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主 論 文 の 要 旨

論文題目 The effects of anthropogenic disturbance on riparian vegetation of two rivers with different urbanization in central Japan

(日本中部の都市化影響の異なる2河川の河畔植生に対する人為攪乱の影響)

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論 文 内 容 の 要 旨

Ongoing urbanization profoundly impacts ecosystems worldwide by changing environmental conditions and reducing biodiversity. Despite the great significance of riparian habitat as an essential component of urban ecosystems, the effects of urban development on the biodiversity of riparian ecosystems remain poorly understood. In this dissertation, this issue was addressed by investigating the effects of anthropogenic disturbance on riparian plant assemblages in central Japan. To achieve this, I applied an urbanization gradient approach, comparing the species diversity and composition of sites in different levels of anthropogenic disturbance. This dissertation consists of three studies.

The first study (Chapter 2) aimed to disentangle the roles of urbanization on vegetation communities in riparian areas. To do this, I started from a new perspective, comparing plant communities in the same riparian habitat type whereas at different levels of urbanization, instead of using the traditional urban-rural gradient. Plant diversity and abundance were recorded in 96 plots along the Shonai River and Miya River. Various urbanization and local environmental characteristics of each sampling plot were assessed to describe the urbanization level. In this study, I compared species richness, types of vegetation, and composition patterns of the plants in our study. From the species diversity aspect, I found the response of species richness to urbanization varied according to the habitat types. In artificial habitats, the sites with relatively high levels of urbanization had the highest species richness, while the opposite trend was observed in semi-natural habitats. From the plant

community composition aspect, I found that a high level of urbanization was always associated with a large abundance of alien and ruderal species in both artificial and in semi-natural habitats. Furthermore, every component of urbanization that contributed to the variation of species richness was examined in this study. The results showed the dominant factors that determine the species diversity pattern differed from habitat types. In artificial habitats, the proportion of impervious surface was the strongest predictor of the variation in species richness and was associated with the richness of alien, native, and riparian species. In semi-natural habitats, most of the richness of alien and native species were associated with the distance to the city center. These results clarified the response of plant assemblages to urbanization was varied with habitat types, and recommend the methods of pair comparison of multiple rivers to analyze the impact of urbanization on plant species in riparian areas.

As a crucial component of species diversity, β -diversity of plant assemblages was investigated in the second study (Chapter 3). The aim of this study is to investigate the effects of anthropogenic disturbance on the β -diversity pattern of plant communities in riparian areas (the Miya River, Mie Prefecture, Japan). I first compared the taxonomic and functional β -diversity among different degradation levels by using the tests for homogeneity in multivariate dispersions. As revealed from the results, anthropogenic disturbance led to taxonomic homogenization at a regional scale while the homogenization was absent in the functional aspect. I then examined the effects of non-native species and environmental factors on β -diversity. I found the increase in non-native invasions tended to improve homogenization both in taxonomic and functional aspects. However, at a low degradation level, the occurrence of non-natives species was related to taxonomic differentiation. Finally, I assessed the relationship between environmental factors and the β -diversity pattern of plant assemblages. The taxonomic β -diversity was significantly affected by the proportion of impervious surface and NDVI, while the functional β -diversity was associated with the artificial management of riverbank and the proportion of forest. According to these results, this study highlighted the significance of looking at riparian areas in the different levels of degradation, and both invasions of non-native species and environmental factors should be considered to gain insights into the response of ecosystems to anthropogenic disturbance. Furthermore, this study suggested that conservation programs in riparian areas should place more emphasis on the preservation of natural processes and forest resources.

The reduction of specialist species might be a symptom of biodiversity loss driven by

humans. In the third study (Chapter 4), I use the *Phragmites australis* as a target species, exploring the variation of specialist species under the pressure of urbanization at individual and community levels. In this study, 40 sampling plots were established on a suburb-urban gradient along the Shonai River. The results demonstrated that urban areas were associated with degraded dominance of *P. australis* and elevated soil chemical attributes. With decreasing coverage of *P. australis*, the height, stem diameter, and leaf area of *P. australis* showed a decreasing trend. Among all of the environmental factors, soil water content (SWC) and imperviousness were the major factors affecting the characteristics of *P. australis* (40.9% and 22.9% relative explanation, respectively). Compared with land cover factors, soil properties had a greater impact on the characteristics of *P. australis* (75.5% relative explanation in total). Concerning the environmental variables, the soil water content, total nitrogen, pH, and electrical conductivity exerted significant effects. The above results contribute to further confirming the link between urban areas, soil physicochemical properties, and native plant colonization. Moreover, this study provided a reference for the conservation of native aquatic plants in urban areas.

This dissertation provides insight into the effects of anthropogenic disturbance on the riparian habitat in central Japan, which may have important impacts on ecosystem services and biodiversity. According to the results, appropriate management actions are suggested to prevent further degradation of riparian ecosystems. It is expected that this dissertation may help to better consider all aspects of nature and human well-being in the future planning process of central Japan.