ISSN 1341-562X

JOURNAL OF FOREST PLANNING

Japan Society of Forest Planning

Vol. 25 No. 1
April, 2019

JOURNAL OF FOREST PLANNING

Aims and Scope

Journal of Forest Planning is a peer-reviewed periodical that publishes articles, reviews, and short communications. It covers all aspects of forest management, modeling, and assessment such as forest inventory, growth and yield modeling, remote sensing and geospatial information technologies for forest management, forest management planning, forest zoning, evaluation of ecosystem services, managerial economics, and silvicultural systems. Manuscripts regarding forest policy, forest economics, forest environmental education, landscape management, climate change mitigation and adaptation strategies, and drone applications for forest management are welcome. The Journal aims to provide a forum for international communication among forest researchers and forestry practitioners who are interested in the above-mentioned fields.

Editorial Board

Submission of Manuscripts

Manuscripts should be submitted to the following Editorial Office.

Dr. Satoshi Tatsuhara
Journal of **Forest Planning**
Graduate School of Agricultural and Life Sciences,
The University of Tokyo
1-1-1 Yayoi, Bunkyo-ku, Tokyo 113-8657, Japan
Phone: +81-3-5841-5201, Fax: +81-3-5841-5429
E-mail: jsfp_e@forestplanning.jp

Notice about Photocopying

Subscription Information

Journal of **Forest Planning** is published half yearly. The subscription for 2019 is 5,000 yen and the single issue price is 2,500 yen. Subscription orders can be sent to the following office.

Journal of **Forest Planning** is published by
Japan Society of Forest Planning
Forestry and Forest Products Research Institute, Forest Research and Management Organization
1, Matsunosato, Tsukuba, Ibaraki 305-8687, Japan

JOURNAL OF

FOREST PLANNING

Vol.25, No.1, April, 2019

Japan Society of Forest Planning

CONTENTS

Article

Economic Analysis of Local People's Involvement in Community-based Forest Management (CBFM) in Desa Ciomas, Indonesia

Septaris Parhusip [1], Sri Suharti [2], Taulana Sukandi [2], Masahiro Amano [3] and Naoto Matsumura [1,*]

ABSTRACT

Local people's involvement in forest management in Indonesia was studied in a context of a community-based forest management program named Pengelolaan Hutan Bersama Masyarakat (PHBM), which emerged from the state-owned forest company, Perhutani. On Java Island, this program has been spreading since 2003 and it was hoped that it would help to increase local people's income by giving them access to the forest, to assist in the thinning process and to cultivate intercropping. This study aimed to observe the impacts of people's involvement in the PHBM program on their economic wellbeing. The study was conducted over three research phases, in 2005/2006, 2006/2007, and 2008/2009, in Desa Ciomas village, Bogor District, West Java Province and through follow-up research performed in 2016 to observe more recent conditions and establish the continuity of the previous research. The results showed that local people in Desa Ciomas were highly interested in PHBM and the benefits that it offered, with an expectation of additional income. The optimal income was not realized in some cases, including when large-scale farming necessitated farming system that replied on hired labor which is known to be less productive than family labor. PHBM should be able to contribute to local people's income by empowering them with respect to both on- and off-farm activities.

Keywords: B/C ratio, community-based forest management, poverty alleviation, rural development

INTRODUCTION

Local community involvement in forest management in Indonesia has been largely based on changes in forest laws and regulations. In the past, there were customary laws that regulated forest ownership and management by local people, called *Hukum Adat*. *Hukum Adat* is usually derived from indigenous knowledge about forests and natural resources passed down through generations (Subarudi, 2014). The involvement of communities in forest management in Indonesia, especially in Java, occurred during the Dutch colonial period. From 1873 to 1950, an intercropping system involving local farmers named *tumpang sari* was in use (Ansori et al., 2011); then, in 1967, the Indonesia Basic Forestry Law stated that all forests inside of Indonesian territory, including natural resources, were controlled by the state. Under this law, individual/personal or communal rights to forests that could not be registered and this law effectively prevented local people from accessing forest resources under customary law (Maryudi and Krott, 2012). Forest areas were brought under the jurisdiction of the Ministry of Forestry and managed by a governmental forest company, named *Perum Perhutani* (hereafter, Perhutani) (Sukendro et al., 2002).

The issue of customary law and local rights to forest resources was resurrected by the Forest Law of 1999, after the fall of the New Order Government, in a period known as the Reform Era. During this area, the Indonesian government created a decentralized government structure, known as *Otonomi Daerah*, or regional autonomy (Sukendro et al., 2002). The decentralized government granted authority to local governments to manage their own natural resources, including forest resources (Siregar et al., 2007). Under Forest Law, existing traditional communities were empowered to utilize their own forests resources based on customary laws, and whether a traditional community still existed or not was determined by local government.

Land ownership and border disputes between local government and local people have been reported (Kusumanto and Sirait, 2002). Local communities had cause to claim forest resources, and even whole areas of forest, which belonged to the state; however, even though Forest Law 1999 granted au-

* Corresponding author. Email: nma@bio.mie-u.ac.jp
[1] Graduated School of Bioresources, Mie University 1577 Kurimamachiya-cho, Tsu-shi, Mie, 514-8507 Japan
[2] Forest and Nature Conservation Research and Development Centre (Indonesia), Jalan Gunung Batu, No 5, PO Box 165, Bogor, 16001 Indonesia
[3] Waseda University, Nishi-Waseda 1-6-1, Shinjuku-ku, Tokyo, 169-8050 Japan

 DOI: 10.20659/jfp.2019.002

thority over community forests to local people, regulations on the management of state-owned forests were not significantly different from the government-based forest management in the New Order Era. Thus, oppression has been observed, as well as rejection of rights, expulsion, and even elimination of the access and rights of local communities with regard to forest resources. From a governmental perspective, local people were squabbling over land rights, and illegal logging and pilferage of forest resources occurred in state-owned forest areas. A number of protected areas in Indonesia suffered illegal logging in the government decentralization period during the transition of power from central to the local government occurred (Colfer et al., 2005). Based on forest community problems in South and Southeast Asia, the most serious issue that forest peoples face is the lack of recognition of their customary rights to their land (Colchester, 1994), resulting from changes in forest policies. In Nepal, prior to 1950, under the feudal system government forests were controlled largely by the government. From the 1950s, a partyless system of panchayat politics replaced the feudal system and the forests were nationalized and placed under the control of the Forest Department (Malla, 2001). In 1970, community forestry was introduced in Nepal, since the Forest department did not have the capacity to manage forests effectively and illegal forest use was increasing (Fisher, 1995).

Land ownership and forest access conflicts can lead to poverty. Poverty has generally been defined as insufficiency in food, income, and other resources required to maintain an adequate standard of living, usually caused by a lack of access to assets (natural, physical, financial, human, social) (Arnold, 2001). In total, 23.8% of Indonesian villages border forests (Badan Pusat Statistik, 2016), and 50% of poor people in Indonesia, i.e., about 32 million people, live in forest villages (CESS-ODI, 2005). Since poor people tend to be heavily dependent on common, pooled resources, sudden restriction or denial of access to such resources can significantly increase the vulnerability of the poor (Mahanty et al., 2006). Poverty alleviation requires local participation in forest management, even if it is legally recognized that forests are owned by the government. In Ghana, poverty reduction strategies promote customary tenurial systems as a mechanism for sustained poverty alleviation (Colfer et al., 2005). Government-based Forest Management (CBFM) has had more success in addressing poverty than either the state or the private sector (Mahanty et al., 2006). In Vietnam, community forestry was finally legally implemented in 2004, after its exceptional success in improving national wellbeing (Sunderlin, 2006) by reducing the rate of poverty from 58% to 29% of the total population between 1993 and 2002, thus representing one of the greatest success stories in economic development worldwide (World Bank, 2003). Being initiated earlier, CBFM in Nepal has enhanced the income of many poor households (Mahanty et al., 2006) who joined the Community Forest User Groups (CFUGs) or Leasehold Forest User Groups (LFUGs) and developed enterprises, with the supports from both governmental and non-governmental organizations (NGOs) (Pandit et al., 2008).

Various schemes promoting cooperation between forest companies and communities have been implemented in Indonesia, including Community Forestry (*Hutan Kemasyarakatan* or HKm), Village Forests (*Hutan Desa* or HD), and Community Forest Plantations (*Hutan Tanaman Rakyat* or HTR). These schemes aim to enhance local prosperity (Fujiwara et al., 2012). In 2001, Perhutani, as the state forestry company, initiated a CBFM scheme named *Pengelolaan Hutan Bersama Masyarakat* (PHBM) for forest villages on Java Island, which is still in operation (Nurjana, 2005). PHBM is a joint program between Perhutani and forest village communities, with principles shared between the stakeholders such that their common interest in achieving sustainability of forest resources can be optimized (Perum Perhutani, 2001). Forest villagers interested in PHBM joined the forest village community bodies *Lembaga Masyarakat Desa Hutan* (LMDH). PHBM adopted a benefit-sharing system wherein famers who were members of an LMDH had the right to profit economically from harvesting timber, with the amount earned being based on negotiations between Perhutani and the LMDH. The maximum profit that can be gained by farmers is 25% of the timber price, while they obtained 100% of the benefits from intercropping plantations (Nurjana, 2005).

The effectiveness of PHBM for overcoming poverty in forest villages in Indonesia has been analyzed in several studies. A study on PHBM in Central Java Province found that benefit-sharing of timber production, which is one of the main features of PHBM, has contributed to the overall development of the village (Fujiwara et al., 2012). Another study on PHBM in West Java Province found that land and plant controls in PHBM resulted in an increase in the minimum income from agroforestry businesses for poor households in villages around the forest, both from timber and non-timber products. The increasing income raised poor households above the poverty line (Aji, et al., 2013). In contrast, based on research in Jambi and East Kalimantan, Urano (2013) concluded that the CBFM poverty alleviation policies promoted by the Indonesian government have not made the expected progress, as they have not solved the problem of weak land rights of customary landowners in forest populations (Urano, 2013).

This study aimed to examine the hypothesis that CBFM contributes to reducing poverty. Although PHBM had been in operation for 10 years by 2011, not all villages around forests in Indonesia had even formed an LMDH (Fujiwara et al., 2012). To investigate the sustainability of the scheme, this study intended to identify local people's perspectives and problems with PHBM, as well as the role of PHBM in increasing income. Therefore, this study was conducted over three research phases and one follow-up research phase. The study was conducted in Desa Ciomas, West Java, one of the villages wherein PHBM has been implemented. First, we observed the process and level of involvement of local people in PHBM in Desa Ciomas, their motivation to participate, and tree species preferences in tree plantations. Second, we identified the problems with PHBM experienced by local people in Desa Ciomas, and estimated the benefit-cost (B/C) ratio of farming on PHBM land in Desa Ciomas. Third, we observed the impact of PHBM on poverty by calculating local

people's incomes in Desa Ciomas. Finally, follow-up research was conducted 7 years later.

DATA AND METHODS

This study was carried out in a village in Bogor District, West Java Province, variously named Desa Ciomas or Ciomas Village. A map of Desa Ciomas is shown in Fig. 1. A PHBM program has been conducted in Bogor District, in the forest area of the Sub-District Parungpanjang, since 2003, over 931.55 ha of the whole 5,432.9 ha forest area of the Sub-District (Ansori et al., 2011). This PHBM area is called Bagian Kesatuan Pemangkuan Hutan (BKPH) Parungpanjang. Since 2000, Perhutani has planted *Acacia mangium,* as the main tree plantation species, in this forest area. In this PHBM model, the tree species and tree spacing were determined by Perhutani, while the annual crop species, tree maintenance, and proportion shared were open for negotiation. As logging activities, farmers were able to practice hauling logs. For timber plantation in BKPH Parungpanjang, farmers receive 100% of the benefits from the timber harvested during the first thinning, 20% from the second thinning, 20% from the third thinning, and 15% from the final cutting. For intercropping plants including fruits and other crops, farmers gain 100% of the harvesting benefits.

This study used both primary and secondary data. Primary data were collected by interviewing LMDH members, informal leaders in the community, local officers of Perhutani, village officers and local researchers from the Forest and Nature Conservation Research and Development Centre (FNCRDC), and by visiting tree plantations directly. Secondary data were acquired by collecting documents from relevant institutions, such as the Bogor Statistics Institution, the Bogor District Planning and Development Office, Perhutani, and the Desa Ciomas village office. We also interviewed local farmers who were familiar with PHBM. The interviews of farmers' group members were conducted in Cinyurup and Banar Hamlet In Desa Ciomas; three farmer groups were involved in the Perhutani tree plantation: 1) the Mitra Wana Saluyu (MWS) group (172 members living in Cinyurup, Lebakpicung, and Bojongsengkol hamlets), 2) the Gua Saung (GS) group (30 members living in Kompa and Rewod hamlets), and 3) the Wana Jaya (WJ) group (105 members living in Banar hamlet (Fig. 2).

Cinyurup and Banar hamlets were chosen as sub-site locations because PHBM was originally introduced in those two hamlets. There were 279 farmer household in Cinyurup hamlet and 272 in Banar hamlet. For PHBM implementation, Perhutani generally enacted six steps: dissemination, dialog, organization building, negotiation, agreement signing, and implementation (Ansori et al., 2011). In Desa Ciomas, local people from farmer groups were involved in PHBM implementation from the outset. Figure 3 shows the PHBM implementation process in Desa Ciomas. Informal dissemination of PHMB program information was completed by hamlet activists working door to door, to determine people's interest in participating in the program. The hamlet activists then engaged in preliminary negotiations with Perhutani officers based on people's interest, to establish program details and the area that PHBM will be implemented in. Then, the first informal meeting between hamlet activists and local people was held to disseminate the negotiation result and plan the next steps of in the agenda. The second meeting was a formal meeting between Perhutani officers, NGOs, village officers, hamlet activists, and local people, involving explanation, dialog and negotiation pertaining to the PHBM program and area. The next step was registration of farmer group members by local farmers, followed by land allocation of PHBM areas by Perhutani. The third formal meeting was held between Perhutani, NGOs, village officers, and farmer group candidate members, to discuss the group name, group board election, and initial thinning plan. The PHBM agreement was signed during the fourth meeting, which was followed by subsequent meetings to further discuss the initial thinning plan. Hamlet activists play a significant role in PHBM initiations.

In the first three phases of this study, our focus with respect to the interviewees was based on the objectives of each phase of research. Some respondents were involved in the first, second, and third phases, while the other interviewees differed among phases. The interviewee composition depended on local FNCRDC researchers' recommendations and the accessibility of local people during the research phase. The objectives of the first phase (2005/2006) were to identify 1) the level of people's involvement in PHBM in Desa Ciomas, 2) the motivation of local people to participate in PHBM in Desa Ciomas, and 3) existing and preferred tree species in the tree plantation. This research mainly focused on the initiation of PHBM, so the interviewees were mainly farmer groups' members in Desa Ciomas; their membership of PHBM was not a consideration at that time. For this research, we interviewed 30 farmers; 17 farmers from the MWS group and 13 farmers from the WJ group.

The objectives of the second phase (2006/2007) were 1) to identify the problems faced by local people with respect to PHBM and 2) to estimate the B/C ratio of farming systems implemented in the tree plantation and managed via the PHBM system in Desa Ciomas. The second research phase focused on problems associated with implementation of PHBM in Desa Ciomas, so the interviews were mainly with farmers who participated in PHBM. There were 50 respondents in this study: 25 people from Cinyurup hamlet and 25 from Banar Hamlet. Based on interviews with local government staff, we listed the problems faced by local people with respect to PHBM implementation and then distributed the questionnaire to respondents to obtain their opinions regarding the problems associated with PHBM implementation.

For the second research phase, we applied B/C ratio analysis, also known as the profitability index, to determine the profitability of different farming systems. The B/C ratio is commonly used in investment proposals in the context of forest management, and can be obtained by dividing the total benefits by the costs. In this study, BCR was used to calculate the profitability of three farming system conducted by the farmer families. Three farming

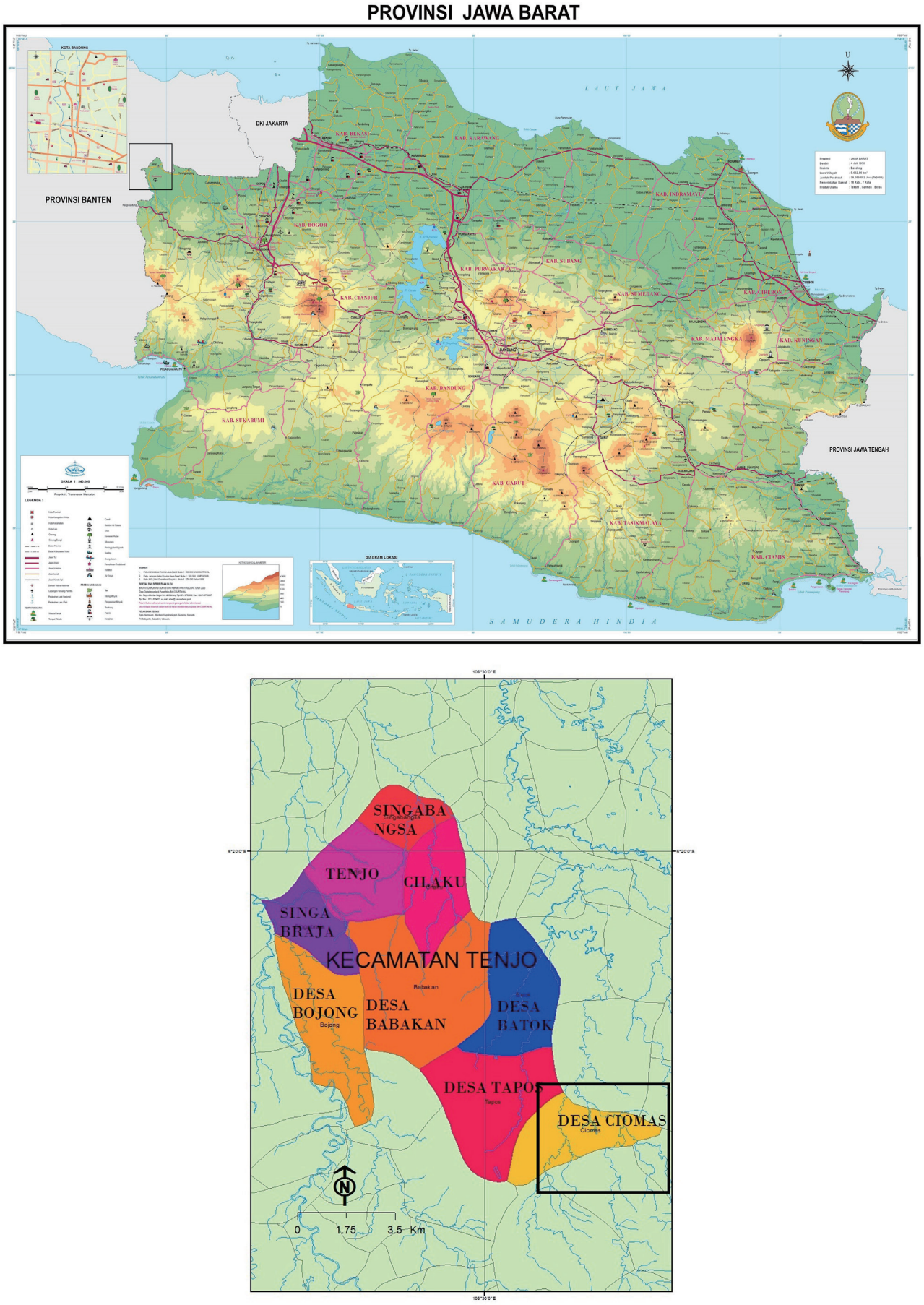


Fig. 1 Map of Kecamatan Tenjo in West Java (Jawa Barat) Province (upper) and Desa Ciomas in Kecamatan Tenjo (lower) (Badan Koordinasi Survei dan Pemetaan Nasional, 2003).

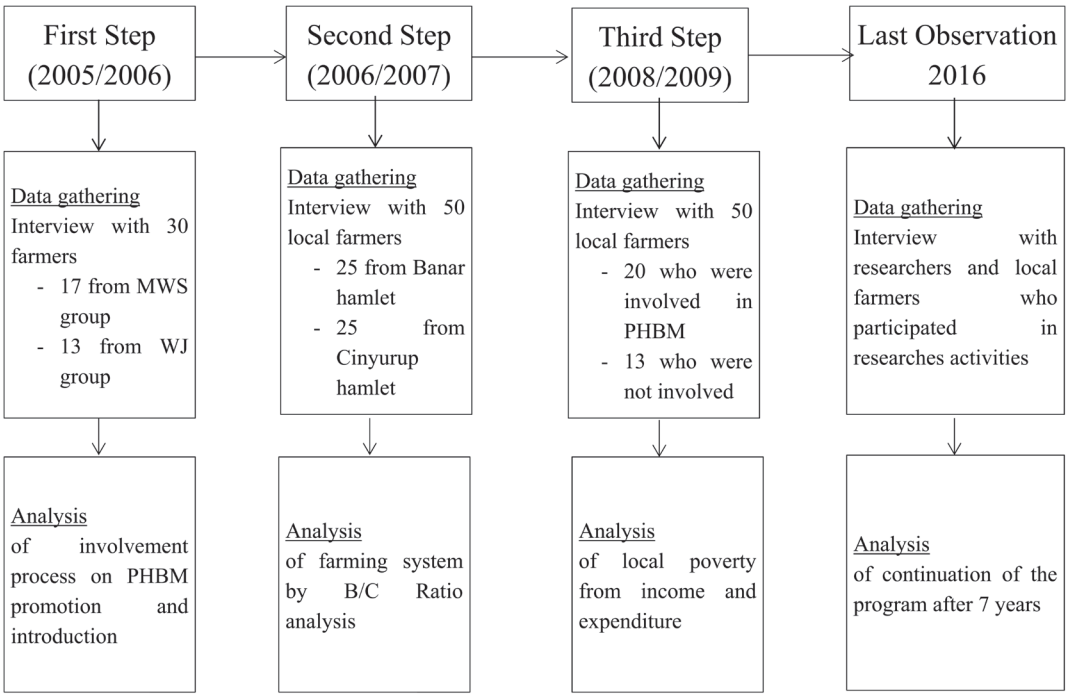


Fig. 2 Research method.

systems were considered: 1) 50% of framing is undertaken by farmers and their family members, and 50% by paid farmers. 2) Farmers hire paid farmers for all land preparation and harvesting activities, and 3) Farmers hire paid farmers for all activities. The value yielded was adjusted according to a prespecified discount rate, as given by Armitage (1998):

$$B/C\ Ratio = \frac{\Sigma \frac{B_t}{(1+r)^t}}{\Sigma \frac{C_t}{(1+r)^t}} \quad (1)$$

where

B_t = the benefits for a period of a year t

C_t = the cost for a period of a year t

r = the discount rate.

Data on the benefits and costs for local people were gathered by interviewing the farmers. The discount rates used were 15%, representing the typical rate, and 18%, representing the extreme interest rate scenario for Indonesia. These interest rates were determined based on the discount rate in Indonesia in 2009, of 14.5%. Only nine farmers in this research were involved in BCR analysis, as they had applied the farming systems before and thus the possessed cost and benefit data; the farmers were asked about these data as they applied the first, second, and third-wave farming systems. In the BCR analysis, if the ratio is greater than 1, then the farming system is considered to be economically worthwhile; however, if it is less than 1, the farming system should be redesigned or abandoned (Armitage, 1998).

The objective of the third research phase (2008/2009) was to establish the impact of PHBM on poverty by calculating local people's income in Desa Ciomas. For this research, we interviewed and distributed questionnaires to 33 farmers: 17 from in Cinyurup hamlet and 16 from Banar hamlet. Data on local people's incomes and expenditures in Desa Ciomas was obtained by questionnaires distributed to 30 of the 33 farmer respondents: one respondent had an extremely high income and two others did not complete the questionnaire. Local people's level of poverty was assessed in the context of the poverty line and the average minimum wage (AMW). This study used two references to determine the poverty line. The Indonesian Statistics Agency (BPS) stated that the poverty line in Indonesia in 2009 was Rp. 200,269.00/capita/month (Purwanto, 2007) while the World Bank (WB) stated that the poverty line was US$ 1.9/capita/day, i.e., Rp. 514,026.00/capita/month where 1US$= Rp. 9,018.00. The AMW in Bogor District in 2009 was Rp. 893,412.00 per month i.e., Rp. 10,720,944.00 per year.

The objective of the follow-up research conducted in 2016 was to observe the persistence of the effects of the previous research phases. For this study, we interviewed researchers and local people who contributed to research activities related to PHBM in Desa Ciomas, BKPH Parungpanjang.

For data analysis, this study used mixed qualitative and quantitative methods, presented as narrative descriptions. This study combined the dominant-less-dominant method, where the study's methods and results are based mainly on the dominant paradigm, but with small proportions being based on a non-dominant paradigm to support the dominant paradigm (Creswell, 1994). The dominant paradigm herein is the qualitative method, and the non-dominant paradigm is the quantitative method. During the first research phase, we interviewed farmers about local people's degree of involvement in PHBM implementation,

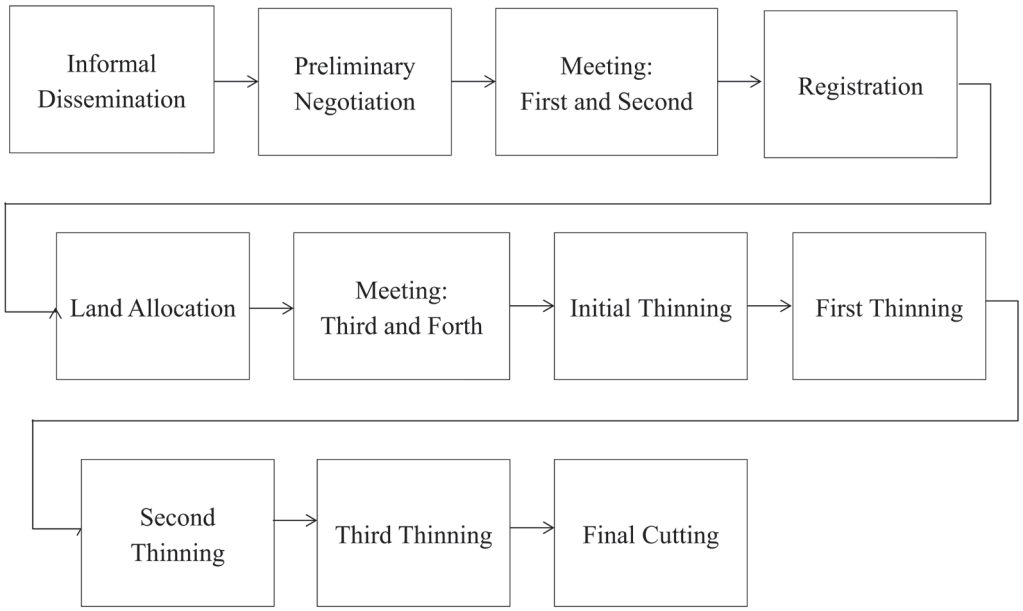


Fig. 3 PHBM implementation process.

and supported the analysis by questionnaire data with statistical calculations. During the second research phase, we interviewed farmers regarding problems with PHBM implementation and supported the analysis by calculating the B/C ratio for farming systems in PHBM. During the third research phase, in-depth interviews were conducted using a structured questionnaire asking farmers about their income after participation in PHBM; this analysis was supported by statistical data on local income and expenditure in Desa Ciomas.

RESULTS AND DISCUSSION

Local People's Perspectives and Preferences in PHBM

Understanding local people's participation in PHBM can be achieved by probing their motivation, to do so, as well as being surveying their perceptions and preferences with regard to tree species in PHBM. Even though decision-making in PHBM was dominated by Perhutani originally, the PHBM was designed to involve local leaders and activists. Strong and legitimate traditional leadership promotes priority-setting among local people (Shackleton et al., 2002). In Desa Ciomas, as mentioned before, the implementation of PHBM involved local people drawn from farmer's groups, and the role of local leaders and activists in Desa Ciomas remained significant even after PHBM had been in place for number of years.

By interview and distributing questionnaires to 30 farmers in Desa Ciomas, who were members of the MWS and WJ farmer groups, we gathered information on local people's motivations for participating in, and perception of, PHBM, and their preferences with regard to tree species for PHBM. Local people's motivation for participating in PHBM was strong, as shown in Fig. 4. The main factor influencing local people's participation in PHBM was their own desire (87%). They were also motivated strongly by their understanding of the PHBM program (77%), and of their rights and obligations within the framework of the program (87%), as well as by their attendance of meetings (73%), and active discussion during the meetings (70%). The role of the hamlet activists can also be seen by the reference to the responses of the farmers; they stated that they received information about PHBM mostly from their neighbors and friends (80%). Other motivations were associated with the farmers' relationship to the forest. Local farmers were motivated by the additional income gained by participating in PHBM (80%) and some of them had been involved in previous tree plantations in the area (63%).

Although they were highly motivated to participate in PHBM, the perception and understanding of local people of PHBM was surprisingly varied, as illustrated in Fig. 5. Only 40% of respondents said that the PHBM program had been progressing well, while 43% said progress was fair; the remainder said progress was poor or absent. Local people's opinions of PHBM were low based on the benefits they had gained thus far. Only 30% of the respondents perceived that they had gained income, 6.7% said they had gained employment, and 26.7% said they had gained both; 36.7% offered no opinion. The respondents admitted that they were motivated by profit-sharing from the PHBM program, though they were actually not sure about the sustainability of the benefits they could receive. Most of the respondents exhibited no detailed understanding of the profit-sharing percentages. The respondents also stated that they needed capacity building or empowerment programs, such as training and education about PHBM. In total, 33% of the respondents suggested training and education to improve PHBM. Another 43% of the respondents suggested technical improvements, such as more tree species or enhanced tree spacing, to enable planting of intercropping plants.

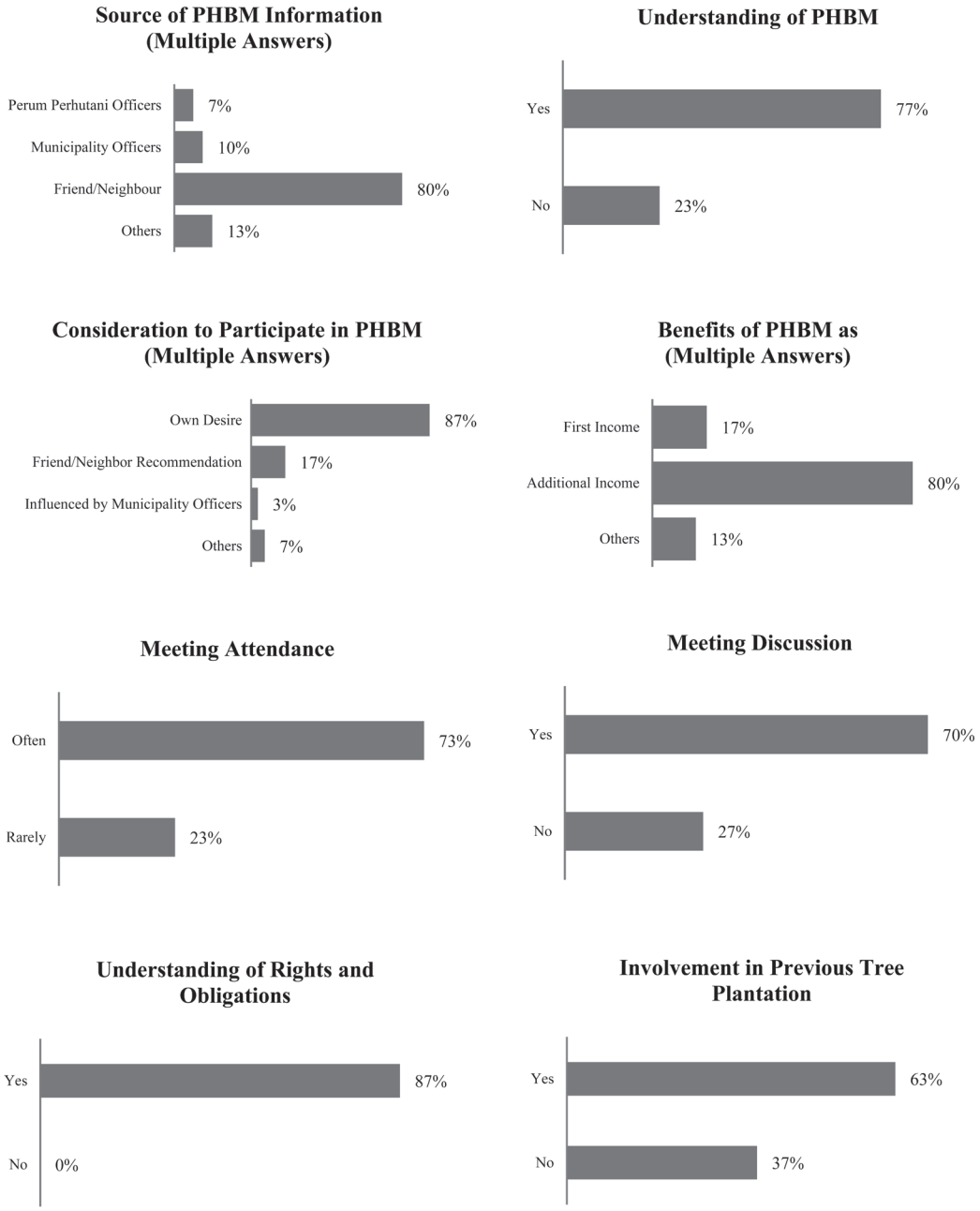


Fig. 4 Motivation for getting involved in PHBM (30 respondents).

The participation of local people requires that they understand the tree species planted in the PHBM area. The tree species planted in the PHBM area were decided in consultation between Perhutani and local people. Timber-producing tree species were nominated by Perhutani, while other multi-purpose tree species, such as fruit and food producing-trees, were preferred by the local community. Through observation and interviews, we gathered data about existing tree species and tree species preferred by locals in Desa Ciomas (Fig. 6).

As a timber-producing tree, *Acacia mangium* has been widely planted on local people's land. The next most popular tree species were other fast-growing species, such as Sengon (*Paraserianthes falcataria*) and Kecapi (*Sandoricum koetjape*). Before *Acacia mangium* was planted extensively, Puspa (*Schima noronhae*) trees were widely grown in this area. Puspa, Mahogani, and teak are classified as slow-growing trees. Even though they produce high-quality wood, they are less preferred due to their long rotations. Local people nominated *Acacia mangium* and Sengon as their most preferred tree species. The respondents stated that it was very easy to find *Acacia mangium* seedlings on land that was previously planted with this species. In addition, they stated that *Acacia mangium* was easy to grow and maintain, and had a good market price. However, one respondent stated that marketing *Acacia mangium* had proven difficult because it was subject to suspicion as an illegal timber logged from the Perhutani plantation. The main species on the Perhutani planta-

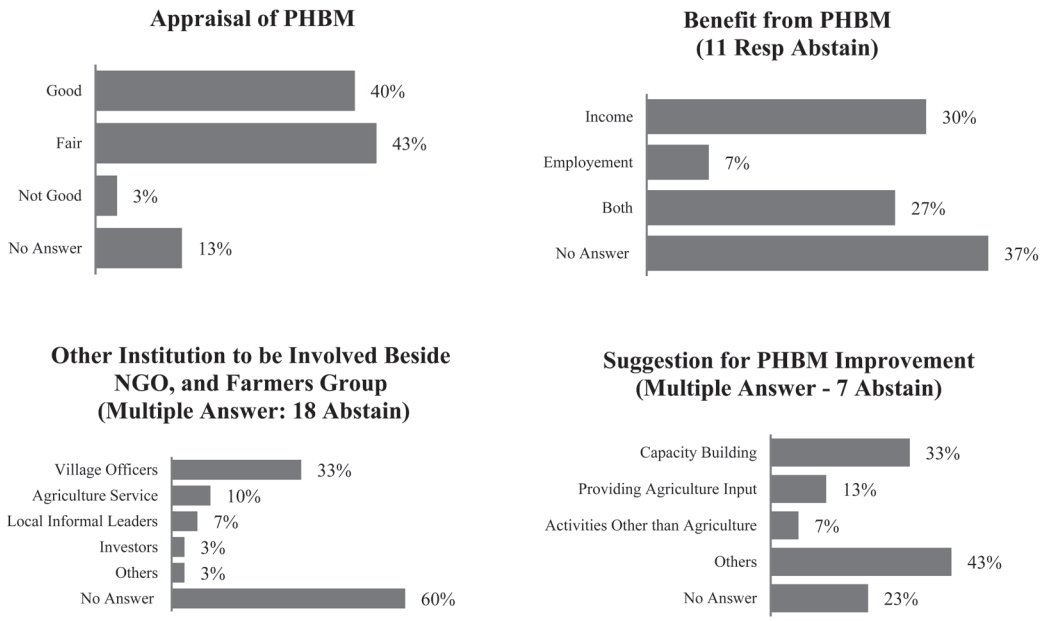


Fig. 5 Perception on PHBM (30 respondents).

tion in this area was *Acacia mangium*, which was actually the most preferred species in the area for both timber production and environmental protection purposes. Perhutani preferred to plant *Acacia mangium* in both PHBM and non-PHBM areas. *Acacia mangium* is a fast-growing tree species that also has a high survival rate in poorer soil, and is expected to prove profitable in the context of saw log and pulp markets. *Acacia* plantations are recognized as valuable assets for climate change mitigation and have been widely introduced throughout tropical regions in conjunction with CDM projects (Matsumura, 2011).

In terms of multi-purpose trees, fruit trees such as *rambutan* (*Nephelium lappaceum*), *cempedak* (*Artocarpus integer*) and *nangka*/jackfruit (*Artocarpus heterophyllus*) were the most widely planted trees. *Rambutan* and jackfruit remained the preferred tree species among farmers, because they had a good market price and are easy to grow. Jackfruit trees also produce good timber. Another fruit, *cempedak,* was less preferred because of its lower price. Local people relied on their own knowledge and understanding of plantation and market conditions when choosing tree species. Fast growing, easy-to-obtain seedlings, which were also easy to grow and maintain, and commanded a good market price, were important to respondents when selecting trees to be planted on their land.

Problems Faced by Local People During PHBM Implementation

In this study, we identified the problems faced by local people in Desa Ciomas during the 4-year PHBM implementation period. Before identifying the problems faced by local people, the survey enquired regarding the reasons for farmers' participation (or not) in the PHBM program. The farmers stated that their main reason for participating in PHBM was to receive additional income by working in the PHBM area. Other reasons were a desire for profit-sharing in the context of timber production, and a desire for more experience and knowledge. As well as receiving additional farmland, farmers who participated in PHBM also received education on farming techniques, such as establishing intercropping plantations between perennial trees and annual crops, and they were able to apply the same practices to their own land. Meanwhile, the main reason cited for not participating in the PHBM program was insufficient time, because the farmers were busy with their own land. The farmers stated that their income from their private land was higher, so they focused on that land instead of participating in the PHBM program.

Based on the questionnaire results, shown in Table 1, the biggest problem with PHBM was illegal logging. For farmers participating in PHBM, illegal logging could reduce the benefits gained from timber products. In theory, the PHBM program could contribute to decreasing illegal logging practices by increasing local awareness that illegal logging might reduce benefits associated with from forest production (Fujiwara et al., 2012). According to local farmers, illegal logging still occurred in the area, albeit to less of an extent than before PHBM implementation. Another problem concerned damage to the plantation caused by the cattle owned by the farmers that roamed with insufficient supervision.

Local people also had difficulties in choosing farming systems for their land. As mentioned earlier, by joining PHBM, local people gained more land to cultivate in addition to their own land. On the land gained from PHBM, local people were allowed to farm intercropping plants. Some farmers who were not able to cultivate their land chose to pay other farmers daily to help them work on both the PHBM land and their own private land. Farmers stated that they needed additional help, either because their farmland was too large or because they were busy with other, non-farming jobs. Through hiring additional farmers, the farmers implemented three kinds of farming system: 1) 50% of the

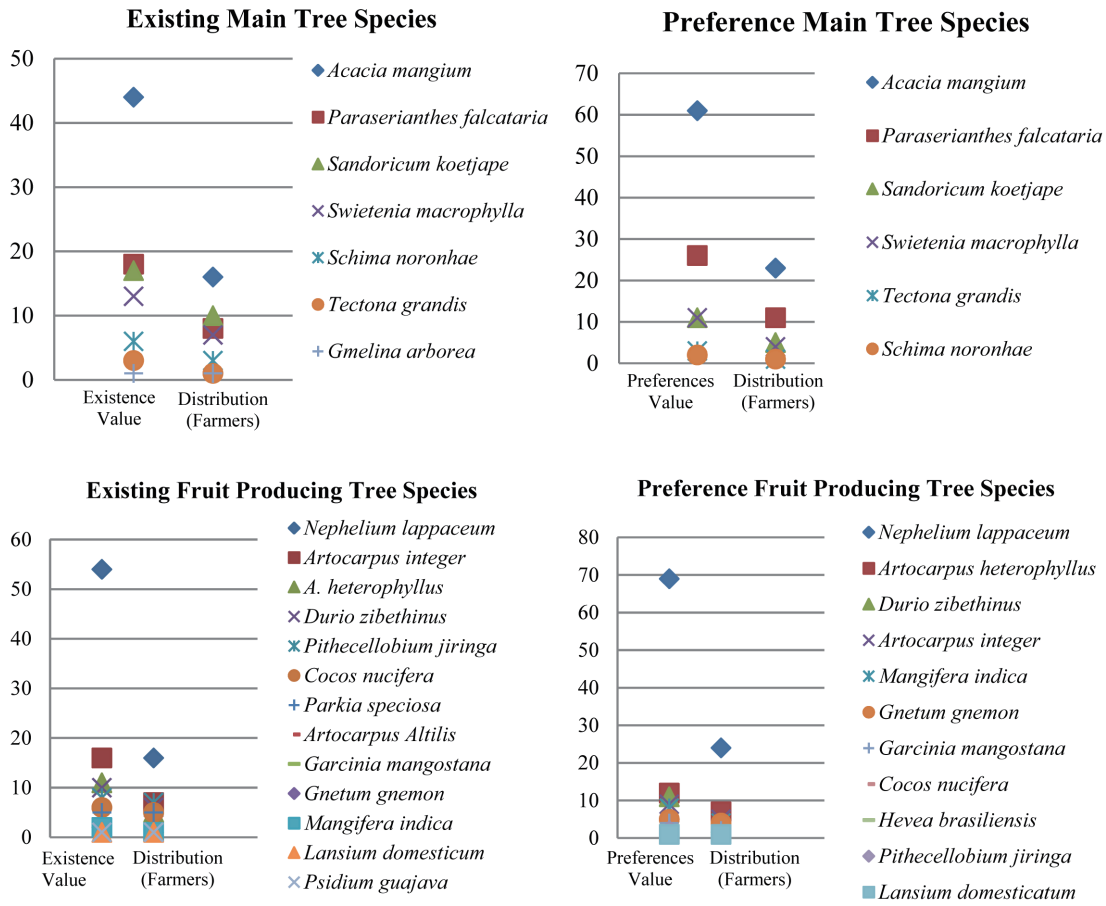


Fig. 6 Existing species and preference species for main tree and fruit producing tree.

farming was undertaken by farmers and their family members, and another 50% by paid farmers. 2) Farmers hired paid farmers for all land preparation and harvesting activities, and 3) Farmers hired paid farmers for all activities. Local farmers received additional land from PHBM through two stages of land allocation: the first was in 2005 and the second in 2006. Table 2 shows the net benefit to respondents of implementing the three farming systems during PHBM Stages I and II. The net benefits were low for both stage I and stage II. Some farmers stated that they covered their costs using their income from their own land, rather than from PHBM land; they did this in the initial years, in the hope of receiving more income later.

The results of the BCR analysis are presented in Table 3. The analysis yielded a low BCR ratio for the third farming system in PHBM Stage I. The BCR ratios for the first and second farming system in PHBM Stage I exceeded 1, indicating that the farming systems could be profitable, with the first system being more profitable than the second. In the second system, farmers had needed to pay high cost for land preparation and harvest activities and then more cost to hire labors. Besides, according to the farmers, hiring labors for land preparation and harvest activities was not effective because hired labors were less skilled enough in those activities.

However, the ratio was lower in Stage II while the average of additional areas is Stage II was also smaller than Stage I. The possible decline in profitability associated with use of hired labor for additional land should be accounted for when additional land is located. The farmers stated that they used more paid farmers during the Stage I, which did not generate sufficient additional benefits to cover the additional cost of labor. The land allocation should thus be adjusted in line with the ability of farmers to work. For example, farmers with more family members available to work could have received more land.

Impact of PHBM on Poverty

Based on our observations, local people in Desa Ciomas have a typical subsistence lifestyle, as per other rural areas in Indonesia, and local people mostly work as farmers. There were some farmers who worked both on their own land and on forest land if they participated in PHBM, and there were others that did not have farms and worked only on other people's land. Farming activities were varied, as shown in Table 6, including farming in home yards, rice fields, dry land cultivation, gardens, and forest areas operated under PHBM. Farmers typically used their harvest to support daily living; if they harvested in excess of that requirement, they would sell their harvested products, depending on the harvest amount and land width.

Even though PHBM in Desa Ciomas had been in place for 6 years by 2009, the local people were still considered poor based on the income from farming and their expenditures.

Table 1 Problems among farmers in PHBM

Problem	Respondents	
	Number	%
A. General problem		
Illegal cutting*	8	40
B. Specific problems		
Bio-physical problem*		
1. Land / site		
a. Far distance	3	15
b. Less fertile	4	20
c. Steep slope	3	15
2. Shade tolerant sp. and spacing of *A. mangium*		
a. Spacing in row is too short (1m)	4	20
b. Spacing between rows is too short (3m)	6	30
c. Limited shade tolerant crop species	4	20
3. Maintenance of *A. mangium*		
a. Weeding	7	35
b. Pest and diseases control	1	5
Management problems*		
1. Respondent had difficulties to register themselves to PHBM	4	20
2. Manpower availability in respondent's household		
a. Not enough quantitatively	11	55
b. Not enough qualitatively	5	25
3. Plantation security/ safety	16	80

* multiple answers

Table 2 Net benefits by doing three different farming systems

Resp. No.	Land from PHBM (m^2)		Net benefit (Rupiah)					
			A		B		C	
	Stage I (2005)	Stage II (2006)	Stage I (2005)	Stage II (2006)	Stage I (2005)	Stage II (2006)	Stage I (2005)	Stage II (2006)
1	10,000	1,000	-107,000	-165,000	-157,000	-214,000	-886,000	-534,000
2	3,500	1,000	258,250	50,000	-4,000	-252,000	-637,500	-472,000
3	5,000	1,250	-108,500	-100,000	-408,000	-103,700	-1,075,000	-423,700
4	5,000	200	-132,500	-25,000	-385,000	-107,000	-1,230,000	-247,000
5	10,000	400	127,500	-20,000	-305,000	-72,000	-760,000	-212,000
6	6,000	3,000	217,100	70,000	-182,200	177,000	-1,148,000	-423,000
7	10,000	2,000	120,000	-210,000	156,500	-373,000	-943,500	-713,000
8*	2,500	1,000	-900,000	-210,000	-541,000	-252,000		
9	5,000	350	-695,000	-115,000	-815,000	-278,000	-1,855,000	-428,000
Total	57,000	10,200	-1,220,150	-725,000	-2,640,700	-1,474,700	-8,535,000	-3,452,700

A: Existing and preference species for tree and fruit plantation
B: Preparation and harvesting activities were done by paid farmers
C: All farming activities were done by paid farmers
* Respondent No.8 did not do the third farming system.

Based on the surveys conducted in this study, the income of respondents was often lower than their expenditure, as shown in Table 4. The income range of the 30 respondents was Rp. 3,530,000.00 – 36,634,000.00 per year, with an average income of Rp. 14,992,850.00, while their expenditure ranged from Rp. 9,001,000.00 – 47,378,000.00 per year, with an average expenditure of Rp. 17,357,408.00. The average income and expenditure in Desa Ciomas are shown in Table 5. In total, 60% of the respondents had an income below the average, and 43.3% had expenditure below the average. Local people's income from farming was lower than their expenditure, indicating that some farmers had an additional income from other jobs. There were also farmers who had no other job, and thus chose to fulfill their daily needs by borrowing money from relatives, and even from

Table 3 B/C Ratio of three farming systems in PHBM Ciomas

PHBM land allocation	Average land size (m^2)	BCR ratio on three farming systems*					
		A		B		C	
		15%*	18%*	15%*	18%*	15%*	18%*
Stage I (2005)	6,333	1.505	1.669	1.466	1.624	0.677	0.750
Stage II (2006)	1,040	0.888	0.934	0.662	0.697	0.354	0.373
Stage I and Stage II		0.824	0.825	0.758	0.760	0.362	0.362

A: Existing and preference species for tree and fruit plantation

B: Preparation and harvesting activities were done by paid farmers

C: All farming activities were done by paid farmers

* There were two discount rates used: 15% and 18%.

Table 4 Comparison of income and expenditure in Desa Ciomas

Income/ Expenditure	Number of Respondents (people)					
	Less than Rp. 5 million/year	Rp. 5 -10 million/year	Rp. 10 -15 million/year	Rp. 15-20 million/year	Rp. 20-30 million/year	More than Rp. 30 million/year
Income	5	7	6	3	8	1
Expenditure	0	5	8	8	7	2

Table 5 Averages of income and expenditure in Desa Ciomas compared with poverty line

	Per year/hh	Per month/hh	Per month/capita
A. Income and expenditure average			
- Income (Rp.)	14,992,850	1,249,404	211,763
- Expenses (Rp.)	17,357,408	1,446,451	245,161
- Deficit (Rp.)	2,364,558	197,047	33,398
B. Poverty line (Rp.)			
- World Bank*	-	-	514,026
- BPS (2009)	-	-	200,269
C. Average minimum wage (AMW)** (Rp.)	-	893,412	151,426

*Based on the World Bank standard: US$ 2.00/day/capita. PPP 1 USD = Rp. 2,230 in 2009.

**Based on the 2009 average minimum wage per month in Bogor District.

banks. Those farmers stated that they would pay back their debts by selling their harvests, which, in the long term, would only add to their debt burden.

Local people in Desa Ciomas were still considered poor, as local people's income per capita was lower than the poverty line per capita stated by the WB (see Table 5). Although the average income was lower than the poverty line stated by the WB, it was still higher than the poverty line stated by the BPS, and the AMW for Bogor District. Since their income was higher than the AMW in Bogor District, local people in Desa Ciomas could be considered to in fact not be poor compared to other village people in Bogor District.

One of the benefits of participating in PHBM is obtaining additional cultivated land. Based on the interviews, local people received farmland from the PHBM that accounted for about 50% of the total land they worked on. The composition of farmland is shown in Table 6. On the PHBM land, farmers were allowed to plant intercropping plants that could provide income in addition to that gained from the main timber plantation. Additional land needed more workers, and traditional farming systems were allowed on the PHBM land. Based on the observations and interviews, it was found that, on the PHBM land, some farmers worked together with their family members, and with neighbors or rural communities. The traditional farming system involving neighbors and rural communities, but without benefit-sharing, is called gotong royong. In contrast, there were also some farmers who worked individually in the same area then shared benefits after the work was completed. This system is known as *nyeblok maro*. Finally, some farmers hired other farmers to work on their land.

Even though the PHBM system granted more land to local farmers to cultivate, it was not able to increase local people's income significantly. Based on the interviews with respondents who participated in PHBM, it made only a small contribution to their yearly income, of about 3.1%. Some farmers stated they also needed money to help with timber plantation, and to cultivate the intercropping space. Based on interviews with local government staff, grants and loans are available to support local people, but the lending process would need to be selective and well-controlled to be successful.

Table 6 Farming characteristic in Desa Ciomas

Farming characteristic	Respondents who own the farm area (people)	Average cultivated land		Cropping pattern		Manpower/ work pattern			
		(m^2)	(%)	Mono culture	Inter cropping	Family manpower	*Gotong royong**	*Nyeblok/ Maro***	Paid laborer
Home yard	33	1,266.4	7.2	-	v	v	-	-	-
Rice field	27	2,802.2	15.9	v	-	v	v	v	v
Dry land cultivation	3	691.0	3.9	-	v	v	v	v	-
Garden	14	3,582.1	20.3	-	v	v	-	-	v
PHBM	20	9,325.0	52.7	-	v	v	v	v	v
Total		17,666.7	100.0						

* Community sharing work without sharing benefit, rolling from one family to the other ones.
** Individual work with community sharing benefit.

Concerning local people's income and expenditure in comparison to the poverty line, and the additional income gained by participating in PHBM, farmers in Desa Ciomas were still considered poor. The farmers stated that they did not receive high income from timber products, and also that they only received Rp. 25,000–75,000 per tree from thinning activities on 4-year old trees. Some farmers stated that the PHBM land area given to each farmer was too small. The area ranged from 0.2 to 0.5 ha per farmer, and farmers could apply for more land if the PHBM area was extended. However, a larger area of farmland was not guaranteed to increase local people's income significantly. One of the results of the previous study in 2006/2007 showed that some farmers experienced a lack of manpower and thus hired other farmers; hence, land allocation in PHBM needs to consider the manpower available to farmers and their families, and also their financial capacity. Expansion of farming activities requires upfront funding, and 55% of respondents stated that farming activities in PHBM needed a lot of money, particularly in the early or land preparation stages.

Local farmers in Desa Ciomas needed to undertake alternative jobs to fulfil their needs. Additional income was earned by exploiting existing resources, such as beekeeping, one of the alternative activities introduced through PHBM. This activity was permitted in PHBM areas with Perhutani as the farmer's partner. Three respondents had an additional job as a beekeeper; one of them was excluded from the respondents' income analysis, as he had an extremely high income from beekeeping compared to the others. Local government has encouraged beekeeping for local people, and the Bogor District Forest Service granted 300 colonies of bees to local people; however, there were only 37 colonies left after 2 years because the local government did not provide sufficient training to the recipients. Off-farm jobs were considered to aid in poverty alleviation in Desa Ciomas and could also help local farmers to fund their plantation. Based on interviews with local government staff, local people need to be encouraged to work in professions other than farming, such as trade, employment in private companies, and office-based governmental roles. Desa Ciomas is relatively close to urban areas in Bogor, and some farmers stated that they worked in restaurants in other cities before opening small restaurants in Desa Ciomas. Beekeeping and other alternative jobs demand more skills and education, and PHBM needs to facilitate community empowerment to support local people to work in alternative jobs.

Further Development of PHBM in Desa Ciomas

In September 2016, we visited Desa Ciomas to observe the status of people's involvement in the PHBM program, and to update the previous research findings. We interviewed purposively selected researchers and local people who were used to contributing to research activities.

PHBM was still running in the area but with less community involvement. Willingness to join PHBM was lower, indicated by the low number of new members. Based on information gleaned from the interviews, this was due to the income gain being considered too low. Also, the older the tree plantation, the lower the benefits gained by local people, because the proportion of the benefits decreased from the first thinning to the final cut. Some farmers had even changed their job, particularly younger farmers, and had started to go to other cities to work or to be construction laborers.

It is important to foster community empowerment in PHBM areas. There have been several programs and events in Desa Ciomas, but not all farmers were willing to join programs related to community learning and empowerment. Based on the interviews, the LMDH board had insufficient organizational skills to manage the farmer group members. As a CBFM scheme, PHBM needed more active participation from local farmers in planning and managing activities; their lack of knowledge and abilities in such activities resulted in high dependency on the forest.

CONCLUSION

This study was conducted to examine the utility of a CBFM scheme in Indonesia, PHBM, for improving the livelihoods of local people. The study was conducted in an area known as Desa Ciomas, and encompassed three research phases and one follow-up study.

Local people initially showed eagerness to take part in the PHBM program. The initial phase of PHBM implementation in Desa Ciomas involved the local people and activists from the hamlets. Local people were motivated to participate in PHBM to acquire additional income and land granted by the program. Their interest in obtaining income from the tree plantation was also demonstrated by their preferences for tree species planted in the area. They preferred *Acacia Mangium* for timber plantation and *rambutan* for non-timber plantation, because those trees were considered more profitable.

While participating in PHBM, local people encountered problems that lowered the income that they earned from the program. The main problem was illegal logging and plantation damage caused by cattle activities. Another problem related to the manpower needed to cultivate the land: some farmers hired paid farmers to help them work with their own land and additional land from PHBM. Hiring additional farmers for larger scale farming was less profitable as additional benefits did not match the additional cost, while working in a smaller scale with family members and traditional farming system was more profitable.

The deficit between income and expenditure explained why farmers in Desa Ciomas still lived in poverty. The contribution of the PHBM program to their income was low, and poverty alleviation via PHBM needs to be supported by a program of local empowerment. Involving the community in forest management requires local knowledge and understanding about the program both for their benefits and their responsibilities. Local people's expectations of the benefits of PHBM participation were varied by their level of understanding of the program. Village community bodies under LMDH should have been more active in educating and encouraging farmers to participate in PHBM.

ACKNOWLEDGEMENT

This study was supported in part by the Japan Society for the Promotion of Science grant numbers JP K17405034 and JP K22405025.

LITERATURE CITED

Aji, G.B., Suryanto, J., Yulianti, R., Wirati, A., Abdurrahim, A.Y. and Miranda, T.I. (2013) Strategi pengurangan kemiskinan di desa-desa sekitar hutan: Pengembangan model PHBM dan HKm [Poverty reduction strategy for forest villages: The development of PHBM and HKm model] (research report). Pusat Penelitian Kependudukan Lembaga Ilmu Pengetahuan Indonesia, Jakarta Selatan, 40 pp (in Indonesian)

Ansori, M., Soetarto, E., Darusman, D. and Sundawati, L. (2011) Community-based forest management partnership for prosperity of the people (A case community-based forest management in Perhutani BKPH Parung Panjang, KPH Bogor). Forum Pasca Sarjana **34**: 185–194 (in Indonesian with English abstract)

Armitage, I. (1998) Guidelines for the management of tropical forests: The production of wood (FAO forestry paper No. 135). Food and Agriculture Organization of the United Nations, Rome, 299 pp

Arnold, J.M. (2001) Forestry, poverty and aid (Report). CIFOR, Bogor, Indonesia. http://www.cifor.org/publications/pdf_files/OccPapers/OP-033.pdf (accessed 9 December 2016)

Badan Koordinasi Survei dan Pemetaan Nasional (2003) Peta Provinsi Jawa Barat [Map of West Java Province]. (ca. 1:2,270,000.) Badan Informasi Geospasial, Bogor, Indonesia (in Indonesian)

Badan Pusat Statistik (2016) Survei kehutanan Indonesia 2014 [Indonesia - Forestry survey 2014]. Badan Pusat Statistik Indonesia, Jakarta. https://mikrodata.bps.go.id/mikrodata/index.php/ddibrowser/723/export/?format=pdf&generate=yes (accessed 25 March 2017) (in Indonesian)

CESS-ODI (Centre for Economic and Social Studies - Overseas Development Institute) (2005) Links between forest and poverty in Indonesia. What evidence? How can targeting of poverty in and near forests be improved? CESS-ODI, London. https://www.odi.org/resources/docs/3914.pdf (accessed 28 April 2018)

Colchester, M. (1994) Sustaining the forests: The community-based approach in South and Southeast Asia. Dev. Change **25**: 69–100

Colfer, C.J.P., Gregersen, H., Blaser, J. and White, A. (2005) The politics of decentralization: Forests, people and power. Earthscan, New York, 322 pp

Creswell, J.W. (1994) Research design: Qualitative and quantitative approaches. Sage, Thousand Oaks, CA, 228 pp

Fisher, R.J. (1995) Collaborative management of forests for conservation and development. IUCN, Gland, Switzerland. http://mekonginfo.org/assets/midocs/0003347-environment-collaborative-management-of-forests-for-conservation-and-development.pdf (accessed 2 April 2018)

Fujiwara, T., Septiana, R.M., Awang, S.A., Widayanti, W.T., Bariatul, H., Hyakumura, K. and Sato, N. (2012) Changes in local social economy and forest management through the introduction of collaborative forest management (PHBM), and the challenges it poses on equitable partnership: A case study of KPH Pemalang, Central Java, Indonesia. Tropics **20**: 115–134

Kusumanto, Y. and Sirait, M.T. (2002) Community participation in forest resource management in Indonesia: Policies, practices, constraints and opportunities. Southeast Asia Policy Research Working Paper, No. 28. ICRAF Southeast Asia, Bogor, Indonesia, 23 pp

Mahanty, S., Gronow, J., Nurse, M. and Malla, Y. (2006) Reducing poverty through community based forest management in Asia. J. For. Livelihood **5**: 78–89

Malla, Y.B. (2001) Changing policies and the persistence of patron-client relations in Nepal: Stakeholders' responses to changes in forest policies. Environ. Hist. **6**: 287–307

Maryudi, A. and Krott, M. (2012) Local struggle for accessing state forest property in a montane forest village in Java, Indonesia. J. Sustain. Dev. **5**: 62–68

Matsumura, N. (2011) Yield prediction for *Acacia mangium* plantation in Southeast Asia. FORMATH **10**: 295–308

Nurjana, I.N. (2005) Sejarah hukum pengelolaan hutan di Indonesia [The legal history of forest management in Indonesia]. Jurnal Jurisprudence **2**: 35–55 (in Indonesian)

Pandit, B.H., Albano, A. and Kumar, C. (2008) Improving forest benefits for the poor learning from community-based forest enterprises in Nepal. CIFOR, Bogor, Indonesia, 64 pp http://www.cifor.org/publications/pdf_files/Books/BAlbano0801.pdf (accessed 2 February 2018)

Perum Perhutani (2001) Keputusan Dewan Pengawas Perum Perhutani No. 136/KPTS/DIR/2001 tentang Pengolahan Sumber Daya Hutan Bersama Masyarakat [Decree of the supervisory board of Perum Perhutani No. 136/KPTS/DIR/2001 concerning processing of forest resources with communities]. Perum Perhutani, Jakarta. http://arupa.or.id/sources/uploads/2012/04/2-SK-Dewan-Pengawas-No.-136-2001-PH-BM.pdf (accessed 19 March 2018) (in Indonesian)

Purwanto, E.A. (2007) Mengkaji potensi Usaha Kecil dan Menengah (UKM) untuk pembuatan kebijakan anti kemiskinan di Indonesia [Assessing the potential of small and medium enterprises for anti-poverty policy making in Indonesia]. Jurnal Ilmu Sosial dan Politik **10**: 295–324 (in Indonesian with English abstract)

Shackleton, S., Campbell, B., Wollenberg, E. and Edmunds, D.E. (2002) Devolution and community-based natural resource management: Creating space for local people to participate and benefit. Natural Resource Perspectives **76**: 1–6

Siregar, U.J, Rahmi, A., Massijaya, M.Y., Ishibashi, N. and Ando, K. (2007) Economic analysis of sengon (*Paraserianthes falcataria*) community forest plantation, a fast growing species in East Java, Indonesia. Forest Policy Econ. **9**: 822–829

Subarudi (2014) Policy on customary forest management after Constitutional Justice Decree No. 35/PUU-X/2012: A critical review. Jurnal Analisis Kebijakan Kehutanan **11**: 207–224 (in Indonesian)

Sukendro, A., Prasetyo, L.B. and Wulandari, R. (2002) Handbook of forest plantation sector business in Indonesia. Forestry Research and Development Agency (FORDA) and Japan International Cooperation Agency (JICA), Bogor, Indonesia, 103 pp

Sunderlin, W.D. (2006) Poverty alleviation through community forestry in Cambodia, Laos, and Vietnam: An assessment of the potential. Forest Policy Econ. **8**: 386–396

Urano, M. (2013) Problems in Indonesian community-based forest management (CBFM) policies: Examination of village forest (HD) programs in the Provinces of Jambi and East Kalimantan. Hokusei Review, the School of Economics **53**(1): 45–60

World Bank (2003) Vietnam - Development report 2004 - Poverty. World Bank, Washington, DC. http://documents.worldbank.org/curated/en/186491468764397103/Vietnam-Development-Report-2004-Poverty (accessed 20 December 2016)

World Bank (2010) Poverty and equity data portal: Indonesia. World Bank, Washington, DC. http://povertydata.worldbank.org/poverty/country/IDN (accessed 20 October 2016)

(Received 18 October 2018)
(Accepted 30 March 2019)
(J-STAGE Advance Published 15 April 2019)

Short Communication

The Current Status of Green Space around Elementary Schools: A Case Study of Malang, Indonesia

Sri Een Hartatik[1] and Akemi Itaya[1,*]

ABSTRACT

Green space is important for childhood development, particularly in developing countries. The city of Malang, Indonesia has experienced steady economic and population growth in recent years, but green space area in the urban environment has been declining. In this study, we elucidated the status of green space accessible to children in Malang, and discussed ways of improving green space use. We identified green spaces around 291 elementary schools using satellite remote sensing. A RapidEye satellite image, which covered the study area with a 5-m ground sample distance, was acquired on May 20, 2015. From this image, the area of green spaces within 1 km radius circles of elementary schools were calculated. The total area of green space in the city was 45.439 km^2, 41.3% of the total city area. Smaller green spaces were located near the city center, whereas larger green spaces were located in the southeastern part of the city. The green space ratio within 1 km of 96 schools was less than 15%, and it was 15–30% around 104 schools. Overall, there were few green spaces within walking distance of schools in Malang. The green space ratio in the city center was also low. Green spaces in the city should be maintained, and additional opportunities should be provided for children to access green spaces.

Keywords: accessibility, childhood, green space, landscape, urbanization

INTRODUCTION

Urban green space provides residents with important environmental services such as water resource management, biodiversity conservation, carbon sequestration, and landscape aesthetics (Arifin and Nakagoshi, 2011; Byomkesh et al., 2012; Coombes et al., 2010; Maas et al., 2006). Urban green space includes public parks, nature conservation areas, sports fields, riparian areas (e.g., stream and river banks), greenways and nature trails, community gardens, roadside trees, green walls, green alleyways, and cemeteries (Roy et al., 2012). Private backyards, communal grounds of apartment buildings, and corporate campuses are also considered private green spaces (Wolch et al., 2014). Green space is important for children living in urban areas (Ioja et al., 2014; Mizuki and Minami, 2003; Richardson et al., 2017), as adult environmental opinions are formed by experiences with nature during childhood (Ewert et al., 2005; Jim and Shan, 2013). Nature-focused kindergartens and schools have provided children with opportunities for interacting with green spaces in Europe and the United States (Elliott and Chancellor, 2014; Fjørtoft and Sageie, 2000; MacEachren, 2013; Schäffer and Kistemann, 2012). Children can explore nature in green spaces in a supervised or unsupervised manner (Jansson et al., 2016). Green spaces not only provide children with opportunities to experience nature (Coolen and Meesters, 2012), but are also places for children to make friends (Seeland et al., 2009). Because of these benefits, Glackin and Jones (2012) suggested that local green spaces should be used for teaching and studying science in south London, United Kingdom. Kweon et al. (2017) and Wu et al. (2014) also showed that children who study in school environments with more trees perform better academically. However, rapid urbanization and population growth have led to changes in land use and cover, resulting in an overall reduction in green space area (Dewan and Yamaguchi, 2009; Kusimi, 2008; Ramdani et al., 2015).

As urbanization and populations increase in developing countries (Dewan and Yamaguchi, 2009; Kusimi, 2008; Ramdani et al., 2015), it is important to understand the status of green space around children in these countries to improve green space access. In 2015, 53.7% of the population in Indonesia lived in urban areas (World Bank, 2016). The urban population is projected to exceed the rural population by 2020. In 2050, 70% of Indonesians are projected to live in urban areas, a higher pro-

* Corresponding author. E-mail: itaya@bio.mie-u.ac.jp
[1] Graduated School of Bioresources, Mie University, 1577 Kurimamachiya-cho, Tsu-shi, Mie, 514-8507 Japan

 DOI: 10.20659/jfp.2019.001

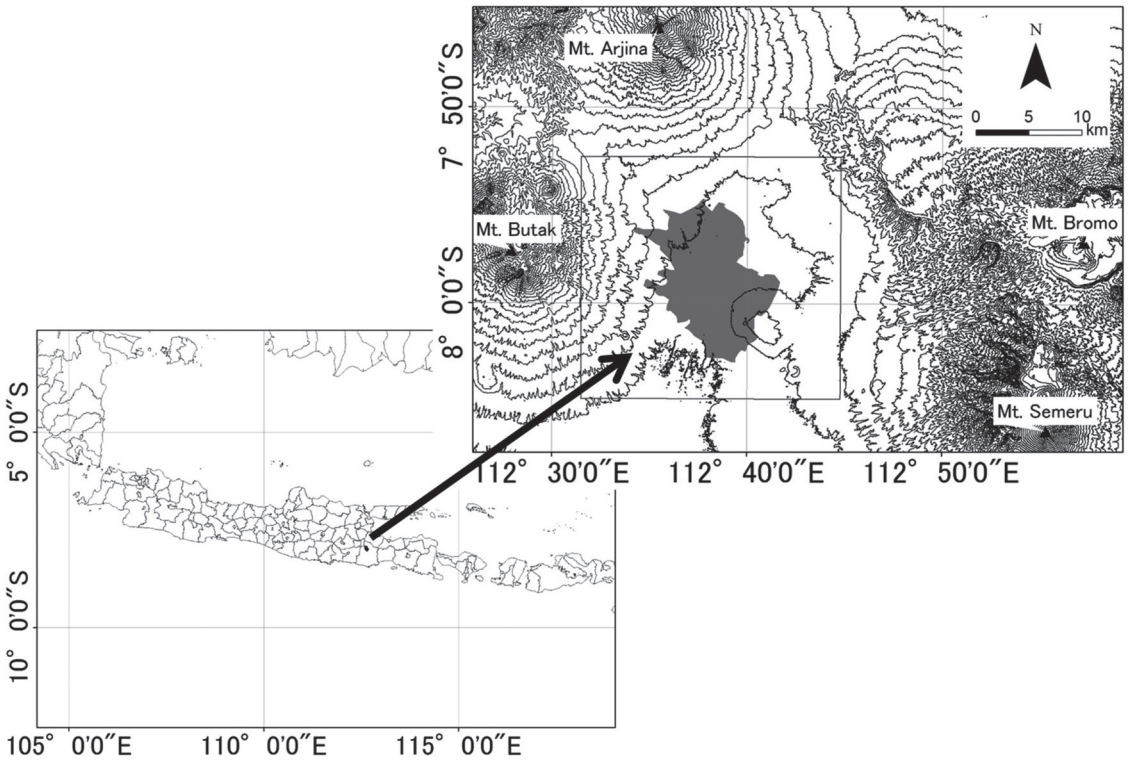


Fig. 1 Location of Malang, Indonesia (gray area). The delineated area is that covered by the satellite image. The 100-m interval contour lines were generated using a digital surface model (DSM) and data obtained from the Advanced Land Observing Satellite (ALOS). The city is surrounded by mountains and mountain ranges.

portion than in other Asian countries (United Nations, 2014). As cities become more urbanized, a smaller proportion of the urban population will experience nature directly (Cox et al., 2017). Thus, children in urban areas in Indonesia may have less access to green space. However, little is known about the status of green space around children in Indonesia. Although studies have been conducted on broad-scale land-cover changes and land management in urban areas (Achmad et al., 2015; Agaton et al., 2016; Ramdani et al., 2015; Wolfersberger et al., 2015), these studies did not focus on green space around children. Malang, the second largest city in East Java, is a typical example of a rapidly urbanizing city in Indonesia. Urbanization in Malang is occurring in an uncontrolled manner (Ramdani et al., 2015), with increasing housing development and a decreasing area of agricultural land and forests. Urban area cover increased from 21% in 2001 to 40% in 2014 (Ramdani et al., 2015). This rapid urbanization has resulted in a steady decrease in green space in Malang.

Although the optimal green space area for children is not known, Indonesia has developed several green space indices for city planning. According to government regulations, at least 30% of the city area should be designated as green space, and at least 20% of this green space should be publicly accessible (Ministry of Public Works, 2008). Additionally, the World Health Organization (WHO) recommends that each city inhabitant should have access to at least 9 m^2 of green space (OECD, 2013). In Japan, the Nishinomiya city government mandated that each residential area should have a green space ratio, defined as the proportion of vegetation to visible land area, of at least 15% (Susaki and Kubota, 2017).

In this study, we used satellite remote-sensing to elucidate the current status of green space around children in elementary schools in Malang, Indonesia, and discuss ways to improve access to green space.

MATERIALS AND METHODS

Study Site

Our study site was Malang, the second largest city in East Java, Indonesia (Fig. 1). Malang has an area of 110.06 km^2, and is surrounded by mountains and mountain ranges, including Mt. Bromo, Mt. Butak, Mt. Arjuna, and Mt. Semeru. Malang comprises a large southern plateau, northern fertile highlands, an eastern plateau with less fertile soil, and a vast western plateau (Pemerintah Kota Malang, 2018). The downtown area is located at the center of the city. According to the 2010 census, the population of Malang is 820,243, and widely dispersed throughout the city. The population has doubled over the last 40 years, and is estimated to reach 874,890 in 2020 (Badan Pusat Statistik, 2015). The economy in Malang has been growing steadily, and the local government has been unable to control the urbanization process and related population growth and urbanization (Ramdani et al., 2015). In 2003, the city was composed of 54.48%

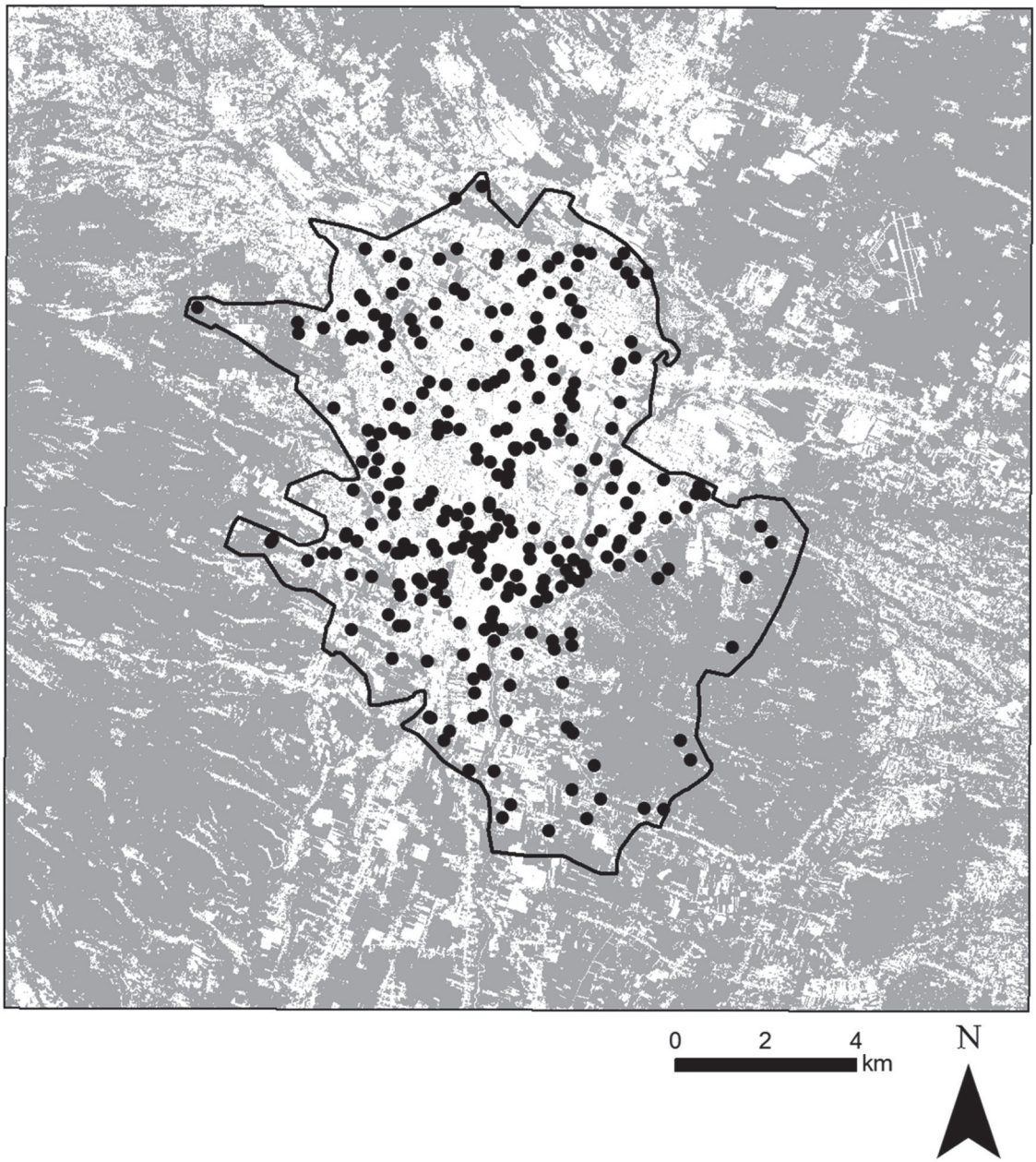


Fig. 2 Green spaces detected using the maximum-likelihood method to classify the RapidEye satellite image (gray area). Points represent the locations of elementary schools.

vegetation, 7.25% open land, and 38.27% constricted land (Purwanto et al., 2016). Ten years later, the composition changed to 35.54% vegetation, 2.41% open land, and 62.05% constricted land (Purwanto et al., 2016). During this period, west and southeast Malang started to develop as well.

Location of Elementary Schools

We obtained the names and addresses of 330 elementary schools in Malang (Malang District Board of Education, 2018). Based on these addresses, we conducted a visual assessment of each location using satellite images hosted by Google Earth Pro and Google Street View, and the latitude and longitude of each elementary school was recorded. The locations of 291 Malang schools were conclusively identified (Fig. 2). The locations of 39 schools could not be determined conclusively.

Detection of Green Spaces around Elementary Schools Using Remote-sensing

Green spaces were detected using a RapidEye satellite image, which was acquired on May 20, 2015, and covered the study area at a spatial resolution of 5 m (Fig. 1). After normalized difference vegetation index (NDVI) values were calculated using red (630–680 nm) and near infrared (760–850 nm) bands, the NDVI layer were combined with red, green (520–590 nm) and blue (440–510 nm) bands. The supervised classification, which was maximum likelihood classifier, was applied for a combined

Table 1 Accuracy of classification of land cover types on the RapidEye satellite image acquired on May 20, 2015

		Interpretation on Google Earth					
		Woody vegetation	Non-woody vegetation	Built-up	Bare land	Total	User's accuracy (%)
Testing data	Woody vegetation	39	8	0	3	50	78.0
	Non-woody vegetation	5	41	1	3	50	82.0
	Built-up	2	2	44	2	50	88.0
	Bare land	0	10	7	33	50	66.0
	Total	46	61	52	41	200	
	Producer's accuracy (%)	84.8	67.2	84.6	80.5		

Overall accuracy = 78.5%, Kappa = 0.71

image. Land cover was grouped into four categories: Woody vegetation, Non-woody vegetation, Built-up and Bare land. In our dataset, 40 polygons were used for classification training, and 200 points were used to assess classification accuracy. Training and testing data were manually annotated by visually interpreting photographs obtained from Google Earth Pro and Google Street View. A confusion matrix was constructed by comparing test data with predicted values to quantify overall accuracy and the kappa coefficient (Congalton, 1991; Forestry and Forest Products Research Institute, 2012; Story and Congalton, 1983). We defined woody vegetation and non-woody vegetation as green spaces. Image processing and pre-processing, such as converting digital numbers to top-of-atmosphere reflectance, were carried out using ERDAS IMAGINE 2016 (Hexagon Geospatial).

We generated a circle with a radius of 1 km from the center of each school, and the green space area within these circles was calculated using ArcGIS 10.0 (ESRI). The reported walking rate of children is 4.3 km/hr (McDonald, 2008); thus, distances of 1 km can be covered by children within approximately 15 minutes.

RESULTS AND DISCUSSION

Detection of Green Spaces Using a Satellite Image

The overall accuracy was 78.5%, and the kappa coefficient was 0.71 (Table 1). The accuracy of detecting green spaces improved to 86.3% when woody vegetation and non-woody vegetation were combined as green space in urban areas. The green space detected on our map is displayed in Fig. 2.

Smaller green spaces were located in the city center, whereas larger green spaces were located in the southeastern part of the city. Total green space area in Malang was 45.43 km^2 and the overall green space ratio was 41.3%. The per capita green space area was 55.38 m^2. The green space area in Malang is larger than the area guidelines proposed by WHO and the city of Nishinomiya (Susaki and Kubota, 2017). In contrast, the capital of Indonesia, Jakarta, which is also the largest city in Indonesia, has 7.08 m^2 of green space per inhabitant (Kirmanto et al., 2012) and far fewer green spaces than Malang.

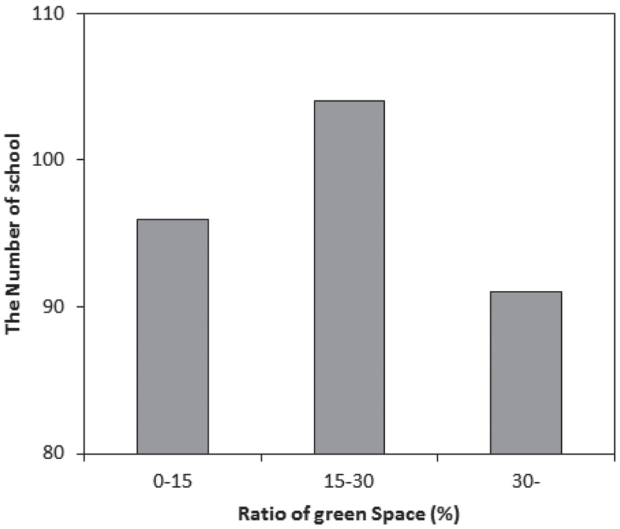


Fig. 3 Distribution of the green space ratio within 1 km radius circles around elementary schools.

Status of Green Space around Children in Malang

The average green space ratio within 1 km radius circles around each school was 26.7% (0.84 km^2). Although the governments of Indonesia (Ministry of Public Works, 2008) and the city of Nishinomiya (Susaki and Kubota, 2017) did not specify the optimal green space area for children in their regulations, we may be able to use their recommendations as guidelines for Malang. Thus, we categorized green space area into three grades based on 15% increments in the green space ratio within 1 km of each school (Fig. 3). The green space ratio was <15% around 96 schools, and 15–30% around 104 schools. Our results suggest that nearly 70% of the elementary school children in Malang have little access to green space, even though experiences in nature during childhood are important for forming adult environmental opinions (Ewert et al., 2005; Jim and Shan, 2013). Because schools near the city center tended to have lower green space ratios (Fig. 4), children living near the city center may have less daily access to nature.

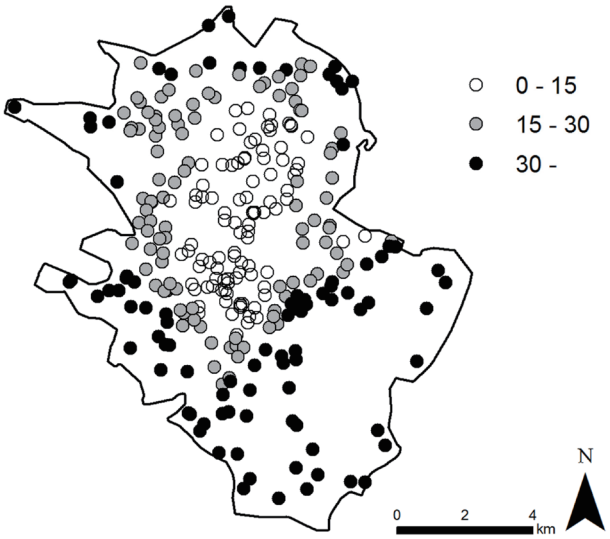


Fig. 4 Green space ratios (%) within 1 km radius circles around each elementary school in Malang.

Recommendations for Improving the Green Space around Children in Malang

Green space is important for childhood development (Coolen and Meesters, 2012; Glackin and Jones, 2012; Ioja et al., 2014; Jansson et al., 2016; Kweon et al., 2017; Mizuki and Minami, 2003; Richardson et al., 2017; Seeland et al., 2009; Wu et al., 2014). Although elementary schools near the city center had less green space surrounding them, the green space ratio within 1 km of each school was more than 30% for schools located on the periphery of the city. Because Malang is highly urbanized, there is little open land left, and these green spaces should be conserved. To do this, the city's residents could lead conservation efforts (Sesanti et al., 2011) in cooperation with private companies. For example, some urban parks in Malang are maintained in partnership with private companies as part of their program of corporate social responsibility (Kurniawati et al., 2017). It is necessary to provide opportunities to stay in green spaces also should be considered. According to the 2016 Malang Regional Policy, 81 green spaces have been designated as urban parks, and 7 green spaces are described as urban forests (Malang City, 2016). These 88 parks and forests can complement the green space available on the periphery of the city to provide children with greater access to green space. The use of these green spaces should be more promoted. Form this point we might go on to an even more detailed examination of the usage of green spaces in our future research.

ACKNOWLEDGEMENTS

We would like to express my deepest gratitude to Prof. Ishikawa who provided carefully considered feedback and valuable comments. Special thanks also go to Mr. Kalther whose meticulous comments were an enormous help to us.

LITERATURE CITED

Achmad, A., Hasyim, S., Dahlan, B. and Aulia, D.N. (2015) Modelling of urban growth in tsunami-prone city using logistic regression: Analysis of Banda Aceh, Indonesia. Appl. Geogr. **62**: 237–246

Agaton, M., Setiawan, Y. and Effendi, H. (2016) Land use/land cover change detection in an urban watershed: a case study of upper Citarum Watershed, West Java Province, Indonesia. Procedia Environ. Sci. **33**: 654–660

Arifin, H.S. and Nakagoshi, N. (2011) Landscape ecology and urban biodiversity in tropical Indonesian cities. Landscape Ecol. Eng. **7**: 33–43

Badan Pusat Statistik (2015) Statistics Malang City. https://malangkota.bps.go.id/ (accessed 5 October 2018)

Byomkesh, T., Nakagoshi, N. and Dewan, A.M. (2012) Urbanization and green space dynamics in Greater Dhaka, Bangladesh. Landscape Ecol. Eng. **8**: 45–58

Congalton, R.G. (1991) A review of assessing the accuracy of classifications of remotely sensed data. Remote Sens. Environ. **37**: 35–46

Coolen, H. and Meesters, J. (2012) Private and public green spaces: a meaningful but different setting. J. House and the Built Environ. **27**: 49–67

Coombes, E., Jones, A.P. and Hillsdon, M. (2010) The relationship of physical activity and overweight to objectively measured green space accessibility and use. Soc. Sci. Med. **70**: 816–822

Cox, D.T.C., Hudson, H.L., Shanahan, D.F., Fuller, R.A. and Gaston, K.J. (2017) The rarity of direct experiences of nature in an urban population. Landsc. Urban Plan. **160**: 79–84

Dewan, A.M. and Yamaguchi, Y. (2009) Land use and land cover change in Greater Dhaka, Bangladesh: Using remote sensing to promote sustainable urbanization. Appl. Geogr. **29**: 390–401

Elliott, S. and Chancellor, B. (2014). From forest preschool to bush kinder: An inspirational approach to preschool provision in Australia. Aust. J. Early Child. **39**: 45–53

Ewert, A., Place, G. and Sibthorp, J. (2005) Early-Life outdoor experiences and an individual's environmental attitudes. Leis. Sci. **27**: 225–239

Fjørtoft, I. and Sageie, J. (2000) The natural environment as a playground for children: Landscape description and analyses of a natural playscape. Landsc. Urban Plan. **48**: 83–97

Forestry and Forest Products Research Institute (2012) REDD-plus Cookbook. Forestry and Forest Products Research Institute. Tsukuba, 156 pp

Glackin, M. and Jones, B. (2012). Park and learn: improving opportunities for learning in local open spaces. Sch. Sci. Rev. **93**: 105–113

Ioja, C.I., Gradinaru, S.R., Onose, D.A., Vanau, G.O. and Tudor, A.C. (2014) The potential of school green areas to improve urban green connectivity and multifunctionality. Urban For. Urban Green. **13**: 704–713

Jansson, M., Elin, S. and Wales, M. (2016) The role of green spaces and their management in a child-friendly urban village. Urban For. Urban Green. **18**: 228–236

Jim, C.Y. and Shan, X. (2013) Socioeconomic effect on perception of urban green spaces in Guangzhou, China. Cities **31**: 123–131

Kirmanto, D., Ernawi, I.S. and Djakapermana, R.D. (2012) Indonesia green city development program: an Urban Reform. Ministry of Public Works, Indonesia. 48th ISOCARP Congress 2012

Kurniawati, D.E., Kusumaningrum, D.N. and Haffsari, P.P. (2017) Revitalization of green open space (GOS) in Kota Malang as the government response to urban social sustainability. Journal of Social Science and Humanities Research **2**: 1–11

Kusimi, J.M. (2008) Assessing land use and land cover change in the Wassa West District of Ghana using remote sensing. GeoJournal **71**: 249–259

Kweon, D.K., Ellis, C.D., Lee, J. and Jacobs, K. (2017) The link between school environments and student academic performance. Urban For. Urban Green. **23**: 35–43

Maas, J., Verheij, R.A., Groenewegen, P.P., de Vries, S. and Spreeuwenberg, P. (2006) Green space, urbanity, and health: how strong is the relation? J. Epidemiol. Community Health **60**: 587–592

MacEachren, Z. (2013) The Canadian forest school movement. Learn. Landsc. **7**: 219–233.

Malang City (2016) Keputusan Walikota Malang No. 188.45/184/35.73.112/2016 Tahun 2016 [Decree of Malang City's Mayor No.188.45/184/35.73.112/2016 Year 2016]. http://disperkim.malangkota.go.id/component/upload/document/taman_kota/TKDOC_171205155438.pdf (accessed 25 December 2018) (in Indonesian)

Malang District Board of Education (2018) Data Sekolah Tingkat SD/SDLB/MI [School data for elementary grades]. https://diknas.malangkota.go.id/?page_id=2964 (accessed 25 December 2018) (in Indonesian)

McDonald, N.C. (2008) Children's mode choice for the school trip: the role of distance and school location in walking to school. Transportation **35**: 23–35

Ministry of Public Works (2008) Peraturan Menteri Pekerjaan Umum No. 05/PRT/M/2008 tentang Pedoman Penyediaan dan Pemanfaatan Ruang Terbuka Hijau di Kawasan Perkotaan [Minister of Public Works regulation No. 05/PRT/M/2008 concerning guidelines for the provision and use of green open space in urban areas]. (in Indonesian)

Mizuki, S. and Minami, H. (2003) Relation of children's behavior and street environments when returning home from school. J. Archit. Plann. **574**: 61–68 (in Japanese with English abstract)

OECD (2013) Frameworks and sector policies for urban development in Chile OECD Urban Policy Reviews, Chile 2013

Pemerintah Kota Malang (2018) Geografis [Geography]. https://malangkota.go.id/ (accessed 5 October 2018)

Purwanto, Utomo, D.H., and Kurniawan, B.R. (2016) Spatio temporal analysis trend of land use and land cover change against temperature based on remote sensing data in Malang City. Procedia Soc. Behav. Sci. **227**: 232–238

Ramdani, F., Putra, A.F. and Utomo, B.N. (2015) Historical land use transformation in virtual geo-library. ISPRS Int. J. Geo-Inf **4**: 1500–1511

Richardson, E.A., Pearce, J., Shortt, N.K. and Mitchell, R. (2017) The role of public and private natural space in children's social, emotional and behavioural development in Scotland: A longitudinal study. Environ. Res. **158**: 729–736

Roy, S., Byrne, J. and Pickering, C. (2012) A systematic quantitative review of urbantree benefits, costs, and assessment methods across cities in different climaticzones. Urban For. Urban Green. **4**: 351–363

Schäffer, S.D., and Kistemann, T. (2012) German forest kindergartens: Healthy childcare under the leafy canopy. Child. Youth Environ. **22**: 270–279

Seeland, K., Dübendorfer, S. and Hansmann, R. (2009) Forest policy and economics making friends in Zurich's urban forests and parks: The role of public green space for social inclusion of youths from different cultures. For. Policy Econ. **11**:10–17

Sesanti, N., Kurniawan, E.B. and Anggaraeni, M. (2011) Optimasi Hutan Sebagai Penghasil Oksigen Kota Malang [Forest optimization as oxygen producer of Malang City]. Jurnal Tata Kota dan Daerah **3**: 65–73 (in Indonesian with English abstract)

Story, M. and Congalton, R.G. (1983) Accuracy assessment: A user's perspective. Photogramm. Eng. Remote Sensing **52**: 397–399

Susaki, J. and Kubota, S. (2017) Automatic assessment of green space ratio in urban areas from mobile scanning data. Remote Sens. **9**: 215. doi:10.3390/rs9030215

United Nations (2014) World urbanization prospects. http://esa.un.org/unpd/wup/ (accessed 20 May 2016)

Wolch, J.R., Byrne, J. and Newell, J.P. (2014) Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. Landsc. Urban Plan. **125**: 234–244

Wolfersberger, J., Delacote, P. and Garcia, S. (2015) An empirical analysis of forest transition and land-use change in developing countries. Ecol. Econ. **119**: 241–251

World Bank (2016) Urban Population. http://data.worldbank.org/ (accessed 5 October 2018)

Wu, D.D., McNeely, E., Cedeño-Laurent, J.G., Pan, W.C., Adamkiewicz, G., Dominici, F., Lung, S.C., Su, H.J. and Spengler, J.D. (2014) Linking student performance in Massachusetts elementary schools with the "Greenness" of school surroundings using remote sensing. PLoS ONE **9**: e108548. doi:10.1371/journal.pone.0108548

(Received 24 August 2018)
(Accepted 24 January 2019)
(J-STAGE Advance Published 29 March 2019)

Guide for Contributors

Please refer to the following guidelines when submitting a new manuscript to the *Journal of Forest Planning* (hereafter "the *Journal*"), of the Japan Society of Forest Planning (hereafter "the *Society*"), so that your manuscript can be handled expeditiously.

Type of Papers: Papers are to be classified as either an article, a review, or a short communication. All papers must represent original research and must not have been submitted or published elsewhere (other than as an abstract). Articles are theoretical or empirical reports on original research. Reviews systematically survey the literature in a particular research field, address research questions related to the field, and provide insight into future developments in the field. Short communications are brief reports of significant findings (for example, proposing a new methodology, confirming existing knowledge, or significantly adding to existing knowledge) intended for rapid publication.

Contributors: The first author or the corresponding author of any paper should be a member of the *Society* unless he/she has been invited to contribute by the editor-in-chief of the *Journal*. The authors can apply for *Society* membership on submission.

Review Process: The *Journal* conducts a single-blind review process. Each manuscript is first handled by one of the editors, at which time it is evaluated for *Journal* suitability. Manuscripts considered to be suitable are then peer-reviewed by at least two anonymous expert referees selected by the editor.

Decision for Publication: The editorial board makes the final decision to accept, reject, or suggest revision to manuscripts based on its contribution in terms of original data and ideas as indicated by the results of reviews conducted by the referees.

Manuscript: Manuscripts should be written in English and follow the guidelines provided in "Manuscript Preparation" below. Either American or British usage/spelling is acceptable, but not a mixture of these.

English: All authors whose first language is **not** English should ask a native speaker to refine the written English of their manuscripts prior to submission.

Final Manuscript and Authors' Proof Correction: When the manuscript is accepted, the authors will be asked to send the final manuscript in editable electronic formats. The required formats will be indicated in the manuscript preparation. A Portable Document Format (PDF) file of the proof will be sent to the corresponding author by email only once for proofreading.

Expense on Publication: No charges will be levied for papers published in the *Journal*. A free electronic reprint will be sent to the author in PDF. However, authors who need color page/special printing will be required to pay the actual expenses involved. Reprints can also be ordered in blocks of 50 copies at the actual expenses involved. All prices are subject to change.

Submission and Inquiry: Authors will be required to send their manuscript and a submission form in electronic format to the editor-in-chief by email. The editor-in-chief's email address can be found on the inside cover of the *Journal*. Submission inquiries may also be sent to the editor-in-chief by email.

Copyright: The *Society* reserves all rights to the papers published by the *Journal*. Written permission by the editor-in-chief is required for the reproduction or republication of Journal-published manuscripts, either in whole or in part.

Rights of Authors: The authors retain the following rights:

(1) Authors are allowed to reproduce their own Journal-published papers, either in whole or in part, in their own literary works providing they acknowledge the *Journal* as its source.
(2) Authors are allowed to provide a PDF file of their paper to the public at repositories of their affiliations and financial contributors after it has been provided to the public via J-STAGE on the condition that they display a link to the paper's abstract on the J-STAGE website.
(3) Authors are allowed to electronically copy and distribute a PDF file of their paper on the condition that they purchase reprints of their paper, or the PDF file of their paper at the same price as the reprints of their paper. In this case, authors are allowed to post the PDF file on their personal website after providing it to the public via J-STAGE and should display a link to the paper's abstract on the J-STAGE website.

MANUSCRIPTS PREPARATION

Style: All manuscripts should be arranged as follows: (1) title page, (2) abstract and keywords, (3) main text, (4) literature cited, (5) tables, (6) figures, and (7) messages to editors.

Typing: Manuscripts should be typewritten, double-spaced, on A4-size pages with margins of 3 cm on the top, bottom, and both sides. Line and page numbers should be included. The desired locations of tables and figures should be indicated in red font characters in the right margins.

Text Style: Characters to be printed in italic or bold font should be entered using the features of the word processing software.

Title Page: The first page of each manuscript should contain the following items: (1) the type of paper, (2) the title of the paper, (3) the authors' full names and affiliations along with their addresses, and (4) the corresponding author's name and e-mail address.

The author affiliations to be listed are the affiliations where the actual research was conducted. If any of the authors have changed affiliation since completing the research, the present affiliation can also be indicated.

Abstract and Keywords: An abstract is required for all paper types, and should be no more than 300 words long. Between three and five keywords, listed alphabetically and separated by commas, should be provided.

Mathematical Equations: If there is more than one equation in the text, the equations should be numbered with Arabic numerals according to their sequence on the right-hand side ((1), (2), etc.). Short expressions not cited by any number may be included in the text. Variables should be presented in italics, although upright-style Greek alphabet letters may be used.

Acknowledgements: Contributors who do not meet the criteria for authorship should be listed in the "Acknowledgements" section at the end of the main text before the "literature cited" section. All sources of funding should be listed in this section, following the contributors' requirements.

Literature Cited: In-text literature citations should show the surname (family name) of the author and the year of publication. In parenthetical citations after the statement concerned, the surname of the author and the year of publication are to be separated by a comma. Multiple citations in the same parentheses are to be placed in chronological order and separated by semicolons. If there are more than two authors, citations should quote the surname of the first author and the words "et al." The names of all authors should be included in the list of literature cited. More than one reference from the same author(s) in the same year should be identified by Roman alphabet letters placed after the year.

The "literature cited" section at the end of the paper should list the cited literature alphabetically by the surname of the first author, and then chronologically for each author. Use the following examples for the style of the "literature cited" section:

a. For periodicals: Shirasawa, H. and Hasegawa, H. (2014) A comparative study of heuristic algorithms for the multiple target access problem. J. For. Res. 19: 437–449
b. For books: Davis, L.S., Johnson, K.N., Bettinger, P.S. and Howard, T.E. (2001) Forest management: To sustain ecological, economic, and social values. 4th ed. McGraw-Hill, New York, 804 pp
c. For chapters in edited books and papers in proceedings: Gadow, K.V. (2005) Science-based forest design and analysis. In: Naito K. (ed) The role of forests for coming generations. Japan Society of Forest Planning Press, Utsunomiya: 1–19
d. For theses and dissertations: Tiryana, T. (2010) Quantitative models for supporting multipurpose management planning of teak plantations in Java, Indonesia. PhD thesis, The University of Tokyo, Tokyo, 100 pp
e. For Internet resources: McGaughey, R.J. (1999) Visualization system. USDA Forest Service, Pacific Northwest Research Station. http://faculty.washington.edu/mcgoy/svs.html (accessed 14 April 2013)

If the literature has no English title, the authors should translate the non-English title into English. The translated title should be placed in square brackets, and the original language should be placed in parentheses after the pagination. The romanized title of the original language may be placed before the translation, as in: Tanaka, K. (1996) Shinrin keikakugaku nyumon [An introduction to forest planning]. Japan Society of Forest Planning Press, Fuchu, Tokyo,192 pp (in Japanese)

Tables: Tables should be numbered with Arabic numerals according to their sequence in the text (Table 1, Table 2, etc.). Each table should be prepared on a separate page and be accompanied by a brief and self-explanatory title. Any explanations for the tables should be given as a footnote at the bottom of the table. Do not use vertical lines to separate columns.

Figures: Figures should be numbered with Arabic numerals according to their sequence in the text (Fig. 1, Fig. 2, etc.). Each figure should be prepared on a separate page. Figure captions should appear on a separate page. Figures should be of publication quality. Color figures can be included, but will incur an additional printing charge. Figures for color printing should be marked with the note "COLOR" in the margin of the page on which the appears.

Messages to Editors: If authors have any potential conflicts of interest in relation to their manuscript, they must describe them in the "messages to the editors" section.

Submission Form: The submission form should be filled out and attached to the manuscript on submission. The form can be found on the last page of the *Journal*. Non-member authors can apply for *Society* membership when submitting their paper by completing and enclosing the application form found on the inside of the back cover of the *Journal*.

Electronic Submission: Authors are required to submit their manuscript in PDF by email. If it is difficult to save the manuscript in PDF, MS Word files are also accepted. Authors are encouraged to save their tables and figures in PDF form, and then combine them with the manuscript file. This means that just one PDF file should be sent to the editor-in-chief. After acceptance, the authors will be asked to submit the final manuscript in the

following formats:

(1) Title page, abstract and keywords, main text, literature cited, and figure captions: an MS Word (doc or docx) file;

(2) Tables: an editable file in MS Word (doc or docx) or MS Excel (xls of xlsx);

(3) Figures: High-quality image files (TIFF, JPEG, or PNG), an MS PowerPoint (ppt or pptx) file, or a PDF file.

(February 2019)

Guidelines on Publication Ethics

These guidelines are based primarily on the *Guidelines on Good Publication Practice* (COPE, 1999), the *Code of Conduct and Best Practice Guidelines for Journal Editors* (COPE, 2011), the *Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals* (ICMJE, 2017), and the *International Standards for Authors* (Wager and Kleinert, 2011).

DUTIES OF EDITORS

Publication decision: The editors' decisions to accept or reject a manuscript for publication should be based on the manuscript's importance, originality, and clarity, as well as the study's validity and its relevance to the scope of the *Journal*.

Confidentiality: Editors should treat all submitted manuscripts as confidential. Editors should not share information about manuscripts, including whether they have been received and/or are under review, their content and status in the review process, criticism by reviewers, and their ultimate fate, to anyone other than the authors and reviewers. Editors should also make it clear that reviewers will be expected to keep manuscripts, associated material, and the information they contain strictly confidential.

Conflict of interest: Editors who make final decisions about manuscripts should recuse themselves from editorial decisions if they have conflicts of interest or relationships that pose potential conflicts related to manuscripts under consideration. If an editor submits a manuscript to the *Journal*, another editor will handle the peer-review process of the manuscript independently of the authoring editor.

Corrections: When a published paper is subsequently found to contain major flaws, editors should accept responsibility for correcting the record prominently and promptly.

DUTIES OF REVIEWERS

Contribution to editorial decisions: Reviewers are experts chosen by editors to provide written opinions. Peer review helps editors decide which manuscripts are suitable for the *Journal*. It may also help authors improve their study.

Promptness: Reviewers are expected to respond promptly to requests to review and to submit reviews within the time agreed.

Reporting standards: Reviewers should provide unbiased and justifiable reports. Reviewers' comments should be constructive, honest, and polite.

Confidentiality: Reviewers should keep manuscripts and the information they contain strictly confidential. Reviewers should not publicly discuss the authors' work and should not appropriate the authors' ideas before the manuscript is published. Reviewers should not retain the manuscript for their personal use and should destroy the copies of any manuscripts they have been provided after submitting their reviews. Reviewers should not use knowledge of the work they are reviewing before its publication to further their own interests.

Conflict of interest: Reviewers should disclose to the editors any conflicts of interest that could bias their opinions of the manuscript, and should recuse themselves from reviewing specific manuscripts if the potential for bias exists.

Ethical issues: If reviewers suspect the authors' misconduct, they should notify the editor in confidence.

DUTIES OF AUTHORS

Reporting standards: Authors should report their methods and findings accurately. Authors should provide sufficient detail to permit other researchers to repeat the work. Authors should present their results honestly and without fabrication, falsification, or inappropriate data manipulation.

Data access and retention: Authors may be asked to disclose the research data for the review process. Authors should maintain the primary data and analytic procedures underpinning the published results for at least 10 years after publication.

Authorship of the paper: The award of authorship should balance intellectual contributions to the conception, design, analysis, and writing of the study against the collection of data and other routine work. If there is no task that can reasonably be attributed to a particular individual, then that individual should not be credited with authorship.

Authorship should be based on the following criteria: (1) Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data used for the work; (2) Drafting the work or revising it critically for important intellectual content; (3) Final approval of the version to be published; (4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Contributors who meet fewer than all four of the above criteria for authorship should not be listed as authors, but they should be acknowledged. Those whose contributions do not justify authorship

may be acknowledged individually or together as a group under a single heading, and their contributions should be specified.

Conflict of interest: Authors should disclose to editors relevant financial and non-financial interests and relationships that might be considered likely to affect the interpretation of their findings. All sources of research funding, including direct and indirect financial support, the supply of equipment or materials, and other support should be disclosed as well.

Originality and plagiarism: Authors should adhere to publication requirements that submitted work be original. Authors should represent the work of others accurately in citations and quotations. Relevant previous work and publications, both by other researchers and the authors' own, should be properly acknowledged and referenced. Data, text, figures, or ideas originated by other researchers should be properly acknowledged and should not be presented as if they were the authors' own.

Redundant publication: Authors should not submit the same manuscript, in the same or different languages, simultaneously to more than one *journal*. Previous publication of an abstract in the proceedings of meetings does not preclude subsequent submission for publication.

Corrections: Authors should alert the editor promptly if they discover an error in any submitted, accepted, or published work. Authors should cooperate with the editors in issuing corrections or retractions when required.

LITERATURE CITED

Committee on Publication Ethics (COPE) (1999) Guidelines on good publication practice. https://publicationethics.org/files/u7141/1999pdf13.pdf

Committee on Publication Ethics (COPE) (2011) Code of conduct and best practice guidelines for *journal* editors. https://publicationethics.org/files/Code%20of%20Conduct_2.pdf

International Committee of Medical Journal Editors (ICMJE) (2017) Recommendations for the conduct, reporting, editing, and publication of scholarly work in medical journals. http://www.icmje.org/icmje-recommendations.pdf

Wager, E. and Kleinert, S. (2011) Responsible research publication: International standards for authors. A position statement developed at the 2nd World Conference on Research Integrity, Singapore, July 22-24, 2010. In: Mayer, T. and Steneck, N. (eds) Promoting research integrity in a global environment. Imperial College Press/World Scientific Publishing, Singapore: 309–316

(August 2018)

JOURNAL OF FOREST PLANNING

Submission Form

1. Date of submission: _____

2. Name of author(s): _____

_____

3. Title of manuscript: _____

_____

4. Corresponding author: _____

5. Affiliated institution: _____

6. Mailing address: _____

_____

Telephone: _____ Fax: _____

E-mail: _____

Mailing address in Japanese (if available): _____

_____

_____

7. Classification of manuscript*: ☐ article ☐ review ☐ short communication

8. Number of pages including abstracts: _____

9. Number of tables: _____ Number of figures: _____

10. Necessary number of reprints: _____

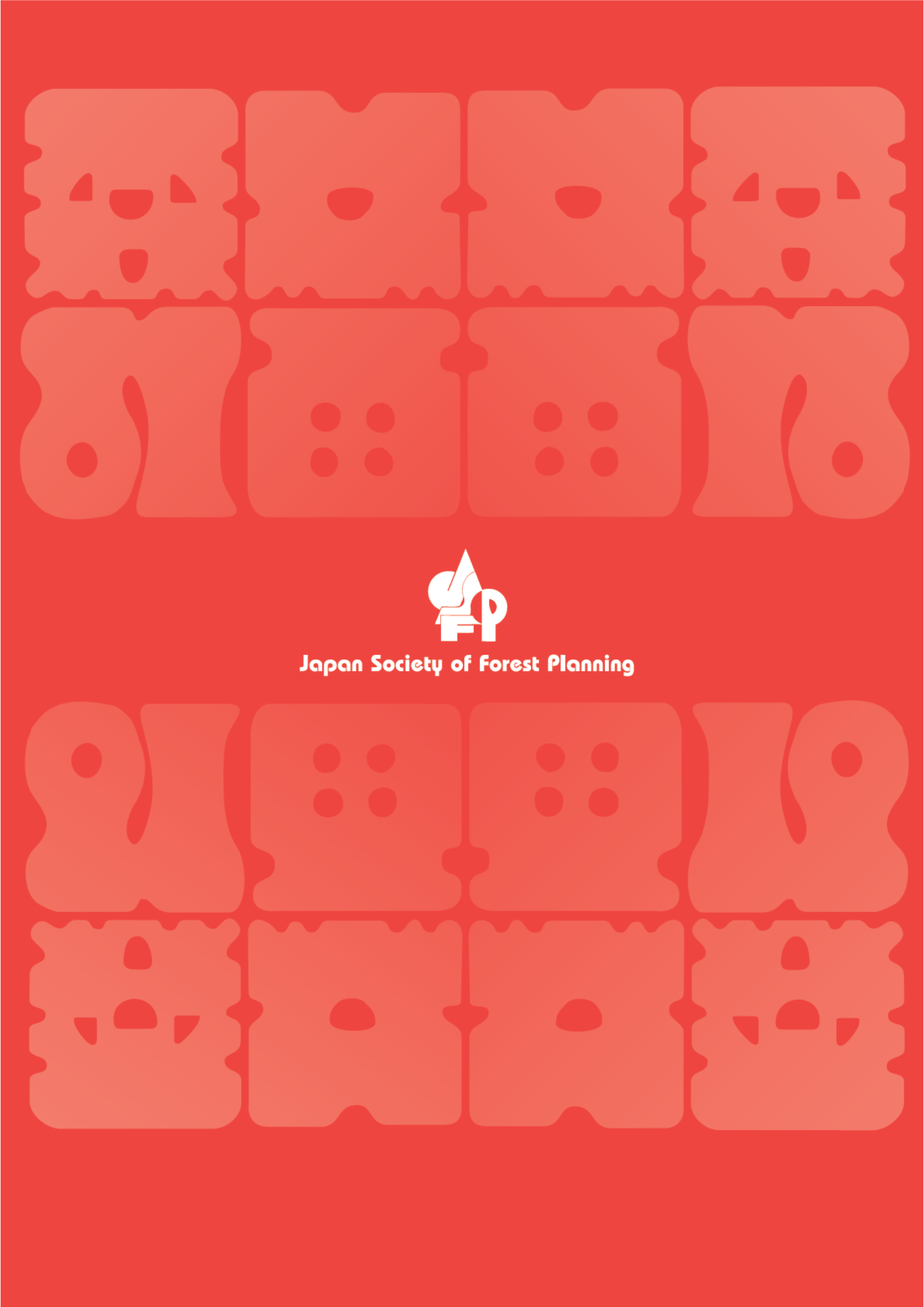
11. Please tick either which apply*:
☐ The written English has been proofread by a native speaker.
☐ I am from an English-speaking country.

*Please tick one of the boxes.

Filled by the Editorial Board

Manuscript No.: _____

Date of receipt: _____ Date of acceptance: _____



Japan Society of Forest Planning