

List of Dissertation Abstract (Department of Natural Environment)

Name	Supervisor	Title	Abstract
Shirai Takeru	Ishikawa Masahiro	Sintering experiments on ultrafine-grained peridotite using Kurose peridotite xenoliths	Understanding the physical properties of the Earth's interior generally involves synthesizing polycrystalline aggregates of constituent rocks and minerals and experimentally measuring their properties. In recent years, fine-grained polycrystalline materials that preserve the composition of natural minerals have been successfully produced; however, these studies have primarily used single-mineral starting materials, and methods targeting natural rocks composed of multiple minerals remain insufficiently explored. In this study, we produced ultrafine-grained powders from Kurose peridotite xenoliths through cryogenic milling, and demonstrated that large, dense, ultrafine-grained sintered peridotite bodies can be successfully fabricated through sintering.
Ichikawa Hiroto	Hiratsuka Kazuyuki	Identification of luminous regions and comparative histological observations of the luminous springtail <i>Lobella sauteri</i>	I investigated the site specificity of luminescence in the luminous springtail <i>Lobella sauteri</i> using image analysis, followed by comparative histological observations among body regions and between luminescent and non-luminescent species. The results showed that the tubercles on the thoracic and abdominal segments emitted light at a high frequency, whereas those on the head emitted light only from the dorsoexternal tubercles. However, no clear histological differences corresponding to the presence or frequency of luminescence were observed. These findings suggest that luminescence in this species is regulated not by histological structures but rather by microscopic biochemical and physiological mechanisms.

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Urata Miu	Sasaki Takehiro	Variation in plant leaf and root traits along shoreline and topographic gradients within a coastal dune	Plant functional traits help explain how plants respond to environmental conditions through trade-offs between resource acquisition and conservation. However, most studies have focused on relatively homogeneous ecosystems, leaving trait responses in environments with strong spatial gradients insufficiently understood. Coastal dune ecosystems experience multiple stresses, including salt spray, strong winds, sand movement, low water retention, and nutrient-poor soils, with stress intensity changing from the shoreline inland. In addition, many dunes face increasing threats such as coastal erosion, reduced sand supply, and vegetation succession caused by human disturbances. Despite this, trait-based evaluations of dune plant communities remain limited, particularly regarding the roles of species turnover, intraspecific variation, and root traits.
Kasuga Kouki	Sasaki Takehiro	Resource-conservative traits increasingly enhance plant community resistance under more intense flooding events	Flooding is a major disturbance regime, and both its frequency and intensity are expected to increase. However, it remains unclear whether the mechanisms underlying plant community resistance and recovery are maintained under repeated floods. We repeatedly surveyed vegetation in permanent plots on urban river floodplains in Japan. Resistance increased with flood intensity and was higher in communities dominated by high LDMC, indicating a significant trait $\times$ intensity interaction. In contrast, recovery was not explained by functional traits or diversity. Instead, vine cover showed a strong negative relationship with recovery. These results reveal an asymmetric stability pattern under repeated floods.

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Shibata Motoki	Yoshida Ryuji	The Role of Moist Convection in Tropical Cyclone Genesis under Easterly Waves in the Western North Pacific	Tropical cyclone genesis is a vortex forming process which progresses with the organization of convective clouds. During this process, the vertical advection and stretching of vorticity by convection are considered important for the formation of an initial vortex in the free atmosphere, whereas the role of vorticity tilting remains unclear. In this study, real case numerical simulations of Typhoon Faxai (2019) were conducted using multiple experiments in which the intensity and area of convection were varied. The results indicate that, in addition to the vertical advection and stretching of vorticity, vorticity tilting by convection under a horizontal wind structure characteristic of easterly wave environments also contributes to the formation of the initial vortex.
Shoyama Tsubasa	Yoshida Ryuji	Impact of Atmospheric Circulation Patterns on Future Changes in Short-Duration Heavy Rainfall in the Kanto Plain	As the increasing frequency of short-duration heavy rainfall in recent years, this study analyzed future changes over the Kanto Plain using an ensemble dataset. By the end of the 21st century, both the rainfall amount and the frequency of these events are projected to increase, mainly due to rising atmospheric water vapor. Regional differences in precipitation increase are also found, likely related to cyclone-associated rainfall, including remote effects of tropical cyclones and precipitation from extratropical cyclones.

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Takahashi Manato	Kagami Maiko	Spatial Variation of Snow Algal Communities in a Beech Forest on Mt. Gassan, Japan	Snow algae cause colored snow, a phenomenon in which the snow becomes patchily colored. In this study, algal communities were compared among three elevations in a beech forest on Mt. Gassan, Yamagata. Community structure differed among elevations and was associated with differences in nutrient and light conditions. In addition, even at the same elevation, community structure differed between green and red snow patches. Motile cells were dominant in green snow, whereas cysts were dominant in red snow. These results suggest that, in forested areas, algal community structure is influenced not only by environmental differences associated with elevation but also by variation in light conditions on forest floor.
Tomioka Masaki	Hiratsuka Kazuyuki	Identification and analyses of a novel space around blood vessels of the brain with specific molecular dynamics	Dynamics of molecules in the brain are important for understanding the mechanisms of biomolecules in complex tissue. However, they have yet to be visualized and remain poorly understood. In this study, we successfully visualized dynamics of molecules in the brain by applying a uniquely developed multimodal multiphoton microscope and a localized molecular delivery method. Furthermore, we newly identified and performed analyses of a space with specific molecular dynamics around the blood vessels of the brain, a critical site for molecular exchange.

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Niimura Kohhei	Ishikawa Masahiro	Temporal Analysis of Supraglacial Lakes in Enderby Land, East Antarctica, Using Satellite Remote Sensing	This study examined the spatiotemporal variability of supraglacial lakes near the nunatak region of Enderby Land, Antarctica, during the summers from 2014 to 2025. Lakes were extracted from Landsat 8 and 9 satellite images, and their areas were analyzed. Climate variables from ERA5-Land, including air temperature, solar radiation, snowfall, and wind speed, were used to investigate relationships with lake area using correlation and multiple regression analyses with time lags up to 42 days. Results show that lake area is positively related to temperature and solar radiation and negatively related to snowfall, with solar radiation having the strongest influence.
Hashimoto Rikuto	Shimode Shinji	Characterization of female gonad types and their relationship with reproductive strategies in planktonic marine calanoid copepods	This study examined the relationship between female gonad morphology and spawning strategies in pelagic calanoid copepods from Sagami Bay. Through incubation experiments and morphological observations, spawning was confirmed in 50 species across 24 genera and 11 families. Female gonads were classified into four types: <i>Calanus</i> type (shallow-layered and multi-layered), <i>Pseudocalanus</i> type, and <i>Aetidius</i> type. Gonad morphology was similar at the genus level and showed relationships with egg volume relative to body volume and clutch size. Combining these results with molecular phylogeny suggested that the <i>Calanus</i> -type gonad may have evolved independently during adaptation to pelagic environments, and that reproductive strategies changed with environmental shifts.

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Mizukami Kein	Nakamori Taizo	Establishment of techniques for creating 3D models and enlarged real models of soil animals	Minute soil animals play essential ecological roles, but their 1–3 mm body size makes direct and tactile observation difficult, limiting their educational use. This study aims photogrammetry as a method to record their external morphology and produce enlarged physical models. Three-dimensional models were reconstructed from multi-angle microscope images using a motorized turntable. Terrestrial mollusks served as stable reference specimens, while Collembola tested technical limits. The models were enlarged and fabricated with FDM 3D printing. Results indicate that, under controlled imaging conditions, photogrammetry can produce sufficiently accurate models suitable for tactile and educational applications despite surface resolution limitations.
Miyagi Sho	Hiratsuka Kazuyuki	Evaluation of a Novel Compound that Induce Jasmonic Acid Response Gene Expression	The JA pathway, which functions as a plant defense response pathway, plays an important role in plant growth regulation and the production of useful substances. In this study, we characterized the compound Ara-C, which induces the JA pathway.

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Yamanashi Marina	Sasaki Takehiro	Mowing regimes enhancing plant diversity across scales in a <i>Satoyama</i> forest understory	Abandonment of <i>Satoyama</i> landscapes causes biodiversity loss. To establish sustainable management, I tested seven mowing treatments combining heights (0/10cm/none) and seasons across 36 plots in Yokohama Zoo. Using mixed models and resampling simulations, I analyzed alpha, beta, and gamma diversity. Early-summer 10cm mowing maximized local (alpha) functional diversity. Moreover, combining diverse mowing intensities and seasons increased community turnover (beta) and buffered overall regional (gamma) diversity loss. Implementing "mosaic management" combining varied treatments maximizes biodiversity, providing a scientific model that balances ecological conservation and labor efficiency in urban forests.

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Wang Yimian	Sasaki Takehiro	Grazing spatial patterns modulate the effects of grazing intensity on arthropod diversity and abundance	Grazing management strongly influences grassland biodiversity, yet the ecological role of grazing spatial pattern is often unclear because intensity and spatial pattern are frequently confounded. We used a field manipulation experiment in a semi-arid grassland in Inner Mongolia, China, to test how grazing spatial pattern (intensive vs. extensive) interacts with grazing intensity to shape ground-dwelling arthropod diversity and trophic structure. Arthropod γ -diversity was higher under intensive than extensive grazing at moderate intensity, and herbivores responded positively to intensive grazing, whereas predators tended to decline with increasing intensity. Structural equation models showed that effects were mediated mainly via reduced plant height. These results highlight the need to consider spatial pattern alongside intensity when designing grazing regimes.