Kasarinlan: Philippine Journal of Third World Studies 2020–21 (35–36): 93–124

How Preserving Biodiversity Mitigates the Impacts of Small-scale Land Grab on Livelihoods and Agricultural Production in Central Java

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ABSTRACT. Large-scale land grabbing has had much attention in the literature in recent years, leaving little room for research on small-scale land grabbing and its impacts. Notably, because of the varied contexts in which these small-scale land grabs have happened, few studies have focused on the different mitigation strategies that can either be adopted by communities or are simply inherent in rural communities. This article contributes to filling this gap by presenting a case of small-scale land grab in the highlands of Central Java, and by using a landscape approach within the framework of ecoagriculture. First, the community of Soko Kembang hamlet and the surrounding landscape, located in the subdistrict of Petungkriyono, district of Pekalongan, are described, as well as their multifaceted dynamics. Second, it is shown that the drawbacks in the community brought about by a land grab in 2013, where all rice fields were forcibly sold for a low price to the state electricity enterprise, are somewhat compensated by the benefits associated with a local biodiversity conservation project. More precisely, the agroforestry systems promoted within this project are sustained harmoniously with the natural environment and its primate populations, while being directly beneficial to the community. Thus, although this mitigation strategy has not been adopted directly in response to the rice fields grab, this study shows how complex socio-ecological systems can help enhance the resilience of rural communities in the face of social disturbances. And it also shows how an analysis based on a landscape approach, more precisely within the framework of ecoagriculture in this very case, can shed some light on such complex systems.

KEYWORDS. land grabbing · socio-ecological landscapes · mitigation strategies · biodiversity conservation · dynamic resilience · Central Java

Introduction

Land grabbing has been extensively covered in the literature, as processes of national and transnational land acquisitions and transactions are now happening at a greater scale than ever, a reality

often referred to as "global land grabbing" (Vermeulen and Cotula 2010; Borras and Franco 2012; Edelman 2013; Messerli et al. 2013, 2014). Apart from the mining sector, the majority of land grabbing cases occurring around the world is linked to the agro-food sector where croplands, forests, or grasslands are being acquired mainly for the production of export crops, biofuels, or timber (Borras and Franco 2012; Messerli et al. 2014). Most of the time, reported land grabs are located in the tropics, with studies often focusing on large-scale land grabs and presenting cases as quantified problems rather than focusing on the social impacts and their implications (Edelman 2013; Messerli et al. 2014; Zoomers et al. 2017). Still, the importance of considering and proposing solutions to alleviate such negative social impacts is generally recognized (Daniel and Mittal 2009; De Schutter 2011). But lesser importance is given to small-scale land grabs, or at the very least to the local impacts of larger-scale land acquisitions (Edelman 2013). And yet, studying social impacts on a local scale is the best way to understand how such transactions can affect local communities, and through which means the associated negative impacts can be mitigated, at least to some extent. Hence, in this article, a case of small-scale land grab is presented, and its impacts described. The objective of the article is to present the mitigation strategies that were observed in the community submitted to this land grab, with a focus on the surrounding natural, agricultural, and socioeconomic contexts.

The term "land grabbing," being a "catch-all phrase" as pointed out by Borras and Franco (2012), can incorporate different phenomena involving different parties, and it may even be perceived as a result of land schemes developed by the state or other entities (Borras and Franco 2012; McCarthy et al. 2012; Semedi and Bakker 2014). Given the broad context under which land grabs can be described, it is relevant to provide a more precise definition for the purpose of this article. Thus, in this publication, "land grabbing" will refer to a context where powerful entities or parties exert some sort of coercive pressure on less powerful parties or individuals in order to gain access to or obtain these individuals' lands without their full consent. It must be noted that the local smallholders' perspective is privileged here and that the more legalistic definition of land grabbing is not within this paper's scope.

Many studies that focus on small-scale land acquisitions, or on the local impacts of larger-scale acquisitions, report that one of the main impacts of land grabbing is the weakening of food security, which is

partly a result of the modification of agricultural production activities (Daniel and Mittal 2009; Shete and Rutten 2015; Marks et al. 2015; Friis and Nielsen 2016). Agricultural lands will often be planted with cash crops and export crops rather than food crops, threatening the food security and livelihoods of local communities. Several ways for mitigating such negative impacts have been reported in the literature (e.g., Qian 2015; Schoneveld 2017; Zoomers and Otsuki 2017). Many mitigation strategies are proposed by either governments or foreign investors to the farmers whose lands have been grabbed. And although in some cases these compensations can genuinely help farmers ensure their well-being, it is not always so. In many cases, compensations are either insufficient or even nonexistent. As have been largely observed in Indonesia, especially on the outer islands, and even more so since the beginning of the palm oil boom (McCarthy et al. 2012; Gellert 2015). Losing one's land, even though it might be part of the state spatial planning processes, has a particular impact on traditional landowners whose livelihoods are rooted in their lands. However, whether these land acquisitions are perceived as "grabs" by local smallholders tend to vary with the benefits they receive from these transactions and their own perception of fairness (McCarthy et al. 2012; Semedi and Bakker 2014).

Responses "from below," as reported by Hall et al. (2015) to illustrate how farmers or local governments respond to land grabs, are rather diverse. They can go from powerful social mobilizations with the sole purpose of disconnecting a given community from the liberal market, to demands for a greater incorporation into agri-food value chains. An interesting avenue, which is less explored in the literature as a potential mitigation strategy, is the possibility for a community to evolve and become dynamically resilient with and within its surrounding environment. Such resilience could allow a community to maintain its livelihoods when faced with disturbances instead of adopting strategies that would force its inhabitants out of their current customs. One way for communities to achieve this is by taking advantage of new opportunities in the surrounding environment while ensuring that the fundamental functions of the landscapes are maintained, which corresponds precisely to the definition of dynamic resilience (Young 2010; Messerli et al. 2013). McNeely and Scherr (2001), as well as Buck et al. (2006), have argued that in any given rural landscape where natural attributes are present, such as is often the case in most tropical landscapes dominated by small agricultural communities, pursuing

multiple objectives jointly might be a more efficient management strategy than treating the landscape's subsystems separately. The objectives brought about by these authors were presented within the framework of the ecoagriculture approach, and they focus on agricultural productivity, biodiversity conservation, and local livelihoods. Thus, such an approach, based on the study of socio-ecological systems, can provide an understanding of the different dynamics that might help alleviate the impacts of land grabbing in a given landscape (Messerli et al. 2013; Hunsberger et al. 2017).

This article presents a case where mitigation of the impacts of a small-scale land grab results from the important dynamic resilience observed in the surrounding socio-ecological landscape. Such mitigation was possible through a local, collaborative effort between a former hunter from the local community and two Javanese researchers with a common purpose: preserving the local biodiversity. The case presented here was first studied in a broader research project focusing on multiple landscapes in the highlands of Central Java. But given the unique context encountered, it is being described here as a separate case.

Study Site and Methods

The research was carried out in the Dieng Mountains, north of the Dieng Plateau, Central Java. The forests covering these mountains form one of the greatest remnant forested area in Central Java, and they arrive second in importance in terms of biodiversity in the province after Mount Slamet (Nijman and van Balen 1998; Widhiono 2009a, 2009b; Setiawan et al. 2010, 2012). The area was initially protected by the Dutch as a water reservoir for the cities on the north coast (Pujo Semedi, pers. comm., July 2014). But nowadays, none of these forests are part of an official protected area, and they are all owned by the government and managed by the Perusahaan Umum Kehutanan Negara, or Perum Perhutani for short, locally called Perhutani, the state forest enterprise (Whitten et al. 1996; Coad et al. 2015; UNEP-WCMC 2016a, 2016b).

In July and August of 2014, and from March to June of 2015, landscape evaluations were undertaken as part of a larger research project (see Tanguay 2018). The study was carried out in the subdistrict of Petungkriyono, district of Pekalongan, which was chosen because contacts with local communities had already been established by Javanese researchers (figure 1). This subdistrict is in the western part of

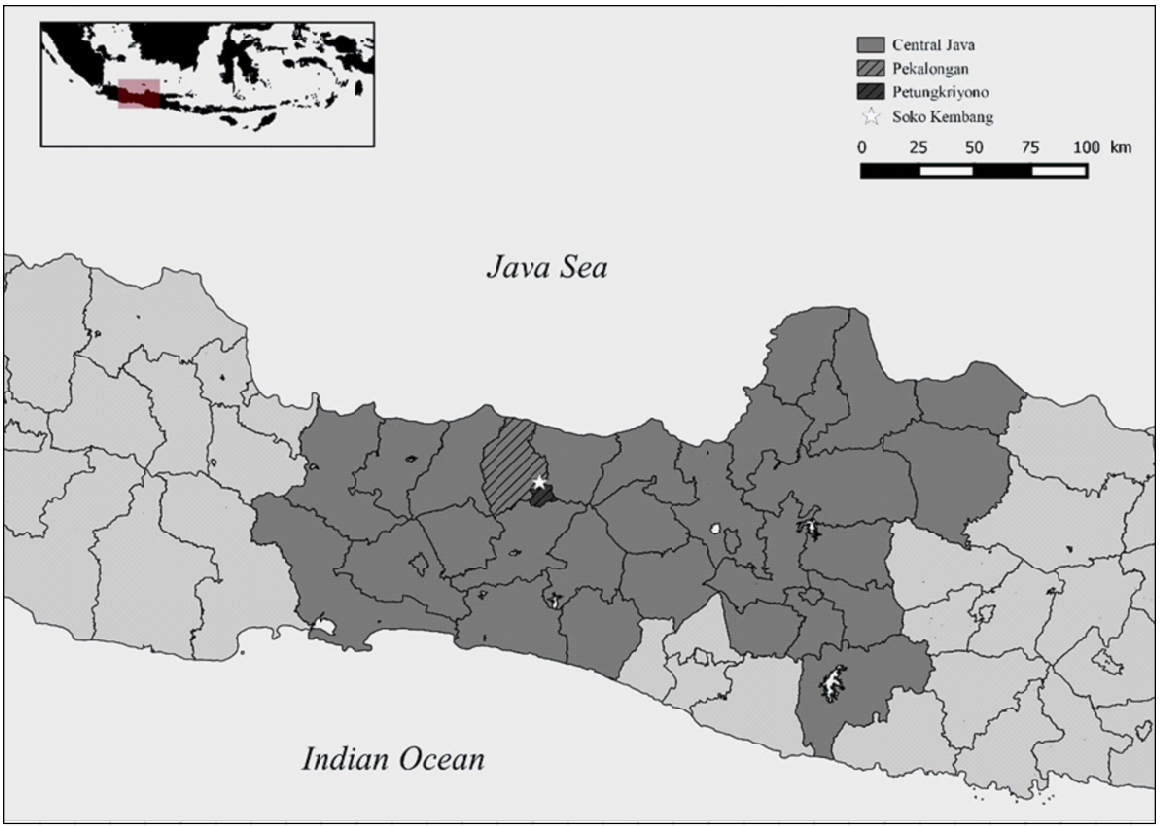

FIGURE 1. Soko Kembang hamlet, subdistrict of Petungkriyono, Pekalongan district, Central Java. (Tanguay 2018)

the Dieng Mountains, between 500 and 2,100 meters above sea level, and it covers an area of 7,358.5 hectares, including 5,190 hectares of forests, and 2,003.6 hectares of agricultural or private agroforest lands (Hamintoko et al. 2014; BPS Kabupaten Pekalongan 2015, 2016).

The main objective of the research project in Petungkriyono was to study how local communities, their agricultural systems, and the surrounding forests interact while analyzing the benefits and inconveniences that each entity can bring to each other. This article focuses on only one of the studied landscapes. This landscape lies in the Welo River valley at the northern edge of the subdistrict. It is in Kayu Puring village, covering only one hamlet named Soko Kembang (figure 1). This hamlet is surrounded by natural and seminatural forests where coffee is harvested and where most daily activities take place. Seminatural forests refer here to forests with many natural attributes but which include some attributes managed by humans, such as shadow crops. Rice fields (*sawah*) are in the vicinity of the hamlet and cover a rather small portion of the landscape (figure 2). Some very sparse private agroforests are also present, but their presence is insignificant when compared to other areas of the subdistrict. And as was discovered during fieldwork, the community of Soko Kembang had suffered the impacts of land grabbing one year before the research project started. For this article, the objective is to analyze how the livelihoods and agricultural production of the community were affected by this land grab, and what processes or strategies helped the community to mitigate the negative effects. In the present case, the land transaction that occurred in Soko Kembang in 2013 is described as a land grab because it was generally perceived as such by the inhabitants of the community who were subjected to it.

Most of the data were gathered through unstructured interviews with farmers from Soko Kembang, originally met for the abovementioned prior larger research project. Some interviews were also had with several researchers from Gadjah Mada University (UGM) in Yogyakarta. Other experts and government officials were met for the same purpose. This study relied on forty-one interviewees, including five who were met regularly and were considered key respondents. Respondents were either met randomly in the fields and hamlet, or they were sometimes chosen because their production activities were relevant in completing or complementing some of the data already acquired. This was not to gather a representative sample of respondents, but rather to collect information from many knowledgeable people

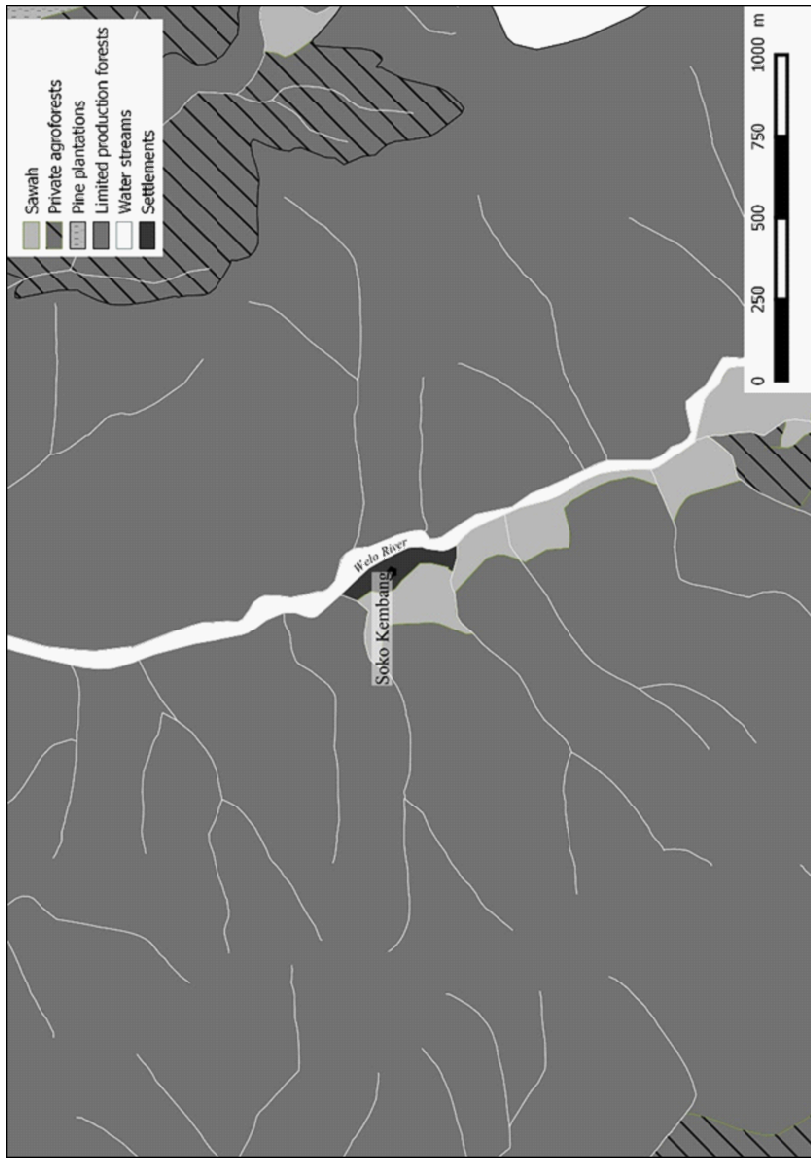

FIGURE 2. The landscape around Soko Kembang hamlet. (Tanguay 2018, PPIK 2015)

who could provide general information on the whole hamlet or landscape as well as share their personal circumstance and attributes. Interviews were completed by the main researcher with the help of a Javanese counterpart and addressed different subjects ranging from social to economic and environmental aspects of the landscape and community. These themes were derived and adapted from De Koninck et al. (1977) and Buck et al. (2006). Local documents and statistics were also collected from the village head office and from the district statistical office in Pekalongan City. Perhutani maps indicating forest lots were obtained from different sources, and land use and geographical shapefiles were obtained from the GIS service center (Pusat Pelayanan Informasi Kebumian, PPIK) in UGM.

Visual assessments of the environment, including vegetation structure, and soil quality and water quality evaluations, were carried out in agricultural and agroforestry systems in order to estimate the impact of these systems on the natural environment. Vegetation structure was assessed by estimating the canopy closure and canopy cover. The first one was evaluated with the help of a densiometer while the second one was assessed by dividing the canopy into six strata inspired by Simons et al. (2006) and Muhamad et al. (2013), and by estimating the percent cover of each stratum with percentage ranges proposed by Daubenmire (1959). Soil quality was assessed with the help of nine visual indicators proposed by Shepherd (2000), Nicholls et al. (2004), and McGarry (2006), while water quality and water channel quality were evaluated with the help of seventeen indicators described by Ball (1982), USDA (1998), Barbour et al. (1999), Bjorkland et al. (2001), and CWT (2011). For length reasons, methods about these visual assessments will not be further discussed here, but more information can be found in the publications mentioned above, or in Tanguay (2018).

These visual assessments provided a more complete picture of Soko Kembang's surrounding landscape, complementing, validating, or adding new information to the data obtained from the interviews. The combination of both sets of data was thus necessary to understand the greater dynamics within the studied landscape. Hence, all data was compiled and analyzed using a landscape approach and within the framework proposed by ecoagriculture proponents, which allows us to integrate information coming from many different disciplines. Indeed, a landscape approach, or landscape perspective, allows us to focus the analysis of a given system on a broader scale than most usual livelihoods

or agro-schemes indicators by incorporating the many different aspects of a landscape and its interactions into a coherent whole (Tscharntke et al. 2005; Buck et al. 2006). The ecoagriculture approach, which is a more specific approach using a landscape perspective, was described by McNeely and Scherr (2001) as a way to recognize the interdependence between the economic, social, and ecological spheres (McNeely and Scherr 2001; Buck et al. 2004; Scherr and McNeely 2008). This approach promotes the merging of agricultural development, biodiversity conservation, and social development objectives, allowing farmers to fulfill their agricultural production needs and maintain or increase their well-being without negatively impacting natural ecosystems. These latter would in turn ensure the sustainability of agricultural production on a landscape scale as a result of the fundamental ecosystem services that they provide (Brussaard et al. 2010).

Thus, the data obtained during interviews, as well as from visual assessments of the environment, were analyzed within the ecoagriculture objectives. The three main objectives established by McNeely and Scherr (2001) were used as guidelines, namely: ensure profitable agricultural development, maintain or improve community's well-being, and ensure biodiversity conservation. A fourth objective concerns the existence of adequate institutions to support ecoagriculture initiatives. This objective, proposed by Buck et al. (2006) in the landscape monitoring and evaluation framework, was also considered. However, for the purpose of this article, only the results obtained for the first two objectives will be presented as the other objectives were less affected by the impacts of land grabbing in Soko Kembang. For each objective, several criteria were established, and they were measured during fieldwork with the help of several indicators. Most criteria were derived from those suggested by Buck et al. (2006), but they were modified and adapted to the study site. Criteria that were irrelevant for the study site were eliminated, some that were lacking were added, and others were rephrased to better depict the reality of Soko Kembang.

SOKO KEMBANG AND THE SURROUNDING LANDSCAPE

This section describes Soko Kembang hamlet and the different social and natural attributes that were observed in the surrounding landscape during fieldwork. Unless stated otherwise, all the descriptions that follow are based on the data acquired during fieldwork, either through interviews, visual assessments of the environment, statistics, or map

analysis. For a more detailed depiction of Petungkriyono landscapes, see Tanguay (2018).

Forest Categories and Governance

The subdistrict of Petungkriyono lies in a densely forested region, as mentioned above, and the landscape around Soko Kembang hamlet illustrates this fact perfectly. This landscape's forests surround all agricultural lands and infrastructure, and they are divided into two categories: limited production forests and production forests. Natural and semi-natural ecosystems constitute limited production forests. Forest preservation is locally believed to be one of the objectives of such a category, as Perhutani employees called *mandor,* in theory, visit these forests for surveillance and rehabilitation programs. But no such program has been undertaken in Petungkriyono since the late 1980s, and the conservation status of these forests is weaker in the country since the Perhutani is mainly concerned with the profitability of production forests, not the preservation of their natural attributes. Inhabitants of the subdistrict have been granted the right to access these limited production forests, but natural resources cannot be harvested nor used, once again theoretically. Production forests of the entire subdistrict account for around 2,000 hectares, and they are planted with pine trees managed by the Perhutani for the benefit of the state. Pine trees are cultivated for their resin and used in the making of many transformed products. Income obtained from the marketization of this resin is mainly beneficial for the state and the Perhutani, although local communities can benefit from this activity to some extent, as described below.

Until the end of the twentieth century, the Perhutani had full authority on the government's lands. But starting in 2002, and as a result of the regional autonomy promoted by the national government, a new program was established to allow a shared governance of forests between the Perhutani and local communities. This program, called *Pengelolaan Hutan Bersama Masyarakat* (PHBM, Forest Management in Collaboration with Communities), was a solution brought about by the government to resolve the numerous conflicts that had defined most relationships between the Perhutani and communities living around state-owned forests (Julmansyah 2007; McCarthy and Warren 2009; Maryudi 2011). The PHBM was based on ten founding principles (see LPF 2007) which all highlight the same fact. That is, the Perhutani was trying to be a collaborative, positive force for the population.

In January of 2004, a *Lembaga Masyarakat Desa Hutan* (LMDH, Community Institution for Forest Villages) was created in Petungkriyono by several members of seven villages, and in collaboration with the Perhutani. One LMDH head was elected in each village by LMDH members, with the head office for the subdistrict being established in Tlogo Pakis village. Up to this day, the LMDH's mandate is precisely to implement the PHBM program. The LMDH's role is to help and improve communication and understanding between local communities and the Perhutani. The organization also has the responsibility to protect the forest and monitor all activities related to it. However, even though the LMDH's head in Tlogo Pakis seems convinced that the organization, being a community institution, maintains good relationships with the people, most farmers interviewed do not agree. Most think that the main purpose of the LMDH is to ensure the management of plantation forests for the Perhutani, which significantly narrows the original objectives of the PHBM. Worse, local communal initiatives that prove economically profitable can be seized by the Perhutani through the LMDH, if that initiative happens to be on state-owned land. And whether the Perhutani manages to exert control over these initiatives or not seems to depend solely on the goodwill of the LMDH's local heads. These kinds of situation did not improve the relationships between communities, the LMDH, and the Perhutani. Fear and suspicion persisted between these different actors at the time of fieldwork, as was the case before the PHBM program was initiated.

These defective relationships left room for different situations that vary from one village to another. In Tlogo Pakis village, where the head office of the LMDH is located, the organization is rather active, and as a result, the inhabitants of this village feel less responsible towards the forest as they consider them LMDH's and the Perhutani's domain. On the contrary, in Kayu Puring village, where Soko Kembang hamlet is located, the LMDH is, in essence, idle. Some respondents were not even aware of its existence in their own village at the time of fieldwork. Therefore, Soko Kembang's inhabitants feel much closer to the forest, and much more responsible for its protection, stating that it is their duty to care for it. These are merely generalizations, but explaining these relationships in more detail would go beyond the scope of the present article. More details can be found concerning these relationships in Tanguay (2018). Based on the observations made in Petungkriyono, the Perhutani still seems to be the only authority able to influence state-

owned forests' management plans, except for the Ministry of Environment and Forestry. And the communities' influence on these forests is still very limited, even with the establishment of the PHBM program. Based on one key respondent, it would also be in the enterprise's power to convert limited production forests into production forests, at the risk of compromising the livelihoods of the people living in the area, as well as the remnant natural ecosystems within these forests.

Forest Use and Conservation

Officially, the only resource that local communities can extract from forests is pine resin. This labor is non-mandatory for the villagers, even though a certain pressure is put on the village's head to make sure that plantation work is promoted in the communities, for instance by presenting production targets. In the entire subdistrict, around 300 farmers are working in plantations to harvest pine resin. But this number is decreasing as the young prefer to seek employment elsewhere, judging that the remuneration for harvesting resin is too small. One gets IDR 3,500 given per kilogram of resin harvested.

Even though the use of other resources on state-owned lands is theoretically forbidden, a memorandum of understanding has been established between local communities and the Perhutani to guide and monitor the communities' activities in state-owned forests. It is thus possible for farmers to grow crops in these forests in exchange for IDR 10,000 per year and per parcel of land, with the size of these parcels being highly variable. Consequently, the payment given to the Perhutani changes depending on the farmers' honesty. It has been reported that some farmers may use many forest parcels but declare only one. The understanding between the Perhutani and communities also requires each entity to share profits with the other. The Perhutani must share 5 percent of the profits obtained from transformed resin with the harvesters and the LMDH. In exchange, farmers must hand over a significant part of the profits they gain from selling products that grow on government lands. It is not clear how much of this memorandum of understanding has been negotiated and how much has been forced upon the communities. What is certain is that it is not similarly implemented in all villages. In Tlogo Pakis village where the LMDH is strong, the share of profits is strictly applied as described above. But in Kayu Puring village, only the first payment of IDR 10,000 is demanded

by the local LMDH head. Therefore, in this latter village, many respondents considered that it was highly beneficial to grow crops in state-owned forests since the payment demanded is lower than property taxes.

Even with the existence of a memorandum of understanding, it remains forbidden to cut down trees in state-owned forests. And most respondents restrain themselves from doing so, but not necessarily because of existing regulations. They are in fact aware of the risks of landslides associated with forest clearing, a constant natural threat in the region. Notwithstanding, rumors of illegal logging persist in the subdistrict, although they are muffled by fear of retribution from the Perhutani. Illegal logging by the employees of the Perhutani themselves might also have occurred, but once more these rumors are hard to verify. Apart from logwood, *rumput gajah* (elephant grass) is harvested and used for fodder by all farmers who possess livestock. This grass grows in pine plantations and in limited production forests where it spreads naturally, although some care can be provided for transplanting sprouts to optimize yield.

Most farmers of Soko Kembang also grow other products in state forests, primarily coffee. Soko Kembang coffee grows in limited production forests where it can be either grafted or reproduced naturally. This represents the community's main source of income coming from either agricultural or agroforestry activities. The return on investment is quite significant since almost no investment is needed to start growing coffee, and no chemicals nor any other external inputs are used in these systems. Coffee beans are mostly harvested unripe and are brought to the regional market of Doro, either by farmers or by a middleman. However, this practice differs for a small group of farmers who learned to harvest ripe beans instead of unripe ones, and to sell them locally, a knowledge transfer gained from a local organization.

This group of farmers learned their new knowledge from a local Javanese gibbon conservation project, which will be called the Soko Kembang conservation project in this article. This project was instituted by a former hunter from the hamlet who worked with two anonymous Javanese researchers—both independent from the present study—in order to protect the surrounding forests, as these latter are home to the greatest metapopulation of gibbons in Central Java. Javanese gibbons live in the surrounding limited production forests where shade coffee is grown. Although the organization's authority is rather limited and cannot ensure the gibbons' preservation per se in the face of governmental

decisions, it promotes respectful agroforestry practices and informs the community about the natural environment in Soko Kembang hamlet as well as elsewhere in the subdistrict. Hence, in exchange for the protection of local gibbon populations ensured by the community, the two researchers associated with the project provided some capacity-building activities. They researched agroforestry practices and taught the former hunter and other farmers how to better benefit from their agroforestry production, notably by preserving the natural equilibrium of the forests and by selecting red coffee beans to sell at a higher price. The former hunter, who now considers himself a protector of the forest, has since opened a small coffee shop along the road, a *warung kopi*. There, he brews and sells his own coffee, as well as several other farmers' coffee, directly to local tourists to make better profit. Many farmers of Soko Kembang are now aware of the importance of protecting the primate populations around them, and several of them joined the former hunter to help and actively protect the biodiversity of local forests to enhance the quality of habitats for primates. The activities of the Soko Kembang conservation project are being further developed. At the time of fieldwork, its members were actively working at bringing awareness of the natural environment into schools, and at supporting other ecotourism initiatives, which were booming in the subdistrict of Petungkriyono.

Agriculture and the Rice Fields Grab

Apart from agroforestry activities, agricultural production is rather modest in Soko Kembang. No private agroforests nor significant vegetable fields are present around Soko Kembang. Only rice fields, locally known as *sawah*, are present. These are in the vicinity of the hamlet and of Welo River, and they are surrounded by limited production forests. This makes it almost impossible for any farmer of Soko Kembang, and of the subdistrict for that matter, to expand his production activities within the subdistrict itself. Indeed, all lands are already owned and used, either by other farmers or by the state. Very few farmers are landless, but for those in this situation, they are usually able to borrow some lands belonging to the village or to other farmers. However, no farmer seems to possess the land titles associated with their property, as these are too expensive to obtain.

Rice in Soko Kembang hamlet is mostly produced for self-consumption, as is the case in most of the subdistrict. Two rice crops are usually grown per year, with the help of irrigation systems that work

exclusively by gravity, through means of small dams, canals, and hoses. Most agricultural techniques were transmitted either as cultural heritage or through informal Javanese networks, which take many forms and allow farmers to share their experiences and knowledge. The workload is also slightly unbalanced in rice production systems as women tend to accomplish more tasks than men, while the workload is more fairly shared in agroforestry systems. Most seeds for rice production can be bought locally, but for the few who choose to grow their own vegetables, in home gardens for instance, seedlings must be bought in markets. Rice production requires significant amounts of fertilizers, both natural and chemical ones, as well as pesticides in order to grow successfully. It has thus a more negative impact on the natural environment when compared with shade coffee production systems. However, since *sawah* cover a relatively small area in the landscape, the environmental impact can only be assessed directly in the rice fields, as observed in soil visual assessments, while no impacts could be observed downstream of the fields in water visual assessments.

During fieldwork, rice fields in Soko Kembang were scarcely cultivated, which was due to a land grab that occurred in 2013. At that time, Soko Kembang's farmers had been pressured into selling their rice fields to the state electricity enterprise, *PT Perusahaan Listrik Negara* (PLN, State Electricity Company). And according to respondents, most farmers did so unwillingly. The PLN is planning to build a hydroelectric power plant near the hamlet and to install the necessary infrastructure in the actual rice fields, hence the grab. These fields were forcibly sold for IDR 65,000 per square meter, a much lower price than the market price which, in 2016, could go anywhere from IDR 90,000 per square meter to IDR 1 million per square meter in Pekalongan district (Mitula 2016). Even though some farmers sold their fields voluntarily for a quick monetary gain, which allowed some to invest in a new house or to buy other expensive goods, many felt forced to sell their lands because of social and governmental pressure. Indeed, according to one respondent, a local head informed farmers that they could either sell their lands willingly, or they could refuse to do so, but the PLN would build the power plant on their land regardless, and those who did not sell their lands initially would lose them without any compensation.

At the time of fieldwork, the power plant project was suspended because of territorial conflicts between the PLN and the Perhutani, as the PLN infrastructures would need to pass through the lands managed

by the Perhutani. Hence, Soko Kembang farmers can still cultivate their rice fields, although sooner or later they will have to stop, as many already did. Indeed, during the field research, many inhabitants of the hamlet were already buying rice in the regional markets instead of growing it as they felt that it was pointless to care for fields that they would eventually lose.

Other Activities and State Support

Other economic activities are becoming increasingly important in the subdistrict, as is the case in the rest of Java. Livestock, especially cattle, represents one of the recent and more lucrative activity for Petungkriyono farmers. Although it requires a substantial initial investment, it provides an important security net after a few years of care. Indeed, cattle heads are fed with free resources—elephant grass and agricultural by-products—and can be sold at high prices in case of need. However, although increasingly popular in the subdistrict, livestock is somewhat rarer in Soko Kembang hamlet and does not represent a security net as important as in other hamlets or villages.

The short distance between Soko Kembang hamlet and the district capital, Pekalongan, allows many men and youngsters to work in the city as construction laborers, notably in textile factories or in government offices. In fact, more often than not, these other occupations represent the main source of income for local households. Other opportunities exist in the subdistrict, for instance in schools, in health centers, in government offices, or in the ecotourism industry which is booming in the region. Many inhabitants can now benefit from this latter sector by either working in newly developed ecotourism projects, selling handicrafts, or opening small shops called *warung* near ecotourism sites. These *warung* offer food, coffee, or other goods to the public. Thus, pluriactivity is the norm for Soko Kembang households. And this pluriactivity, together with improving health care, adequate nutrition and education, and generally improved infrastructure in the subdistrict, is responsible for the people's wealth in the hamlet, as well as in the entire subdistrict. Indeed, based on a three-level wealth scale used by the national government, Petungkriyono households fall between the middle and high wealth levels.

The main state support system, which also contributes to the well-being of Soko Kembang inhabitants, comes from the *Program Nasional Pemberdayaan Masyarakat Mandiri Perdesaan* (PNPM, National Program for Community Empowerment), and from the forestry extension

service. To obtain such support, farmer organizations must be created to submit applications to these services. But farmer organizations are generally only formed for this sole purpose and are either dissolved or ignored by farmers afterwards. Help used to be provided in three ways through the PNPM: as microcredit, as support for health and education, and as infrastructure improvement, which was the most appreciated kind of support at the time. However, the change of government in 2014 also engendered a change in national support programs. Support previously for the PNPM program started focusing on the *Pengembangan Penghidupan Berkelanjutan* (P2B, sustainable livelihoods approach) program. This latter program provides support exclusively under the form of microcredit, savings assistance, and workshops for the poor. A notable issue with the microcredit program is that only farmers who are part of a borrowing organization have access to the provided credit, while the others do not. Thus, in the entire village of Kayu Puring, only 20 percent of all households have had access to such credit during the first half of 2015, and this percentage was even lower in other villages.

The forestry extension service is the local office established by the Ministry of Environment and Forestry. Support to the community is provided through the distribution of seedlings, demonstration fields, and workshops. Tree seedlings are rather commonly provided, notably for the acacia tree, as the state tries to promote agroforestry to increase the economic opportunities of rural communities. Seedlings can be provided to local heads or to farmer organizations, and, as opposed to microcredit, these are usually equally distributed among all farmers of a given hamlet. Demonstration fields, combined with workshops, are also quite commonly organized and allow farmers to learn about specific agroforestry production systems.

Support from the state also take several other forms which were less thoroughly researched but are worth a mention. Examples of such supports are: local health centers, *danah alokasi khusus,* which is a special kind of subsidy that can be accessed by village heads for specific development projects, or rice distribution through the Raskin program (World Bank 2012).

LANDSCAPE EVALUATION THROUGH THE ECOAGRICULTURE APPROACH

The description of Soko Kembang community and of the surrounding landscape, provided in the preceding section, as well as all the

TABLE 1. Satisfaction of indicators and criteria associated with the objective of ensuring profitable agricultural development

Criteria	Indicators	SK	S1	S2	S3
Agricultural production systems satisfy food security and nutrition requirements of producers and consumers in the region	Total per capita and per household production of different products	0	0	1	1
	Percent of production used for local subsistence, local markets, and outside markets	2	1	1	2
	Percent of income expended on food, fuel, and other needs	1	1	2	2
	Nutritional status	2	2	2	2
	Criterion mean	1.25	1	1.5	1.75
Agricultural production systems are financially viable and can dynamically respond to economic and demographic changes	Aggregate value of agricultural output	1	1	2	2
	Agricultural profits	2	1	1	2
	Returns to labor, capital, land, energy, water, germplasm, nutritional amendments, and pest and disease control inputs	2	1	1	2
	Security of market linkages for products and services	2	2	2	2
	Criterion mean	1.75	1.25	1.5	2

corresponding data thereby summarized, are used in this section for a landscape analysis within the ecoagriculture framework. Data is thus classified here within the two ecoagriculture objectives relevant for this article: ensuring profitable agricultural development (agriculture objective); and maintaining or increasing the community's well-being

TABLE 1. (*continued*)

Criteria	Indicators	SK	S1	S2	S3
Agricultural production systems are resilient to natural and anthropogenic disturbances	Percent of production inputs that are locally derived	2	2	1	1
	Introduction of alternative agricultural techniques	2	1	1	2
	Introduction of integrated pest management	2	1	1	2
	Diversity of agricultural products at farm, community, and landscape scales	1	1	1	1
	Diversity and origin of agricultural products sold in the region	1	1	2	2
	Soil health	2	2	2	2
	Animal/crop health and disease	2	2	1	1
	Criterion mean	1.71	1.43	1.29	1.57
Agrobiodiversity is optimally managed for current and future use	Conservation status of land races and crop wild relatives	1	1	1	1
	Diversity of varieties, land races, cultivars used on the farm	0	0	0	0
	Abundance of parasites, pests, and pathogens that diminish agricultural productivity	2	2	1	1
	Criterion mean	1	1	0.67	0.67
Objective mean		1.43	1.17	1.24	1.5
Objective verdict		P	P	P	G

TABLE 2. Satisfaction of indicators and criteria associated with the objective of maintaining or increasing community well-being

Criteria	Indicators	SK	S1	S2	S3
Households and communities are able to meet their basic needs while sustaining natural resources	Nutritional status	2	2	2	2
	Availability and quality of housing	2	2	1	1
	Portion of households living in poverty	2	2	2	2
	Presence of social safety nets	1	1	1	1
	Proportion of income spent on food, fuel, and other needs	1	1	2	2
	Diversity of income sources within communities	1	1	1	1
	Viability of non-agricultural economic activity	1	1	1	1
	Profitability of production activity	2	1	1	2
	Criterion mean	1.5	1.38	1.38	1.5

(livelihoods objective). Based on the acquired data, all indicators included within the framework were given a score of 0, 1, or 2, indicating respectively negative data, mixed data, and positive data for the objectives' satisfaction. Means were calculated for each criterion, and then for each of the two objectives presented here, illustrating their satisfaction level in the landscape. Hence, the objectives were considered either unsatisfied (U) if means were under 0.5, lightly satisfied (L) if means were between 0.5 and 0.99 inclusively, partially satisfied (P) if means were between 1 and 1.49, or greatly satisfied (G) if means were equal to or above 1.5.

TABLE 2. (*continued*)

Criteria	Indicators	SK	S1	S2	S3
The value of household and community assets increases	Level of public infrastructure	1	1	1	1
	Level of social services	1	1	1	1
	Returns to labor, capital, land, energy, water, germplasm, nutritional amendments, and pest and disease control inputs	2	1	1	2
	Education levels of respondents and officers	2	2	2	2
	Level of social capital	2	2	2	2
	Extent of private forests, grasslands, and economically valuable plants	0	0	1	1
	Land value	0	0	1	1
	Criterion mean	1.14	1	1.29	1.43
Households and communities have sustainable and equitable access to critical natural resource stocks and flows	Extent and strength of access rights to different economic and cultural groups	1	1	1	1
	Access to fields, forests, and wild products	1	1	2	2
	Fair chore distribution within households	2	2	1	1
	Access to agricultural inputs	2	2	2	2
	Access to water	2	2	2	2
	Criterion mean	1.6	1.6	1.6	1.6

The same exercise is also realized with three different hypothetical scenarios. These scenarios evaluate the same objectives for the same landscape, but by looking at the results if: (1) the Soko Kembang

TABLE 2. (*continued*)

Criteria	Indicators	SK	S1	S2	S3
Local economies and livelihoods are resilient to external perturbations and to changes in human and non-human population dynamics	Degree of household income diversification	2	2	2	2
	Degree of community economic diversification	1	1	1	1
	Land use plans and regulations	1	1	1	1
	Level of social capital	2	2	2	2
	Presence of social safety nets	1	1	1	1
	Criterion mean	1.4	1.4	1.4	1.4
Objective mean		1.41	1.35	1.42	1.48
Objective verdict		P	P	P	P

conservation project had not been instituted (S1), (2) the Soko Kembang conservation project had not been instituted but rice fields had not been grabbed and farmers were still able to cultivate their own rice (S2), and (3), rice fields had not been grabbed and the conservation project had been instituted (S3). Tables 1 and 2 present the result for the landscape of Soko Kembang as observed during fieldwork (SK) as well as for these three scenarios.

Discussion

Results presented within the ecoagriculture framework in the preceding section show that both the agriculture and the livelihoods objectives were partially satisfied in the landscape surrounding Soko Kembang. Many different landscape attributes contribute to this partial satisfaction, as described above, namely pluriactivity, traditional social capital, state support, shade coffee production, biodiversity conservation through a local organization, quality of infrastructure, and proximity of the provincial capital. Moreover, as noted by one of the key respondents, shade coffee production and the local conservation organization could

provide even further benefits to the community if more farmers were inclined to engage in the new associated economic activities, such as the production of higher quality coffee and ecotourism opportunities. Nonetheless, these activities still represent a significant benefit for the community. And overall, all these attributes contribute to the high dynamism of the community and to the associated high resilience of the landscape.

Several factors also prevent the landscape from reaching a greatly satisfactory status within these two objectives. Rice fields, which were forcedly sold to the PLN, were the only fields available for the community. And even though some respondents enjoyed the sudden monetary gain, food sovereignty has decreased in the hamlet since then. Farmers had to start buying rice instead of growing their own because they have no more fields to do so and cannot clear new ones as they are surrounded by state forests. Thus, the loss of rice fields led to a notable decrease in agricultural production and in the community's well-being. This is in line with the literature which, as seen above, reports decreases in food sovereignty as one of the major impacts of land grabbing for rural communities (Daniel and Mittal 2009; Shete and Rutten 2015; Marks et al. 2015; Friis and Nielsen 2016). Other factors that negatively impacted the satisfaction of the ecoagriculture objectives are the small diversity of agricultural or agroforestry products, the more feeble security nets when compared to other hamlets, as well as the instability of the state support system and of several economic institutions and activities. The institutional capacity surrounding the landscape was in fact the most significant weakness reported within the greater research project on which this article is based (Tanguay 2018). This underlines the importance of including governance systems within a landscape analysis, as argued by Buck et al. (2006).

The three scenarios proposed above show a slightly different picture for the studied landscape. Within both objectives, the satisfaction level would have been lower if the Soko Kembang conservation project was absent from the community (S1), while it would have been better off if rice fields had not been grabbed (S3). Indeed, on one hand, the presence of the conservation project allows for an improved productivity within production systems as a whole, a more profitable use of products, a better return on investment as a result of the shade coffee production and of improved coffee price, as well as more environmentally respectful production systems. On the other hand, the rice fields grab led to smaller diversity of production,

dependency on the market and hence more money spent for sustenance, and smaller land value per household. However, the decrease in rice production also led to less diseases in the production systems and a smaller need for chemical inputs, which are both beneficial for the satisfaction of the present objectives. If rice fields had not been grabbed, the agriculture objective in the landscape of Soko Kembang would still have been better off and considered greatly satisfied.

S2 shows how the landscape would have been analyzed if the Soko Kembang conservation project and the associated systems had not been adopted in the community, but if the rice fields had not been grabbed either. This scenario is of special interest because, when compared to the actual state of the landscape, it shows how the impact of rice fields on agriculture and livelihoods compares to the impacts of the Soko Kembang conservation project. Interestingly, the agriculture objective is better satisfied when only the conservation project is present, with a satisfaction level of 1.43, compared to a scenario where it is absent but rice fields have not been grabbed, which shows a satisfaction level of 1.24. This is mainly due to better marketization of shade coffee cultivated in the forests where gibbon populations thrive, to less diseases associated with these agroforestry systems, and to more environmentally respectful techniques. As for the livelihoods objective, the decrease in food sovereignty and in access to land is compensated by an increase in profitability of the production and in production systems, and techniques less harmful to the farmers' health. Thus, the actual state of the forest (SK in tables 1 and 2) and S2 come very close in terms of satisfaction for the livelihood objective, with 1.41 and 1.42 respectively. This shows that, for both objectives, the Soko Kembang conservation project can compensate or even improve on the drawbacks brought about by the rice fields grab. However, it is noteworthy to mention that conservation activities are not, by themselves, responsible for this compensation. Rather, the beneficial factors come from: the associated production systems resulting from traditional agroforestry systems improved and promoted by the Soko Kembang conservation project, the complex socio-ecological dynamics within the landscape, and education of the community through the expanding activities of the conservation project.

Differences in the satisfaction level of the objectives between the real state of the landscape and the different scenarios are rather small, but they are meaningful nonetheless. These small differences can be attributed to the complexity of the landscape as observed through a

landscape approach. As mentioned above, many different attributes contribute to the satisfaction of these objectives, thus the community of Soko Kembang have many ways of satisfying their social and agricultural needs. In a different context, for instance in a community more dependent on its production systems, differences in agricultural production and in the well-being of the community brought about by the recent land grab, as well as by the presence or absence of the conservation organization, could have been much greater. This illustrates once again how important dynamic resilience is for rural communities, and how a complex socio-ecological system can help sustain basic functions in the face of disturbances, as described by Young (2010) and Messerli et al. (2013).

This latter assessment also shows the strengths of a landscape approach for socio-ecological research. Indeed, a more focused research could have led to other conclusions and have analyzed the situation to be more critical than it really is. For instance, an approach based on agroecology, as novel as the concept is, would have focused solely on the dynamics within agricultural parcels (Altieri 2002), while providing little to no analysis of the surrounding socioeconomic context and of the community's mitigation strategies. On the other hand, an approach based solely on socioeconomic analysis of the households might have omitted the benefits brought about by the surrounding landscape. But here, a landscape approach allowed us to have a more appropriate perspective on the situation by highlighting the many different dynamics that influence diverse aspects of the system, and to understand that the recent land grab did not represent, after all, a catastrophic event for Soko Kembang households. This approach also allowed us to understand how focusing efforts on the preservation of the natural integrity of forests that surround Soko Kembang hamlet led to beneficial interactions, which provided benefits to both the community and their production activities. Finally, this shows how a well-balanced socio-ecological landscape can indeed improve the dynamic resilience of communities and landscapes in the face of social disturbances, as rightfully argued by McNeely and Scherr (2001), and Buck et al. (2006).

Conclusion

This article presented the landscape located around the hamlet of Soko Kembang as a highly dynamic socio-ecological system. The many

dynamics that define this landscape and the local community were reviewed, with a focus on the impacts of a recent land grab that occurred in Soko Kembang where farmers were forced to sell their rice fields to the state electricity enterprise. The article highlighted the importance of agroforestry systems around the hamlet, of their preservation by a local conservation organization as well as their contribution to the well-being of the community. Using a modified version of the landscape monitoring and evaluation framework, as proposed within the ecoagriculture approach, the article showed that the negative impacts brought about by the loss of rice fields, in terms of agricultural production and livelihoods, were compensated by the creation of a local conservation organization. The latter was shown to work on the preservation of local Javanese gibbon populations by encouraging the preservation and good governance of agroforestry production systems where these primates thrive.

The case presented here is very specific to a small area within the subdistrict of Petungkriyono, and even though similar dynamics might exist elsewhere in the subdistrict, in the province or on the island, generalizations cannot be made easily. However, what this case does show is that production systems associated with certain conservation practices, and particularly in socio-ecological systems, can provide significant benefits to local communities and increase their resilience to environmental or social disturbances, as observed in Soko Kembang community which was subject to a recent land grab. Since these benefits are not directly derived from conservation practices but rather from associated production systems, similar benefits can probably be observed within other alternative agricultural systems, whether they exist for conservation purposes or other purposes. Marketable products, as well as products that come from integrated systems, less dependent on external inputs and which are better integrated with natural cycles, can assuredly enhance rural communities' livelihoods and agricultural profitability. Just as well-balanced, complex socio-ecological systems can help improve the resilience of the system's attributes in the face of disturbances. ❁

Acknowledgement

This article is derived from the author's thesis for which many thanks are in order. I would like to thank Stéphane Bernard and Yann Roche, professors of geography at the University of Quebec in Montreal

(UQAM), Jean-François Bissonnette, assistant professor at the University Laval, Rodolphe De Koninck, professor emeritus of geography at the University of Montreal, and Dominique Caouette, professor of political science at the University of Montreal, for their help, inputs, and insights during this research. I would also like to thank colleagues from the Faculty of Cultural Sciences at the Universitas Gadjah Mada, notably the dean of the faculty, Pujo Semedi, for sharing his resources with our research team in Yogyakarta, and Inda Marlina, whose assistance in the field was crucial for the success of this research. Finally, I would like to thank the funding sources which made this research possible: the Fond de Recherche du Quebec – Société et Culture [grant number B2], the Canada Chair of Asian Research, the UQAM Faculty of Sciences, and the UQAM Centre interdisciplinaire de recherche en développement international et société.

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