BOOK OF ABSTRACTS

I. SESSION DESCRIPTION

ID: **T4**

Using earth observation systems (EOS) to support ecosystem service assessments in forest landscapes

Hosts:

	Title	Name	Organisation	Email
Host:	Dr	Melvin Lippe	Thuenen Institute of International Forestry & Forest Economics (TI-WF)	melvin.lippe@thuenen.de
Co-host:	PD Dr	Sven Günter	TI-WF	sven.guenter@thuenen.de
Other organiser	MSc	Ruben Weber	TI-WF	ruben.weber@thuenen.de
Other organiser	MSc	Ferdinand Peters	TI-WF	ferdinand.peters@thuenen.de

Abstract:

Forests play an important role in biodiversity conservation, terrestrial carbon cycling, hydrological regimes and other important ecosystem services for humankind. Attempts to preserve forests' role in providing ecosystem services require information on the spatial and temporal distribution at various scales (i.e. patch, landscape, watershed or administrative units) to support environmental management and policy processes such as the Convention of Biological Diversity (CBD), the Sustainable Development Goals (SDGs) or United Nations Framework Convention on Climate Change (UNFCCC). This is important as the share of forest areas designated primarily for nature conservation and water protection is increasing while on the same time, forest biodiversity and carbon stocks are lost due to deforestation, forest degradation and an increasing habitat fragmentation. Ecosystem service assessments are often limited by spatial and spatiotemporal data to which Earth Observation Systems (EOS) has many features to overcome. Despite widespread recognition, in practice only a few ecosystem service studies use EOS. This session invites studies that shows the link of EOS (i.e. satellite, aircraft, drone, optical, SAR, hyperspectral) and ecosystem service assessments (i.e. experimental studies, field inventories, long-term monitoring, or as part of a citizen science approach) with a particular focus on forest landscapes.

Goals and objectives of the session:

Studies highlight new ways in which EOS can be used to analyze, assess, or monitor ecosystem services at patch, landscape or larger spatial scales. Possible further topics include mapping of ecosystem functions and services under landscape change dynamics, effects of scale on monitoring ecosystem services in conjunction with EOS, and approaches of integrated socioecological assessments with a particular focus on EOS.

The session is organized by up to 5 presentations of 12min. followed by 5min. Q&A (ca. 100mins. due to potential online challenges) and a plenary discussion (20min) to discuss on to how to make better use of EOS approaches for forest ecosystem service assessments and policy advice in light of the CBD, SDGs and the UNFCCC.

Planned output / Deliverables:

Selected papers will be invited for a planned special issue in the Journal Remote Sensing

Voluntary contributions accepted:

Yes

Related to ESP Working Group/National Network:

TWG 4 – Mapping ES

II. SESSION PROGRAM

Date of session: Thursday, 16 December 2021

Time of session: 15:30 – 17:00

List of abstracts and speakers

	First name	Last name	Title of presentation
	Jian	Li	Mapping supply-demand relationship changes of flood regulation service in rapid urbanization basin — A case study in Baiyangdian Basin, China
	Melvin	Lippe	Potential of diverse earth observation products to monitor multipurpose forestry – a multi source extrapolation approach
	Melvin	Lippe	Using earth observation systems (EOS) to support ecosystem service assessments in forest landscapes – Current potentials and new directions with a particular emphasis on citizen science approaches
	Kamlisa Uni	Kamlun	Monitoring Land Use Change and Ecosystem Services In Montane Forest Protected Areas Of Sabah, Malaysia

III. ABSTRACTS

Mapping supply-demand relationship changes of flood regulation service in rapid urbanization basin — A case study in Baiyangdian Basin, China

Presenting author: Jian Li
Contact: j_lioh@163.com

Recognizing the supply-demand relationship dynamic changes of flood regulation service (FRS) is of great significance for rational planning of urban patterns and prevention of flood risks in river basins. Most of the existing studies have explored the spatial pattern of regional FRS supply and demand, but pay less attention to the changes in the temporal and spatial pattern. The objective of this study is to explore the dynamic changes in the supply-demand relationship of FRS in rapid urbanization basins. We propose the supply-demand ratio (SDR) method, which uses the Soil Conservation Service-Curve Number (SCS-CN) model and the flood vulnerability index to quantify the supply and demand of FRS, and then calculate the SDR. We also calculate the change rate of SDR from 1990 to 2018 in basin and subbasin. The case study in Baiyangdian Basin shows that the SDR method can effectively measure changes in the relationship between supply and demand of FRS in the river basin. Compared with the bivariate mapping method, the FRS supply and demand pattern obtained from it is highly consistent with Kappa coefficients in 1990 and 2018 were 0.610 and 0.835, respectively. We also found that from 1990-2018, the imbalance if FRS supply and demand have intensified. The SDR of watershed decreased by 0.088, with the change rate -27.8%. Rapid urbanization is an important reason for the intensification of FRS supply and demand imbalance. The proportion of urban area is the most relevant factor for the supply and demand relationship of FRS, whose Pearson correlation coefficient is -0.845 ($p<0.01$). Therefore, we suggest active policies to defend against flood disaster risks in the future construction of the Xiong'an New Area located in the downstream Baiyangdian Basin.

Potential of diverse earth observation products to monitor multipurpose forestry – a multi source extrapolation approach

Presenting author: Melvin Lippe
Contact: melvin.lippe@thuenen.de

Multifunctional forestry refers to the management of forested landscapes for more than one purpose. A prerequisite for spatial planning of multipurpose forestry are suitable maps covering all ecosystem services of interest. Earth observation (EO) offers the opportunity to monitor diverse functions and services provided by forests. In contrast to the established method of applying average values to different types of forest, extrapolation maps can show the heterogeneity of ecosystem services at different scales within a landscape or within a land-use type. Evaluations on existing literature showed that these extrapolations are largely depended on limited earth observation products, mainly optical images. For example, the extrapolation of stored carbon for climate

regulation has been successfully applied in the past, but there is increasing potential for spatial analysis of multiple ecosystem service through multiple earth observation sensors. Our approach will address mixed EO sources to monitor diverse ecosystem services products using North Luzon in the Philippines as a case study region. We outline a novel extrapolation approach using data from 130 inventory plots and 8 landscapes (each covering an area of 60-100 km²), that reflect the local increasing high forest fragmentation gradient for the extrapolation of selected ecosystem services indicators (aboveground carbon, timber volume, species richness and structural diversity). This process will first be based on vegetation indices (Landsat and Sentinel 2) using multiple linear regression and machine-based learning. We will enhance these models by including radar reflections (Sentinel 1) and forest fragmentation indices from forest binary maps and show the subsequent improvement. The new approach will show how diverse EO products enable the extrapolation of multiple ecosystem services. The results can find application in the identification areas of conflicts and hotspots of ecosystem services. This will support decision makers to identify or evaluate protected areas or to improve land-use planning.

Using earth observation systems (EOS) to support ecosystem service assessments in forest landscapes – Current potentials and new directions with a particular emphasis on citizen science approaches

Presenting author: Melvin Lippe
Contact: melvin.lippe@thuenen.de

Forests play an important role in biodiversity conservation, terrestrial carbon cycling, hydrological regimes and other important ecosystem services for humankind. Attempts to preserve forests' role in providing ecosystem services require information on the spatial and temporal distribution at various scales (i.e. patch, landscape, watershed or administrative units) to support environmental management and policy processes (i.e. Convention of Biological Diversity, Sustainable Development Goals, United Nations Framework Convention on Climate Change). This is important as the share of forest areas designated primarily for nature conservation and water protection is increasing while on the same time, forest biodiversity and carbon stocks are lost due to deforestation, forest degradation and an increasing habitat fragmentation. Ecosystem service assessments are often limited by spatial and spatiotemporal data to which Earth Observation Systems (EOS) has many features to overcome. This study presents the state-the-art in using EOS for ecosystem service assessments in forest landscapes based on outcomes of a systematic literature review. It discusses current gaps of applications and elaborates on future needs to support environmental management and policy processes. It concludes with an outlook on how to better include citizen sciences approaches and other forms of participatory elucidations for integrated long-term EOS and ecosystem service assessments.

Monitoring Land Use Change and Ecosystem Services In Montane Forest Protected Areas Of Sabah, Malaysia

Presenting author: Kamlisa Uni Kamlun
Contact: kamlisa@ums.edu.my

Mapping the ecosystem and its services is essential to development planning and decision processes conducted for the benefit of society. In Sabah, vast ecosystem service (ES) supply by the existing tropical rainforest has contributed to the local community's well-being. Highland protected forest contributed to bundles of ES supply since it possesses a unique ecosystem structure and functions. However, the ES capacity supply of this forest type is minimal. This study is conducted to assess the potential supply of ES using multi-temporal land use change combining with the local community's expert knowledge. This study was conducted in Crocker Range Park, Kinabalu Park, and Kinabalu Eco-Linc. The finding exhibited dynamic degree in the changes of land use and land cover within 28 years. The potential supply of ES by expert based assessment for the classified land cover indicated that the primary forest supplied high potential supply of ES. However, supported by the land cover change monitoring indicated a decreasing of potential supply in the study area. Hence, the overall finding is important as a baseline data to assist imminent land use planning and policy making where conflicting issues commonly occur between the management and the incircling local communities in conservation areas.