NATIONAL BEST PRACTICES REPORT
RWANDA

NBI / NTEAP / MGP

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Acronyms and Abbreviations:

ASOFERWA	Association de Solidarité des Femmes Rwandaises
BPs	Best Practices
COAMV	Cooperative des Agriculteurs de Mais dans la zone de Volcans
COOCASTER	Cooperative de Conservation et d'Amelioration de Sol/Terrassement Radical
COVAGA	Cooperative des Vannerie de Gashora
DAP	Draught Animal Power
FMD	Foot and Mouth Disease
GoR	Government of Rwanda
HH	House Hold
M asl	meters above sea level
MDGs	Millennium Development Goals
MGP	Micro Grants Project
MINECOFIN	Ministry of Finance and Economic Planning
NB	Nile Basin
NBI	Nile Basin Initiative
NGOs	Non Governmental Organization
NTEAP	Nile Transboundary Environmental Action Plan
RADA	Rwanda Agricultural Development Authority
RARDA	Rwanda Animal Resources Development Authority
RDO	Rwanda Development Organization
RwF	Rwandan Franc
SAP	Subsidiary Action Program
SOCAMAF	Societe d'Amenagement du territoires et des Agro-Foresteries
UNDP	United Nations Development Organization

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Executive Summary:

The Nile Transboundary Environmental Action Project (NTEAP) is one of the eight projects under the Nile Basin Initiative Shared Vision Programs (SVP) with the objective to provide a strategic environmental framework for the management of the transboundary resources and environment challenges in the Nile River Basin.

In 2007, NTEAP embarked on a major exercise to identify, review, select and document the best practice projects that have the potential to be sustainably replicated and/or up scaled within the countries of the basin.

In environmental management, the concept of best practice is defined as the most efficient and effective series of outcomes that have proven desirable and further generate sustained impact, both on the resource base and beneficiaries and, as such, they could be further replicated or up-scaled in similar ecosystems.

Promotion of extensive use of Draught Animal Power (DAP) in all environments where terrain and physical characteristics of soils are appropriate proved to be an ideal mean of low cost rural transport, reliable technology and a feasible mean of income generation. In this regard, it is recommended that the Government should mobilize resources from either local budgets orpledge funds from development partners in order to replicate and/or up-scale such successful initiative.

High land areas with steep slopes enhance porgressive soil erosion and pose serious impact on agricultiral porduction and, hence create pockets of food insecutity in many rural areas of Rwanda. To ameriolate this situation the successful pilot of innovative land use technologies to halt soil erosion could be further disseminated to similar ecosystems within the NB.

The process of transforming the biomass of Water Hyacinth, the noxious aquatic weed, into salable products such as the handicrafts is a break-through technology. To that effect, efforts should be made to up-scale this pilot project through extensive community sensitization, additional financing and identifying cost-effective technologies of harvesting the water weeds. To generate more income there should be a search for an efficient technology of fabricating handicrafts as well as looking for appropriate marketing avenues.

The Integrated Soil Erosion Control projects contributed significantly in halting soil erosion through putting simple physical structures that impeded surface run-off. The project increased production through the integration of livestock into agriculture and the adoption of supplementary irrigation along the hillside. Lastly, the project provided employment to the direct beneficiaries as well as other people within the area, as construction of terraces (radical and progressive) and the excavation of the irrigation canal, are all labor-intensive operations.

The Environmental Conservation through Use of Alternate Energy project is innovative one due to the introduction of alternate energy technologies including metallic solar cook stoves, fuel economy clay cook stoves and energy saving thermal baskets. The project significantly reduced the intensity of deforestation, particularly in places with high population density. The practice also contributed a lot to the welfare of community in view of the time saved for searching fuel wood for cooking, hence availing time for more productive activities and increasing rates of school attendance by children.

Promoting environment friendly farming practices contributed to the protection of the river, controlling soil erosion and water sedimentation, through tree and grass planting along the river bank. Beneficiaries acquired various and useful knowledge (soil erosion control through tree planting along the river bank, tree nursery preparation, improved and efficient techniques of vegetable production; zero tillage, drip irrigation, and rain water harvesting) and they are disseminating the practices among neighboring communities.

The project for Capacity building in organic farming aims at addressing land degradation and Persistent Organic Pollutants (agro-chemicals). The practice contributed to improved quality of the environment and preventing its pollution by chemical products. The soil fertility improved the infiltration of rain water facilitated and erosion intensity reduced. In addition, the quality of crops produced in field fertilized by organic mater contained less toxicity and are healthy.

The erosion control project and integrated agriculture into livestock is the model and referral one. Farmers are coming from other areas to learn from the successful integrated practices because of the effectiveness of the project both in soil erosion control and improved livelihoods of directly involved beneficiaries and other members of the community. Lastly, the practice contributed to social cohesion among the community because of sharing the most valuable things (cow) in Rwandan society, without paying any cash. Most of beneficiaries are poor widows who would not be able to acquire a cow.

Finally, there should be concerted efforts through given programmes/projects such as the Carbon Credit (CC) funds that have been earmarked for countries of the South to deal with Climate Change or the Integrated Management of Critical Ecosystems under the World Bank funding and others in up-scaling some identified best practices that contribute to the success of these global environmental issues.

1. Introduction:

The Nile Transboundary Environmental Action Project (NTEAP) is one of the eight projects under the Nile Basin Initiative Shared Vision Programs (SVP). The main objective of the project is to provide a strategic environmental framework for the management of the transboundary resources and environment challenges in the Nile river basin. The project specifically intends to: (a) improve the understanding of the relationship of water resources development and environment; (b) provide a forum to discuss development paths for the Nile with a wide range of stakeholders; (c) enhance basin-wide cooperation and environmental awareness; and (d) enhance environmental management capacities of the basin-wide institutions and the NBI. Operationally, the project has 5 components namely, Institutional Strengthening to Facilitate Regional Cooperation, Community-Level Land, Forest and Water Conservation, Environmental Education & Awareness, Wetlands and Biodiversity Conservation and Water Quality Monitoring.

In the above context, NTEAP has established major activities on the ground that have an impact on the environment of the basin, poverty and income generation and, as such, they remained significantly important to the NB countries. All these activities are implemented by the project in collaboration with government officials, communities, NGOs, CBOs, networks, school teachers and students. The collective objectives of these activities are to pilot successful approaches to land and water conservation measures at the national level; raise awareness on the major environmental threats that face the Nile basin and enhance the technical cooperation among the NB countries.

In 2007, NTEAP embarked on a major exercise to identify, review, select and document techniques and processes that have the potential to be sustainably replicated and/or up scaled.. In support of this process a regional workshop was held in Kigali in August 2007 in order to enhance the capacity of the National Coordinators in the identification and selection of the best practices in their respective countries.

For Rwanda a five-step selection approach was used to identify some projects that have the potential to be further disseminated as best practices. These steps can be listed as follows:

- Critical analysis of the on-going NTEAP projects, including the micro grants as well as the national environmental projects which were either completed or due to be.;

- Short listing of the projects that have passed the preliminary screening exercise;
- Setting of five selection criteria namely, sustainability, replicability, poverty alleviation, affordability and innovativeness with a final score range of 1 as lowest to 5 as highest;
- screening of potential projects based on the above merit scores; and
- Summarizing the results.

The results of the final sieving culminated into the selection of five NTEAP micro grant projects that can be considered as best practices in Rwanda. These can be listed as follows:

No	Title of Project	Total Score
1.	Animal traction to reduce soil erosion around River Muvumba	21
2	Integrated control of water hyacinth (*Eichhornia crassipes*)	19
3	Integrated Soil Erosion Control in Murambi and Gakoma Sectors	19
4.	Integrated Soil Erosion Control in Muko and Rwaza Sectors	18
5.	Alternatate Energy use for cooking	16

2. Best Practice Concept: Basic Definition

Generally, within the NTEAP, the art of best practice is defined as a visibly sustained impact of an innovative project/Programme brought about by a particular design, a technique, a process, a methodology and finally delivered with fewer problems and unforeseen complications.

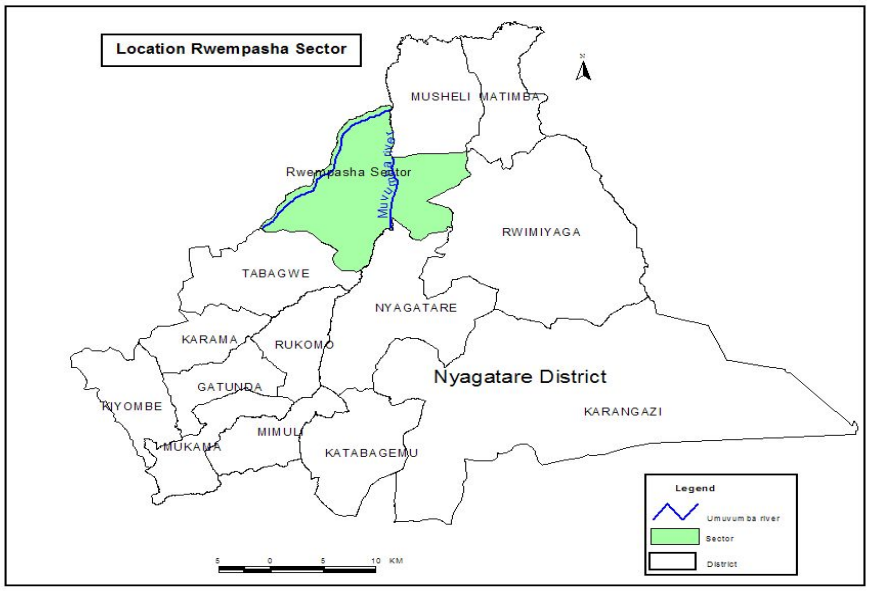
Specifically, in environmental management, the concept of best practice is literally defined as the most efficient and effective series of outcomes that have proven desirable and further generate sustained impact, both on the resource base and beneficiaries. As such, they could be further replicated or up-scaled in similar ecosystems; advisably with a recorded multiplier value.

As a conduit for knowledge management, the best practice concept facilitates wide exchange of information, enhances trading of sustainable good operating systems" and promotes cross-border, transboundary and regional cooperation.

3. Best Practice (1): Animal Traction to Reduce Soil Erosion around Muvuma River

3.1 Climatic, Physical and Socio-economic Factors:

Rwempasha is one of the 12 Sectors of Nyagatare District and it is also one of the 7 Sectors that are adjacent to Muvumba River, located within the Eastern Province of Rwanda, approximately 8km east of Nyagatare township (Map 1). The Akagera River shares its Eastern boundary with the neighboring Kizinga District, Ntungamo Province, Uganda. It is situated at an altitude of 1,600m, within the semi-arid Eastern savannah region, characterized by virgin fertile sandy-loam soils with a very high agricultural potential. Over 98% of Rwempasha sector is covered by lush pasture species during the rainy season, dominated by highly palatable species such as *Brachiaria spp., Hyperrhaenia spp., Chloris spp.,* etc. with scattered *Acacia spp*. It receives an annual average rainfall ranging between 600-800 mm/annum, with temperatures ranging between 24 and 30^{0}C.



Map (1): Nyagatare District, Showing Rwempasha Sector and Muvumba River.

The total population of Rwempasha sector is estimated at 11,428 people, comprising approximately 6,170 females (MINECOFIN, 2002). The predominant occupation of the population is agro-pastoralism with dominance of animal production. Crop production is dominated by cereals and pulses (maize, sorghum, rice, beans). Improved banana and pine apple production are gradually gaining importance as a source of cash income, especially, after the introduction of draught animal power (DAP) used for ox-cultivation and farm transportation.

3.2 Problem Statement:

Rwempasha sector, Nyagatare District, is one of the twelve sectors where the animal traction project was initially piloted. It is generally characterized by an undulating terrain with gentle slopes and relatively low rainfall. The high cattle population in the area has led to overgrazing and loss of vegetative cover due mainly to extensive tracks created by livestock trekking to Muvumba River in search of drinking water. The tracks measuring approximately 20 m wide for a total length of over 20 km are highly vulnerable to strong wind causing sheet erosion and formation of slight gullies. There is also a reported high siltation rate which results into reduced river depth and narrowing of its banks.

Rwempasha sector has a total population of 11,428, comprising approximately 6,170 females (MINECOFIN, 2002), and predominantly engaged in agro-pastoralism. Crop production is dominated by cereals and pulses (maize, sorghum, rice, beans). Improved banana and pine apple production are gradually gaining importance as a source of farm income, especially, after the introduction of draught animal power (DAP) used both for ox-ploughs and farm transportation.

The main characteristics of the pre-project baseline situation include: (a) extensive cattle tracks; (b) low water level along Muvumba river; (c) poor water quality; and (d) high siltation. Taking this into consideration the broad objective of the project is to contribute towards poverty reduction through increased land productivity and environmental conservation.

Plate (1): Cattle Drinking Water along Muvumba River

3.3 Justification for Selection (innovativeness):

The innovative nature of the Animal Traction project stems from the attempts to integrate environment conservation into poverty reduction, since the former as a standalone project is normally perceived by farmers as having little incentives to them. While this project has direct effects on the environment namely, soil erosion control and reduced silt deposition into the Muvumba River bed, it is simultaneously enhancing income generation, henceforth contributing to poverty reduction. It has been reported that addition income is gained through increased milk production (1litere/cow/day to 5 litere/cow/day) and increased crop production with a reported marketable surplus of the existing traditional food crops such as maize, sorghum and rice and newly introduced crops such as bananas and pineapples. The project has also contributed significantly to reduced incidences of cattle epidemics especially FMD (morbidity and mortality rates) as a result of some veterinary services. An important multiplier value of this project is reflected by increased rate of employment for women and youth amongst the Rwempasha population, especially as regards the day-to-day management and use of the trained oxen within the farming system. The establishment of an active "Animal Traction Training Association" of the project trained community members who are currently generating income from DAP (oxen/donkey training) activities within Rwempasha's neighboring districts or even other provinces of Rwanda.

3.4 Technical Approach: Design and Methodology:

The design of the project is premised on four main components mainly: (a) sensitization of the beneficiaries in DAP techniques, (b) training of target groups in DAP; (c) selection and training of oxen; and (d) acquisition and distribution of DAP equipments and tools. The project was implemented directly by the beneficiaries (92 males and 28 females) in close collaboration with field staff responsible for providing day-to-day technical support and backstopping. The grassroots administration and the district authorities contributed significantly to the implementation of the project. The key success indicators of project include, among others: (a) the obvious healing of originally printed cattle tracks and cattle drinking on way to drinking points; (b) increased households' income; and (c) creation of a wider partnership.

Plate (2): Ox-cart transporting water from Muvumba River to a Cattle Trough within Rwempasha

3.5 Partnership:

The key indicator of successful implementation of the Animal Traction project was the creation of a wider partnership. Such a partnership is critical for the exchange of information on the success of the project, its further dissemination and adoption in similar ecosystems. The main stakeholders include project beneficiaries (92 men, 28 women), grassroots administration at Umudugudu, cell and sector levels, the district authorities, NBI/NTEAP/MGP, Government agencies such as RADA, RARDA and NGOs operating within the sector and the district. While project beneficiaries played a direct role in the implementation of the project, all other partners provided necessary support as needed. It is worthnoting that NBI/NTEAP/MGP unit in Kigali provided technical and managerial backstopping whenever consulted.

Plate (3): Project Beneficiaries at a Meeting in Rwempasha Sector

3.6 Essence of the Best Practices: Benefits and lessons learnt

The essence of a best practice porject takes into consideration three key issues namely, accrues benifits and lessons learnt, sustainability and replicability. For the Animal Traction Porject these could be further elaborated as follows:

The Ox-cart technique is now used to bring water from the river and sell to others at the rate of 4,000 RWf (US$ 8) per trip. With this technique two trained oxen can carry up to 800 liters of water and that three trips can water up to 100 animals. As a result of in-situ watering of animals milk production has increased from 1 liter to about 6 liters per day because of the energy lost in reaching the river. According to many beneficiaries the daily net income per household is approximately 15,000 RWf (US$ 30) which is partly used to get agricultural inputs and partly spent in the general welfare of the family.
The ox-chart technique also liberated some resources which were previously used by farmers to meet the cost of labour required to transport crop products at harvest. On the gender dimension, the project relieved many women from the burden of traveling long distances to fetch water and avail more time fro them to be invested in other income related activities.

Plate (4):Ox-cart transporting water from Muvumba River to a cattle trough within Rwempasha

3.6.1 Sustainability:

The initiative has been in use successfully for 12 months, the actual duration of the project.

Unless otherwise constrained by physical or biological empediments, as in the challenges and limitations below, accured benfits both on the environment plus the additional income to beenficiaries are key factors conducive to the sustainability of the porject.

3.6.2 Replicability

There is a significant potential for dissemination of the technology and its replication in other parts of the country under similar ecological conditions. The technology is specifically suitable in flat areas where people have to travel long distances to get water.

3.6.3 Limitations and Challenges:

Taking into considerationthe history ofthe area some major limitations to the sustainability of the animal traction technology would likely include: (a) failure to achieve the expected project outputs due to calamities such as prolonged drought conditions in the area; (b) cattle disease epidemics; (c) lack of collaboration amongst the beneficiary communities with local and district authorities; (d)lack of awareness; and (e)existence of steep slopes wich do not favour animal traction.

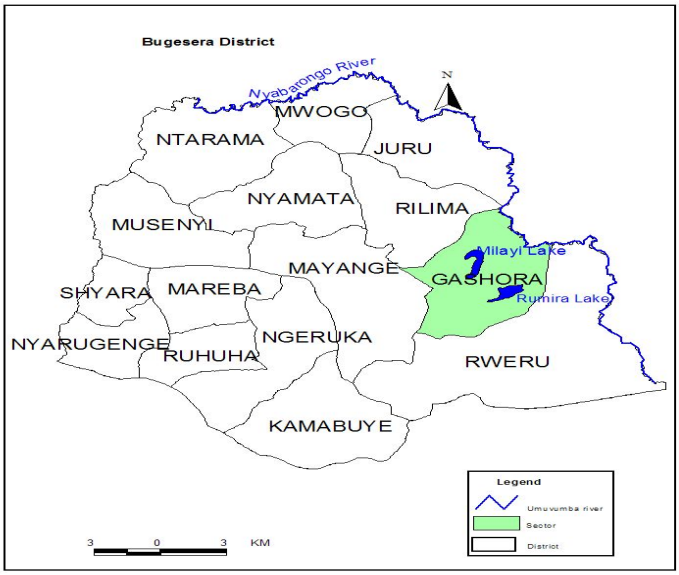
4. Conclusion:

There is a significant potential for dissemination of the technology and its replication in other parts of the country under similar ecological conditions. The technology is specifically worthy in flat areas where people have to travel long distances to get water and not the undulating terrain which constrain the performance of the traction unit.

5. Best Practice 2: Control of Water Hyacinth

5.1 Climatic, Physical and Socio economic Factors:

Gashora is one of the 15 Sectors of Bugesera District, Eastern Province of Rwanda (Map 2). It lies within the semi-arid eastern savannah region. The sector has four small inland lakes and Akagera River passes through the eastern portion of the sector. Over 95% of Lakes Mirayi & Rumira had been encroached by the notorious weed, the water Hyacinth.



Map of the District

The total population of Gashora Sector is estimated at 15,248 people, comprising approximately 8,234 females (MINECOFIN, 2002), and about 70% of Gashora population depend on fish from Lakes Mirayi & Rumira. The predominant economic activity of the members of COVAGA is fabrication of various handicrafts from the biomass of Water Hyacinth such as caps, baskets, slippers, baby corts. More recently these fabrics remained to be attractive to tourists.

5.2 Problem Statement:

The encroachment of Water Hyacinth on Lakes Mirayi and Rumira in Gashora sector, Akagera River, and other water reservoirs has been identified as serious environmental threats affecting aquatic livelihoods, particularly those earning from fish industry. Gashora, which lies within the semi-arid eastern savannah region, has a total population of 15,300 (8,300 females and 7,000 malesa) where 70% of them depend on fishing in lakes Mirayi & Rumira. Over 95% of Lakes Mirayi & Rumira had been encroached by the notorious weed.

Water Hyacinth (Fig 1) with its fast Encroachment speed coupled with its choking effects on aquatic life, has reached an alarming state and, as such, there appeared to be an urgent need to develop appropriate technologies to deal with associated challenges.

Plate (1): Biomass of Water Hyacinth (*Eichhornia crassipes)* Hharvested

5.3 Justification for Selection (innovativeness):

The "Water Hyacinth (*Eichhornia crassipes*) control through manual harvesting and transformation of the biomass into handcraft products" project was qualified as a best practice project in Rwanda. The innovative nature of this project is the actual transformation of serious environmental and economic threats into valuable economic goods in favor of deprived women groups in Gashora sector, hence contributing to the national poverty reduction agenda. In addition, eradication of Water Hyacinth had re-invigorated the fishing occupation undertaken by a large number of Gashora community members. So the reported benfifits are two-fold: firstly, the transformation of the Hyacinth biomass into valuable handicraft products fabricated by women; and secondly, the resumption of fishing activity which was physically impeded by the large Water Hyacinth biomass that previously ill-favored boating.

5.4 Technical Approach: Design and Methodology:

In response to the reported challenges, the NGO BAMPOREZE in close collaboration with the Gashora sector administration and members of COVAGA (a local cooperative in Gashora sector comprising of 50 members, mainly women), initiated the project: ''Water Hyacinth (*Eichhornia crassipes*) Control Through Manual Harvesting and Transformation of the Biomass into Handcraft Articles''.

To that effect, a total amount of Rwf 23,580,500 (US$ 42,411) had been pledged for weed control activities. BAMPOREZE in partnership with COVAGA, was granted a NTEAP micro grant for weed control in lakes Mirayi & Rumira. This wasa portioned as NBI/NTEAP/MGP cash grant of RwF 13,900,500 (US$ 25,000), and BAMPOREZE in kind contribution of RwF 9,680,000 (US$ 17,411), mainly provision of technical support. The main objectives of the project are five-fold: firstly, to protect Akagera river and lakes in Gashora sector through elimination of Water Hyacinth; secondly, to train vulnerable women the techniques of recycling and adding value to the water hyacinth; and thirdly, to create sustainable employment opportunities to the vulnerable women; fourthly to enhance environmental protection; and fifthly, to create a reliable marketing avenues for water hyacinth recycled products.

The coherent design of the project is premised on the manual harvesting of Water Hyacinth (*Eichhornia crassipes*) and further transformation of its biomass into handcraft products in order to mitigate the encroachment speed of the weed while simultaneously create employment opportunities for the target communities (Plate 2).

Plate (2): COVAGA women of Gashora, Bugesera District Fabricating Handicraft Articles from the Water Hyacinth

The technical approach used in the project implementation involved: (a) sensitization of the Gashora community members and the local administrative authorities on the environmental and economic gains of eliminating Water Hyacinth; (b) manual collection of the Water Hyacinth weeds from the surface of the lakes and other water sources in Gashora sector; (c) training of the COVAGA members on the techniques of fabricating various products from Water Hyacinth; (d) marketing of the handicraft products; and (e) training of beneficiaries on environmental protection.

5.5 Partnership:

The main partners entrusted with the implementation of the project include the direct beneficiaries (47 women and 3 men) who are the members of the cooperative COVAGA, NBI/NTEAP/MGP, local and district administration and NGOs. NBI/NTEAP/MGP usually provided technical and managerial backstopping.

5.6 Essence of the Best Practices: Benefits and lessons learnt

The essence of a best practice porject takes into consideration three key issues namely, accrues benifits and lessons learnt, sustainability and replicability. For the Water Hyacinth Porject these could be further elaborated as follows:The potential control of Water Hyacinth through manual harvesting and recycling of its biomass into fabricated products had effectively transformed a serious environmental and economic threat into valuable outcomes, hence contributing to rural poverty reduction. Generally, the overall direct effects of the initiative were improved aquatic life, increased marine transport along the Nile River Basin and reduced poverty through increased income.

The advantage of the prolonged activities of the project was the control and eventual elimination of the notorious Water Hyacinth (100%) together with the resultant long-term effects on the quality of water of the Nile and further increased the total fish production from 2 Kg to 10 Kg. making a total revenue of US$60 per household per day.

The fabricated handicrafts are presently sold for attractive market price making a total monthly income of (US$ 100) per individual household (Fig 3). The success of the recycling of the Water Hyacinth is evident by the increased demand on the handicraft products, particularly accruing from the unique art innovatively presented by the beneficiaries.

Plate (3): Some of the Handcraft Articles Fabricated from Water Hyacinth

5.6.1 Sustainability:

The project is considered highly sustainable since it is directly addressing a serious environmental threat while significantly contributing to poverty reduction through income generated from the sales of the handicrafts and re-invigoration of the fish industry. Also, facilitation of more aggressive marketing of good quality fabricated goods remains a great incentive for the communities living along the Nile Basin. For that to happen, some capacity support to enhance the technical capacities of women beneficiary groups is needed. In situations where the raw material gets scarce or depleted, some other sources for fabrics should be tapped.

5.6.2 Replicability:

In view of the cost effectiveness of the Water Hyacinth transformation technology it could be easily replicated in other parts of Rwanda where the weed is encroaching at a high rate and affecting livelihoods. The major recommendation is to mobilize adequate resources for up scaling the Water Hyacinth control activities and fabrication of high quality products from the weed.

5.6.3 Limitations and Challenges:

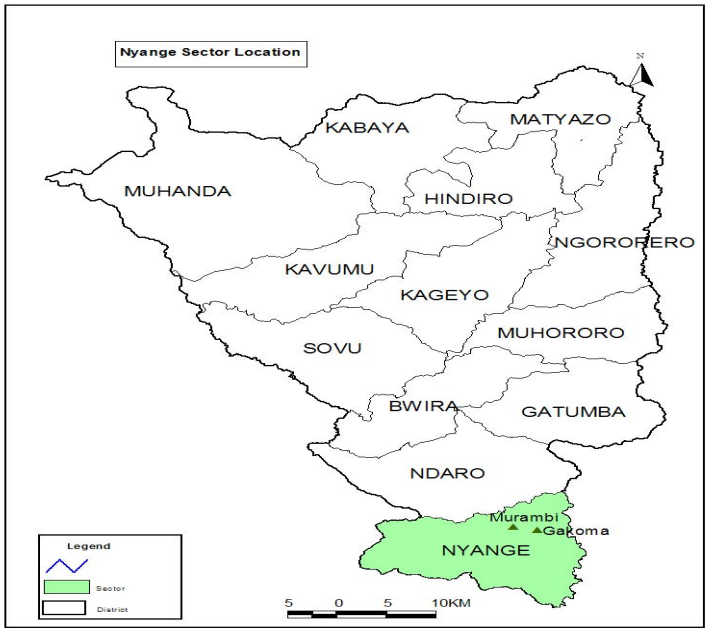
The serious limitation is that manual removal of the Water Hyacinth is an intensive labour business which demands a high labour input. Such a demand would eventually distract women from other household related activities and may also subject them to some other potential risks. A resort to an effecient technology of harvesting the Water Hyacinth through using power-operated equipment, could provide enough time for beneficiary women to produce more handicrafts and henceforth generate more income while equally attending to other household related activities. Also in some areas the raw materials may be depleted in a relatively short period of time henceforth, put the whole recycling process of the biomass into jeopardy.

6. Conclusion:

The intervention has become more or less a national environmental conservation strategy and further incorporated into the National Agricultural Policy (NAP) 2005. In view of the accrued benefits the project has been replicated in all districts of the country that are characterized by steep slopes. The outcomes of the project could be used to develop relevant training modules in environmental conservation and improved husbandry practices.

7. Best Practice (3): Integrated Soil Erosion Control in Murambi and Gakoma Mountains

7.1 Climatic physical and Socio Economic Factors:



Map (1): Location of Ngororero District, Nyange Sector Showing Murambi and Gakoma Mountains

The project is situated along the mountains of Murambi and Gakoma dissected by Cyangwe River, which feeds into Sagaterere River and finally into Nyabarongo (Map 3). It lies within the Nile-Congo crater where the soils are predominantly sandy with low fertility due to severe erosion. Almost 100% of the inhabitants depend on agriculture for their livelihoods.

7.2 Problem Statement:

Dwellers of Murambi and Gakoma mountains and associated hillsides are predominantly farmers, albeit agricultural production is seriously constrained by soil erosion. This is mainly due to the fact that crop fields are located in mountainous slopes with a gradient ranging between 40 to 80%, which in turn facilitates high surface run-off and sheet erosion. This phenomenon would eventually result into poor soil physical and chemical conditions and hence low fertility.

Plate (1): Progressive Terraces Established with Cabbages and protected by *Pennisetum purpureum*

7.3 Justification for Selection (innovativeness):

The innovative nature of the project stemmed from the integrated approach used to: (a) significantly halt soil erosion through putting simple physical structures that impede surface run-off; (b) include livestock into agriculture; and (c) adopt supplementary irrigation along the hillside.
The beneficiaries confirmed that there was an increased crop production as the result of the above measures. Also many farmers have changed to higher value crops, that is, from the dominant sweet potatoes to vegetables, maize, tomatoes, soybeans and alike, as they are now assured of supplementary irrigation. On the other hand, the impact on the environment is remarkable, since the rate of loss of soil nutrients from Gakoma and Muko hillsides and their further movement downstream to Cyambwe River basin was completely recessed through the use of low cost technology. Lastly, the project has provided employment to the direct beneficiaries (TUZAMURANE members) as well as other people within Nyange sector, as construction of terraces (radical & progressive) and the excavaction of the irrigation canal, are all labour-intensive operations.

Plate (2): Hillside Irrigation Canal from Cyangwe River with Fodder Production

7.4 Technical Approach: Design and Methodology:

The project, Soil Erosion Control, was initiated after the realization that the community of Bambiro cell was no longer able to produce adequate food for their families as a result of reduced agricultural production within the existing farming system. This was mainly caused by extensive soil erosion during the rainy season, associated with excessive water deficit along the hillside, hence failure to support crop production.

Societe d' Amanagement du Territories et Des Agro-Foreteries (SOCAMAF) in collaboration with Nyange sector and Ngororero district authorities in association with a local association TUZAMURANE came up with the project proposal on the integrated soil erosion control using radical and progressive terraces and retention ditches along Murambi and Gakoma Mountains. In addition to that there was hillside irrigation using water diverted from Cyangwe river. The NBI/NTEAP/MGP provided 93% of the total project investment, whereas the remaining 7% was provided by the beneficiaries, mainly in-kind contribution. The technical approach to the implementation of the project includes: (a) conduction of a topographical survey of the project area earmarked for the construction of the different anti-erosion measures, and the site for layout of the hillside irrigation canal; (b) demarcation and field layout of the terraces (radical & progressive), retention ditches, irrigation canal; (c) carrying out works on terraces, ditches, and canals; (d) training of beneficiaries on construction and management practices; and (e) demonstration and supervision of the crop establishment and management practices; and (f) establishment of fodder species along the terraces. The inclusion of the dairy heifers is also part of the integration process.

In this regard, the members of the association are trained in improved livestock production under zero grazing management system. The project was implemented by TUZAMURANE association comprising 10 households with a total of 50 people, through the technical and financial support by SOCAMAF and NBI/NTEAP/MGP, respectively. The core project activities included: (a) training of beneficiaries on integrated soil control techniques, hillside irrigation, and improved dairy cattle management techniques; (b) preparing land for radical terraces, progressive terraces and hillside irrigation canal; (c) providing miscellaneous support to beneficiaries (iron sheets, cement, cattle); and (d) monitoring by an agronomist and a veterinary technician. The expected project outcomes include among others the following:

- increased crop productivity accruing from reduced soil erosion and use of farmyard manure.
- improved welfare (poverty reduction) of the TUZAMURANE members and their families resulting from increased incomes from sale of marketed surplus crops and milk.

7.5 Partnership:

The main partners include the direct project beneficiaries of 10 households (50 persons) belonging to a local association TUZAMURANE, Societe d' Amanagement du Territories et Des Agro-Foreteries (SOCAMAF), Nyange sector and Ngororero district authorities and NBI/NTEAP/MGP.

7.6 Essence of the Best Practices: Benefits and lessons learnt:

The essence of a best practice porject takes into consideration three key issues namely, accrues benifits and lessons learnt, sustainability and replicability. For the Integrated Soil Erosion Control in Murambi these could be further elaborated as follows: The project has produced positive effects on the environment considering the highly reduced runoff and transfer of soil nutrients from upstream to the Cyangwe River Basin. As a result of reduced soil erosion and use of farmyard manure, there was a reported increase of agricultural production where the total income generated per household per season was US$ 420. As animals were fully integrated into the project activities through provision of adequate fodder, total milk yield reportedly increased from 2 liters per day to 7 liters per day, which in turn generated a daily income of (US$ 4). It follows that the total monthly household income form agriculture and animal production was (US$540).

7.6.1 Sustainability:

The project is cost-effective given the fact that all the envisaged outputs were realized by the end of the project. The intgeration of the essence of this project in the national environmental policy and strategies, the incentives to the farmers resulting from increased soil productivity and improved animal production are clear indicator of long-term sustainability.

7.6.2 Replicability:

The intervention has been replicated in all districts of the country with steep slopes, and has become more or less a countrywide environmental conservation strategy, following clear policy actions within the National Agricultural Policy (NAP 2005). The impact of the practice is remarkable in terms of soil erosion control and increased land productivity.

7.6.3 Limitations and Challenges:

The main limitations for this project include high initial cost for the construction of radical terraces, excavation of hillside irrigation canals and other related land preparation which involve tedious labour intensive works. Another limitation is the succumbing of cattle to diseases due to inadequate veterinary services.

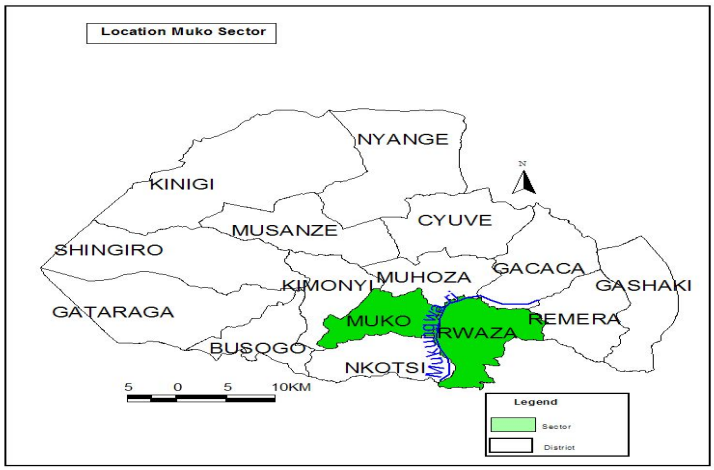
8. Conclusion:

The intervention has become more or less a national environmental conservation strategy and further incorporated into the National Agricultural Policy (NAP) 2005. In view of the accrued benefits the project has been replicated in all districts of the country characterized by steep slopes. The outcomes of the project could be used to develop relevant training modules in soild erosion control and improved husbandry practices.

9. Best Practice (4): Integrated Soil Erosion Control in Muko Rwaza Sectors (Northern Province)

9.1 Climatic, physical and Socio Economic Factors:

The project is located in the sectors of Rwaza and Muko, Musanze District (Map 4). The area is characterized by steep slopes ranging from 12 to >45%, which is vulnerable to soil sheet erosion associated with high silt deposition into Mukungwa River basin. The main livelihood of the local community is agriculture. However there is a call for appropriate land use practices that would enable the production of adequate food for domestic use as well as some marketable surplus.



Map (1): Rwaza and Muko Sectors, Musanze District.

9.2 Problem Statement:

The sectors of Rwaza and Muko of Musanze District of the Northern Province, are characterized by steep slopes ranging from 12 to >45%. The main livelihood of the population is agriculture both to ensure domestic food security and attain a salable surplus to meet other household needs. In view of the steep slopes of Rwaza and Musanze sectors, farming lands are extremely vulnerable to soil erosion associated with high silt sedimentation into Mukungwa River bed. In view of low soil fertility resulting from removal of top soil during sheet erosion, agricultural production is reportedly low.

With the above background that COOCASTER in collaboration with the local association/farmer group “TWITEZIMBERE TURENGERA IBIDUKIKIJE” and in partnership with the local administration of Rwaza and Muko sectors and Musanze district authorities prepared and submitted the integrated soil erosion control project for financing by NBI/NTEAP/MGP.

9.3 Justification for Selection (innovativeness):

The integrated approach of soil erosion control through the use of terraces (radical & progressive) and inclusion of animal into crop rotation proved to be suitable for land reclamation where sheet erosion was practically halted down, soil fertility restored and food production (climbing beans, sorghum, maize) improved.

Also fodder production (*Calliandra calothyrsus, Pennisetum purpureum)* for dairy cattle was significantly increased. The increased agricultural production resulting from better land use practices through terracing, use of cattle manure, fertility build up through nitrogen fixation attributed to increased beneficiary family income, hence improved standard of living. The impact on the environment is clearly visible as the originally depleted bare land is covered by valuable crops (sorghum and others). Also the reduced siltation is seen as the river width and water depth was increased. In addition there were increased employment opportunities in a number of labour intensive works related to the project.

Plate (1): Terrace Cultivation along Mukungwa River Basin.

9.4 Technical Approach: Design and Methodology:

The technical approach used to implement the project include: (a) conducting a topographical survey of the project area earmarked for the construction of the different counter erosion measures; (b) demarcation and field layout of the terraces and retention ditches; (c) carrying out works on terraces and ditches; (d) training of beneficiaries on construction, management and maintenance practices; (e) demonstration and supervision of the crop establishment and management practices, including establishment of fodder species along the terraces; and (f) training of beneficiaries on management of zero-grazing of dairy cattle and related husbandry practices, including elementary cattle diseases diagnosis. The main project activities include: (a) training of beneficiaries on techniques of integrated soil erosion control, agro forestry management, and improved dairy cattle management; (b) preparation of land for radical and progressive terraces); (c) Procurement of improved cattle and construction of cattle sheds; and (d) enhancing monitoring by an agronomist, and veterinary technicians.

9.5 Partnership:

The main partners within the project include the main project beneficiaries, grassroots institutions, COOCASTER, Farmer Group "TWITEZIMBERE TURENGERA IBIDUKIKIJE", local administration of Rwaza and Muko sectors and Musanze district authorities and the funding partners NBI/NTEAP/MGP.

Plate (2): Partners at Dairy Cattle Reception Ceremony in Rwaza Sector.

9.6 Essence of the Best Practices: Benefits and lessons learnt

The essence of a best practice porject takes into consideration three key issues namely, accrues benifits and lessons learnt, sustainability and replicability. For the Animal Traction Porject these could be further elaborated as follows: On the physical state of the environment there was a remarkable reduction in soil erosion and significant restoration of soil fertility which was evident from improved crop yields. As a consequence of improved soil fertility resulting from reduced soil erosion and extensive use of the farmyard manure, yield of the traditional crops increase by more than 70%. Reportedly, there was no empty period during the year relating to the household food security. On the other hand, milk production was increased from 2.5 liters per day to 10 Liters per day and consequently each individual household is getting a daily income of US$ 6. It follows that the monthly income of individual household participants to the project form all activities was estimated at US$ 680.

Plate(3): Climbing Beans Flourishing along Mukungwa River Basin

9.6.1 Sustainability:

The key factors of the future sustainability of the project include: (a) reported accrued benefits from agriculture and livestock to beneficiary farmers; (b) the intervention has been recommended for all areas with slope exceeding 12%, and there are now terraces (radical, progressive) in most of the hilly areas of Rwanda; and (c) Musanze adopted land-use technologies in their respective plans (*imihigo*).

9.6.2 Replicability:

The intervention has been recommended for all areas with slope exceeding 12%, and there are now terraces (radical, progressive) in most of the hilly areas of Rwanda. At present Musanze and other neighbouring districts have appreciated the benefits associated with the porject and have aggressively advocated its success to the farming communities. Not only that, but also have included the land-use technologies in their respective plans (*imihigo*).

9.6.3 Limitations and Challenges:

The main limitations include: (a) the high initial investment cost to integrate improved animal stocks; (b) the relatively higher cost related to the construction of radical terraces; and (c) cattle succumbing to diseases due to limited veterinary services.

9.6.4 Total Investment:

The total project investment was RwF 18,221,573 (US$ 32,773) of which NBI/NTEAP/MGP pledged RwF 12,420,073 (US$ 22,338) and an in kind contribution of RwF 2,180,000 million (US$ 3,921) provided by the beneficiaries.

10. Conclusion:

The intervention was recommended for all areas with slope exceeding 12%, and there were terraces (radical, progressive) in almost all of the hilly areas of Rwanda. Construction of terraces is a high labour-intensive activity which requires a lot of resources in support of the various operations. Musanze and other neighboring districts have fully realized the benefits associated with such soil conservation initiative and they have strongly included the land-use technologies in their respective plans.

11. Best Practice (5) : Environmental Conservation through Use of Alternate Energy

11.1 Climatic, Physical and Socio- economic Factors:

The project is located in the semi-arid eastern savannah area of the country, characterized by prolonged droughts associated with frequent food shortages. Due to high population density coupled with poor agricultural production techniques, there has been extensive deforestation to meet the demands for building materials, cultivation and fuel wood for cooking in homesteads. While the majority of the population (>98%) depend on agriculture for their livelihood, albeit most of the inhabitants are among the poorest in the country and frequently confronted with famine.

11.2 Problem Statement:

The farming communities (98%) in Kanzenze, Cyugaro and Kibungo cells of Ntarama sector, Bugesera District, Eastern Province, are constantly facing a serious problem of lack of fuel wood traditionally required as a source of energy for cooking in the homesteads. This semi-arid region of the country is normally characterized by prolonged droughts and frequent food shortages related to the high population density and poor agricultural production.

In search of traditional energy source (fuelwood), building materials and land clearance for cultivation, there has been extensive deforestation. Concurrent with the above there are concerted government efforts in reforestation with greater emphasis on appropriate agroforestry techniques as a long-term strategy for resolving the problem. In this context, the major theme of the intervention is the demonstration of the use of feasible alternate energy sources for cooking such as solar cookers, clay stoves and thermal baskets.

11.3 Justification for Selection (innovativeness):

The innovative nature of the project stems from the fact that the introduction of alternate energy technologies including metallic solar cook stoves, fuel economy clay cook stoves and energy saving thermal baskets has significantly reduced the intensity of deforestation in Ntarama sector as well as in many other parts of the country, particularly in places with high population density.

Plate (1): Solar Energy Cook stove in Ntarama Sector.

The revelation of the beneficiaries is that the project has contributed a lot to their welfare in view of the time saved for searching fuel wood for cooking, hence availing time for more productive activities and increasing rates of school attendance by children. Regarding the impact on the environment, on the spot assessment of agroforestry and reforestation efforts is highly promising. According to the beneficiaries there was an increased amount of seasonal rainfall received in the area and, of course, this was reflected in increased agricultural production.

11.4 Technical Approach: Design and Methodology:

The NGO, ASOFERWA, in collaboration with the local authorities and the farmers' group of 490 members (437 men and 53 women) came up with an idea of using solar energy cook stoves.

The technical approach was premised on the following: (a) conducting a baseline survey for participatory assessment of the project needs; (b) training 90 members of various associations from the three Cyugaro, Kanzenze and Kibungo cells; (c) provision of material and supplies to the workshop in Ntarama village, (iv) organization of study tours to Kinihira (Rulindo District); and (d) monitoring & evaluation of project activities.

Plate (2): Energy-saving Cookstove in Ntarama Sector

The technical approach was premised on the following: (a) conducting a baseline survey for participatory assessment of the project needs; (b) training 90 members of various associations from the three Cyugaro, Kanzenze and Kibungo cells; (c) provision of material and supplies to the workshop in Ntarama village, (iv) organization of study tours to Kinihira (Rulindo District); (d) monitoring & evaluation of project activities. ASOFERWA implements the project in close collaboration with 90 trained community members who will in-turn extend the technique to the remaining members of the group, mainly women. The indicators of success are that the tree stands are visible unlike in the past years, implying that the rate of deforestation has been reduced significantly. Also the findings of the interviews held with beneficiaries and other randomly picked residents indicate that the burden of fetching fuel wood for cooking has been reduced significantly.

11.5 Partnership:

At present the main partners of the project include the direct beneficiaries (490), the NGO, ASOFERWA, the local authorities, associations from the three Cyugaro, Kanzenze and Kibungo cells, and NBI/NTEAP/MGP.

11.6 Essence of the Best Practices: Benefits and lessons learnt

The essence of a best practice porject takes into consideration three key issues namely, accrues benifits and lessons learnt, sustainability and replicability. For the Environmental Conservation Through use of Alternate Energy Porject these could be further elaborated as follows: Some of the key outcomes of the project were namely, increased conservation of the environment (reduced deforestation), increased agricultural production and increased school attendance by children as a result of saved time previously used for fuel wood collection and cooking. The main success indicators include significant reduction in the rate of deforestation, time used to fetch fuelwood was saved and energy use efficiency in cooking was significantly improved.

11.6.1 Sustainability:

Based on the success of this initiative, it is becoming increasingly significant to continue this practice as the supply of forests and forestry products are decreasing at a high rate. Consequently, the government is now putting in a lot of emphasis regarding promotion of research in support of the use of alternatate energy sources. The long-term effects on climate change as indicated by the community members in Ntarama sector should not be under estimated. All the above areas of impact of the project assure its sustainability

11.6.2 Replicability:

The technology of cook stoves and basket thermoses have been used in Ndera sector, Gasabo district, several parts of Nyagatare and Karongi districts, and many other locations of Rwanda, though using different materials such as clay. The initiative is becoming increasingly significant as the supply of forests and forestry products are decreasing at a high rate, and the GoR is putting in a lot of emphasis in terms of promoting research into use of alternative sources of energy.

11.6.3 Limitations and Challenges:

The main limitations recorded were: (a) the aluminum foil used as solar energy recipient requires a lot of sunshine to cook efficiently; and (b) lack of a detailed marketing strategy for the generated technologies.

11.6.4 Total Investment:

The total investment made was Rwf 14,473,400 (US$ 26,031) where NBI/NTEAP/MGP donated Rwf 12,473,400 (US$ 22,434) and RwF 2,000,000 (US$ 3,597) from the own resources of the NGO, ASOFERWA.

12. Conclusion:

Selection of best practice projects as tradable outcomes should be a continuous process where success made in part of the country by a given innovation could be exchanged either locally or within the countries of the Nile Basin. Dissemination of best practice projects and their further adoption by other partners within the region is a cost effective way of sharing results and managing knowledge. In this regard Rwanda, under the NBI/NTEAP/MGP has come up with a number of environmentally related initiatives that are all qualified as best practices and, as such, they can be disseminated and further replicated or up-scaled in other parts of the Nile Basin. In high land areas with steep slopes, it would be feasible if the Government with its development partners mobilize adequate resources to assist local communities in saving erosion-prone high altitude densely populated areas of Rwanda and simultaneously attend to the marked food insecurity in such areas.