Physiological and Ecological Responses of Plants and Plant Communities in Dryland Environments

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Naoko H. Miki¹ · Nobuhito Ohte²

Published online: 15 June 2021

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Foreword

Ecosystem degradation due to the desertification of drylands has a negative effect on the environmental conditions and lives of the residents. Therefore, it is crucial to prevent the enlargement of desertified land and to rehabilitate the ecosystem through the conservation of native plants and revegetation using native plants. To prevent the spread of desertification and to restore ecosystems, it is necessary to understand the physical and chemical conditions of the location and accurately assess the carrying capacity of the land. In particular, it is important to assess the amount of water resources available and accurately understand the water use characteristics of the vegetation used for restoration. Although native species often have a variety of physiological and ecological characteristics adapted to harsh environmental conditions, newly introduced species from other regions may have lower water use efficiency or higher water consumption than native species. Revegetation using species that have deep roots, use groundwater, and have active transpiration, for example, may often consume large amounts of water (Wilske et al. 2009), and may eventually result unsuccessful rehabilitation.

Species diversity affects the current functioning of ecosystems, as well as their resistance and resilience to future climate change (Chapin III et al. 2000). It also affects the resistance of the ecosystem to desertification (Maestre et al. 2012). In harsh environments such as drylands,

interactions between plants are important factors in constructing ecosystem species diversity (e.g., Tielborger and Kadmon 2000; Hochstrasser and Peters 2004). Therefore, it is also important to consider the interactions between plants in revegetation practices in drylands. Interactions between plants exert direct and indirect effects on the growth and survival of one to another species (Miller 1994), which include both promotive and inhibitory effects (e.g. Callaway et al. 2002). For indirect effects, under severe environmental conditions in drylands, shrub species have a great promotive effect on the growth of understories through the moderating effect (nurse effect) of environmental conditions (Gutiérrez et al. 1993), on the other hand, a great inhibitory effect through resource competition has also been considered (e.g. Carvajal et al. 2014). As direct effects, there is allelopathy, which is the inhibitory or promotive effect of a chemical substance produced by one plant on another plant (Molisch 1937; Fujii and Hamano 2003). In addition, since many dryland ecosystems are maintained and established under various natural and unnatural disturbances, such as wildfire and grazing pressure, it is also important to evaluate the effects of these disturbances on the structure and function of the ecosystem.

Ecosystems in drylands are originally established under conditions of low precipitation. Therefore, regeneration of these ecosystems is often fraught with difficulties, and recovery after destruction takes time. Therefore, it is necessary to evaluate the effects of revegetation both in the short and long term. In addition, it is important to practice revegetation that does not cause irreversible damage to water resources, which is reasonable in terms of plant physiology and ecology. For this purpose, it is essential to accumulate basic knowledge to understand the physiological and ecological characteristics of plant species inhabiting drylands that are distributed over a wide area of the world. The purpose of this special feature is to promote research in this field and to consolidate the

✉ Naoko H. Miki
miki@okayama-u.ac.jp

¹ Department of Environmental Ecology, Graduate School of Environmental and Life Science, Okayama University, 1-1-1 Tsushimanaka, Kita-ku, Okayama 700-8530, Japan

² Department of Social Informatics, Graduate School of Informatics, Kyoto University, Kyoto 606-8501, Japan

knowledge necessary for further development of revegetation and ecosystem restoration in drylands.

Papers in the special feature

1. Allelopathic effects of the revegetation species *Juniperus sabina* L. in semiarid areas of China. Long Qin, Naoko H. Miki, Guosheng Zhang, Yoshiharu Fujii
2. Life history of *Juniperus sabina* L. adapted to the sand shifting environment in the Mu Us Sandy Land, China: a review. Nobuhito Ohte, Naoko H. Miki, Naoko Matsuo, Lingli Yang, Muneto Hirobe, Norikazu Yamanaka, Yoshiaki Ishii, Ayumi Tanaka-Oda, Michiko Shimizu, Guosheng Zhang, Keiji Sakamoto, Linhe Wang, Ken Yoshikawa
3. Effects of large-scale forest fire followed by illegal logging on the regeneration of boreal forests in Mongolia. Keiji Sakamoto, Misaki Tomonari, Uyanaga Ariya, Erika Nakagiri, Tetsuya K. Matsumoto, Yasuaki Akaji, Takashi Otda, Muneto Hirobe, Baatarbileg Nachin
4. Effects of livestock grazing intensity on soil arbuscular mycorrhizal fungi and glomalin-related soil protein in a mountain forest steppe and a desert steppe of Mongolia. Altansukh Goomaral, Masahide Yamato, Ryota Kusakabe, Jamsran Undarmaa, Norikazu Yamanaka, Takeshi Taniguchi

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