IBC-CARBON

Integrated Biodiversity Conservation and Carbon Sequestration in the Changing Environment

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Climate Change – a threat to biodiversity, carbon sequestration and soil quality

Climate change represents a major threat to biodiversity (BD) as well as to the sustainable management of the ecosystem services (ES). Successful integration of BD conservation with sustainable forest use under global climate change is a major challenge for the Finnish society. The consequences of the planned large shift towards bio-based economy are poorly known, and the sustainability of these policies needs to be evaluated. Land use changes and increased biomass withdrawal can have far-reaching consequences on BD conservation, carbon (C) sequestration and soil quality, as well as downstream waters. Climate change directly influences many ecosystem processes and indirectly affects the development of mitigation and adaptation strategies that are likely to have substantial environmental impacts.

Multidisciplinary team develops integrated model-based tools to optimize land-use

The key aims of the IBC-CARBON project (2018-2023) (Fig.1) include development of integrated model-based tools to determine spatially optimized land-use in forest ecosystems for the joint BD conservation and C-sequestration targets. Integrated impacts of climate change, forest bioenergy policies and other drivers on BD indicators and C-sequestration/balances (also accounting for biophysical effects) are also studied. Earth Observation (EO) based variables are developed and tested to provide cost effective tools to detect and quantify changes in forest BD and ecosystem services (ES). IBC-CARBON project is carried out by a multidisciplinary team from the Finnish Environment Institute SYKE, and Universities of Helsinki and Eastern Finland, and financed by the Strategic Research Council under the Academy of Finland.

Forest catchment ecosystem services and sustainability are in main focus

Forest catchment ecosystem services and sustainability is studied in WP3 (Fig. 1). Elevated nitrogen (N) deposition and changing climate exerts various negative effects on ecosystem processes (e.g. Forsius et al. 2005, Vuorenmaa et al. 2017), and forest BD (Dirnböck et al. 2014). Our framework will include advanced modelling tools and databases to calculate C and nutrient fluxes from catchments to waters (Fig. 2) (Wade et al. 2002, Futter et al. 2011). They will be quantified using empirical, statistical and process-based methods (Tuomi et al. 2011, Rankinen et al. 2016, Akujärvi et al. 2016). We will explore the possible implications for water resources, environmental pollution and ESs at the catchment level for well-studied catchments, using spatially extensive databases on land use, water quality, biodiversity and climate. Models will first be developed and calibrated for small-scale, well-monitored catchments and then up-scaled to higher order river basins. The approach will be developed and tested using data from the intensively studied Long-Term Ecological Research (LTER) sites.

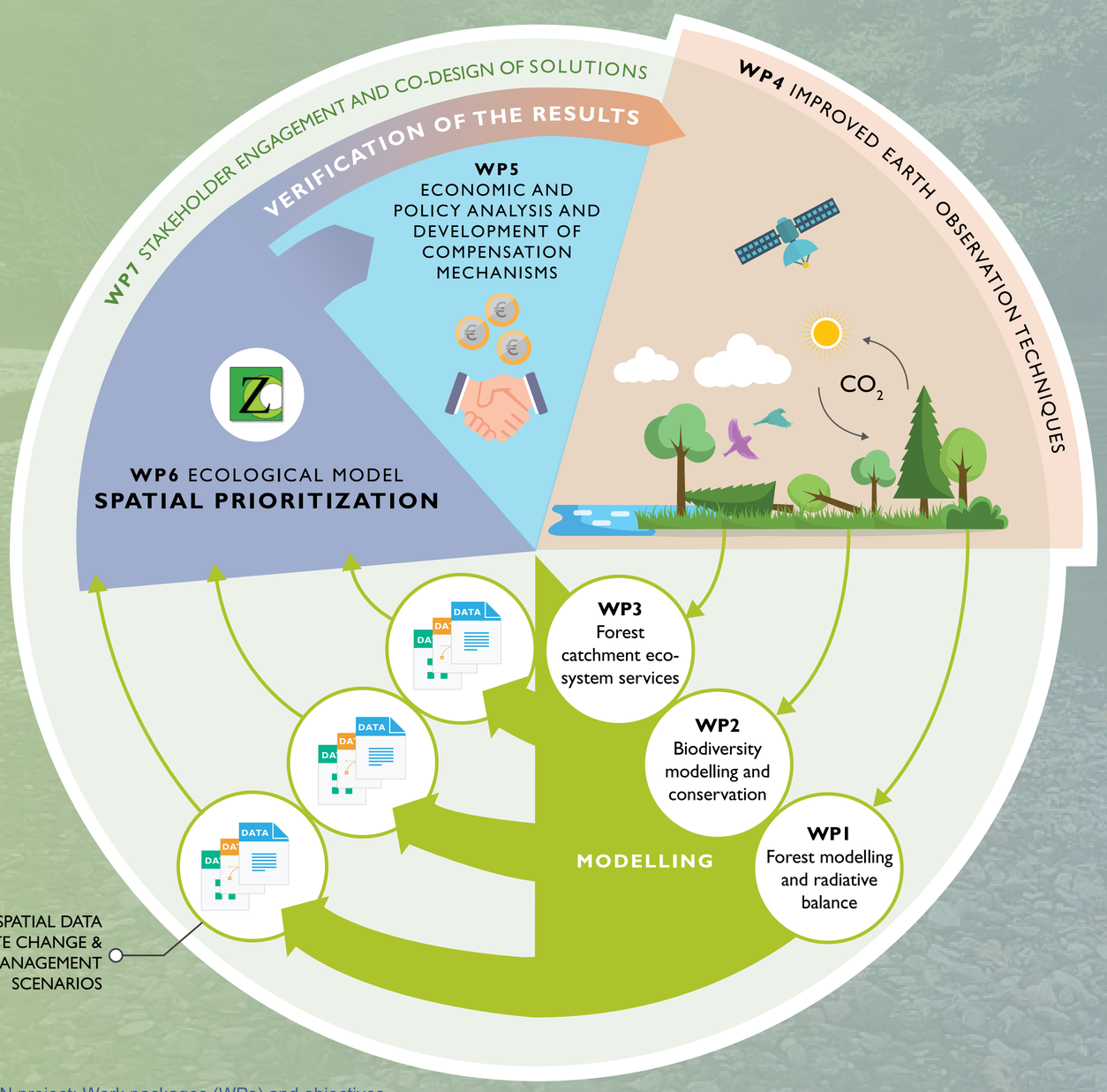

Fig.1. IBC-CARBON project: Work packages (WPs) and objectives

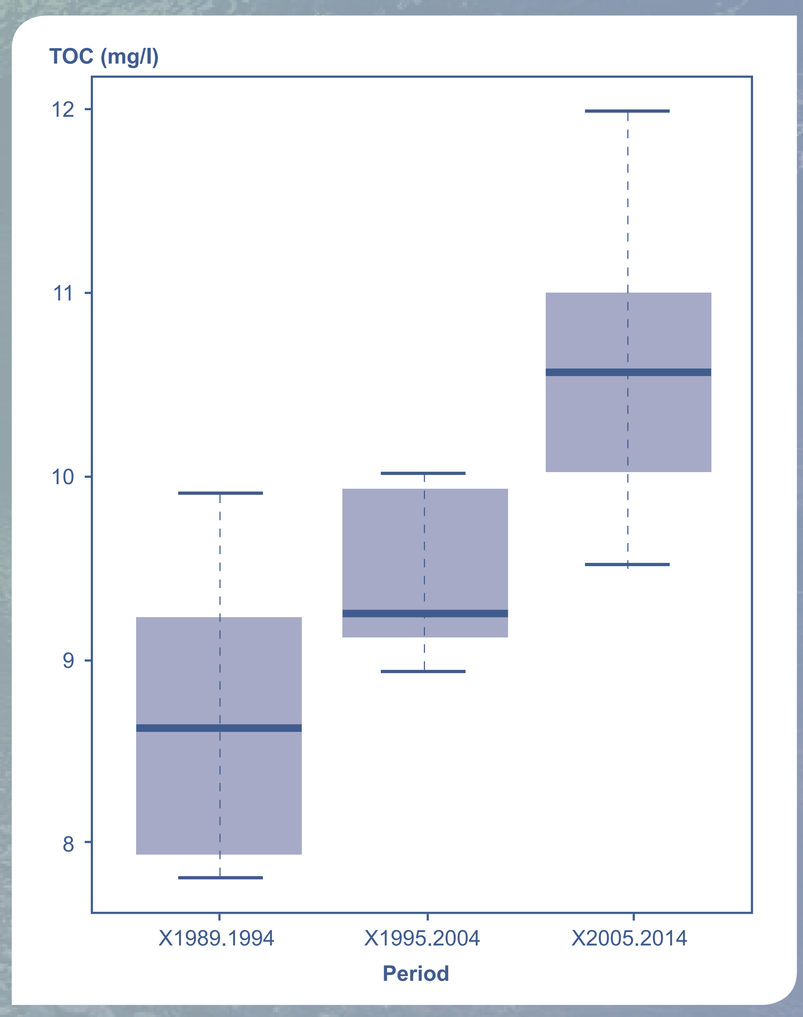

Fig. 2. Increase in total organic carbon (TOC) concentrations are observed in several lakes. Median, inner 50% of data and values that differ at most 1.5 times (the inner quartile range) from the median of lake Pääjärvi data.

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