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Assessment of ecosystem services in homegarden systems in Indonesia, Sri Lanka, and Vietnam

Hideyuki Mohri [a,*], Shruti Lahoti [a], Osamu Saito [a], Anparasan Mahalingam [a], Nimal Gunatilleke [b], Irham [c], Van Thang Hoang [d], Gamini Hitinayake [e], Kazuhiko Takeuchi [a,f], Srikantha Herath [a]

[a] Institute for Sustainability and Peace, United Nations University, 5-53-70 Jingumae, Shibuya, Tokyo 150-8925, Japan
[b] Faculty of Science, University of Peradeniya, Sri Lanka
[c] Faculty of Agriculture, Gadjah Mada University, Indonesia
[d] Centre for Natural Resources and Environmental Studies, Vietnam National University, Vietnam
[e] Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka
[f] Integrated Research System for Sustainability Science, University of Tokyo, Japan

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ABSTRACT

Numerous studies have been conducted on homegarden systems by researchers from different disciplines and countries, but most of them focus on ecological structure or specific ecosystem services in a selected study area. Few studies take a comprehensive look at the ecosystem services provided by homegardens, especially on a regional scale. This paper shows how these homegardens are ecologically, socially, and economically diversified and how beneficial they are to human well-being as ecosystem services. It also investigates the impacts of drivers on homegarden systems in rural areas in three countries. These studies involved comprehensive literature reviews and field survey along with a framework of the Millennium Ecosystem Assessment. Four types of ecosystem services—provision, regulation, cultural, and support—were assessed and compared. We found that traditional homegardens maintain high ecosystem diversity especially in rural areas; however, recent socio-economic changes are converting subsistence-oriented homegardens into commercial ones. Future challenges for further research include how to enhance the resilience of homegarden systems against socioeconomic and global climate changes by integrating traditional homegarden systems, modern technology, and the global economy.

Contents

* Corresponding author. Tel.: +81 3 5467 1212; fax: +81 3 5406 7347.
E-mail address: mohri@unu.edu (H. Mohri).

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1. Introduction

A homegarden is a garden surrounding a residence that provides various goods and services to members of the household. A homegarden is usually a small-scale supplementary food production system designed for local inhabitants, but sometimes it mimics natural, multilayered ecosystems (Hoogerbrugge and Fresco, 1993). Soemarwoto and Christanty (1985) define a homegarden as a land use system with a structure resembling a forest and one that combines the natural architecture of a forest with species fulfilling the social, economic, and cultural needs of people. A homegarden is often considered part of an agro-socio-ecological system that comprises domesticated plants and/or animals, as well as people (Soemarwoto and Conway, 1992). By producing a variety of fruits, vegetables, and non-timber forest products, homegardens contribute to a family's diet and may even provide additional income.

The majority of homegardens are distributed in East and West Africa, South and Southeast Asia, Pacific Islands, and Mesoamerica, which suggests that homegardens are predominantly a tropical phenomenon (Kumar and Nair, 2006). Tropical homegardens are considered one of the oldest forms of managed land use activity next to shifting cultivation (Kumar and Nair, 2004). Various studies have been conducted on these homegarden systems, but most of them focus on physical structure, function, and ecological structure or a specific ecosystem service in a particular study area (e.g., Abdoellah et al., 2006; Karyono, 1981; Kehlenbeck et al., 2007; Phong et al., 2006; Phong et al., 2010; Soemarwoto and Conway, 1992; Ueda, 1996; Wiersum, 1977). Methodological problems associated with each homegarden's uniqueness have hindered research, despite the structural and functional similarities between various homegardens (Kumar and Nair, 2004). A challenge in homegarden research is the use of commonly accepted research frameworks and procedures (Kumar and Nair, 2004). Agroforestry and traditional production systems that include homegardens are recently reevaluated as effective measures for adapting to climate and ecosystem changes (Rao et al., 2007; Takeuchi, 2010). However, several studies present empirical evidence demonstrating how a homegarden system can contribute to the enhancement of adaptive capacity.

The objectives of this research are as follows:

(a) To investigate the scale, structure, and diversity in home-
(b) garden systems of Southeast Asia countries.
To assess the biodiversity and ecosystem services provided by homegarden systems.
(c) To identify recent changes and drivers of these changes, including climate change, on homegarden systems in rural Asia.

2. Methodology and materials

2.1. Methodology

We have used the Millennium Ecosystem Assessment (MA) framework to evaluate the interaction among various services offered by homegarden systems and current drivers of change to address the recent findings on ecosystem services and environmental benefits provided by the homegarden system. Although the MA (2003, 2005) states that homegardens are intensively managed and modified by humans to avail ecosystem services, it is an important source of the maintenance of local biodiversity. The MA framework focuses mainly on linkages and dynamic interactions between ecosystem services and human well-being (MA, 2005). In addition to the dynamic process of evolution in homegardens, sociocultural and economic factors alter the human condition, while various natural factors influence ecosystems.

On the basis of the MA framework, a comprehensive literature review was conducted. As listed in the references, a total of 104 books, peer-reviewed journal articles, and conference papers were examined. Distribution of publications is diverse in terms of publication year and theme. Almost equal numbers of literature for three countries' homegarden studies are referenced to identify components, spatial layout, temporal/spatial scales, diversity, and functions of each system by country. In addition to the literature review, field observation and professional workshops were conducted in each country in 2011 and 2012, as shown in Table 1.

2.2. Study area

The homegarden is a traditional land use system that has evolved from prehistoric times (e.g., hunters and gatherers), through ancient civilizations to the modern era. Hutterer (1984) reported that the homegardens of Java originated in the 7th millennium BC. The historical records suggest that they were attached to temples, palaces, elite residences, and the homes of

Table 1
Professional workshops in Indonesia, Sri Lanka, and Vietnam.

Country	*Indonesia*	*Sri Lanka*	*Vietnam*
Workshop date	6–8 January 2012	17–19 September 2011	30 June–1 July 2011
Workshop venue	Gadjah Mada University, Yogyakarta, Indonesia	Peradeniya University, Kandy, Sri Lanka	Vietnam National University, Hanoi, Vietnam
Number of local experts	16	13	10