, Herzliya, Israel. [28]National Institute of Geophysics, Geodesy and Geography – Bulgarian Academy of Sciences, Sofia, Bulgaria. [29]Department of Marine Biology, Leon H. Charney School of Marine Sciences, University of Haifa, Haifa, Israel. [30]Faculty of Agriculture, Department of Water Management, University of Novi Sad, Group for Systems Analysis and Decision-Making, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia. [31]Institute of Applied Science, Malta College of Arts, Science and Technology (MCAST), Paola, PLA9032, Malta.

INTRODUCTION

Small and medium-sized islands (SMI) are widely recognised as ecologically significant yet highly vulnerable regions. Rising sea levels and warming temperatures, changes in precipitation patterns and the intensification of extreme events, together with unsustainable development practices, threaten not only their natural resources but also the livelihoods and well-being of communities that depend on them

Nature-based Solutions (NbS) despite growing policy interest, empirical studies on the effectiveness of NbS in SMI remain scattered, with few systematic syntheses, underscoring the need for further research and data-driven analysis. Key knowledge and practice gaps related to the understanding of NbS principles and cost-effectiveness, and their adaptation to the local social-ecological-technological conditions continue to limit uptake of NbS globally and regionally, which challenges are expected to be more strongly felt in SMIs (Grace et al., 2021; Balzan et al., 2022).

AIM

To fill this gap, within the EU-funded COST Action CA21158 SMILES, we have developed an open-access and easily usable global compendium of SMI NbS.

SMILES

PICO Research Question

In SMI (P), how has the implementation of NbS (I) been conducted and documented in existing peer-reviewed and grey literature across different island types and regions (C), and what are the key strengths and knowledge gaps (O)?

Literature Search

Grey Literature

- Considered a total of 8 existing repositories of NbS across different regions, from which existing case-studies of SMI NbS were identified through filtering by geographic context, key words or manual searches.

Published Literature

- Defined the search term to conducted a Scopus peer-reviewed literature search
  - Publication Years: until 2024
  - Developed a set of inclusion and exclusion criteria.

ANALYSIS

DATA EXTRACTION, SYNTHESIS and INTEGRATION

- Created data extraction forms for data gathering from selected studies in 1st screening
- ~10% of the selected scientific literature and all case-studies extracted from grey literature were reviewed by 2 reviewers (final QA/QC)
- Data synthesis and integration

Development of the Small and Medium-Sized Islands Nature-based Solutions (SMI-NbS) database

- A total of 149 SMI NbS cases were identified from peer-reviewed literature.
- A total of 131 SMI NbS cases were identified from grey literature, **for a total number of 280 SMI-NbS cases covering different regions.**

RESULTS

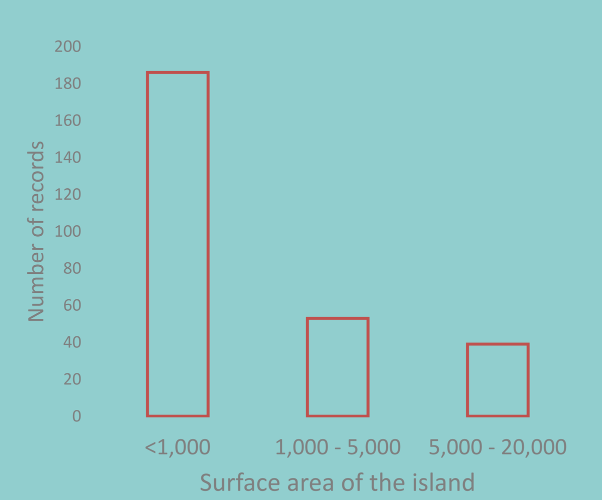
SMI NATURE-BASED SOLUTIONS

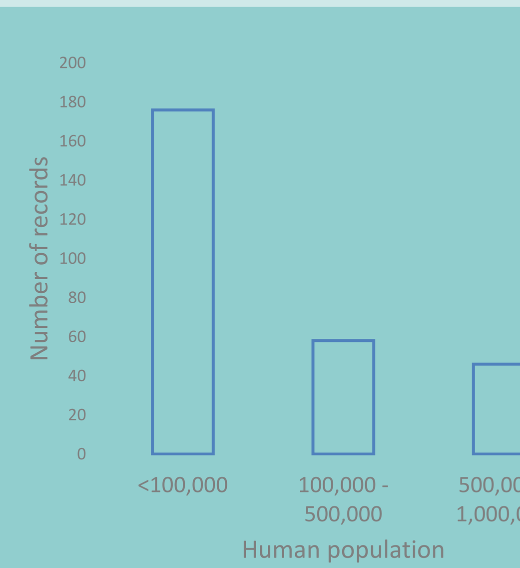
- Most NbS cases from small islands, carried out in different global regions.

Majority of SMI NbS included a focus on ecosystem restoration but were very diverse.

Different methods of ecosystem assessment & stakeholder engagement

Top 3 challenges addressed: ecosystem degradation, biodiversity loss, & climate adaptation.





Sustainable Development Goals (SDGs)

Multiple SDGs were addressed, with some receiving greater focus

Conclusions

- The SMI-NbS database bridges fragmented knowledge, showcasing how nature-based solutions in small and marginalised islands (SMIs) contribute to biodiversity, climate resilience, and multiple SDG targets.
- By sharing local NbS experiences globally, the database supports more integrated, inclusive, and sustainable pathways for SMIs, helping to formalise evidence for policy and nature recovery agendas.

REFERENCES

Balzan, M.V., Geneletti, D., Grace, M., de Santis, L., Tomaskinova, J., Reddington, H., Sapundzhieva, A., Dicks, L.V, & Collier, M. 2022. Assessing nature-based solutions uptake in a Mediterranean climate: insights from the case-study of Malta. Nature-Based Solutions, 100029. https://doi.org/10.1016/j.nbsj.2022.100029

Grace, M., Balzan, M., Collier, M., Geneletti, D., Tomaskinova, J., Abela, R., Borg, D., Buhagiar, G., Camilleri, L., Cardona, M. and Cassar, N., 2021. Priority knowledge needs for implementing nature-based solutions in the Mediterranean islands. Environmental Science & Policy, 116, pp.56-68, doi: 10.1016/j.envsci.2020.10.003

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Funded by the European Union

This publication is based upon work from COST Action Enhancing Small-Medium Islands resilience by securing the sustainability of Ecosystem Services (SMILES) – CA21158, supported by COST (European Cooperation in Science and Technology).

COST (European Cooperation in Science and Technology) is a funding agency for research and innovation networks. Our Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers. This boosts their research, career and innovation.

Web: https://cost-smiles.eu/
Get in touch with us: mario.balzan@ecostackinnovations.com