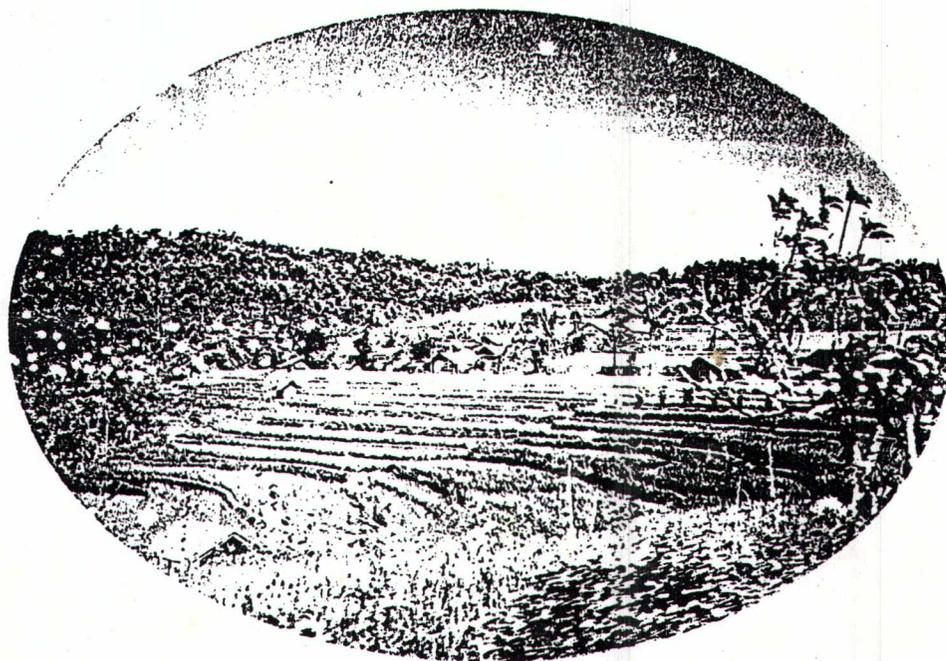


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**Toward Harmonization between Development and  
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# Utilization of Agricultural Waste in Several farming Systems by Farmer's Families Living Along Cihideung River, Sub-Watershed Area of Cisadane, Bogor District, West Java<sup>1</sup>

Jamaludin<sup>2</sup>, C.M. Kusharto, and D. Martianto<sup>3</sup>.

**ABSTRACT.** The research is aimed to 1) identify types, quantity and utilization of agricultural waste on different type of farming system; 2) determine agricultural waste contribution to household income; and 3) analyze factors influence agricultural waste utilization. Study sites were purposively selected based on the linear slope extends from the edifice of an stratovolcano "Salak" to its foot, whereas Sukajadi village represented upper-part of watershed area (590-680 masl) and Cihideung village represented transitional part of watershed area (190-360 m asl). Data collection was conducted on April to June 1999. Sampling frame of the study was farmers' household with various land utilization. Stratification was than used based on waste productivity of various land utilization. A total of 112 farmer families were participated in this study (75 families living in Sukajadi village and 37 families living in Cihideung Ilir Village). Data was collected using a structured questionnaire. A descriptive and statistical analysis such as t-test, Pearson-R, Chi Square and Regression analysis were applied during data analysis. The results of this research showed that agricultural wastes that were produced in both villages originated from plant and animal sources. The farmer utilized plant and animal wastes, such as wood as firewood, branches and leaves of tree, and hay mixed with manure for organic fertilizer. The average of the farming waste in Sukajadi village is 563.6 kg/month with contributed 92.6 % of total farming waste, while at Cihideung Ilir village is 895.8 kg/month contributed 88.0% of total farming waste. The average of the income from the utilization of household agriculture waste at Sukajadi Village was Rp 1.299.00/cap/month (the average of the total income household Rp. 41.683.00/cap/month), while at Cihideung Ilir Village Rp 1.068.00/cap/month (the average of the total income household Rp 79.214.00/cap/month). Achieving income from agriculture waste at Sukajadi is 3.1% and Cihideung Ilir village was 1.3%. The results of statistical test by regression analysis showed that in Sukajadi factors that affect agricultural-waste utilization were included age of the family's head (husband), educational attainment of family's head, level of knowledge about agriculture waste utilization, and family's income ( $R^2 = 0.922, p < 0.05$ ), while in Cihideung Ilir village the factors were included age of family's head, level of knowledge about agriculture waste utilization and the distance between agricultural waste-sources and place of agricultural waste-processing ( $R^2 = 0.906, p < 0.05$ ).

## I. Background and Method of Study (Place and Time).

Various land farming system and planting were laid along sub-watershed area of Cisadane, Bogor, West Java. However, biodiversity of this sub-watershed land area was not well studied and utilization of agricultural waste on farming system was not applied optimally. Lesson learned from Vietnamese experienced, VAC ecosystem, where V (a stands for farming)-A (a stands for water resource development)-C (includes animal husbandry). creates a system where all food product from each system are used

and waste product are reused. These creates a good environment by using all wastes, gives the family a diversified diet, assures good health and contributes to stable agriculture and limits the migration to urban areas (Giay and Khoi, 1996). And Quisumbing et al, 1996 noted that women could play a role as the key to food security. Therefore, this research aims to 1) identify types, quantity and utilization of agricultural waste on different type of farming system; 2) determine agricultural waste contribution to household income; and 3) analyze factors influence agricultural waste utilization.

<sup>1</sup> Part of research entitled "Bioresource and Management System to Support Household Food Security: A Longitudinal Study among Rural Household in Java". Acknowledgements are due to Advisory Committee: Husaini M. Anwar and Asep Rustiawan. Special thanks to the RUBRD research team Suprihatin Guhardja, Yayuk F. Baliwati, Emmy S. Karsin, Dadang Sukandar and Nino Sa'ddiyah.

<sup>2</sup> Lecturer and Researcher of Universitas Terbuka, Jakarta

<sup>3</sup> Lecturer and Researcher, Dept. Community Nutrition and Family Resources, Fac. of Agriculture (GMSK, Faperta), Bogor Agricultural University, Indonesia

The research is a part of grand research entitled "Bioresources Management system to support Household Food Security; a Longitudinal study among rural Household In Java". Study sites were purposively selected based on the linear slope extends from the edifice of an stratovolcano "Salak" to its foot. Each site is characterized by (L) landform type and surface-form characteristics with some morph metric information in parenthesis (general slope, average distance and relative height from an adjacent main dissecting valley bottom), (S) soil, (G) geology and (W) drinking irrigation water supply. Sukajadi village represents upper-part of watershed area (590-680 m asl) with is characterized by (L) Upper lahar plateau, slightly undulating and a shallow valley emerges in the settlement (10%, 200 m, 70 m); (S) dark brown loamy tp clay-loamy Andosol, A horizon 40 cm thick. (G) Yellow pumice (Lempung) 170 cm thick/Paleosol (andosol)... "Lahar", (W) Directly from the stream or through pipes from spring within the settlement, whereas Cihideung Ilir village represent a transitional-part of watershed area (190-360 m asl) with (L) Floodplain, Natural levee - Back swamp complex (2%, <100m, <2m), (S) Unknown but loamy or clay-loamy Fluvisol (G) Flcoplain deposits, sandy-clayey, (W) Directly from a tributary channel. (Tamura and Kitamura, 2000). The study was conducted on April to June 1999. Sampling frame of the study was farmers' household with various land utilization. Stratification was

then used based on waste productivity of various land utilization. 112 households served as samples of this study, which consist of 75 samples out of 238 households from Sukajadi village and 37 samples out of 65 households from Cihideung Ilir village (see Appendix).

Data was collected using a structured questionnaire. A descriptive and statistical analysis such as t-test and regression analysis was then applied in data analysis. Regression analysis was used to analyze factors influenced utilization of agricultural waste.

## II. Production and Utilization of Agricultural Waste

Agricultural waste that was produced in both villages originated comes from plant and animal sources. Plant wastes, which were coming from home garden, "kebun-talun", dry field, and rice field, consist of plant sticks (particularly corn and cassava sticks), paddy straw, and plant leaves (particularly corn, cassava leaves), while animal waste produced was manure. The average production level of agricultural-farming waste in Sukajadi was 563.6 kg/month (Table 1), lower than those was produced in Cihideung Ilir (895.8 kg/month). Most of the agricultural waste in Sukajadi was coming from rice-field ("sawah"), while in Cihideung was coming from dry-field ("tegalan) and rice field.

Table 1. Agricultural-waste Production by Type of Land-Use in Sukajadi and Cihideung Village

Type of Land Use	Sukajadi Village		Cihideung Village	
	Kg/month	%	Kg/month	%
Home Garden	126.1	28.8	125.3	14.0
"Kebun-Talun"	-	-	1.2	0.1
Dry Field	115.3	20.5	399.7	44.6
Rice Field	286.2	50.7	369.6	41.3
TOTAL	563.6	100.0	895.8	100.0

The agricultural waste produced then utilized into several purposes, such as used as feed (animal and fish feed), fertilizers (*humus*, compost, manure), and other purposes (for sale, fire woods, etc). The

utilization of agricultural waste in detail is presented in Table 2. The data revealed that most of agricultural waste was returned into the agricultural system as organic fertilizers.

Table 2. Average Agriculture-Waste Utilization in Sukajadi and Cihideung Village

Utilization	Sukajadi Village		Cihideung Village	
	Kg/month	%	Kg/month	%
Organic Fertilizers for:				
- Home Garden	9.1	1.6	0.8	0.1
- "Kebun-Talun"	-	-	-	-
- Dry Field	174.3	30.9	343.6	38.4
- Rice Field	255.0	45.2	349.1	39.0
Feed (animal, fish)	15.6	2.8	11.7	1.3

### III. Income Contribution from Agricultural Waste

The study showed that average household income (Rp/cap/month) was lower in Sukajadi than in Cihideung Ilir i.e., Rp 41.683,00 in Sukajadi, and Rp 79.214,00 in Cihideung Ilir. Statistical analysis showed a significant difference ( $p < 0,05$ ) in terms of income between the two groups. Contribution of farming system into family income was relatively higher in Sukajadi (58,7%) than in Cihideung (51,9%). Contribution of agricultural waste to total household income was 3,1 percent and 1,3 percent, respectively in Sukajadi and Cihideung, as shown in Table 3. It implies that contribution of agricultural-waste is still small to the lives of farmer's household along sub-watershed area of Cisadane.

### IV. Factors Affecting Utilization of Agricultural Waste

Factors that were suspected to influence the utilization of agricultural waste were age of household head, educational attainment (years of study), knowledge on agricultural waste utilization, household income, and the distance between agricultural waste sources and place to process the waste. The study shows that in Sukajadi factors that influence agricultural-waste utilization were; age of the household head, educational attainment, knowledge on agricultural-waste utilization and household income (Table 4). While in Cihideung Ilir the factors were; age of the household head, knowledge on agricultural-waste utilization, and the distance between agricultural waste-sources and place of agricultural waste-processing.

Table 3. Income Contribution from Agricultural Waste in Sukajadi and Cihideung

Sources of Income	Sukajadi Village		Cihideung Village	
	Rp/cap/month	%	Rp/cap/months	%
Agricultural Waste	1,299.00	3.1	1,068.00	1,3
Others (farming and Non farming)	40,384.00	96.9	78,146.00	98,7
TOTAL	41,683.00	100.0	79,214.00	100.0

**Table 4. Result of Regression Analysis**

Dependent Variables	Regression Coefficient	Partial Correlation	p-value
<b>Sukajadi Village</b>			
Age	1.33	0.684	0.000
Educ. Att. (years of study)	2,329	0.274	0.019
Knowledge on agr. waste utilization	0.307	0.252	0.031
Household income	0.0002	0.286	0.014
(R <sup>2</sup> = 0.922; p < 0.05)			
<b>Cihideung Village</b>			
Age	1.275	0.619	0.000
Knowledge on agr. waste utilization	0.449	0.335	0.046
Distance sources of waste and place of processing	23.197	0.389	0.019
(R <sup>2</sup> = 0.922; p < 0.05)			

#### V. Conclusions and Recommendations

The study showed that both study sites were potential to reused agriculture waste products. The average production level of agricultural waste in Sukajadi was 563.6 kg/month, much lower than those was produced in Cihideung Ilir (895.8 kg/month). Source of agricultural wastes product in Sukajadi was mostly coming from rice-field ("sawah"), while in Cihideung was coming from dry-field ("tegalan) and rice-field. Most of agricultural waste was returned into the agricultural system as organic fertilizers, however, contribution of agricultural wastes to total family income, in both villages still small (only 3,1% in Sukajadi village and 1,3% in Cihideung Ilir village). It is recommend trains farmers to develop innovations and manage local resources optimally. Builds on local knowledge and experience to improve quantity as well as quality of waste products, which have added value i.e. saving income by less expenditure for agriculture inputs.

Factors that were influenced the utilization of agricultural waste were age of household head, knowledge on agricultural waste utilization, household income, educational attainment and distance between sources of waste and place of processing the waste. It is necessary and more efficient to collect the waste first at one place which not to far away from the place of processing. Support them appropriate technology and management that focuses on

soil conservation, improving cropping pattern and incorporates energy saving and waste recycling strategies to minimize harmful effect to the ecosystem itself.

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Appendix.

Table 1. Sampling Frame of the Study .

Grouping of HH by Type of Land Use/Land of Ownership.	Sukajadi		Cihideung Ilir	
	$\sum$ HH/ Stratum (ni)	$\sum$ samples /Stratum (ni)	$\sum$ HH/ Stratum (ni)	$\sum$ Samples /Stratum (ni)
1. Sawah, pekarangan, kebun-talun, tegalan/ Sawah, pekarangan, kebun talun/ Sawah, tegalan, kebun-talun	91	24	11	7
2. Sawah dan kebun-talun/ Sawah dan pekarangan	36	10	35	13
3. Tegalan, pekarangan, dan kebun-talun/ Tegalan dan kebun-talun Tegalan dan pekarangan	11	3	3	2
4. Tegalan Pekarangan dan kebun-talun	31	9	-	-
5. Kebun-talun/ Pekarangan	109	29	26	15
Total	278	75	65	37

## **Comments on the Landscape-Ecological Studies on Sustainable Bio-Resources Management System in Rural Indonesia**

First Seminar "Toward Harmonization Between Development and Environmental Conservation in Biological Production" sponsored by the JSPS-DGHE Core University Program in Applied Bio-Sciences. February 21-23, 2001. Yayoi Auditorium, University of Tokyo, Tokyo Japan.

### **ARMANDO M. PALIJON**

Associate Professor  
UPLB College of Forestry and Natural Resources  
College, Laguna 4031 Philippines  
Tel. No.: 063 (049)536-5305  
Telefax: 063(049)536-2557 & 3206  
E-mail : armp@mudspring.uplb.edu.ph

### **INTRODUCTION**

Upon receipt of the invitation as commentator to this 1st seminar entitled "Toward Harmonization Between Development and Environmental Conservation in Biological Production" under the JSPS-DGHE Core University Program in Applied Biosciences, I immediately accepted it despite the knowledge that it is quite hard to process the travel papers particularly visa application.

- ◆ First, it is an honor and a privilege to be with agricultural and environmental scientists, economists, landscape ecologists and conservationists and to be able to share/gain insights and experiences.
- ◆ Second is to somehow contribute to the success of the seminar and be part in advancing the art and science of sustainable development and management aimed at optimizing biological production without sacrificing environmental conservation.
- ◆ Third is to establish network or linkage with the individual experts and institutions participating in this momentous event and to explore future collaborative research with University of Tokyo, Bogor Agricultural University, Gajah Mada University, Padjadjaran University, Bandung Technology University, Chiangmai University, Prince of Songkla University, Kobe University, Kyushu University and others.
- ◆ Finally, to provide some comments to the **9 excellent research papers** included in the **Landscape-Ecological Studies on Sustainable Bio-Resources Management System in Rural Indonesia**. Without it, the JSPS-DGHE Core University Program may not be able to justify my official trip to Japan.

Before I proceed further, I would like to personally and officially commend the organizers of this seminar specifically Dr. Yoshihiro Hayashi, Dean, Graduate School of Agricultural and Life Sciences and Dr. Kazuhiko Takeuchi also of the same institution for taking the initiative in hosting this seminar with a very relevant theme "Toward Harmonization Between Development and Environmental Conservation in Biological Production." More particularly, I am very grateful for the invitation extended to yours truly and be part of this seminar and future endeavors of the JSPS-DGHE Core University Program.

## **COMMENTARY TO THE PAPERS**

Generally, the topics essentially and substantially cover the landscape-ecological aspects of sustainable bio-resources management system.. Though most studies are still on-going and methodologies still need to be further refined in order to generate sufficient and more accurate data, however, the information generated and shared by the various authors is already very relevant and can significantly contribute to the art and science of sustainable development and management. Furthermore, the information can help in clearly defining/understanding development and environmental conservation and how they can be harmonized i.e. balancing the two to better achieve optimum biological production for the maximum socio-economic and ecological benefits of the society. The succeeding comments focused on specific topic orally presented in the seminar.

### **Topic 1. Spatial Analysis of Urbanization and Greenery in Jabotabek, Indonesia**

The study is one of my favorite topics being an advocate of sustainable green space management or urban forestry. The study is able to characterize and correlate urbanization and greenery in Jabotabek area using Clark and Newling Model and land use analysis and greenery prediction model, respectively.

While the result of study is obvious that greenery areas are low in built up areas like the industrial/commercial and residential and high in forest, plantation and agriculture. The fact remains that if urban development continues without regard to preserving, developing or even expanding greenery areas, urban deterioration will continue. It has been recognized that the life of the city depends not only on the extent of its greenery (the lungs of the city) but on how well these greenery areas are managed and conserved.

The study should be continued to cover some of the bio-physical, social, economic, political/legal, institutional factors influencing land use changes or landscape fragmentation. This will make the research more meaningful from the perspective of its possible contribution to land use policy formulation, planning and development and management

### **Topic 2. Present Situation of Rural Environment and Bio-mass Utilization**

The study attempted to characterize the state of rural environment in terms of the quality of water around villages in West Java. This, to me, is very relevant since water is one of

the most basic necessities for human survival. Thus, if food security for the society is to be sustained, water not only in terms of quantity but also quality must be made available. The analysis on the present state of water in the villages of West Java, can therefore provide basis for concerned local as well as national institutions in coming up with appropriate regulations and actions that would cater to improving the quality of water in the villages for domestic and other uses to ensure human health. The study explores the possibility of using plants and charcoal for improving the quality of water- a strategy which offers high degree of adoption.

I pity the Philippines because, unlike before, we can even drink the water that was running in our rivers. Now, even the underground water is not anymore potable because of contamination. Thus, even in the villages bottled water has become popular-making life very expensive.

The study likewise estimated the quantity and analyzed the chemical composition of agricultural and plantation wastes with the end in view of utilizing optimally these wastes for producing other economically useful products under the principle of zero-emission system. Such technological approach is very much important particularly if it can provide additional source of income to the farmers and help improve the environment.

Lastly, the study included the annual growth of plants and the corresponding ability to fix CO<sub>2</sub> and the biodegradation of plant cell walls and CO<sub>2</sub> evolution. This is relevant because climate change and the mitigating effect of vegetation in terms of CO<sub>2</sub> sequestration capacities is the trend now in environmental research.

Over-all this study needs to be continued to generate more empirical information.

### **Topic 3. Study of Rural Landscape Structure Based on Its Different Bio-Climatic Conditions in Middle Part of Citarum Watershed, Cianjur District, West Java, Indonesia**

The study is able to characterize fully the agricultural community in terms of land use and housing pattern and the floristic structure of the various farming systems being practiced in the watershed area. Such provides vital information for the continuously growing agro-forestry knowledge. It is also able to identify some threats to the sustainability of the system like farmland fragmentation due to inheritance system and the pressure of rich, lowland urban residents. Such problem is not exclusive to the area rather it is international in nature being, specifically prevalent in Asia and Pacific region.

The study, however, should include characterization of the sustainability of the system in terms of hydrology, nutrient cycling, soil fertility, erodibility, productivity, economics and others.

Similarly, the information will be important for government planners policy and decision makers to consider land-use policy options compatible with social equity dimensions or one which is rather protective of the rights of the poor.

#### **Topic 4. Estimation of Material Flow due to Human Activities in Three Rural Hamlets in the Cianjur-Cisokan Watershed, West Java, Indonesia**

This one is a rare study of the inflow/outflow of material in farming communities and to me, is really very relevant for the point of view of land use sustainability. One of the predicaments of the farmers in Asia Pacific region is the high cost of inputs particularly N-rich inorganic fertilizers. As a farmer myself, I regret maintaining a 2 hectare rice farm raising high yielding varieties (HYV) which are heavily requiring inorganic fertilizers and chemicals.

The study has tried to demonstrate the feasibility of estimating the input/output of the material (here, in terms of total nitrogen), determining the material balance and evaluating and comparing the sustainability in the system. It should, however, try to look at all sources of inputs and outputs, say lost of N from the system due to leaching, volatilization and others.

One aspect that touched me most is the significance of the study in promoting organic farming specifically the use of mud and other wastes which is very much common in divers, integrated production system in China and other countries. This should be the trend now in this region considering the environmental benefits from this practice..

The study should be much appreciated, however, if this is coupled with economic aspect and could emphasize some possible implications.

#### **Topic 5. A study on Animal Husbandry Systems at Three Bio-Climate Zones in the Middle Part of Citarum, West Java**

The study is able to descriptively present the differing animal husbandry systems in each of the three bio-climatic zones. Obviously, the environmental conditions, culture and preferences, economic importance, existing local ordinances affect the kind of animals to be raised in an area. The animal that is more adopted to the has the better chance of survival and productivity. Again, this study should be coupled with economic aspect. It should include meat and milk consumed, sold or just shared by the community. Cost of raising and the income accruing to the individual farmers and community. The study has correlated productivity with environment but not with cultural practice.

The study should also include information like carrying capacity of the three zones. Also problems, issues and concerns like economic and environmental impacts of animals in each zone should be identified and measures should be recommended.

**Topic 6. Utilization of Agricultural Waste in Several Farming Systems by Farmer's Families Along Cihideung River, Sub-Watershed Area of Cisadane, Bogor District, West Java**

One of the problems in the Asia Pacific region is burning as a means of easy disposition of agricultural wastes. This particular study therefore is able to provide information that could help convince farmers to consciously use agricultural waste for various purposes. Again, this has considerable relevance in the promotion of organic farming and raising income of the farmers. However, the study could have been more interesting if it can include valuation (pricing) of each type of waste and their specific use. Marketing schemes of agricultural waste must also be included. It should also present the number or % of farmers buying and using agricultural wastes for use as fertilizers or other purposes. Are there no farmers burning the agricultural wastes? Are there programs or agencies promoting use of agricultural wastes or incentives to encourage such?

**Topic 7. Food Availability of Farmer's Household Living Along Cihideung River, Sub-Watershed Area of Cisadane, Bogor District, West Java**

Food always in the home (FAITH) is normally the desire of every family whether rich or poor. Food security is one of the priority programs in many countries in Asia and Pacific region. If food is always available and complete diet is provided then health and nutrition of people regardless of economic status can be assured.

The study provided information as to the level of food available and the manner of food consumption or energy intake in the subject villages. Such can be basis for the local and national government to come up with food security program to be tied up with nutrition and health. It is not always true that villages, though they produce the food commodities, have sufficient food for their consumption. The study has shown such. It will be more meaningful if the study could have identified the problems or issues related to inadequate energy intake. In the Philippines, farmers normally sell almost all their produce due to immediate need for cash either to repay their debts or for the education of the children. They worry about their food later and try to survive by working in other farms, earn cash and buy the food for the day.

**Topic 8. Bio-Resource Utilization in the Changing Landscape of Upper Citarum Watershed: The importance of Natural Subsidy in Rural Production Systems**

Bio-resources especially the non-wood forest products play a major role in the management and conservation of the natural resources including the forests. In most countries in Asia Pacific region, bio-resources are the main products extracted for the subsistence and source of cash for forest communities or communities at the fringes or immediate vicinity of the forests. The right to exploit timber in the natural forests was and is still given to rich concessionaires. Other bio-resources (fiber, medicine, food, fodder, resin, latex, honey, bush meat and others) are extracted by the poor people mostly indigenous. Unregulated exploitation of these bio-resources, however, definitely could have some environmental repercussions.

Previous natural resources or forest management stream only included timber. Other bio-resources were partly or not at all included. While the new strategies in natural resources conservation is establishment and management of protected areas, still it can not be ignored that communities need to extract products from these areas for their subsistence. Thus, the need for integrating bio-resources utilization in the whole stream of management and conservation.

The present study provide information as to the kind of bio-resources that are available and extracted from the natural as well as from inhabited or cultivated farms. Although the study limits its investigation on forage and fuelwood, such could provide basis as to the kind of approach and policy of utilizing bio-resources from the natural sources and in promoting sustainable bio-resources production in cultivated areas and their efficient utilization. The study should include other economically useful products that the forest provide and the attempt of the community in domesticating the plants as sources of cash of merely for their existence. This is relevant in terms of lessening the pressure to the natural forest.

The study likewise provided information on the utilization of agricultural wastes in the subject villages. Again, such is very relevant as far as promoting organic farming is concerned and in developing integrated production system with efficient nutrient cycling. It likewise could help design efficient organic waste management strategies for better biological production and sustainable environmental conservation and management.

The study however, should include the economic aspects of bio-resource utilization.

### **Topic 9. Structure and Function of Homegarden: A Revisitation**

Similar with other previous studies, this one provide basic information about the structure and function of home gardens- a predominant production system in inhabited areas not only in Indonesia but also in other parts of Asia and Pacific region.

The description of the structure of the home garden should be accompanied with both horizontal and vertical profile just like the previous study for better appreciation and for better understanding of the biological, economic and environmental functions of the individual components and the whole home garden.

It may likewise be necessary to look at the historical, cultural and social dimension of the evolution and continued or changing practice of the home garden not only as a production system but also for environmental, aesthetic and amenity reasons.

Bio-intensive, organic homegarden production system in many countries in Asia-Pacific region is being promoted because of the need to have food security (not only sufficient but also safe food) in every home and at the same time an ecologically wholesome environment.