Impacts of swidden cultivation on the soil fertility in the Highlands, Papua New Guinea

Dr Ryosuke Fujinuma[1], Dr Gunnar Kirchhof[1], Professor Neal Menzies[1]
[1]*The University Of Queensland*

The swidden cultivation is the traditional soil fertility management in the Papua New Guinea Highlands. Sweetpotato (Ipomoea batatas) is a staple food for the country and also a major crop type in the region. Recent population growth with limited opportunity to expand land use for cultivation in the region leads to the hypothesis of that land use intensification would induce the natural resource degradation; however, the magnitudes of degradation and differences between nutrients are not well understood. Surface soil samples (0-20 cm) and sweetpotato leaves were collected for chemical analyses in a total of five villages located across three provinces (Eastern Highlands, Shinbu, and Western highlands) with 6-7 subsamples per village in 2005 and 2014. Multivariate analysis indicates that both time and field location are the two main controlling factors for the soil fertility. The nine years of swidden cultivation affected on P, Na, Mn, and Zn. On the other hand, the field location affected total C, total N, pH and base cations. The extractable concentration of immobile nutrients in the soils, such as P, Na, Zn, in 2014 decreased more than 50 % compared with that in 2005. Even though the significant site-specific effects on total C and N, changes in C:N ratio indicates the nutrient mining of non-labile N pool over the years. The chemical composition of sweetpotato leaves showed the significant decrease in N, S, Ca, Fe, and B. Further the concentration of N, S, B, and Zn were below the critical concentration. The data indicated that developing effective soil fertility management tools, particularly for immobile nutrients, are crucial for preventing further nutrients run-down by the ongoing intensification of the swidden cultivation in the region.