

Local Wisdom of the Karangpuang Indigenous People in Sustainable Forest Management in Sinjai District, Indonesia

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ABSTRACT: Forests in Indonesia have a wide variety of wild life and ecosystem types (mega-biodiversity) that live in them, and play an important role as a life support system and the national economy. The Government of the Republic of Indonesia has made various rules and policies regarding the sustainable use of natural resources, including the preservation of forest ecology, but sustainable forest management remains a national problem. The government should implement a community-based forest management system, namely the use of local knowledge systems in formulating policy concepts and implementing them. The involvement of local knowledge systems is very important in supporting programs for the sustainable use of natural resources, including the preservation of forest ecology. This article is the result of research in assisting the government's forestry program which is based on local wisdom values and social-customary institutions, especially the Karangpuang indigenous people in South Sulawesi Province, Indonesia. The article is expected to be able to fulfill the achievement of social forestry goals, namely the realization of a forest management system that provides access and a greater role for communities living around the Karangpuang customary forest area so that sustainable forest management is realized which improves the economic level of local communities. The research data in this article were collected qualitatively using a purposive sample, namely taking several people as key informants. The field data obtained was combined with interviews using a tape recorder to maintain data accuracy. The results of the research show that forest management requires the direct participation of the people living in the forest area. The forms of local knowledge adopted by the Karangpuang Indigenous People in maintaining the balance of nature are setting a certain time in taking forest products and setting a number of prohibitions in managing forest areas.

KEYWORDS –local wisdom, sustainable forest management, Karangpuang Indigenous People

I. INTRODUCTION

The forest is a form of grace and gift from God Almighty to all His creatures on this earth. Indonesia is one of the countries that has received this great blessing with the abundant forest natural resources as an ancestral cultural heritage. According to the Ministry of Forestry of the Republic of Indonesia [1], the total area of forest in Indonesia currently is 143 million hectare or around 74.43 of the 197 million hectare of the entire land area of the Indonesian islands. Sinjai Regency is a region within the Province of South Sulawesi in Indonesia based on its physiography consisting of 15% flat land and approximately 85% in the form of hilly and mountain areas. According to data from *Sinjai Dalam Angka* [2], Sinjai Regency has a forest area of 18,894.3 hectare, of which 11,794 hectare is a protected forest area and 7,100.3 hectare is a production forest. Particularly in Bulupoddo sub-district, where the Karangpuang indigenous people group is domiciled, no protected forest areas were found, except for customary forests which had been designated as Limited Production State Forest areas or *Kawasan Hutan Negara Produksi Terbatas*. Thus, the area of production forest in Bulupoddo sub-district is larger than in other sub-districts, namely 2,196.30 hectare.

Forests in Indonesia have a wide variety of wild life and ecosystem types (mega-biodiversity) that live in them, and play an important role as a life support system and the national economy. Over the past three decades, these abundant forest resources have indeed made quite a large and significant contribution in driving the wheels of the national economy, particularly in the non-oil and gas export sector through large-scale and high-tech advanced forest exploitation and forestry industries. During this period it turned out that the Indonesian people had to bear a heavy burden, especially for the people living around the forest. This burden accumulates in various forms of problems such as the impact on damage to forest ecosystems and other sectors such as the economy, ecology and socio-culture of local communities. From an ecological (environmental) perspective, this pressure has resulted in further degradation of forest resources. The results of the interpretation of Landsat imagery (aerial photography) in 2000 put forward by Kartasubrata [3] show that currently there are 54.6 million forest areas that are damaged and need to be rehabilitated immediately because they are worsening and hindering the economy of the people living around the forest, especially in terms of urban planning, social and cultural local community.

The consequences of the orientation of forest resource management based on modern and sophisticated technology have resulted in various negative impacts on society, but this has apparently not received serious attention from various parties. This indifference is caused by the following factors, namely the social-economic and cultural values of the local community have not been taken into account in managing forest resources, the benefits of forest resources have not been distributed fairly among the people who live in the vicinity, and the increasing conflicts over forest resource management. The decision of the Government of the Republic of Indonesia to grant concessions to timber processing or mining entrepreneurs without involving local communities who are part of this natural resource base. Government policies often ignore local ways of regulating the use of natural resources in maintaining their sustainability. Indigenous peoples who have long lived from these natural resources and have claimed them as their own only get a small share of the existing benefits or results, while large profits are accrued by a certain small group of political and economic elites. Thus, if this condition is allowed to continue, it will have an impact on the failure of sustainable forest resource management.

The Government of the Republic of Indonesia has made various regulations such as Decree of the Minister of Forestry Number 622/kpts-ii/95 in conjunction with Number 677/Kpts-II/1998, in conjunction with Number 865/Kpts-II/1999 which was later refined in SK-Menhut Number 31/Kpts -II/2001 concerning Guidelines and Implementation of Community Forestry or *Hutan Kemasyarakatan*(HKM), but sustainable forest management remains a national problem that cannot be resolved. Sustainable forest management should ideally be built from social-based forest resource management with local community empowerment patterns and systems through local wisdom values approaches. In its implementation, these values must be protected by government policies under the umbrella of the concept of social forestry. Indigenous peoples must be empowered to provide maximum benefits for the people while maintaining the continuity of their functions and capabilities in preserving their environment. Forest management on a local self-reliance scale should be handed back to the surrounding community in order to improve their economic level and welfare. Community self-help participation will be able to maintain ecological sustainability and nature conservation.

In order to realize the government's good intention to restore a community-based forest management system, it turns out that there is still an element that has been forgotten in the formulation of various concepts and development policies, namely the use of local knowledge systems. The involvement of local knowledge systems is very important in supporting programs for the sustainable use of natural resources, including the preservation of forest ecology. Community-based forest management must still pay attention to the values, norms, and social institutions of the community around the forest. In this regard, the researcher published this article as a result of research in assisting government forestry programs based on values and social institutions, especially the Karangpuang indigenous people in South Sulawesi Province, Indonesia. The Karangpuang Indigenous People have succeeded in preserving nature and their customary forest, values and social institutions that have been passed down from generation to generation from their ancestors to the present day through a tradition in the form of Karammpuang customary message or *Paseng ri Karampuang* which is conveyed

through oral tradition or folklore. This research is expected to be able to fulfill the achievement of social forestry goals, namely the realization of a forest management system that provides greater access and role to the people who live around forest areas. This is intended so that in addition to realizing sustainable forest management it can also generate community economic activities so that in the end their income can increase.

II. RESEARCH METHOD

The existence of local knowledge systems can increase the possibility of an effective and humane process in the development of science and technology to significantly improve the standard of living of people in rural areas. Adimihardja [4] argues that the components of the local knowledge system are sufficient to provide literal meaning and inspire the development of a new concept that addresses current needs faced by the community. This means that local knowledge systems have a big role in complementing science, especially in solving socio-cultural problems. As part of socio-culture, the local knowledge system contains a set of unique and specific cultural expressions in the order of values, ethics, norms, rules, and community skills (skills of society). All of these things are useful in fulfilling the demands of the local community's living needs in the fields of food, health, education, natural resource management, and several other social activities of rural communities.

Dutton [5] believes that the existence of a local knowledge system in addition to science should not be seen as two opposing camps. Local knowledge systems should take an active part and role in the development of social forestry, even though their role is still ambiguous, because their application in solving technological problems is always only seen as a support. Local knowledge systems must be integrated with modern science in order to build local capacities and competencies so that each description produced is capable of providing an adaptation support effect in changes in the natural and socio-economic environment of the people, especially those living in and around forests. The knowledge system can be seen as elements of culture, elements with an indigenous perspective, original elements, elements with an ecological perspective, and scientific aids.

The term "culture" initially appeared as an absorption word from the English language, namely culture, which etymologically comes from the Latin *colere*, meaning 'cultivating, working', especially in terms of 'cultivating the land'. From the word culture, according to Koentjaraningrat [6], a new meaning develops is namely all human efforts and actions to cultivate the land and change nature. Culture can be defined as the whole system of ideas, actions and human creations in order to organize people's lives as learning media. Al-Barry [7] also views culture as a product of human creation, taste, and creation which is based on intention and is a collection of knowledge and experience of humans as social beings who are used to understand the environment as a guide for their behavior. One of the universal cultural elements which are the subject of this research is the knowledge system, which is specifically absorbed from the local knowledge system. These cultural elements are then linked to a form of forest resource management system in Indonesia, namely social forestry.

The word local has more to do with the problem of extending individual and community classes than with issues concerning indigenous. People who take part in the character of indigenous people's lives are seen as social groups with a "traditional lifestyle". It is a reason why some of the articles on the Biological Diversity convention are more interested in the protection of science from a perspective. In the 169th International Labor Organization convention with the topic Concerning Indigenous and Tribal Peoples in Independent Countries in 1989, the word Indigenous was defined as a society derived from the populations of a country or region. These people live in the conquered or former colonial areas of several countries, but they still maintain some or all of the social, economic, cultural and political institutions or institutions that they have. Dutton [5] says that the term local knowledge system can be interpreted as knowledge held by a group of people in a certain geographical area in the utilization of natural resources. This study discusses the elements of indigenous insight as local knowledge systems that influence decision making in carrying out ecological activities of indigenous peoples.

Original knowledge system (native knowledge) is based on direct experiences, customs, values, traditions, way of life, social interaction, certain ideological orientations and religious beliefs of an indigenous community. According to Aliardi [8], the richness and complexity of traditional management systems principally arise from the fact of solving problems from two world viewpoints. Several environmental researchers fail in their mission without the help of traditional ecological science because they are unable to see and understand what is felt by native people through their holistic participatory approaches. Theoretically and practically, the system of original knowledge (native knowledge) is a combination of traditional knowledge and experimental knowledge that forms new knowledge through personal experience.

A number of great scientists have succeeded in laying the foundation for cultural studies in solving environmental problems called cultural ecology, such as Franz Boas and Alfred Koeber. The two scientists, according to Hari [9], have succeeded in raising the issue of environmental possibilism. A perspective view of the natural environment like this can lead to certain possibilities or options, that is, a culture can be conditioned and determined through the history of certain cultures. This positivistic view of the relationship between culture and environment can be categorized as a form of compromise between culture and environmental determinism. Environmental possibilism in various ways can mark the existence of an important paradigm that is more directed towards an integrative and dialective environment rather than towards a deterministic view, namely more concerned with the relationship between culture and its environment. This possibilistic approach often characterizes current cultural ecological approaches. So, indigenous people who live in an area have an understanding and knowledge of natural resources towards the surrounding natural environment and its ecosystem. This is able to provide support or a participatory approach in the management and development of resources in various cases. The forms of their participation can be in the form of direct and full participation or only participating in one of the activities (partial participation).

The concept of "cultural ecology" in a number of studies is related to environmental issues in change or evolution. The use of the concept of adaptive action in the word ecology according to Haviland [10] is intended to explain the origin of a new genotype in an evolution that is used to discuss the process of occurrence of phenotypical variation, as well as to describe the linkage networks of life itself in a form competition, succession, climax, separation and other supporting concepts. Genotype is the gene composition that actually exists from an organism, while phenotypical is the physical appearance which is or is not a manifestation of the genotype because the genotype can contain alleles, namely alternative forms of a single gene that are recessive. Cultural ecology can be used in building the participation of indigenous peoples in managing the environment and forests in a sustainable manner. One form or model of a community-based forest management system that is most appropriate and appropriate to the current situation and circumstances, according to Kartasubrata [11], is to use a plant diversification system, or more popularly known as *agroforestry*. It, as with other forest management systems (community forestry, communal forestry and so on) is a form of application of community-based forestry (social forestry). This form of agroforestry management is well known in Indonesia, as evidenced by the study of the local wisdoms of several indigenous communities in Indonesia, especially indigenous peoples who live in and around forests.

In order to obtain a complete and systematic description of the relationship between local knowledge systems and community-based forest management in this study, the following data collection or recording techniques were used:

- a. Documentation techniques, namely reviewing archives, both data in the form of written documents and data orally (folklore) related to environmental management issues, natural resources, and social forestry.
- b. Observation techniques, namely observing directly the daily behavior of the Karampuang indigenous people, including their stakeholders and customary councils in their natural resource management activities, especially the problem of community-based forest handling and management in the Karampuang customary forest area.
- c. Interviews, namely conducting in-depth interviews with a number of informants about the Karangpuang customary forest management system, both structured in nature, namely making a

framework or list of questions to be asked of the informants or casual chats, namely forms of conversation with no topic or framework for discussion beforehand.

- d. Recording, namely recording all forms of interviews and observations using a tape recorder (oral data) and a camera (data in the form of patterned actions and behavior of the community).

III. RESULT AND DISCUSSION

One form of nature conservation for the Karangpuang community is exploring the value of local wisdom contained in their customary area, namely preserving the forest. Morality is an inherent demand by the Karangpuang indigenous people. This morality concerns not only their behavior with each other, but they also with the forest. There is a moral religious belief that attitudes and behavior that are wrong, fraudulent, and damaging to the order of human relations with the forest are believed to bring havoc, both to oneself and to the community. The Karangpuang indigenous people believe that all of creation is a harmonious whole. They believe that spirits are everywhere and that all natural elements, namely animals, plants, forests, mountains and rivers, have their own soul, personality and character.

In the customary law system of the Karangpuang people, if someone wants to cut down a tree in the forest, he must get permission from the customary leader. People are only allowed to cut wood in the forest for internal family needs such as raw materials for houses, and not for sale. If someone is found illegally logging, he will be fined in the form of 5 sacks of cement or ostracized from society as he cannot attend all rituals and is not served when he has administrative needs at the village office. It means that residents who live in the Karangpuang customary area are not allowed to cut down trees in the forest for economic or business interests, let alone take actions that are considered to damage and destroy the forest and its contents without reasons that can be justified by custom, morals, also applicable laws and regulations.



Picture 1. The researcher is in the middle of one of the Karangpuang Customary Forest areas which is still sustainable based on the local wisdom values embraced by indigenous peoples

The main moral principle in the Karangpuang indigenous people is *denamakkasolang* or not destroying the meaning that humans have a moral obligation and responsibility for forest preservation and the preservation of nature. They analogize the environment in 8 principles into their customs, namely:

1. The principle of respect and appreciation (*Mappakalebbe ale'*)
2. Responsibility (*jujung matane'*)
3. Humanizing forests and nature (*mappatau ale'*)
4. The principle of compassion (*makkamase ale'*)
5. The principle of non-destruction (*mappedeceng ale'*)
6. Simple Living Principles and in harmony with Nature (*tu kamase mase*)
7. Principle of Justice (*adele'*)
8. Principles of Democracy (*assamaturuseng*)

3.1 The Cosmology of the Karangpuang Indigenous People

The word cosmology comes from the Greek words "*kosmos*" and "*logos*", which were used by Pythagoras (580 - 500 BC) to describe the regularity and harmony of the movements of the heavenly bodies. This term was also used by C. Wolff when dividing the areas of study of philosophy and giving the sense that cosmology is the study of cosmic systems, in which the universe is investigated according to its absolute essence and nature, both in terms of material and in terms of its meaning. Supelli [12] states that the objects studied are not a priori limited to physico-chemical or biotic objects, but also humans and the universe as far as humans experience it. Furthermore, Keesing [13] defines cosmology as a person's assumptions about nature, creatures and the forces that control them, the organization of the universe, and the role of humans in nature.

The Karangpuang Indigenous People believe the concept of "world, nature and human beings" as one "cosmic" that substitutes for one another. The surrounding nature or forest is a macrocosm of the traditional house which is also a microcosm of the real world. On the other hand, besides being a microcosm of nature, traditional houses are also a macrocosm of humans. The connection with mythical elements can be proven by the presence of three levels of customary forest. According to the cosmological point of view of the Karangpuang indigenous people, a human life has three levels, namely the upper world (*akhera'*), the middle world (*lino*) and the underworld (*buri liu*). The three levels of nature are then reflected into three levels or parts in the traditional house, namely the upper realm (*rakkiang*), the middle realm (*hatampola*), and the lower realm (*diaha bola*). All valuable or sacred items such as rice, money chests, heirlooms, and so on are placed on the third level (*rakkiang*) because the place is considered sacred.

The Karangpuang Indigenous People have a small cosmic view of their everyday world, namely the unseen world (macrocosm) and the real world (microcosm). According to their perception, the relationship between the two realms cannot be separated from one another. The world they live in is a representation of a larger realm, namely the world (universe) where human spirits reside. Someone who wants to take something that is in the customary forest must get permission from those who own it, namely their ancestors. Views like this make people not dare to take anything from the forest or cut down trees without the permission of the adat council (*adekke*). If anyone dares to violate it, the person concerned will receive two forms of sanctions namely, customary fines (*ripassala riadekke*) and disobedience to the ancestors (*mabusungi riattoriolonna*).

The cosmology of the Karangpuang Indigenous People towards customary forest is also clearly illustrated in the processions of several existing traditional rituals such as *mappogauk Sihanua*, *Mabbissa Lompu*, and *Makkaharu*. The traditional house occupied by the *arung* and *gella* traditional elders is considered a representation of the mortal world. According to the beliefs of the Karangpuang indigenous people, there is a close relationship between the microcosm (traditional house) and the macrocosm (customary forest) which are representations of the supernatural and the real world. That is why the traditional house occupied by both *arung* and *gella* is considered a representation of a "woman". This assumption is based on a cosmos, that almost all life in this world starts from a natural world (environment), namely the realm of the womb (humans) and ends in the afterlife (the unseen world).

From the past to the present, it is strictly forbidden for a person to climb to the top attic (*rakkiang*) in the Karampuang traditional house without the permission of the traditional head because it is feared that the guard will get angry and curse the person concerned. All forms of worldly activities are normally carried out in the main house (*hatampola*) and less important or less sacred objects such as cattle, firewood, mortar, plow and so on are placed under the house (*diaha bola*). Of the three levels in the traditional house of the Karangpuang people, it symbolizes the body structure of a female human being. Kitchen (*dapureng*) is associated as a woman's breast which is the source of livelihood for someone who has just been born, symbolized by two hearths. The right is slightly larger than the left. The position and location are right opposite the door of the traditional house which symbolizes a woman's vital organ (*vagina*). The door of the house is right in the middle of the house and above it hangs a package containing two round stones as weights when the door is opened or closed. The stone symbolizes a man's vital organs (*testicles*). Around the edge of the roof of the traditional house hang ornaments of wooden carvings symbolizing a woman's jewelry and on the upper ridge of the house there is a *lajo bola* (a wooden ornament resembling a buffalo horn) symbolizing a hair bun or hair accessory for a woman.



Picture 2. The Karampuang Traditional House which is occupied by a Tribal Chief with the title *Arung* or *Gella* is associated as a daily world or microcosm

Another very interesting thing in the construction of the Karangpuang traditional house is the principle of environmentally friendly development. Almost all of the materials used are taken from the natural surroundings and the use of external materials (zinc, nails, paint, bolts and so on) is strictly prohibited because this is considered not in accordance with their environment and culture. As a substitute for tin roofs, thatch is used (*bakkaheng*), palm fiber (*tulu gemme'*) or rattan (*hillareng*) is used instead of nails, bee dung is mashed as a kind of wax (*patti*), and pegs (*pallaca'*) are used as substitutes for nails. In Karangpuang culture, there are grand rituals that are held regularly every year, such as *mangade'*, *mabbisa lompu*, *mappoto* and so on. The ritual is intended to raise the spirits of its citizens after working hard and as a sign of appreciation to their ancestors for all the results they have achieved within a certain period of time. They consider their ancestors who live in the natural surroundings to continue to provide assistance as a liaison medium between themselves and their God so that what they get is considered a blessing from God through the efforts of their ancestors. Thus, the ritual as a

representation of a form of appreciation and gratitude to the ancestral spirits must be celebrated, both individually and collectively.

3.2 Perception of the Karangpuang Indigenous People's Forest Management System

The forest, according to the perception of the Karampuang indigenous people, apart from having economic value, is also a form of cultural inheritance from *Toma-nurung* as their ancestor. When he was about to disappear (*mallajang*), he also handed over a form of inheritance (*arajang*) in the form of sacred objects (keris, lontara', and so on) and land (rice fields and plantations, including customary forests) to the next generation. successor. These heritage objects, especially customary forests must be preserved so that the demand for ingredients for traditional house ingredients which are also inherited also remain sustainable. The forest, according to the cosmology of the Karampuang indigenous people, is a small realm (microcosm) of the universe inhabited by various creatures, including supernatural beings. That is why almost all traditional ceremonies carried out by indigenous peoples are always related to forest issues, even the two big traditional ceremonies are the annual traditional party (*mappogau'sihanuae*) and the traditional party after leaving the fields (*mabbissa lompu*). The two rituals end in a forest area or on the top of Mount Karangpuang.

The customary council (*adekke*) as the heir to the culture of Karangpuang has full responsibility for the existence and preservation of the forest because this is the most valuable heritage. According to their myth, any activity that destroys the forest is equivalent to destroying the ancestors and is also equivalent to destroying oneself because the forest is considered a representation of human beings. The forest in the culture of the Karangpuang indigenous people is considered a sacred value. In addition to the moral responsibility carried by the Karangpuang customary council, the existence of two traditional houses as the palaces of *Arung* and *Gella* is also a cause for their interest in maintaining the preservation of their forests. Almost all of the raw materials for the traditional house have to be pulled (*diruwi*) from the customary forest (*ale' adekke*) to the location of the traditional house. The main purpose of this ceremony is to foster a sense of solidarity and togetherness, as well as the mutual cooperation of the Karampuang indigenous people in doing a job. If the wood is the raw material for the traditional house, it is shared with the community as a form of their participation in custom.



Picture 3. The Karampuang indigenous people work together to pull tree trunks as wood materials for repairing traditional houses from the forest as a form of their sense of solidarity and togetherness

In the Karangpuang customary area, the customary forest management system (shared use rights) is governed by the social institutions that they adhere to. Existing customary forests must be able to provide social security to community members experiencing economic difficulties. In order to regulate the circulation of forest

and land use in the Karampuang cultural area, the *Arung* customary leader morally and based on the concept of one derivative (*sianang*) fairly gives rights and opportunities for forest management to the community (*ana'ade*), whose economic level is truly less fortunate.

As a legacy from their ancestors, the preservation of the ecosystem in the customary forest must be maintained by all its members. In order to maintain its sustainability, the Karangpuang customary council and the government agreed to manage the customary forest while maintaining and using local knowledge that is laden with social institutions in the form of prohibitions, invitations, and sanctions. These social institutions were read out as a form of customary fatwa (*paseng riade'*) by *Gella* at the peak of the traditional ceremony after leaving the fields (*mabbissa lompu*) in front of the residents and the adat council as a form of joint resolution for the next one year. The sound and contents of the fatwa issued at the *mabbissa lompu* event are as follows:

1. *Forest management through social institutions in the form of prohibitions*

In accordance with their customs and habits in managing forests, the Karampuang indigenous people are prohibited from carrying out activities at certain times because they are worried that it could disrupt the ecosystems in the forest. According to local knowledge, forms of community activity that disrupt the natural balance system are tapping palm trees at certain times, prohibiting soaking bamboo segments in stone wells, arrangements for taking processed wood and rattan, prohibiting taking forest honey, prohibiting replacing roofs of houses.

2. *Forest management through social institutions in the form of invitations*

The climax of the traditional ritual of *Mabissa Lompu* is an invitation from the adat council to hunt (*rengngeng*) wild boar or monkeys. It is intended to reduce animal populations which are the main pests in forests and plantations, as well as a form of channeling talents and hobbies.

3. *Forest management through social institutions in imposing sanctions*

Sanctions were given to the Karampuang indigenous people who did not heed customary institutions and followed the customary council's invitation. For the Karampuang indigenous people who dare to violate these prohibitions and invitations, they will be subject to severe customary sanctions (*ripassala*), it is even possible that they will be subject to the heaviest customary sanctions in the form of exclusion from the Karampuang customary environment (*pabbatang*) and/or being expelled from their hometown (*ripaoppangi tana*), if this form of violation cannot be tolerated or pardoned by the adat council.

IV. CONCLUSION

Social forestry is a form of forest management that emphasizes the direct participation of communities living in and around forests by synergizing cooperation in the form of partnerships between communities, entrepreneurs and the government. Social forestry can be carried out both inside a forest area known as a community forest (village forest) and outside a forest area or what is often referred to as a community forest (public forest). Forest management has so far experienced several forms of failure because it only relies on pure knowledge which is universal in nature, even though it should be combined with a local knowledge system that is full of wisdom, easy to implement, developed in local communities according to environmental conditions and situations. To achieve maximum results, social forestry management as a forest management system aimed at increasing the welfare of people in and around the forest and improving forest quality towards sustainable forests, should be combined with a form of method diversifying forest plants known as Agroforestry.

Agroforestry (intercropping) has important parts in helping local communities optimize the use of natural resources in their environment, such as multipurpose forests, namely planting short-term timber (chocolate, vanilla, pepper, and so on) under forest plantation trees to meet the short-term needs of the family; *fish pond*, namely raising fish in the existing dam or river flow to meet family consumption; *agri-silviculture*,

namely planting agricultural crops (upland rice, corn, and so on) to meet family food needs; and *sylvopastoral* systems, namely raising livestock (goats, cows, and so on) under timber stands to supplement family income.

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