

(続紙 1)

京都大学	博士 (農 学)	氏名	A. T. M. ZINNATUL BASSAR
論文題目	Above and belowground biomass and net primary productivity in two subtropical mangrove forests in Japan 日本の亜熱帯マングローブ 2 林における地上部・地下部のバイオマスと純一次生産量の推定		
(論文内容の要旨)			
<p>In this doctoral study, biomass and net primary production are estimated for mangrove forests on Okinawa Island and Ishigaki Island. It quantitatively evaluates the dynamics of the belowground parts including fine roots, which had rarely been documented in previous studies, along with aboveground biomass and litterfall. Mangroves are among the most carbon-rich tropical forests, storing carbon in the tree biomass and in the soil. Coastal ecosystems with mangroves, sea grass, and marsh vegetation are considered effective carbon sinks, which receive much attention as blue carbon in the context of climate change mitigations. Accurate estimation of the carbon accumulation capacity of these mangrove ecosystems close to the northern limit of their distribution, such as the Okinawa region, is an important issue for climate change mitigation, especially because climate change and other anthropogenic factors can change their distribution.</p> <p>Chapter 1, “General Introduction”, discusses the importance of mangrove ecosystems, and three common species found in Japan are introduced. Chapter 2, “Site description”, provides an overview of the climate of the two study sites and their mangrove stand structures.</p> <p>Chapter 3, “Development of allometric equations of <i>Rhizophora stylosa</i> and <i>Bruguiera gymnorrhiza</i> in the Manko Wetland of Okinawa Island in Japan”, reports the biomass of two mangrove species, evaluating the relationships between stem diameter and log-transformed biomass of each organ, i.e., leaves, stem, and root. From these relationships, allometric equations are developed specific to the mangrove forests on the Okinawa Island.</p> <p>Chapters 4 and 5, “Seasonal pattern of aboveground litterfall of three <i>Rhizophoraceae</i> family species in two subtropical regions in Japan” and “Fine root dynamics of three <i>Rhizophoraceae</i> family species in two subtropical regions in Japan”, analyze the data on fine roots and aboveground litter fall dynamics collected for three mangrove species in the Okinawa Island site and two species in the Ishigaki Island sites. Monthly collection of aboveground litter with traps showed seasonal variations of leaf fall on Okinawa Island, but not on Ishigaki Island. On the other hand, the litters of reproductive organs, such as flowers, fruit and propagules, showed the seasonality across sites and species. Litter of stipules and branches showed seasonal patterns as well. For fine root production, the sequential core method as well as the ingrowth method were used to estimate fine root production in the Manko wetland on Okinawa Island, whereas only the sequential core method was implemented in the Miyara River sites on Ishigaki Island. In all sites, decomposition rates were measured with a litter bag method. The integration of these data indicates the importance of fine root dynamics as the source of soil carbon in mangrove stands.</p>			

Chapter 6, “Measuring biomass and net primary production of two subtropical mangrove forests in Japan”, estimates the biomass with the equations developed in Chapter 3. The mangrove forests on Okinawa Island, representing the northern limited area of mangrove distribution along the Asian coastal area, had relatively lower biomass than the mangroves on Ishigaki Island. The root biomass accounted for 30% of the total biomass, while the belowground NPP accounted for 28% of the total NPP. Fine roots, which accounted for only 5 % of the total biomass, accounted for 15 % of the total NPP.

Chapter 7, “Conclusion and recommendation”, discusses the differences among three mangrove species studied in the three sites on Okinawa Island on Ishigaki Island, along with how the study findings are relevant for management of mangroves.

In summary, this study significantly contributes to forest ecology and ecosystem science, improving the data on biomass and NPP of mangrove forests in Japan. In particular, it highlights the importance of fine root dynamics at the ecosystem level as a key component of the blue carbon accumulation in mangrove ecosystems.

注) 論文内容の要旨と論文審査の結果の要旨は1頁を38字×36行で作成し、合わせて、3,000字を標準とすること。

論文内容の要旨を英語で記入する場合は、400～1,100 wordsで作成し
審査結果の要旨は日本語500～2,000字程度で作成すること。

(続紙 2)

(論文審査の結果の要旨)

マングローブは熱帯において最も炭素蓄積量が多い生態系の一つと推定される。近年はマングローブを含む沿岸から浅瀬の植生はブルーカーボンとも呼ばれ、水域での炭素吸収と蓄積の重要な要素として認識される。しかし、細根の動態をはじめとする地下部の炭素蓄積を地上部の炭素蓄積とともに推定した研究の例は少ない。本研究は、分布北限に近い沖縄本島および石垣島のマングローブ林を対象として、バイオマス量および、純一次生産量(NPP)を推定した。評価すべき点は、以下の3点にまとめられる。

1. 沖縄本島のマングローブ林で、*Rhizophora stylosa*と*Bruguiera gymnorhiza*の2樹種について、アロメトリー式を作成した。
2. シークエンシャルコア法を用いた従来の細根生産量の推定に、細根リターバックを併用することで分解率を考慮にいった手法を適用した。
3. 沖縄本島漫湖湿地のマングローブ林分3カ所および、石垣島宮良川流域のマングローブ林分2カ所を対象地にして森林のNPPを求めた。日本のマングローブ林において初めてNPPと細根推定値を同時に測定し、NPPに占める細根生産量の高い寄与率を定量的に示した。

以上のように、本研究は、分布北限に近いマングローブ林の基礎的なデータを収集解析し、森林生態学、熱帯林生態学、生態系生態学の発展に寄与するところが大きい。よって、本論文は博士(農学)の学位論文として価値あるものと認める。

なお、令和6年2月13日、論文並びにそれに関連した分野にわたり試問した結果、博士(農学)の学位を授与される学力が十分あるものと認めた。