



The Second International Conference on Green Agro-Industry Resource Management for Sustainable Future August 4-6, 2015



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# Proceedings

**The Second  
International Conference on Green Agro-Industry  
(ICGAI)**

**“Resource Management for Sustainable Future”**



**Conference is held on 4 – 6 August 2015  
hosted by Faculty of Agriculture, UPN “Veteran”  
Yogyakarta, Indonesia**

# Proceedings

## The Second International Conference on Green Agro-Industry (ICGAI)

### Scientific Editors

Sakae Shibusawa

Lilik Soetiarso

Shiva Muthaly

Paul Holford

lin Handayani

Ping Fang

Sri Wuryani

Abdul Rizal

RR. Rukmowati Brotodjojo

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# Preface

Bismilahirrahmanirrahim, Assalamu'alaikum wa rahmatulahi wa barokatuh.

Praise be to Allah who has bestowed His grace, so that the event can take place smoothly.

The Honourable Rector UPN "Veteran" Yogyakarta, The Honourable Head of Agriculture Office of Yogyakarta province, the Honourable invited speakers, Distinguished Guests, Distinguished Participants, Ladies and Gentlemen,

On behalf of The International Conference on Green Agro-Industry Organizing Committees, I am pleased and honoured to welcome all of the participants to the Second International Conference on Green Agro-Industry at Mustika Sheraton Hotel, Yogyakarta, Indonesia from 4-6 August 2015. This conference is hosted by the Faculty of Agriculture Universitas Pembangunan Nasional "Veteran", Yogyakarta, Indonesia and this event would not have been possible without the support of its global partners: Tokyo University of Agriculture and Technology, Japan, Murray State University, USA, Universiti Malaysia Sarawak, Malaysia, University of Colombo, Sri Lanka, University of Western Sydney, Australia, Royal Melbourne Institute of Technology, Australia, Tongji University, China, and Gadjah Mada University, Yogyakarta, Indonesia.

Ladies and gentlemen,

The theme of the Second International Conference on Green Agro-Industry is "Green Agro-Industry: Resource Management for Sustainable Future". Agro-industry is important not only because it can transform raw agricultural materials into value added products while generating income and employment, but it is important in the bigger picture because it contributes to the overall economic development in both developed and developing countries. In the context of trade, agro-industry provides significant impact to Indonesia's export. The government is targeting exports of the agro industry to grow up to 29% amounting to USD 40 billion this year, from USD 31 billion in 2014.

As we are all well aware, the resources available to support the development of agro-industry is not unlimited, therefore, it is crucial for us to manage the resources that we have carefully. Recently, there has been an increased pressure on agro-industries to shift to more resource-efficient and low-carbon production processes as part of the global efforts to sustain growth, conserve resources and slow down the pace of climate change. To provide a sustainable future, the development of agro-industry should not merely aim for high profit, but it should also be environmentally friendly and socially sustainable.

In furtherance of this ideal, this conference is organized with the hopes of achieving three things. First, it is held to foster and support the development of highly productive methods and technologies for the various segments of the agro-industries. Second, it is designed to provide a forum for the presentation, discussion and debate of state-of-the-art and emerging technologies in the field of agro-based industry and any issues related

to sustainable agro-industry. Third it aims to promote interaction and communication among researchers, observers and practitioners to discuss and discover solutions to the problems related to the development of the agro-industry and how it can further improve welfare.

Topics of interest for the conference are divided into four major categories, namely: **Economics, Social and Business; Agronomy; Soil and Land Management; Agricultural engineering.** Our keynote speaker Prof. Lilik Soetiarso from Universitas Gadjah Mada, Yogyakarta, Indonesia will present a keynote speech entitled “*The Role of Bio-system Engineering in Green Agro-Industry*”. Other invited speakers from a broad range of backgrounds including leading industry and academic experts will provide insights into sustainable agro-industry from various perspectives. In addition, the supporting papers from the participants will also enrich and liven the discussions related to the development of sustainable agro-industry.

On behalf of ICGAI Committee I would like to apologize that due to unforeseen circumstances three of our invited speakers: Assoc. Prof. Shiva Muthaly (RMIT University, Australia); Prof. (Rev). Wimalaratana (University of Colombo, Sri Lanka); and Assoc. Prof. Ping Fang (Tongji University, China) were unable to attend this conference. I am sorry for this inconvenience.

Finally, we would like to express our gratitude to the Rector UPN “Veteran”, Yogyakarta for the financial support, the Dean of the Faculty of Agriculture for hosting this event, and the Scientific and Steering Committee. We would also like to convey our utmost gratitude to the keynote speaker Prof Lilik Soetiarso (Universitas Gadjah Mada, Yogyakarta), the invited speakers Prof. Sakae Shibusawa (Tokyo University of Agriculture and Technology, Japan, Mr. Marc Vanacht, MBA/ML (President, AG Business Consultants, St Louis, USA);, Mr. Jeewan Jyoti Bhagat (Managing Director-STM Projects Ltd, India); Dr. R.P. Singh (Associate Agronomist and Sugarcane Advisor for STM Projects Limited, Prof. Iin Handayani (Murray State University, USA); Dr. Partoyo (UPN “Veteran” Yogyakarta, Indonesia) as well as all the participants for their contribution in making this conference a success. We wish to also thank the sponsors of this event: PT. Bank BNI, Bank BPD, Bank BRI and Bupati Kabupaten Wonosobo, for their contribution in making this conference possible. Finally, as the Chairperson, I would like to convey my highest appreciation to the members of the organizing committee whose relentless hard work and dedication made this conference a great success.

Thank you and I wish everyone a fruitful and pleasant day ahead.

Wassalamu’alaikum wa rahmatulahi wa barokatuh

Yogyakarta, August 4, 2015

Dr. R.R. Rukmowati Brotodjojo  
ICGAI Chairperson

# Table of Contents

ICGAI Committees  
Preface  
Table of Contents

## Keynote Speaker

- 1 The Role of Bio-System Engineering in Green Agro-Industry. **K - 1**  
(**Lilik Soetiarso** - Universitas Gadjah Mada, Yogyakarta, Indonesia)

## Plenary Speakers:

- 1 Precision Farming in Sustainable Agro-Industry Concep. (**Sakae Shibusawa** - Tokyo University of Agriculture and Technology, Japan) **P-1**
- 2 Land Management to Support Sustainable Agro-Industry: Enhancing Soil Quality and Carbon Sequestration. (**Iin P. Handayani** - Murray State University, USA) **P-11**
- 3 Business Strategy for A Sustainable Agro-Industry. (**Marc Vanacht** - President, AG Bussiness Consultants, St Louis USA) **P-26**
- 4 “Developing Sustainable Sugarcane Industry in India”- Lessons Learnt (**J.J. Bhagat** - Managing Director-Stm Projects Ltd, India and **R.P. Singh** - Associate Agronomist and Sugarcane Advisor For Stm Projects Limited) **P-32**
- 5 Conservation Issues in Agricultural Areas in Dieng, Central Java and Implementation of Local Wisdom to Support Sustainable Agro-Industry (**Partoyo, Eko Amiadji Julianto, Muhammad Husain Kasim, Indah Widowati, Teguh Kismantoroadji** - UPN “Veteran” Yogyakarta, Indonesia, and **Sumino** - Institut Seni Indonesia) **P-45**

## Economics Social and Bussiness

1	Feasibility Study of Tuber Flour Factory Using in Pack Curing or Modified Tuber Flour (Motuf) to Support Food Diversification (C. E. Susilawati, E. Supriharyanti, L. A. Siswanto, D. Maria, and I. Epriliati)	1
2	Developing Agro-Industry Region with Traditional Woven Fabric Basis (Nurindah)	12
3	Empowering Women on Indonesia Tea Plantation Through Strengthening The Role of Tea Small Holder Institution (A Case Study on Mulyawangi I Tea Farmer Group, Bandung – West Java, Indonesia) (Kralawi Sita)	19
4	Policies Recommendations to Safe Indonesian Tea Plantation (Rohayati Suprihatini)	27
5	An Analysis of Value Added on The Integrated Agriculture System in Aceh Besar District (Suyanti Kasimin)	35
7	Strategic Management Perspective on Sustainable Certification to Palm Oil Plantation Based Corporations Sustainability as Source of Competitive Advantage and Basis for Corporate Advantage (Zulkifli)	46
8	Perceived Environmental Responsibility, Man Nature Orientation, Enviromental Knowledge and Environmental Attitude Toward Mangrove Conservation Decision (Yuni Istanto and Dyah Sugandini)	56
9	Analysis of Integrated Farming System Patterns (Siti Hamidah and Vandrias Dewantoro)	62
10	Integrated Precision Farming (IPF) as A Future Technology for Performance Monitoring “Back to Organic Matter Program” at PT. Perkebunan Nusantara X (Case in Development Area of Tuban Bojonegoro) (Cahyo Hadi Prayogo and Suhadi)	67

## Agronomy

1	Effects of Forest Strips in Forest Clearings for Oil Palm Agro Industry: Quantifying Species Richness of Bats at Small Holdings in Sungai Asap, Belaga, Sarawak, East Malaysia (Charlie Justin Mergie Laman, Lyhmer Jack, Mathew Jenang, And Andrew Alek Tuen)	74
---	--	----



2	The Effect of Maintenance Leaf Layers Number and Foliar Fertilizer on Growth and Leaf Production of Tea Plant ( <i>Camellia Sinensis</i> (L.) Kuntze) ( <b>O. Sucherman, Salwa L. Dalimoenthe</b> )	85
3	The Impact of Climate Change on Adjustment Tea Plantation Management in Indonesia ( <b>Salwa L. Dalimoenthe</b> )	94
4	Growth Response of <i>Aloe Vera</i> Plants to Treatment Combination of KCl Fertilizer and Compost of Empty Fruit Bunches of Oil Palm ( <b>Marulak Simarmata, Entang Inorlah and Novi Istanto</b> )	103
5	Effect of Steaming Time to The Physical and Nutritional Quality of Parboiled Organic Rice ( <b>Sri Wuryani and Oktavia Sarhesti Padmini</b> )	111
6	Acute Toxicity Test of Granular Organic Fertilizer Enriched with Neem Leaves Powder to Common Carp <i>Cyprinus Carpio</i> Linn. ( <b>R.R. Rukmowati Brotodjojo and Dyah Arbiwati</b> )	118
7	Efficacy of Various Insecticides for Controlling Plant Hopper on Paddy ( <b>Mofit Eko Poerwanto and Siwi Hardiastuti</b> )	123
8	Application of Liquid Organic Fertilizer Production Plant to Increase Cayenne Pepper ( <i>Capsicum sp</i> ) at Different Growing Media ( <b>Endah Wahyurini and Heti Herastuti</b> )	129
9	The Assessment of Superior Mutant Wheat M4 Generation Which are Tolerant to The Drought Stress in The Lowland ( <b>Budyastuti Pringgohandoko</b> )	137
10	Mapping of NPK in Soil for Precision Agriculture Application on Rice Plant ( <b>OS Padmini, Sari Virgawati, and Mofit Eko Poerwanto</b> )	146
11	Exploration and Isolation Bacteria from Rhizosphere of High Temperature Tolerance Mutan Wheat ( <b>Yanisworo Wijaya Ratih, Budyastuti Pringgo Handoko, and Endah Budi Irawati</b> )	153
12	Hands of God in Enhancing Bioethanol Implementation Through Pricing Policy ( <b>Ariel Hidayat</b> )	162

## **Soil and Land Management**

1	The Fertility Fluctuation of Tea Planting Area from Three Soil Orders on West Java ( <b>R. Wulansari and E. Pranoto</b> )	172
---	---	-----

2	Improving Nutrient Retention of Highly Weathered Tropical Soils With Biochars ( <b>Arnoldus Klau Berek and Nguyen V. Hue</b> )	182
3	The Effects of Fresh Organic Waste Amendments on Pineapple ( <i>Ananas Comosus</i> ) in Ultisol, Lampung, Indonesia ( <b>Susila Herlambang</b> )	196
4	Powerful Factors in Directing Diversity of Coloring Soils Overlying Carbonate Rock of Baron-Wonosari ( <b>Djoko Mulyanto and Bambang Hendro Sunarminto</b> )	204

## **Agriculture Engineering**

1	The Quality and Acceptability of Bakasi Eel ( <i>Anguila</i> ) Cookies ( <b>Wilma C. Giango</b> )	211
2	Partial Biochemical Characterization of Egg Masses of The Wedge Seahare <i>Dolabella Auricularia</i> (Lightfoot, 1786) ( <b>Gloria G. Delan, Ador Rivera Pepito, Manabu Asakawa, Kaori Yasui, Venerando D. Cunado, Aurelia G. Maningo, Amalia A. Gonzales, and Rachel Luz V. Rica</b> )	218
3	Isolation of Hydrogen Producing Bacteria from Sludge of Anaerobic Biogas Reactor ( <b>Mahreni, Yanisworo Wijaya Ratih, Siti Diyar Kholisoh, and Harso Pawignyo</b> )	228
4	Comparison of Green Technology to Produce Tuber Flour Using in Pack Curing Versus Parboiling-Fermenting-Modified Tuber Flour (MoTuF) ( <b>Indah Epriliati, Lorensia Audrey Siswanto, Devina Maria, Indah Kuswardani</b> )	235
5	Ergonomic Design of Grass Chopper Machine for Working System Improvement ( <b>Dyah Rachmawati Lucitasari and Dwi Susilo Utomo</b> )	249

## **Any Other Topics related to Agro-Industry**

1	Effect of Pome and Sludge Ratio on Acclimation Process of Biogas Production from Palm Oil Mill Effluent ( <b>Sarono, Yana Sukaryana, Yatim R Widodo, and Udin Hasanudin</b> )	254
---	---	-----

## Category Poster

1	Prospect of Developpe Chrysanthemum Farming ( <b>Siti Hamidah and Indah Widowati</b> )	263
2	An Analysis on The Effects of Internal and External Factors Towards Public Participation in Community Forest Establishment (A Case Study on Sedyo Raharjo Farmers Group Purworejo Regency) ( <b>Teguh Santoso, Nanik Dara Senjawati and Juarini</b> )	267
3	Quality Assessment on Four Genotypes of Sweet Sorghum Sap With Dosage Variations of <i>Arbuscular Mycorrhizae</i> and Husk Charcoal as Biological Fertilizer and Soil Conditioner for Bioethanol ( <b>Rati Riyati and Nurngaini</b> )	273
4	Study of Microbial Community of Oil Palm Rhizosphres Infected by <i>Ganoderma</i> Sp. and Their Potency in Green Oil Palm Industry ( <b>Happy Widiastuti</b> )	280
5	Efficacy of Herbicides with The Active Ingredient Penoxulan + Bentazone to Control Weeds in Rice Field ( <b>Abdul Rizal AZ and Dyah Arbiwati</b> )	285
6	Production Capability of Hybrid Rice and Non Hybrid Rice Which Facing Irrigation Poluted by Sewage Spiritus Plant ( <b>Sugeng Priyanto and Wahyu Widodo</b> )	293
7	Selection of Parent's Jackfruit Tree in Sleman District to Improve Quality of National Jackfruit ( <i>Artocarpus Integra Merr.</i> ) ( <b>Basuki and Suyanto Zainal Arifin</b> )	299
8	Effect of Soil Moisture Against Infection of <i>Enthomopathogenic</i> Fungi on White Grub ( <b>Tri Harjaka, Edhi Martono, Witjaksono, and Bambang Hendro Sunarminto</b> )	307
9	Goat Milk Ice Cream Processing in Argoyuwono Village, Malang ( <b>Aniswatul Khamidah and SS. Antarlina</b> )	312
	<b>The Second International Conference on Green Agro-Industry: Questions and Answers</b>	323
	<b>Participants of The Second International Conference on Green Agro-Industry (ICGAI 2) Yogyakarta, Indonesia 4-6 August 2015</b>	326
	<b>Acknowledgement</b>	337

# CONSERVATION ISSUES IN AGRICULTURAL AREAS IN DIENG, CENTRAL JAVA, AND IMPLEMENTATION OF LOCAL WISDOM TO SUPPORT GREEN AGRO-INDUSTRY

Partoyo<sup>1\*</sup>, Eko Amiadji Julianto<sup>1</sup>, Muhammad Husain Kasim<sup>1</sup>, Indah Widowati<sup>1</sup>, Teguh Kismantoroadji<sup>1</sup>, and Sumino<sup>2</sup>

<sup>1</sup>Faculty of Agriculture, Universitas Pembangunan Nasional “Veteran” Yogyakarta, Jl. Lingkar Utara Condongcatur Yogyakarta 55283

<sup>2</sup>Institut Seni Indonesia, Jl. Parangtritis, Bantul, Yogyakarta

\* Corresponding author: partoyo@upnyk.ac.id

## ABSTRACT

In the last few decades, the rapid development of agro-industries has led to some problems related to the sustainable utilization of land resources. Some of the issues that are arising are change in land use and land cover from forest to agriculture land and deterioration in soil quality due to intensive soil use and soil erosion. This paper discusses about the facts of land degradation in Dieng and efforts to promote soil conservation in Dieng in line with the development of small scale agro-industry in the area.

## BACKGROUND

Dieng Plateau is a highland located at Central Java Province and administered in borderline area of Wonosobo Regency and Banjarnegara Regency (Fig 1). Dieng area is a major supplier of various horticultural products, recharge area for several districts, as well as location of water springs of Serayu River. This area is located at an elevation between 1,500 - 2.095 meters above sea level, with a slope between 15-40% and in some regions >40%, with andisol as major soil type. Annual rainfall in the Dieng plateau is 3.917 mm/year. With a fertile soil and cool climate enables various specific vegetable plants grow well in the area (BPS-Wonosobo, 2013; Julianto et al., 2013).

Unfortunately, in the last three decades the region has experienced an accelerated degradation resulted from the excessive use of land for agricultural practices. Thousands hectares of land in Dieng has become a critical land. The rate of soil loss due to erosion is very high. The high rate of physical damage the area was induced by intensive and extensive practice of potato cultivation by the farmers (TKPD, 2007). The practice of intensive potato cultivation ignores the concept of proper soil conservation (Julianto et al., 2014).

Dieng Plateau is a place for tourist destination. It has many temples as priceless archaeological sites preserved. Dieng also has several post volcanism phenomena and geothermal exploration that serves as natural laboratory for the development of earth sciences. Therefore, development of the Dieng plateau should be oriented to economic,

social, cultural and ecological balance for sustainable future of society and area of Dieng as well as Wonosobo Regency in general.

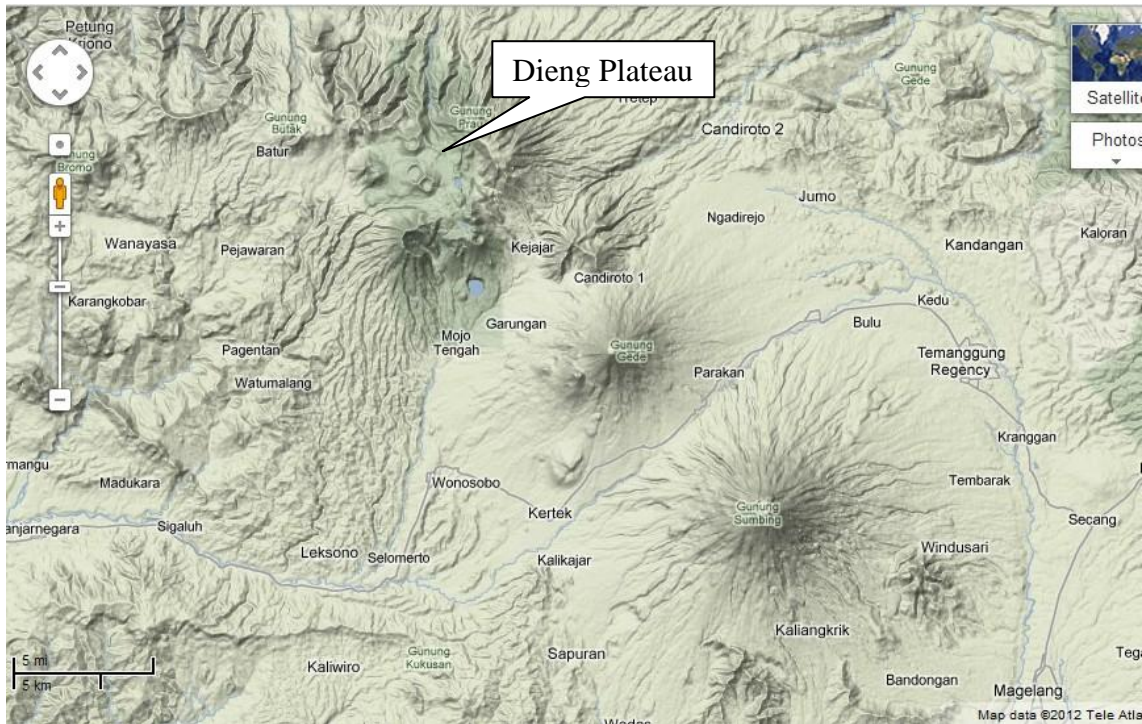


Fig. 1: The Dieng Plateau located in highly area of both Wonosobo Regency and Banjarnegara Regency (Captured from Google Earth©, 2015)

## LAND DEGRADATION IN DIENG

Land degradation in Dieng has been accelerated since 1990s. Dieng has been popular as producer of potato instead of other vegetables in Central Java Province. Area of land planted with potatoes was expanded tremendously, even occupied forest land. Soil erosion and surface water distribution, as well as soil quality are the major problem in Dieng.

### Soil erosion

In the last three decades the region has experienced accelerating land degradation due to agricultural activity, beyond the carrying capacity of the environment. Figure 2 shows several facts related to soil erosion in the Dieng area. According to the data, there are about 7,758 hectares of land in Dieng is in critical condition. The erosion rate reached 10.7 mm/year or an average soil loss of 161 tons/hectare/year (TKPD, 2007). Even in some locations, soil is left only as thick as 15 cm with rock outcrops and very stony soil surface. It was observed that several lakes experiencing siltation due to a very high sedimentation from the eroded area in the surrounding hills. In some parts of the formerly lake land it was developed a peat soil and used as agricultural land, although it is not in a good soil quality.

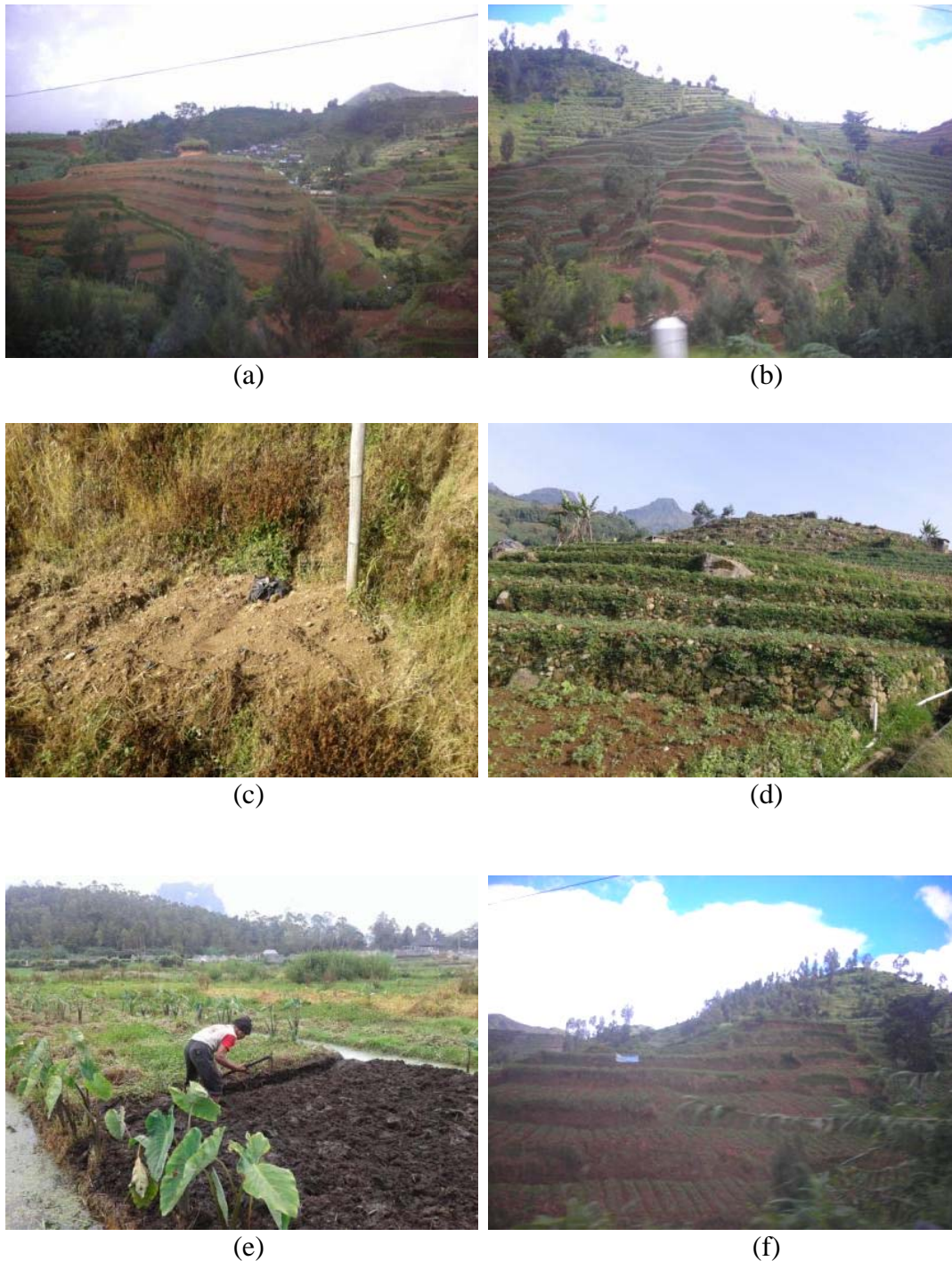


Fig. 2: Highly eroded soil in the steep slope at Kejajar district, Wonosobo regency (a); Agricultural land extended to formerly forest area (b); Thin soil depth (c) with rock outcrops and stony soil surface (d) due to soil erosion; Peat soil developed in lake induced by siltation due to sedimentation (e); Potato crop beds perpendicular to the slope may induce high rate soil erosion (f)

Some practices of potato cultivation are contradictive to soil conservation rule. Several researchers reported a high rate of soil erosion that exceeded the tolerable soil loss.

Rudiarto & Doppler (2013) reported the annual soil loss rate in Dieng changed from 0 until 1,096 tons/ha/year for the year 1991 and 0 up to 1,063 tons/ha/year in 2006. From the results of actual soil loss, afterwards, the classification has been made to show different erosion hazard levels, which more than 40% area included as very high hazard severity.

### Surface water disruption

Due to land clearing for extension of agricultural land, many water channels were destructed and water distribution and infiltration were disrupted. It is observed that many springs disappeared and people have to pump the water to irrigate their agriculture land. Even they have to operate a powerful jet pump to distribute irrigation water along PVC pipeline from the downhill to the uphill.



Fig. 2: PVC pipelines to distribute irrigation water from the downhill to the uphill

### Soil quality deterioration

Farmers found a less fertile soil after long term use for cultivating potato. It was caused by imbalance soil nutrient as well as disturbed soil microbial population. It is logical as the farmers applied very high agrochemicals including fertilizer and pesticides for their potato plants.

Unfortunately, they multiplied fertilizer dosage to achieve the targeted yield. They also apply many kind of pesticides they considered effective to kill the pest. So the soil quality and soil health become worse and worse.

## DISCUSSION

Soil erosion is a major environmental and agricultural problem worldwide (Pimentel *et al.*, 1995). Although erosion has occurred throughout the history of agriculture, it has intensified in recent years (Lal & Stewart, 1990). In the context of Dieng, the erosion rate is considered as excessively high, and it is imperative to control the erosion very tightly. Otherwise, the soil will continue to loss and emerging more critical land in the area.

Actually, many erosion countermeasures have been done but they cannot significantly reduce the erosion rate. The erosion control activities were implemented sporadically in location and time. In addition, the program could not attract farmers and people to be involved in the activities. Usually, the program were implemented for directly replanting the area with trees, conducting a campaign not to cut the trees, educating the farmer to apply a more sustainable practice in agricultural land, and so on.

In the context of these unfruitful efforts, then it was conducted several evaluation and assessment to find out better alternatives. Many focused group discussions were done with local farmers, farmer group leaders, as well as many stakeholders from the government. As a result, it was concluded that the conservation strategy should be change by involving a broader approach to conserve the soil and environment of Dieng. Many programs were developed together with farmer leaders and government officers. The main concept is to provide alternatives for the farmers to earn income not only from cultivating potatoes. One of the strategies introduced was inducing agro-industry activity as a household income generating activity. It was developed activities with multiple objectives: (1) to promote alternative commodities to be cultivated other than potato, (2) to develop agro-industry at household or farmer groups level for income generating other than potato, (3) to induce soil conservation practice by cultivating indigenous prospective plant i.e. carica, kemar, and purwaceng in the broader area of Dieng (Julianto, et al., 2013, 2014; Partoyo et al., 2013).

## **ALTERNATIVES**

The required increase in agricultural production to meet future food demand will further increase pressure on land resources. Integrative indicators of the current status of the agricultural production capacity of land and their change over time are needed for promoting land management practices to maintain or improve land productivity and a sustainable use of natural resources (Bindraban, Stoorvogel, Jansen, Vlaming, & Groot, 2000).

Smallholders in many tropical highlands caused serious environmental damage. Farmers interact with environment, changing markets, infrastructure development, indigenous peoples and tourism. Farmers have intensified production and in doing so some have adopted less damaging practices (Barrow, Chan, & Masron, 2008). It has been promoted in the area of Dieng that farmers were encouraged to revive their local wisdom to cultivate several commodities that are suitable to the land and potential for generating valuable income.

To stimulate this initiative, we assisted development of small scale industry of carica, purwaceng and kemar processing in Dieng. It was included to guide for a more hygienic and more efficient process, to facilitate registration of trademark for their products, as well as to develop the market for their products. By increasing the production capacity and broader captive market, it will increase the demand for raw material of carica, purwaceng and kemar fruit. To fulfil the increased demand, it will induce farmer to grow more carica, purwaceng and kemar. As a consequence, population of those plants will increase and will help to suppress soil erosion. It was hoped that the activity will have a snow-ball effect.



## Carica

Carica from Dieng plateau is kind of papaya. As better known that papaya is a tropical plant and requires a lot of heat and sun, but Carica can only grow in high altitude, it requires quite cold temperatures and lots of rain.

Some references called carica as **mountain papaya** (*Vasconcellea pubescens*). It is a species of the genus *Vasconcellea*, native to the Andes of northwestern South America from Colombia south to central Chile, typically growing at altitudes of 1,500–3,000 metres (4,900–9,800 ft) m. It has also been known as *Carica pubescens*, or *Carica candamarcensis* (Morales & Duque, 1987).

According to Moya - Leon et al . (2004) carica has a smaller fruit with the texture of the flesh is crunchy, egg-shaped, green colored while unripe and green to yellow during ripening. Fruit is 6-14 cm in diameter with many seeds enclosed in the cavity of the middle pieces (Simirgiotis, Caligari, & Schmeda-Hirschmann, 2009). This plant not fully utilized because the flesh is sour and contains a lot of sap cause itching in the throat if consumed as a fresh fruit (Kalie, 2008). Up to now, carica fruit is only used as sweets, while the sap untapped as a source of papain. One type of papaya plants that can be used as a source of papain is a mountain papaya.

Carica fruit is commonly used to make candied carica. However carica fruit has other uses that are beneficial namely young fruit is dried to make powder as materials for skin disease drug in Europe and America, or as cosmetic ingredients. Carica fruit is also rich in the enzyme papain. The papain enzyme has the advantage that it can be used in beverages and candy. For dried product can be used as dried fruit, and the pharmaceutical industry including the production of chewing gum, making drugs for a variety of gastrointestinal diseases, textile industry, industry in soap and shampoo. (Morales & Duque, 1987).

## Kemar

Kemar is a fruit tree which is in local name called as '*terong belanda*' (Indonesian name). It may be internationally known as '*tamarillo*' with botanic name *Solanum betaceum* (Bioversity-International, 2013).

## Purwaceng

Purwaceng (Indonesian name) or Pruatjan is well known as herbal plant that is beneficial as aphrodisiac. It has a botanic name *Pimpinella pruatjan* Molk (Rostiana, 2014).



Fig 3. Carica (a) and Kemar (b) are fruit trees; Purwaceng (c) is a stolon plant

Considering economic value as well as environmental benefit, development of those local crops is very promising. Presently, it is still in the stage of promotion to motivate the local people/farmer to be interested in developing carica, kemar, and purwaceng as the re-emerged commodities from Dieng Plateau. Many farmers grow the three crops either for economic and conservation reasons. Considering the morphology of those three crops, they will potentially reduce soil erosion. Carica and kemar are tree crops with big leaves and dense canopy. It will very effective in protecting soil surface from high energy of rain drops, so that reducing soil disaggregation. Purwaceng is an herb plant grows on the surface of soil. It will cover the soil surface and protect soil particle no to be transported by runoff water during and after rainfall. So, these three plants are very potential in suppressing soil erosion.



Fig 4. Planting purwaceng seedlings (a), Strip of carica trees (b), Multiple cropping of carica, kemar and potatoe (c)

## CONCLUSION

From the above description, it can be concluded that land conservation in Dieng should be accompanied by social, economic and even cultural approach to involve the farmer and people to contribute the conservation action.

By developing agro-industries activity based on local prospective commodities which are economically feasible and environmentally sustainable, land conservation Dieng will be successfully achieved.

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