

Identifying the characteristic of *SundaParahiyan* landscape for a model of sustainable agricultural landscape

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Abstract. This study was an explorative study of the various forms of traditional ecological knowledge (TEK) of Sundanese people in the context of sustainable agriculture. The qualitative method was used to identify *SundaParahiyan* landscape by using Rapid Participatory Rural Appraisal through semi-structured interviews, focus group discussions, and field survey. The Landscape Characteristic Assessment and Community Sustainability Assessment were used to analyze the characteristic of landscape to achieve the sustainable agricultural landscape criteria proposed by US Department of Agriculture. The results revealed that the *SundaParahiyan* agricultural landscape has a unique characteristic as a result of the long-term adaptation of agricultural society to their landscape through a learning process for generations. In general, this character was reflected in the typical of Sundanese's agroecosystems such as forest garden, mixed garden, paddy field, and home garden. In addition, concept of *kabuyutan* is one of the TEKs related to understanding and utilization of landscape has been adapted on revitalizing the role of landscape surrounding the agroecosystem as the buffer zone by calculating and designating protected areas. To support the sustainability of production area, integrated practices of agroforestry with low-external-input and sustainable agriculture (LEISA) system can be applied in utilizing and managing agricultural resources.

1. Introduction

The issue of sustainable development in agriculture requires a change in direction, systems, strategies, and policies to establish agriculture highly competitive, productive, profitable, environmentally friendly, as well as improving health, food quality and safety in the present and future. Thus, agricultural development should be able to conserve soil, water, maintain biodiversity, eco-friendly, technically appropriate, economically viable, and socially and culturally acceptable [1]. As an agriculture-based development country, Indonesia has a strong linkage with sustainable agricultural development. This is proved by the condition of most Indonesian people (35% of Indonesia's total population) are dependent on agriculture and the majority are living in rural areas [2].

Agricultural society in the *SundaParahiyan* region is an integral part of the agricultural landscape who utilize natural resources and the environment into various forms of agroecosystems [3][4]. This integrated system is formed by the union of ecological systems, socio-economic and spiritual-cultural society. Aside from being a source of life, with their wisdom, the agricultural society



plays an important role in managing natural resources and the environment [5]. Thus, the local wisdom that reflected in the traditional ecological knowledge (TEK) can be a trigger in achieving the sustainable agriculture development in rural areas, respectively. The existence of TEK of Sundanese people is expected to filter the negative effects as well as to improve the positive effects of modernization for both socio-cultural life of the community and their environment. Accordance with the important of TEK [6][7][8], the purposes of this study was to (1) identify the characteristics of the *SundaParahiyangan* agricultural landscape along with a variety of manifestation of TEK of *SundaParahiyangan* society in the context of sustainable agricultural landscape, and further to (2) develop a model of sustainable agriculture landscape management.

2. Methodology

2.1. Study site

This study was conducted in Ciomas Village, Panjalu District, Ciamis Regency, West Java Province, Indonesia (latitude 07°07'00" to 07°12'00" S, longitude 108°15'00" to 108°19'00" E). The study sites were determined based on etymology of *SundaParahiyangan* which defined as the mountainous area with the elevation ≥ 600 m above sea level (hereafter: m asl) [9][10]. The area of this village is about 1350 ha where located between 512 and 1762 m asl with the average daily temperature is about 25 °C, humidity is 80%, the average annual precipitation is about 2000 mm, and the rainy season lasting almost all year long except June, July, and August. The dominant of landscape (36.6%) is used for production forest that managed mainly by resident. Forest upland has 31.7% in total area that used for conservation forest designated by national law as a game reserve of Sawal Mountain as well as for production forest that managed by Indonesian Forest Enterprises (*PerumPerhutani*).

2.2. Data collection and analysis

Rapid Participatory Rural Appraisal (rPRA) method through semi-structured interview, focus group discussion, and field survey was conducted during 2012-2014 to identify the characteristic of *SundaParahiyangan* landscape and its society by using TEK's approach [6][8][11][12]. Representative respondents were selected through purposive sampling such as community leader, spiritual leader, local administrative government, and professional in agricultural activity. A set of question related to sustainable agricultural landscape management was conducted in relevant to Landscape Characteristic Assessment (LCA) [13] and Community Sustainability Assessment (CSA) [14] to describe the characteristic of Sunda Parahiyangan both landscape and its society. Sustainability analysis was conducted by combining LCA and CSA method which focussed on three main factors (ecology, social-economy, and spiritual-culture) to achieve the USDA's sustainability criteria [15].

3. Results and Discussion

3.1. Characteristic of *SundaParahiyangan* landscape

As part of *SundaParahiyangan* mountainous landscape, Ciomas Village has typical agroecosystems that reflect the Sundanese philosophy of life in interacting with nature. *SundaParahiyangan* landscape was generally used for several types of agricultural activity. This condition was fully supported by the physical environment factors which are ideal for farming such as domination of latosol soil type with sloping degree from flat to very steep, the average of daily temperature about 25 °C, the average of relative humidity of 80%, and an abundant of water resource through the average annual rainfall of 2,000 mm. Those factors contribute to the optimal development for various types of agroecosystem as well as providing habitat for a variety of vegetation and wildlife in accordance with the physical environment [16]. The agroecosystem formed in the study area consists of forest garden (*kebun-talun*), mixed garden (*kebuncampuran*), paddy field (*sawah*), and home garden (*pekarangan*), while shifting cultivation system (*huma*) has been discontinued (Figure 1).



Figure 1. Landscape structure of agroecosystems in Ciomas Village: (a) forest garden/*kebun-talun*, (b) mixed garden/*kebun campuran*, (c) paddy field/*sawah*, and (d) home garden/*pekarangan*

This study revealed that these agroecosystems have been formed through a mutual interaction and deep understanding between human and their landscape. Agroecosystem formation begun with the opening of forest areas into agricultural areas in general. The main factor that influence the type of agroecosystem was the availability of water resources. Land that was not supported by the availability of abundant water resources, functioned as a dry land farming system (*kebun-talun* or *kebuncampuran*). While the water resources available, land was cleared and watered to be functioned as a wetland farming systems (*sawah*). The next development was influenced by people's demand for a permanent residence. People used their land in each agroecosystem to build a permanent house at the time of fallow land. The remaining land after optimized for buildings was used for agriculture called *pekarangan* (Figure 2). In general, the utilization of land resources to be various types of agroecosystem was more adapted to the physical condition of the land as well as the perceptions and preferences of local people. An example, mixed garden was dominant (26.5%) in this village due to local people's preference to utilize their land efficiently by planting various type of plant species [3].

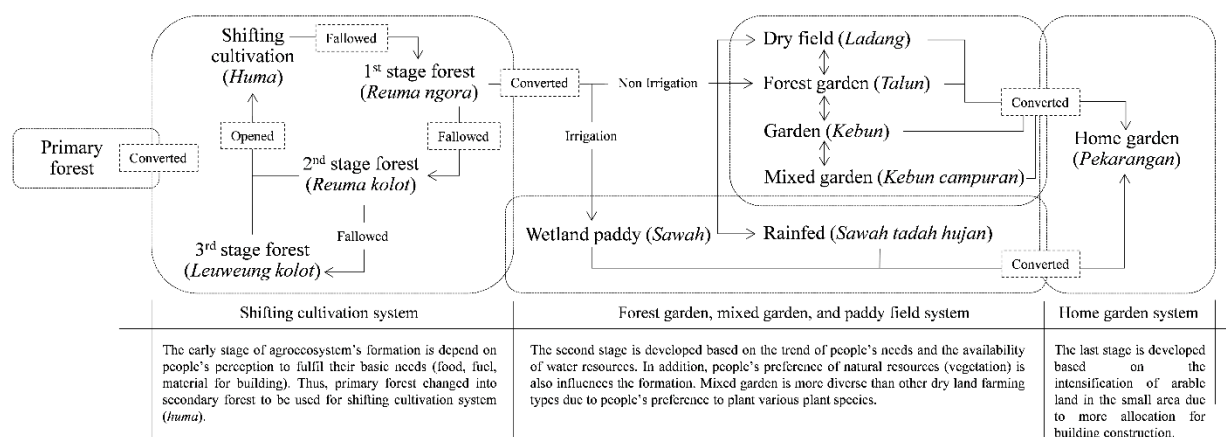


Figure 2. Development of agroecosystem in *SundaParahiyangan* landscape

3.2. *Agricultural society in SundaParahiyangan landscape*

Socio-economic system of agriculture was expressed in the productive and reproductive activities. These activities constitute agricultural resource extraction activities to be used as a source of life. Productive activities carried out on farm, while reproductive activities conducted outside the land for agricultural resource utilization more feasible (off farm). Dominant land use as agricultural areas have not been able to provide optimal results despite a core source of income farm families. High production costs, lack of support for agricultural science and technology, as well as the lack of effective government's role in supporting the agricultural production have affected the low agriculture's role in improving farmer's life. Moreover, this study found that the ownership of arable land is relatively narrow with an average of 0.3 ha/farmer. This indicates the lack of power for farmers to support their basic needs, while the availability of land is important. A significant development strategy need to be implemented to empower the ability and capability of farmers as the key person in utilizing and managing agricultural landscape and its resources such as by implementing land reconsolidation or intensifying land [3][4][17].

Traditional ecological knowledge (TEK) related to agriculture in the spiritual-cultural system was expressed by the term of the local customs, activities, and cultural objects of agriculture [6][7]. The concept of *kabuyutan* is one of the TEKs that implemented in the management of agroecosystems for generations. *Kabuyutan* was believed to be a model of managing agricultural landscapes to provide benefits in the sustainable condition. *Kabuyutan* concerned to protect the main elements in the landscape to protect a whole landscape. For example, the existence of spring water is an important element in the landscape that should be protected to ensure the availability of water resources. In term of vital element, the protection should be considered as a whole part of area, both its core, buffer, as well as its development zone. Therefore, the concept of *kabuyutan* is proposed to consider the elements of landscape as an integrated system that link each other.

The term of *kabuyutan* is not widely known by local people, but the existence is remaining in their knowledge. People reported that to implement this concept, three development steps should be taken into consideration (setting places, times, and actions). To set the place, the knowledge about the landscape should be mainly focussed on ecological aspect such as the ecological boundary (watershed) is prefer to be used rather than administrative boundary. In case of Ciomas Village, village area located in the area of Cidarma Watershed that connected to Citanduy River as a main watershed. Then, the main spring water in the landscape should be prioritized to protect both its existence and surrounding environment. Considering the location of this spring, the prohibited area (*leuweunglarangan*) and conserved area (*leuweungtutupan*) would be designated. These two types of protected area are distributed in every land types that considered to be protected such as springs, riverbanks, lakes, valleys, hills, steep slope, and even very gentle slope that located in settlement area (Figure 3).

The existence of *kabuyutan* was shown by the existence of some protected areas that culturally perceived as sacred places. These sacred places varied in size and have protected for generations due to the customary rules (*taboo*). People perceived that applying taboo is the appropriate cultural strategy to protect something, especially in order to prevent a destruction of place. They reported that *kabuyutan* (sacred places also named as *kabuyutan* by local people) provides many benefits such as water resources, especially for *kabuyutan* where located close to settlement or agricultural land area. Accordingly, implementation of this concept in broader scale is suggested to ensure the hydrological system that will influence the whole ecosystem. Further, the potential of the community who will be enhanced to be more productive community with full of fairness and wisdom rather than exploitative consumers. Fairness means utilization based on carrying capacity of landscape, while wisdom means utilization by considering the use for future generations. After designating the place for protection function both prohibited (core zone) and conserved (buffer zone) as well as for limited production (development zone), a development time as well as some actions to be implemented for improvement as well as for recovery were set. People reported that setting of time and actions depend on the

condition of landscape especially the degree of damages that occurred within the landscape. More damages need more time to recovery and more detail actions to be conducted [17][19].

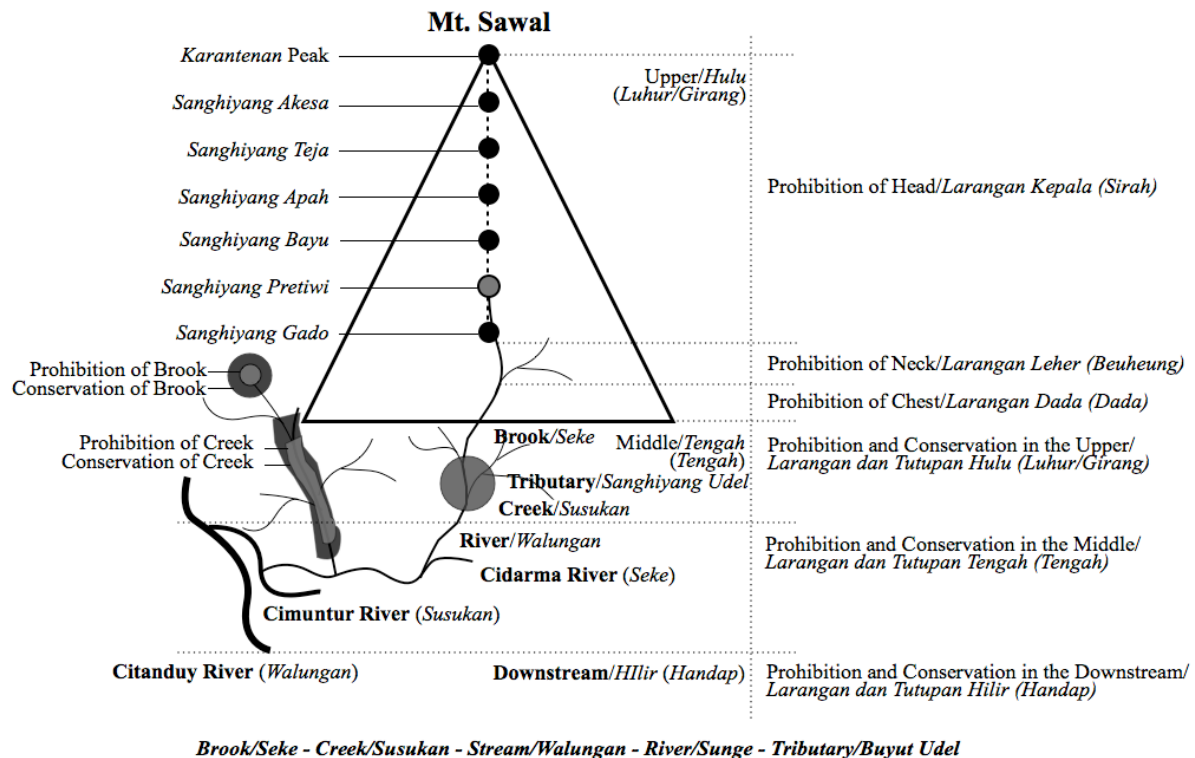


Figure 3. The concept of *kabuyutan* and its implementation in a landscape

3.3. Landscape sustainability analysis

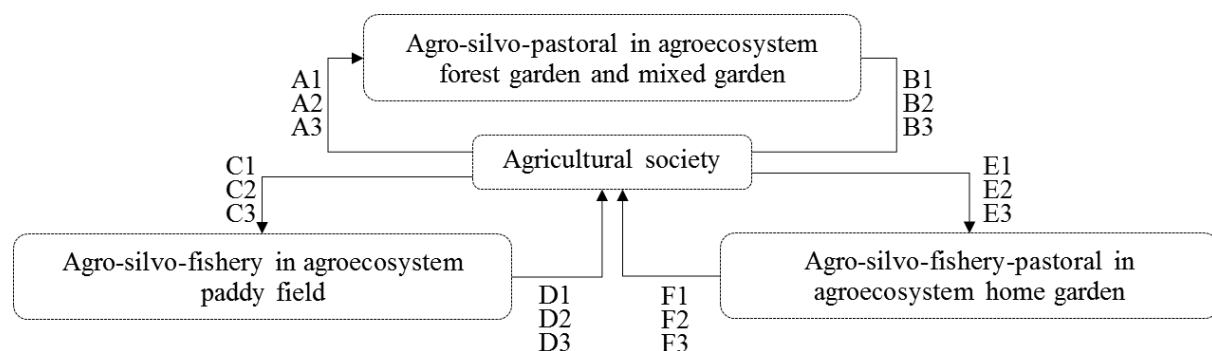
Landscape Characteristic Assessment (LCA) method was used to identify the characteristic of *SundaParahiyangan* landscape. This method focused on exploration of main factors that influence the development of a landscape. Results indicated that *SundaParahiyangan* landscape is more likely a mountainous agricultural landscape due to three physical environment aspects (elevation, soil, and climate) that assumed have great influence to develop its characteristic. Ecologically, the existence of Mount Sawal provides sufficient amount of water resources, fertile soil, as well as various type of plant and animal species. Culturally, natural resources have been used for long time period wisely in accordance with local people's TEK. They proposed a traditional concept of *kabuyutan* that focused on how managing landscape and its resources wisely.

According to the analysis of the LCA criteria, Ciomas Village has a potential become a sustainable landscape to support agroecosystems. The condition of the abundant agricultural resources provides an opportunity for farmers to use agricultural resources for present and future needs. In addition, the availability of agricultural resources to provide a decent quality of farmer's life with the availability of jobs for productive and reproductive activities, as well as the availability of food with high quality, adequate nutrition, accessible, and affordable price [1][16]. Optimal conditions can be achieved by maintaining the quality and quantity of water and land resources as the main elements of the *SundaParahiyangan* agricultural landscape.

Further, based on the analysis of the sustainability of the Community Sustainability Assessment (CSA) method, *SundaParahiyangan* society indicates the level of infallible progress toward sustainability with a total value of 1184 (ecological aspect of 300, social aspect of 405, and spiritual aspect of 479). However, the improvement efforts in some aspects with value less than 50 is necessary to achieve the optimal sustainability aspects such as enhancement of local people's sense of belonging

to their place, and provision of infrastructure (land) for supporting agricultural activity. According to USDA's sustainability criteria, result showed that the condition in Ciomas Village both landscape and their people has a potential towards sustainable. The landscape can provide sufficient amount of food, fuel, fiber, and building material, while the society can improve their landscape through their valuable TEK. Furthermore, those benefits can preserve the existence of agricultural economic that will improve the welfare of agricultural society in particular [17].

The concept of managing *SundaParahiyangan* agricultural landscapes applied by combining both traditional and modern model. TEK is the main capital that enhanced by modern science in order to respond to the ecological landscape dynamics [6][8][11]. The integration can be applied through the implementation of an integrated concept of *kabuyutan* with agroforestry farming systems in each agroecosystem by optimizing intake and efficiency of the input from the outside (low-external-input and sustainable agriculture/LEISA) (Figure 4) [20]. In addition, external influences such as the initiation of the rural development programs from government or private organization need to be applied by an active involvement of local people. Empowerment is proposed to strengthen cultural-spiritual society that can increase their productivity and work ethic, further welfare of agricultural society will be realized.



1. Sustainability of socio-ecological function: planting conservational plant species for water and land conservation as well as for biodiversity (A1, C1, E1); providing environmental services such as gen bank, fresh air and water, and fertile soil (B1, D1, F1)
2. Sustainability of socio-economic function: planting annual plant combined with perennial plant and middle husbandry (A2); planting local species of paddy combined with perennial plant and small fishery (C2); planting plant with various uses and function combined with small husbandry and fishery (E2); providing resources for basic people's need as well as economic benefits (B2, C2, E2)
3. Sustainability of spiritual-cultural function: planting local plant species based on TEK (A3, C3, E3); providing a place for appreciating their local spiritual-culture.

Figure 4. Concept of sustainable agricultural landscape management

4. Conclusion

This study revealed that the characteristic of *Sunda Parahiyangan* landscape is a mountainous agricultural landscape with water as the major landscape elements. This characteristic has been actualized in the various form of Sundanese agroecosystems, mainly forest garden (*kebun-talun*), mixed garden (*kebun campuran*), paddy field (*sawah*), and home garden (*pekarangan*) as a manifestation of local people's traditional ecological knowledge (TEK). The concept of *kabuyutan* as one of TEKs that focussed on revitalizing the hydrological system is strongly suggested to be implemented in a broader scale. This concept is important to protect particular areas by designating as the sacred places that culturally perceived to be preserved (through application of a customary rule, named as *pamali*). We concluded that the availability of agricultural land with fully supported by the existence of *kabuyutan* is essential to realize the sustainable agricultural landscape. We proposed an integrated farming system through optimally implementation of agroforestry combined with the LEISA system, as well as fully support from government or private organization through attractive and participative rural development programs to achieve a sustainable physical agricultural landscape with the strong society in term of socio-economic and cultural-spiritual aspect.

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