（第３号様式）(Form No. 3)

学 位 論 文 要 旨
Dissertation Abstract

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学位論文題目：
Title of Dissertation　Comparative studies on leaf litter decomposition and forest floor dynamics as influenced by tree functional types　（落葉分解と林床動態に関する比較研究－樹木生活型の影響を受けるものとして）

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We are now approaching the stage at which we can predict the rate of litter mass loss from bags of any litter anywhere in the world based on 2 major factors: substrate quality and macro climate. However, we cannot yet predict at the same level of accuracy the forest floor turnover rate, the proximate factor regulating nutrient cycling and carbon sequestration in forest ecosystems. In boreal to cool temperate regions where low temperatures are a major limiting factor of decomposition, the power of substrate quality for predicting litter turnover rate across different tree functional types is relatively high. This high predictability may be ascribed to synergistic influence of substrate quality and site factors on forest floor dynamics. However, the extent to which substrate quality predicts forest floor turnover rate is not yet known for warm temperate to tropical regions where low temperatures under the canopy are not a major limiting factor of decomposition.

In order to evaluate the power of substrate quality for predicting forest floor dynamics in warm temperate to tropical regions, I studied the litter quality, litter decay rates in litter bags, and forest floor dynamics in relation to microbial activity in two types of forests consisting of different tree species in each of the following three regions: a warm temperate area in Japan, a humid tropical lowland area in Sarawak, and a subtropical monsoon area in Bangladesh.

In Japan, an evergreen broadleaved forest (EBF) and a deciduous broadleaved forest (DBF) in the Kochi University Forest were selected as study sites. Substrate quality, CO_2 emission rate of litter in

litter bags, and mass loss rate of litter in litter bags were lower in EBF than in DBF. However, CO_2 emission rate from the A_0-layer was higher in EBF than DBF, and litter turnover rate was similar between EBF and DBF. Regarding this discrepancy, effects of substrate quality on forest floor dynamics were considered to be counterbalanced by the effects of site factors such as water content of the A_0-layer, leaf fall phenology, and activity of surface living earthworms.

In Sarawak, a primary forest (PF) and a young secondary forest (YSF) in the Lambir Hills National Park were selected as study sites. Substrate quality, CO_2 emission rate of litter in litter bags, and mass loss rate of litter in litter bags were lower for PF litter than for YSF litter. However, CO_2 emission rate from the A_0-layer and litter turnover rates were higher at PF site than at YSF site. Regarding this discrepancy, effects of substrate quality on forest floor dynamics were considered to be overridden by the effects of water content of the A_0-layer.

In Bangladesh, 2 semi-evergreen forests of different tree species (site A and site B) in the Lawachara National Park were selected as study sites. Although differences between the sites were less conspicuous than those between EBF and DBF and between PF and YSF, a consistent relationship between substrate quality, CO_2 emission rate of litter in litter bags, and mass loss rate of litter in litter bags was found across site A and site B. However, the difference in litter turnover rate between the sites was reverse to that expected from this relationship. Regarding this discrepancy, substrate quality and leaf fall phenology were considered to affect antagonistically on forest floor dynamics.

In contrast to boreal to cool temperate regions, the power of substrate quality for predicting litter turnover rate was reduced by antagonistic effects of site factors in all 3 localities investigated.

It was concluded that substrate quality has a strong power for predicting litter decomposition rates in litter bags anywhere in the world, but that the power of substrate quality for predicting litter turnover rates depends on macro-climatic conditions.