Illipe nut as the 'glue' for integrated watershed management

Experiences from the Labian-Leboyan watershed

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Main points

- Though stakeholders are already aware of the importance of sustainable non-timber forest product (NTFP) management and integrated watershed management, they have yet to fully appreciate or implement them.
- Experiences from community facilitation show that management of one type of traditional NTFP – *tengkawang* (illipe nut) – from its upstream cultivation to downstream marketing could become an entry point for integrated landscape management in the Labian-Leboyan watershed.
- Lessons learned from activities in several Iban Dayak communities show that external facilitation from outside the villages is important as it can accelerate collaboration processes between village communities and external stakeholders; and help in establishing local strategies that integrate modern knowledge with customary rules.

Introduction

The Kapuas, Indonesia's longest river, flows 1143 km from its source in the Müller Mountains to the South China Sea. The Kapuas watershed covers an area of 10,030,308 hectares, 176,760 hectares of which is in extremely critical condition with another 1,577,491 hectares in critical condition (West Kalimantan Watershed and Protection Forest Management Authority/BPDAS-HL 2011). This extensive degradation resulted in the Kapuas watershed being included in Minister of Forestry Decree SK 328/Menhut-II/2009 as one of 108 critical watersheds in Indonesia and becoming a national priority for watershed restoration (Ministry of Environment and Forestry 2015).

The hydrology of the Kapuas is highly dependent on conditions of Danau Sentarum wetlands, which covers an area of more than 130,000 hectares, excluding a network of watersheds and tributary sub-watersheds. One of the main rivers flowing into Danau Sentarum is the Labian-Leboyan, whose headwaters is located in Betung Kerihun National Park. The Labian-Leboyan watershed covers an area of 106,925.46 hectares (West Kalimantan BPDAS-HL 2018 in Danau Sentarum Management Working Group 2018). Integrated watershed management

is necessary to ensure watershed hydrology is maintained without ignoring the needs of communities living in the watershed.

All stakeholders appear to have accepted integrated watershed management as a concept, but it remains difficult to apply. The approach does not focus solely on forestry and hydrology issues but places more emphasis on natural resource management as a local socioeconomic development process (FAO 2006), and consequently requires not only an understanding of conditions, but collaboration with local communities. In Indonesia, integrated watershed management is regulated under Law No. 32/1999 on Environmental Protection and Management, and Government Regulation No. 37/2012 on Watershed Management. In West Kalimantan Province, it is also regulated by Provincial Regulation No. 2/2018, which stresses the importance of the planning, implementation and control aspects of watershed management. This provincial regulation grants district governments the authority to regulate the use and management of rivers in their regions, so they become the responsibility of district forestry offices and involve cooperation between relevant parties upstream and downstream. Under Law No. 23/2014 on Regional Governance, rivers had previously come under provincial government authority.

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Since 2000, Riak Bumi has been facilitating communities in the Labian-Leboyan watershed to conserve forests through integrated watershed management, using landscape approach principles (Sayer et al. 2013). Initial steps involved finding alternative sources of income from non-timber forest products (NTFPs), for instance forest honey in Nanga Leboyan village, and ecotourism in Pelaik hamlet, both of which are in the lower reaches of the watershed. In 2014, Riak Bumi facilitated upstream communities, beginning in Keluin hamlet. This paper describes our experiences, particularly findings and important lessons learned during the facilitation process, keys to success, challenges and the strategies we applied. We commence this paper with an overview of the location, and follow up by discussing the main reasons for choosing illipe nut as an important NTFP. We also provide an overview of the facilitation process, as well as important lessons learned and recommendations.

Overview of the Labian-Leboyan watershed

The Labian-Leboyan watershed is located between two national parks; Danau Sentarum and Betung Kerihun, and is a corridor between habitats for wildlife species, including the Bornean orangutan (*Pongo pygmaeus pygmaeus*). Most land in the upper reaches has *Protection Forest* or *Hutan Lindung* (HL) status, while most land in the lower reaches is classified as *Production Forest* or *Hutan Produksi* (HP) (see Figure 1). The point where the river empties into Danau Sentarum wetlands is inside the boundary of the national park. Based on Colupsia data (2015)³, land cover in the watershed consists of relatively intact forest at 65.79%, degraded forest at 14.75%, traditional swidden farming land (cultivated plots and *damun*/fallow) at 14.47%, and wetlands at 4.99% (see Figure 2).

Based on our survey in early 2018, there are 16 hamlets in eight villages along the Labian-Leboyan watershed, with a total population of 3489 (1104 households), comprising 1815 men and 2331 women. The watershed is home to three main ethnicities: Iban Dayak in the upper reaches, Embaloh Dayak in the middle reaches, and Melayu (Malay) in the lower reaches. Livelihoods of the Iban and Embaloh people are generally from farming (shifting cultivation), cultivating rubber, catching fish, and gathering NTFPs including honey from forests. Ethnic Melayu generally catch and farm fish, but also grow rubber and farm forest honey. During facilitation processes, communities detailed various challenges relating mainly to community livelihoods and well-being. These challenges include: extreme floods causing crops to fail; difficulties with clean water for drinking; dwindling fish

catches; difficult access and expensive transport particularly in the upper reaches; and timber utilization conflicts between communities and national park authorities where hamlets are located inside national park boundaries. In addition, communities voiced their concerns over oil palm companies continuing to seek new land. Villagers are worried because government maps categorize their hamlets as Production Forest regions.

Selecting NTFPs and participatory planning

Facilitation by Riak Bumi aimed mainly at developing alternative revenue sources for communities and environmental conservation. The main choices were local NTFPs that meet the following criteria (Chokkalingam et al. 2005; Uprety et al. 2012; Yuliani et al. 2015): (a) are beneficial for the local community; (b) have social or cultural significance; and (c) have ecological functions, for instance, can prevent erosion, help water infiltration, and/or enrich soil.

By using semi-structured in-depth interviews (SSIs), focus group discussions (FGDs) and narrative walks with villagers from Keluin hamlet, we secured information on a variety of NTFPs with economic potential. However, only illipe nut met all the above criteria (as explained in the following section). In addition to illipe nut, villagers considered local fruits, rubber and coffee to be important NTFPs potential for alternative sources of income. After identifying NTFP types, as well as their traditional uses and management practices, the next step was to facilitate collaborative planning with villagers.

Facilitation was planned to cover 'upstream to downstream' processes, meaning production to marketing, including establishing an illipe nut farmer network (as explained below).

A brief overview of the ecology, sociocultural and economic value of *tengkawang* in West Kalimantan

Ecology of *tengkawang*

Tengkawang (*Shorea* spp.) is better known to the general public as meranti. In West Kalimantan, *tengkawang* – also known as *engkabang* or *kakawang* by Iban and Embaloh communities respectively – is a forest tree species native to western Indonesia. The species grows well in tropical rainforest with rainfall types A (monsoonal) and B (equatorial), on latosol, red-yellow podzolic and yellow podzolic soils at elevations up to 1300 m ASL (Martawijaya et al. 1981). In Indonesia, thirteen species of *tengkawang* are protected under Government Regulation No. 7/1999, eight of which are found in West Kalimantan.

³ Based on Colupsia data (2015), the Labian-Leboyan watershed covers an area of 81,000 hectares, so our land use and land cover percentage calculations used this figure as the total.

Figure 1. Map of formal land status in the Labian-Leboyan watershed

Figure 2. Map of land cover in the Labian-Leboyan watershed

Figure 3. Distribution of *tengkawang* trees in Mensiau village documented by Riak Bumi in 2018

In addition to occurring naturally in forests, many communities plant *tengkawang* trees on farming land, *damun* (fallow), riverbanks and *tembawai* (sacred sites, sites of earlier longhouses). Figure 3 shows the result of our *tengkawang* tree distribution mapping in Mensiau village.

Sociocultural value: Local knowledge and *tengkawang* management institutions

In West Kalimantan, illipe nut butter has been used traditionally for generations, as was apparent from the oldest piece of literature we found on illipe nut butter published by William Burck in 1886. Local communities have extensive knowledge and homegrown perceptions regarding *tengkawang*, which have been passed down from generation to generation. Members of the Keluin community in the upper reaches of the Labian-Leboyan watershed were no exception. When passing along the river, they pointed out that riverbanks with *tengkawang* trees were generally better protected against erosion. In their opinion *tengkawang* roots are strong and bind the soil. Villagers also told us that *tengkawang* trees growing in riverbanks are more fertile and bear more fruit than those growing further from rivers.

Iban communities in Kapuas Hulu district recognize nine types of *tengkawang*: *ajul*, *engkabang*, *engkabang bintang*, *engkabang rambai*, *engkabang tukul*, *engkabang tungkul*,

lelanggai, *sepit undai* and *tegelam*.⁴ However, only those with larger fruits, such as *engkabang* and *engkabang tungkul*, are most prized as butter producers. In addition to occurring naturally, large fruit *tengkawang* trees are also planted around longhouses and in *tembawai*. For that reason, *tengkawang* trees are also considered heirlooms and signifiers of family and communal longhouse ownership rights. As the Iban expression says, "Wherever there's *tembawai*, there you'll find *tengkawang* trees."

Harvest seasons for large fruit *tengkawang* species occur once every 3-4 years. In the *tengkawang* flowering season, almost all local fruit-bearing species will flower too. This is a sign for communities to hold customary *Ngampun* ceremonies, asking for forgiveness from the deities of nature to deliver them from diseases, which they believe to be a consequence of the *tengkawang* and local fruit tree flowering season. All hamlet residents are involved in *Ngampun* rituals.

According to Iban Dayak elders, there are customary rules for harvesting and processing *tengkawang* fruit that regulate when to begin harvesting, who is involved, the sharing of tasks including for women and children, and the clear and equitable sharing of harvest produce. Illipe nuts are then processed traditionally to make butter for cooking, lighting, medicines

4 We have not included scientific names for these species here as observations of tree, fruit, and leaf morphology and characteristics are required to verify their scientific names.

and other things. The butter extraction process is carried out in secret far from settlements because villagers believe that if anyone sees the extraction process and asks many questions, then the resulting butter will not meet expectations and the process may even fail.

Other parts of the *tengkawang* tree can also be used. In the past, its sap was used as a lighting fuel and for plugging holes in boats, and is now sometimes sold for around IDR 5000/kg if buyers come to the hamlet. Fresh green leaves are used to wrap *tumpe*, a traditional cake that must be provided and irreplaceable in customary rituals as an offering to ancestral spirits of Dayak peoples in Kapuas Hulu. In addition to wrapping *tumpe* cake, the leaves are also used for wrapping other foods, for making various cakes and as a natural dye in traditional woven fabrics.

However, according to villagers in the Labian-Leboyan watershed, many of the younger generation are less familiar with customary rules governing the harvesting and utilization of *tengkawang*. Further, there are no local institutions specifically for regulating ownership of *tengkawang* trees. Both things, the lack of knowledge regarding customary rules and the absence of local institutions, require special attention to prevent conflicts over ownership competition or capture, particularly as their economic value increases.

Economic value and other benefits

Tengkawang and particularly *tengkawang tungkul* was once a flagship commodity for West Kalimantan. In the early 1990s, illipe nut exports reached 3519.2 tons with a value of USD 7,707,800 (Winarni et al. 2005). The mascot for West Kalimantan of hornbills holding a *tengkawang* flower exemplifies the tree's significance to the province (see Figure 4).

Figure 4. West Kalimantan mascot: hornbills gripping a *tengkawang* flower in their bills

Photo by Valentinus Heri/Riak Bumi

However, illipe nut prices reportedly fell as a result of Minister of Trade Regulation No. 44/M-DAG/PER/7/2012 on Goods Prohibited for Export. As a member of the meranti family, *tengkawang* wood is recognized as a high-quality timber for buildings in wet or swampy regions. Its buoyancy and water resistance make it unparalleled as a material for constructing *rumah lanting* floating houses. At a time when illipe nut prices fell due to the export ban, *tengkawang* wood prices ranging from IDR 300,000 – 600,000 (equal to US \$ 32-64 with 2012 exchange rate) per cubic meter were deemed more attractive than earnings from nuts and butter derived from fruits than could only be harvested once every 3–4 years. As a result, numbers of *tengkawang* trees in Kalimantan's forests have fallen, but this has only become a realization as demand and prices of illipe nuts are bouncing back. Fortunately, populations of *tengkawang* trees have been reasonably well maintained in Kapuas Hulu district due to their important social and cultural values for Iban communities.

Under Minister of Environment and Forestry Regulation No. 20/2018, illipe nuts are no longer prohibited for export, but at the time of writing, the Minister of Trade regulation had yet to be revoked.⁵ Nevertheless, illipe nut demand and prices have increased significantly and provide hope as an alternative income source.

To calculate illipe nut production capacity and estimate its economic value, Riak Bumi conducted simple research in the four hamlets of Entebuluh, Engkadan, Keluin and Kelawik. In 2015, the four hamlets had approximately 5600 trees between them (Atmanto et al. 2015). Each tree could produce 200–400 kg of fresh fruit in one season, totaling 1100–2200 tons of fresh fruit (or 275–550 tons of dry nuts) across the four hamlets. With a dry weight price of IDR 8000/kg at that time, harvest produce could generate from IDR 2.2–4.4 billion. However, villagers only collected what they were able to, and the four hamlets produced only 47 tons of dry nuts. "At harvest time there are so many *tengkawang* fruits. Despite only happening once in three or four years, we can't take them all, so we only take what we're able to," a villager said during one longhouse discussion.

Summary of facilitation activities

The above information gathered on the economic value and social and cultural aspects of *tengkawang* provided us with the knowledge to advance to the facilitation stage, where we used a Participatory Action Research (PAR) approach to encourage learning among all those involved. Core activities are carried out following a cycle of Reflection – Planning – Implementation (action) – Monitoring and Evaluation – Reflection – Adaptation of plans and further action. PAR will

⁵ Related news article: <https://moneter.id/57598/kadin-kalbar-cabut-permendag-no-44-2012>

only be effective if there is a 'binding' issue that becomes a common need or concern (Kusumanto et al. 2005). A common concern and entry point is also one principle of the landscape approach. In facilitating PAR processes in the Labian-Leboyan watershed landscape, the common concern was striving to increase community income from illipe nut.

In 2014, during the preliminary reflection process with the Keluin community, *tengkawang* was identified as an NTFP suitable for development as an alternative revenue source. Then, in 2016 during a workshop on *tengkawang* development in West Kalimantan involving relevant stakeholders (*tengkawang* fruit farmers and processors, brokers, forestry and estate crops offices, BPDAS-HL, BKSDA, researchers from Tanjung Pura University, several NGOs and private companies), participants identified potential forms of 'capital' that required strengthening. These were: (a) the existence of local knowledge, sociocultural value and customary rules on *tengkawang* use and ownership, as well as traditional land use; (b) *tengkawang* trees in every district having different harvest seasons, thus allowing inter-district cooperation; (c) the presence of *tengkawang* farmer groups in a number of locations; and (d) emerging awareness of the need for *tengkawang* farmers in different locations to work together, and share experiences and lessons learned.

In addition to potential, challenges were also identified during the facilitation process. These began with seed/nut production, post-harvest management and marketing, to aspects of customary institutions and formal policies. As *tengkawang* trees only produce seeds once every 3-4 years, they are deemed an irregular and uncertain source of income. Large volumes of fruit are produced all at once, but can rot quickly while the capacity to dry and process them into butter remains limited. Challenges during the marketing stage include large-scale consumers (industries) being uninterested in using illipe butter due to inconsistent supply, and the monopolistic practices and unilateral application of quotas by large companies. The outcome is illipe nut producers selling dried nuts or butter to brokers for relatively low prices during the harvest season. Meanwhile, older community members, particularly women, said that gathering *tengkawang* fruit from the forest was tiring because they had to walk long distances and return carrying heavy loads, so they needed an income source closer to home. In response to these challenges, the Keluin community suggested having activities to develop alternative income sources besides illipe nut.

The community felt other challenges were the absence of guidelines or policy on butter quality standards, and different perceptions among stakeholders on whether the collection and processing of NTFPs from protected species and from protection forest estates is permitted or not. Until now, existing rules remain limited to harvesting methods, marketing and seed exports, while there have yet to be any rules on the production, sales and export of

illipe butter. Unclear regulation limits the marketing of illipe butter to domestic markets and hinders export, despite the commodity's huge export potential. Various regulations relating to *in situ tengkawang* conservation are ineffective and not implemented fully. This is apparent from the prevalence of conversion permits for forests and other ecosystems that constitute *tengkawang* habitats. The government once made a center for flagship products, including illipe nut in West Kalimantan, but illipe nut producers felt the government had not yet promoted them properly.

To address these challenges, we facilitated communities and relevant stakeholders in seeking solutions and making the following joint plans and activities: strengthening local institutions and customary rules relating to *tengkawang*; working with the Dian Tama Foundation to provide technical training on *tengkawang* cultivation using a mulch system (see Figure 5); planting *tengkawang* trees along riverbanks (see Figure 6); establishing a West Kalimantan *tengkawang* network and working with illipe nut producer groups to ensure supply continuity; striving to develop alternative income sources by improving post-harvest technologies for other commodities (rubber, coffee) through comparative studies to Sanggau and Kubu Raya districts; and developing nurseries for a variety of commodities to become alternative income sources for villagers, including the elderly. Riak Bumi also experimented with producing rudimentary processing tools developed from the traditional '*alat apit tengkawang*' to produce illipe butter more efficiently and hygienically. The potential for alternative incomes from illipe nut made villagers more enthusiastic to plant and conserve *tengkawang* trees in riverbanks.

Figure 5. Mulch system: seedlings are stored in a small space covered with transparent plastic sheeting. This method minimizes maintenance and especially watering as moisture transpiring from the seedlings collects on the plastic and drips back onto the plants. Holes are made on one side for air circulation to stop it becoming too hot inside

Photo by Valentinus Heri/Riak Bumi

Figure 6. Keluin villagers plant *tengkawang* trees along the banks of the Labian-Leboyan river to prevent erosion.

Photo by Riki Rikando/Riak Bumi

In addition to its activities with communities and *tengkawang* promoters, in early 2017, Riak Bumi and CIFOR held a workshop involving institutions that had conducted, or were in the process of conducting activities relating to integrated watershed management in order to share lessons learned and establish inter-institution communications (Heri et al. 2017). During the workshop, all participants articulated the need for awareness, effort and willingness to collaborate from all stakeholders from the upper to lower reaches in order to conserve the watershed. Further, participants also saw the importance of using a key species as a 'glue' or the main issue in establishing coordination between communities and between institutions. The enthusiasm of the Keluin community to plant *tengkawang* trees in riverbanks and strengthen customary rules in response to enhancing the economic value of *tengkawang*, shows it has the potential to be that key species for the Labian-Leboyan watershed. The large numbers of institutions and activities relating to *tengkawang* also provide an opportunity for establishing learning and marketing networks.

During the hamlet joint reflection and planning processes, villagers also posed questions beyond *tengkawang*; for instance, regarding the Mensiau Village Forest, formalized in 2017 through Minister of Environment and Forestry Decree No. SK.5740/ Menlhk-PSKL/PKPS/PSL.0/10/2017. Villagers asked about the meaning and benefits of village forests, how to secure those benefits, and the status of customary regions that become village forests. In response to these questions, we planned to facilitate communication between communities and key stakeholders including the Directorate General of Social Forestry and Environmental Partnerships, the provincial forestry office and district forest management units (FMUs) so villagers' questions could be relayed directly. Lessons learned and conclusions

Some keys to successful integrated watershed management are: (i) using local NTFP species that are deeply rooted in communities and are managed using traditional knowledge and customary rules; (ii) a strong desire from all stakeholders to be active in seeking strategies and solutions; and (iii) reliable facilitators to perform the following strategic roles: (a) strengthen local institutions and build bridges between modern and local knowledge of customary institutions or farmer groups involved with specific commodities; (b) foster creativity, confidence, leadership, concern for communities and nature, and local economic resilience to withstand changing market dynamics and policies; and (c) facilitate dynamic discussions and ensure all stakeholders, not only dominant groups, can relay their thoughts.

In our experience it is not easy to perform these roles. Experiences from forest honey activities with communities around Danau Sentarum became important capital (Riak Bumi 2012). Facilitation of those activities, from commencement to establishing a reliable income, including building local institutions and downstream rewards, took around 10 years. With *tengkawang*, it requires readiness to facilitate the whole chain of activities starting from planting, harvesting and butter production, to organizing *tengkawang* promoters, marketing, and building community self-sufficiency. Good strategies and readiness are also necessary to link illipe nut marketing chains to more holistic watershed landscape management.

With appropriate facilitation and simple technologies developed from local traditional tools, *tengkawang* and local plant commodities could play important roles in economic, social and environmental enhancement to preserve or even increase tree cover along the whole watershed. Now, the reach of facilitation needs to be expanded to connect all stakeholders from the upper to lower reaches. Traditional knowledge and customary rules constitute fundamental elements of local institutions. However, the following needs remain: (a) regulatory support on *tengkawang* oil trade, from fruit harvesting, butter production, storage, transportation to export regulations; (b) tenurial certainty; (c) learning about production, institutions, networking, marketing, and small- and medium-scale processing facilities from other places; and (d) financing.

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References

- Atmanto L, Bakara DO and Sami J. 2015. *Laporan Studi Potensi Tengkawang di Kecamatan Batang Lupar dan Badau, Kabupaten Kapuas Hulu, Kalimantan Barat*. Riak Bumi, Pontianak.
- West Kalimantan Watershed and Protection Forest Management Authority (BPDAS-HL). 2011. *Rencana Pengelolaan DAS Kapuas Terpadu*. West Kalimantan BPDAS-HL, Pontianak, Indonesia.
- Burck W. 1886. *Minjak Tengkawang: En Andere Weinig Bekende Plantaardige Vetten uit Nederlands-Indie*. Batavia Landsdrukkerij.
- Chokkalingam U, Sabogal C, Almeida E, Carandang A, Gumartini T, Jong W, Brienza S, Lopez A, Murniati, Nawir A, Wibowo L, Toma T, Wollenberg E and Zaizhi Z. 2005. Local participation, livelihood needs, and institutional arrangements: Three keys to sustainable rehabilitation of degraded tropical forest lands. In Mansourian S, Vallauri D and Dudley N, eds. *Forest restoration in landscapes: Beyond planting trees*. New York: Springer. pp. 405-414.
- Colupsia. 2015. http://www1.cifor.org/fileadmin/subsites/colupsia/maps/Kapuas_Hulu/Vegetasi/indexvegetasi.htm
- FAO. 2006. The new generation of watershed management programmes and projects. FAO Forestry Paper 150. Food and Agriculture Organization of the United Nations, Rome.
- Heri V, Adnan H and Yuliani EL. 2017. Proceedings from the workshop on integrated watershed management in Kapuas Hulu district, West Kalimantan. Putussibau, 16 March 2017. Riak Bumi and CIFOR.
- Danau Sentarum Management Working Group. 2018. *Danau Sentarum Management Plan for 2019-2023 (Pengelolaan Terintegrasi Daerah Tangkapan Air, Sempadan dan Perairan Danau Sentarum)*. Putussibau, West Kalimantan.
- Ministry of Environment and Forestry. 2015. Ministry of Environment and Forestry Strategic Plan for 2015-2019.
- Kompas. 2008. *2,2 Juta Hektare DAS Kapuas Kritis*. <https://ekonomi.kompas.com/read/2008/09/09/2152469/2.2.juta.Hektare.DAS.Kapuas.Kritis>
- MacKinnon K, Hatta G, Halim H and Mangalie A. 1996. *The Ecology of Kalimantan, Indonesian Borneo*. Periplus Editions, Hong Kong.
- Martawijaya A, Kartasujana I, Kadi K and Prawira SA. 1981. *Atlas Kayu Indonesia*. Forestry Research and Development Board, Department of Forestry, Bogor.
- Riak Bumi. 2012. *Sertifikasi Organik Madu Danau Sentarum*. <http://riakbumi.or.id/sertifikasi-organik-madu-danau-sentarum/>
- Sayer J, Sunderland T, Ghazoul J, Pfund J, Sheil D, Meijaard E, Venter M, Boedhihartono AK, Day M, Garcia C, van Oosten C and Buck LE. 2013. Ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses. www.pnas.org/cgi/doi/10.1073/pnas.1210595110.
- Upreti Y, Asselin H, Bergeron Y, Doyon F and Boucher JF. 2012. Contribution of traditional knowledge to ecological restoration: Practices and applications. *Ecoscience* 19(3): 225-237.
- Winarni I, Sumadiwangsa ES and Dendy S. 2005. *Beberapa Catatan Pohon Penghasil Biji Tengkawang*. Info Hasil Hutan, 11(1): 17-25.
- Yuliani EL, Mulyana A, Adnan H, Manalu P, Achdiawan R, Tias P, Moeliono M, NGO Balang and NGO Teras. 2015. Agroforestry and Forestry in Sulawesi series: Local perceptions of forest ecosystem services and collaborative formulation of reward mechanisms in South and Southeast Sulawesi. Working paper 210. World Agroforestry Centre (ICRAF), Bogor, Indonesia. DOI: <http://dx.doi.org/10.5716/WP15721.PDF>

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