Abstract

Study on Sustainable Ecosystem Management of River Watersheds toward Climate-Change Adaptation

Principal Investigator: Jun NISHIHIRO
Institution: National Institute of Environmental Studies, 16-2 Onogawa, Tsukuba,Ibaraki, JAPAN
E-mail: nishihiro.jun@nies.go.jp
Cooperated by: Toho University, Chiba Prefectural Environmental Research Center, Public Works Research Institute, National Agriculture and Food Research Organization, Japan River Front research Center, University of Yamanashi

[Abstract]

Technological development of ecosystem-based climate change adaptation (EbA) measures was conducted in the Lake Inbauma watershed of Chiba Prefecture, Japan. It was suggested that conserving and restoring ecosystems in small valleys at the uppermost reaches of rivers flowing into the lake into wetlands can enhance ecosystem functions related to biodiversity conservation, water purification (nitrogen removal), and flood control. To achieve this, an increase in the rainwater infiltration surface on the plateau, which serves as the catchment area of the valley, was recommended. Increasing the infiltration surface of rainwater on the plateau is effective in ensuring that organisms inhabiting wetlands occurring in the valley bottom can adapt to future climate conditions with rising temperatures. Furthermore, wetlands in agricultural landscapes can reduce the risk of agricultural damage from pests by maintaining shallowly inundated conditions.

In the study on flood control, the effect of wetland restoration within river basins on reducing the amount of flood damage was examined. The results suggest that wetland restoration in areas with many abandoned rice paddies upstream can contribute to the reduction of flood damage. However, inappropriate site selection may increase the amount of flood damage. Therefore, site selection is crucial in planning flood control using wetlands.

A theoretical study on approaches to adaptation to climate change with uncertainty was conducted, utilizing Info-gap theory. A method was proposed to evaluate the adaptive capacity of a system based on the amount of uncertainty it can tolerate. The developed method was applied to ecosystem data to quantify adaptive capacity. Furthermore, the concept of an "adaptation dashboard" was proposed, which visualizes and compares the performance of multiple issues requiring climate change adaptation under the same environmental axis. The results of the above studies were incorporated into lake watershed management plans and water quality management plans of the local government.

Key Words: Climate change adaptation, Ecosystem-based adaptation (EbA), Ecosystem-based disaster risk reduction (Eco-DRR), Nature-based solutions (NbS), Other effective area-based conservation measures (OECM), Green infrastructure, Watershed management, Wetland, Nature restoration

[References]

1) Yoshikawa T, Koide D, Yokomizo H, Kim JY, Kadoya T.: Scientific Reports 13:5932 (2023) Assessing ecosystem vulnerability under severe uncertainty of global climate change. (Impact Factor: 5.516)
2) Fukaya K, Kondo N, Matsuzaki SS, Kadoya T.: Methods in Ecology and Evolution. 13:183-193 (2022) Multispecies site occupancy modeling and study design for spatially replicated environmental DNA metabarcoding. https://doi.org/10.1111/2041-210X.13732. (Impact Factor: 8.335)
3) Nakanishi K, Yokomizo H, Fukaya K, Kadoya T, Matsuzaki SS, Nishihiro J, Kohzu A, Hayashi TI.: Science of The Total Environment 838:156088.(2022) Inferring causal impacts of extreme water-level drawdowns on lake water clarity using long-term monitoring data. https://doi.org/10.1016/j.scitotenv.2022.156088. (Impact Factor: 10.754)
4) Matsushima N, Hasegawa M, Nishihiro J.: Wetlands 42(8):106. (2022) Effects of landscape heterogeneity at

multiple spatial scales on paddy field-breeding frogs in a large alluvial plain. https://doi.org/10.1007/s13157-022-01607-w. (Impact Factor: 2.074)

5) Hirano Y, Kobayashi M, Hashimoto Y, Kato H, Nishihiro J.: Ecological Research, 38:146–153. (2023). Effect of local- and landscape-scale factors on the distribution of the spring-dependent species *Geothelphusa dehaani* and larval *Anotogaster sieboldii*. https://doi.org/10.1111/1440-1703.12352. (Impact Factor: 2.056)
6) Kohzu A, Matsuzaki SS, Komuro S, Komatsu K, Takamura N, Nakagawa M, Imai A, Fukushima T: Science of the Total Environment 881:163097 (2023) Identifying the true drivers of abrupt changes in ecosystem state with a focus on time lags: extreme precipitation can determine water quality in shallow lakes. (Impact Factor: 10.754)
7) Ohtsuki K, Nishihiro J, Kato H, Nakamura K. : 14th International Symposium on Ecohydraulics, Nanjing, China，(with referee) (2022) Evaluation of the Impact of Drainage Channel on Flood Flow in the Urban-Rural Landscape, Proc. https://www.iahr.org/library/infor?pid=22009
8) Katayama N, Mashiko M, Koshida C, Yamaura Y.: Agr Ecosyst Environ 319:107539 (2021) Effects of rice-field abandonment rates on bird communities in mixed farmland–woodland landscapes in Japan. (Impact Factor: 6.576)
9) Baba YG, Osawa T, Kusumoto Y, Tanaka K.: Wetlands 43:17. (2023) Multi-spatial-scale factors determining the abundance of frogs in Japanese rice paddy fields and their potential as biological control agents. https://doi.org/10.1007/s13157-023-01661-y. (Impact Factor: 2.074)