EXECUTIVE SUMMARY

Terrestrial and marine ecosystems provide essential goods and services to human societies and are of crucial importance for the sustainable development of our societies and for meeting the Sustainable Development Goals (SDGs). In the last decades, however, anthropogenic pressures are causing serious impacts to ecosystem integrity, diversity, functions and processes, potentially leading to constrained resilience towards environmental changes, habitat degradation, and the creation of uncertainty related to "novel ecosystems" and increased risk of collapse. All facets of different intensity of ecosystem change ranging from modification to degradation and finally collapse and replacement are linked with the loss of ecosystem services that will seriously affect human wellbeing at local and regional scales. Repercussions of biodiversity loss and ecosystem degradation are likely to amplify negative effects of global change.

Knowledge-based conservation, adapted management and restoration policies are urgently needed in order to ensure delivery of ecosystem benefits in the face of rapidly increasing anthropogenic pressures. Fundamental to all these are effective monitoring, understanding and modelling of the state and trends in ecosystem functions and services, including state changes in biodiversity, energy fluxes, carbon storage, and nutrient cycling. New analytical and monitoring methodologies are now available that combine approaches in geo- and bio-science, remote-sensing and in situ monitoring approaches. Current satellite missions, such as the European Sentinels, will provide a large amount of high-quality data on the environment and ecosystems. In situ data, usually collected independently by different research groups, is being organised and made available through international activities such as the International Long-Term Ecological Research (ILTER) network and various open access and data portals resulting in challenges for efficient data mining. Ecosystem models capable of incorporating information from Earth Observations and Global Climate Models are being further developed to maximise the utility said information databases, thereby enhancing their predictive capacities, and are made available in Virtual Research Environments such as those provided by the European LifeWatch ERIC.

Based on these perspectives and building upon existing activities, the GEO ECO Initiative intends to utilise available Earth Observation data, results and information. Such activities will aid in identifying Protected Areas of international relevance on a global scale, extending the analysis to vulnerable, unprotected areas by adopting the view of ecosystems as "one physical system" with their environment. Furthermore, such efforts are enhanced by a strong consideration of geosphere-biosphere-anthroposphere interactions across multiple spatial and temporal scales. Both terrestrial and marine ecosystems are considered through this work, with a special focus on interactions and processes taking place in the sensitive layer at the surface of our planet (the Earth Living Skin) such as the Earth Critical Zone. This extends to include the rocky matrix to the top of tree canopy for terrestrial ecosystems, and the dynamics in the euphotic layer and in coastal areas for marine ecosystems. The knowledge on ecosystems acquired through the activities of GEO ECO will be built together with the people in charge of the management of the Protected Areas, and an Ecosystem Community of Practice will be created.

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