Nitrogen cycling in the soil-plant systems along a series of coral islands affected by seabirds in the South China Sea

Libin Wu¹, Xiaodong Liu¹, Yunting Fang², Pingqing Fu³ and Liqiang Xu⁴

¹ University of Science & Technology of China, Hefei, China. (L) wulbustc@mail.ustc.edu.cn.
² Institute of Applied Ecology, Chinese Academy of Sciences, Shenyang, China.
³ Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China.
⁴ Hefei University of Technology, Hefei, China.

Nitrogen (N) source and use strategy for plants have become the focus of phytogeocology, and previous studies showed that they can response to climate and environment changes. However, there are still few studies on N cycling in coral island from the perspective of ecosystem evolution. Here, we aim to assess the impacts of seabird-driven nutrient transport on the N cycling in the soil-plant systems in coral islands. A series of coral islands affected by seabirds at different levels, in Qilian Yu, Xisha Islands, South China Sea, were investigated. Soils and two dominant plant species, Scaevola sericea and Lepturus repens, which are C₃ and C₄ plants, respectively, were sampled. The contents and δ¹⁵N of TN, NH₄⁺-N and NO₃⁻-N (IN) in soils; and TN, C/N, δ¹³C and δ¹⁵N in plant leaves, were determined. The content of phosphorus (P), one of the most important avian bio-elements, was also determined. Our data indicate that TN in soils is greatly influenced by TP. Accompanied by the increase of TP, TN, IN and δ¹⁵N in soils become higher. As soil N increases, plant C/N decreases and δ¹⁵N increases. When TN in soils is low, δ¹⁵N in plant leaves is close to δ¹⁴N of soil NO₃⁻ but far from that of soil NH₄⁺ (with lower content relative to NO₃⁻). When TN in soils is high, δ¹⁴N values are all close. These data suggest that the growth of plants is closely related to N in soils. When the coral island is barren, soils, as well as plants, are N-limited and their main N source is highly likely atmospheric deposition. Influenced by N input from seabird guano to the soils, plants can use N from guano as the main N source and grow better, and NH₄⁺ most likely accounted more for the N utilization of plants. Overall, our study emphasized the key role of seabird, the diversity of soil properties and plants N-acquisition strategies in coral island. It is instructive to predict future change of ecosystem and protect it.