



Agricultural Water Management Scenarios in the Nariarlé Watershed, Volta Basin, Burkina Faso

K. Ouattara, S. Pare, S. Sawadogo-Kabore,
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Report for Agricultural Water Management (AWM) Solutions Project

K. Ouattara, S. Pare, S. Sawadogo-Kabore,
S. Cinderby, and A. de Bruin¹

¹ Annemarieke.deBruin@sei-international.org)

Stockholm Environment Institute
Kräftriket 2B
SE 106 91 Stockholm
Sweden

Tel: +46 8 674 7070
Fax: +46 8 674 7020
Web: www.sei-international.org

Head of Communications: Robert Watt
Publications Manager: Erik Willis
Layout: Richard Clay

Cover Photo: Annemarieke de Bruin

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1. INTRODUCTION

This report describes the results of different Agricultural Water Management (AWM) scenarios in the Nariarlé watershed of the Volta River Basin in Burkina Faso.

The work is part of the IWMI project entitled ‘Agricultural Water Management Solutions’ which aims to analyse the impacts and potential of AWM interventions to improve livelihoods at the community, and watershed scales and assess the opportunities, constraints and impacts of the use of AWM technologies. Similar work has been done in two other watersheds, the Mkindo watershed in Tanzania and the Jaldhaka watershed in West Bengal, India. The work in the Nariarlé watershed was done during June 2010 in cooperation with Institut de l’Environnement et de Recherches Agricoles (INERA), Ouagadougou, Burkina Faso.

Previous to the scenario analysis a baseline assessment of the current resource-based livelihood strategies was done¹. Focus groups were first held in four villages: Arzoum Baongo, Tanvi-Nakamtinga, Wantinga, and Boulbi (see Figure 1) with groups of Farmers concentrating on rainfed agriculture, Farmers utilising irrigation for gardening and agriculture, Pastoralists, and Fishermen. The number of participants is presented in table 1.



Figure 1: Villages where community level fieldwork has taken place

These detailed studies at the community level were then up-scaled to the watershed level during an expert meeting with a small group of local experts. Participants at the expert meeting mapped and discussed the current situation of water management, livelihoods and resilience of different livelihood groups within the Mkindo watershed. The participants worked in a part or throughout the watershed, with some involved in research and others working in local NGO's. The four main livelihoods in the

1 Ouattara, K., S. Pare, S. Sawadogo-Kabore, S. Cinderby, and A. de Bruin. 2012. *Baseline assessment of current livelihood strategies in the Nariarlé watershed, Volta Basin, Burkina Faso*, York, UK: Stockholm Environment Institute.

Table 1: Participants of community fieldwork

Location	Male Participants	Female Participants	Total Participants
Arzoum Baongo	33	8	41
Tanvi Nakamtenga	16	9	25
Wamtinga	16	8	24
Boulbi	22	7	29
Total	87	32	119

area are Farmers concentrating on rainfed agriculture, Farmers utilising irrigation for gardening and agriculture, Pastoralists, and Fishermen.

Scenarios are defined as ‘Plausible futures, each an example of what might happen under particular assumptions’.² Participants were asked to develop believable stories of possible future outcomes with a time horizon of 10 years. The particular assumptions were called starting points. Each was developed by the project team. The starting points reflect a range of possible future changes that would affect different stakeholders in specific parts of the watershed. They described the context and the resulting agricultural water management changes that would occur. In the Nariarlé watershed the starting points were ‘Improvement of irrigation channels’, ‘Development of the use of motor pumps’, ‘Development of drip irrigation technology’, and ‘Development of gardening wells’. According to the experts, the single scenarios had merits proper to each technology, but their combination could give more advantages and efficiency when implemented. This is why two other starting points discuss a combination of technologies: ‘Irrigation channels and motor pumps’ and ‘Motor pumps and gardening wells’.

The participants discussed which stakeholder groups in the watershed would be potential beneficiaries and for what reasons, who would be unaffected, and which groups would their livelihoods negatively impacted or would dis-benefit as a result of the suggested changes. The location and extent of each of these types of stakeholder groups were then indicated on a map. Participants then went on to discuss any factors that would need to be in place to maximise the benefits of the AWM interventions and indicated which factors would be high, medium or low priority for future interventions. They also discussed factors that could mitigate the foreseen negative effects for dis-beneficiaries or compromise the success of the changes.

The results of each individual technology starting point are presented in the same order as the discussions took place. Results of the two combined starting points are presented with a map. Participants were also asked to summarise the full story of the scenario at the end of the meeting to answer the question: what will happen over a ten year time period if .. (starting point).. would occur?

2 Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-Being. Synthesis*, Island, Washington, DC.

2. SCENARIO 1 – IMPROVEMENT OF IRRIGATION CHANNELS

2.1 Impacts on livelihoods

The improvement of irrigation channels would take place in an area that expands beyond the current extent.

2.1.1 Those who will benefit

Stakeholder group	Direct impact on livelihoods
Livestock keepers	Improvement of water access for agriculture also improves domestic water access Livestock keepers would stop migrating cattle if water points had reliable quantities of water Livestock keepers would not be willing to pay for the access to the reservoir
Small scale irrigation farmers with land in the suitable area for expansion	The existing areas irrigated using traditional canal systems could have significant increases in yields if the irrigation systems are improved Rice production will have the higher improvement, but also vegetables and fruits Farming incomes improve from small plots by improvements in yields The specific groups of users who will benefit include legume producers (gardeners), rice producers, fruit producers, local beer makers (women), women, youth, and agri-business actors. Improvement to water access for agriculture also improves domestic water access
Most of the residents	This include small scale irrigation farmers, the big scale farmers and also other people not involved in agriculture, who will gain access to a diversity of productions at better price
Municipality (Commune)	The improvement of income of residents will also generate profit for the commune
People from outside the watershed	Mainly the capital buyers who will buy at a better price

2.1.2 Those unaffected

Livelihood strategy	Direct impact on livelihood strategy
the tree planters, the livestock keepers, the fishers men, the bricks makers, local beer maker and the land owners	Although everyone is affected through secondary benefits such as changes in food prices which will affect everyone's income/expenses, these groups are not or very weakly affected

2.1.3 Those negatively affected

Stakeholder group	Direct impact on livelihoods
Fishers	The water level will be reduced and this will reduce the duration of their activities. Fish often follow the channels thereby leaving the fishing areas
Agribusiness actors	The competition for water can disturb the activity of this group of actors because many of them are using the ground water near the dam from drillings
Land owners	Their influence and importance will drop because their lands are reduced and the compensation is not always guaranteed

2.2 Factors

2.2.1 Factors that can maximise benefits of improving irrigation channels

- Capacity building of the farmers – develop the technical and organisational capacities of farmers (High priority)
 - User associations/groups need to be trained
 - More training in agricultural techniques as well as better management of the natural resources including water
- Promote model of farmers:
 - Promote the good farming based on “innovators or models” to serve as example for the dissemination of technological innovations
- Sensitizing actors and education (Medium to high priority)
 - Efficient water use
 - Better use of pesticides and other chemicals
 - Protection of the banks of rivers and dams
- Thorough studies on the watershed (Medium priority)
 - Environmental impact studies of the current management systems
 - Studies on the improvement of the production systems and their sustainability
 - Development of participatory approach in the studies
- Reinforcement of the dialogue between stakeholders (High priority)
 - Identification of users per area to avoid conflicts
 - Necessity to get common agreements between actors and ensure their longevity
- Better organisation of the agricultural channels
 - Open up access to markets for the cereals, legumes and fruits producers
- Enhance the use of the research results
 - Dissemination of the use of improved seeds
 - Application of soil fertility improvement techniques

2.2.2 Factors that can mitigate dis-benefits of improving irrigation channels

- Training in soil and water conservation (SWC) techniques, and agro-forestry
- Common agreement on the regulation in the use of water resources
- Cost of equipment – Create the condition to ease the access by poor farmers

2.2.3 Factors that can compromise the benefits of improving irrigation channels

- Lack of maintenance of water infrastructures
- Land insecurity - Land ownership and appropriation need to be secured
- The lack of a real dialogue between the different stakeholders in the watershed
- The high cost of infrastructures and equipment – this requires strong support from the government and others donors, as well as local contribution efforts
- Politic instabilities or interruptions can fail the implementation of the scenario,
- Environmental pollution
 - Pollution of surface water
- The master plan of the urban expansion of the capital called ‘Schéma d’aménagement de Grand Ouaga’ can seriously compromise all the scenarios development in the watershed

2.3 Scenario

- Increase of field sizes and productions
- Reduction of water conflicts
- Generation of employment, mainly for women and youths,
- Improved livestock activity (intensification)
- Reduction of forest degradation
- Reduction of water course degradation
- Efficient use of water
- Water pollution problem
- High pressure on land reducing the areas for pasture
- Proliferation of mosquitoes and increase of malaria

3. SCENARIO 2 – DEVELOPMENT OF THE USE OF MOTOR PUMPS

3.1 Impacts on livelihoods

The development of the use of motor pumps would take place in an area that expands beyond the current extent and therefore provides more access to upper or remote lands.

3.1.1 Those who will benefit

Livelihood strategy	Direct impact on livelihood strategy
Small scale irrigation farmers with land in the suitable area for expansion	The possibility to pump water will booster the traditional garden- ing systems with significant increases in yields Rice production will have the higher improvement, but also veg- etables and fruits The specific groups of users who will benefit include legume producers (gardeners), rice producers, fruit producers, women, youths, agri-business actors and external users of water Improvement of the access to water for agriculture also improves domestic water access
Most of the residents	Most people will gain access to a diversity of productions, as well as other people living in the watershed
Municipality	The improvement of income of most residents will also generate profit to the entire Commune
People from outside the watershed	The external buyers (who will buy at better price) and also the tankers

3.1.2 Those unaffected

Livelihood strategy	Direct impact on livelihood strategy
the tree planters, the livestock keepers, the fishers men, the bricks makers, local beer maker and the land owners	Although everyone is affected through secondary benefits such as changes in food prices which will affect everyone's income/ expenses, these groups are not or very weakly affected

3.1.3 Those negatively affected

It is likely that no one in the watershed will have a disadvantage in the development of the motor-pump.

3.2 Factors

3.2.1 Factors that can maximise benefits

- Capacity building of the farmers – develop farmers technical and organisational capacities (High priority)
 - User associations/groups need to be trained
 - Better access to the credits and equipment
 - More training in water management techniques and better management of the natural resources

- Promote models of farmers:
 - Promote the good farming based on ‘innovators or models’ to serve as example for the dissemination of technological innovations
- Sensitizing of actors and education (Medium to high priority)
 - Effective use of water
 - Efficient use of pesticide and other chemicals
 - Protection of river banks and soils
- Thorough studies on the watershed (Medium priority)
 - Environmental impact studies of the current management systems
 - Studies on the conflict management of multiple users or water resources
 - Impacts of the urban expansion on the future of the watershed
- Reinforcement of the dialogue between stakeholders (High priority)
 - Necessity to get common agreements between actors and ensure their efficient implementation
 - Set up structures for conflict mitigation/ management, particularly for the multiuse of water
- Better organisation of the actors in the agricultural channels
 - Open up access to markets for the legumes and fruit producers
- Improving the food security situation
 - Increase of food production is improving the food security condition
 - Crop diversification contributes to enhanced nutritional condition

3.2.2 Factors that can mitigate the dis-benefits

- Implementation of the regulation in the use of water resources, with the cooperation of the agri-business actors and the external users
- Development of cooperation with the Health Extension to mitigated the healthy problem related to water
- Cost of equipment – Create incentives for access to the equipments by a large number

3.2.3 Factors that can compromise the benefits

- The weakness or absence of the maintenance of water infrastructures
- Land insecurity - Land ownership and appropriation issues need to be clarified
- The lack of a real dialogue between the different stakeholders in the watershed
- The high cost of infrastructures and equipments – this requires strong support from the government and others donors
- Environmental pollution
 - Pollution of surface water

- Conflict between upstream and downstream users

3.3 Scenario

- Secured employment and job security
- Ensures good supply of crops and legumes
- Increase of crop field sizes and productions
- Reduction of water conflicts
- Increase of farmer's income
- Improved food security in terms of quantity and quality



Figure 2: A compromising factor according to the participants: a lack of or weak maintenance of water infrastructures in the watershed

4. SCENARIO 3 – DEVELOPMENT OF DRIP IRRIGATION TECHNOLOGY

4.1 Impacts on livelihoods

4.1.1 Those who will benefit

Stakeholder group	Direct impact on livelihoods
Gardeners and fruit (banana, papaya, citrus, etc.) producers	The technique saves a lot of water and time for irrigation
Elite farmers (agro-business) in the watershed	They can afford the drip irrigation because of their financial capacity
Small scale farmers of rain-fed agriculture are the main beneficiaries	They can use small size plots for dry season irrigation cropping

4.1.2 Those unaffected

Livelihood strategy	Direct impact on livelihood strategy
Irrigated rice producers	Not affected
livestock breeders, fishermen, bricks producers, land owners and water tanks owners.	These groups are not or weakly affected by the development of this technology

4.1.3 Those negatively affected

None: no disadvantaged group was identified by participants.

4.2 Factors

4.2.1 Factors that can maximise benefits

- Capacity building of the farmers – develop farmers’ technical and organisational capacities (High priority)
 - Training on drip irrigation technique
 - Training on water management as well as management of natural resources
- Availability and access to equipment for drip irrigation
 - Better access to credit and material
- Promote models of farmers:
 - Promote the good farming based on ‘innovators or models’ to serve as example for the dissemination of technological innovations
- Sensitizing actors and education (Medium to high priority)
 - Efficient use of water

- Reinforcement of the dialogue between stakeholders (High priority)
 - Necessity to get common agreements between actors and ensure their efficient implementation
 - Set up structures for conflict mitigation/ management between water users.
- Better protection of soils and reduction of water course degradation

4.2.2 Factors mitigating dis-benefits

- Training in Soil and water conservation (SWC) techniques.
- Cost of equipment – Ease the access to equipment for poor farmers

4.2.3 Factors compromising benefits

- Lack of or weak maintenance of the infrastructure
- The urban expansion of the capital:
 - Loss of lands owned by local farmers
 - High competition on land between the intensified crop producers (Agro-business) and traditional system farmers increases the insecurity for the large proportion of farmers
- Land tenure insecurity – New land reform more favourable for a minority of rich farmers than the majority of poor people

4.3 Scenario

- An enormous reduction of time in the irrigated fields, which could be used for other purpose
- Reduction of water conflict
- Better protection of soils
- Valuation of the research findings
- Reduction of water course degradation
- Efficient use of water
- Reduction of water pollution
- Contribution to livestock breeding intensification
- Increase of farmer's income
- Improved food security in terms of quantity and quality

5. SCENARIO 4 – DEVELOPMENT OF GARDENING WELLS

5.1 Impacts on livelihoods

The improvement of irrigation channels would take place in an area that expands beyond the current extent.

5.1.1 Those who will benefit

Stakeholder group	Direct impact on livelihoods
Small scale irrigation farmers with land in the suitable area for expansion	The specific groups of users who will benefit include legume producers (gardeners), rice producers, trees planters, fruit producers
Rainfed farmers and livestock keepers	Remote land from the reservoir will be used, which will expanded the area of their activities Water from the well can also favour the access of water to livestock and improved domestic water access
Actors of the agro-business	

5.1.2 Those unaffected

Livelihood strategy	Direct impact on livelihood strategy
Mainly, the pure rainfed farmers far from the reservoir	Not affected
Water tanks users, and the local beer makers, land owner's group in general	These groups are not or weakly affected by the development of this technology

5.1.3 Those negatively affected

None: no disadvantaged group was identified by participants.

5.2 Factors

5.2.1 Factors that can maximise benefits

- Capacity building of the farmers – develop farmers technical and organisational capacities (High priority)
 - Intensive training in water management techniques and also natural resources
- Promote the good farming based on “leaders or models” to increase the performance and serve as example for dissemination of best practices
- Sensitizing of actors and education (Medium to high priority)
 - Efficient use of water
 - Bring actors to use built wells instead of traditional wells
 - Develop the participatory approach during interventions

- Protection and maintenance of the infrastructure
 - Maintenance of wells
 - Protection of river banks and dams
- Reinforcement of the dialogue between stakeholders (High priority)
 - Necessity to get common agreements between actors and ensure their efficient implementation
 - Set a structures for conflict mitigation/ management, particularly for the multiuse of water
- Better organisation of the actors in the agricultural channels
 - Open up access to markets for the legumes and fruit producers

5.2.2 Factors mitigating dis-benefits

- Training on Soil and Water conservation (SWC) and Agro-forestry techniques, and also the maintenance of water infrastructures
- Environmental impact assessment undertaken
 - Management plans could mitigate the potential environmental impacts
- Costs of equipment –Ease the access to equipment for poor farmers
- More support from government and donors could lead to the development of well construction in the watershed

5.2.3 Factors compromising benefits

- Lack of or weak maintenance of infrastructure
 - Misuse of wells
 - No incentives and weak support system from government
 - Lack of local initiative and/or willingness
- Increasing areas of land are sold to elite farmers, leading the reduction of cultivable lands for poor farmers
- The urban expansion of the capital:
 - Loss of lands owned by local farmers
 - Increase of living cost for all people
 - High competition for land use and cash crop production is increasing the insecurity for the extensive farming system of a large proportion of farmers
- Land tenure insecurity – New land reform should secure the access to land for all stakeholders of the region.

5.3 Scenario

- Access to water for greater number of farmers
- Reduction of water course degradation
- High risk of conflict between the multiple users of water
- Increase of farmer's income, mainly the legume and fruit producers
- Improved food security in terms of quantity and quality
- Expansion of irrigation areas

6. SCENARIO 5 – IRRIGATION CHANNELS AND MOTOR PUMPS

6.1 Impacts on livelihoods

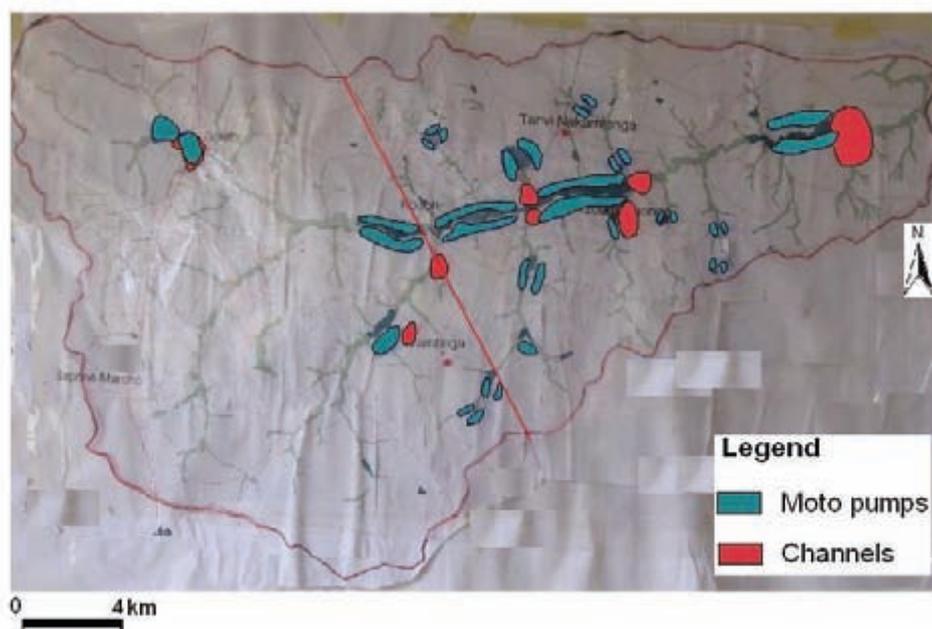


Figure 3: Scenario A - irrigated channels and motor pumps

6.1.1 Those who will benefit

Stakeholder group	Direct impact on livelihoods
Livestock breeders	They would stop migrating cattle if water points had reliable quantities of water
Small scale irrigation farmers with land in the suitable area for expansion	The existing areas irrigated using traditional canal systems could have significant increases in yields if the irrigation systems are improved The specific groups of users who will benefit include legume producers (gardeners), rice producers, fruit producers, local beer makers (women), women, youth, and agri-business actors.
Most of the residents	This include small scale irrigation farmers, the big scale farmers and also other people not involved in agriculture, who will gain access to a diversity of productions at better price
Municipality (Commune)	The improvement of income of residents will also generate profit for the commune

6.1.2 Those unaffected

Livelihood strategy	Direct impact on livelihood strategy
No one as such	everyone is affected through secondary benefits such as changes in food prices which will affect everyone's income/expenses

6.1.3 Those negatively affected

Stakeholder group	Direct impact on livelihoods
Fishers and land owners	These groups have less or no advantage from the implement of this scenario

6.2 Factors

6.2.1 Factors that can maximise benefits of improving irrigation channels

- Capacity building of the farmers
- Sensitizing actors and education (Medium to high priority)
- Reinforcement of the dialogue between stakeholders (High priority)
- Better organisation of the agricultural channels
- Improving the food security situation
- Environmental impact assessment undertaken

6.2.2 Factors that can mitigate dis-benefits of improving irrigation channels

- Increase the training in Soil and Water Conservation (SWC) techniques.
- More financial and technical support from government and donors
- Cost of equipment – Create the condition to ease the access by poor farmers

6.2.3 Factors that can compromise the benefits of improving irrigation channels

- Lack of or weak maintenance of infrastructures
- Increasing areas of land are sold to elite farmers, leading the reduction of cultivable lands for poor farmers
- Urban expansion of the capital
- Persistence of land tenure insecurity

7. SCENARIO 6 – MOTOR PUMPS AND GARDENING WELLS

7.1 Impacts on livelihoods

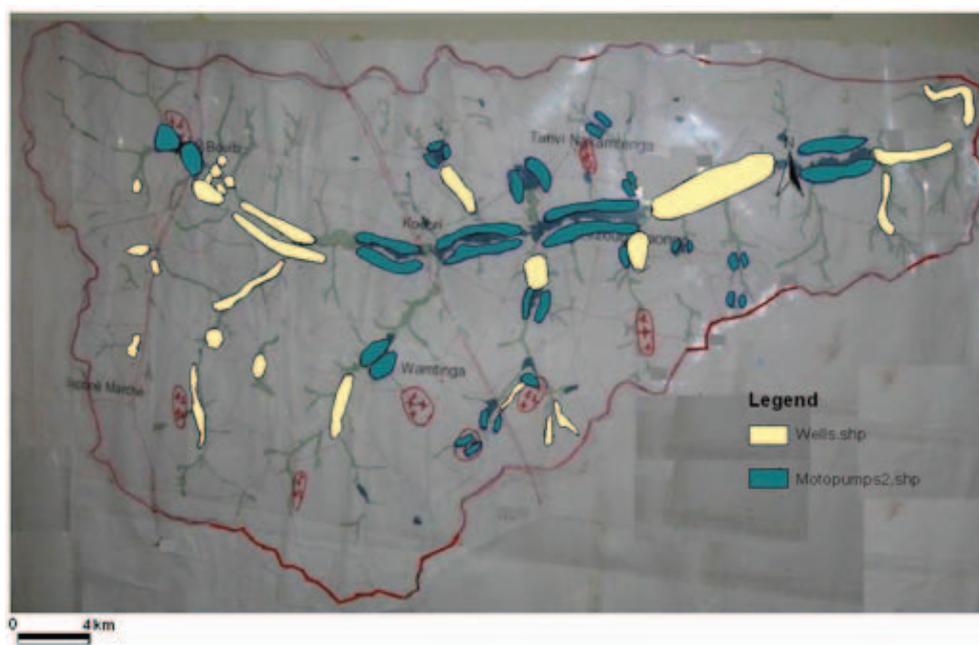


Figure 4: Scenario B - motor pumps and gardening wells

7.1.1 Those who will benefit

Stakeholder group	Direct impact on livelihoods
Small scale irrigation farmers with land in the suitable area for expansion but especially rainfed and poor farmers	The existing areas irrigated using traditional canal systems could have significant increases in yields if the irrigation systems are improved Rainfed farmers can increase their irrigated fields and also expand the duration of cropping The specific groups of users who will benefit include legume producers (gardeners), rice producers, fruit producers, local beer makers (women), women, youth, and agri-business actors. Poor farmers will be able to exploit drier lands
Most of the residents	Residents and people from outside the watershed will gain access to a diversity of productions at better price
Municipality (Commune)	The improvement of income of residents will also generate profit for the commune

7.1.2 Those unaffected

Livelihood strategy	Direct impact on livelihood strategy
No one as such	everyone is affected through secondary benefits such as changes in food prices which will affect everyone's income/expenses

7.1.3 Those negatively affected

None: no disadvantaged group was identified by participants.

7.2 Factors

7.2.1 Factors that can maximise benefits of improving irrigation channels

- Capacity building of the farmers
- Sensitizing actors and education (Medium to high priority)
- Better organisation of the agricultural channels
- Improving the food security situation
- Environmental impact assessment undertaken

7.2.2 Factors that can mitigate dis-benefits of improving irrigation channels

- More financial and technical support from government and donors
- Cost of equipment – Create the condition to ease the access by poor farmers

7.2.3 can compromise the benefits of improving irrigation channels

- Lack of or weak maintenance of infrastructures
- Increasing areas of land are sold to elite farmers, leading the reduction of cultivable lands for poor farmers
- Urban expansion of the capital
- Reduction of the access to land and land tenure insecurity

SEI - Africa
Institute of Resource Assessment
University of Dar es Salaam
P.O. Box 35097, Dar es Salaam
Tanzania
Tel: +255-(0)766079061

SEI - Asia
15th Floor Witthayakit Building
254 Chulalongkorn University
Chulalongkorn Soi 64
Phyathai Road Pathumwan
Bangkok 10330
Thailand
Tel: +(66) 22514415

SEI - Oxford
Suite 193
266 Banbury Road,
Oxford, OX2 7DL
UK
Tel: +44 1865 426316

SEI - Stockholm
Kräffriket 2B
SE -106 91 Stockholm
Sweden
Tel: +46 8 674 7070

SEI - Tallinn
Lai 34, Box 160
EE -10502, Tallinn
Estonia
Tel: +372 6 276 100

SEI - U.S.
11 Curtis Avenue
Somerville, MA 02144
USA
Tel: +1 617 627-3786

SEI - York
University of York
Heslington
York YO10 5DD
UK
Tel: +44 1904 43 2897

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