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Final report

Small research and development activity

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1 Acknowledgments

The project team wishes to express thanks to the staff and researchers contributing to the technical workshops, policy roundtable, RIMBA study fieldwork and the Phase I proposal development.

The study was made possible by funding from the Australian Centre for International Agriculture Research (ACIAR). The project researchers gratefully acknowledge the support and guidance provided by ACIAR's Agricultural Development Policy Research Program Manager, Dr Ejaz Qureshi. In addition, the Project Team thanks: Paul van Hofwegen, Mariam Rikhana and Fabrizio Bresciani from the World Bank; Pak Agung Henardi from IAARD; Tahlim Sudaryanto, Achmad Suryana and Handewi Purwati from ICASEPS; Barrano Sulistyawan, Heri Irawan, Febri Anggriawan Widodo, Gemasakti Adzan, Deasy Srishantika and Yudi Agusrin from WWF. Teluk Kuantan, Singingi District Leader, Riau Province. Laura Bateman, Alexandra Peralta, Dale Yi and Mike Young from Global Food Studies.

1.1.1 Executive summary

The overall aim of this SRA was to identify how ACIAR can best support sustainable agriculture policy and program research initiatives for the Medium-Term National Development Plan 2015-2019 (RPJMN). The key SRA output (along with providing a final report) was a Phase I ACIAR project proposal outlining how ACIAR can contribute to Indonesia's 'sustainable agriculture' research agenda. The SRA's main outputs provide the basis for future work derived from the technical workshops, the Policy Roundtable and the background/concept papers.

The project was a collaborative effort partnering the University of Adelaide's Global Food Studies, the Centre for Policy Studies, Victoria University, the World Bank Jakarta, WWF Jakarta and the Indonesian Centre for Agriculture, Socio-Economic and Policy Studies (ICASEPS) and the World Agroforestry Centre-Southeast Asia Office.

The original project activities included organizing a series of four policy roundtables and three workshops in collaboration with IIARD, ICASEPS and the World Bank. Additional activities included producing six concept papers to motivate and justify a full four-year ACIAR project.

The concept for a series of four, half-day policy roundtables shifted to one, two-day Policy Roundtable at the request of IAARD. The reasons IAARD requested that the SRA project team and the World Bank organize one, two day Round Table include: (i) the need accommodate a larger expert group of the policy community to explore all agricultural landscapes collectively; (ii) attract a much higher level of policy makers, including Vice Ministers, at the roundtable to increase the profile and engage the new government (eg, the new Minister of Agriculture; (iii) the desire to cover all three targeted landscapes (irrigated lowlands, upland rain fed, and peat and swamp lands) at one time, allowing synergies and encourage collaboration across activities; and (iv) the importance of involving and learning from a greater range of scientists than originally intended.

Among the Policy Roundtable outcomes are an outline of the practical steps required to support land management practices, agricultural technologies and profitable farm households in ways that promote long-term agricultural productivity. The Roundtable examined these issues in relation to current and future farming practices in three different agro-ecological zones: (i) irrigated lowland areas; (ii) upland rain fed agriculture; and (iii) swamp lands and peat lands agriculture. Addressing policy needs at the agricultural landscape level is relatively innovative for Indonesia's policy community.

The SRA conclusions and recommendations are that Indonesia's agricultural productivity gains are a major source of the country's past pro-poor growth success. However, recent

studies conclude that agricultural productivity is at risk due to insufficient investments in long-term productivity and a fragile natural capital base. Indonesia's National Planning Agency (BAPPENAS), the World Bank, ICRAF and OECD reports highlight a range of natural resource management issues related to agriculture. Among the issues identified for the 2015-2019 Mid-Term National Development Plan (RPJMN) include: the excessive use of legal and illegal chemicals; soil fertility problems; nitrate pollution of water bodies; conversion of forest land to agriculture that is linked to soil erosion, carbon and nutrient losses, declining water quality and downstream sedimentation. The scale of these issues is country-wide.

ICASEPS and IAARD requested ACIAR to focus on agriculture issues in upland landscapes identified at the April 2015 Policy Roundtable on sustainable intensification organised by IAARD, the World Bank and ACIAR. The potential research questions include:

The key research questions identified by the SRA. To answer these research questions in ways that inform development policy and program design to enhance long-term agricultural productivity in Indonesia's upland landscapes, the SRA proposes five objectives for the four-year proposal. These objectives are intended to increase the adoption rates of land use management practices designed to address natural resource degradation in three upland study sites.

RQ 1 What are the determinants of household land use decisions in upland study sites?

RQ 2How do markets, technology, social capital and regulatory systems impede or encourage farm household adoption, dis-adoption and intensity of adoption?

Objective 1: Understand the drivers of land-use decisions by smallholders in upland study sites.

- Through focus groups and interviews with village heads and District offices to collect key information on how farmer groups, village organizations and governance structures influence land use and natural resource management decisions.

- Semi-structured interviews with male and female household heads to identify socio-economic determinants affecting land use decisions

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RQ 3 How do gender and natural resource use perceptions influence innovation and adoption?

RQ 4 How do farmer groups, village organizations and governance structures influence natural resource management?

Objective 2: Identify the constraints and determinants of adoption by smallholders in upland landscapes.

- Designing household and village questionnaires to capture key variables to understand how markets, technology, social capital and regulatory systems impede or encourage adoption and innovation in upland landscapes.

- Modelling adoption processing and understanding the differences and incentives across farm households and the agricultural landscape.

RQ 5 What are the negative and positive externalities associated with farm level land use decisions?

Objective 3: Document the externalities associated with alternative land-use patterns using a landscape approach.

- By identifying the productivity gaps and externalities associated with alternative land uses (i.e. effects on sedimentation, water quality, risk of floods, CO_2 emission reductions etc.)
- Modelling future effects of alternative policies on key performance indicators (eg, food security, household income, employment, income stability, etc.)

RQ 6 What are the priority policy, institutional and technological strategies to promote more productive and pro-poor natural resource management in upland landscapes?

RQ 7 Can practical modelling tools support local level (district) decision makers understand the consequences of regulatory incentives on adoption and natural resource outcomes and the promising potential of alternative systems?

Objective 4: Identify and promote sustainable intensification activities to encourage durable adoption of desirable systems.

- By understanding the priority policy, institutional and technological strategies to promote more productive and pro-poor natural resource management in upland landscapes.
- Design and individualise the intensification activities for farm household clusters and for plot characteristic clusters across the landscape.

Objective 5: Build capacity to enhance the skills of farmers, village leaders and District land use planners to apply the project's landscape model approach in planning.

- Designing a general conceptual model to assess how local, District and national 'policy levers' are related to desirable outcomes based on the aggregate behavior of individual households.
- Explore how to adapt the project's models to user friendly tools for district level managers supported by the local university researchers to assess regulatory barriers and land use planning needs

Project outputs

1. *The Policy Roundtable*

   The 2015 April 29-30 Policy Roundtable on Research Priorities for Sustainable Intensification explored the opportunities and constraints to sustainable agriculture across the country. Environmental issues and agricultural resources deterioration in Indonesia are very diverse, depending on where they are taking place. The Policy Roundtable examined these issues in relation to current and future farming practices in three different types of agro-ecological zones, namely: (i) lowland irrigated; (ii) lowland rain-fed; and (iii) degraded and upland areas.

2. *Concept paper addressing the role of CGE modelling to support irrigation policy*

   'Exploring the nexus between food and water policy in Indonesia', M. Young, G. Wittwer and P. van Hofwegen.

3. A background paper and literature review identifying: (i) how the BRICs are addressing sustainable intensification; (ii) the key agricultural resource management issues in Indonesia; and (iii) the most relevant outcomes of the Policy Roundtable for an ACIAR project

   Sustainable agriculture programs in the BRICS: Gaps and lessons for Indonesia? L. Bateman, Erwidodo, Wahida, R. Stringer

4. Background paper highlighting the key results of the 2015 Roundtable on Research Priorities for Sustainable Intensification.

   Research Priority for Sustainable Agriculture in Indonesia, Erwidodo and Wahida

5. Concept paper identifying key research questions and methods for an ACIAR project focusing on upland agriculture

   Landscape policy, environmental services and climate change research opportunities,

   B. Leimona, O. Cacho, Erwidodo and R. Stringer

6. *A background paper outlining how to model adoption issues scenarios in upland agriculture, using qualitative and quantitative research methods to understanding the determinants of land expansion in a key 'hot spots.*

   The logistics of households research in upland agricultural sites: focusing on land expansion into protected forests. L. Bateman, R. Stringer, O. Cacho, H. Perkasa, T. Barrano and Dale Yi.

7. *A research paper testing innovative approaches to analysing agriculture and environment linkages.*

   Estimating the cost of strengthening ecosystem connectivity in an agricultural landscape in central Sumatra. L. Bateman, D. Yi, O. Cacho and R. Stringer. This paper is in progress and will be presented at the AARES Conference in Feb 2016.

8. A background paper presenting research methods for collecting household survey data in protected forests.

   Testing Research Methods for Understanding Household Land Management Practices in Upland Landscapes

9. An Australian PhD student from the University of Adelaide.

   Ms. Laura Bateman participated in the SRA project as a University of Adelaide scholarship student. She will use the household data collected in the RIMBA project site for her PhD papers.

10. An Indonesian PhD student at Utrecht University in the Netherlands

    Thomas Barrano is a PhD student at Utrecht University in the Netherlands and the RIMBA project manager. Mr. Barano will complete his PhD studies using the project's household data survey.

11. An Indonesian Masters student at the University of Indonesia.

    Ms. Deasy Srishantika is a masters student at the University of Indonesia and a WWF staff member. Deasy will use the project's household survey to complete her masters program.

12. A Phase I Proposal.

    The project presented a Phase I proposal for IHR in October. The IHR requested the project team to resubmit.

2 Introduction

In June 2013, Government of Indonesia (GoI) launched a Green Growth Program (GGP) aligned with and supportive of achieving the country's existing vision for economic development. The GGP aims to demonstrate how economic growth can be maintained while reducing poverty and inequality, maximizing ecosystem services, reducing GHG emissions, and making communities, economies and the environment resilient to economic and climate shocks.

The following year, Indonesia's Ministry of Agriculture (MoA) and the National Planning Agency (BAPPENAS) began developing a 'sustainable agriculture' strategy as a major component to the Medium-Term National Development Plan 2015-2019 (RPJMN). This is the country's third RPJMN, providing ministries and agencies the basis for future policy development.

This SRA provide the basis for priority research work that was derived from the technical workshops, the Policy Roundtable and the background/concept papers. The proposed SRA contributes to ACIAR's overall mission to achieve more productive and sustainable agricultural systems in Indonesia.

The original project activities included organizing a series of policy roundtables and workshops in collaboration with the Indonesian Agency for Agriculture Research and Development (IAARD) and Indonesian Center for Agriculture Socio-Economic and Policy Studies (ICASEPS) and the World Bank. Additional activities included producing six concept papers to motivate and justify a full four-year ACIAR project.

The concept for a series of four, half-day policy roundtables shifted to one, two-day Policy Roundtable at the request of IAARD. The reasons IAARD requested that the SRA project team and the World Bank organize one, two day Round Table include: (i) the need accommodate a larger group of experts to explore all agricultural landscapes collectively; (ii) attract a much higher level of policy makers, including Vice Ministers, at the roundtable to increase the profile and engage the new government (eg, new Minister of Agriculture; (iii) the desire to cover all three targeted landscapes (irrigated lowlands, upland rain fed, and peat and swamp lands) at one time, allowing synergies and encourage collaboration across activities; and (iv) the importance of involving and learning from a greater range of scientists than originally intended.

This SRA was a collaborative effort, implemented by the University of Adelaide Global Food Studies, the Centre for Policy Studies, Victoria University, the World Bank Jakarta, WWF Jakarta and the Indonesian Centre for Agriculture, Socio-Economic and Policy Studies (ICASEPS) and the World Agroforestry Centre- Southeast Asia office.

2.1 Aims & Objectives

The SRA's overall aim was to identify how ACIAR can best support sustainable agriculture policy and program initiatives for the 2015-2019 RPJMN. The key SRA output is an ACIAR project proposal outlining how ACIAR can contribute to Indonesia's 'sustainable agriculture' research agenda. The key SRA output (along with providing a final report) was a Phase I ACIAR project proposal outlining how ACIAR can contribute to Indonesia's 'sustainable agriculture' research agenda. The SRA's main outputs provide the basis for future work derived from the technical workshops, the Policy Roundtable and the background/concept papers

2.2 Project Outputs

A summary of the SRA main outputs are presented in Table 1, comparing the outputs initially proposed to the actual outputs. The following section presents a brief summary of each output.

Table 1: Summary of Planned Deliverables compared with Actual Deliverables

Planned Deliverables	Date	Actual Deliverables	Comments
Roundtable 1: Lowland landscapes	June 2014	IAARD requested one high profile roundtable.	Policy Roundtable delayed due to presidential elections and appointment of new Minister of Agriculture, RT held April 2015
Roundtable 2: Upland landscapes	June 2014	IAARD requested one high profile roundtable.	Policy Roundtable delayed due to presidential elections and appointment of new Minister of Agriculture, RT held April 2015
Roundtable 3: Peat land landscapes	July 2014	IAARD requested one high profile roundtable.	Policy Roundtable delayed due to presidential elections and appointment of new Minister of Agriculture, RT held April 2015
Roundtable 4: Research Priorities	August 2014	IAARD requested one high profile roundtable.	Policy Roundtable delayed due to presidential elections and appointment of new Minister of Agriculture, RT held April 2015
Technical Workshop 1: CGE Modelling for Water	August 2014	Nov 2014	Workshop in Adelaide with World Bank and CoPS staff.
Technical Workshop 2: Field Issues and methods	Sept 2014	June and Aug 2015 Jan 2015	Two workshops in Jakarta with ICRAF, WWF, World Bank, IPB, UNE, and ICASEPS. A third workshop in Adelaide, WWF and UNE
Technical Workshop 3: Phase I proposal development	Nov 2014	July 2015	Workshop in Adelaide, with UNE, ICASEPS, and ICRAF.

Concept Paper 1 Survey, inventory of Indonesia programs, BRICS, Indonesia data gaps, research needs.	Sept 2014		Paper completed. Title, *Sustainable agriculture programs in the BRICS: Gaps and lessons for Indonesia? L. Bateman*
Concept Paper 2 Assesses the extent of economy-wide approaches to the greening of Indonesian agriculture and natural resource use.	Oct 2014		Paper completed. Title, *'Exploring the nexus between food and water policy in Indonesia*
Concept Paper 3 Policies for creating value and sustainability in Indonesia's agricultural value chains.	Nov 2014		Paper converted to focus on research methods and district level information needs for land use decisions in upland landscapes. Described in Concept paper 4. Title, *The logistics of households research in upland agricultural sites: focusing on land expansion into protected forests*
Concept Paper 4 Landscape policy, environmental services and climate change research opportunities.	Oct 2014		Paper completed. Title: *Landscape policy, environmental services and climate change research opportunities*
Concept Paper 5 District, village and household level data needs for upgrading IndoTerm.	Dec 2014		Combined with INDOTERM model paper. Title, *'Exploring the nexus between food and water policy in Indonesia*
Concept Paper 6 Economic and environmental tradeoffs in Indonesia: assessing three agroecosystems in Indonesia	Feb 2014		Paper completed. Title, Research Priority for Sustainable Agriculture in Indonesia
First Draft: ACIAR Project Proposal	Dec 2015		Phase I draft submitted in October 2015.
Final: ACIAR Project Proposal	Feb 2015		Outcome of IHR is resubmit Phase I

Unplanned Deliverables			
Journal Paper *The costs of strengthening ecosystem connectivity in an agricultural landscape in central Sumatra. L. Bateman, D. Yi, O. Cacho and R. Stringer*	September 2016		Paper accepted at AARES February 2016
Journal Paper *Assessing the determinants of smallholder land expansion into protected forests in Sumatra. L. Bateman, D. Yi, and R. Stringer*	October 2016		In preparation
Journal Paper *How does gender influence willingness to accept estimates within and among households: the case of returning agricultural land to protected forest in central Sumatra. L. Bateman, D. Yi, O. Cacho and R. Stringer*	December 2016		In preparation
Indonesian PhD student thesis, Utrecht University, Netherlands.	August 2016		T Barrano's PhD thesis based on 300 household surveys and four village surveys.
Australian PhD student thesis, University of Adelaide.	December 2016		L. Bateman PhD thesis based on 300 household surveys in the RIMBA project area.
Indonesian Masters student	June 2016		D. Srishantika, using household data to work to analyse how social networks impact environmental service provision.

Output Summaries

13. The Policy Roundtable

The 2015 April 29-30 Policy Roundtable on Research Priorities for Sustainable Intensification explored the opportunities and constraints to sustainable agriculture across the country. Environmental issues and agricultural resources deterioration in Indonesia are very diverse, depending on where they are taking place. The Policy Roundtable examined these issues in relation to current and future farming practices in three different types of agro-ecological zones, namely: (i) lowland irrigated; (ii) lowland rain-fed; and (iii) degraded and upland areas.

For each agro-ecological area the Roundtable focused on the following aspects: (i) current farm management and cultivation practices including existing integration of crops and livestock, (ii) current impacts on land and water resources and ecosystem services associated with main farming practices; (iii) opportunities for introducing production and post-harvest technologies and supply chain innovations that can improve land/water management while improving yields and ecosystem services, reduce waste, and contribute to energy production, and increase smallholder income; (iv) constraints to the adoption of above technologies at farm and post-harvest level (this can include also cost and benefits of adopting good agricultural practices); (v) current best practices and lessons learned from recent projects; and (vi) areas for future public intervention.

Among the roundtable outcomes are an outline of the practical steps required to support land management practices, agricultural technologies and profitable farm households in ways that promote long-term agricultural productivity. The Roundtable examined these issues in relation to current and future farming practices in three different agro-ecological zones: (i) irrigated lowland areas; (ii) upland agriculture; and (iii) swamp lands and peat lands agriculture. Addressing policy needs at the agricultural landscape level is relatively innovative for Indonesia's policy community.

Finally, the Roundtable focused on policy and institutional options to support the adoption of sustainable practices in agricultural production and post-harvest value chain development. The format design was structured as a forum to exchange views and experiences among participants on agricultural policies, farming practices that enhance productivity but minimize damage to the agricultural resource. The paper presents the key issues by landscape.

14. Concept paper addressing the role of CGE modelling to support irrigation policy

'Exploring the nexus between food and water policy in Indonesia', M. Young, G. Wittwer and P. van Hofwegen.

This paper highlights the relationship between food and water in Indonesia, and the country's desire for both secure access to both food and water. In the past both these objectives have been attainable but, as demand increases and sustainable limits are being reached, tensions are emerging. As a result, there is a need to improve national capacity to develop new strategies associated with the management of food and water.

The paper begins with a focus on the island of Java as the island contains 58% of Indonesia's population; is responsible for around 53% of Indonesian GDP; and produces just over half of the Nation's rice. The water management and irrigation literature and policy analysis are reviewed along with the potential to introduce a water management model into the CGE model INDOTERM.

The paper identifies two research needs. *The first is to develop Indonesian capacity* to develop options for the improvement of water allocation and management arrangements. The second is to improve Indonesia's capacity to explore the interdependence of water

and food policies at the regional level and couple this with a capacity to explore the likely impacts of options at the national and international level.

The paper recommends focusing on Java before extending this capacity to other regions once we have proved the concept and gained interest. The suggested research components include: (i) collect the data needed to convert INDOTERM into INDOTERM-WATER and extend it to include land-use restrictions in a manner that has not yet been done in Australia; (ii) investment in the development of the regional water accounts necessary to enable blue and green water to INDOTERM working with local experts to develop a new set of policy options; (iii) bring Australian expertise in the development of water allocation and trading regimes to Indonesia; and (iv) improve Indonesia's capacity to explore the interdependence of water and food policies at the regional level and couple this with a capacity to explore the likely impacts of options at the national and international level.

15. A background paper and literature review identifying: (i) how the BRICs are addressing sustainable intensification; (ii) the key agricultural resource management issues in Indonesia; and (iii) the most relevant outcomes of the Policy Roundtable for an ACIAR project

Sustainable agriculture programs in the BRICS: Gaps and lessons for Indonesia? L. Bateman, Erwidodo, Wahida, R. Stringer

The Government of Indonesia (GoI) has pursued both food self-sufficiency and export crop promotion objectives through largely production-led policies. However, in pursuit of these agricultural production and food security strategies, Indonesia has encountered a range of environmental problems associated with natural resource degradation, at least partly in response to unsustainable agricultural production systems. Historically, the issue of whether current patterns of resource use are sustainable, or whether current investment programs and incentives schemes to boost production are contributing to natural resource degradation, has not been a major policy concern. Securing food at affordable prices and reducing poverty have dominated the policy landscape in recent years. This paper examines how Indonesia is addressing natural resource issues, comparing recent initiatives with the BRICS and important agricultural exporters in Southeast Asia. The paper concludes that a better understanding is required of how the existing community institutions can be adapted to manage natural resources and provide the necessary incentives for local communities to supply ecosystem services. Effective institutional mechanisms that can monitor and enforce natural resource management responsibilities and rights are urgently needed to address this complex natural resource management policy issue E.G HAKA program. Further research is required to understand the drivers of smallholder land use behaviour and how policies, programs and incentives can be used to change these behaviours.

16. Background paper highlighting the key results of the 2015 Roundtable on Research Priorities for Sustainable Intensification.

Research Priority for Sustainable Agriculture in Indonesia, Erwidodo and Wahida

Indonesia's economic growth record over the past decade is among the strongest and most consistent in Asia, contributing to steady progress in poverty reduction and improved food security. Indonesia has one of the world's largest farming populations. It is the world's most important palm oil producer, the second-largest natural rubber producer, the second largest cocoa exporter, and the third-largest rice producer and consumer. Indonesia is also one of only a handful of the countries that will likely meet its food security MDG target. However, recent reports suggest that agricultural productivity is at risk. Among the key issues identified include: the excessive use of both legal and illegal

chemicals; pollution and soil fertility problems; nitrate pollution of water bodies; conversion of forest land to agriculture linked to soil erosion, carbon and nutrient losses, declining water quality and downstream sedimentation.

The paper describes the current condition of agricultural development, progress and challenges faced in realizing Indonesian green agriculture. The paper highlights the adverse environmental effects, resource and environmental constraints in agriculture, providing an overview of existing government efforts and the gap between aspiration and commitment. The key results and recommendations from the 2015 April 28-29 Policy Roundtable on Sustainable Intensification are for future research are presented

17. Concept paper identifying key research questions and methods for an ACIAR project focusing on upland agriculture

Landscape policy, environmental services and climate change research opportunities, B. Leimona, O. Cacho, Erwidodo and R. Stringer

Designing a sustainable agriculture program at the national level is a complex task and this is particularly true in a country like Indonesia, where considerable geographical variation occurs. Spatial variation in demographic, economic, environmental and institutional factors must be taken into account when planning and implementing policies. The process of climate change, which introduces additional uncertainty into the system, further complicates the task. In the face of climate change, a sustainable agricultural policy must include both food security and climate resilience in its list of priorities. These outcomes need to be achieved at different levels ranging from the household to local community to national and global. The institutional infrastructure and the networks existing within a community will influence the adaptive capacity and resilience of its households, but individual agricultural households also need to take actions in order to adapt to climate change. To achieve synergy between multiple objectives, actors, processes and levels, a landscape approach becomes relevant.

Some of the actions required to achieve sustainable agriculture will involve substantial costs, require effective incentives and/or face obstacles that are difficult to overcome. Obstacles may be related to factors such as availability of human, financial and natural capital, infrastructure constraints, or profit motives. For example, in regions where oil palm is contributing to deforestation and land degradation, the advantages of this crop in terms of profit per hectare and return to labour are difficult to match by other agricultural systems (Cacho et al. 2014). In these cases, the aspiration of households to improve their financial situation, coupled with poor enforcement of forest protection laws and lack of incentives for providing agriculture ecosystem services results in unsustainable agricultural growth coupled with loss of ecosystem services.

One role of policy is to help remove barriers by providing effective incentives for farmers to contribute to ecosystem services provision and reduce the costs of farmers adopting sustainable agricultural practices. In the last two decades or so, climate policy has been viewed as a possible source of financing to help overcome such obstacles. This has been motivated by the fact that many practices associated with sustainable agriculture result in accumulation of biomass and soil carbon and therefore have mitigation advantages.

Over the years, ACIAR Projects have contributed to research and capacity building for sustainable agriculture and climate mitigation in Indonesia. This paper proposes a project to build upon that work. It helps integrate different methods and brings separate strands of evidence into a coherent strategy to capture synergies and contribute to policy coordination. This concept note contributes to two project objectives for a new ACIAR Project: (1) *develop and adapt assessment methods and modeling tools to analyse alternative policy strategies*); and (2) *design a capacity building program to enhance the*

ability of collaborators to implement, monitor and assess 'sustainable agricultural' strategies).

18. A background paper outlining how to model adoption issues scenarios in upland agriculture, using qualitative and quantitative research methods to understanding the determinants of land expansion in a key 'hot spots.

The logistics of households research in upland agricultural sites: focusing on land expansion into protected forests. L. Bateman, R. Stringer, O. Cacho, H. Perkasa, T. Barrano and Dale Yi.

The purpose of this paper is to present outcomes of the SRA project activity supporting IAARD and ICASEPS to identify research priorities on sustainable development. One aim is to better understand the agricultural land management practice issues in upland landscapes. The paper tests innovative research methods and logistical issues in parts of the RIMBA project in Sumatra. The final survey included 300 randomly selected households from 4 villages. Separate interviews were conducted with male and female heads of households. The paper outlines the collaboration with district offices, the sample design, and household survey process. This paper is in preparation.

19. A research paper testing innovative approaches to analysing agriculture and environment linkages.

Estimating the cost of strengthening ecosystem connectivity in an agricultural landscape in central Sumatra. L. Bateman, D. Yi, O. Cacho and R. Stringer

This article investigates the use of payments for environmental services as an alternative to constructing wildlife crossings in central Sumatra. A large Global Environmental Facility project plans to build bridges across six rivers within a protected forest in Riau, Indonesia. The bridges are expected to reduce human wildlife conflict, allowing safer migration routes for tigers and elephants. Several hundred smallholders farm, mostly rubber, along the highway within the protected forest. The success of the project depends on the willingness of these smallholders to accept a payment requiring them to forgo access to their land in the protected forest for 5 years. Willingness to participate in the 'buyout' program is examined via surveys of 300 randomly selected households from 4 villages bordering the protected forest. The study analyses the factors that determine the decision to participate in the program and the factors influencing the amount of compensation required. Both male and female household members are included in the survey and analysis, with inferred valuation techniques used to address social desirability bias and hypothetical bias. This paper is in preparation. It will be presented at the AARES 2016 Conference in Canberra. This analysis provides insights into land-users willingness to participate in conservation programs in Indonesia, with policy and program design implications. The data provides the research team to answer three important research questions; (i) What are the factors influencing the household crop adoption and land expansion decisions?; (ii) What level of compensation are farm households willing to accept to give up their land for wildlife corridors? and (iii) How do gender and environmental perceptions influence willingness to accept compensation?

20. A background paper presenting research methods for collecting household survey data in protected forests.

Testing Research Methods for Understanding Household Land Management Practices in Upland Landscapes

The purpose of this paper is to explore methods for assessing the determinants of agricultural land management practice in upland landscapes. To meet this aim, the SRA

team, including ICASEPS, WWW and the World Bank experimented with fieldwork techniques in the RIMBA project area to test the team's ability to carry out research with village leaders and households clearing and using land illegally in protected forests. The rapid conversion of high conservation value forests to agriculture (often to rubber and oil palm) is leading to widespread biodiversity losses, and declines in the condition of the natural resource base in much of Sumatra's highlands. Sumatra's forests produce vital ecosystem services and provide habitats to species of global consequence, including the Sumatran Tiger and Sumatran elephant. The continuing loss of these forests would be disastrous for the region's biodiversity and have global welfare implications.

In recognition of this, 10 Sumatran governors in the Riau, Jambi and West Sumatra provinces signed on to create the RIMBA green development area. With support from the Global Environmental Fund (GEF,) WWF are seeking to build an eco-construction involving 6 flyovers along an 11 km road through the protected forest in one section of the RIMBA area to protect the habitat of Sumatran tigers and elephants. However, the preservation of this key biodiversity hotspot is largely dependent on the cooperation of local communities to give up agricultural practices within the protected forests. This paper describes the SRA's research teams efforts to design and carry out surveys collaborating with the local university. This paper is in preparation.

21. An Australian PhD student from the University of Adelaide.

Ms. Laura Bateman participated in the SRA project as a University of Adelaide scholarship student. She will use the household data collected in the RIMBA project site for her PhD papers.

22. An Indonesian PhD student at Utrecht University in the Netherlands

Thomas Barrano is a PhD student at Utrecht University in the Netherlands and the RIMBA project manager. Mr. Barano will complete his PhD studies using the project's household data survey.

23. **An Indonesian Masters student at the University of Indonesia***.*

Ms. Deasy Srishantika is a masters student at the University of Indonesia and a WWF staff member. Deasy will use the project's household survey to complete her masters program.

24. A Phase I Proposal.

The project presented a Phase I proposal for IHR in October. The IHR requested the project team to resubmit.

3 Conclusions and recommendations

3.1 Conclusions

The SRA concludes that a full ACIAR project can make important contributions to sustained growth and development contributions in Indonesia's upland landscapes. The SRA partners, in collaboration with the IAARD and the World Bank, identified the key sustainable intensification research issues across Indonesia main landscapes and

The SRA concludes that in most upland conservation development projects and agricultural intensification efforts in Indonesia's uplands, no empirical research exists or is planned to explain: why upland producers in are making the decisions about what to plant, how to grow it and when and where to expand their production. The most basic information required for understanding farm household land use decisions is missing: the determinants of farmland expansion.

Likewise, little is known about: (i) the barriers farm households in the study site face to adopt the proposed on-farm land use management practices; (ii) what influences the intensity of their adoption within and across plots;[1] and (iii) the incentives and household circumstances leading to dis-adoption. The intensity of adoption is important as farmers usually only partially adopt promoted practices. The household variables and policy levers that may increase the intensity of adoption are relevant for designing strategies to increase overall adoption. Dis-adoption experiences are important for similar reasons, as households tend to dis-adopt at different times over time.

The key research questions identified by the SRA. To answer these research questions in ways that inform development policy and program design to enhance long-term agricultural productivity in Indonesia's upland landscapes, the SRA proposes five objectives for the four-year proposal. These objectives are intended to increase the adoption rates of land use management practices designed to address natural resource degradation in three upland study sites.

RQ 1 What are the determinants of household land use decisions in upland study sites?

RQ 2How do markets, technology, social capital and regulatory systems impede or encourage farm household adoption, dis-adoption and intensity of adoption?

Objective 1: Understand the drivers of land-use decisions by smallholders in upland study sites.

- Through focus groups and interviews with village heads and District offices to collect key information on how farmer groups, village organizations and governance structures influence land use and natural resource management decisions.

- Semi-structured interviews with male and female household heads to identify socio-economic determinants affecting land use decisions.

RQ 3 How do gender and natural resource use perceptions influence innovation and adoption?

[1] *Adoption intensity is defined as how many plots and how much of the plot is under the new practice.*

RQ 4 How do farmer groups, village organizations and governance structures influence natural resource management?

Objective 2: Identify the constraints and determinants of adoption by smallholders in upland landscapes.

- Designing household and village questionnaires to capture key variables to understand how markets, technology, social capital and regulatory systems impede or encourage adoption and innovation in upland landscapes.
- Modelling adoption processing and understanding the differences and incentives across farm households and the agricultural landscape.

RQ 5 What are the negative and positive externalities associated with farm level land use decisions?

Objective 3: Document the externalities associated with alternative land-use patterns using a landscape approach.

- By identifying the productivity gaps and externalities associated with alternative land uses (i.e. effects on sedimentation, water quality, risk of floods, CO_2 emission reductions etc.)
- Modelling future effects of alternative policies on key performance indicators (eg, food security, household income, employment, income stability, etc.)

RQ 6 What are the priority policy, institutional and technological strategies to promote more productive and pro-poor natural resource management in upland landscapes?

RQ 7 Can practical modelling tools support local level (district) decision makers understand the consequences of regulatory incentives on adoption and natural resource outcomes and the promising potential of alternative systems?

Objective 4: Identify and promote sustainable intensification activities to encourage durable adoption of desirable systems.

- By understanding the priority policy, institutional and technological strategies to promote more productive and pro-poor natural resource management in upland landscapes.
- Design and individualise the intensification activities for farm household clusters and for plot characteristic clusters across the landscape.

Objective 5: Build capacity to enhance the skills of farmers, village leaders and District land use planners to apply the project's landscape model approach in planning.

- Designing a general conceptual model to assess how local, District and national 'policy levers' are related to desirable outcomes based on the aggregate behavior of individual households.
- Explore how to adapt the project's models to user friendly tools for district level managers supported by the local university researchers to assess regulatory barriers and land use planning needs

Proposed Outputs

New knowledge that fills research gaps in socioeconomic data and economic analyses to confirm, guide, encourage or dispel the current rationale for policy and program decision-making in upland landscapes.

New databases and modeling applications that reduce uncertainty associated with tradeoff estimations between long-term productivity and the natural resource base supporting that landscape.

Capacity building programs supporting women's groups and organizations to address adoption barriers specific to women.

Decision-making tools and baseline indicators for district and provincial government offices, supporting their role as land use and land management decision makers.

Practical research tools to: (i) determine where and what practices are most needed in upland landscapes; (ii) inform and benefit women as well as men; and (iii) address adoption barriers to sustainable agricultural growth.

Watershed and landscape-scale assessments that are geographically relevant, reliable estimates of the household and natural resource impacts and tradeoffs of alternative regulatory and policy regimes aimed at meeting desired development goals.

3.2 Recommendations

Among the recommendations for the Phase I project design include:

link the ACIAR project to ongoing upland sites sites with existing development projects that are attempting to introduce conservation practices to reduce soil erosion, soil nutrient loss, improve soil carbon storage and reduce downstream sedimentation and flooding;

introduce household survey research activities in the study sites to gather information about the drivers of land use change and the barriers to adoption of conservation practices;

carry out survey designs that capture the heterogeneity of the landscape and the farm housholds;

collaborate with district level land managers and DINAS offices represented by Forestry, Agriculture, Planning and Environment;

provide district officers who manage land use planning and land concessions with decision-making tools and support them in preparing land use plans to secure access to federal funding;

The proposed study sites have ongoing land use programs funded by the Global Environmental Fund, IFAD, the World Bank and ICRAF among others. These development projects are collecting a range of GIS related information about slopes, land use, soil loss, and related biophysical information. None the proposed sites are collecting household data to assess farm decision-making. And none of the sites have gender data The proposed project can take advantage of existing project networks but fills important gaps in the four sites.

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