Food and Agriculture Organization
of the United Nations

Climate change and agriculture scenarios for Viet Nam

Using scenarios to guide Climate-Smart Agriculture (CSA) planning

Report of the Second Scenario Workshop

Hanoi, Viet Nam
8-9 May 2014

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The project, funded by the European Commission, was launched in January 2012 in Malawi, Viet Nam and Zambia. It aims to support partner counties in their transition towards Climate-Smart Agriculture.

For further information on EPIC, visit: www.fao.org/climatechange/epic

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Background

The FAO Economics and Policy Innovations for Climate Smart Agriculture (EPIC) Programme[1] and the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) together with the Northern mountainous Agriculture and Forestry Science Institute (NOMAFSI) organized a national workshop on May 2014 for Climate Smart Agriculture (CSA) investment proposals and policy recommendations for Viet Nam, based on future climate and socio-economic scenarios. More than 30 national experts and policy makers participated to this 2 days' workshop. The meeting was opened by Dr Tran Van Cong, Deputy Director of the Department of International Cooperation, MARD.

This national workshop is a follow up of the regional workshop organized on the 5- 7 November, 2013 in Ha Long City, Viet Nam. In this first workshop, Southeast Asian stakeholders came together to develop future scenarios which have subsequently been quantified through simulation modelling. These socio-economic/climate scenarios provided the contexts for the review of 4 investment proposals developed within the FAO EPIC process in the workshop documented in this report.[2]

[1] For further information on the EPIC programme, visit www.fao.org/climatechange/epic
[2] All documents related to the first scenario workshop are available at: www.fao.org/climatechange/epic/events/scenarios

Workshop Objectives and Outputs

The use of the CCAFS/FAO scenarios for Southeast Asia is aimed at a number of goals:

- Identifying entry points for most urgent and effective action
- Testing impact
- Revealing risks

To be able to meaningfully analyse entry points for action, impacts and risks for CSA, and in this case, assess the feasibility and appropriateness of Climate Smart Agriculture investment proposals, these have to be examined in the context of multiple scenarios representing diverse future socio-economic and climate developments. If a proposal is likely to be successful under a wide range of different conditions, this can be used as evidence for the feasibility of the proposal.

The CCAFS/FAO scenarios for Southeast Asia were used to ask the following questions to the investment proposal designed by the participants:

- If a given proposal is based around a single strategy, is this strategy robust/flexible enough to be successful under different scenarios? What improvements can be made?
- Alternatively, if a given proposal provides a portfolio of strategies, which strategies in this portfolio are more or less feasible in different scenarios? What has to be changed, are additional options needed?
- Is the proposal concrete enough to even have meaningful information about how some of the challenges could be tackled? How can the proposal be made more concrete?

Using scenarios to test the investment proposals is a way to engage actors in a dialogue about future uncertainties which results in an active, critical understanding of the proposals, and therefore leads to co-ownership of these plans and will make it more likely that they are truly informed by regional perspectives.

Through the 2 days' workshop 7 main group exercises were conducted. This report aims at giving an overall view on the rationale of each of those exercises and presents the direct outcomes of this national workshop. The agenda of the meeting and list of participants are available in the Annex A and B.

SESSION 1
Presentation of the evidence base for CSA generated by the EPIC Programme

In this session Dr Leslie Lipper and Dr Aslihan Arslan (FAO) presented the evidence base for Climate Smart Agriculture generated by the project, and a first version of an investment proposal to be reviewed and tested in the workshop.

At first Dr Lipper gave an overall view on CSA and its evidence-based agricultural development strategies, policies and investment frameworks to:

- Sustainably increase agricultural productivity and incomes,
- Build resilience and the capacity of agricultural and food systems to adapt to climate change, and
- Seek opportunities to reduce and remove GHGs compatibly with national food security and development goals.

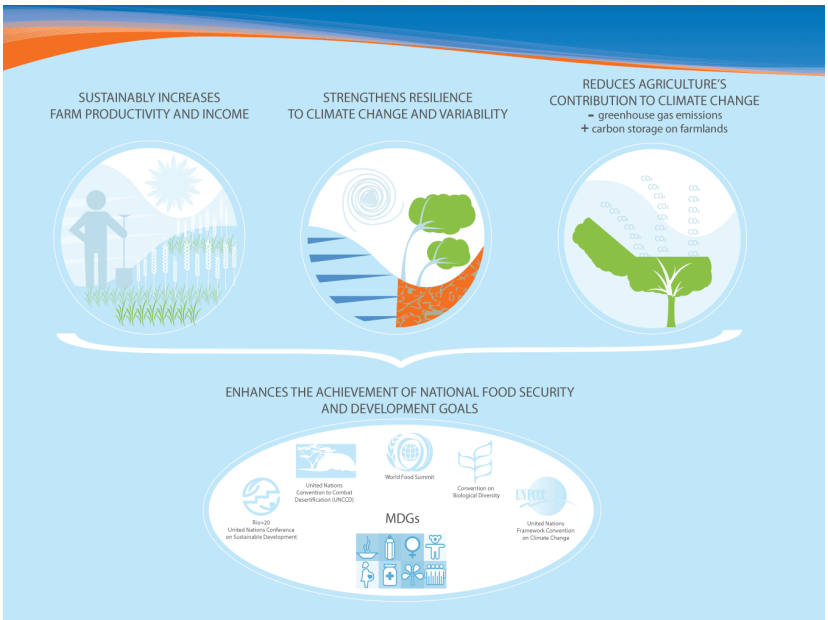

Figure 1. CSA pillars, FAO presentation

Dr Arslan introduced then the Climate-Smart Agriculture project in Yen Bai, Son La, Dien Bien and the potential of CSA investment in Viet Nam.

SESSION 2
Reviewing the existing Investment Proposal and developing new ones

In this session participants were divided into 4 distinct groups lead by national experts and facilitators from CCAFS and FAO. The investment proposal presented in the morning was reviewed and elaborated by two groups of participants; two other groups worked on developing a new proposal from recommendations emerging from the evidence base not covered by the initial proposal. Both groups had to use the following guiding questions:

- *Is the overall objective of the proposal clear?*
- *What is the sequence of implementing the proposal? Which steps come first?*
- *How concrete are the various steps? How can they be made more concrete?*
- *What are the funding sources? How can the proposal be made suitable for that funding source?*
- *What needs to be added to the evidence base of the proposal?*
- *Who should be responsible for various steps in the proposal?*
- *What are the key indicators of interest the proposal is looking to change (such as farmer's food security, incomes)? What are the key contextual factors influencing success or failure of the proposal (such as global markets, government support)?*

Table 1. Key Interests and Context Factors

List of key indicators of interest	List of key contextual factors
GHG from Agriculture increase	Deforestation land use change
	Increased market linkage (TPP-Trans Pacific Partnership)
Increased income of farmers	Land Tenure
	Lack of appropriate support: policies, investment
	Economic Situation and donors interest
Increased soil fertility	Climate Shocks
	Funding shortage (credit crunch)
	Underdeveloped and unstable markets
CSA Practices	Political and policies changes
	Risk of middle income trap
	Lack of forecasting system for the market
	Limited linkages btw stakeholders
	Farmers are conservative
water quality	Farmer behaviour / attitude
	Policy change
Better forest coverage	Migration (both in and out)
CC integrated into local development program	Local Staff are not always active
National (and international) Recognition of competence related to CSA	International commitment on CC
Increased Awareness	Trading Policies and agreements
Reduction of farming input cost	Policy environment
Post-harvest loss reduced	Relevant data available
Negative impact of Flood reduced	Lack of qualified/ skilled HR
CSA action plan launched	Extreme Weather events

SESSION 3
CCAFS/FAO MEAL SCENARIOS FOR SEA AND ASSOCIATED QUANTITATIVE MODEL RESULTS

In this session, Dr Joost Vervoort (CCAFS) together with Dr Rathana Peou (CCAFS) presented the CCAFS/FAO MEAL scenarios for Southeast Asia developed in Ha Long at the end of 2013.

A. MEAL Scenarios, Four scenarios for Viet Nam and its Southeast Asian context

In a workshop in Ha Long Bay on 5 to 7 November 2013, four scenarios were developed with a group of participants from different sectors, based on their assessment of the top factors of change for the future of agriculture and food security in Southeast Asia. These factors of change were 1) Markets, 2) Government enforcement capacity and regional collaboration as a combined factor, 3) Agricultural investment and 4) Land degradation through land use change (see table 2).

Table 2. Four scenarios for Viet Nam in a Southeast Asian context

Factors	Markets	Enforcement capacity and regional collaboration	Agricultural investment	Land degradation through land use change
Land of the Golden Mekong	Common regulated market	Strong enforcement and strong regional collaboration	High public and private	Low
Buffalo, Buffalo	Unregulated	Weak enforcement and weak regional collaboration	Unbalanced: high private investment in business and research	High
The Doreki Dragon	Common regulated market	Strong enforcement and strong regional collaboration	Unbalanced: high private investment in business and research	High
Tigers on the Train	Protectionism and closed market	Strong enforcement and strong regional collaboration	Low public and private	Low

B. Narratives and images for the CCAFS/FAO MEAL Scenarios for SEA[3]

Land of the Golden Mekong

In this scenario, unification of Southeast Asia in terms of political, economic and environmental concerns slowly becomes a reality. Though challenges around urbanisation and migration initially increase, ultimately institutions become effective enough to enable improved development and environmental management. Aging populations and the lack of labour due to egalitarianism become a problem – migrants from poorer countries replace the regional population in the working class but are shunned and abused. Strength and inclusiveness of governance (at least for the autochthonic population) is the key source of the significant change in food security, livelihoods and environments that can be observed. Climate resilience is strong in that respect, though biophysical vulnerabilities remain significant, especially in the form of extreme events that still sometimes overwhelm the region's adaptive capacity. The migrants become the most vulnerable groups.

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Buffalo, Buffalo; water flows uphill

In this scenario we start out in 2013 looking up. ASEAN agreements appear to be going ahead. Myanmar is starting to produce more and be more economically active. Moving to 2020 we start to see more problems: there are major corruption scandals that greatly weaken national governments. High oil and food prices due to global as well as local situation and increased demand for biofuels increases pressure for private sector to acquire land – increasing pressure on population that is dependent on farming for their living. Logging concessions to private industry lead to massive deforestation. Environmental change creates incredible regional tensions. ASEAN closes borders and cooperation between countries is lost. Food production is significantly decreased – migration and conflicts increase.2050 sees a situation of unsustainable agricultural intensification. There is a big plantation sector, greater emphasis on processed foods, but only the rich people in the country can afford it. There is

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[3] For a complete description of the scenarios developed at the first scenario workshop, please refer to the worshop report available at www.fao.org/climatechange/epic/events/scenarios

huge environmental degradation. Social conflict is rampant. Local governance and civil society at times make some progress in solving problems, but they cannot overcome the overall declining situation.

The Doreki Dragon

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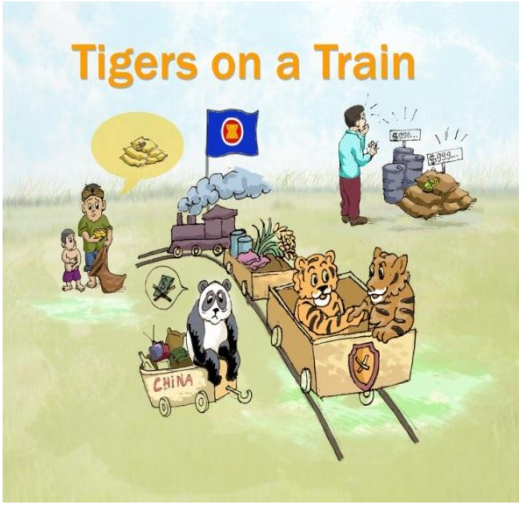
In this scenario, the ASEAN-facilitated development of a regional market and the increasingly effective political focus on big business in all sectors, including agriculture, drives significant change. GMOs become the norm and are no longer exceptional – it's all just "food". Agricultural industrialisation develops to the degree that agriculture, while a massive source of growth, is almost no longer recognizable as such. Smallholder famers struggle more than ever, and very often fail, to maintain a livelihood – many become workers on highly industrial farms. Urbanisation is high. Environmental degradation and natural land conversion are extreme. Food security for the poor is very low, though food safety is stringent. The different societal classes are more divided than ever in terms of climate resilience with climate impacts being made significantly worse due to large-scale manipulation of the natural environment.

Tigers on a Train



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This scenario sees Southeast Asia becoming increasingly collaborative regionally but also protectionist with regard to outside economic influences from China and other global actors. Riding on a time of high food prices in the first decades of the scenario, the region manages to use investments in agriculture that are not by themselves extremely high very effectively. The highly controlled region develops its focus from primary production more to agricultural processing, and eventually away from agriculture and toward industrialisation. Protectionist economic policies cause tensions with China and the need for continued negotiations. By 2050, some deep issues with the protectionist policies threaten to cripple the regional economy. In terms of climate resilience, this increased economic fragility threatens food security for the poorest who have felt the consequences of the shift away from agricultural development in recent decades.

C. Summaries of quantitative results for the Southeast Asia scenarios

Dr Joost Vervoort (CCAFS) presented the following summaries that are based on scenarios results produced by the GLOBIOM model, developed by the International Institute for Applied Systems Analysis (IIASA) and the IMPACT model, produced by the International Food Policy Research Institute (IFPRI) GLOBIOM and IMPACT both modelled the production of a number of commodities in the Southeast Asia region up to 2050 in a global context of changing demand and prices for these commodities. The models also simulate land use change and calorie availability per capita per day available on average as a result of the dynamics of production and demand. A longer document with graphs is available as well for reference in Annex D.

Land of the golden Mekong summary of quantitative results:

- As incomes increase, demand for agricultural commodities goes up.
- Investments in yield increase production to respond to regional and global demand.
- There are strong pressures for land expansion due to regional and global demand, so this has to be moderated by policies on land use.
- Prices for rice, maize and beef drop due to increased yields and agricultural expansion.
- Calorie availability per capita increases on the whole; though this may hide inequalities between demographic groups.

Buffalo, Buffalo, summary of quantitative results:

- Low incomes and high production costs limit production in this scenario.
- However, in most cases demand for commodities still goes up, and so does production, relatively.
- Rice prices are relatively high; maize and beef prices decrease.
- Calorie availability per capita per day increases the least in this scenario compared to the other scenarios.

DoReKi Dragon summary of quantitative results:

- Incomes increase in this scenario, though this increase masks inequalities that are very large.
- Because of increasing incomes, demand for various commodities increases.
- There are no considerations for sustainable development and no limits on land expansion.
- Because of this, production for most commodities increases in an unsustainable fashion.
- Calorie availability per capita per day increases; again, this masks inequalities between demographic groups.

Tigers on a Train summary of quantitative results:

- Investment in agriculture increases initially but then the region shifts away to other sectors.
- Because of moderately rising incomes, demand increases moderately as well.
- Production of key commodities goes up in response to this.
- Yield increases happen but are not as strong as in the other scenarios, due to the shift away from agriculture investment later in the scenario.
- Calorie availability per capita per day increases moderately.

SESSION 4
Adapting Scenarios to case study scope and key indicators of interest

In this session the regional scenarios were translated to function as tailored decision contexts for the participants and the investment proposals. This was done by taking the list of key indicators of interest and outlining what a given scenario means for this indicator of interest over different time periods.

Four groups were organized, one per scenario, with members from all proposals writing teams. The group took ten minutes to get acquainted with the scenario and imagine themselves in that world. Then, the key indicators identified in the previous exercise were presented as a list. The group described what their scenario meant for each indicator. This way, the scenarios were each expanded and tailored specifically for use in testing the investment proposals. Please refer to Annex 6. MEAL Scenarios tailored for Viet Nam for summaries.

SESSION 5
Testing the 4 investment proposals

In this session, participants were asked to test the 4 investment proposals against multiple adapted scenarios; to develop recommendations for improving the proposals for a given scenario: The group splinted up into breakout groups, each group testing the investment proposals against a different scenario, highlighting where the proposal was strong and where it had weakness dealing with the scenario, and proposing recommendations to overcome these problems. The group also considered what policy conditions may be created that would better enable CSA to be successfully implemented.

Each group linked to their scenario and took the time to read each investment proposal, and then goes through it point by point to say whether each step or action is feasible under their scenario (+), not feasible (-), or its feasibility is unclear (?). For each point, the group made notes as to why this verdict was made, and suggested possible alternatives.

SESSION 6
Comparison and improvement of the robustness of proposals

By comparing proposal feasibility across the different scenarios and comparing recommendations for improvement, the groups came together to compare the strengths and weaknesses of the proposals in the context of different scenarios, and to compare which recommendations for improvement would increase the feasibility of the proposal across this range of futures. The groups that developed the proposals came back together.

Each group got the results for their proposal as reviewed across the different scenarios and discusses point by point where their proposal was strong/robust and where it was weak and/or overly dependent on specific conditions. For instance, some parts of the proposal

may work under all 4 scenarios, while others work under no scenarios or under only one scenario. The group outlines improvements and alternatives to the main weaknesses of the proposal. Please look to Annex 7 for the final versions of the proposals.

SESSION 7
Setting Priorities and next steps

Discussions were guided by the scenarios on the priorities for the next years and how the next phase of the EPIC program should be designed to provide the best support to focus on these priorities. There was a large interest to develop the GEF proposal in particular, but there were plans to take all proposals forward, possibly combining some elements.

CONCLUSIONS

Scenarios become useful when applied to examining the feasibility of concrete actions. The workshop achieved its objectives of elaborating a number of investment proposals, down-scaling the CCAFS/FAO socio-economic/climate scenarios and using these scenarios to improve the robustness of the proposals elaborated in the workshop by cross-testing them in the different future worlds, providing diverse feedbacks on the strengths and weaknesses of the proposal drafts. Elements of the investment proposals developed in the workshop are brought together in a combined GEF proposal which will be further developed with government actors and researchers. Insights from the quantitative scenario results presented in the workshop will be used to further highlight the need for priority actions in the proposal.

ANNEX A: AGENDA OF THE WORKSHOP

Day 1		Sessions lead by
8.00-9:00	Brief for the facilitators, Group Leaders, Note Takers and Translators, Movenpick hotel, 2nd floor	Dr Rathana Peou , Mr Ngha Le and Dr Joost Vervoort
8:30-9:00	Registration	NOMAFSI/ CCAFS
9:00-9:20	*Opening Speech*	*Dr Dinh Vu Thanh(MARD) Deputy Director of Department of Science and Technology, MARD*
9.20-9.25	Group Picture	Dung
9:25-10:00	Presenting the project, Overall Objectives of the workshop, introducing participants	Dr Joost Vervoort (CCAFS)
10.00-10.10	Coffee Break	
10:10-12:00	Presenting the evidence base for Climate Smart Agriculture generated by the project, and a first version of an investment proposal to be reviewed and tested in the workshop.	Dr Leslie Lipper and Dr Aslihan Arslan (FAO)
12:00-13:00	Lunch break	
13:00-15:00	Breakout session Two groups discuss the following guiding questions: ➢ Is the overall objective of the proposal clear? ➢ What is the sequence of implementing the proposal? Which steps come first? ➢ How concrete are the various steps? How can they be made more concrete? ➢ What are the funding sources? How can the proposal be made suitable for that source? ➢ What needs to be added to the evidence base of the proposal? ➢ Who should be responsible for various steps in the proposal? ➢ What are the key indicators of interest the proposal is looking to change (such as farmer's food security, incomes)? ➢ What are the key contextual factors influencing success or failure of the proposal (such as global markets, government support)?	Facilitators and Group Leaders
15.00-15.30	Coffee Break	
15.30-16.00	Presenting MEAL scenarios and associated model results: The regional scenarios and their associated model analyses (IMPACT/GLOBIOM) will be discussed.	Dr Rathana Peou and Dr Joost Vervoort
16.00-17.30	Adapting scenarios to key indicators of interest: The regional scenarios are translated to function as tailored decision contexts for the participants and the investment proposals. This is done by taking the list of key indicators of interest and outlining what a given scenario means for this indicator of interest over different time periods. The result is a tailored set of scenarios.	Key Facilitators together with the group leaders Key Facilitators is as follow: Rathana Peou for the scenarios of the land of Golden Mekong Joost Vervoort for the

		Tiger on the train Dr. Sen/ Leslie Lipper for the Buffalo Buffalo Soojin Kim for the Doreki Dragon
Day 2		
9.00-10.30	Breakout session: Testing the 4 investment proposals against multiple adapted scenarios; develop recommendations for improving the proposals for a given scenario:	Key Facilitators
10.30-11.00	Coffee break	
11.00-12.30	Breakout session Compare proposal feasibility across the different scenarios	
12.30-13.30	Lunch break	
13.30-15.30	Discussion, guided by scenarios, on the priorities for the next years and how the next phase of the EPIC program should be designed to provide the best support to focus on these priorities	Leslie Lipper and Joost Vervoort
15.30-16.00	Coffee break	
16.00-17.20	Next steps forward – funding and implementation Details: for each proposal, it is clarified who champions the proposal, which would fund it, and who has to be consulted, as well as an immediate time line.	
17.20	Closing Remarks	

ANNEX B: PARTICIPANTS

List of workshop participants and their organizations of affiliation

NAME	ORGANIZATION OF AFFILIATION
Mr Tran Van Cong	Ministry of Agriculture and Rural Development (MARD) International Cooperation Department
Ms Bui Mỹ Bình	Ministry of Agriculture and Rural Development (MARD) International Cooperation Department
Truong Quoc Can	Ministry of Agriculture and Rural Development (MARD) Centre for Sustainable Rural Development (SRD)
Ms Le Hoang Anh	Ministry of Agriculture and Rural Development (MARD) Department of Science, Technology and Environment
Ms Nguyen Hong Uyen	Ministry of Agriculture and Rural Development (MARD) Crop production Department.
Mr Trieu Do Kien	Ministry of Planning and Investment
Mr Tran Manh Cuong	Ministry of Science and Technology
Mr Dang Anh Tuan	Ministry of Finance
Mr Pham Ngoc Toan	Ministry of Labour, Invalids and Social Affairs
Ms Nguyen Thi Thu Ha	Disaster Management Center (DMC)
Dr Ha Quyet Nghi	Department of Agriculture and Rural Development (DARD) Son La Province
Mr Pham Duc Hien	Department of Agriculture and Rural Development (DARD) Dien Bien Province
Ms Vu Thi Luu	Department of Agriculture and Rural Development (DARD) Yen Bai Province
Ms Le Thuy Hang	National Institute of Animal Husbandry
Mr Vu Hoang Quang	Rural Development Centre
Dr Mai Van Trinh	Viet Nam Academy of Agricultural Sciences (VAAS) Institute for Agricultural Environment
Dr Le Sy Trung	Thai Nguyen University of Agriculture and Forestry
Dr Dao Thanh Van	Thai Nguyen University of Agriculture and Forestry
Dr Ho Dac Thai Hoang	Hue University of Agriculture and Forestry
Ms Tran Thi Huyen	University of Labor and Social Affair
Ms Pham Thi Sen	Northern Mountainous Agriculture and Forestry Science Institute
Dr Nguyen Huu La	Northern Mountainous Agriculture and Forestry Science Institute
Mr Le Huu Huan	Northern Mountainous Agriculture and Forestry Science Institute
Mr Hoang Xuan Thao	Northern Mountainous Agriculture and Forestry Science Institute
Ms Do Thanh Hai	Northern Mountainous Agriculture and Forestry Science Institute
Mr Nguyen Thanh Thuy	Northern Mountainous Agriculture and Forestry Science Institute
Mr Le Diệu Hương	Northern Mountainous Agriculture and Forestry Science Institute
Ms Nguyen Mai Phuong	World Agroforestry Centre (ICRAF), Viet Nam
Ms Elizabeth Silmeton	World Agroforestry Centre (ICRAF), Viet Nam
Mr Bui Manh Tien	World Agroforestry Centre (ICRAF), Viet Nam
Mr Bui Kien Cuong	Institute of Policy and Strategy for Agriculture and Rural Development (IPSARD)
Ms Nguyen Thanh Ha	Japan International Cooperation Agency (JICA)

Ms Nguyen Thi Yen	CARE Disaster Risk Reduction and Climate Change Department
Ms Bui Phuong Lan	OXFAM NOVIB
Dr Tran Thi Thu Ha	World Bank Second Northern Mountains Poverty Reduction Project (NMPRP2)
Ms Nguyen Thi Hong Minh	Minh Tien Coffee Company
Mr Chu Van Hoi	Joint Stock company for import-export Agricultural and Forestry products
Dr Rathana Peou	CGIAR Research Program on Climate Change, Agriculture and Food Security(CCAFS)
Dr Joost Vervoot	CGIAR Research Program on Climate Change, Agriculture and Food Security(CCAFS)
Mr. Ngo Duc Minh	International Rice Research Institute (IRRI)
Dinh Thi Dung	CGIAR Research Program on Climate Change, Agriculture and Food Security(CCAFS)
Dr Leslie Lipper	Food and Agriculture Organization of the United Nations (FAO) Italy
Dr Aslihan Arslan	Food and Agriculture Organization of the United Nations (FAO) Italy
Mr Le Đại Nghĩa	Food and Agriculture Organization of the United Nations (FAO) Viet Nam
Dr Nguyễn Văn Linh	Food and Agriculture Organization of the United Nations (FAO) Viet Nam
Ms Soojin Kim	Food and Agriculture Organization of the United Nations (FAO) Viet Nam

Photo Workshop Participants

ANNEX C. Preliminary results of the CCAFS Southeast Asia scenarios from the GLOBIOM agricultural economic model

The following graphs are produced by the GLOBIOM model, developed by the International Institute for Applied Systems Analysis (IIASA) (Havlík *et al.*, 2013), and the IMPACT model, produced by the International Food Policy Research Institute (IFPRI) (Rosegrant, 2012). GLOBIOM and IMPACT both modelled the production of a number of commodities in the Southeast Asia region up to 2050 in a global context of changing demand and prices for these commodities. The models also simulate land use change and calorie availability per capita per day available on average as a result of the dynamics of production and demand.

Drivers

The scenarios provided different assumptions for Gross Domestic Product per Capita, population and production costs for farmers. Figure 1 gives an example of how the GDP trajectories for Viet Nam were developed in comparison to the new global socio-economic scenarios of the IPCC, the Shared Socio-economic Pathways (SSPs) (Moss *et al.*, 2010). SSP1 is called "sustainability", corresponding most closely to the Golden Mekong scenario, SSP 2 is called "middle of the road" and is linked to the Tigers on the Train scenario, SSP 3 is the most negative scenario, called "fragmentation" and is linked to the Buffalo Buffalo scenario, SSP4 is called "inequity" (on a global level) and SSP 5 is called "conventional development" – corresponding most closely to Doreki Dragon.

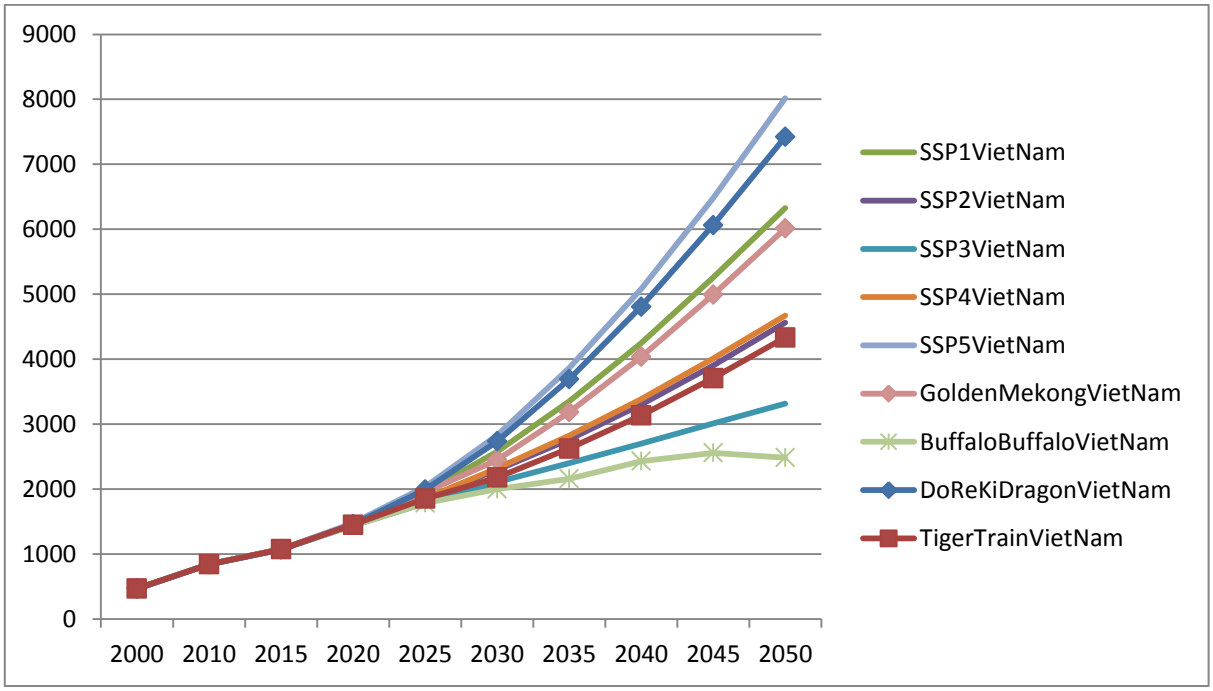

Figure 1. Gross Domestic Product per Capita for the four CCAFS scenarios in Viet Nam, compared to the five global Shared Socio-Economic Pathways (SSPS) of the IPCC.

Results

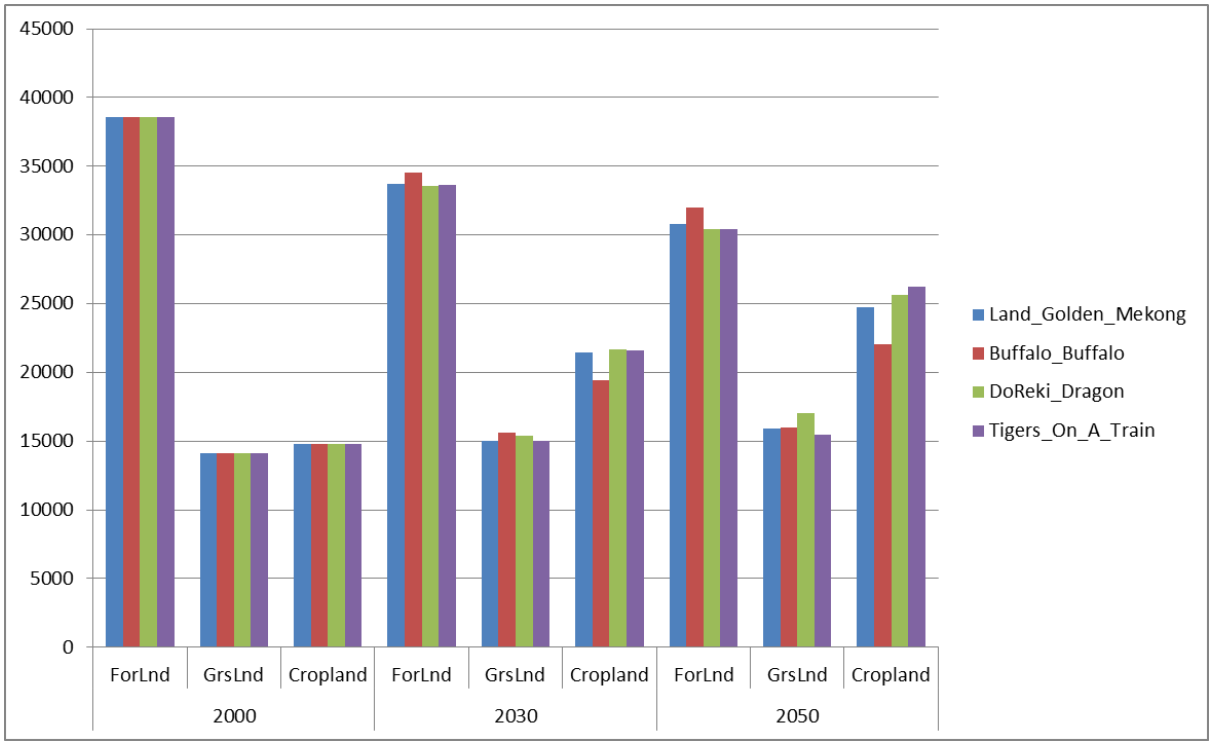

Figure 2. Land use, indexed to present conditions, by the GLOBIOM model. All scenarios see a decrease in forest cover and the strongest increase in cropland, responding to demand. Buffalo, buffalo expands the least due to demand for cropland being lower and the higher costs of production. Cropland increases in the sustainable "Land of Golden Mekong" scenario are more than might be expected – because the model has not incorporated any policy restrictions on land use change.

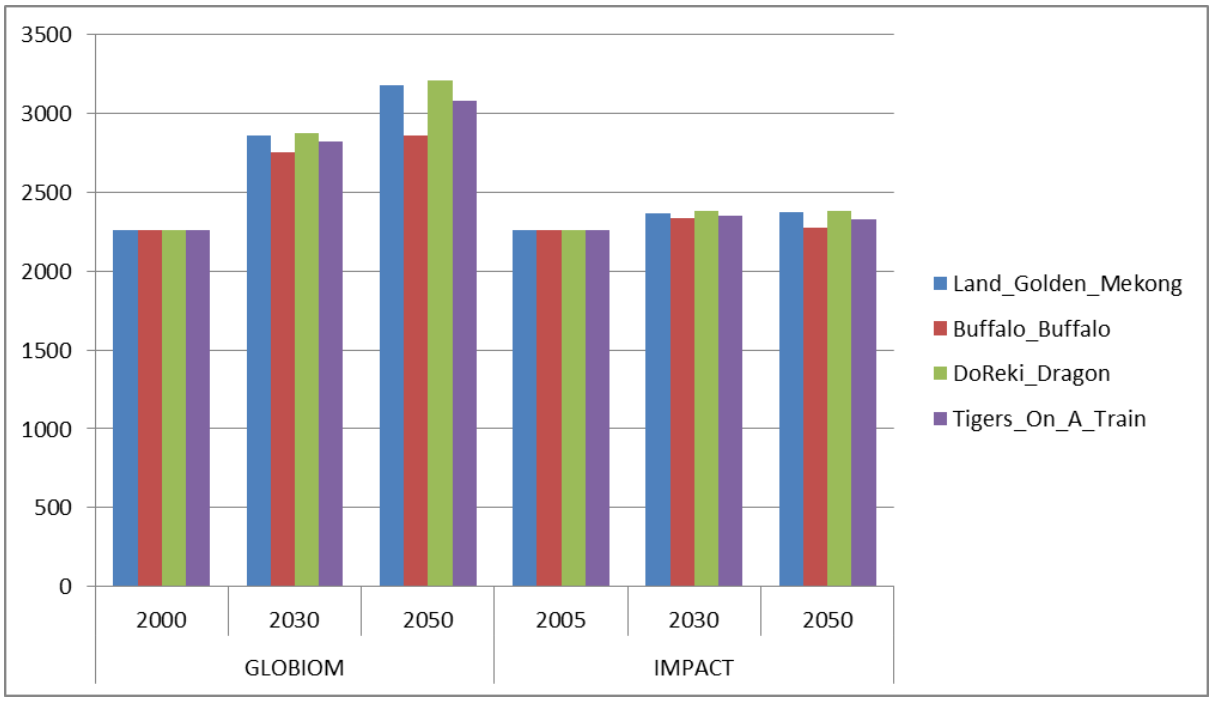

Figure 3. Calories per capita per day, as simulated by GLOBIOM and IMPACT. GLOBIOM shows higher increases in calorie availability, but in both models Buffalo Buffalo sees the lowest increases and the highest increases occur in DoReKi Dragon and the Land of Golden Mekong.

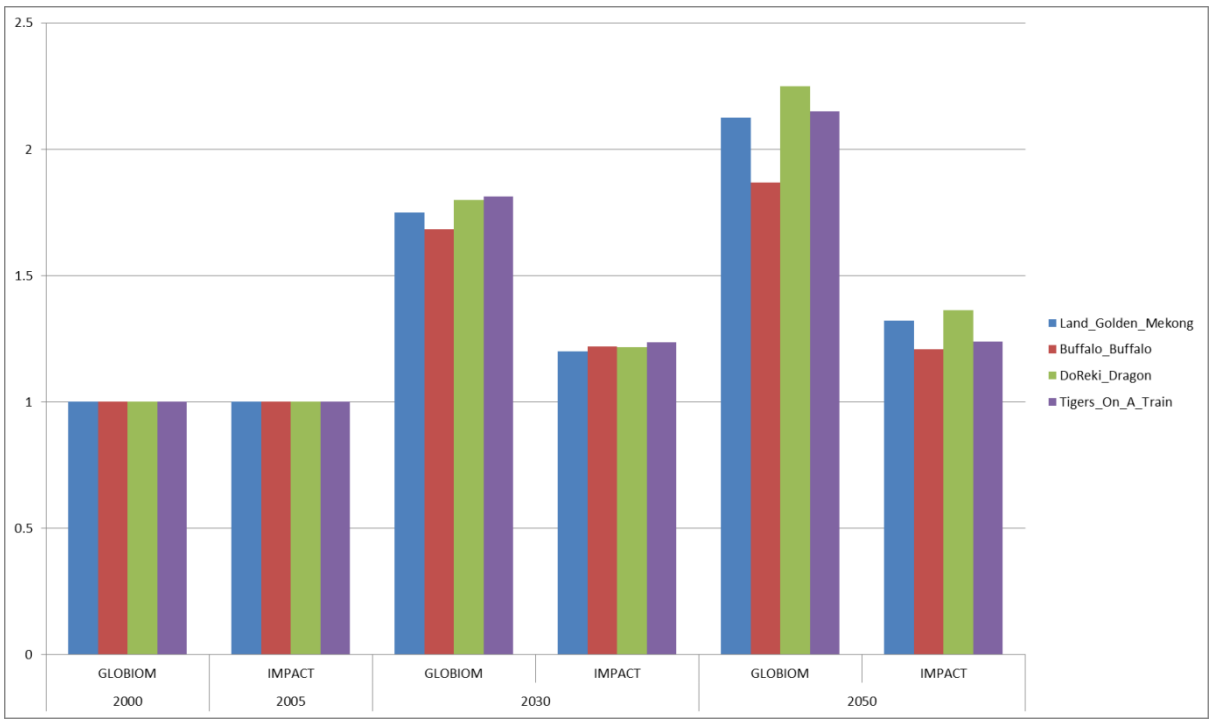

Figure 4. Rice production for Southeast Asia up to 2050 by GLOBIOM and IMPACT, indexed to the present. Depending on the model, very different results emerge – GLOBIOM projects much higher increases in rice production because the model takes changes in area into account in a spatially explicit way. Since DoReKi Dragon has the highest demand and a push for large-scale production, it sees the most increase. Buffalo, buffalo sees the lowest increase since food demand is lowest and production costs are highest.

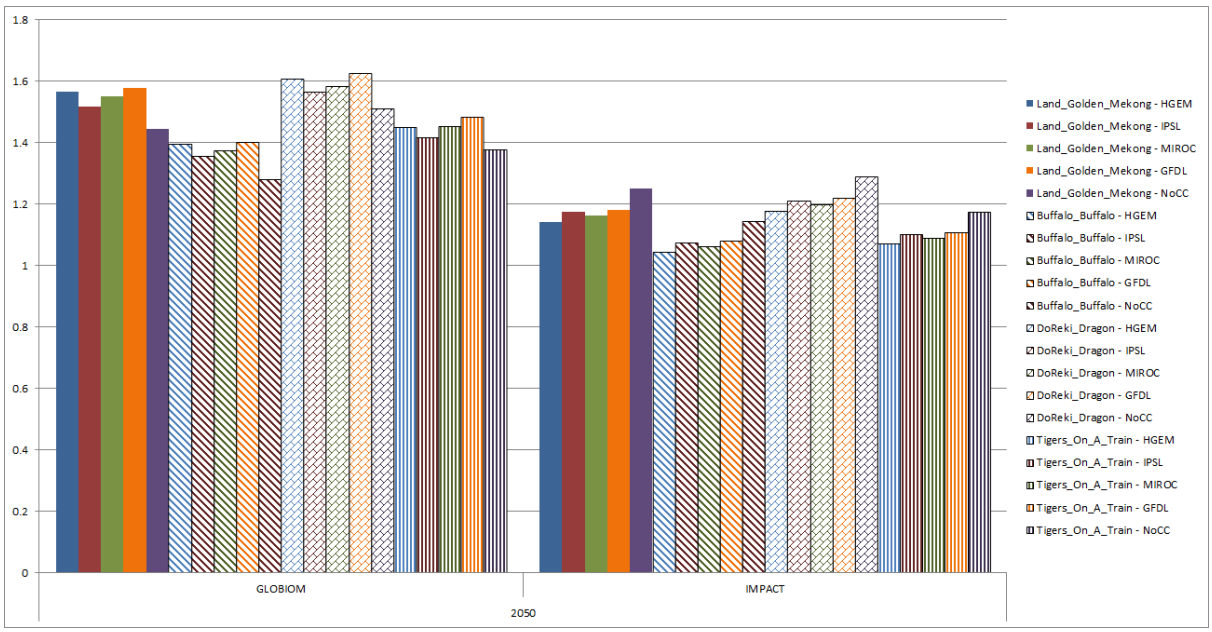

Figure 5 Rice yields under different Global Circulation Models for the four scenarios in Southeast Asia, as well as no climate change, simulated by GLOBIOM and IMPACT. IMPACT mainly simulates market adaptations

and yields turn out lower than without climate change; GLOBIOM also involves adaptations due to changing production systems and land use, and under assumptions of ideal adaptations yields can benefit from climate change in some scenarios, and depending on the climate model. However, in both cases problems of maladaptation (economic and spatial lock-ins, inequality and institutional blockages, etc) are not represented which may lead to lower yields under CC scenarios.

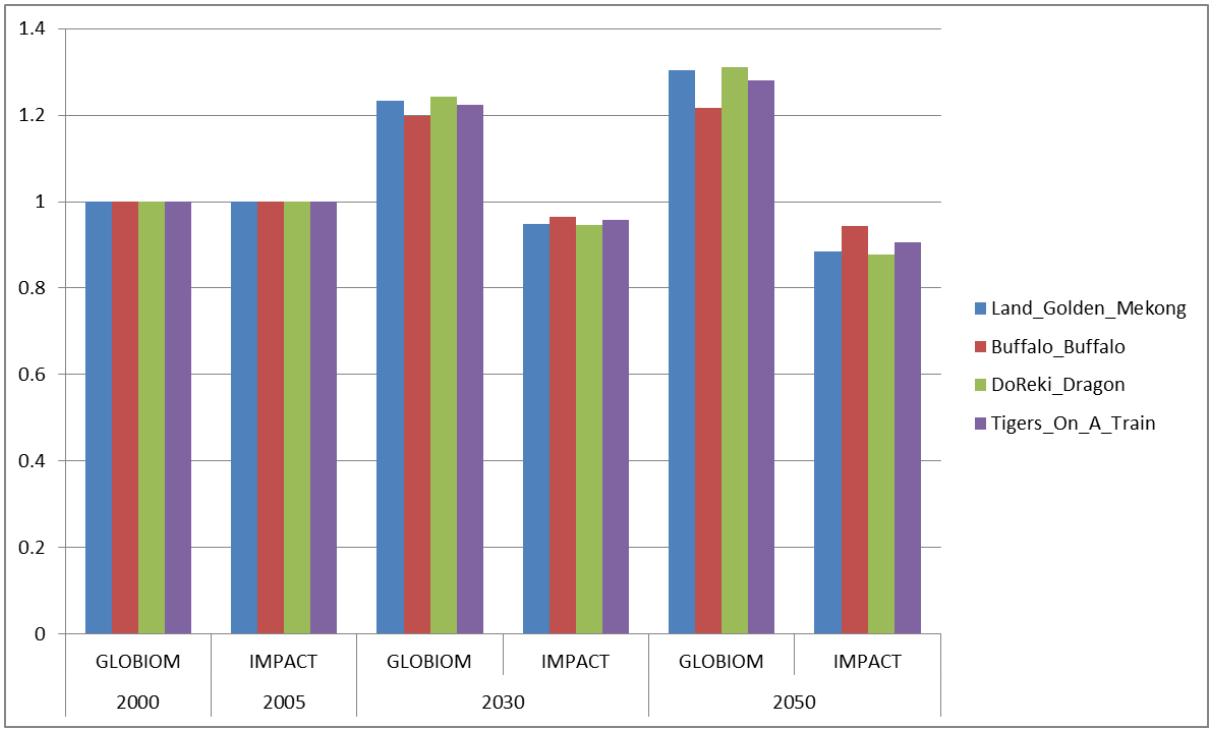

Figure 6. Rice demand per capita in Southeast Asia, indexed to the present, simulated by IMPACT and GLOBIOM for Southeast Asia. In GLOBIOM, rice demand increases and in the scenarios with the highest GDP, rice demand is highest (Golden Mekong and DoReKi Dragon). In IMPACT, by contrast, consumers shift to more expensive commodities on the whole, but rice demand is highest in Buffalo, Buffalo because of the lack of consumption of other commodities.

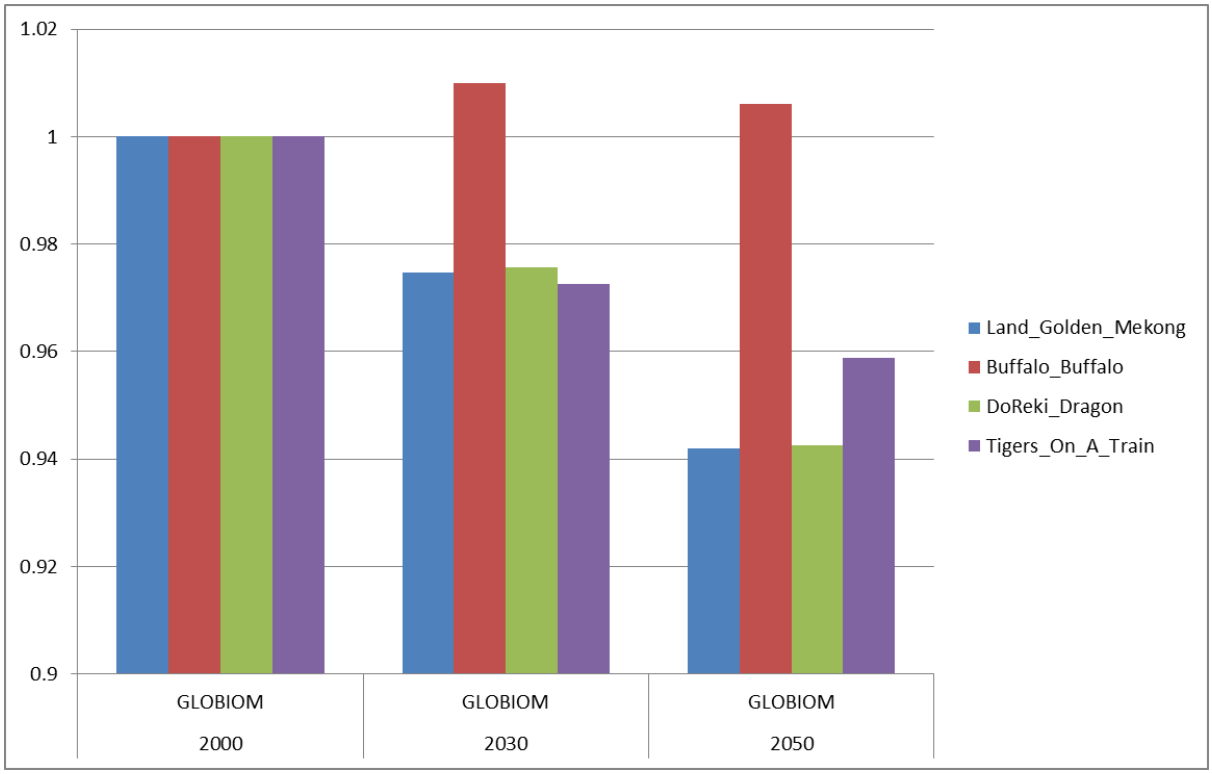

Figure 7. Rice prices indexed to the present, simulated by GLOBIOM for Southeast Asia. The price of rice is highest because of high production costs in Buffalo Buffalo. Otherwise, the price of rice drops.

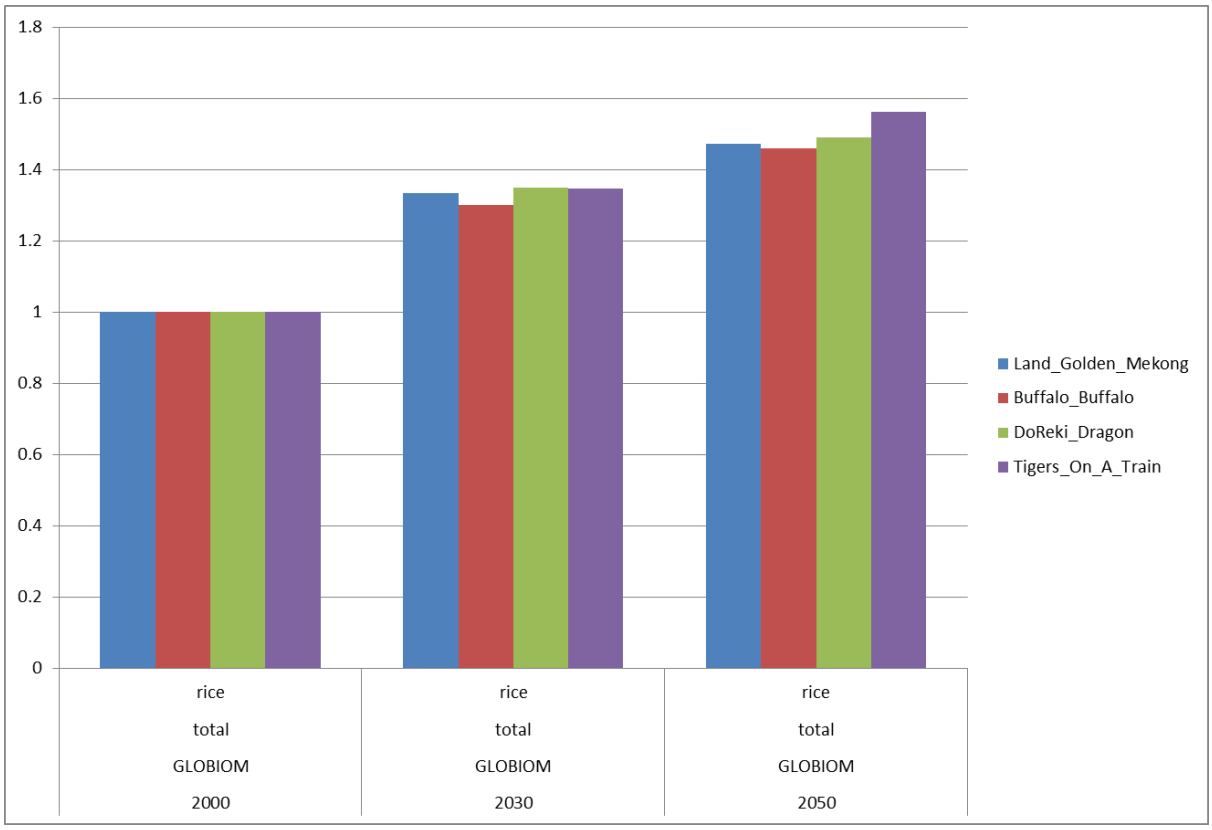

Figure 8: Rice area in Southeast Asia as simulated by GLOBIOM, indexed to the present. Rice area increases the most in Tigers on the Train – demand is fairly high but yield increases are moderate. In the Land of

Golden Mekong and DoReKi Dragon scenarios, yield increases are higher. In the Buffalo Buffalo scenario, demand is relatively lower due to lower GDP.

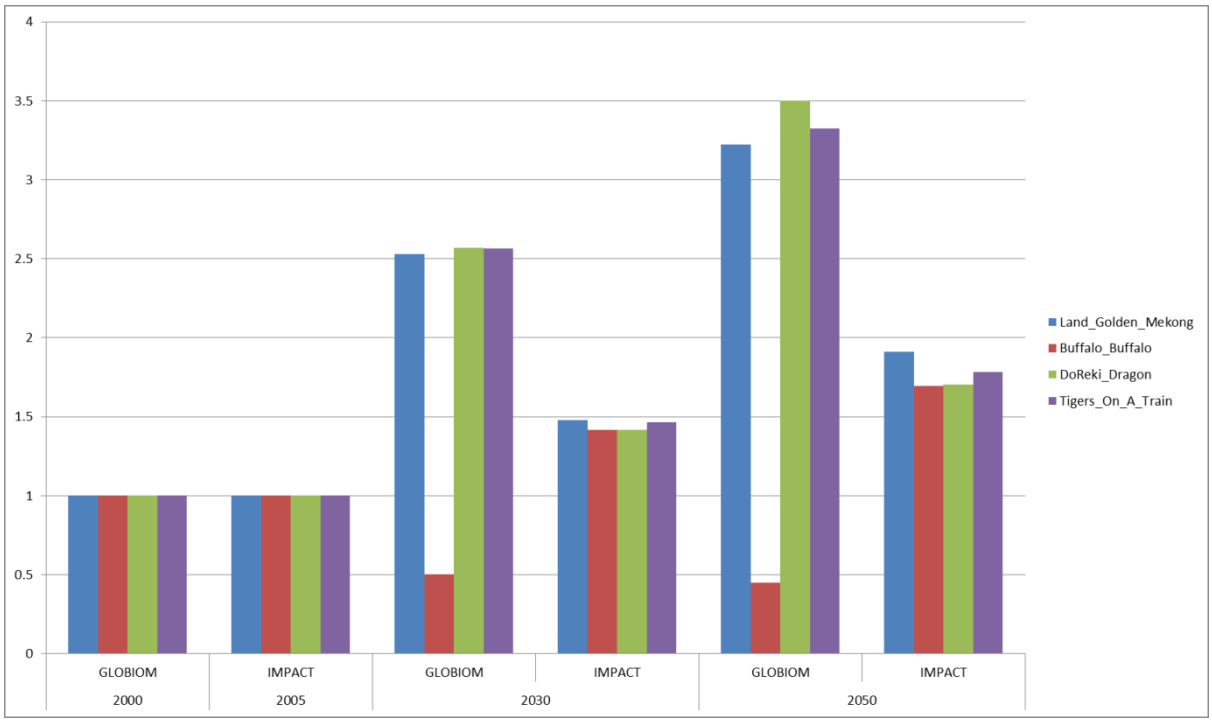

Figure 9: Maize production for Southeast Asia as simulated by GLOBIOM and IMPACT, indexed to the present. IMPACT shows an increase in maize production for all scenarios; however, while GLOBIOM shows a strong increase in most scenarios, Buffalo Buffalo actually declines, which links to the fact that land use and crop production systems are modelled differently, and production costs also are a factor.

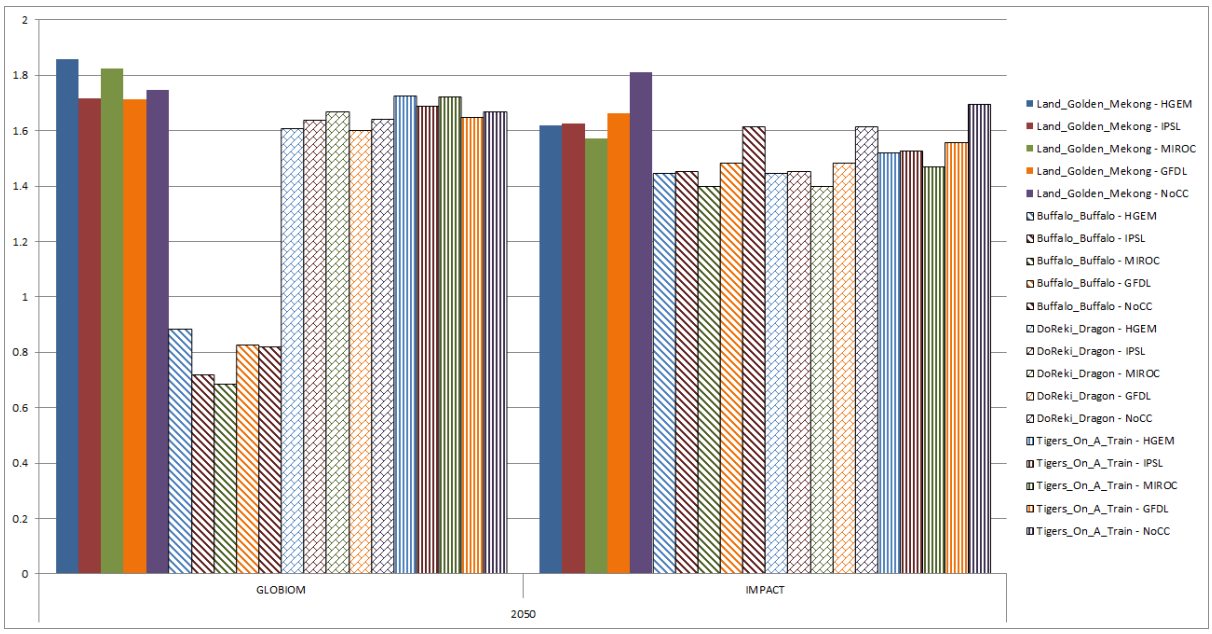

Figure 10 Maize yields under different Global Circulation Models for the four scenarios in Southeast Asia, as well as no climate change, simulated by GLOBIOM and IMPACT. IMPACT mainly simulates market adaptations and yields turn out lower than without climate change; GLOBIOM also involves adaptations due to changing production systems and land use, and under assumptions of ideal adaptations yields can benefit

from climate change in some scenarios, and depending on the climate model. However, in both cases problems of maladaptation (economic and spatial lock-ins, inequality and institutional blockages, etc) are not represented which may lead to lower yields under CC scenarios.

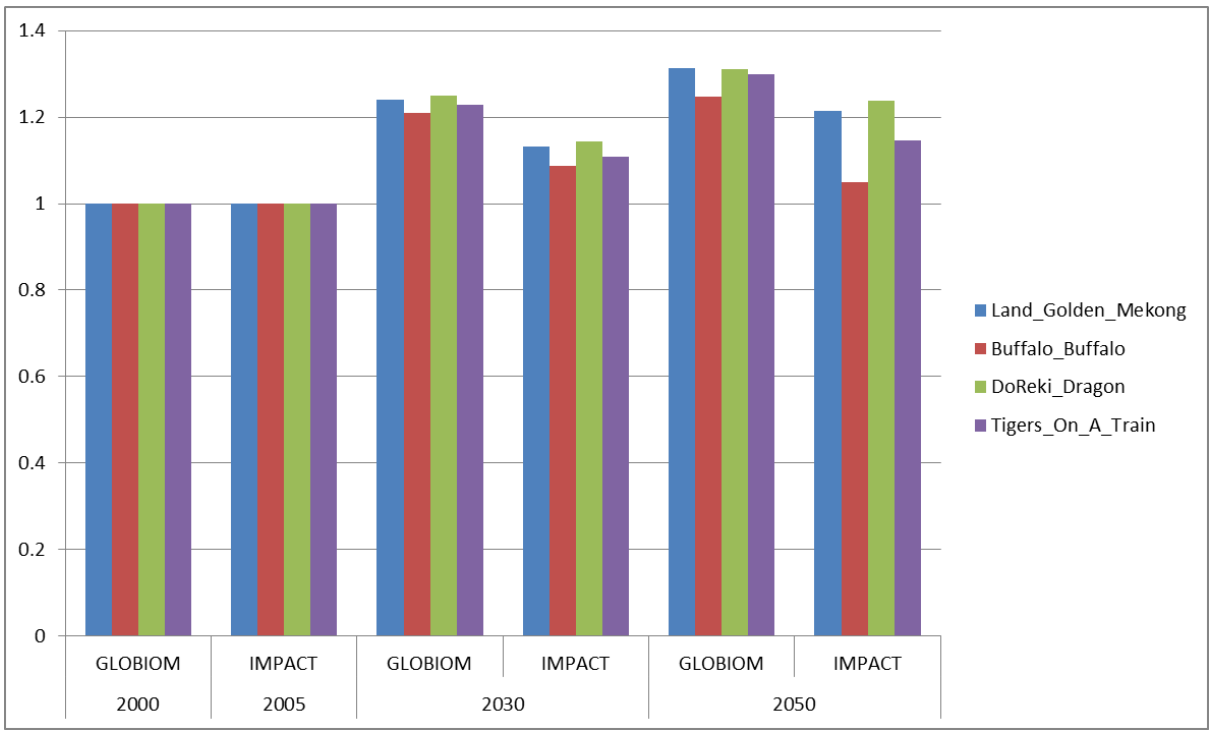

Figure 11: Maize demand per capita as simulated by GLOBIOM and IMPACT for Southeast Asia, indexed to the present. Both models show an overall increase in demand with differences in the scenarios according to GDP.

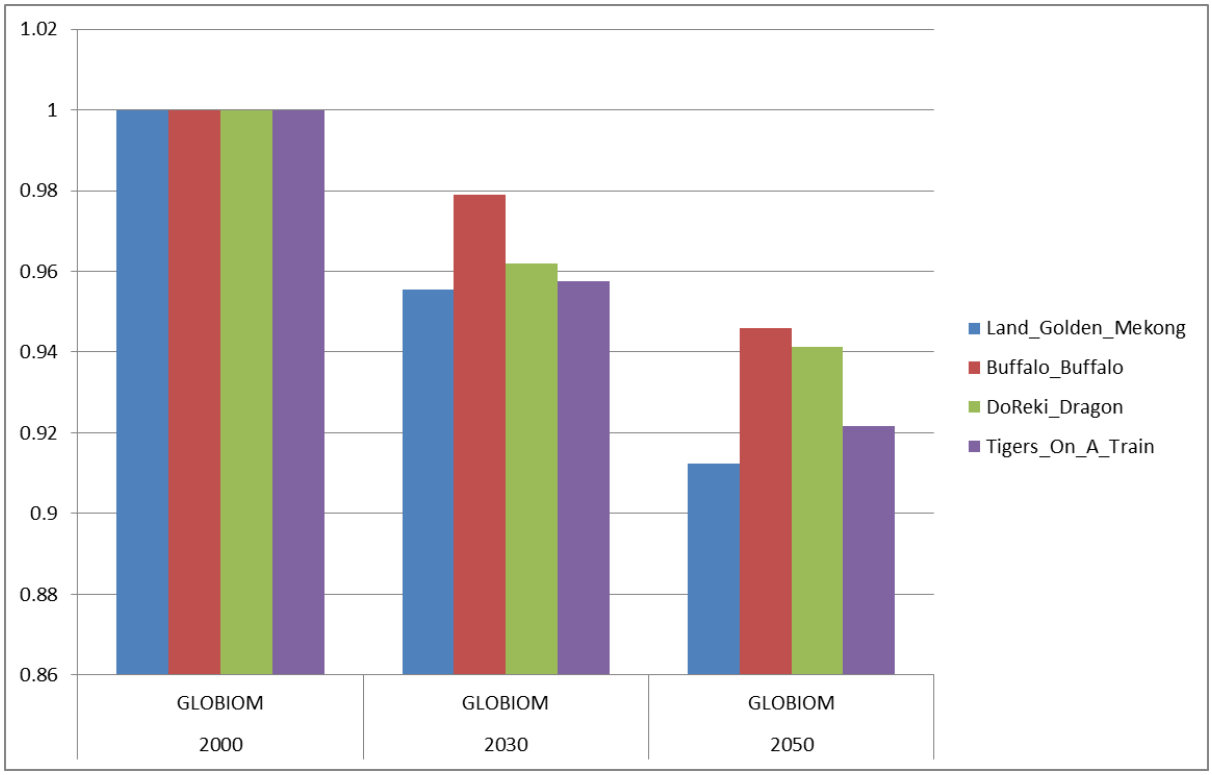

Figure 12. Maize prices simulated by GLOBIOM for Southeast Asia, indexed to the present. Maize prices drop in all scenarios, but the least in Buffalo Buffalo; this is linked to high production costs in this scenario.

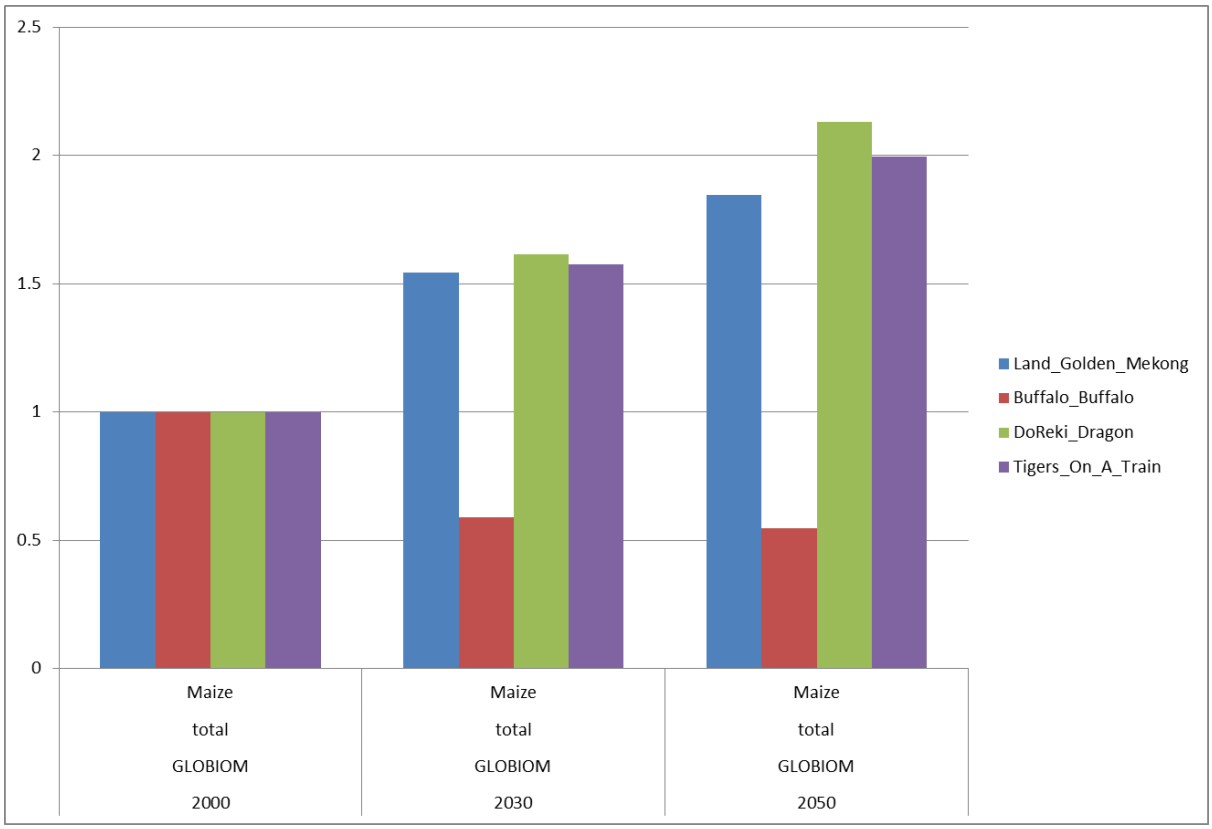

Figure 13. Maize area simulated by GLOBIOM for Southeast Asia, indexed to the present. Maize area expands in all scenarios except in Buffalo Buffalo, where high production costs for maize prevent its expansion.

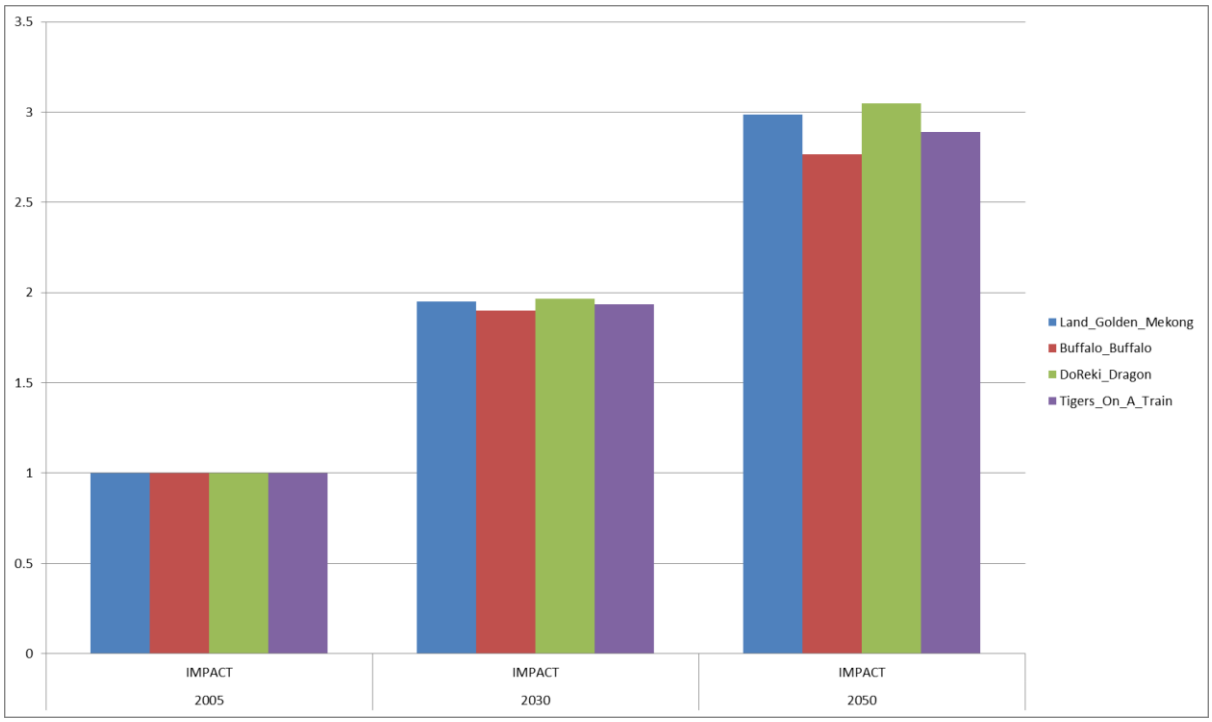

Figure 14. Beef production in Southeast Asia simulated by IMPACT, indexed to present conditions. Beef production goes up in all scenarios and follows demand driven by GDP in the different scenarios.

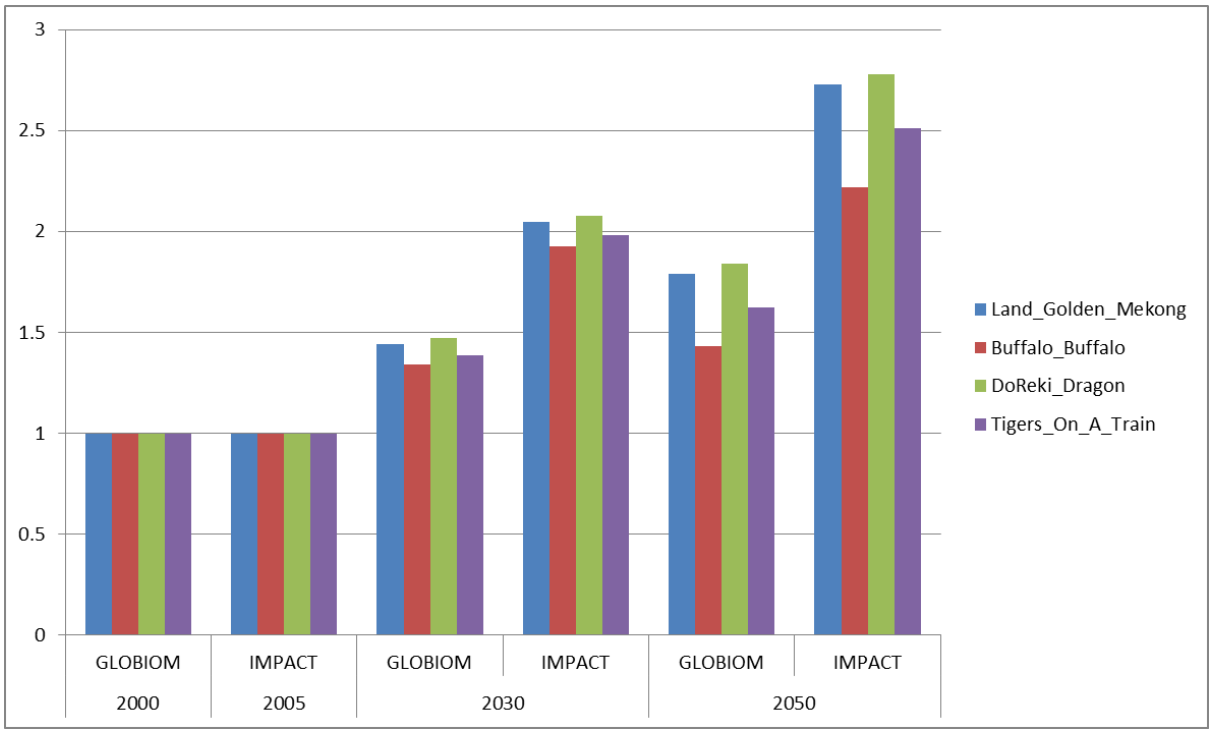

Figure 15. Beef demand per capita Southeast Asia across the different scenarios, indexed to the present, simulated by GLOBIOM and IMPACT. Beef demand is driven by GDP and therefore follows the assumptions for economic growth in the different scenarios.

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ANNEX D. MEAL Scenarios Tailored for Northern Mountainous Region of Viet Nam

All groups down-scaled their scenarios for Southeast Asia to make them relevant for the Northern mountainous region. The results here are reported in different summary styles depending on the groups.

Scenario: Buffalo, Buffalo

In the Northern Mountainous Area in Viet Nam, in this scenario, farmer incomes decrease. Forest coverage also decreases with land expansion. Better cultivation practices are taken up in some places despite the fact that technology availability remains very low. Greenhouse gasses from agriculture do increase because of unsustainable agricultural production. Extreme weather events increase and communities are not well armed against such crises. There is a shortage of funding for agricultural development and investment is highly coordinated. Migration out of the Northern Mountainous Area is high. Local government staff are not capacitated and largely inactive. Farmers are not open to innovations, generally conservative and distrustful of outsiders, though exceptions innovate and adapt where possible. There is an absence of trading policies and agreements. Social capital is low, and this poses limitations for community-led adaptations. Communities have limited access and linkage to markets.

Scenario: Tigers on the Train

List of key indicator of interest	Means
Farmer income	Will increase in the first period (3-5 years) of scenario and then will decrease afterward
GHG from agriculture sector	Will decrease because low investment in agriculture and reduction of agriculture production (livestock and cultivation areas reduce…)
Soil quality/fertility	Will decrease because of land degradation though land use change
Water quality	Will decrease because deforestation
Forest coverage	Will decrease because of excessive exploitation to capture benefit
Number of farmers adopting CSA practice	Will decrease because a lot of farmers change the job (off-farm activities)
Climate change integrated into agriculture development program	Will decrease
Demand on climate-smart product	Will increase
National recognition of competence related to CSA	-
Awareness of farmer and consumer about CSA	Will decrease because farmer pay their attention to other sectors
Farming input cost	Will decrease because agriculture is not the first farmer's interest
Soil erosion	Will increase because deforestation
CSA adaptation	Will decrease
Infrastructure in rural	Will degrade because of lacking investment
Migration to city	Will increase because farmer go to the city to look for the new job with high income

Scenario The Doreki Dragon.

The mono crop in the big field scale expands, but belongs to the big agricultural companies. It makes GHG increased, flood, and drought in winter and spring is more serious, forest covering reduced. Another, the famer become landless, income reduced, they tend to go to the city and other country to find work. Because of the development of agricultural companies, small scale famers have better behavior, their knowledge is improved. Larger scale agriculture contributes to HGH increase, climate become shock, people stay in the city only.

Many big farmers will also apply CSA practices (because farmer change behavior). Investment on Hydropower is major as there are fewer lands for crop. People get job in industry zone. In addition, new policy will support agriculture activity, soil erosion will be controlled and farmer income increase.

Scenario The Golden Mekong

In this scenario, the forest coverage in the Northern Mountainous Viet Nam will be improved and improved farming practice, impact of soil erosion will be reduced. Due to increasing demand on climate smart products, farmer's income is remarkably increased. More farmers adopt CSA practices and their livelihood options are diversified in which indigenous knowledge is critical in CSA practices. More ethnic minority will migrate to the city for better study and job opportunities. Cultivation practice on sloping land in the Northern mountainous of Viet Nam is more and more become better and more sustainable. That is achieved by applying advanced techniques in farming, improving policy of local government in production and promoting sustainable agriculture. People's income is increased; reducing the cost of inputs, cultivation on steep slopes toward conservation technique lead to land be protected, control erosion. Farmers have high yield lead to reducing burning, forest coverage is increasing. People migrate and the proportion of the economic sectors increasingly diverse, balanced and sustainable development.

Mountainous region is considered rich natural resources and climatic diversity. Many people from the plains migrated here to clear land, exploitation of natural resources for intensive agricultural production and develop other industries. Agricultural production is developed lead to people's income increase. However, resource is depleted leading to local people move up for farming in upland areas and deforestation. Exploiting without applying sustainable techniques led to soil erosion, land degradation. By adopt good farming methods and CSA techniques in the future, increasing production, reducing emissions and increasing GDP in the area. Crops: will be diversified including food crop i.e. rice, maize, legumes and industrial trees. Herbal medicine tree will become good income resource for local people.

Policies: Social economic development plans integrate CC & promote CSA practices. Climate funds such as green climate funds will be decentralized to lower levels and support community adaption. There is the good starting and cooperating between ASEAN countries in NRM and CSA. Policies for futures sustainable development increased.

The local people and local government found that there are many risks such as soil erosion, decrease yield… from maize mono culture in sloping land and unsustainable cultivation. It needs to be change the traditional to sustainable cultivation for natural resource protected. However, it is not easy to let farmers change their conventional farming, because the new techniques often requite high labor, high cost and difficulty in the beginning time of applying. The government decided to change the policy in order to help improve farming sustainably through support to each farmer who want to apply new techniques, for example 5 million per ha. They also add more fund to training on sustainable farming and smart climate agriculture. Farmers will be fined if they continue burning. In addition, government also increase promotion through communication ways such as local speaker, TV program, local regulations …

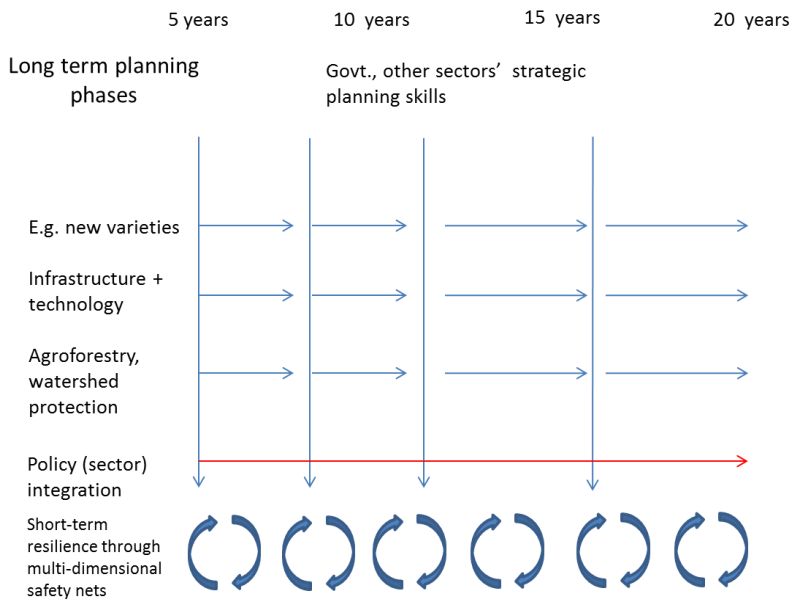
In the results, there are 50% people change their old farming practice after 5 years and over 90% after 10 years. At the end policy changes:

- Sharing of benefits between hydropower production and crop production
- Support people to change positions of farming and cultivation method
- Diversification of agri-products by processing from traditional agricultural products.

ANNEX E. REVISED INVESTMENT PROPOSALS

Title	**Climate Smart Program in the 3 provinces of SL, DB, YB**
Overall objective	To make the NMPRP activities in the 3 provinces (SL, DB, YB) climate smart
Funding source	World Bank
Specific action steps:	
1. Infrastructure (irrigation systems)	-Define CSA cropping systems -Water resources available in short + long term -Design appropriate CSA mar + irrigation systems -Build irrigation systems -Training and management of the systems
2. Livelihoods	-Benchmarking the current situation and long-term potentials -In collaboration with NMPRP to identify priorities/needs -Varieties/breeds -Practices (CSA) -Market/value chains -(Policy) support mechanisms -Investment/institutional/farmers' organizations -Realisation of PES
3. Capacity building	-Training and communication in CC related aspects of CSA -Capacity building for development of farmers' organizations
Actors and roles	
1. Infrastructure (irrigation systems)	• Farmers' groups • Local authorities • Experts • CDB of NMPRP
2. Livelihoods	• DARD • Extension services • Researchers (NOMAFSI, CASRAD, INU, CUA, ICRAF, NGOs) • Private sector
3. Capacity building	• Farmers • Local authorities • PTI • Extension services • Experts • NGOs • DONRE
Key indicators of interest	• Higher HH income and stability (net profits) • Improved effectiveness and efficiency of water use • Increased numbers of farmers adopting CSA practices • CC integrated into local agricultural development programs
Key contextual factors	• Farmers are conservative • Local staff are not always active • Lack of appropriate support: policies, investment • Limited linkages between stakeholders • Undeveloped and unstable markets • Lack of forecasting system for the markets

Title	**Climate risk, resilience, long-term and short-term perspectives**
Overall objective	Integrating short-term and long-term resilience and climate-smart agriculture to improve livelihoods in the Northern Mountainous Region in Viet Nam, through a combination of multi-dimensional safety nets and building adaptive planning capacity.
Target groups	• Safety nets: smallholders, technical expertise through research and academia, extension services, consumers, private companies. • Long-term adaptive planning capacity: DOLISA, DARD, central government.
Funding source	The government at various levels should be the main facilitator of the proposal and can provide co-funding. The focal point for local organization and therefore funding should be the provincial committee on natural disaster management. Additional funding can be provided by IFAD and NGOs. Financial partners are credit/financial institutions, the private sector (collectors and traders) and pawn shops as an "unofficial financial body".
Key activities	1. Assess short-term and long-term climate impacts and risks as they interact with other (socio-economic etc.) stressors on agriculture and livelihoods. 2. Review existing policy alignment on short-term safety nets and on long-term socio-economic development and adaptation planning. 3. a) Organize a collaboration platform on safety nets based on results of the assessment: the provincial funding committee on natural disaster management brings together the financial partners to organize a platform that integrates diverse dimensions of safety nets: • Safety nets for agricultural production • Economic safety nets for livelihoods support • Social safety nets This platform will include funders, technical expertise, policy participants, education experts, market experts, and insurance actors. b) Develop the government's capacity at multiple levels in long-term adaptive/ transformative planning. Build strategic planning capacity of governments at multiple levels by providing strategic planning tools for robust decision-making. Focus on strategic issues such as new crop varieties, water resources, landslides and infrastructure and technology. 4. Link short-term and long-term components: • Long-term strategic planning will shape priorities and opportunities for safety nets – reassess what is needed in terms of safety nets at each planning cycle. • Long-term strategic planning will build toward autonomous resilience so that safety nets are not essential on the long run. • Train regional communities in adaptive planning.



List of key indicators of interest	Awareness, farmer income, income diversity, reduction of farm input costs, harvest loss, soil erosion, negative impacts of CC, GHG from agriculture, CSA action plans, policy support, adoption of CSA practices.
List of key Contextual Factors	Data availability. Funding shortages (global financial crisis), lack of human resources, increased economic market ex. TPP, extreme weather events, political change, policy change (e.g. land law), rise of middle income trap.

Title	**A Climate Smart Label for Shan Tea in North Mountainous Region**	
Overall objective	Improve efficiency of environmental protection and Shan tea production under Climate Change	
Specific objectives	• Develop Climate Smart tea label (such as label of organic tea product) • Stable tea productivity/yield • Reduce inputs/costs • Emission mitigation • Ensure farmers' income	• Improve tea quality (test the content of different substances in the Shan tea product) • Protect environment and natural resources (land, water, vegetation…)
Target groups	• farmers (mountainous ethnic groups, incl. gender issues) • Producers: processing, marketing • Traders	• Extension service providers • Policy makers (at all level) • Consumers: domestic and international
Funding source	WB, FAO, GEF, Government, private sector; USD 1million/ 5 years	
Specific action steps		
Year 1	Baseline survey: market assessment (demand and supply), tea quality analysis, productivity/yield assessment, area of tea production, investment status, farming practices, soil quality analysis, climate change review	
Year 2	Model establishment 1. Different farming practices: intensive, intercropping, sustainable/standard farming 2. Processing: apply good/standard technologies for tea processing 3. Tea quality analysis 4. Planning tea production: area, regions, geographical features suitable to tea production	
Year 3	Continue activities 1, 2, 3 and 4 of year 2. Market promotion: 1. Improve awareness of consumers about the safe and "smart" tea product 2. Product promotion/marketing	
Year 4	1. Keep doing activities from year 3 2. Registration of the label 3. Copy models to other regions 4. Label design and packing	
Year 5	1. Expand models of Shan tea production 2. Expand models of Shan tea processing 3. Present project outcomes and apply them in other regions	
Stakeholders identified and rationale of actions	- Incomplete and untrustworthy trading policies and agreements - Economic crisis bring barriers to adopt Shan tea production practices - Funding mechanisms depend much on donors' interest - Environmental policies may bring barriers to Shan tea production as well - Awareness of famers, consumers, traders, even policy makers is limited - However, the demand for the climate smart Tea product is high	
Investment Proposal (Tea label) List of key indicators of interest	Increased income of the farmers Better Cultivation practices More fertile, better soil quality – environment Increase demand on climate smart products National (and international) recognition of competence related to CSA	
List of key contextual factors	International commitment on CC Trading Policies and agreements Economic Situation and donors interest Policy environment	

Title	**Sustainable Agriculture in the NMR of Viet Nam**	
Overall objective	Document, assess and upscale CSA practices for crop/livestock/fishery/ and agriculture/forestry interface	
Target groups	• Small-scale farmers on the sloping lands • Decision/policy makers (Provincial, District, commune) • Cooperatives	
Funding source	GEF	
Specific action steps		
To document:	a. RRA of existing CSA practices on the ground • Local level climate impact data/analysis • Literature review, last surveys • CSA participatory mapping (at farm and local leader level) • Comparing farmers ranking /local leaders b. Identifying new/potential CSA practices (on documents): from research findings and/or success models in other locations of the selected provinces/other regions of Viet Nam including use of "climate analogues" e.g. developing maps that show where current climates in one location match future predicted climates in project locations	
To assess:	a. Analysis of resilience, mitigation and food security (farm returns, productivity) of CSA "best bets" identified in documentation phase b. Selecting potential CSA practices, c. Assessing selected CSA practices (climate data included) d. Baseline survey to collect baseline data for outcome indicators	
Up-scaling activities:	a. Development of incentive mechanism for the upscaling: b. Identifying key barriers to adoption and building incentive mechanisms to overcome them such as: • Provision of inputs/seed/animals • Extension (Demonstration, Training of farmers, Communication) c. CSA supporting markets	
Key stakeholders	• DARD • DONRE (climate data supply) • PPC, DPC and CPC authorities • Buyers/sellers (input and output)	• Enterprise • NGOs • Banks/credit agents • Institute (NOMAFSI) • Universities (TBU, TUAF, HAU)
List of key indicators	• Farm income (Increasing) • emission from AS (reduce) • Soil fertility (improved) • water quality (improved) • tree/forest cover (increase)	
List of key Contextual Factors	• Hydropower development • Deforestation • Landslide • Climate shocks • Farmer behavior/attitude (more market oriented) • Migration (both in and out) • Policy change: more control at local level for planning/land use	

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