# I. GENERAL INTRODUCTION

## Research background

Indonesia is one of the major tropical rainforest areas worldwide, with 10% of the world's rainforest area and nearly 50% of Asia's remaining tropical rainforest, but Indonesia also has one of the highest deforestation rates worldwide, 1.17% annually in the last decade. The most important factor causing deforestation in Indonesia is expansion of agriculture (FAO 2001). Deforestation has often been evaluated from the rainforest conservation perspective. However, large human rural communities depend on agriculture in rainforest margin areas. According to Lanly (1985) slash and burn agriculture worldwide sustains the livelihood of estimated 500 million people, most of them in tropical and subtropical areas. Therefore studies on forest margin stability should not only focus on forest conservations but also on potentials and sustainability of agricultural practices in rainforest conversion areas (Dechert 2003). South East Asia and especially some regions on the Indonesian archipelago including Central Sulawesi were identified as areas of particularly high deforestation rates (Archard et al. 1998, Drigo 2004).

An agroforestry system such as shade-grown cacao (*Theobroma cacao*) is one alternative of land use systems to slash-and-burn agriculture and is recommended for sustainable development in the humid tropics (Johns 1999). Although cacao has also been linked to deforestation (Ruf 1998), the link depends on certain conditions such as the suitability of cleared land for cacao, property rights, labor availability, and whether farmers capture forest area by planting cacao or substituting other shifting cultivation practices (Vosti et al. 2003). Because cacao is shade-tolerant and can grow under a canopy of trees maintained, regenerated, or replanted from the traditional tropical forest (Beer et al. 1998), its inclusion as a component of a forest agro-ecosystem can maintain biodiversity and ecological services provided by the native forest (Glor et al. 2001, Rice and Greenberg 2000).

The land use change from forest into agroforestry systems has an impact on ecosystem changes. The ecosystem changes will be changing the biological systems, e.g. nutrient cycling. The beginning of nutrient cycling change was the changing in vegetation structure and composition, which influenced the litterfall production. Litter production from plants, particularly trees, is a major source of

organic matter and energy to soil, and it is important for nutrient cycling in ecosystem. Changes in soil management practices influence the amount, quality and turnover of soil organic matter. Soil organic matter is a key of nutrients for plant growth.

The changes in vegetation structure from natural forest to agroforestry systems may not only lead to changes in quantity and composition of litter, but also to the other ecosystem properties (e.g. soil microclimate, Vetaas 1992; and nutrient return, Kochy and Wilson 1997) that could influence ecosystem function (Sangha et al. 2006).

Lore Lindu National Park (LLNP), Central Sulawesi, Indonesia was chosen as the focus of this study. It is the most important protected areas in Indonesia and was declared as a "Biosphere Reserve" in 1978. Biosphere reserves were conceived as "experimental sites for sustainable development, research, and monitoring on ecosystems and conservation of biodiversity", and are at the same time meant to "promote well being of local people who live in and around the reserve" (UNESCO 1995). Generally, habitats in the interior of LLNP are still relatively less disturbed, but some areas of the park have been converted to agricultural land and in several locations plantations of coffee and cacao have transgressed the park boundary.

The Toro community is one of the indigenous groups ("Ind.: *masyarakat adat"*) living around LLNP by planting mostly cacao. Changes in land use under LLNP, particularly in Toro village, into cacao agroforestry systems may change ecosystem function.

**Objectives**

1. To determine litterfall dynamics, leaf-litter decomposition, and fine root biomass in the natural forest and cacao agroforestry systems.
2. To determine active fraction on soil macro-organic matter (SOM) in the natural forest and cacao agroforestry systems.
3. To assess nitrogen resorption and nitrogen use efficiency (N NUE) in cacao agroforestry systems.

**Hypotheses**

The hypothesis of the research is that the land use change has an impact on ecosystem characteristic, which includes changes in the litterfall production, the rate of litter decomposition, active pool content in SOM, the soil nitrogen content, the biomass of fine root, the cacao foliar nitrogen content, the nitrogen resorption, and N NUE; also its implication to cacao establishment.

**Expected results**

The research result may be useful information for establishment of cacao agroforestry system at margin of the LLNP, Central Sulawesi.