

Place Theory for Studying Biodiversity of Kandyan Home Gardens in Sri Lanka

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Abstract- Kandyan Home Gardens (KHG) of Sri Lanka are economically efficient, socio-culturally and politically embedded, ecologically sustainable unique places, which managed by dwellers based on the knowledge that transmits over generations, and experience gained by living in the society. The main objective of the study was to identify the mechanism behind it, especially biodiversity. To achieve the objective seven traditional villages of Kandy district of Sri Lanka were studied for 5 years. The main finding of the study is that biodiversity of KHGs is a part of place process of the study area. Hence, to identify the biodiversity and biodiversity conservation role of KHGs place process of the place has to be understood. Location determines the basic biophysical characteristics of the home gardens (HG). Social structures define the ethno-botanical values of plant species and create the demand for that resource. Then, based on ethno-botanical values of plant species, people change the place and its biodiversity as a place that produces essential resources for reproduction of social structures. In this sense, biodiversity of KHGs is a result of place process. On the other hand, HGs ensure the reproduction social structures by continues supply of resources to perform the institutional projects. It leads to the societal security and the stability (both in family and community). Such a feeling of structures motivates dwellers to maintain vast numbers of plant species in their HG.

Index Terms- Biodiversity, *Kandyan* home garden, Place theory, Social structuration

I. INTRODUCTION

In Sri Lanka, there are about 1.42 million HGs (DCS, 2002) approximately 14.3% of land area (except Northern Province) of the country was under HGs in 2002 (Ariyadasa, 2002).

Because its multi-functionality, such as socio-economic cultural and biophysical environmental conservation functions, many researchers have paid their attention to studying the function of KHGs based on their point of view or approach. Several distinct approaches to studying HGs are evident in the literature. Some of these approaches are conceptually distinct while others have considerable overlap with each other and having strength as well as weaknesses. These approaches can be categorized into three groups; ecological, economic, and cultural.

In ecological approach mainly focuses on studying the environmental and ecological dimension, such as similarities of HGs and natural forests in respect of productivity, stability, sustainability, and anatomy but 'overlooking the central

importance of 'home' in its management' (Wickramasinghe, 1995). Economic approaches focus on studying the contribution of composition and structure of HGs to the economy. Therefore, some researchers have defined HGs as food production system (Hoogerbrugge and Fresco, 1993), agro-ecosystem (Soemarwoto, 1985), an agroforestry system (Fernandes, et.al., 1986). However, this economic approach under-conceptualized dwellers and locale community as atomistic individuals and commodities. It leads to neglect the cultural, political, historical and spatial dimensions of HGs. The cultural approaches focus on studying the socio-cultural, economic and historical dimensions of HG but overlooking the spatial dimension of HGs. HGs are not solely a result of biophysical environment or/and socio-cultural, economic and political behavior of dwellers but also a cause for spatial variation. Therefore, HG studying approaches should involve holistic, integrated and interdisciplinary approaches to understanding the HGs' holistic scenario and its biodiversity conservation role. Hence, the study was based on place theory that has the ability to fulfill the above basic requirements.

According to the place theory, the place is a process of interwoven three elements, location, locale and sense of place of the place (Figure 1). The settings in which social relations are constituted are called locale; location, the geographical area encompassing the settings for social interactions as defined by social and economic processes operating at a wider scale; and sense of place, the locale structure of feeling" (Agnew, 1987:28p). Moreover, feelings of quality/ security of life at a particular place and time are called the sense of place (Pred, 1983, cited in Agnew, 1987).



Source: Adopted from Agnew, (1987)

Figure1: Place Conceptualization According to the Place Theory

II. METHODOLOGY

In the study, data and information gathered to explain the interconnectivity of KHGs and its biodiversity to the place process of traditional seven villages of Patadumbara Divisional Secretariat Devotion (DSD), Kandy District of Sri Lanka. Those villages are *Millanga, Moonamalaya, Bogahakumbura, Aluthgama, Doragamuwa, Udurawana* and *Yatawara*. Data and information related to biophysical characteristics, demographic, socio-economic, cultural, and political characteristics, and HGs' biodiversity, structure, function and sense of HGs was gathered from secondary sources as well as primary sources. Sample household's survey method was used as the main primary data collecting method and 244 households (10 percent of total households in the study area) were used as the sample. In addition to that, 42 key informants' interviews and seven community discussions were done for collecting primary data. The research was done from 2008 to 2012.

III. RESULTS AND DISCUSSION

A. Location Aspect of the Study Area:

Geographically, the village mosaic is located at latitudes $7^{\circ} 20' 44.50'' - 7^{\circ} 22' 42.83''$ N and Longitudes $80^{\circ} 37' 49.62'' - 80^{\circ} 40' 26.00''$ E. The general climatic backdrop of the island is directly affecting to the climatic condition of the area. Climatologically the study area is located in the intermediate climate zone of the country. Average annual rainfall is about 1804 mm and rainfall variation is about 202mm. During the south-west monsoonal period, the area experiences relatively dry climatic condition as the dry zone of the country. During the period, the area receives 33% of the total annual rainfall. During the October to November period, the area experiences heavy rainfall (30% of total annual rainfall). Mean annual temperature is about 25.1°C and average relative humidity varies from 75% during the day to 88% in the night.

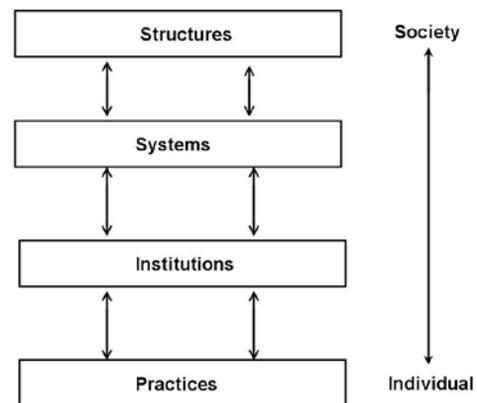
Geomorphologically, the area is located in the highland complex and the area is made up of Precambrian crystalline rocks (Dahanayake, et.al., 1985). Altitude of the study area varies from 400-500 meters from the mean sea level. Most part of the area has 0-10 degree slopes. Yatawara permanent stream and Badaganalla and Palletalavinna seasonal streams are located in the area.

Most predominant soil types of the area, reddish brown latosolic soil or immature brown loams is a result of climatic, lithologic and terrain conditions of the area. Alluvial soils occurs the lower courses of the streams. Thus, the area has been classified into mid country intermediate and mid country wet zones in the agro-ecological region map (MoFE, 1999), into wet and intermediate zones of bio-region map (MoFE, 1999), and into northern wet lands of floristic region map (MoFE, 1999) of Sri Lanka. There for on the one hand, biological diversity and structure of HGs are results of natural processes. It can be identified through the germination type of HG's plant species and the layered structure of home gardens. In the study, 345 plant species were identified and 58% plant species are completely naturally germinated. Some About 30% of plant species were recorded as naturally germinated or intentionally planted category. Therefore, it is clear that natural processes contributed

to germinate more than 80% of plant species in home gardens. Four layers can be many of KHGs of the area. Out of total plant species, 17% species make the uppermost layer (10 meter-25 meter), 31% species make the second canopy layer (2 meter-10 meter), the next layer (0.5 meter-2 meter) consists of 19% species and the rest of species make the ground layer of KHGs. This structure reveals that location characteristics of the area force the HGs to grow like natural forests. However, on the other hand, social structuration process leads to modify the natural landscape.

B. Locale Aspect of the Study Area

The locale is the social structuration process of the place. The enduring and relatively stable patterns of social relations which followed by individuals is called social structures. "Social structures are both constituted by human practice and, concurrently, the medium for this constitution. ... By means of lifelong socialization, and though the limits set by the physical environment, people draw upon social structures. But while they do this they are also reconstituting that structure" because 'people are to a certain extent capable and knowing agent; they are not cultural dopes' (Giddens, 1979, cited in Agnew, 1987:30p). Social structures and individual practices, such as HG practice, cannot be conceived apart from one another. This argument was provided by Giddens with a mediating concept (Figure, 2), which integrating individual practices with the institutions, larger systems, and structures which we are a part. Social structures regulate social practices (including resource utilization and management practices) of the members of the society, providing guidelines within the cultural norms for accomplishing the goals defined by cultural values. Social systems refer to the pattern of relations in grouping small-scale places into macro order (Giddens, 2000). The organizational systems, which function to satisfy basic social needs by providing an ordered framework linking the individual to larger social structures, are called social institutions.



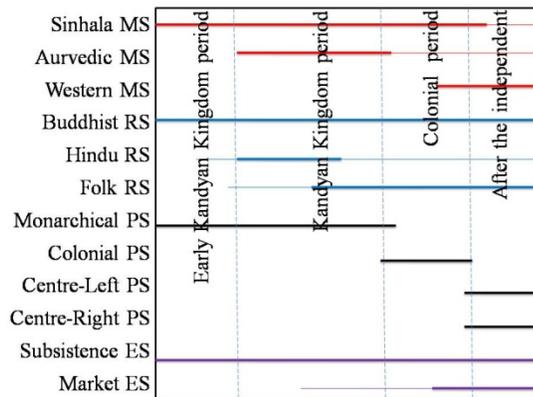
Source: Adopted form Agnew (1987: 30p)

Figure 2: The mediating concept proposed by Giddens to relate social structure and agency

Rules and resources are most important elements of any social structure. Structural rules define and arrange the way of achieving goals of life. These rules define how a practice has to be done, appropriate forms of performing the social action, resource allocation among activities and members of the society

and the authority of resources. In this sense, ethno-botanical values of HG plant species is a product of social structuration process. On the other hand, without appropriate resources, some institutional projects cannot be performed as socially accepted way.

Due to the social structuration process, socio-structural reproduction, transformation, and diffusion occur. When considering the last 1000 years, structural diversity of the study area has been increased as shown Figure 3.



(MS – medicinal structures; RS – religious structures; PS – Political Structures; ES – Economic Structures)

Figure 3: Historical Evolution of Social Structural Diversity of the Study Area

There are many social structures reproduced or eradicated by the local community of the area. Any social structure cannot be reproduced apart from other social structures that constituted to the place; they are interconnected. However, for easy understanding most of them can be categorized into Political social structures (such as monarchical, colonial, left center and right centre), religious structures (such as Buddhist, Hindu, and folk religious), economic structures (such as subsistence and market), and medicinal structures (such as traditional Sinhala, *Aurvedic*, and western medicine). All these structures force to social institutions to do the institutional projects that ensure the structural reproduction. These projects can be categorized as resource utilizing, resource producing and innovating, resource conservation, and educating, etc.

Buddhism is the predominant religious structure that reproducing by the study community. About 99% of the population is Buddhist. Each village has a temple which conducts daily worships, full moon day worship, *Bodhi Puja* (the veneration of the *Bodhi* Tree), *Priith* chanting (chanting of the words of load Buddha), funeral ceremony, arms giving ceremony, *Katina Puja* (specific ritual conduct during the rainy season) etc. with the participation of local community. The structural rules force to the community to avoid killing animals and maintain the inhabitable environment. Hindu religious structure also has been spread over the study area under the rules of *Nayakkar* –Hindu kings and noblemen of Kandyan Kingdom. Worshipping and offering to gods (such as *Pathtini*, *Kataragam*), planets and demon are remnants of Hindu religious practices of the area. Each village has one or two folk religious institutions that conduct Bali and *Dehi Kapeema* (worshipping the deities of

the planet), *Tovil*, *Huniyan* (devil dancing - ritualistic healing ceremony to drive away the demons), *Bahirawa Puja* (a ritual held for worshipping the ghosts who are haunts or have taken their abode in a place), etc. Further, *Adukku Mangallaya* and *Aluth Sahal Mangallaya* held for offering the first portion of the agricultural production to the load Buddha and the sun. Plant products are very essentials to perform these kinds of projects. In the sample KHGs, 54 plant species (15.7%) ensure the reproduction of mentioned cultural structures. Religious structures affect to the horizontal structure of the sample KHGs too. Flowerbed, the zone adjoined to the front and side cleared yards of the home is an example.

In the Patadumbara DSD, 35 traditional Sinhala medicinal institutes conduct institutional projects to reproduce the traditional medicinal structure. These institutes provide services related to general medicine, osteopathy and for treatments for snake venoms. Apart from medicinal drugs provided by the institute, community who get the service also has to maintain some kind of supportive medicinal plant products for solve the health problems. Hence, all KHGs consist of traditional medicinal herbals. There are 45 plant species maintaining for performing the domestic remedies and traditional medicinal practices. In some KHGs, there is a spatial zone called *Ausada Uyana* where herbal plants are growing. In addition to the treatments, these institutions organize some projects such as *Hisatelgama* (hair oil applying ceremony). However, day-by-day western medicinal structure is been popularized among the study community.

The study area had governed under the rules of kings before the colonial era of the country. Many parts of the area such as Mahagama, Paranagama, and Aluthgama had been considered as royal garden villages. Under the Kandyan caste system, the service of the villagers was supplying HG products to the palace, to the houses of noblemen, and to temples and *Devalas* (Lawrie, 1898). During the colonial period, 69% of the land in the area was grabbed under crown land encroachment ordinance in 1840 (Pathmasiri, 2014). Moreover, the colonial administration introduced the cocoa, coffee, and rubber plantation to the area and neglected the subsistence economic activity of the community (Sanderathne, 2000). In addition to that, the market economic structure was spread over the study area under plantation economy. After the struck of leaf blight, *Hemilia vastatrix* many coffee lands were abandoned (Sanderathne, 2000). When it was 1948, many of abandoned lands were encroached and had been converted to KHGs by the inhabitant of the area. Some coffee and cocoa trees of the study HGs are remnants of the former plantation.

After the independence, the political structure of the country was converted to a dualistic structure; center-Left or center-Right. When the political ideology of the governing political party is in the Right, economy of the country was more opened to economic liberalization, free trade, lesser controls than the political ideology in the center-Left. To win the franchise of the community, the government had conducted many projects that affected to the HG biodiversity, structure, etc. *Swarnabhumi* proofs granting project is one of them. Under this program, many landless families had an opportunity to convert the abandoned coffee, cocoa lands into KHGs. In the Patadumbara Divisional Secretariat area, 1355 new KHGs (about 1114 acres) were

established under this program during 1980 to 2010. Grow more food campaign launched during 1953-1956 period, Let Us Cultivate and Uplift the Nation program launched during the 2010-2011, and Livelihood Development program launched from 2011 are some of projects conducted by the government to encourage the reproduction of subsistence economic structure (but some in some areas these programs had encouraged the reproduction of market economic structures too). Under these programs planting materials, fertilizer, equipment as well as agricultural training had been given to the study community. For example, under the livelihood development program, ten perennial crop varieties (coconut – *Cocos nusifera*, lemon – *Citrus medeia*, pomegranate – *Punica granatum*, avocado – *Persea americana*, guava – *Psidium guyava*, Ambaralla – *Dichilanthe zeylanica*, Durian – *Durio malaceensis*, pepper – *Piper nigrum*, coffee – *Coffea arabica*, and jackfruit – *Artocarpus heterophyllus*) per home gardening household had been distributed in the study area in 2011. Further, community-based organizations, as well as village level political organizations had conducted perennial crop distributing programs (Pathmasiri, 2014). In addition to that, the government established village level institutes, such as agriculture officer (*Waga Niladhari*), agrarian research and development officer, livelihood development officer that facilitates to the local community to home gardening and other agricultural activities. To give the agricultural training and educating the community government established an agricultural training center at Nawayalatanna (a border village of the study area).

Apart from that, the government had declared several programs to encourage the market economic structures too. Crop diversification project in 1970 (CBSL, 1998) and export decade 1992-2002 are two of them. These projects lead to popularize the minor export crops such as cloves, nutmegs, and pepper in the study area KHGs.

These political and economic institutional projects lead to establishing the ethno-botanical values of KHG's plant species as shown table 1.

Table 1: categorizing KHG plant species of the study area based on ethno-botanical value

Structure	Purposes	No of species	%
Religious	Rituals & ceremonies	54	15.7
Medicinal	Domestic remedies	45	13.0
Subsistence economy	Vegetable	35	10.1
	Leaf vegetable	38	11.0
	fruits	62	18.0
	spices	21	6.1
	beverages	4	1.2
	Timber	65	18.8
Market economy	Fuel woods	52	15.1
	Direct selling	50	14.5
Others	Inputs	31	9.3
	Animal foods	15	4.3
	Fencing	223	64.6

	Erosion controlling	13	3.8
	Water conserving	8	2.3
Total		345	100

C. Sense of Place Aspect of KHGs

The sense of KHG is the feeling of quality/security of life at the KHG and at a particular time. As explain above, KHGs provide resources to conduct many institutional projects. Hence, KHG safeguard and secure the social power, wealth and solemnity of dwellers as well as the community that share the same social structure. In other words, KHG resources, services, and the structure provide the food security, income security, energy security, health security, mental satisfaction, and social dignity to the dwellers.

All households of the sample fulfill their subsistence needs from their own KHG while earning money by selling some goods to the market. Indirect income which produced by the consumed KHG products is about 3,200.00 Rupees/household/month. It is about 6.5% of total annual direct income a household of the study area. KHGs secure the cooking energy security of 80% of sample households. Direct income earned by a household of the study area by selling of KHG products is about 26,440.00 Rupees per month. The minor export crops such as nutmeg – *Myristica fragrans*, cloves – *Eugenia caryophyllata*, pepper, and coffee are the high income generating crop species maintaining in the study KHGs. In addition to these purposes, there are some purposes that behind the plant species maintaining in KHGs. Those are producing resources for rituals and ceremonies (72% of the sample)and for economic activities (56%), ensuring and displaying the ownership of the land (96%), creating pleasant environment (51%), conserving the land and soil against soil erosion (50%), obeying to the rules of the government (33%), and creating a livable environment around the house (32%).

Then the sense of HG connects to the identity of dwellers as well as the community. Identity is 'connected to a particular place by a feeling that you belong to that place, it is a place in which you feel comfortable, or at home, because part of how you define your self is symbolized by certain qualities of the place' (Rose, 1995:89p). Because of the feeling of belonging, dwellers invest their time, knowledge, and resources for ensuring the security by managing the HG. These management practices can be categorized into three groups; introducing new plant species while maintaining the naturally germinated species, inviting seed carriers to enrich the system, and the maintaining the stability and sustainability of the system. About 10% of plant species of reported in the study is intentionally introduced by the dwellers to the system. Moreover, another 31% of plant species naturally emerged but the dwellers intentionally replant these species into suitable places in the KHGs. Naturally germinated species (about 58%) also have one or more ethno-botanical values. Hence, they are also maintained in the KHGs. Therefore, whatever the size of the land, a vast number of plant species can be identified in KHGs. Population density is about 1102 and it is about 3.4 times higher than the national population density. It directly affects to the KHG size. The average HG size of the area is about 0.67 acres but about 58% of KHGs are less than the average size. However, species per perch is 2.59 and 68 species per HG in the

study area. Further, 65% of reported plant species use to make live fences that demarcate and protect the interior zones from animal attack or unauthorized access. ¾ of plant species of live fences are naturally emerged. Although the layered structure is slightly distorted once (75% of the sample) or twice (16% of the sample) per year by lopping the tops of perennials, dwellers try to maintain the layered structure of the system. About 37% of KHGs consist of surface litter layer that protects and enrich the soil of the system.

D. The contribution of Place process to the biodiversity of KHGs

The place process indicates that as a cause of place process and a result of place process, 345 plant species are conserved in KHGs of the study area. These plant species belonging to 88 plant families. Most commonly reported plant species belongs to *Febraceae* (8% species), *Moraceae* (4% species), *Apocynaceae* (4% species), *Rutaceae* (4% species), *Euphorbitaceae* (3% species). In addition to that, 47% plant species have been evaluated under IUCN Red List 2012 (MOE, 2012). Out of them, *stachyphrynium zeylanicum* species has been categorized as Critically Endangered Possibly Extinct species. *Ziziphus lucida*, *Alocasia fornicate*, *Typhonium flagelliforme*, *Iphomoea staphylina* were reported as critically endangered species. Six species, namely *Loxococcus rupicola*, *Girardinia diversifolia*, *Basella alba*, *Areca concinna*, *Plectranthus zatarhendi*, and *Klugia notoniana* were reported as endangered species. Fifteen species, *Broussonetia zeylanica*, *Spondia pinnata*, *Dichilanthe zeylanica*, *Saraca asoca*, *Ochrosia oppositifolia*, *Antidesma thwaitesianum*, *Canarium zeylanicum*, *Oncosperma fasciculatum*, *Chonemorpha fragrans*, *Cinnamomum zeylanicum*, *Cycas nathorstii*, *Rhipsalis baccifera*, *Phyllanthus emblica*, *Ixora calycina* and *Crinum zeylanicum* were reported as vulnerable species. Forteen species (*Syzygium alubo*, *Strychnos wallichiana*, *Gmelina arborea*, *Carallia brachiata*, *Monochoria hastaefolia*, *Chukrasia tabularis*, *Petchia ceylanica*, *Erythrina fusca*, *Sapindus trifoliolate*, *Chrysephyllum rexburghii*, *Madhuca longifolia*, *Vitex altissima*, *Cynometra zeylanica* and *Syzygium amphoraecarpus* were reported as near threatened species. there are 116 species which classified as least concerned species under IUCN Red list.

IV. CONCLUSION

It is clear that any plant species selected by the natural selection can survive in the manmade ecosystems such as KHGs if the species is a part of the place process of the study area. Hence, conservators should pay attention to maintaining the socio-structural diversity to conserve biodiversity in manmade ecosystems and to do such an effort, manmade ecosystems have to be studied based on place theory approach.

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