

2nd INTERNATIONAL
AGROFORESTRY CONGRESS

*“agroforestry for sustainable and resilient farming
communities”*

November 28-29, 2016
Tay Nguyen University
Buon Ma Thuot City, Vietnam

MESSAGE

The Southeast Asian Network for Agroforestry Education (SEANAPE) was formed with the hope of enhancing links between and among agroforestry institutions to help advance the science and practice of agroforestry. The holding of agroforestry conferences is one of the opportunities where the member-institutions of SEANAPE, together with the other agroforestry stakeholders, exchange recent agroforestry information, establish and/or renew partnerships, and chart the directions of agroforestry at the local, regional and international levels.

The 2nd International Agroforestry Congress, with the theme “*Agroforestry for sustainable and resilient farming communities*”, will provide a forum that highlights the role of agroforestry in climate change adaptation and enhancing sustainable land management – the two most important basic considerations in upland farming communities considering the recent and emerging concerns in climate change and food production. This event will also put emphasis on the emerging programs and policies that influence agroforestry development and promotion.

SEANAPE takes pride in organizing the 2nd International Agroforestry Congress, together with the Tay Nguyen University in Vietnam as the host-institution, and the University of the Philippines Los Banos. This regional network also extends its gratitude to the different agroforestry stakeholders who will take part in this agroforestry milestone. Indeed, this Agroforestry Congress would not have been convened, had it not for your expressed interest and enthusiasm to participate in this event.

By all means, SEANAPE will always take part in any initiative that will come out of this International Agroforestry Congress. It will continue to promote regional collaboration towards advancing the science and practice of agroforestry in Southeast Asian region.

Congratulations to all of us for making it to the 2nd International Agroforestry Congress!!!

WILFREDO M. CARANDANG

SEANAPE Executive Director

In addition to the training activities, the University continuously promotes the activities of science, technology and international cooperation. Through years, the staff of the University have conducted a large number of scientific projects at the State, Ministerial, Provincial levels as well as participated into many important programs, projects of both domestic and international scopes. The University also has signed and implemented numerous Memorandum of Understanding with national and international partners.

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Tay Nguyen University (TNU) is a leading public university in the Central Highlands of Viet Nam. The University was founded on November 11th, 1977 under Vietnamese Government's decision No.298/CP with missions: i) Training highly professional human resources of science and technology in many fields such as Medicine and Pharmacy, Education, Forestry, Agriculture, Economics, Social Humanity, Technology, etc; ii) Researching and technology transferring to satisfy the huge demand of socio-economical development of Viet Nam in general and Vietnam's Central Highlands in particular as well as the development of Cambodia-Lao-Vietnam triangle; iii) Reserving and promoting indigenous ethnic minorities' cultures.

Currently, the University offers 46 undergraduate majors, 10 masterates and 2 doctorates specialties. Moreover, TNU has cooperated with numerous high reputation and ranking institutes and universities in Viet Nam to provide 46 joint and multi-disciplinary Master programs. Since its establishment, TNU has trained more than 25,000 students (Bachelors, Engineers and Medical Doctors), including approximately 3,000 ethnic minority students, over 800 Master students and 2,700 joint-training master students with high reputation institutes and universities in Viet Nam. In the academic year of 2016-2017, a total of 17,500 and 1,200 students completed their undergraduate and graduate programs, respectively.

The total workforce of the University is 756 people (including 413 females; 36 ethnic minorities), which include 14 Associate Professor Ph.D., 54 Ph.D. and 252 Masters. The academic staff is 507 lecturers and teachers. There are 10 training faculties and research center (Faculty of Animal and Veterinary Science, Pre-University Training, Natural Science and Technology, Economics, Politic Science, Foreign languages, Forestry – Agriculture, Pedagogy, Medicines & Pharmacy and Institute of Biotechnology and Environment), 11 departments (Personnel Department, Department of Undergraduate, Graduate, Science & International Relations, Planning & Finance, Politics & Students Issues, General Administration, Facility Management, Inspection, Examination & Education Quality Assurance and Management board of Construction Project) and 8 service and practical centers (Practical High School of Central Highlands, Center of Foreign languages and Informatics, Center of Supplementary education and Occupation training, Center of Educational National Defense of Tay Nguyen, The hospital of Tay Nguyen University, Library, Center of Students's Services, Centre of Information).

Distinguished delegates of the 2nd International Agroforestry Congress

On behalf of the Board of Rectors, I would like to welcome heartily the distinguished delegates of the 2nd International Agroforestry Congress at Tay Nguyen University, Buon Ma Thuot City, Dak Lak Province, Viet Nam. The theme of this Congress is *“Agroforestry Towards Sustainable and Resilient Farming Communities”* is relevant as there is a need to adapt to the changes in the market, global trade, globalization, climate changes and others environmental and social issues.

These days, together with the changes in global trade, climate change has challenged the farming communities, especially the people in the highlands, the ethnic minorities, to move towards sustainability and resiliency. Climate change has been impacting the production and living of farming communities. The Central Highlands of Viet Nam, the place where we are at the Congress, has been confronted with these above challenges towards sustainable development. The Highlands is also impacted by the changes of climate in numerous aspects including the cultivation, income and livelihood of poor people – the ones who could hardly adapt rapidly and reasonably to the changes.

In Vietnam, the climate changes have affected the coastal areas in terms of increasing sea level, the loss of productive land and to the highlands in terms of longer duration of drought, serious deficiency of water and abnormal storms. Subsequently, the habitualness with and capacity to adapt with the above changes are significant challenges to the farming communities – especially the poor localities. Practically, the existing mono-cultivation in large scale and in the climate changes context, as well as the market's changes, trade competitiveness increasing have made the production unsustainable, resulting to low yield. The farmers are faced with the loss, damages due to the unpredictably and fluctuation of the price and market.

As a result, the agroforestry system – a sustainable and resilient farming to the multi-aspects' changes and climate changes, has still proven the advantages and appropriateness to the highlands. Therefore, the discussion and sharing of practices, good models and selection, and continuous research for new orientation of development of agroforestry are very important issues not only to the academia but also to the agroforestry extension practitioners and the agroforestry farmers.

SOUTHEAST ASIAN NETWORK FOR AGROFORESTRY EDUCATION

The above issues are the main reasons for our gathering today - to discuss, share and figure out a roadmap to promote the application of agroforestry to support and to assist the farming communities to adapt to the huge global changes and challenges. I do believe that the Congress shall have satisfactory outcomes, which shall be the voice and contribution to the development of sustainable farming system in the South-East Asia, towards the support to agroforestry farming communities to overcome the challenges and attain sustainable development.

It is an honor for the Tay Nguyen University to hold this special event. The University will surely benefit from the results of the Congress including improving the textbooks, searching for initiatives in research and development of agroforestry for the local areas. The University would like to thank SEANAFE for allowing the organization of this Congress at TNU and would like to thank for the participation and the contribution of honorable delegates. TNU is still in the developing process. Thus, there will be definite inconveniences due to limitations in infrastructures, human resources to the organization of this Congress. On behalf of the University, I am looking forward to the understanding of the honorable delegates.

Allow me to send the best wishes to every honorable delegate on health, getting high quality congress, experiences and time to explore the land as well as the hospitality of the people in Buon Ma Thuot Highlands, Vietnam.

Respectfully,

NGUYEN TAN VUI

Associate Professor, Ph.D.

The Rector of Tay Nguyen University

SEANAFE is a regional collaboration of agroforestry institutions in Southeast Asia. Its mission is to help improve agroforestry education, training, research and extension, and contribute to socioeconomic development, empowerment of farming communities and sustainable natural resources and environmental management in the Southeast Asian region. SEANAFE has 82 member-institutions in six country networks in Indonesia, Lao PDR, Malaysia, Philippines, Thailand and Vietnam. Since 1999, SEANAFE has been assisting the member countries to:

- Prioritize educational needs in agroforestry and natural resources management;
- Access and analyze research outputs, policies, and trends in forestry, agroforestry and natural resources management;
- Agree on regional strategies for developing curricula and teaching materials;
- Strengthen the teaching and research capacities of lecturers in agroforestry and natural resources management;
- Improve access to appropriate teaching resources;
- Develop and adapt teaching methods and materials to national settings;
- Share agroforestry knowledge and management techniques through media and direct participation;
- Collaborate at the national, regional and international levels on agroforestry projects;
- Strengthen partnerships with government extension agencies, NGOs and farmer organizations;
- Advocate for improved agroforestry education policy among member institutions; and,
- Produce graduates with practical knowledge and leadership skills

SEANAFE is an international NGO which is based at the University of the Philippines Los Banos. The SEANAFE Board is responsible for policy making and developing the network. It meets once a year and consists of the six national network chairs, and two ex-officio members coming from the Philippine Agroforestry Education and Research Network (PAFERN) and one from non-SEANAFE member-institutions.

November 28-29, 2016

Tay Nguyen University

Buonmathuot City, Vietnam

COMPARING THE ATTAINMENT OF POTENTIAL YIELD OF DRY-SEEDED RICE IN NON-PUDDLED SOIL WITH OVERHEAD SPRINKLER IRRIGATION AND TRANSPLANTED RICE IN PUDDLED SOIL WITH FLOOD IRRIGATION

Ronaldo G. Orpiano^a, Roland J. Buresh^b, James R. Quilty^b, and Pearl B. Sanchez^c

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^b International Rice Research Institute, Los Baños, 4031 Laguna, Philippines

^c University of the Philippines Los Baños, 4031 Laguna, Philippines

The high water requirements and labor cost of transplanted rice in puddled soils contribute to high production expenses. Dry-seeding rice in non-puddled soil could reduce the water requirements but there were uncertainties in the productivity as rice is normally growing in flooded or submerged soils. Using the unreplicated 4-ha production plot each, dry-seeded rice was established as component crop of rice-mungbean-rice system in non-puddled soils with overhead sprinkler irrigation and the transplanted rice established in rice-rice system in puddled soils with flood irrigation in a dry and a wet season. Crop phenology was observed throughout the rice growth and the number of days to reach the important stages was counted. The leaf area index (LAI) was also measured using a portable area meter. The attainment of potential yield, estimated using crop phenology and weather data and processed through ORYZA 2000, was higher in dry-seeded rice during dry (64.6%) and wet (55.6%) seasons because of higher plant density and this was associated to soil water. Transplanted rice only attained 51.3% and 49.3% of the potential yield during dry and wet seasons, respectively. Rice yield can thus be maximized if ample water was supplied, even without puddling.

Keywords: dry-seeded rice, transplanted rice, potential yield, ORYZA 2000

RATIONALE

Many of the developing countries around the world depend largely on agriculture for their economic development. Thus, a number of farming communities are engaged in various forms of agricultural activities for their livelihood. Besides their financial and technical limitations, these farming communities are vulnerable to the changing market policies, globalization or international trade, climate change and other environmental and social problems. These issues call for an agricultural technology or innovation that would help address the social and environmental concerns.

Agroforestry is the combined production of agricultural crops and woody perennials in the same unit of land for ecological stability and socioeconomic productivity. Its potentials have long been explored, and thus, research and development programs are continuously being implemented to improve the science and practice of agroforestry. It is hightime to provide a forum that will highlight these agroforestry research and development initiatives not only for academic and scientific contributions, but more importantly towards addressing the global environmental and social concerns.

The 2nd International Agroforestry Congress is being organized by the Southeast Asian Network for Agroforestry Education (SEANAPE), a regional network of academic institutions engaged in agroforestry education, research and development, in close partnership with the Philippine Agroforestry Education and Research Network and the Vietnam Network for Agroforestry Education. This event is participated by the different agroforestry stakeholders including researchers, extension workers, practitioners, students, government agencies, non-government organizations, private industries, farming communities, and academic institutions.

OBJECTIVES

1. To share recent research development programs and initiatives on the role of agroforestry in sustainable and resilient farming communities and the policy trends in agroforestry development and promotion
2. To consolidate issues, concerns, prospects and opportunities in agroforestry development and promotion
3. To promote information exchange and partnership building towards a sustained agroforestry development and promotion

SUB-THEMES

- *Agroforestry for Sustainable and Resilient Farming Communities* will dwell on basic research and field trials/experiments, applied and action research, development programs that put emphasis on the role of agroforestry in climate change mitigation and adaptation; role of agroforestry in ensuring food security; and agroforestry's potentials in promoting community resiliency.
- *Agroforestry for Sustainable Land Management* will dwell on basic research, field trials and experiments as well as applied and action research that highlights the agroforestry's potentials in improving farm productivity, controlling soil erosion and promoting nutrient cycling, among others.
- *Emerging Policies for Agroforestry Development and Promotion* will highlight the recent policy trends that are likely to influence agroforestry development and promotion. Topics could be the national policies and laws, local ordinances and resolutions, or indigenous/customary practices.

SESSIONS

Plenary Paper Presentation. This session will feature the invited papers from key researcher and scientists whose topics will revolve around the following sub-themes:

1. Agroforestry and Farming Communities' Resiliency and Sustainability
2. Agroforestry for Sustainable Land Management
3. Emerging Policies for Agroforestry Development and Promotion

POSTER PAPER PRESENTATION

DOCUMENTATION OF SUSTAINABLE RUBBER-BASED AGROFORESTRY SYSTEMS AS CLIMATE CHANGE ADAPTATION STRATEGY IN NORTH COTABATO, PHILIPPINES

Arturo S.A. Castillo, Roselyn F. Paelmo, Roberto G. Visco, Rowena Esperanza D. Cabahug, Russel Son A. Cosico and Arnold Karl A. Castillo
University of the Philippines Los Banos, College, Laguna, Philippines

Rubber-based Agroforestry System (RBAS) is among the adopted smallholder farming practices because of its potential in rehabilitating degraded areas and simultaneously providing economic benefits to the farmers particularly in Kabacan, Kidapawan and Makilala, North Cotabato. This paper documented the observed effects of climate change, pest and diseases occurrence and adaptation strategies being implemented by farmers to address the adverse effects of climate change in a farm-level scenario. A total of 363 respondents were interviewed. The average land holding of rubber farmers in North Cotabato is about 2.07 hectares with a mean annual cuplump production of 1,436 kg per hectare, wherein the RRIM series was the most commonly used rubber clone. Moreover, this paper also identified several RBAS typologies, namely: a) rubber planted with agricultural crops; b) rubber with fruit trees; c) pure rubber; d) rubber with plantation trees; d) rubber with plantation crops mixed with fruit trees; e) rubber with agricultural crops mixed with plantation and fruit trees; and f) rubber with agricultural crops and plantation trees as well as the income derived from these variants. This research was funded by Department of Agriculture – Bureau of Agricultural Research (DA-BAR).

Keywords: *rubber-based agroforestry system, climate change, typology*

POSTER PAPER PRESENTATION

ASSESSMENT OF FLORAL BIODIVERSITY INDICES OF AGROFORESTRY PRACTICES OF SMALLHOLDER FARMERS IN NAGCARLAN, LAGUNA, PHILIPPINES

*Jans Nexus Reyes, Roberto G. Visco and Nelson M. Pampolina
University of the Philippines Los Banos, College, Laguna*

The study was conducted to assess the floral biodiversity indices of agroforestry practices of smallholder farmers in selected barangays in Nagcarlan, Laguna, Philippines. The agroforestry farming practices in the study area include monocropping with or without live trellis; crop rotation with or without live trellis, multiple cropping with or without live trellis; multiple purpose trees on farmland with or without live trellis; and multi-storey agroforestry. The most prominent annual crops planted are Tomato (*Solanum lycopersicum*) in combination with Ampalaya (*Momordica charantia*). Meanwhile, the most common perennial crops are Lanzones (*Lansium domesticum*), and Coconut (*Cocos nucifera*). Results show that the multistorey agroforestry has the highest flora diversity index of 2.15. Monocropping without live trellis is determined to be significantly different to other identified agrofarming practices in the study; except to live trellis system with monocropping, and live trellis system with multiple cropping.

Concurrent Paper/Poster Presentation. This session will feature agroforestry researches, development programs and other initiatives along the three sub-themes mentioned above.

Field Visit. A visit to the agroforestry farms in Central Highlands of Vietnam will be organized to expose the participants to the different agroforestry practices and climate change adaptation strategies

SIDE EVENT

Capacity Development for Climate Change Adaptation in Southeast Asia: Lessons from the Collaborating Countries. This is a side-event which is being organized by the Philippine Agroforestry Education and Research Network that provide opportunities for the collaborators to share their experiences, including best experiences and lessons learned in the implementation of the four-year project on capacity development for climate change adaptation that was funded by the Asia-Pacific Network for Global Change Research (APN).

PROGRAM

SCHEDULE	ACTIVITY	PERSON/S IN-CHARGE
November 27, 2016	ARRIVAL PARTICIPANTS AND SPEAKERS	SEANAPE and TNU
November 28, 2016		
9:00—9:30 AM	OPENING CEREMONIES <ul style="list-style-type: none"> • Singing of Vietnam National Anthem • Welcome Remarks • Acknowledgment of participants and co-sponsors • Message • Introduction of Keynote Speaker • Keynote Speech • Awarding of the Plaque of Appreciation and Tokens 	Dr. Nguyen Tan Vui <i>Rector, TNU</i> Dr. Wilfredo M. Carandang <i>SEANAPE Executive Director</i> Dr. Bao Huy <i>SEANAPE Chair</i> Mr. Nguyen Hoai Duong <i>Director, Agriculture and Rural Development</i>
9:30—9:45	GROUP PHOTO CONGRESS OVERVIEW	
9:45—11:30	PLENARY PAPER PRESENTATION <i>(Session Chair: Dr. Roberto G. Visco, Professor, IRNR, CFNR-UPLB)</i>	
9:45—10:15	Agroforestry Towards Sustainable and Resilient Farming Communities	Dr. Bao Huy Faculty of Forestry, Tay Nguyen University
10:15:10:45	Agroforestry for Sustainable Land Management	Dr. Wilfredo M. Carandang Professor, IRNR-CFNR, UPLB
10:45—11:15	Emerging Policies in Agroforestry Development and Promotion	Dr. La Nguyen Agroforestry Specialist, ICRAF-Vietnam
11:15—11:30	OPEN FORUM/DISCUSSION	
11:30—12:00	VIEWING OF POSTERS	
		Poster Paper Presentors

POSTER PAPER PRESENTATION

TREE COMMUNITY STRUCTURE AND CARBON STOCK OF SELECTED SECONDARY GROWTH FOREST PATCHES IN ILOG-HILABANGAN WATERSHED FOREST RESERVE

Gregorio D. Predo, Reynaldo T. Tababa, Maryann S. Dagunan, Jun Erwin Dela Cruz and Mae Flor G. Posadas
Central Philippines State University, Kabankalan City, Negros Occidental, Philippines

This paper highlights the study which determined the tree community structure and carbon stock of selected secondary growth forest patches in Ilog-Hilabangan Watershed Forest Reserve, particularly in the three villages of Barangay Buenavista, Himamaylan City. This study identified the different species of trees and families, estimated the volume of standing trees and determined the current carbon stock. A three 100m of transects in every site were established with a 20m x 20m plots set up in each transect to gather different species of trees. A total of 66 tree species were identified, which belonged to 28 families and 47 genera. The most common species found were Bagtikan in NIDCO, Taloot in Madaja (Cansirmon) and White Lauan in Candi-is. Cansirmon had the highest diversity among the sampling sites. This site is being mEditedamaged by the DENR, in collaboration with the indigenous people who have also been engaged in enrichment planting. Hence, the number of tree species was perceived to be evenly distributed. NIDCO had the highest carbon stock among the sampling sites due to the dominance of old and bigger trees.

Keywords: tree community structure, carbon stock, forest patches

POSTER PAPER PRESENTATION

MANDUYOG HILL BIODIVERSITY CONSERVATION PROGRAM

Danilo E. Abayon, Melba L. Raga-as, Josephine R. Pajo, Marilyn E. Romaquin and Rogelio L. Felizardo

Aklan State University, Banga, Aklan, Philippines

There is a loss of forest biodiversity and productivity of the 15-ha Manduyog Hill due to Typhoon Haiyan, Frank and Undang and encroachment of the neighbouring community. This scenario coupled with lack of awareness and involvement of the immediate stakeholders, thus, prompted the University to launch this program. The main goal is to protect and conserve biodiversity towards sustainable development. Different approaches were implemented such as policy formulation on conservation and management together with the creation of multidisciplinary team and unifying the efforts of the different production units, strengthening researches, development and extension advocacies and integration of the program goals to curricular objectives. Enhanced biodiversity and improved regeneration of affected forest stand through massive planting of indigenous trees and crops, supported and practiced soil and water conservation farming and upland rehabilitation through farm diversification, integrated pest management and organic agriculture were among the project outcomes. The project has established instruction, research, extension and production areas; increased awareness among stakeholders on biodiversity conservation and management; and promoted influx of local and foreign tourists resulting to additional income of the University. Likewise, through this program there are recognition from local and national agencies, proactive relationship the University, government agencies and the community. In the future, sustaining the University's initiatives lies in social acceptance and cooperation. Understanding that biodiversity conservation should be a concerted efforts and biological diversity promotes economic sustainability.

SCHEDULE	ACTIVITY
POSTER PAPERS	
	Agroforestry and Small Ruminant Production: The Agusan del Sur State College of Agriculture and Technology (ASSCAT) Experiences <i>Rodrigo L. Bongolan, Jr. and Madeline R. Bongolan</i> <i>Agusan del Sur State College of Agriculture and Technology, Bunawan, Agusan del Sur, Philippines</i>
	Performance of Cowpea (<i>Vigna unguiculata</i> L) as Alley Crop on Established Calamansi as Affected by Organic Fertilizers <i>Orlando P. Almoite and Winnielyn Palabay</i> <i>Don Mariano Marcos Memorial State University, Bacnotan, La Union, Philippines</i>
	Domestic Uses of Intoxicating Yam (<i>Dioscorea hispida</i>) <i>Dominic Billen, Richmark Degala, Maryann Dagunan and Franklin Piad</i> <i>Central Philippines State University, Kabankalan City, Negros Occidental, Philippines</i>
	Tree Community Structure and Carbon Stock of Selected Secondary Growth Forest Patches in Ilog-Hilabangan Watershed Forest Reserve <i>Gregorio Predo, Reynaldo Tababa, Maryann Dagunan, Jun Erwin dela Cruz and Mae Flor Posadas</i> <i>Central Philippines State University, Kabankalan City, Negros Occidental, Philippines</i>
	VDK Farm: A Diversified Sustainable Agri-Fishery-Livestock Technology for Food Security and Ecological Productivity <i>Casticon, IS, Domingo EDC, Mendoza, JD, Casticon AMC, Mendoza, EM, Diampos RM, Baniqued RV and EV Barcellano</i> <i>Isabela State University and Kalinga State University, Tabuk, Kalinga, Philippines</i>
	Ronquillo Farm: A Lowland Agroforestry Strategy for Food Security and Environmental Sustainability <i>Mendoza JD, Da Jose MILO, Diampoc RM, Mendoza EM, Casticon AMC, Fernandez SMG and Barcellano EV</i> <i>Isabela State University and Kalinga State University, Tabuk, Kalinga, Philippines</i>
	Callagdao Agroforestry: A Sustainable Strategy for Food Sufficiency and Environmental Security <i>Bayonga A, Bayongan L and EV Barcellano</i> <i>Kalinga State University, Tabuk, Kalinga, Philippines</i>
	Garcia's Integrated Mango-Based Fruit Tree Farm in Roxas, Isabela, Philippines <i>Mendoza JD, Casticon AMC, DiampocRM, Mendoza EM, Fernandez SMG, Garcia MA and EV Barcellano</i> <i>Kalinga State University, Tabuk, Kalinga, Philippines</i>
	Soil Fertility Assessment of Selected Community-Based Forest Management Sites in Kalinga, Philippines <i>Ernesto G. Guiabao and Emerson V. Barcellano</i> <i>Kalinga State University, Tabuk, Kalinga, Philippines</i>

SCHEDULE	ACTIVITY
	Assessment of Floral Biodiversity Indices of Agroforestry Practices of Smallholder Farmers in Nagcarlan, Laguna, Philippines <i>Jans Nexus Reyes, Roberto G. Visco and Nelson M. Pampolina</i> <i>University of the Philippines Los Banos, College, Laguna, Philippines</i>
	Manduyog Hill Biodiversity Conservation Program <i>Danilo E. Abayon, Melba L. Ragaas, Josephine R. Pajo, Marilyn E. Romaquin and Rogelio L. Felizardo</i> <i>Aklan State University, Banga, Aklan, Philippines</i>
	Documentation of Sustainable Rubber-based Agroforestry Systems (RBAS) as a Climate Change Adaptation Strategy in North Cotabato, Philippines <i>Arturo Sa. Castillo, Roselyn F. Paelmo, Roberto G. Visco, Rowena Esperanza D. Cabahug, Russel Son A. Cosico and Arnold Karl A. Castillo</i> <i>University of the Philippines Los Banos, College, Laguna, Philippines</i>
	Comparing the Attainment of Potential Yield of Dry-Seeded Rice in Non-Puddled Soil with Overhead Sprinkler Irrigation and Transplanted rice in Puddles soil with Flood Irrigation <i>Ronaldo Orpiano, Roland Buresh, James Quilty and Pearl Sanchez</i> <i>Occidental Mindoro State College, San Jose, Occidental Mindoro</i>

SOIL FERTILITY ASSESSMENT OF SELECTED COMMUNITY-BASED FOREST MANAGEMENT SITES IN KALINGA, PHILIPPINES

For. Ernesto G. Guiabao and Emerson V. Barcellano
Kalinga State University, Tabuk City, Kalinga, Philippines

This study was conducted to assess the soil fertility status of selected Community-based Forest Management (CBFM) sites in Kalinga. Soil samples were collected and analyzed for the different soil fertility indicators such as soil pH, Nitrogen (N), Potassium (K), and Phosphorus (P). Results showed that the CBFM project site in Pinukpuk had higher Nitrogen (N) content compared to the CBFM site in Tabuk City with an average of 1.548 and 1.354 respectively. In terms of Phosphorus (P) content, Pinukpuk site has an average of 4.647 while Tabuk City has an average of 3.4. For the Potassium (K) content, Pinukpuk site had an average content of 194.90 while only 48.71 for the Tabuk City site. In terms of pH, the sites revealed that almost the same pH value of 5.159 and 5.114 respectively. Soil fertility in the Pinukpuk CBFM site was higher than the CBFM site in Tabuk City due to higher biodiversity of plant species coupled with the presence of native tree species and the production of litter fall and its decomposition is greater as compared in the Tabuk City CBFM area. The CBFM site in Tabuk City is dominated with Yemane (*Gmelina arborea*), Mahogany (*Swietenia macrophylla*) and Mango (*Mangifera indica*) for the woody components and in between the strips are planted with corn (*Zea mize*) and other agronomic or vegetable crops. The CBFM site in Pinukpuk is dominated with Dipterocarp species, Dao (*Dracontamelon dao*), Tuai (*Biscofia javanica*), Narra (*Pterocarpus indicus*), Kalumpit (*Terminalia nitens*), Rambutan (*Nephelium lappaceum*), Coffee species (*Coffea spp*) and Mahogany for the woody component while Pineapple (*Ananas comosus*), Taro (*Colocasia esculenta*), Banana (*Musa sapientum*), corn and various vegetable crops are planted between spaces of the woody perennials.

Keywords: Community-Based Forest Management, woody perennial, biodiversity, soil fertility, agroforestry

POSTER PAPER PRESENTATION

GARCIA'S INTEGRATED MANGO-BASED FRUIT TREE FARM IN ROXAS, ISABELA

Mendoza, JD¹, Casticon, AM C¹, Diampoc, RM¹, Mendoza, EM¹

Fernandez, SMG¹, Garcia MA², and EV Barcellano³

¹Faculty members, Isabela State University, Roxas, Isabela; ²Owner, Garcia's Integrated Mango-based fruit tree farm, Roxas, Isabela; ³Faculty member, Kalinga State University, Tabuk, Kalinga

The Garcia's integrated Mango-based fruit tree farm in San Rafael, Roxas, Isabela existed and sustained over the 20 years of operation has brought sustainable financial and environmental rewards to the family, community and the environment. The farm is a diversified Lowland Agroforestry System with an approximate land area of about 16.00 hectares that is used to be marginal grassland with rolling and gently sloping sites. The perimeter of the farm is enclosed with fence where Coconut (*Cocos nucifera*), Mahogany (*Switenia macrophylla*), and Yemane (*Gmelina arborea*) served as the live post. Parallel to the fence are strips of other fruit tree species like Pomelo orange (*Citrus grandis*), Jack fruit (*Artocarpus heterophyllus*), Cacao (*Theobroma cacao*), Guyabano (*Anona muricata*), Banana (*Musa sapientum*) and dragon fruit (*Hylocereus undatus*). The rolling portion of the farm was devoted to sustainable, organic and environment friendly mango (*Mangifera indica*) production with an average of 60 cm diameter at breast height of the 150 mango trees. The low lying area of the farm is devoted to lowland rice production with an area of 11 hectares. The areas between the strips of the higher plants and the dikes of the rice field are cultivated for the production of various organic vegetable crops for the sustainable supply in the local market and the rest of the products are for the family and friends. Several animals are also raised in the farm such as 6 heads of cattle (*Bos taurus indicus*), 15 heads of carabao (*Bubalus bubalis*), and 11 heads goat (*Capra aegagrus hircus*) that are raised in a semi-confinement and cut and carry methods of feeding. The farmer- owner also maintained pig (*Sus domesticus*) in the four pigpens while native chicken (*Gallus gallus domesticus*), turkey (*Meleagris ocellata*), swan goose (*Anser cygnoides*), Pacific black duck (*Anas superciliosa*) and pekin duck (*Anas platyrhynchos domestica*) are raised freely in the farm as another sources of income and the protein source of the family.

Keywords: Mango-based Lowland Agroforestry, diversified farming, biodiversity, carbon sink

SCHEDULE	ACTIVITY
12:00—1:00	LUNCH
1:00—4:15 PM CONCURRENT PAPER PRESENTATION	
SESSION 1. AGROFORESTRY TOWARDS SUSTAINABLE AND RESILIENT FARMING COMMUNITIES (Session Chair: Dr. Roselyn F. Paelmo, Assistant Professor, UPLB-College of Agriculture)	
1:00—1:15	Conservation Farming Village: An Approach for Extending Sloping Land Management for Productivity and Climate Resiliency <i>ReX Victor O. Cruz, Catherine C. de Luna, Wilfredo M. Carandang, Genevieve A. Galapia, Via Carandang and Dixon Gevana</i> University of the Philippines Los Banos, College, Laguna, Philippines
1:15—1:30	Mitigating and Adapting to Climate Change Through Sustainable Aquaforestry in San Jose, Occidental Mindoro, Philippines <i>Nelson A. Orfiano, Arnold N. Venturina and Susanita G. Lumbo</i> Occidental Mindoro State College, San Jose, Occidental Mindoro, Philippines
1:30—1:45	Roles of Agroforestry in Livelihood Development: A Case Study of Tai Ethnic Group in Nahinboun Village, Thathom District, Saisomboun Province, Lao PDR <i>Anoulom Vilayphone and Visien Sihaphanh</i> National University of Laos, Vientiane, Lao PDR
1:45—2:00	Sustainability Level of Selected Upland Farming Communities in the Philippines Using Community Capitals Framework <i>Leila D. Landicho, Josefina T. Dizon, Agnes C. Rola, Maria Ana T. Quimbo and Rowena DT. Bacongus</i> University of the Philippines Los Banos, College, Laguna, Philippines
2:00—2:15	Participatory Agroforestry Development in the Central Highlands of Vietnam: Practices and Lessons Learned <i>Vo Hung, Tay Nguyen University, Buonmathuat City, Vietnam</i>
2:15—2:30	OPEN FORUM/DISCUSSION
2:30—2:45	Ecosystem Services of Coffee-Based Agroforestry: Role of Earthworm and Litter Against Soil Hydrological Function <i>Rosyda Priyadarshini, K. Hairiah and J.B. Baon</i> University of Pembangunan Nasional Veteran Jawa Timur, Indonesia
2:45—3:00	Evaluating the Contributions of Community-Based Resource Management Project as a Management Strategy for Upland Development in Barangay Usmad, Argao, Cebu, Philippines <i>Archiebald Baltazar B. Malaki</i> Cebu Technological University, Argao, Cebu, Philippines

SCHEDULE	ACTIVITY
3:00—3:15	Assessment of Ecosystem Services of Agroforestry Systems in Selected Community-Based Forest Management Areas in Laguna, Philippines <i>Engelbert delos Reyes Lalican</i> <i>Forestry and Environment Research Division-PCAARRD, Los Banos, Laguna, Philippines</i>
3:15—3:30	Conservation Agriculture with Trees for Sustainable Crop Production Intensification in the Uplands Amidst Climate Change <i>Agustin R. Mercado, Jr., Rodel D. Lasco and Manuel Reyes</i> <i>World Agroforestry Centre (ICRAF), Claveria, Philippines</i>
3:30—3:45	Traditional Agroforestry Rattan Gardens As An Alternative for Rehabilitation of Tropical Forest Areas <i>Prof. Dr. Yudi Firmanul Arifin</i> <i>University of Lambung Mangkurat, Indonesia</i>
3:45—4:00	Ecological Services of Agroforestry Systems in Selected Watershed Areas in the Philippines and Indonesia: Implications Towards Developing Resilient Farming Communities <i>Romnick S. Baliton, Christine L. Wulandari, Leila D. Landicho, Rowena Esperanza D. Cabahug, Roselyn F. Paelmo,, Reynaldo A. Comia and Roberto G. Visco</i> <i>University of the Philippines Los Banos, College, Laguna, Philippines</i>
4:00—4:15	OPEN FORUM/DISCUSSION
SESSION 2. AGROFORESTRY FOR SUSTAINABLE LAND MANAGEMENT <i>(Session Chair: Dr. Reynaldo A. Comia, Director-Institute of Agroforestry, UPLB)</i>	
1:00—1:15	Potentials of Giant Bamboo (<i>Dendrocalamus asper</i>) in Soil Conservation of Agroforestry Farms <i>Rico A. Marin, George R. Puno, Angele Grace Toledo-Bruno and Scarlet Wyne Dumago</i> <i>Central Mindanao University, Musuan, Bukidnon, Philippines</i>
1:15—1:30	Health Status of Community Forests Planting Through Agroforestry System in Lampung Provinces <i>Rahmat Safel, Christine Wulandari, Hari Kaskoyo, Irwan Sukri Banuwa, and Yayan Ruchyansyah</i> <i>Lampung University, Lampung, Indonesia</i>
1:30-1:45	Rehabilitation of Protection Forest through Social Forestry-Based Agroforestry in South Kalimantan, Indonesia <i>Mahrus Aryadi, Hamdani Fauzi and Trisnu Satriadi</i> <i>University of Lambung Mangkurat, Indonesia</i>

CALLAGDAO AGROFORESTRY: A SUSTAINABLE STRATEGY FOR FOOD SUFFICIENCY AND ENVIRONMENTAL SECURITY

Bayon A., Bayongan L and EV Barcellano
Kalinga State University, Tabuk, Kalinga, Philippines

The practice of agroforestry in Kalinga Province, Philippines is a tradition that has been passed from generations to generations and has become a way of life to the people of Kalinga. The Callagdao agroforestry farm represents various crop combinations of farm enterprise, cropping system, livestock, fisheries, forestry, poultry and the resources available to the farmers farm. The Agroforestry components interacted without dislocating the ecological and socio-economic balance while attempting to make a profit or provide food for the farmer and the farmer’s family. The Agroforestry project has an approximate land area of 3.60 hectares situated in Sitio Manzanita, Ipil, Tabuk City, Kalinga that used to be denuded and marginalized grassland area. With the passion and love for nature of the owners, this area was transformed to an integrated fruit-tree based agroforestry farm that started in 2007. After 8-years of operation, significant developments in the farm have been observed. . The soils have become fertile, the biodiversity of soil flora and fauna has increased increased and the project contributed in global sequestration of carbon emissions. Various forest tree species like rambutan (*Nephelium lappaceum*), guyabano (*Annona muricata*), mango (*Mangifera indica*), cacao (*Theobroma cacao*), oranges (*Citrus spp*), jackfruit (*Artocarpus heterophyllus*), kalamansi (*Citrus microcarpa*), coconut (*Cocus nucifera*) while narra (*Pterocarpus indica*) trees and other species are planted along the periphery of the farmers’ farms that served as live fence and boundary plants while *Carica papaya*, *Musa sapientum*, and other fruit species and agronomic crops like *Phaseolus lunatus*, *Vigna unguiculata*, *Phaseolus vulgaris*, *Zea maize* and other species are planted in the farm. The low lying areas in the farm are cultivated with rice (*Orayza sativa*) where water is being supplied from the check dams within the area. The dams are also maintained as fish pond, swimming pool for the duckery and cattle. The products in the farm are all organically produced. Compatible agronomic crops with the higher story plants are also raised underground and served as other source of income and the vitamins and minerals daily source of the farmers. Cattle and small ruminants are also raised by the farmers in semi-confinement and cut-and-carry methods of feeding as another source of income and the protein source of the farmers’ family.

Keywords: Agroforestry system, biodiversity, poverty alleviation, carbon

POSTER PAPER PRESENTATION

RONQUILLO FARM: A LOWLAND AGROFORESTRY STRATEGY FOR FOOD SECURITY AND ENVIRONMENTAL SUSTAINABILITY

Mendoza, JD, Da Jose ML, Diampoc RM, Mendoza EM, Casticon AMC, Fernandez SMG and EV Barcellano

¹Faculty members, Isabela State University, Roxas, Isabela

²Faculty member, Kalinga State University, Tabuk City, Kalinga

The Ronquillo farm in Simmimbaan, Roxas, Isabela is a form of Lowland Agroforestry system that started in 2006. It has an approximate land area of about 12.00 hectares with rolling and gently sloping site. The farm is enclosed with live post fence of mahogany (*Switenia macrophylla*) and Madre de cacao (*Gliricidia sepium*). The marginal grassland farm area was transformed by planting native/carabao mango (*Mangifera indica*) and intercropped with leguminous cash crops such as mungo (*Vigna radiata*), upland rice (*Oryza sativa*) and corn (*Zea maize*) and various vegetable species. The low lying part of the farm was converted to organic rice production. The water requirement of the rice field is supplied from the developed reservoir *cum* fish pond area in the upper portion of the farm. The dikes of the rice field and the fishpond area are maximized by planting organically produced dragon fruit (*Hylocereus undatus*) that supplied the fruit requirement of the local market of Roxas, Isabela. Through the years of operation, the outcome showed that there was a significant development of the farm. The soils have become fertile, increased biodiversity particularly on bird species, improved the micro-environment and also served as a carbon sink within the area. Organic fertilizers are applied in all the crops which are taken from the local market to augment the farm organic fertilizer production. The farm served as leisure of the owner that provides sustainable source of vitamins and minerals of the family and also served as other source of income of the family.

Keywords: Lowland Agroforestry, biodiversity, organic fertilizer, carbon sink.

SCHEDULE	ACTIVITY
1:45-2:00	Performance of mustard (<i>Brassica junce</i> L) in Between Three Month-Old Guyabano Plantation As Affected by Spacing <i>Orlando P. Almoite and Melanie Costales</i> <i>Don Mariano Marcos Memorial State University, Bacnotan, La Union, Philippines</i>
2:00—2:15	Efficiency of Industrial Plants with Macadamia Intercropping in the Central Highlands of Vietnam <i>Tran Trung Dzung, Tuyet Hoa Nie Kdam, Phan Van Truong and Nguyen Thanh Phuong</i> <i>Tay Nguyen University, Buon Ma Thuot City, Vietnam</i>
2:15—2:30	OPEN FORUM/DISCUSSION
2:30—2:45	Agrobiodiversity and Carbon Stock Assessment of Agroforestry Systems in Selected Community-Based Forest Management sites in Kalinga, Philippines <i>Clemecia, H., EV Barcellano, RJ Padre, SF Malao and MTJ Silang</i> <i>Kalinga State College, Tabuk, Kaling, Philippines</i>
2:45—3:00	Rubber-Based Agroforestry of CPSU Kabankalan City, Negros Island Region <i>Maryann Dagunan, Reynaldo Tababa, Gregorio Predo, Dominic Billen and Mae Flor Posadas</i> <i>Central Philippines State University, Kabanaklan City, Philippines</i>
3:00—3:15	Potential of Microbial Isolates for Growth of Agroforestry Crops in Selected Farms in CALABARZON, Philippines <i>Nelson M. Pampolina, J.A. Anarna, D.M. Manalo, J.K. Argayoso and M.U. Garcia</i> <i>University of the Philippines Los Banos, College, Laguna, Philippines</i>
3:15—3:30	Analysis of Hydrological Function Caused by Land Cover Changes at Sumber Brnias Sub-Watershed <i>Bakti Wisnu Widjajani, Rossyda Priyadarshini, Amir Hamzah</i> <i>University of Pembangunan Nasional Veteran, Jawa Timur, Indonesia</i>
3:30—3:45	Evaluation of Arabica Coffee Varieties for Organic Production Under Piine-Based Agroforestry Systems at BSU, La Trinidad, Benguet, Philippines <i>Valentino L. Macanes, Von Y. Amaddo and Loida Malucay</i> <i>Benguet State University, La Trinidad, Benguet, Philippines</i>
3:45—4:00	Growth Rate of Clonal Colonies of Paco Fern (<i>Diplazium esculentum</i>) Grown Under Varied Light Conditions <i>Reynaldo Tababa, Maryann Dagunan, Gregorio Predo, Neil Ferrer and Mae Flor Posadas</i> <i>Central Philippines State University, Kabankalan City, Negros Occidental, Philippines</i>
4:00—4:15	OPEN FORUM/DISCUSSION

SCHEDULE	ACTIVITY
SESSION 3. EMERGING POLICIES AND PROGRAMS IN AGROFORESTRY DEVELOPMENT AND PROMOTION <i>(Session Chair: Dr. Roberto G. Visco, Professor, Institute of Renewable Natural Resources, University of the Philippines Los Banos)</i>	
1:00—1:15	Enhancing the LGU Capacity to Implement Conservation Farming Villages as a Strategy for Climate Change Adaptation and Upland Development <i>Catherine C. de Luna, Wilfredo M. Carandang, Vida Q. Carandang, Nathaniel F. Dimog, Antonio P. Payonga, Santiago B. Utzurum, Jr., Danilo B. Pacoy, Genevieve A. Galapia and Rex Victor Cruz</i> <i>University of the Philippines Los Banos, College, Laguna, Philippines</i>
1:15-1:30	Holistic Transformation for Effective Management of the Bororo Watershed in the Philippines <i>Vida Q. Carandang, Rex Victor O. Cruz, Wilfredo M. Carandang and Catherine c. de Luna</i> <i>University of the Philippines Los Banos, College, Laguna</i>
1:30—1:45	Women on Watershed: Its Role in Conservation and Protection of the Ecosystem Through Agroforestry Approach <i>Dr. Ma. Eugenita C. Capaciete</i> <i>Iloilo Science and Technology University, Iloilo, Philippines</i>
1:45-2:00	How Trust Influence Social Capital to Support Collective Action in Agroforestry Management <i>Rommy Qurniati, Indra Gumay Febryano, Pitojo Budiono</i> <i>Lampung University, Lampung, Indonesia</i>
2:15—2:30	Knowledge, Attitudes, Perceptions of Smallholders on Climate Change and Agroforestry and Its Impacts on Adaptation Practice: A Case Study of Farmers in Penablanca, Cagayan <i>Regine Joy P. Evangelista, Amy Christine Cruz and Rodel D. Lasco</i> <i>World Agroforestry Centre, College, Laguna, Philippines</i>
2:30—2:45	OPEN FORUM/DISCUSSION
2:45—3:00	PEACE-UDP: An Agroforestry Extension Program for Settlers within the Land Reservation of West Visayas State University, Iloilo, Philippines <i>Joel A. Araquil, Eleodoro L. Alicante, Nanette S. Alicante and Jelly A. Brillion</i> <i>West Visayas State University, Lambunao, Iloilo, Philippines</i>
3:00—3:15	Strengthening Local Agroforestry Policy Towards Food Security in the Communities Around Marga Forest in Lampung Province <i>Christine Wulandari, Mahrus Aryadi, Eny Puspasar, and Surnani Widyanstitu</i> <i>Lampung University, Lampung, Indonesia</i>

VDK FARM: A DIVERSIFIED SUSTAINABLE AGRI-FISHERY-LIVESTOCK TECHNOLOGY FOR FOOD SECURITY AND ECOLOGICAL PRODUCTIVITY

Casticon, IS, Domingo EDC, Mendoza, JD, Casticon, AMC, Mendoza EM, Diampoc RM, Baniqued, RV and EV Barcellano

¹Superintendent, TESDA, Ilagan City, Isabela; ²Assistant Municipal Agriculturist, LGU, Mallig, Isabela, ³Isabela State University, Roxas, Isabela; ⁴Farmer owner, VDK Farm, Mallig, Isabela; ⁵Kalinga State University, Tabuk City, Kalinga

VDK Farm was established in 2010 and is located in Centro 2, Mallig, Isabela with a total land area of 3.70 hectares. The VDK farm used to be idle and marginal lowland grassland area. The farm owner constructed an organic and environment-friendly piggery composed of 18 pigpens with a capacity of 15 heads per pen, a fish pond, duckery and native chicken *cum* balot production, lowland rice field, Meat shop, Rice and Corn mill, vegetable and fruit production, goat and cattle production in a semi-confinement and cut-and-carry production technology system. The farm has a potable free flowing source of water that irrigates the rice fields, supply the water requirements of the fishponds, piggery, duckery, and other components of the farm. The piggery has 300 heads for fattening and are raised freely in the pigpens with beds made of 1-meter thick of Carbonated Rice Hull (CRH), making the piggery an odorless and free from flies due to the organically produced fermented fruit and vegetable juice sprayed over the pigpens, poultry, cow and goat areas. The garbage produced from the operation of the Rice and Corn Mill is directly converted to CRH for the sustainable supply of organic beddings of the animals. The used pigpen beddings are harvested and applied as organic fertilizer for the plants raised in the farm. The piggery and poultry are the constant sources of the meat, fresh eggs and balot with a regular daily supply of 4-heads butchered pigs in the meat shop. The farmer-owner acknowledged that the farm contributed much to the income of the family and as constant sources of protein and minerals.

Keywords: Diversified farming, Agri-fishery-livestock technology, ecological productivity

POSTER PAPER PRESENTATION

DOMESTIC USES OF INTOXICATING YAM (*Dioscorea hispida*)

Dominic L. Billen, Richmark Degala, Maryann S. Daganan and Franklin S Piad
Central Philippines State University, Kabankalan City, Negros Occidental, Philippines

A study on the domestic uses and indigenous methods of preparation of intoxicating yam (*Dioscorea hispida*) was conducted in Central Philippines State University Kabankalan City, Philippines to highlight the uses and processes involved in its preparation. Personal interviews were done with respondents who have first-hand knowledge of its uses and preparation. Plant population density was computed to determine the distribution of *D. hispida* in the study site. Flow charts were used to present the step-by-step processes employed in the preparation of the intoxicating yam. Study shows that *Dioscorea hispida* is well-distributed in the study site. It grows profusely in relatively undisturbed areas particularly under partial canopy of trees. Its economic uses include food, medicine and botanical pesticide. In food preparation, two distinct methods of toxin extraction were documented. The plant, applied alone or in tandem with tobacco (*Nicotiana tabacum*) leaves is used to treat scrotal myiasis in carabaos. Juice extracted from the plant mixed with kerosene and laundry detergent is used as botanical pesticide to eliminate pests in rice. Recommendations are directed at cultivating the crop and harnessing its potential as food source, determine other ways of preparing it as food, and design mechanized approach in toxin removal.

\Keywords: Intoxicating yam, kayos, *Dioscorea hispida*, indigenous food crop

SCHEDULE	ACTIVITY
3:15 –3:30	Agroforestry for Resilient Recovery of Vulnerable Upland Farming Families in the Bufferzones of Mt. Masaraga Watershed, Philippines <i>Alberto B. Gonzales</i> <i>Bicol University College of Agriculture and Forestry, Guinabatan, Albay, Philippines</i>
3:30 –3:45	Prescribing the Technical Standards for Climate-Change Adaptation Practices in Pineapple Plantation Projects in Northern Mindanao, Philippines <i>Raoul T. Geollegue and Sabdullah Abubacar</i> <i>Hineleban Foundation, Inc., and Environmental Management Bureau, Cagayan de Oro City, Philippines</i>
3:45—4:00	OPEN FORUM,/DISCUSSION
4:30—6:00 PM	<p>SIDE EVENT: DISTILLING LESSONS IN CAPACITY DEVELOPMENT PROGRAM FOR CLIMATE CHANGE ADAPTATION IN SOUTHEAST ASIA (Moderator: Dr. Leila D. Landicho)</p> <p>Presentations from the SEANAFE national networks:</p> <p>Philippine Agroforestry Education and Research Network Indonesia Network for Agroforestry Education Vietnam Network for Agroforestry Education</p>
6: 30—9:00 PM	<p>WELCOME DINNER/FELLOWSHIP NIGHT</p> <p>CLOSING PROGRAM</p> <p>BRIEFING FOR THE FIELD VISIT</p>
November 29, 2016	FIELD VISIT TO AGROFORESTRY FARMS
	DEPARTURE

AGROFORESTRY TOWARDS SUSTAINABLE AND RESILIENT FARMING COMMUNITIES

Dr. Bao Huy

Faculty of Forestry Resources Management

Tay Nguyen University

This literature review is to show: i) The role of agroforestry in climate change mitigation and adaptation: For mitigation: Carbon sequestration in tree biomass of agroforestry models reaches 25% of total tree aboveground carbon sequestration in evergreen broad-leaf forests (an example of agroforestry model: *Litsea glutinosa* – Cassava in the Central Highlands of Viet Nam); for adaptation: Trees improve water storage and reduce soil evaporation in agroforestry systems, agroforestry improves the land's resiliency and resistance to soil malnutrition, windbreak of agroforestry models using multiple canopy layers protect crops, livestock, wildlife or people from wind's harmful consequences, and a wide diversity of plant species of agroforestry characterizes natural ecosystem, which suffer much less than from pests and diseases than cultivated ecosystems; ii) Agroforestry's potentials in promoting community resiliency under changing market policies: Mono-cultivation systems make unsustainable land use, emissions from deforestation and unstable income; therefore agroforestry helps balance between investments and income sources from agriculture and forestry product variety and support to sustainable land use; iii) Agroforestry for other environmental and social problems: Agroforestry helps decrease expanding cultivation land, reduce impact on forest conversion; provide stable incomes for the poor; maintain stable farming and ensure society security due to avoiding conflicts of land use change. For conclusions: We should apply appropriate approach to develop agroforestry, in particular for the Poor, Ethnic Minority Groups; we need more good practices for agroforestry models for resilient farming in the context of climate, market, society, environment changes; and we should promote new policies on environmental payment for agroforestry landscape services such as carbon sequestration, watershed management, soil conservation.

Keywords: agroforestry, agriculture market, community, climate change

PERFORMANCE OF COWPEA (*Vigna inguculata* L) AS ALLEY CROP ON ESTABLISHED CALAMANSI AS AFFECTED BY ORGANIC FERTILIZERS

Orlando P. Almoite and Winnielyn C. Palabay

Don Mariano Marcos Memorial State University, Bacnotan, La Union, Philippines

Intercropping is one of the most practical ways of maximizing the use of land. Legumes as intercrop help improve the fertility of the soil. Organic fertilizers differ from chemical fertilizers by providing the nutrients needed by the plants while adding organic materials in the soil. This study was conducted to determine the yield performance of cowpea as alley crop on established calamansi as affected by different organic fertilizers. The study was laid out following the Randomized Complete Block Designed (RCBD) with four treatment and four blocks. The treatments were as follows: T_0 = control, T_1 = chicken manure tea, T_2 = cattle manure tea and T_3 = goat manure tea. Result revealed that the cowpea plants performed comparably in terms of plant height at 30 DAP, number of green pods per hill, total green pod and the derived net income per hectare, total weight of marketable and non-marketable pods and marketable pods per not fertilized by such manure teas, and benefit cost ratio analysis was observed from chicken manure tea.

Keywords: intercropping; cowpea; calamansi; alley crop; organic fertilizers; manure tea

AGROFORESTRY AND SMALL RUMINANT PRODUCTION: THE EXPERIENCE OF AGUSAN DEL SUR STATE COLLEGE OF AGRICULTURE AND TECHNOLOGY (ASSCAT)

Rodrigo L. Bongolan, Jr., and Madeline R. Bongolan
 Agusan del Sur State College of Agriculture and Technology,
 Bunawan, Agusan del Sur, Philippines

ASSCAT is the agro-industrial Institution of Agusan del Sur situated at the north-eastern part of Mindanao, Philippines. The College has an approximate land area of 300 hectares. Majority of the land is planted with plantation crops such as oil palm and newly established coconut, coffee and cacao. Fruit orchards like mangosteen (*Garcinia mangostana*), rambutan (*Nephelium lappaceum*) and lanzones (*Lansium domesticum*) and a secondary growth forest are also cultivated. In addition, the college has integrated livestock production with sheep and goat as the main components. Agroforestry practices were adopted to increase the farm production. Sheep and goat were allowed to graze under fruit orchards and oil palm plantation when paddock's forages are insufficient. Calliandra (*Calliandra calothyrsus*), ipil-ipil (*Leucaena leucocephala*), kakawate (*Gliricidia sepium*) and flamengia (*Flamengia macrophylla*) were fed to animals through "cut and carry" method. Due to these practices, it was observed that there was a significant increase of 50% and 40% on the number of heads of both goats and sheep, respectively. However, 58% percent mortality rate of goat was observed during the initial year of the production. On the other hand, no mortality of sheep was observed. Frequent occurrence of rainfall, insufficient forages and fodders, lack of improve varieties of forages and occurrence of noxious weeds are the problems that significantly affect animal production.

AGROFORESTRY FOR SUSTAINABLE LAND MANAGEMENT

Dr. Wilfredo M. Carandang
 Professor, Institute of Renewable Natural Resources
 College of Forestry and Natural Resources
 University of the Philippines Los Banos

Over the years, agroforestry has proven to be a sustainable form of land use management. Research results and documentation of observation and experiences in the region have indicated that agroforestry has undoubtedly fulfilled its role as a sustainable form of farming across most types of lands, from the physical, biological, and socio-economic perspectives. In the tropics, farming systems in sloping lands are being converted into various agroforestry systems found suitable to the area. There are a number of reasons for this phenomenon. One, agroforestry systems play a critical role in moderating the microclimate. Second, these farming systems are highly effective in soil and water conservation through the provision of permanent cover. Third, they have the capacity to enhance the efficiency of use of rainfall. Fourth, agroforestry systems offer a major pathway for sustainable diversification of farming systems. Fifth, they provide economically viable and environment friendly means to improve soil productivity. Sixth, agroforestry systems have the potential to curb carbon emissions and assimilate carbon. And last but not the least, agroforestry has the ability to conserve/restore biological diversity of an area. Today there are many challenges towards enhanced livelihood and enterprise development in agroforestry. These include among others the conduct of more research on the underground biomass and interactions beneath the soil surface and more studies on the compatibilities of forest tree and agricultural crops. There should be more research and development on product development enhancing value chain of agroforestry. Farmers should be accorded secure land tenure/use conditions, and supportive policy environment. They should be provided access to and knowledge regarding the management of quality tree germplasm. Furthermore, farmers need adequate market information and linkages through product demand and specification, and developing market access (identifying channels and developing linkages with agents). Finally, there should be continuous promotion of agroforestry as a sustainable land use.

Keywords: diversity, sustainable, soil and water conservation, environment-friendly

PLENARY PRESENTATION

AGROFORESTRY DEVELOPMENT IN NORTHWEST VIETNAM — FROM PARTICIPATORY RESEARCH TO POLICY SUPPORT

*Dr. Nguyen La
Agroforestry Specialist
ICRAF-Vietnam*

In Northwest Vietnam, rainfed crop cultivation is dominated by monoculture of maize, upland rice and cassava on sloping lands. The loss of topsoil during the rainy season leads to a reduction in nutrient and crop yield. Farmers have to invest heavily on chemical fertilizers for the maize to remain productive as in the past. Harsh weather conditions also reduce yields or even crop loss and make soil and water conservation more difficult. Agroforestry offers an integrated approach that can secure the livelihoods of rural households while curbing land degradation and deforestation. The “Agroforestry for Livelihoods of Smallholder Farmers in Northwest Vietnam” introduces trees in monocropped landscapes through agroforestry to reduce dependence on annual crops, as well as increase and diversifies incomes from tree products, while also conserving the natural resource base. To promote the agroforestry adoption, the project has been developed at three levels: Participatory Farmer Trials, Farmer Demonstration Trials and Exemplar Landscapes. The scientific knowledge and local knowledge are combined. Incorporating local knowledge in developing options aimed at sustaining and improving agricultural production is usually complementary to what is available scientifically and reveals contrasts among different groups of people in terms of both their needs and knowledge. This approach is primarily based on the classic extension and dissemination theories, but highlights the important elements of collective action and social capital development among farmers, and between extension workers, local governments and researchers. The result was found useful in demonstrating farmer adoption of agroforestry under varying contexts and supports local government on define strategy development thought policy.

Keywords: participatory farmer trials, farmer demonstration, exemplar landscapes, collective action

CONCURRENT PAPER PRESENTATION

Emerging Policies and Programs in Agroforestry Development and Promotion

PRESCRIBING THE TECHNICAL STANDARDS FOR CLIMATE CHANGE ADAPTATION PRACTICES IN PINEAPPLE PLANTATION PROJECTS IN NORTHERN MINDANAO, PHILIPPINES

*Raoul T. Geollegue and Sabdullah Abubacar
Hineleban Foundation, Inc and Environmental Management*

Amid climate change, the Philippines requires a more resilient agricultural production systems that is better able to resist extreme weather disturbances and guarantee human and food security. On this pretext, the Philippine government passed the following: Climate Change Act of 2009 (Republic Act 9729); Philippine Disaster Risk Reduction And Management Act of 2010 (Republic Act No. 10121) and National Climate Change Action Plan (2011). Pursuant to the bold mandates of the above laws, the Environmental Management Bureau (EMB) of the DENR issued Memorandum Circular 2011-005, incorporating Disaster Risk Reduction (DRR) and Climate-Change Adaptation (CCA) concerns in the Philippine Environmental Impact Statement (EIS) System. The said circular provides the Technical Guidelines for adoption in the conduct of Environmental Impact Assessment (EIA) for projects requiring Environmental Compliance Certificates (ECC) prior to project implementation. But after a cursory review it was determined that MC 2011-005 is wanting of technical details to guide its application at the farm level especially for agricultural plantation projects. This prompted the preparation of this supplemental guidelines to MC 2011-005. This supplemental guideline is a product of a series of workshops that gathered a balanced representation of experts and stakeholders from the banana and pineapple growers industry, academe, NGOs, Civil Society in organized in partnership with the EMB of Region 10 and the Office of the Presidential Adviser for Environmental Protection (OPAEP). The guidelines provide the technical details for climate-proofing agro-ecosystems, particularly pineapple plantation projects to climatic extremes and variability, without losing sight of the need of plantation growers to manage their plantation crops in an economically and environmentally sustainable manner.

Keywords: DENR Memorandum Circular 2011-005, climate change-adaptive guidelines for growing pineapple

CONCURRENT PAPER PRESENTATION

Emerging Policies and Programs in Agroforestry Development and Promotion

AGROFORESTRY FOR RESILIENT RECOVERY OF VULNERABLE UPLAND FARMING FAMILIES IN THE BUFFERZONES OF MT. MASARAGA WATERSHED, PHILIPPINES

Alberto B. Gonzales

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Mt. Masaraga Watershed in Albay Province, Philippines plays an important role in the maintenance of ecological balance and provision of livelihood opportunities to bufferzone communities populated by marginalized farmers. For its viability as a biologically diverse watershed for socio-economic and ecological uplift, an Action Cum Research undertaking, with external funding support from Heifer International, was implemented from 2011 to 2013 dubbed as VALUES-BASED DEVELOPMENT ALTERNATIVES FOR THE WELFARE OF THE NEEDY (V-DAWN) Project, involving 106 participating families. This project integrates agrosilvipastoral system as the main production technology. Project results in terms of deep level, ground level and external outcomes/impacts were encouraging. Majority (80%) of the partner families enhanced values, attitudes and practices through internalization of Cornerstones Principles of "PASSING ON THE GIFTS"; all (100%) farms were enhanced through adoption of agrosilvipastoral farming systems and environmental services of these farms were enriched; a little more than half (55%) had increased income by 35% after 2 years; agroforestry farms had carbon density of 558.15kg. per hectare and contributed to improved environmental services; and majority (78%) had improved health, nutrition and sanitation of children 0-3 years old. Likewise, participating families and community had increased knowledge on preparedness and resiliency against disasters through community managed disaster risk reduction/climate change mitigations and adaptations. Lessons learned were summarized into sixteen (16) social technologies packaged as Project's Good Practices which were adopted by other community engagements of the University and Other Local Government Units. Building family resiliency is not just helping families attain food and income sufficiency, nor reducing vulnerability and building capacity to attain resiliency, as revealed by the 1st level of project outcomes. There is a need to upscale the farmers' sufficiency/resiliency to easily recover from economic shocks and disasters by building their capacities as agroforestry farmer entrepreneurs.

Keywords: values-based, holistic community development; cornerstone principles, agroforestry, community-managed enterprises

CONCURRENT PAPER PRESENTATION

Agroforestry Towards Sustainable and Resilient Farming Communities

CONSERVATION FARMING VILLAGE: A METHODOLOGY FOR EXTENDING SLOPING LAND MANAGEMENT FOR PRODUCTIVITY AND CLIMATE RESILIENCY

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The Conservation Farming Village (CFV) is a modality of transforming traditional upland farming systems into sustainable upland production systems that will not only address upland degradation but will also stimulate upland community's resilience to climate change. It helps upland farmers improve their economic conditions by strengthening their capacities to manage the natural resources, thereby protecting their communities from environmental degradation while sustaining their sources of livelihood. CFV is being implemented across the Philippines in five areas representing five different biogeophysical and social-economic-cultural environment. The program includes the empowerment of farmer-volunteers enabling them to become the vanguards of sloping land resources by providing them with skills and knowledge in food, wood and fiber production and resource management; tapping the active leadership and participation of the local government units (municipal, barangay) in carrying out program activities down to the barangay level such as extension work, community organizing, and facilitating market linkages and other support services; and provision of technical expertise and guidance of a state university/college in the province or nearest the site. Farmers now have diverse sources of income. Increased farm productivity has likewise been observed because of the practice of agroforestry. This program has likewise promoted soil and water conservation, which minimized the use of inorganic fertilizers. The shift from collecting resources from the forest to tilling and making productive lands has eased the pressure on the forest. The forest is now valued as a shelter against extreme events and not as a resource to be depleted. The ability of the FVs to adapt to climate changes is brought about by the improvement of their land management practices. The shift from monocropping to diversified and scheduled planting brings about different products at different times of the year, making the farmers self-sufficient.

Keywords: conservation farming village, sloping land management, agroforestry, natural resources management, climate change adaptation strategy

CONCURRENT PAPER PRESENTATION

Agroforestry Towards Sustainable and Resilient Farming Communities

MITIGATING AND ADAPTING TO CLIMATE CHANGE IMPACTS THROUGH THE SUSTAINABLE AQUAFORESTRY IN SAN JOSE, OCCIDENTAL MINDORO, PHILIPPINES

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Ansiray is one of the 11 coastal barangays of Ilin Island in San Jose, Occidental Mindoro that is vulnerable to typhoons and tropical storms. Occidental Mindoro State College (OMSC) with funds provided by the Bureau of Fisheries and Aquatic Resources Region IV-B (BFAR IV-B) established the aquaforestry project to make Ansiray a resilient barangay. Aquaforestry is an agroforestry technology that deals with coastal environment. It has three components, namely: mangroves (*Rhizophora* species) as long-term crop, fishes (*Siganid* species) as medium-term crop, and crab as short-term crop. Their mutual relationships dictate the sustainability of this technology. The mangrove zonation is aimed at achieving higher survival of 183,000 mangrove propagules. *Rhizophora* species were planted in all abandoned fishponds. Mangrove rehabilitation included construction of eight fish cages that serve as the locals' additional source of livelihood. The livelihood component of the project is manned by eight leaders, each with four to six members. Each cage, which occupies an area of at least 600 square meters is integrated with "samara/kitang" (*Siganus guttatus*) and crab/"bulik" (*Scylla serrata*). The OMSC provided the start-up capital for the short-term crop. Management of the project is not costly. The fishes being herbivore require less commercial feeds while the crab feeds on shells and mangrove litters. To date, the aquaforestry project is on its second cycle of operation. It has become an additional source of food and income for Barangay Ansiray.

Keywords: aquaforestry, mangrove, mitigation, adaptation, resiliency

CONCURRENT PAPER PRESENTATION

Emerging Policies and Programs in Agroforestry Development and Promotion

WOMEN ON WATERSHED (WOW): ITS ROLE IN CONSERVATION AND PROTECTION OF THE ECOSYSTEM THROUGH AGROFORESTRY

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Tons of eroded soil every year that cause siltation and threatens the ecosystem of our downstream bodies of water are direct and reflective evidence that watershed areas are becoming unstable. This paper focuses on the issues brought about by exploitation due to increasing social pressure to fragile watershed areas invaded by improper farming practices and exposing its vulnerability to degradation that reduced its capacity to provide ecological services to the biological community. Rapid Rural System Appraisal (RRSA), a demographic survey was employed to establish benchmark and to give comprehensive data analysis as basis in delivering strategic development intervention. Strategic development approaches were conducted which included designing agroforestry approach that conformed with the local culture, capacity building, technological skills, marketing skills, entrepreneurship and women empowerment. The present practice of women in the local community is sustainable by producing organically grown crops and animals for human consumption while maintaining and conserving the wild species of flora and fauna in the watershed areas. Most of the empowered women participate effectively in the management process and in the protection of the natural resources. It is highly recommended that more sustainable agroforestry approaches be provided to the biological component of the ecosystem.

Keywords: agroforestry, conservation, ecosystem, protection, watersheds and women empowerment

CONCURRENT PAPER PRESENTATION

Emerging Policies and Programs in Agroforestry Development and Promotion

PEACE-UDP: AN AGROFORESTRY EXTENSION PROGRAM FOR SETTLERS WITHIN THE LAND RESERVATION OF WEST VISAYAS STATE UNIVERSITY, ILOILO, PHILIPPINES

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To solve the long-standing conflict between the school and the settlers who occupy large portion of the land reservation of the College of Agriculture and Forestry of the University at Lambunao, Iloilo, Philippines, the PEACE-UDP program was initiated. This agroforestry extension program with research component was designed to integrate the settlers in the school developmental activities and turned them into-farmer cooperators for the mutual benefit of the squatters and the school. The slash-and burn farming activities of the settlers in the past resulted to massive forest denudation. But following the program, the settlers were organized and given technical and material assistance especially in terms of high-value fruit trees and forest trees such as durian, rambutan, lanzones, mangosteen and mahogany with the implementation of the DBP Forest Project. Baseline studies on the socio-economic status of settlers and the bio-physical characterization of the area were carried out to serve as benchmark for evaluation research that will be undertaken once the program is in full swing. Started in 2007, initial observation showed that forest cover was restored in many of the once denuded area and wildlife started to return. Fruit trees are also starting to bear fruits with positive impact on the economic life of the farmer-cooperators.

Keywords: PEACE-UDP, DBP Forest, agroforestry, socioeconomic, biophysical, land Reservation

CONCURRENT PAPER PRESENTATION

Agroforestry Towards Sustainable and Resilient Farming Communities

ROLES OF AGROFORESTRY IN LIVELIHOOD DEVELOPMENT: A CASE STUDY OF TAI ETHNIC GROUP IN NAHINBOUN VILLAGE, THATHOM DISTRICT, SAISOMBOUN PROVINCE, LAO PDR

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Agroforestry plays a significant role in livelihood development in areas where land is scarce and labor is limited. This study was conducted in a newly-relocated remote village of Thathom District, Saisomboun Province. This village was resettled from a dam construction affected area. The study is related to a livelihood program which was developed to support this village and financed by the dam construction company. The aim of the program was to support livelihoods of the villagers by involving them in communal agroforestry practices that generates income, and at the same time, minimizing pressure on land use. Three agroforestry initiatives were introduced including (i) mulberry cultivation for silk production, (ii) pigeon pea cultivation for lac production, and (iii) nepia grass cultivation for livestock raising to support short-term, medium-term and long-term income generation, respectively. . The agroforestry trail plots were carried out in a total land area of 5 hectares; of which three hectares were allocated for nepia grass cultivation, and one hectare each for mulberry and pigeon pea cultivation. This paper discusses important roles of the three agroforestry initiatives that helped reduce pressure on land use while addressing livelihoods challenges and improved income and well-being of the villagers.

Keywords: agroforestry, income generation, livelihood

CONCURRENT PAPER PRESENTATION

Agroforestry Towards Sustainable and Resilient Farming Communities

SUSTAINABILITY LEVEL OF SELECTED UPLAND FARMING COMMUNITIES IN THE PHILIPPINES USING COMMUNITY CAPITALS FRAMEWORK

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This article argues that sustainability of the upland farming communities does not rely solely on the development pathways that were undertaken by the upland farmers. The institutional mechanisms also contribute towards sustainable upland farming communities. This argument is based on the study conducted in the three pilot upland farming communities of the Conservation Farming Villages program in Albay, Ifugao and Negros Oriental, Philippines. From seven focus group discussions (FGDs) with at least 12 participants per FGD for a total of 147 farmers, and farm household survey of 230 upland farmers, research results indicate that there were five development pathways that were undertaken by the upland farmers. These include monocropping in contour, multiple cropping in contour, agroforestry, agroforestry with non-farm activities, and multiple cropping/monocropping without contour. Analysis indicated that the five development pathways contributed to a high level of social, human and political capitals having mean scores of 0.73, 0.55 and 0.54, respectively; a moderate level of physical, financial and natural capital, with mean scores of 0.23, 0.20 and 0.23, respectively; and a very low level of cultural capital with mean score of -0.08. At the community level, on the other hand, research results revealed that the CFV sites in Ligao, Albay and La Libertad, Negros Oriental have almost similar contributions to the sustainability of the upland farming communities, while Alfonso Lista, Ifugao had the lowest. Thus, institutional arrangements with the farmers' association and the local government units also played a key role in the sustainability of the upland farming communities. These results imply the need for a holistic and collaborative engagement towards attaining sustainable upland farming communities.

Keywords: *institutional arrangements, agroforestry, community capitals, Conservation Farming Villages*

CONCURRENT PAPER PRESENTATION

Emerging Policies and Programs in Agroforestry Development and Promotion

KNOWLEDGE, ATTITUDES, PERCEPTIONS OF SMALLHOLDERS ON CLIMATE CHANGE AND AGROFORESTRY AND ITS IMPACTS ON ADAPTATION PRACTICE: A CASE STUDY OF FARMERS IN PENABLANCA, CAGAYAN, PHILIPPINES

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Climate change threatens to derail the lives and livelihoods of farmers all over the world if appropriate adaptation measures are not put in place. Smallholder farmers, more so those in developing countries like the Philippines, are especially at risk because of inherent socio-economic characteristic and environmental factors limiting their capacity to adapt. One adaptation measure that can potentially benefit smallholder farmers is agroforestry. However, limited understanding, incorrect information and a negative mindset could hinder the successful adoption of this practice. The case study of smallholder farmers in Peñablanca, Cagayan, Philippines attempts to explain the farmers' adaptation practices by analyzing their knowledge and attitudes on climate change and agroforestry. The results show that most farmers are aware of the basic concepts of climate change and agroforestry, specifically the impacts of climate extremes on their farms and the benefits of agroforestry. However, this may not always translate to correct practice of agroforestry and other adaptation measures. It is recommended that information, education, and communication programs on climate change and agroforestry for farmers should present targeted information on impacts and adaptation in a way that is relatable and understandable to them.

Keywords: adaptation practices, climate change impacts, agroforestry, smallholder farmers

CONCURRENT PAPER PRESENTATION

Emerging Policies and Programs in Agroforestry Development and Promotion

HOW TRUST INFLUENCE SOCIAL CAPITAL TO SUPPORT COLLECTIVE ACTION IN AGROFORESTRY MANAGEMENT?

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Trust is an important factor in strengthening social capital. Many communities have been successful through their collective action in small-scale of agroforestry. However, it was challenging to note that some communities have low levels of social capital. This study analyzed and explained how trust influence social capital to encourage collective action in agroforestry management. The study took place in two villages surrounding state forest. The areas were selected based on disparities of sea level of villages. The methods used were structured interviews and in-depth interview with farmer group members who manage agroforestry. The study found that trust between farmer group members is high. However, trust as a source of social capital was not propelling collective action since institutional of farmer group is weak. Farmer group does not perform optimally and it can be initiated by increasing group activities, develop norms and networks so social capital would increase through the cooperation and collective action.

Keywords: trust, social capital, collective action, agroforestry, community

CONCURRENT PAPER PRESENTATION

Agroforestry Towards Sustainable and Resilient Farming Communities

ECOSYSTEM SERVICES OF COFFEE-BASED AGROFORESTRY: ROLE OF EARTHWORM AND LITTER ON SOIL HYDROLOGICAL FUNCTION

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Diversity of shade trees on coffee-based agroforestry will affect the amount and quality of organic matter inputs. Organic materials has an important role in maintaining the hydrological functions through improved quantity of soil macropores (directly or indirectly), through the activity of earthworms. This experiment identified and analyzed the relationship between diversity of litter on coffeebased agroforestry and the improvement of soil hydrological services (runoff). This experiment was done by mixing the litter (litter transfer) from various trees which are commonly found in the field, Using factorial randomized block design, two factors, i.e.: (1) the type of coffee plantations (simple shade coffee and complex coffee plantations multistory), and (2) kinds of litter (control, pine, *Gliricidia* sp., coffee + *Gliricidia* sp., Avocado + *Gliricidia* sp., + coffee; coffee + *Gliricidia* sp., + avocado + *Duriano* sp.) as treatments with four replications. Litter diversity did not increase by increasing the quantity of macropores, infiltration and earthworm diversity. But, the density and biomass of earthworm was increased. The density, biomass and diversity of earthworms in simple shade coffee was recorded at 156 m⁻²; 22.09 g m⁻²; with seven species, while 125m²; 32g m² and seven species were recorded in the complex coffee multistorey, The size of each earthworm in the simple shade coffee was 0.12 g, while 0.13 g size of each earthworm was recorded in the coffee multistorey system. The dominant worm species that were found in both types of coffee plantations were, *Pontoscolex corethrurus* (endogeic) and *Peryonix excavatus* (epigeic). Selection of the type of shade trees in coffee plantations to improve hydrological services should pay attention to the quality of the resulting litter. Low quality of litter means a slower decaying process, and therefore, its presence on the ground would be much longer.

Keywords: coffee, agroforestry, litter diversity, earthworm, soil

CONCURRENT PAPER PRESENTATION

Agroforestry Towards Sustainable and Resilient Farming Communities

EVALUATING THE CONTRIBUTIONS OF THE COMMUNITY-BASED RESOURCE MANAGEMENT PROJECT (CBRMP) AS A MANAGEMENT STRATEGY FOR UPLAND COMMUNITY DEVELOPMENT AND FOREST RESTORATION IN BARANGAY USMAD, ARGAO, CEBU, PHILIPPINES

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The Community-based Resource Management Project (CBRMP) in Argao, Cebu was evaluated for its effectiveness in empowering the recipient community and improving the status of the forest resources. A survey was conducted among the project beneficiaries in Brgy. Usmad from January to March 2006 to determine the impacts of the project on beneficiaries household income, level of awareness on the importance of forest resources, their participation in various project activities, condition of the forest and other natural resources and the various problems in implementing the projects and their potential solutions as identified by the respondents. Two groups of respondents were involved in the survey: a) project beneficiaries; and b) project implementers. In situ measurement on the survival and growth of reforestation species and fruit trees in tree plantation and agroforestry farm was also conducted. Results of the study show that the respondents were moderately empowered economically, socially and intellectually but highly empowered politically. Respondents' average monthly household income has increased significantly ($p < 0.00$) by 92% from their income without the project. The beneficiaries were involved in almost all planning and decision-making processes in project implementation, but some decisions were done solely at the municipal level especially on matters involving budgetary allocation. The project has improved the respondents' level of awareness on the environment, which has also led to the improved participation in managing the resources. The project was able to reforest about 98.6% of the target areas. About 70% of the target areas for agroforestry was established as agroforestry farm. Among the fruit trees planted jackfruit had the highest survival rate (68.3%) while mango had the lowest (28.3%). The level of participation was not significantly correlated with the survival rate of planted trees and fruit trees in tree plantation and in agroforestry farms. The mean survival rate in tree plantation obtained from in situ assessment is significantly different ($p < 0.05$) with what is obtained from the interview. Water scarcity and low level of soil fertility were the major problems identified by the respondents. These problems have results to poor growth of planted seedlings and low farm productivity. Observance of the planting season & proper choice of species to be planted are the two very effective solutions they have identified.

Keywords: participation, agroforestry, in situ assessment

CONCURRENT PAPER PRESENTATION

Emerging Policies and Programs in Agroforestry Development and Promotion

STRENGTHENING LOCAL AGROFORESTRY POLICY TOWARDS FOOD SECURITY IN THE COMMUNITIES AROUND MARGA FOREST IN LAMPUNG PROVINCE

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In Indonesia, there is a right forest which is could be individual or customary forest. In Lampung, the two areas referred to "marga" forest since it is located outside of state forest. Generally, structure of the vegetation in "marga" forest consists of various trees species that can be called a forest managed by agroforestry. In West Lampung was known to have "marga" forests that formed as customary forests and also individual forests which are managed by community at surrounding village. Community maintaining their customary forests in order to keep it sustainable with existing customary rules and had received government awards for its maintained sustainability. To meet the daily needs, they take from individual forests. Until now the two forests do not have a legal framework that making it vulnerable to possibilities of changes in land use in the region if the authorized government wanted it. These changes can have an impact on the change of land use from agroforestry into a monoculture plantation and can reduce the food security that has been there. Based on that, the research that was conducted in November-December 2015 is to obtain alternative policies development that can ensure the functions sustainability of the two forests.

Keywords: agroforestry, local policy, marga forest, land use

CONCURRENT PAPER PRESENTATION

Emerging Policies and Programs in Agroforestry Development and Promotion

HOLISTIC TRANSFORMATION FOR EFFECTIVE MANAGEMENT OF THE BARORO WATERSHED IN THE PHILIPPINES

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To promote science-and technology based watershed management in the Philippines, long-term watershed monitoring was initiated in three selected watersheds in 2011 and another 3 watersheds in 2014. This was conducted to fast track the build-up of empirical databases, technologies and other knowledge products related to watershed management in the Philippines. In 2015, the addition of the Baroro Watershed in La Union, Philippines was done to develop the adaptive capacity of local stakeholders to monitor watershed functions for disaster risk reduction and other purposes. An adaptive capacity building program to empower the LGUs, local communities, teachers and students, NGOs and technical personnel of private corporations, other local stakeholders to conduct collaborative and participatory watershed monitoring was conducted. A combination of lectures, workshops, demonstrations, field visits, online learning methods, and experiential learning were also organized. Three training courses designed specifically for 1) LGU personnel and farmers; 2) secondary students and their teachers; and 3) other stakeholders were held. Instruments like Automated Water Level System that is able to monitor water level and the Automated Weather Station able to monitor rainfall, temperature, wind direction and velocity, were installed along the Baroro River. Data are now being transmitted to a server via text every 15 minutes and can be seen at www.philwatershed.org. The engagement of the stakeholders in the actual planning and visioning for Baroro Watershed was instrumental in raising the level of awareness of the stakeholders on the importance of the watershed to their daily lives. In addition, the relevance of monitoring the watershed in generating information and knowledge that are useful in making sound management decisions that will improve the quality of services rendered by the Baroro Watershed has also gained recognition. The activity also united the different stakeholder groups in improving the management of Baroro Watershed and how each of them can actively participate in watershed monitoring and other management activities. It was also seen that the leadership of local executives and local champions i.e., mayor, former mayor, congressman, governor in motivating the local stakeholders to participate is important.

Keywords Science-based watershed management, collaborative management, watershed

CONCURRENT PAPER PRESENTATION

Agroforestry Towards Sustainable and Resilient Farming Communities

ASSESSMENT OF ECOSYSTEM SERVICES OF AGROFORESTRY SYSTEMS IN SELECTED COMMUNITY-BASED FOREST MANAGEMENT (CBFM) AREAS IN LAGUNA, PHILIPPINES

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The study assessed the ecological services of agroforestry systems of CBFM sites in Liliw and Sta. Maria, Laguna focusing on the characterization of agroforestry systems; determination of socio-economic and demographic characteristics of farmers; agroforestry system's agrobiodiversity; soil physical and chemical properties, and carbon stocks; assessment of the effects of ecosystem services provided by agroforestry systems to the socio-economic well-being and resiliency; and formulation of policy recommendations for the implementation of agroforestry practices in the study areas and other agroforestry sites. Results revealed that farmers practiced shelterbelts/windbreaks-cum live trellis system in Liliw., Laguna and multilayer tree gardens in Sta. Maria, Laguna. Agrobiodiversity of agroforestry systems were moderately diverse for members while low diversity was recorded for non-members. Farms had low soil bulk density and erosion rates, with high organic matter, Nitrogen, Phosphorous, and Potassium contents. Carbon stock is low due to the dominance of annual crops in their production systems and young woody perennials. Ecosystem services of agroforestry systems were rated as moderately to highly resilient to climate change impacts across CBFM sites and membership. Practice of agroforestry in CBFM sites; enhancement of socio-economic resiliency and ecosystem services thru agroforestry; and enhancement of the implementation of CBFM were recommended.

Keywords: agroforestry, carbon stock, resiliency, socioeconomic

CONCURRENT PAPER PRESENTATION

Agroforestry Towards Sustainable and Resilient Farming Communities

PARTICIPATORY AGROFORESTRY DEVELOPMENT IN THE CENTRAL HIGHLANDS OF VIETNAM: PRACTICES AND LESSONS LEARNED

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Traditional research and extension for developing agroforestry can perform effectively in the lowlands, where the access of production inputs and support services are favorable. Whereas, because of the difficulties of infrastructure and limited resources in the highlands, traditional extension approach is less effective and less sustainable. From the demand of the extension in Vietnam, a new approach has been developed: "Participatory Agroforestry Development - PAFD". This approach allows local people and stakeholders involved together in research and development of agroforestry. This is an approach associating participatory research with extension, based on real ability, resources and expectation of upland communities to find out new ideas and develop sustainable agroforestry models. PAFD has the following characteristics: (i) agroforestry trails should be new, feasible and easy to disseminate; (ii) in accordance with the conditions and resources of the local people; (iii) combination of local knowledge with scientific knowledge; (iv) aims to improve the capacity of stakeholders to improve production, cultivation in the uplands; (v) experiences, lessons learnt from the process of PAFD should be monitored, records for scaling up purpose. Procedure of PAFD includes 5 main steps: Initiation, implementation, monitoring and documentation, end and evaluation, and dissemination of successful agroforestry techniques. PAFD approach has been developed and applied in the Central Highlands, Vietnam for 15 years by consultancy group of Tay Nguyen University. The group has trained and supported upland farmers and also extensions to develop and disseminate many potential agroforestry models such as "To Nu jackfruit mixed with pineapple on sloping, erosion land", "Cashew mixed with hybrid corn in thin, young dipterocarp forests", "Enrichment of poor dipterocarp forests using teak trees", "Jackfruit – Cayen pineapple on contour lines of sloping land", etc. The success and efficiency of agroforestry models mentioned above in economic, social and environmental aspects reflected feasible, adaptable approach of PAFD in the uplands. Valuable experiences and lesson learned of the process of PAFD have been documented.

Keywords: Agroforestry, participatory, upland, Viet Nam

CONCURRENT PAPER PRESENTATION

Emerging Policies and Programs in Agroforestry Development and Promotion

ENHANCING THE LGU CAPACITY TO IMPLEMENT CONSERVATION FARMING VILLAGES AS A STRATEGY FOR CLIMATE CHANGE ADAPTATION AND UPLAND DEVELOPMENT

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The Conservation Farming Villages (CFV) was implemented to build the capacities of the local government unit executives and their technical personnel to undertake sustainable development related programs and strategies and facilitate adoption and implementation of science and technology-based sloping land management and agroforestry systems to promote sustainable upland development and adapt to climate change variability. In its effort to provide immediate sound technical inputs, and establish a mechanism to sustain the project initiatives, the CFV has engaged in the active participation of the agricultural state colleges and universities, namely: Ifugao State University, Bicol University College of Agriculture and Forestry, Silliman University, University of Southeastern Philippines, and the University of the Philippines Los Banos. The formation of the site management teams allowed for the continuity of the CFV initiatives in the five regional clusters formed. The CFV gains on the provinces of Quezon, Ifugao, Albay, Negros Oriental and Davao Oriental provided the vital foundation for the expansion of the CFV practice in the nearby provinces targeted. Training Needs Assessment (TNA) was conducted to elicit training needs of LGU personnel and farmers. Based on the results of the TNA, five training courses were developed and implemented which were attended by 272 participants. Participants to the training courses had the opportunity to visit previous CFV sites where sloping land management technology, livelihood opportunities and agroforestry systems are showcased. During the visit to the CFV site, farmer-to-farmer training/interaction was made possible; farmer volunteers of the previous project served as resource persons already. This provided the opportunity for the potential farmer volunteers in the APN supported project to appreciate the kind of role they would be playing in the scaling up of CFV in their areas. Eighteen farms have been developed in the 15 provinces where CFV capacity building was implemented.

Keywords: conservation farming village, local government units, agroforestry

CONCURRENT PAPER PRESENTATION

Agroforestry for Sustainable Land Management

GROWTH RATE OF CLONAL COLONIES OF PACO FERN (*Diplazium esculentum*) GROWN UNDER VARIED LIGHT CONDITIONS

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This study was conducted to determine the growth rate, habitat preference, and economic significance of clonal colonies of Paco Fern (*Diplazium esculentum*) grown under varied light conditions. Three different areas within the vicinity of the Central Philippines State University were used as study sites. The areas were geographically located with the following coordinates: 09°51.288'N, 122°53.456'E; 09°51.479'N, 122°53.479'E; and 09°51.306'N, 122°53.436'E representing the fully shaded area inside a forest (700 to 800 lux), partially shaded at a forest edge (6,000 to 7,000 lux) and in open area (2,000 lux). The three study sites shared a common soil type and had similar pH value. Results show that Paco ferns planted under full sunlight exposure performed well in terms of growth and development of new fronds. Poor exposure of Paco ferns to sunlight deterred the plant from maximizing photosynthetic activity during the day which relied only on reflected and ultraviolet light to manufacture food. This impeded the growth and development, and decreased the economic gain that can be derived from the planted ferns.

Keywords: growth rate, paco fern, clonal colonies, light conditions

CONCURRENT PAPER PRESENTATION

Agroforestry Towards Sustainable and Resilient Farming Communities

CONSERVATION AGRICULTURE WITH TREES FOR SUSTAINABLE CROP PRODUCTION INTENSIFICATION IN THE UPLANDS AMIDST CLIMATE CHANGE

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Degraded landscapes are expanding rapidly in Southeast Asia. Through conservation agriculture with trees (CAT), principles and practices of minimal soil disturbance, continuous mulching, pests and nutrients management, species rotations, integration of trees; and rainwater harvesting; and Landcare approach constitute the best 'tool box' for sustainable crop production intensification (SCPI). Interplanting of maize with cowpea relayed with upland rice insured food and nutritional security and better farmers income to smallholders. *Arachis pintoii* grown with maize provided better ground cover protecting soil against erosion, feed for livestock, eliminated herbicides and increased yields. Promising varieties of maize, upland rice, cowpea, forage grasses, forage legumes, sweet potato, cassava, sorghum including "adlai" (Job's tears) were identified out-yielding locally grown varieties in economic and biomass yield which are suitable for CAPS. We also found out the cost effective way of creating rainwater harvesting system through animal built embankment (ABE). Series of ponds can mitigate severe run off during heavy rainfall events by increasing water infiltration thus mitigating flooding. Rainwater harvesting ponds provided an opportunity for farmers to grow fish, ducks and other aquatic animals which enhanced household food and nutritional security while pond water enriched with nutrients can be used to irrigate trees and crops during dry spells. Our research results are extrapolated to other upland areas in the Philippines through the Landcare approach. Through the active participation of farmer groups, local government units (LGU) and technical facilitators which constitute the Landcare approach, we have achieved a rapid and inexpensive method of scaling up technologies in the Philippine uplands and perhaps we will achieve similar success in other areas in Southeast Asia with similar bio-physical and socio-economic environments.

Keywords: Agroforestry, conservation agriculture with trees, climate change, sustainable crop intensification

CONCURRENT PAPER PRESENTATION

Agroforestry Towards Sustainable and Resilient Farming Communities

TRADITIONAL AGROFORESTRY RATTAN GARDENS AS AN ALTERNATIVE FOR REHABILITATION OF TROPICAL FOREST AREAS

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Traditional rattan gardens is one of land use systems in Kalimantan, Indonesia. The area of rattan gardens is the abandoned area after shifting cultivation. There are two types of rattan gardens; `rotan sega`-gardens and `rotan irit`-gardens. The `rotan sega`-garden is divided on two types, namely: temporary rattan garden and permanent rattan garden. `Rotan sega`-gardens is located on ultisol soil, and `rotan irit`-garden is on alluvial soil. This research want to compare kinds of species in both of rattan gardens and in natural forest. This study was based on silvicultural survey in rattan gardens and in natural forest. The areas of rattan garden are normally grown by fast growing pioneer species, rubber and rattan. The role of trees for rattan is very important as climbing trees. Most of rattan sega gardens dominated by *Hevea brasiliensis*, *Vitex pubescens*, *Macaranga* sp., *Artocarpus anisophyllus*, *Pternandra caerulea*, *Buchanania arborescens*, and *Garcinia parvifolia*. Rattan irit-gardens are less species rich than rattan sega gardens. The area of rattan irit gardens is dominated by *Mallostus muticus*, *Syzygium* sp., *Diospyros* sp. and *Cananga odorata*. The succession processes on the traditional rattans are running well to be natural forest. Development of traditional agroforestry rattan gardens is more effective for rehabilitation of natural forest and also improving the income for local people.

Keywords: rattan garden, pioneer species, natural forest, rehabilitation

CONCURRENT PAPER PRESENTATION

Agroforestry for Sustainable Land Management

EVALUATION OF ARABICA COFFEE VARIETIES FOR ORGANIC PRODUCTION UNDER PINE-BASED AGROFORESTRY SYSTEMS AT THE BENGUET STATE UNIVERSITY (BSU), LA TRINIDAD, BENGUET, PHILIPPINES

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Eleven organically-grown Arabica coffee varieties were characterized at the BSU-Institute of Highland Farming Systems and Agroforestry in Bektey, La Trinidad, Benguet, Philippines. This farm was internationally certified in 2007-2008 as producer and processor of organically-grown Arabica coffee. The varieties used were Red Bourbon, Yellow Caturra, Granica Broad Leaf, Granica Fine Leaf, Kenya-38, Moka, MSAC Selection No. 1, Mondo Nuvo, San Ramon, Improved San Ramon and Typica. Most of the varieties originated from South America except for Typica which came from Ethiopia, Moka from Yemen and Kenya-38 from Kenya. The study covered the vegetative and reproductive characteristics, postharvest processing, cup quality and pests and diseases. Results revealed that all the varieties used are recommended for organic production under Pine-Based Agroforestry System. Mondo Nuvo, Red Bourbon and Granica Broad Leaf exhibited highly significant green bean yield. Kenya-38, MSAC Selection No. 1, Improved San Ramon, San Ramon and Moka gave good cup quality. There was a slight incidence of pests and diseases attributed to the biodiversity and high elevation of the study area. The most common pest observed was snout beetle while coffee leaf rust was the common disease.

Keywords: organic, Arabica coffee, evaluation, cultivars, biodiversity

CONCURRENT PAPER PRESENTATION

Agroforestry for Sustainable Land Management

ANALYSIS OF HYDROLOGICAL FUNCTION CAUSED BY LAND COVER CHANGES AT SUMER BRANIAS SUB-WATERSHED

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Conversion of forest into agricultural and residential land caused decline soil fertility, erosion, floods, droughts and even global environmental change. Based on hydrological indicators, sub-watershed Sumber Brantas has a poor hydrological conditions (water system). Fluctuations in river flow caused the Brantas river basin becomes prone to flooding. Research methods is survey through observation, literature study, and interviews either with officials of East Java Provincial Forestry Department or the community surround the research area. Data were analyzed by descriptive, qualitative and quantitative method. The results showed that the land cover change has a widely impact on the hydrological function in Brantassub watershed. One indicator that indicate hydrologic watershed health conditions, is the Relative Buffering Indicator (RBI), Buffering Peak Event (BPE) and the coefficient of river regime (KRS). Hydrological function decline can be seen from the value of RBI and BPE < 1, and KRS for 56.9 shows that the condition of the watershed in a bad state.

Keywords : sub-watershed, hydrological function

CONCURRENT PAPER PRESENTATION

Agroforestry Towards Sustainable and Resilient Farming Communities

ECOLOGICAL SERVICES OF AGROFORESTRY SYSTEMS IN SELECTED WATERSHED AREAS IN THE PHILIPPINES AND INDONESIA: IMPLICATIONS TOWARDS DEVELOPING RESILIENT FARMING COMMUNITIES

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This article argues that the practice of agroforestry provides ecological contributions to the smallholder farmers cultivating in the watershed areas. Specifically, this farming system provides contribution for carbon sequestration potential of the woody perennials and the biodiversity conservation of the other components of the system. This argument is based on the research conducted in Molawin-Dampalit Sub-Watershed in the Philippines and Way Betung Watershed in Indonesia, involving an interview of 106 and 261 smallholder farmers, and an assessment of a total of 27 and 14 agroforestry plots for carbon stock assessment and biodiversity assessment, respectively. Research results indicate that the total carbon found among the crop components was 52.32 MgC ha⁻¹ and 244.26 MgC ha⁻¹, which suggests the high carbon sequestration potential of the woody perennials and understory crops in an agroforestry system. The farmlots being cultivated by the smallholder farmers were found to contribute to biodiversity conservation having a moderate biodiversity index of 2.59 and 2.53, respectively. With these findings, promotion of desired agroforestry systems in suitable portions of the watershed areas should be intensified and heightened to contribute to ecological balance across the landscape. Agroforestry should always be an integral part of all initiatives toward ecological restoration with the cultivators/smallholder farmers as potential partners. The agroforestry system should consider all the technical and socioeconomic considerations toward having diverse components and ensure food security among the smallholder farmers throughout the year.

Keywords: agroforestry; biodiversity index; carbon stock; Molawin-Dampalit Sub-Watershed; Way Betung Watershed

CONCURRENT PAPER PRESENTATION

Agroforestry for Sustainable Land Management

POTENTIALS OF GIANT BAMBOO (*Dendrocalamus asper*) IN SOIL CONSERVATION OF AGROFORESTRY FARMS

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Bamboo is a non-timber plant that is known to reduce soil erosion, especially along sloping areas and riverbanks. However, data on the extent of soil erosion control of bamboo is wanting. This study assessed the extent of giant bamboo stand in arresting soil erosion within the Taganibong watershed. Using the concept of paired watershed approach, two land uses were considered in this study, i.e. with bamboo and without bamboo. Erosion plots were established to measure and compare erosion rates while sediment collectors were installed to trap the flowing water in the stream to determine sediment yield. Other parameters such as climate, soil, litterfall and infiltration were also considered. Findings revealed a significant difference in soil erosion rate between giant bamboo stand and in an open area (without bamboo) with 22.66 Ton Ha⁻¹ Yr⁻¹ and 90.12 Ton Ha⁻¹ Yr⁻¹, respectively. Giant bamboo stand has lower sediment yield ranging from 1.09 to 1.45 g m⁻² hr⁻¹ as against the open area (without bamboo) with values ranging from 21.95 to 59.53 g m⁻² hr⁻¹. Infiltration rates are also found to be higher in the giant bamboo stand at 102 mm hr⁻¹ as against 56.6 mm hr⁻¹. Bamboo litterfall generated 945.1 kg ha⁻¹y⁻¹ may have contributed to soil nutrients and in reducing the raindrop impact that leads to the decrease of soil erosion in the bamboo stand. The results of the study may imply that giant bamboo is effective in reducing soil erosion and sediment yield, which are the major causes of siltation in rivers and flooding along lowland areas. This plant is indeed recommended in sloping uplands where agroforestry farming systems are practiced.

Keywords: giant bamboo, Taganibong, watershed, soil erosion, sediment yield

CONCURRENT PAPER PRESENTATION

Agroforestry for Sustainable Land Management

POTENTIAL OF MICROBIAL ISOLATES FOR GROWTH OF AGROFORESTRY CROPS IN SELECTED FARMS IN CALABARZON, PHILIPPINES

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The application of microbial inoculant to improve growth and yield of agricultural and agroforest crops has been of great interest to farmers and environmentalists that advocate clean technology. Beneficial bacteria and endomycorrhizal fungi are known symbionts in rhizosphere that sustain plant nutrition. Known commercially and locally to farmers are vegetable crops for *Pinakbet*, as well as coffee and cacao. This study was conducted to evaluate effectiveness of microbial isolates for growth of tomato, eggplant, and okra in the nursery for future field-testing in selected farms of Batangas, Rizal and Quezon. Isolates of bacteria from soil and roots of tested crops were grown in suitable medium in the laboratory. Strains were inoculated under sterile and unsterile soil in the nursery for a month to determine the best isolates that will increase growth responses in height, diameter, dry biomass, and root-shoot ratio. Among growth parameters, height of all crops was significantly ($p < 0.001$) improved in sterile over unsterile soil, suggesting effectiveness of defined symbiont in rhizosphere of sterile soil. Field testing of the best microbial isolates for three crops is recommended in the target farm sites in CALABARZON.

Keywords: microbial inoculant, symbiont, isolates, CALABARZON

CONCURRENT PAPER PRESENTATION

Agroforestry for Sustainable Land Management

RUBBER-BASED AGROFORESTRY OF CPSU KABANKALAN CITY, NEGROS ISLAND REGION, PHILIPPINES

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This paper aimed to address sustainable supply of forest products and provision of ecosystem services particularly biodiversity and watershed protection and landscape beauty for the mutual benefit of Central Philippines State University and the community living within the 4,653.70-hectare university reservation area. Specifically, it aimed to develop a land use plan and rehabilitate the degraded reservation using various site-specific indigenous and fast-growing exotic tree species through the establishment of multi-purpose tree plantation, EP/ANR and rubber-based agroforestry system. A Land Use Plan Technical Working Group was created while geo-spatial and socio-economic data were gathered and used for resource assessment, tenure assessment, stakeholder analysis and organizational analysis. A co-management scheme good for 25 years, renewable for another 25 years with production sharing of 25% (institution) and 75% (farmer beneficiaries) was initiated. A total of 122 farmer-occupants participated in the project covering a total of 201.76 hectares were reforested using the three project models. Sustainability mechanism was seen as an important consideration in strengthening project implementation such as project monitoring the project, (2) allocating internally-generated funds for protection, care and maintenance practices of the forest plantation and agroforestry farms.

Keywords: *Agroforestry, rubber, reforestation*

CONCURRENT PAPER PRESENTATION

Agroforestry for Sustainable Land Management

HEALTH STATUS OF COMMUNITY FORESTS PLANTING THROUGH AGROFORESTRY SYSTEMS IN LAMPUNG PROVINCE

Rahmat Safel, Irwan Sukri Banuwa, Christine Wulandari, Hari Kaskoyo and Yayan Ruchyansyah

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The health condition of forest ecosystems will be very important in the world, when global issues, such as climate change, air pollution, acid rain, forest fires, the quality and quantity of water, and the increase in human population has affected to sustainable forest management. Therefore, valid data and reliable information about the health condition of community forests planting by agroforestry system absolutely be necessary to obtain the right decision towards sustainable forest management. Forest health study conducted in February 2013 at 3 sub districts i.e. Pringsewu, Pesawaran, and Tanggamus. Objective of this study is analyzing status of community forest health that planted by agroforestry system. The case study of analyzes of forest health status was assessing through 8 cluster-plots (32 plot units) of Forest Health Monitoring (FHM) tools. Parameters of community forest health namely agroforestry planting system are tree growth, tree damage, crown condition, and soil fertility. The research results showed that the status of community forest health planting by agroforestry system in Lampung is mostly good (score 5.79 – 7.07) due to 4 cluster-plots has proven that forests on good condition. Then agroforestry planting system is recommend to be implemented in all community forests in Lampung province. Key words: forest health, community forests, agroforestry planting system.

Keywords: *forest health, community forests, agroforestry planting system*

CONCURRENT PAPER PRESENTATION

Agroforestry for Sustainable Land Management

REHABILITATION OF PROTECTION FOREST THROUGH SOCIAL FORESTRY-BASED AGROFORESTRY IN SOUTH KALIMANTAN, INDONESIA

*Mahrus Aryadi, Hamdani Fauzi and Trisnu Satriad
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Indonesia has a total forest area of 134 million ha, of which, 30.5 million hectares are classified as protected forest. Most of the protected forests have already been damaged because of illegal logging and forest fires. These areas, have eventually become grasslands. According to MFI (2012), the extent of critical land in Indonesia is 22.02 million hectares with critical category up to very critical. This writing aims to provide lesson learning rehabilitation of protection forest area through Social forestry based agroforestry. The first step is social reconstruction and the second step is training and planting activity. The planting of rubber began with a distance of 3m x 7m area covering around 13 hectares. Meanwhile, 12 has were planted with rubber in 2013 and 2014. These areas were planted with about 80% rubber trees and 20% multipurpose tree species. In addition, 50 has of bee forage plants was established in 2014. These areas were enriched by planting coconut and sunflower. Results indicate that the cooperation, mutual trust and work groups are the social factors that are necessary in the plantation establishment. Meanwhile, the establishment of paddy crops, chili, long beans and squash contributed to the economic aspect. Lastly, the presence of birds, prevention of forest fires and the improvement of the microclimate were among the ecological contributions of this initiative. ;.

Keywords: agroforestry, grassland, protection forest, social forestry

CONCURRENT PAPER PRESENTATION

Agroforestry for Sustainable Land Management

AGROBIODIVERSITY AND CARBON STOCK ASSESSMENT OF AGROFORESTRY SYSTEMS IN SELECTED COMMUNITY-BASED FOREST MANAGEMENT (CBFM) SITES IN KALINGA, PHILIPPINES

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CBFM is a national strategy of the Philippines' Department of Environment and Natural Resources (DENR) in the rehabilitation of denuded forest by establishing forest trees in upland areas and integrating fruit tree and agricultural crops thus accelerating the socio-economic condition of the upland areas while indirectly improving environmental quality with agroforestry as a major upland technology. The agroforestry systems practiced in most CBFM areas were characterized based on structure. Results revealed that the upland farmers practiced shelterbelt/windbreaks, live fence, and tree/home gardens. The average agrobiodiversity index of agroforestry systems in the various CBFM areas is 2.61. For the carbon storage, the various agroforestry systems in all the CBFM sites revealed to have low carbon stock due to the higher dominance of cash/agronomic crops planted in the area and still young woody vegetation in the CBFM sites. The woody vegetation and fruit bearing crop species in all the CBFM sites are dominated with like Rambutan (*Nephelium lappaceum*), Mango (*Mangifera indica*), Nangka (*Artocarpus heterophylla*), Pomelo (*Citrus grandis*), Chico (*Manilkara sapota*), Coffee species (*Coffea spp*), Pineapple (*Ananas comosus*), Banana (*Musa sapientum*). The forest tree species consists of Yemane (*Gmelina arborea*), Mahogany (*Swietenia macrophylla*), Kakawate (*Gliricidia sepium*), Ipil-ipil (*Leucaena leucocephala*), Dao (*Dracontamelon dao*), Tuai (*Bischofia javanica*), Narra (*Pterocarpus indicus*), Kalumpit (*Terminalia nitens*) while the agronomic crops raised are corn (*Zea maize*), Taro (*Colocasia esculenta*), Cowpea (*Vigna unguiculata*), Black beans (*Phaseolus vulgaris*), Eggplant (*Solanum melongena*), and Ginger (*Zingiber officinale*).

Keywords: agrobiodiversity, Community-Based Forest Management, woody perennial, carbon stock, agroforestry

CONCURRENT PAPER PRESENTATION

Agroforestry for Sustainable Land Management

EFFICIENCY OF INDUSTRIAL PLANTS AND MACADAMIA INTERCROPPING IN THE CENTRAL HIGHLANDS OF VIETNAM

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Macadamia is a new crop that was introduced in Vietnam in the last 10 years. This plant is expected to contribute strongly to promote the socio-economic development in The Central Highlands of Vietnam. In the Government plan for Macadamia development for 2020, the Central Highlands have been identified as key areas of Maca development using agroforestry practices in the 5940-hectare land, which accounts for about 80% of the area of interplanting with Maca of the country. In recent years, the spontaneous Maca plantation in The Central Highlands showed some limitations. Specifically, the efficiency of the industrial plants with Macadamia interplanting has not been fully evaluated. This study aimed to evaluate the economic, social and environmental efficiencies of the intercropping models. To overcome the limitations of previous studies in the use of partial budgeting and marginal analysis methods in the agricultural systems analysis, this paper highlights the use of the Net Present Value (NPV) calculation methods to assess economic efficiency of those interplantings with Macadamia in the Central Highlands of Vietnam.

Keywords: maca, agroforestry, economic efficiency, Net Present Value

CONCURRENT PAPER PRESENTATION

Agroforestry for Sustainable Land Management

PERFORMANCE OF MUSTARD (*Brassica juncea L*) IN BETWEEN THREE-MONTH OLD GUAYABANO PLANTATION AS AFFECTED BY SPACING

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The study aimed to determine the growth, yield, net income and Benefit Cost Ratio of Mustard planted between three months old guayabano plantation as affected by spacing and the growth of guayabano during the conduct of the study at the Agroforestry Nursery, DMMMSU-NLUC, Bacnotan, La Union from December 5, 2015 to January 5, 2016. The study was laid out following the Randomized Complete Block Design with four replication and three treatments. T_1 – 10 cm x 40 cm; T_2 – 20 cm x 40 cm; and, T_3 – 30 cm x 40 cm. Results of the study revealed that T_1 and T_3 had the same final height of 31.75 cm while T_2 had 31.00. On the final number of leaves produced, mustard plants planted at a spacing of 10cm x 40cm had the most number of 7.60 leaves and the least number of leaves were the mustard planted at a spacing of 30cm x 40cm. the highest weight of mustard per hill, per plot and per ha: net income per plot and per ha. Treatment 1 – 10cm x 40cm registered the highest benefit-cost ratio with a mean of 1.33. Guayabano obtained a height increment of 0.35, crown diameter increment of 0.20m and stem diameter increment of 0.24cm.

Keywords: Agroforestry, benefit-cost ratio, spacing, yield

REHABILITATION OF PROTECTION FOREST THROUGH COMMUNITY FORESTRY-BASED AGROFORESTRY IN SOUTH KALIMANTAN, INDONESIA

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Abstract

Indonesia has a total forest area of 134 million ha, some of which 30.5 million hectares are classified as the protected forest. Most of the protected forests have already been damaged because of illegal logging and forest fires. These areas have eventually become grasslands. According to MFI (2012), the extent of critical land in Indonesia is 22.02 million hectares, with a critical category up to a very risky one. This writing aims to provide lesson learning rehabilitation of protection forest area through Community forestry-based agroforestry. The first step is social reconstruction, and the second step is training and planting activity. The planting of rubber began with a distance of 3m x 7m area covering around 13 hectares. Meanwhile, 12 hectares were planted with rubber in 2013 and 2014. These areas were planted with about 80% rubber trees and 20% multi-purpose tree species. Also, 50 hectares of bee forage plants were established in 2014. These areas were enriched by planting coconut and sunflower. Results indicate that cooperation, mutual trust, and workgroups are the social factors that are necessary for the plantation establishment. Meanwhile, the establishment of paddy crops, chili, long beans, and squash contributed to the economic aspect. Lastly, birds' presence, prevention of forest fires, and the microclimate's improvement were among the ecological contributions of this initiative.

Keywords: agroforestry, grassland, protection forest, community forestry

Introduction

Indonesia has a total forest area of 134 million ha, of which 30.5 million hectares are classified as protected forest. Most of the protected forests have already been damaged because of illegal logging and forest fires. These areas have eventually become grasslands. According to MFI (2012), the extent of critical land in Indonesia is 22.02 million hectares, with a critical category up to very risky.

A community-based forest rehabilitation approach can be taken to improve the area. Forest rehabilitation is a comprehensive effort to improve the forest environment's quality by considering the ecological and social aspects of the community's economy (Stanturf, 2005).

In the past, most rehabilitation programs were controlled by the government, dependent on funding from the Indonesian government and international donors and generally focused on technical aspects. Institutional arrangements for implementing rehabilitation programs effectively in the field have not yet been developed. As a result, local communities have not

adopted rehabilitation techniques, both those living in and around the target area. An innovative approach is needed to achieve the rehabilitation program's goals while also providing economic and social benefits to the company and the community (Nawir et al., 2007).

Forest rehabilitation activities must be planned in the long term. Government policies and the involvement of various parties are needed to support the success of forest rehabilitation (Liu et al., 2003). The key to success in forest rehabilitation is to create sustainable benefits for local communities. This is why rehabilitation projects must be planned to improve the lives of local people in the long term. In other words, the key to successful forest rehabilitation is securing land use rights of local communities to harvest trees planted with wood products or the right to collect non-timber forest products.

In recent decades, the Ministry of Environment and Forestry has implemented some rehabilitation projects in degraded Protection Forests for environmental purposes and not for harvesting wood. In the case of an environmental rehabilitation project, it is difficult for local communities to benefit from the project because there are no timber forest products utilized by local communities. Therefore, forest fires often occur, and there is no community participation in maintaining rehabilitation projects. This also happened in Protection Forest in Tanah Laut Regency.

The program of local community-based forest rehabilitation was developed through the concept of community forestry. One of the schemas, one of the schemes is the Community Forest. The Community Forest Program involves the community to play a role in the management of state forests. Of course, this community forest program provides great benefits for the community. The implementation of the Rakat Forest program is intended to develop capacity and provide access to local communities in managing forests in a sustainable manner. This is intended to ensure the availability of employment for local people to solve economic and social problems. Community Forest aims to improve the welfare of the local community through the utilization of forest resources in an optimal, fair, and sustainable manner while maintaining the preservation of the forest and the environment's functions.

The active involvement of local communities in the management of protected forests has important significance. This is reflected in the Minister of Environment and Forestry Regulation No. 83 of 2016 concerning community forestry. The Government of Indonesia of the Republic of Indonesia through the Ministry of Environment and Forestry has issued a community forestry policy or program. Community Forestry is intended to plant, protect forests, and improve the local community's standard of living. One of the implementations of the above policy is the rehabilitation program of the international cooperation W-BRIDGE of Waseda University, JIFPRO, and Lambung Mangkurat University. Through this collaboration, the Community Forest Program with an agroforestry scheme, rehabilitation will be carried out in degraded Protection Forest based on local community participation covering 58 hectares.

Method

The W-Bridge project was carried out in Tebing Siring Village, Bajuin District, Tanah Laut Regency, South Kalimantan. The object of observation is physical activity. Physical activities include planting and maintaining the land. The area of forest that has been managed is 58 hectares, with 80% rubber species and 20% Multi-purpose Tree Species (MPTs). The basic method is the descriptive method, to obtain facts from the existing symptoms and find out factual information about the institution's role and mechanism, group dynamics, and physical activity processes in the field. Data collection techniques refer to Creswell (1994), are including in-depth interviews, Focus Group Discussions (FGD), and participatory observation. The research subjects were members of active farmer groups involved 25 people, including group administrators. Key informants included the Village Head, Forestry Extension Officer, and Head of the Forest Service of Tanah Laut Regency.

Data analysis was based on an interaction model consisting of three activities that occurred simultaneously after the data collection period (Miles and Huberman, 1992), namely: reducing data, e.g., sharpening, classifying, removing unnecessary and organizing data in such a way so that the conclusions can be drawn and verified: Presentation of data in the form of a compiled set of information provided the possibility of drawing conclusions and taking action. Conclusions are drawn loosely but openly and formulated in detail and firmly rooted.

Results and Discussion

Social Reconstruction and Role Sharing

Management and utilization of forest resources in Indonesia have been carried out on "timber management-oriented and pure economic oriented. Such management has failed, triggering the destruction of natural resources and ignoring the interests and participation of rural communities around the forest (Awang, 2004). According to Hubeis (2004), forest management activities that are more oriented to economic growth have caused people to be marginalized from the surrounding forests. In this relation, the physical exercises in forest management, e.g., planting and maintaining plants, require community participation. The W-Bridge Project begins with social engineering. This includes : (1) the involvement of community leaders, e.g., Head Village and Chairs of Farmer Groups, (2) the limited discussion about the reasons for working together in these activities, (3) making an understanding and agreement on the pattern of partnership collaboration that will be built in activities with the leaders, and finally (4) socializing to the members of the farmer groups about planned activities that will be carried out together.

This social engineering is in line with the idea that the utilization and management of forest resources is basically not merely a technical issue of forestry (land, water, trees, wood production, and non-timber forest products), but rather a "social" problem that stems from fulfillment basic needs and improvement of the welfare of rural communities. Therefore forest management must involve the participation of rural communities by providing opportunities to participate in utilizing and managing forests according to their understanding, knowledge, technology, experience, and traditions (Aryadi, 2012; Nurjaya, 2005; Masserschmidt, 1992; Burch 1992; Peluso et al.).

Social reconstruction activities are carried out comprehensively and continuously. Socialization and discussion with farmer group members are carried out at least 3 (three) meetings to produce an agreement to form cooperation with the parties. Agreements between farmer groups and facilitators (Team of the Faculty of Forestry, Lambung Mangkurat University) include (1) half wage system, (2) types of plants, (3) spacing, (4) system of determining the location of land per member, and (5) statement of farmer group members. The agreement was attended by (1) management, (2) group members, (3) village officials, and (4) forestry instructors. While the Team of the Faculty of Forestry, Lambung Mangkurat University was present to facilitate and provide suggestions or recommendations if needed. The social engineering carried out by the Team of the Faculty of Forestry, Lambung Mangkurat University, in preparation for the W-Bridge Project for 6 (six) months before the physical activities were agreed to be implemented.

The half-wage system is regulated that each farmer group member-only gets half of the current wage. For example, the daily work wage is Rp. 70,000 / person, he must be willing to be paid Rp. 35,000 / person. The stakeholder role sharing activities have been carried out since the activity plan was prepared. The W-Bridge Project involves stakeholders, namely:(1) The team of the Faculty of Forestry of Lambung Mangkurat University, as a facilitator, mediator, research, and connective party communication; (2) WASEDA University, which acts as a researcher; (3) JIFPRO, which acts as a researcher, director, and mediator of the parties from Japan, (3) Bridgestone Japan / PT. Bridgestone Kalimantan Plantation (BSKP), acting as for providing seeds, fertilizer, and technical training; (5) Tanah Laut Regional Government (Tanah Laut Forestry Service), whose role is to encourage local policies, allocate APBD / APBN, counseling; and (6) Tebing Siring Village Government, whose purpose is to promote local politics and policies, and to form the Farmers Group " Kelompok Tani Ingin Maju." The six related parties or Win 6 agreed to participate equally to succeed in this program.

According to Fauzi (2010), the form of partnership by placing the community as the main actor in and around the forest means that at the same time, the partnership functions the Village Government and Farmer Groups in forest management. This is a clear manifestation of decentralized forest management. In this connection, the values of cooperation and solidarity will develop informally following government-formed institutions. The support and cooperation of related institutions that can create a program's success is a factor driving the success of an activity that involves the community (Aryadi, 2012). The government plays an important role in determining the area's management as a place of livelihood for the community (Manivong and Cramb, 2008).

The Team of the Faculty of Forestry, Lambung Mangkurat University, with W-Bridge Project funds, places one active student of the Faculty of Forestry as a companion who attends at least 1 (one) time a week. Routine meetings are held at the beginning of each month. The meeting was attended by a team of Lambung Mangkurat University facilitators and farmer group members and management. The purpose of the meeting was to evaluate the activities' results and plan activities for the following month. Regular monthly meetings are often attended by relevant parties, such as the Team of Waseda University, the Team of JIFPRO, the Team of PT. BSKP

and Forest Service Officers of Tanah Laut Regency. Assistance and regular monthly meetings with farmer groups run-up to the present time.

Types of Plants Selection

The rehabilitation of the Forest of Mount Langkaras Protection is carried out by considering the community's social aspects. In the beginning, most members of the Community Forest Farmer Group (HKm) "Ingin Maju" worked as community gold miners. A small number of them work as laborers in rubber companies. Work skills gained from rubber plantations are an experienced capital in forest rehabilitation. Guiding a group becomes easier if the commodity is developed under the habits of the community/members (Gilmour, 2000). Members who are familiar with rubber cultivation can transfer their knowledge to other inexperienced members. This condition is a driving factor in choosing rubber as the dominant plant type.

Agroforestry was developed by combining rubber as a staple crop with other types of plants to enrich the diversity of species within the HKm Area. Examples of supporting plants are plants with many benefits (multi-purpose trees / MPTS) such as durian, durian, mangosteen, breadfruit, *petai*, mango, aloes, and *cempedak*. The percentage of rubber plants is 80% of the total number of plants. These species were planted in stages from 2012 to 2015, with a total area of 40 hectares.

The development of agroforestry was also carried out with bee feed based in 2014. Types of bee feed plants planted in the form of Kaliandra, coffee, rambutan, mahogany, and kapok. The selection of these types of plants has been adjusted to the calendar of flowering and the availability of pollen (P) and nectar (N) for each kind of plant. This development is the initiation of the Team of ULM and the Tanah Laut Regional Government, and the Tanah Laut District Forestry Service. The addition of 50 ha of plantations as bee food has provided hope of increasing income for members of farmer groups and the community of Tebing Siring Village in developing beekeeping on their Community Forest land. This is in accordance with the objectives of the Community Forestry program to increase the carrying capacity of the land, increase land productivity and people's income, and conservation of natural resources (forest, land, and water) and all of their functions (Kartasubrata, 2003).

Planting and Maintenance

Based on Regent Decree No. 522/021 / Dishut / 2011 in December 2011 concerning the Proposal of Determining the Area of Community Forest (HKm) and Village Forest (HD), Farmers Group Wants to Progress Tebing Siring Village covering an area of 308 Ha (Aryadi, Fauzi and Satriadi, 2012). The activity has been carried out since 2011/2012, starting with social engineering to the physical actions of plants. The physical action of planting in the field began in 2012/2013. In the first phase of 2012/2013, rubber (80%) and MPTs (20%) were planted in 13 hectares with a spacing of 3 x 7 m. PT provides the procurement of rubber seeds and initial fertilizer. BSKP / Bridgestone, while the W-Bridge Project provides mPTs seeds (Rambutan, Durian, Cempedak, Mangosteen, *Petai*, Breadfruit). Before the physical activity in the field, 25 farmer members were involved in the training, facilitated by PT. BSKP / Bridgestone. Training materials include the introduction of superior rubber seedlings, techniques for making

runs/planting paths, techniques for making planting holes, transport and planting techniques, and maintenance. The spacing of 3 x 7 m was prepared for the second year of planting paddy fields and chili rice, and the third year of planting coffee. In the outer border, hedges were planted in the type of Gamal (*Gliricidia sepium*) with a spacing of 0.5 m.

Agarwood plants (*Aquilaria* spp) are also planted for some members' boundaries among the farmer groups. Maintenance of rubber plants through "wiwilan", land clearing, and fertilizer application according to instructions given by PT. BSKP. The plants have been planted in the area of 15 hectares with 80% rubber staple species and 20% MPTs, with 3 x 5 m spacing for the second phase of 2013/2014. The combination of rubber plants with other types of plants such as fruit plants, woody plants, and seasonal plants can provide additional income for farmers (Wibawa et al., 2006, Penot, 2004 and Ogwuche, et al., 2012)

Agroforestry land maintenance is also carried out with the pattern of planting annual crops under young rubber stands. There are five members of farmer groups who plant field rice between 7 meters of rubber plantations. They also planted chili between 3 m rubber spacing. They also make fish ponds in the second phase of the area. They get training given by Bridgestone / PT. BSKP for 2 (two) days. The first day's training materials include running / path-making techniques, hole-making techniques, planting and maintenance, and simple fire fighting techniques; The second day's training material is the practice of seeding Mukuna (*Mucuna bracteata*) for prevention of land fires. Plant maintenance is carried out on rubber plants of the first and second phases by planting paddy fields and chili (agroforestry systems), cleaning the aisles, and carrying out fertilizers. According to Smith (2010) has a positive impact on ecological aspects.



Picture 1. Corn and long bean plants between the rubber trees

Conclusions and Recommendations

The development of agroforestry on Community Forest land (HKm) is an appropriate strategy. One-season plants can provide income for members when rubber trees are still young. The cost savings of maintaining rubber plants can also be done with the one-season plants. The results of the research indicate that cooperation, mutual trust, and workgroups are the social factors needed for the plantation establishment. Meanwhile, the establishment of paddy crops, chili, long beans, and squash contributed to the economic aspect. Lastly, the presence of birds, prevention of forest fires, and the improvement of the microclimate were among the ecological contributions of this initiative.

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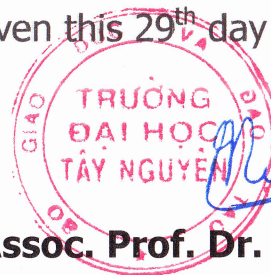
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