3. WATERSHED ASSESSMENT

3.1 Characterisation of the Kagera sub-basin

3.1.1 Sub-watershed delineation

In line with IWRM principles requiring watersheds to be managed as hydrological units, the Kagera sub-basin was delineated into sub watersheds. The criteria used to delineate the sub-basins by the Kagera Monograph were topography derived from the United States Geological Service (USGS) Shuttle Radar Topographic Mission (SRTM) digital terrain model (DTM) with a 90 metres vertical resolution. The criteria to determine the size of the sub-watersheds in the Kagera Monograph appears to have been the presence of a Strahler River Order 5 at the outlet[26]. The Kagera Monograph did not use sub-watersheds for characterisation or ranking, adopting instead four "hydro-geographic zones". These were not subject to any ranking. An alternative would have been to use the USGS Hydro1k global basin delineation. The USGS Hydro1k 6th order basins would have produced 18 Sub-watersheds. However, the DTM used here had only a 1km^2 resolution which is too coarse for the present analysis.

The use of digital terrain models (DTM) to delineate watershed boundaries is standard practice as is the use of Strahler River Classes to determine approximate size of watersheds. The consultants improved upon the sub-watershed delineations outlined in the Kagera Monograph using the ASTER digital terrain model with a 30 metre vertical resolution and proceeded to define them in detail using GIS. This resulted in defining 22 Sub-watersheds and provided a considerably more detailed basis for analysis and to enable ranking to be undertaken.

The 22 sub watershed boundaries are shown in Map 8 below.

3.1.2 Analysis and Modelling: sub-watershed and sub-basin characterisation

Sub-watershed characterisation

The HYSIM computer model was used to model the hydrology of each of these 22 sub watersheds.

Using recent Landsat and ASTER digital terrain elevation imagery[27] the consultants then mapped soil erosion risk for each sub watershed using a soil loss estimation model [SLEMSA]. Soil erosion risk maps were produced for each sub watershed. The Landsat imagery was also used to map land cover / land use in each of the sub watersheds.

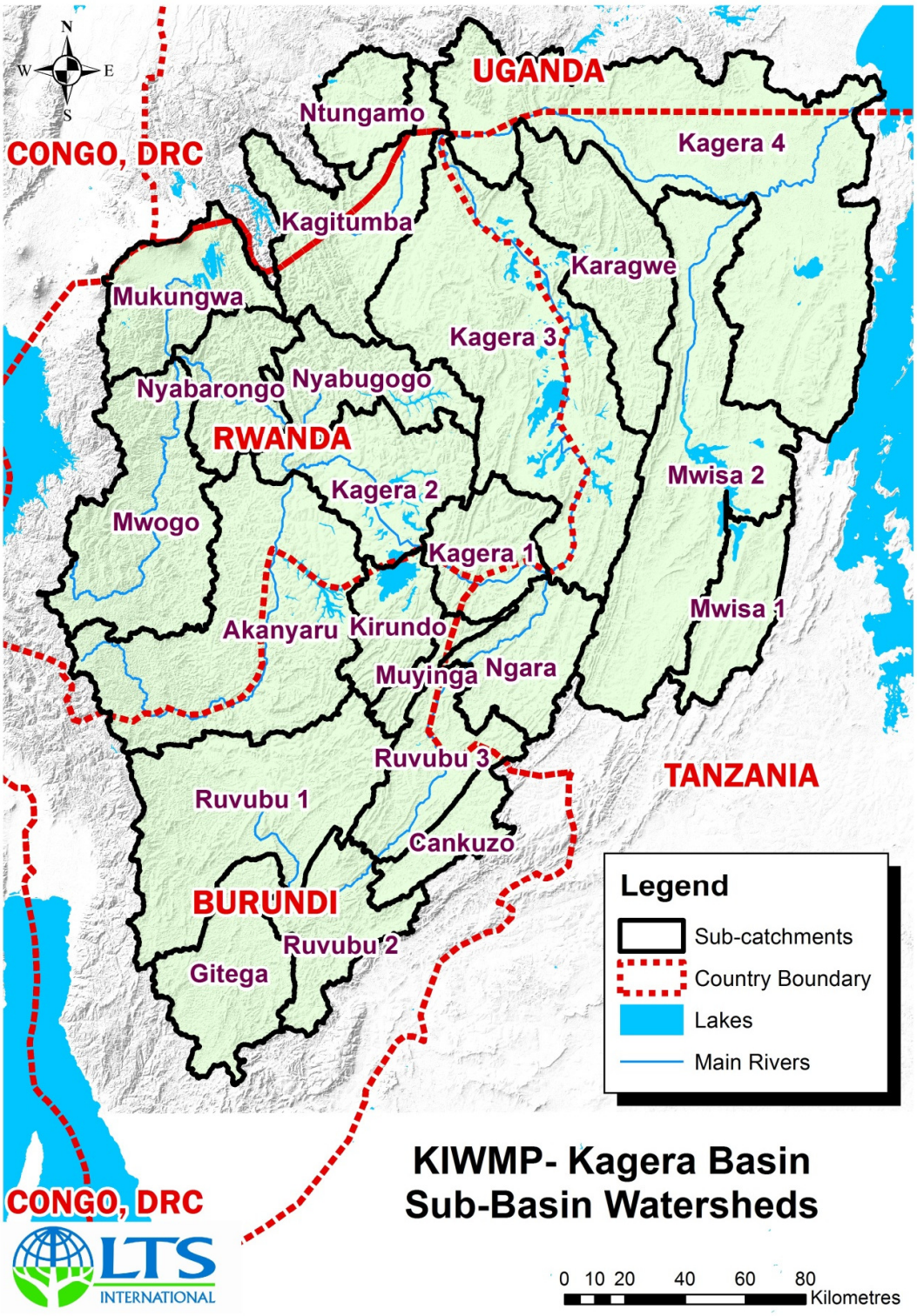
A descriptive report for each sub-watershed was produced which presents tabulated data, GIS mapping and text organized into the following sections (included as Annex F of the DFR):

- Hydrology including flows, precipitation, irrigation demand, soil water stress and groundwater recharge
- Landuse and land cover as tables and maps
- Narrative description of the watershed covering status of degradation, status of soils, population, present development trends and key issues of concern

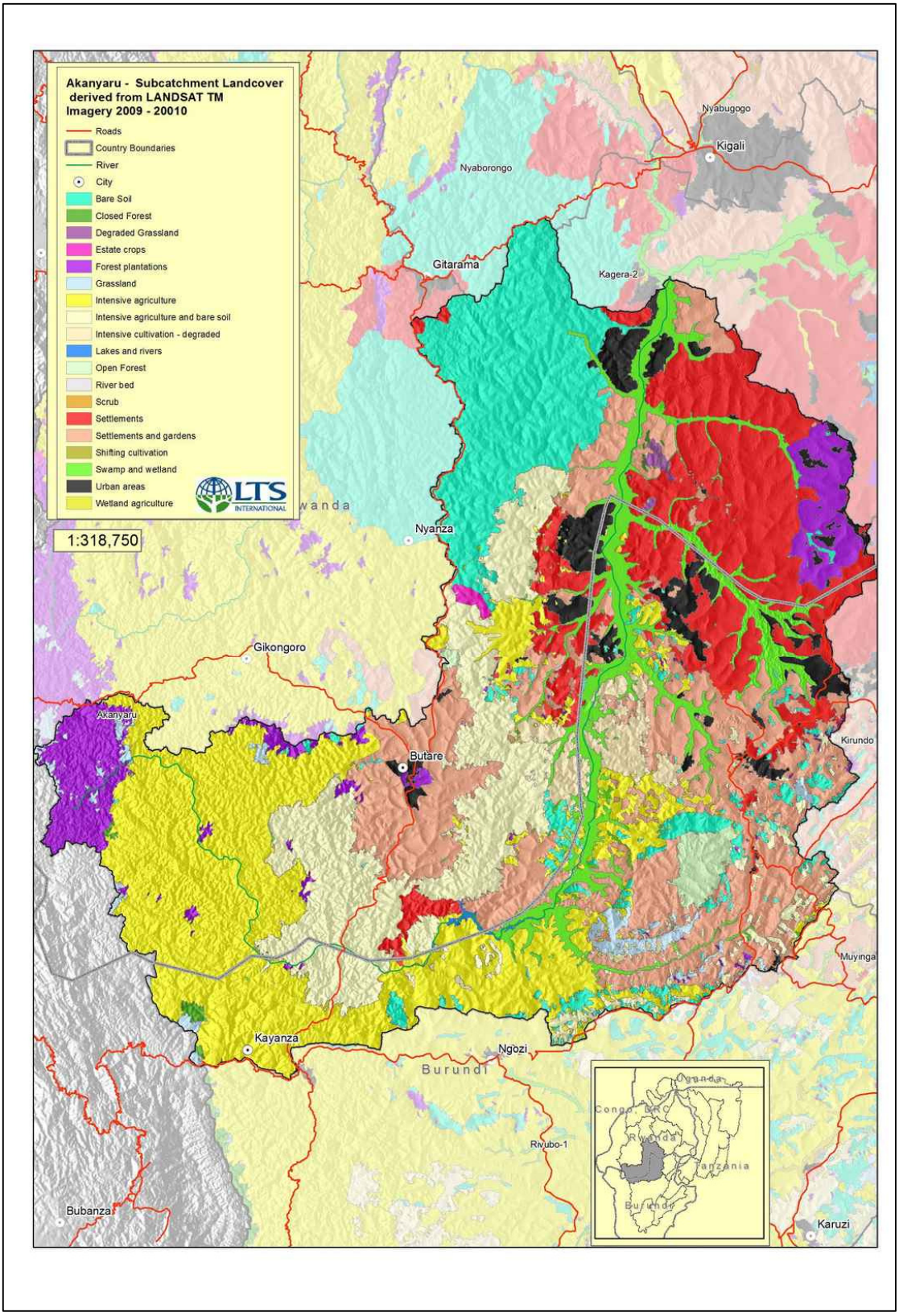
Examples of a landcover map and soil erosion risk map for Akanyaru sub watershed are shown below in Maps 15 and 16.

[26] The Monograph does not indicate this but a careful examination of the map shows that outlet rivers were all Strahler Class 5 .
[27] ASTER has a vertical resolution of 30 meters compared with SRTM's 90 meter resolution.

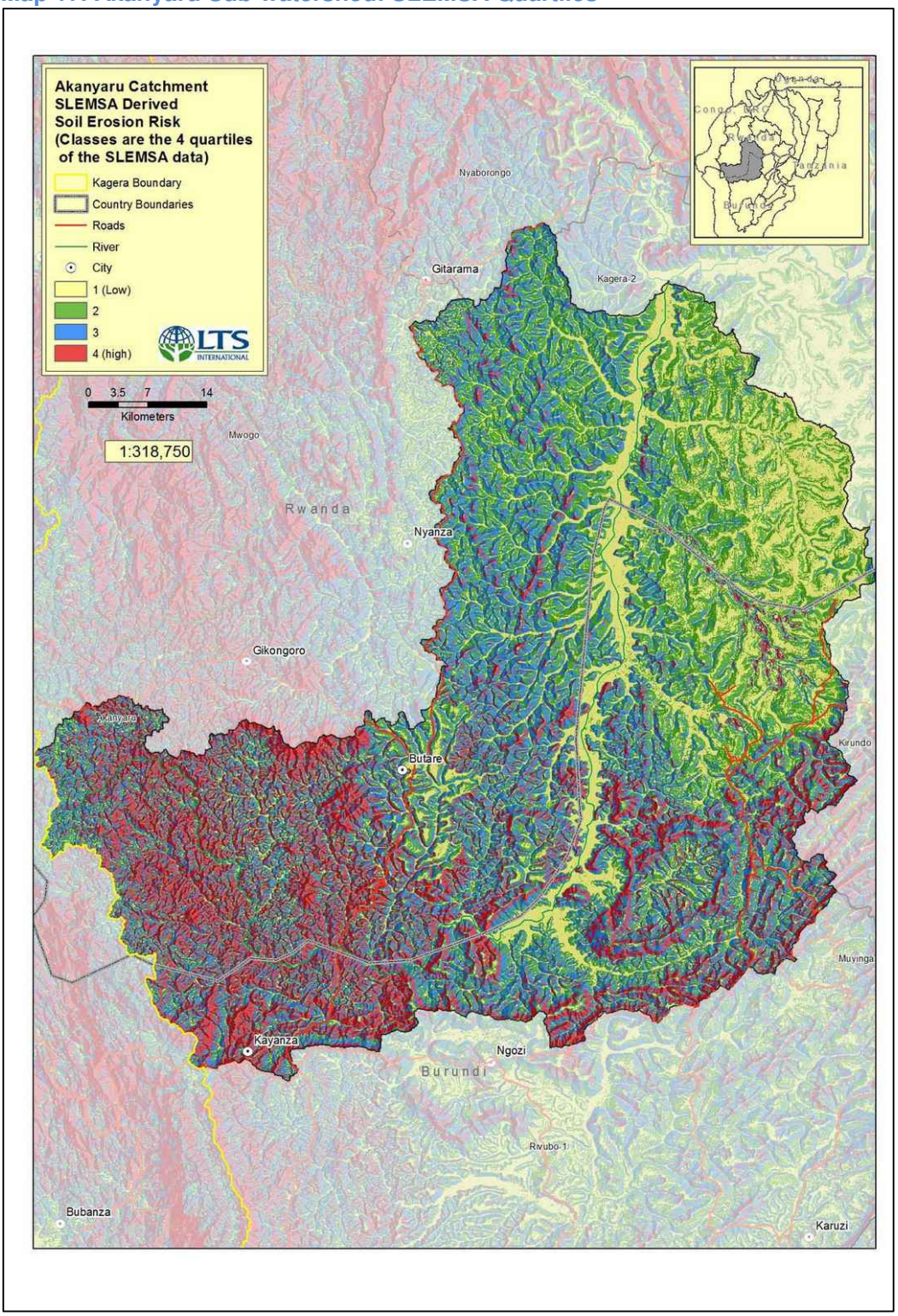
Map 15. 22 sub-watersheds used for the delineation and analysis



Map 16. Akanyaru Sub-watershed: Dominant Landcover



Map 17. Akanyaru Sub-watershed: SLEMSA Quartiles



Sub-basin characterisation

In addition the overall Kagera sub-basin characterisation, which will form Annex F of the DFR, provides whole basin analysis and mapping organised as follows:

- Relief and drainage

- Geology and soils
- Hydrological parameters including climate change analysis
- Land cover and farming systems
- Wetlands
- Biodiversity and protected areas
- Natural resource trends
- Political and administrative structures
- Population structure and distribution
- Infrastructure

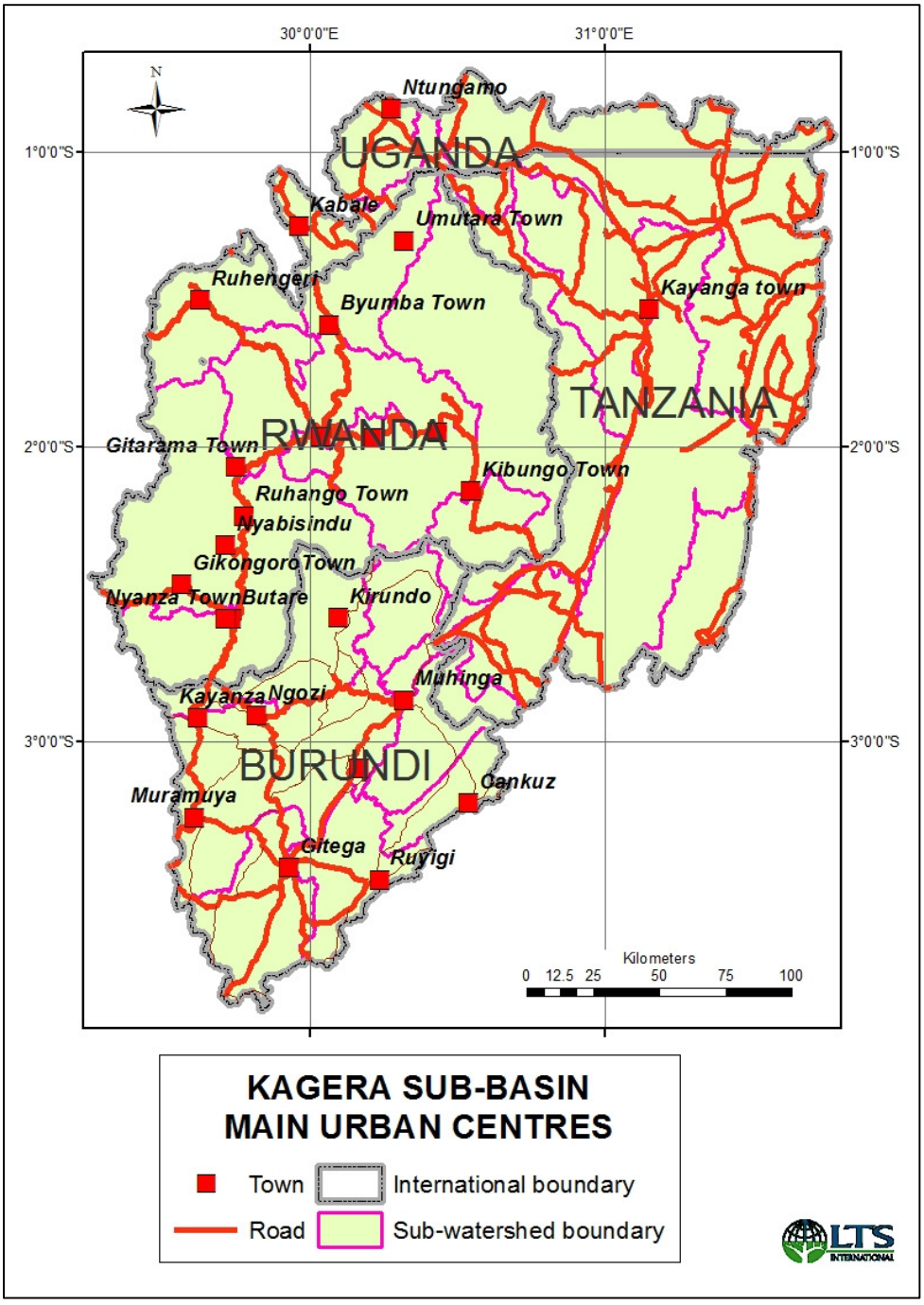
Water pollution risk

Water pollution risk was modelled for all major population centres using a standard runoff model to arrive at BOD_5 loading in the receiving water course. The results of this analysis are shown in Table 9. A map showing their locations in shown in Map 18. The location of wetlands within the sub-basin and their proximity downstream of the potential pollution sources enabled a first approximation and location of potential wetlands sub-projects to treat this water pollution.

Table 9. Water pollution risk by urban centre

City	Population	Drainage area(km^2)	Runoff (mm)	Flow (m^3/s)	Per capita pollution load (gm/day)	BOD_5 in receiving water course (mg/l)
Kigali	751,000	1556	85	4.2	77	159.6
Isingiro	21,000	111	60	0.212	77	88.6
Ngozi	20,000	180	320	1.82	77	9.8
Gitega	26,000	54	290	0.50	77	46.7
Kabale	44,000	423	70	0.94	77	41.8
Rwamagana	58,000	0	70		77	
Ruhengeri	89,000	231	800	5.9	77	13.5
Ruhango	63,000	66	250	0.52	77	107.3
Nyanza	76,000	0	160		77	
Kibungo	55,000	41	120	0.16	77	314.2
Kabuga	64,000	163	80	0.416	77	137.9
Gitarama	108,000	0	180		77	
Byumba	83,000	140	75	0.33	77	222.2
Butare	96,000	99	310	0.97	77	87.9

Map 18. Locations of Urban Centres with Water Pollution Risk



3.2 Priority Watersheds

3.2.1 Identification of sub-watersheds most at risk from present and future developments

A quantitative comparison between sub watersheds was undertaken in two forms: (i) relative soil water availability and (ii) the relative land degradation risk. The reason for using these two criteria is that each encapsulates a number of contributing factors. They are thus "**multi-factor criterion**". In this way they characterise or summarise a range of single factors of relevance to the analysis. These two criteria are each distinct and separate. They are not combined. They are

separate because they represent two very distinct "development pressures": (i) soil water deficits for plant growth, and (ii) degradation of natural resources. In addition, as the analysis reveals, they also have two very distinct spatial patterns.

Relative soil water availability

"Relative soil water availability" refers to soil water that is available for plant growth: crops and natural vegetation (including grazing). This is conditioned by two factors: the balance between rainfall and potential evapo-transpiration (PET). When PET exceeds rainfall there is a soil water deficit which negatively affects plant growth. This deficit is made worse if the soil water holding capacity (whc) is also low. Thus shallow soils, soils with light textures and soils on steep slopes can hold less later than those which are deep, with heavier textures and on flatter slopes.

The sub-watershed ranked 1 had the highest amount of PET exceeding rainfall and that ranked 22 exhibited the highest amount of rainfall exceeding PET. Soil water holding capacity was determined from GIS based soil mapping and is the % area of the sub-watershed of soils of low water holding capacity (i.e. Ferralsols and Lithosols). Sub-watersheds were ranked where 1 has the highest % area of low water holding capacity soils. These two rankings were then combined resulting in a ranking of 1 for the watershed with the lowest soil water availability.

Sub-watersheds with relatively low soil water availability are subject to soil water deficits with reduced or lack of plant productivity and a high risk of crop failure. Low crop and pasture (and thus livestock) productivities have severe negative impacts on food security and peoples' livelihoods. It is thus a very important component of "**Development pressures**". Sub-watersheds that have high soil water deficits are very sensitive to future development. In the soil water deficit sub-watersheds, seasonal burning and over-grazing of pastures leads in turn to a downward spiral of pasture and soil degradation. The rankings are shown in Table 10.

Table 10. Sub-watersheds ranked by low soil moisture availability

Sub-Watershed	Rainfall - PET	Soil:whc	soil water availabilit	soil water availability
rank 1 =	Lowest	Lowest	Composite	Ranking
CANKUZO	3	1=	4	1
MUYINGA	8	1=	9	2
KAGERA 2	5	6	11	3
NGARA	1	10	11	4
RUVUBU 3	9	4=	13	5
KAGERA 1	6	9	15	6=
KIRUNDO	7	8	15	6=
KAGERA 3	2	14	16	8=
RUVUBU 2	15	1=	16	8=
NTUNGAMO	10	12	22	10
RUVUBU 1	16	7	23	11
GITEGA	20	4=	24	12=
MWISA 1	4	20=	24	12=
NYABUGOGO	13	13	26	14
AKANYARU	17	11	28	15
KAGERA 4	14	15	29	16
MWISA 2	11	19	30	17
KARAGWE	12	20=	32	18
KAGITUMBA	18	17	35	19
MWOGO	21	16	37	20=
NYABARONGO	19	18	37	20=
MUKUNGWA	22	20=	42	22

Land degradation risk

Land degradation risk was derived from a composite index of population density (the highest density being ranked 1) and soil erosion risk determined from SLEMSA modeling (the most at risk being ranked 1).

High population density itself does not necessarily result in land degradation. Currently there are two basic hypotheses regarding the relationship between population density and land degradation. The “neo-Malthusian” hypothesis predicts that agricultural production is unable to keep pace with population growth and increasing population density leading to falling agricultural production per capita, and increasing negative impacts on natural resources including land, water, forests and biodiversity.

More recently, a more optimistic perspective has developed following from the work by Ester Boserup (Boserup, 1965) and others. This perspective emphasizes the responses of households and communities to population pressures that include a reduction in fallow periods, intensified use of labour and land, development of labour-intensive technologies and institutional changes. However, recent evidence suggests that additional conditions appear to be needed to get a Boserupian scenario to operate. These have been identified in the Machakos (Kenya) study (Tiffen et al., 1994) as secure tenure, efficient markets, cash crops, supporting social organization and proven SWC measures.

The consultants’ analysis, together with stakeholder information and other studies clearly indicate that currently the Boserupian scenario does not operate within the Kagera sub-basin. High rural population pressures are likely to result in unsustainable natural resource use and to resource degradation because of constraints in land tenure, inefficient markets, emphasis on subsistence crops and non-availability of agricultural intensification inputs (e.g. fertiliser, improved seed and livestock fodder). The population density factor is thus used in the context of a neo-Malthusian situation and is thus a multi-factor criterion indicating areas with a high risk of natural resource degradation and is an important component of “development pressures”.

Soil erosion risk (hazard) measured using the SLEMSA model is also a multi-factor criterion in that it is the multiplication of three main factors and four sub-factors according to the following equation:

$$\mathbf{Z = C\ K\ X}$$

Z is the annual potential loss of topsoil in tons/ha/yr.

C is the landcover type and its ability to protect the bare soil from the erosive power of rainfall.

K is the soil loss factor which is a combination of the erosive power of rainfall (related to total rainfall amount) and the erosivity of the particular FAO soil type.

X is the topographic factor which is a combination of the slope angle and the slope length.

All these factors were combined within the GIS to calculate soil loss hazard across each sub-basin. Soil erosion risk is a multi-factor criterion.

The Population Density ranking was added to the Soil Erosion Risk ranking to obtain a composite (multi-factor) Land Degradation Risk ranking. This allowed the identification of Sub-watersheds that are sensitive to future developments and which are likely to have greater potential for natural resource restoration. The rankings are shown in Table 11.

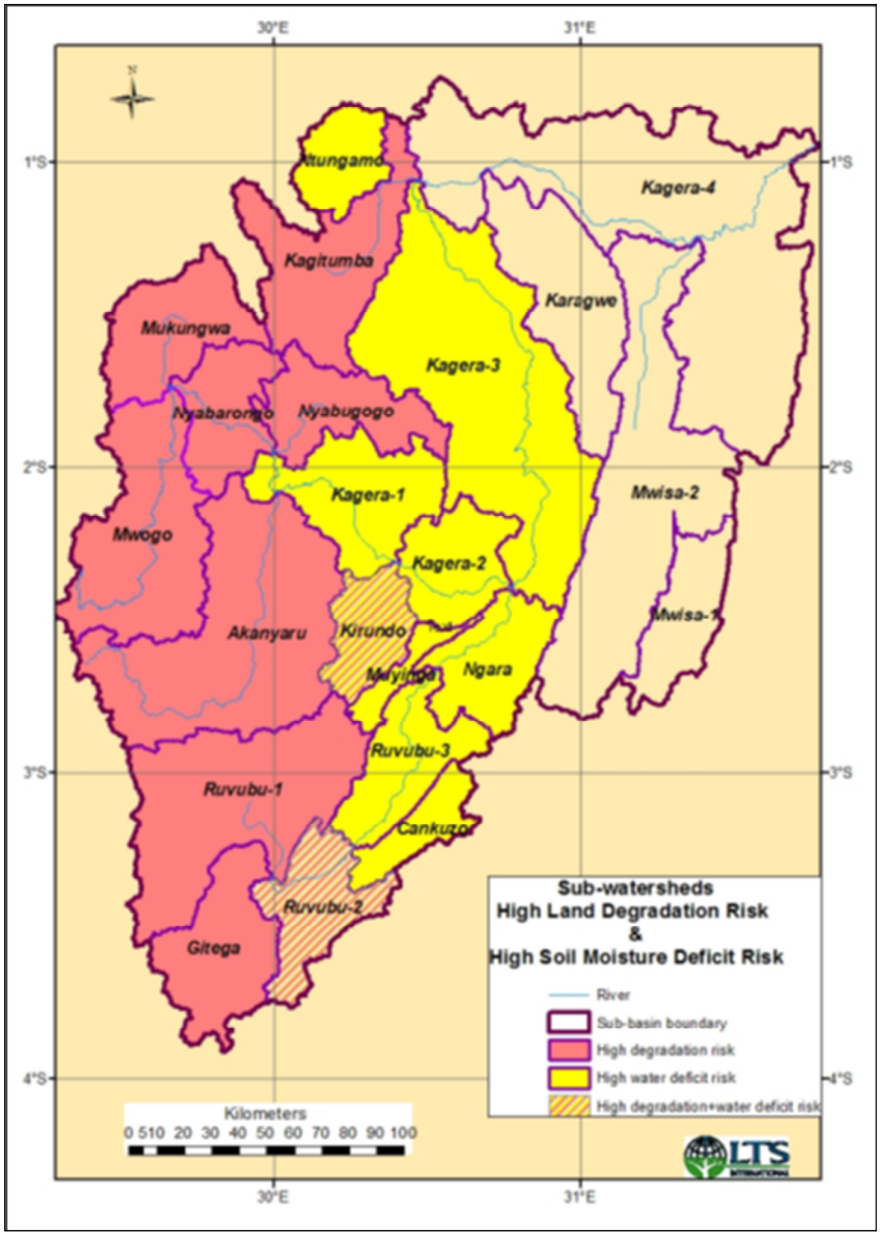
Table 11. Sub-watersheds ranked by high land degradation risk

Sub-Watershed	Population Densi	Soil Erosion	Land Degradati	Land Degradati
rank 1 =	Highest density = 1	Most at risk = 1	**Composite**	Ranking
NYABARONGO	2	1	3	1=
MUKUNGWA	1	2	3	1=
AKANYARU	4	4	8	3
NYABUGOGO	3	7	10	4
GITEGA	7	4	11	5
RUVUBU 1	6	6	12	6
MWOGO	10	3	13	7
KIRUNDO	5	12	17	8=
RUVUBU 2	8	9	17	8=
KAGITUMBA	9	10	19	10
RUVUBU 3	8	14	22	11
CANKUZO	15	8	23	12
MUYINGA	13	13	26	13=
KAGERA 2	12	14	26	13=
KAGERA 1	16	11	27	15
NTUNGAMO	14	14	28	16
KAGERA 4	17	16	33	17
MWISA 1	22	17	39	18
MWISA 2	18	21	39	18
KAGERA 3	21	19	40	20
NGARA	19	22	41	21
KARAGWE	22	20	42	**22**

Spatial patterns of low soil moisture and high land degradation risk

A composite map indicating the ten sub-watersheds ranked highest in terms of Soil Water Availability (yellow) and Land Degradation Risk (red) in shown in Map 19. Two Sub-watersheds were ranked highly in both Soil Moisture Availability and Land Degradation Risk. The map shows clearly that the Kagera sub-basin falls into three Zones: (i) a western Zone where sub-watersheds are ranked high in terms of Land Degradation Risk, (ii) a central Zone where sub-watersheds have low Soil Moisture Availability, and (iii) an eastern Zone where Land Degradation Risk is relatively low and Soil Moisture Availability is not a major problem.

Map 19. Sub-watersheds with highest risk to land degradation and to soil moisture deficits



3.2.2 Criteria and identification of 1st approximation potential sub-projects

From the sub-watershed analysis and the 1st round of stakeholder consultations two sets of criteria were identified to be used in the identification of the 1st approximation sub-projects as shown in Table 12.

Technical Criteria were identified in the sub-watershed characterisation, assessment of the extent of natural resource degradation and the identification of development pressures. These are largely quantitative criteria.

Stakeholder Criteria were revealed during field visits and stakeholder consultations. These are quantitative and qualitative criteria.

Table 12. Technical and stakeholder criteria

Technical Criteria
Projects should address land and vegetation degradation / soil moisture deficits • Unsustainable land use practices, and degradation: loss of soil fertility, soil erosion • Encroachment of river banks and lake shores leading to accelerated bank erosion • Seasonal migration of pastoralists, burning, overgrazing, pasture degradation • Destruction of biodiversity • Unsustainable use of biomass energy leading to deforestation • Seasonal soil moisture deficits: reduced crop and rangeland production **Projects should address hydrological change** • Changes in flow regimes (reduced base flows, increased flood peaks) • Increased river sediment loads • Increased pollution loads **Projects should address threats to wetlands** • Encroachment and degradation of wetlands due to over exploitation • Sedimentation of wetlands

Stakeholder Criteria
• Project is aligned to national development and poverty reduction policies and strategies • Existence of and complementarity with ongoing programmes/projects & existing local plans • Project addresses gaps not being addressed in current watershed or wetland management activities • Downstream and trans-boundary benefits accrue • Project addresses weak agricultural research and extension • Project addresses weak environmental law enforcement • Lack of knowledge of groundwater resources in areas of soil moisture deficits • Project addresses issues identified by stakeholders not identified above such as lack or/poor provision of human and livestock water supplies and/or livestock feed deficits

The criteria used to locate sub-projects were hotspot areas identified in sub-watershed characterisation. Sub-watersheds had been ranked according to (i) Land Degradation: Population pressure and Soil Erosion Risk, and (ii) Soil Moisture Deficits: Rainfall-PET and Soil moisture holding capacities. This analysis allowed locations to be identified at sub-watershed level.

This very clear spatial pattern of these two multi-factor criteria and the identification of the three broad areas of technical criteria allowed a first approximation of potential sub-projects and their general location. Potential sub-projects in the **Red Zone** would need to address immediate issues such as accelerated soil erosion, low soil fertility, unsustainable harvesting of biomass energy sources (deforestation), accelerated run-off, stream sedimentation and river bank erosion, changing stream flow-regimes and wetland degradation. But these sub-projects would also have to address the underlying factors that were preventing the achievement of the Boserupian Scenario such as land tenure reform, community participatory land-use planning and land-use zoning, improved value-chains and marketing, micro-credit provision and improved-technology transfers together with improved supply of agricultural intensifying inputs.

Potential sub-projects in the **Yellow Zone** need to address immediate issues such as soil water deficits through water harvesting techniques and small-scale irrigation. Underlying factors that emerged during the characterisation analysis was the weak knowledge base of groundwater resources, the lack of participatory land-use planning for sustainable rangeland management and bush fire control, the strategic location of livestock water supplies to reduce overgrazing patterns and improved value-chains and marketing of crop and livestock products.

In the eastern part of the sub-basin the characterisation revealed that existing water resources were not fully realised, evidenced by the low level of irrigation development. This indicated that there was the potential to utilise existing water resources more fully.

These findings were aligned with information received during the 1st Stakeholder Consultation on stakeholder-identified issues, priorities, potential locations and potential project components. These 1st approximation projects were then assessed to assure that they would accrue down-stream and trans-boundary benefits. The potential sub-projects were then assessed in terms of their conformity to the IWRM principles. These are shown in Table 13.

Table 13. Principles of IWRM

The Principles of IWRM		
	Dublin Principles	**IWRM Principles**
I	Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.	• A holistic approach • Resource yield has natural limits • Effects of human activities • Upstream-downstream user relations • An institutional approach
II	Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels.	• Real participation • Participation is more than consultation • Achieving consensus • Creating participatory mechanisms and capacity • The lowest appropriate level (subsidiarity)
III	Women play a central part in the provision, management and safeguarding of water.	• Involvement of women in decision-making • Women as water users • IWRM requires gender awareness
IV	Water has an economic value in all its competing uses and should be recognized as an economic good.	• Water has a value as an economic good • Value and charges are two different things • Useful water value concepts • Useful water cost concepts • The goal of full cost recovery • Managing demand through economic instruments • Financial self-sufficiency versus water as a social good

Source Global Water Partnership Technical Advisory Committee (TAC) Background Paper No 4 2000

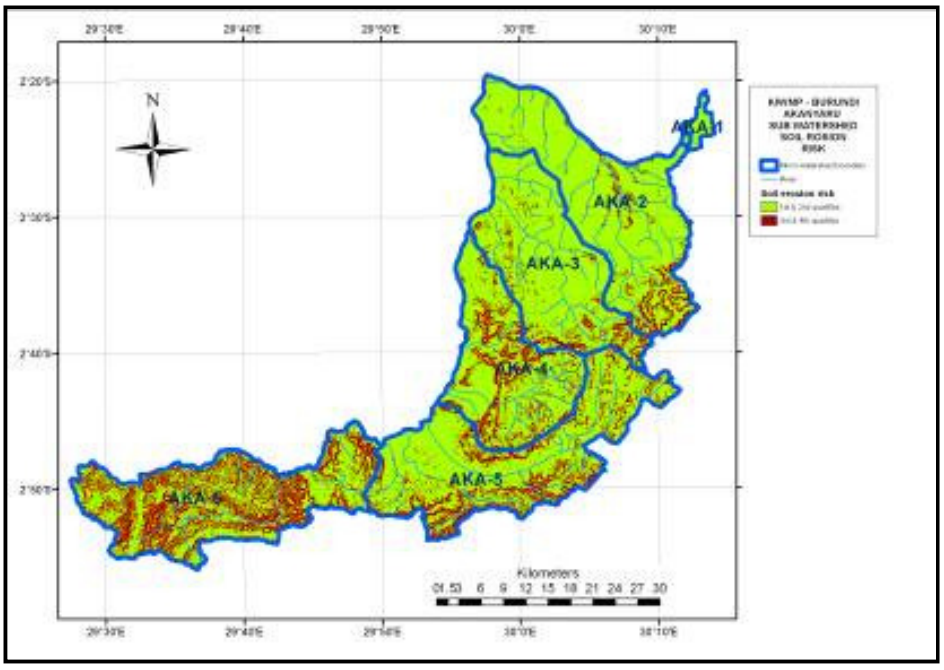
The second stage process essentially took into consideration the views, information and feedback from stakeholders as well as subjecting the projects to more intense spatial data analysis and re-checking with respect to the technical, IWRM, Transboundary and RAMSAR criteria. These considerations are summarised below.

3.2.3 Variation within sub-watersheds

Even with the delineation of 22 sub-watersheds there is considerable variation in the criteria within the sub-watersheds. For example the western half of Kagitumba sub watershed is dominated by high relief - between 1,600 and 2,300 masl, whilst its eastern half lies between 1200 and 1500 masl. Whilst this is a single drainage basin, it is effectively two different physiographic units with sharp environmental contrasts. At its mid-point the sub watershed is only around 30 kilometres from West to East and 50 kilometres from North to South. It is worth noting that Kagitumba represents the average size of the 22 sub watersheds.

In another example the Akanyaru sub watershed in Burundi displays two distinct patterns of soil erosion risk. Here the Sub watershed has been divided further into micro watersheds. Map 20 shows that micro watersheds AKA2 and AKA 3 appear to have smaller areas of high soil erosion risk than micro watersheds AKA4, AKA5 and AKA6.

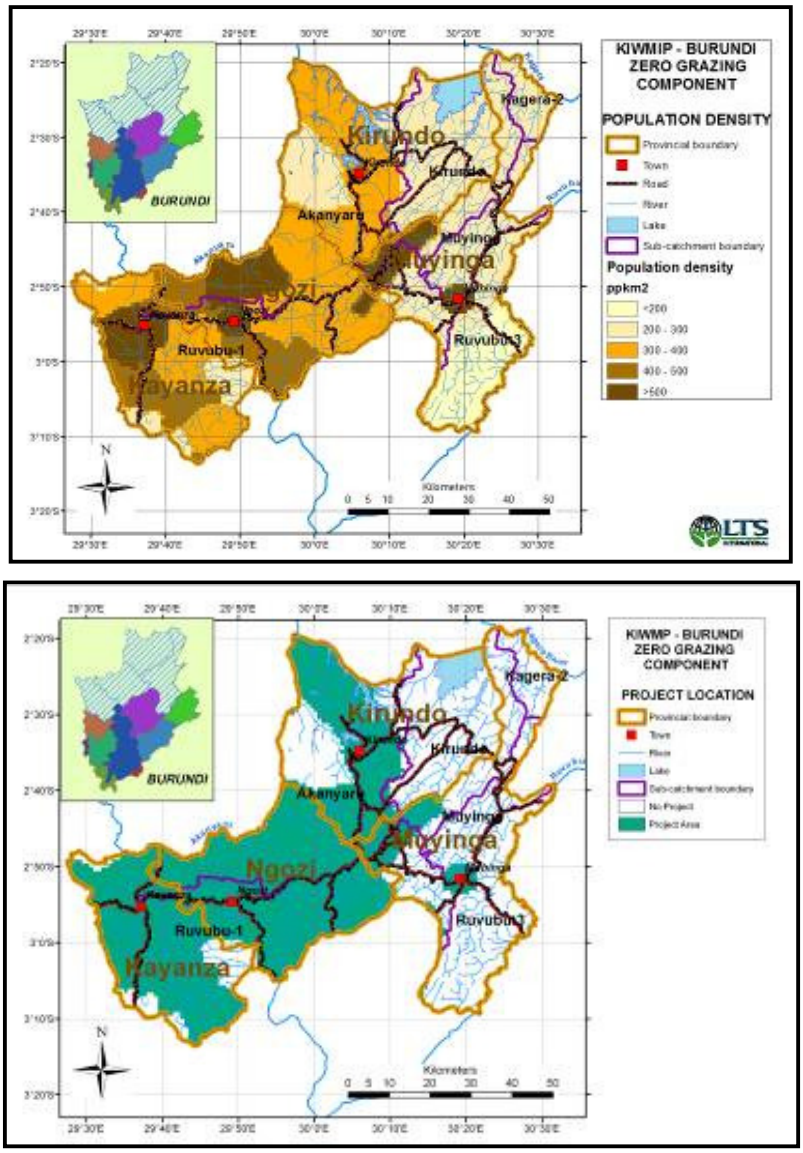
Map 20. Akanyaru sub-watershed in Burundi: soil erosion risk by micro watershed



3.2.4 Hydrological and political boundaries

In some cases spatial variation of socio-economic factors was evident only by administrative units, caused in main, by the fact that most socio-economic data is collected by administrative unit. A case in point was the zero grazing project in Burundi whose location was defined by administrative units with high human and therefore livestock populations as indicated in the two maps in Map 21.

Map 21. Zero Grazing Project: (a) Population density, and (b) Project locations



3.2.5 Identification of 2nd approximation potential sub-projects

The implication of these variations within sub-watershed spatial variation was the need for more detailed spatial analysis. The next stage of sub-project identification involved undertaking field visits and detailed stakeholder consultations in the field. These, together with more detailed GIS analysis[28] enabled the acquisition of data on the spatial variation within sub watersheds of bio-physical and social economic conditions of considerable relevance to the 2nd approximation of project identification and location. In this way the technical criteria identified in Stage 1 could now be applied in more detail. This in turn allowed a more defined project to be identified in terms of components and location.

The detailed country stakeholder consultations and the specific areas for project interventions that emerged revealed some distinct variations among the four countries that reflected between country variations in specific issues. There were nevertheless some clear generic similarities. As a result of this it was decided that the 2nd approximation watershed management and the

[28] Which included a more detailed sub-division of the Sub-watersheds into Micro watersheds as well as the examination of within Sub watershed variations in population (and by proxy livestock) densities.

wetlands management projects would comprise of 4 country programmes and two basin wide programmes.

The 1st Priority sub-projects comprise of 4 country programmes will be implemented through government structures in each of the four countries – engaging with communities and civil society. These country programmes are built upon the stakeholder proposals, but also propose additional interventions where these can augment and strengthen the country programme. The two basin wide programmes will be administered through NELSAP but each country will be responsible for implemented on their side.

3.3 Identification of Potential Intervention Strategies

The potential intervention strategies are a combination of the technical and stakeholder criteria noted above and further elaborated in Table 14.

Table 14. Management objectives and examples of potential activities and interventions

1. Land and vegetation degradation / soil moisture deficits
• Promote sustainable land use practices, and reduces degradation: loss of soil fertility, soil erosion
• Promote reduction in encroachment of river banks & lake shores leading to accelerated bank erosion
• Reduce impacts of seasonal migration of pastoralists, (i.e. burning, overgrazing, pasture degradation
• Promote sustainable use of biomass energy leading to deforestation
• Reduce destruction of biodiversity
• Reduce seasonal soil moisture deficits: increases crop and rangeland production
2. Hydrological change
• Reduce river sediment loads
3. Integrated watershed management
• Control of soil erosion
• Improve food security for the local population through the promotion of improved farming techniques
• Support in the acquisition of agricultural and animal husbandry inputs and product markets
• Practice of agroforestry in the watersheds, rainwater harvesting and fuel wood saving techniques
• Develop irrigated farming through the construction of an irrigation dams
• Develop rural infrastructures including the rehabilitation of rural roads, potable water supply systems, and electricity supply
4. Stabilise watercourses to reduce erosion and siltation
• Introduce appropriate farming techniques involving the stabilization of river and lake banks and the requirement for a buffer zone
• Produce, disseminate and plant stabilising plants along the banks of major rivers and lakes
• Monitor progress in stabilising the banks of rivers and lakes
5. Promotion of aquaculture
• Promotion and support to establishment of fishery cooperatives
• Participatory establishment of sustainable fishery harvesting quotas and techniques
• Promotion of aquaculture and fish tanks
• Support to value chain addition, fish storage and marketing

4. WETLANDS ASSESSMENT

4.1 Priority Wetlands that Require Interventions

4.1.1 Strategic wetlands management framework

Past and current experience (e.g. Rugezi in Section 3.1, COBWEB in Section 3.2) has demonstrated that wetlands cannot be isolated from their watersheds, and that management interventions must apply to the whole catchment in which a wetland lies. Major cumulative impacts on wetlands have resulted from agricultural practices in the uplands and in the wetlands themselves. The two principal threats to wetlands in the Kagera sub-basin are siltation due to soil erosion and conversion to agricultural land; the soil erosion itself caused by deforestation of hillsides to produce cultivable/grazing land and poor farming practices. Whilst human activities, both direct and indirect, are the principal contributors to wetland degradation and loss, other factors include inadequate planning and management of resources, and lack of basin information and public – and institutional - awareness of wetland values. Wetlands are also degraded or lost because of policy deficiencies, planning deficiencies and institutional weaknesses.

All of countries of the Kagera sub-basin are making progress in environmental management and many of these issues are being addressed, albeit slowly in some cases and within the pressures imposed by population growth and land demand. Indeed, it can be argued that it is because of these pressures, and acknowledgement of the links between ecosystem services and economic development, that efforts should be increased and the wetland resources of the Kagera sub-basin should be carefully managed to enable their sustainable utilisation now and in the future. In light of this NBI is in the process of finalising the NBI Wetlands Management Strategy which should give guidance on how to address regional wetland issues[29].

Within the riparian countries there are many examples of best practice that can be transferred, and an excellent Nile Basin Wetlands Management Strategy 2011-2016 exists and is about to be implemented. This feasibility study presents an opportune moment to influence the processes to facilitate a coherent approach to wetland management and wetland policies across the Kagera sub-basin through harmonisation of existing efforts and identification of information gaps not yet covered by other studies for the better management of the basin.

Degradation of the ecosystems for short-term gain will compromise medium- and long-term sustainable development (REMA, 2006); hence, the link between economic development and poverty reduction and wetland ecosystem services. Based on the wetland sectoral analysis and technical assessments described in previous sections, stakeholder interviews and literature surveys (e.g. NRE, 2002; Ramsar, 2007; NBI, 2010) a 10-point wetland strategic management framework is proposed in Box 1. The goal of the framework is to maintain the character and ecosystem services of Kagera wetlands through conservation and wise use and, thereby, contribute to the Nile Basin Wetlands Management Strategy (NBI, 2010) and sustain the livelihoods of wetland and other communities.

4.1.2 Wetland project selection criteria

Taking account of the critical issues raised by stakeholders and others during the review of past, present and future projects, a set of project selection criteria were proposed and applied in the selection process:

The project activities contribute to the wetland strategic management framework presented in Section 4.1.1.

[29] nileis.nilebasin.org/system/files/NBSF%20Technical%20Annexes.pdf

The project recognises that much wetland degradation is caused by activities, not solely in the wetland, but also in the watershed. Activities apply to the whole catchment in which a wetland lies, or an explanation of why this approach is unnecessary is provided.

Box 1 Wetland Strategic Management Framework

1. Increase scientific understanding of wetlands and their management requirements
2. Maintain, or where appropriate restore, suitable hydrological regimes in wetlands
3. Address adverse processes and activities causing wetland degradation
4. Manage wetlands within an integrated watershed management framework
5. Manage wetland resource utilisation on a sustainable basis
6. Protect, and where appropriate enhance, wetland ecosystem services
7. Encourage strong partnerships between wetland management agencies
8. Promote community awareness and opportunities for involvement in management and sharing of benefits
9. Ensure recreational use of wetlands is consistent with protection of other services
10. Develop appropriate monitoring and evaluation programmes for wetlands

The sub-project complements or links with existing initiatives and programmes in the Kagera sub-basin (e.g. LVEMP, PAIGELAC, PAIR, TAMP) in order to develop synergies and generate mutual beneficial outcomes.

The sub-project outputs contribute to the information base that informs management decision and provide best practice guidelines for transfer to other wetlands.

The sub-project seek opportunities to integrate wetlands with the curriculum of course on water management, engineering and agriculture fund PhD and MSc places at universities in the region as part of the overall project activities in order to build regional research capacity.

The sub-project has a clear dissemination plan. This includes a designated budget for "clustering" activities (e.g. coordination of use of wetland sites, sharing of data and information, attendance at cluster project meetings and major conferences, preparation of common publicity material and web linkages, joint presentations to national policymakers and NELSAP, general coordination activities, etc) with other Kagera projects to increase and extend project impact.

The sub-project includes awareness-raising, capacity building and training initiatives - in environment generally and wetlands specifically - at all levels from national government to local community and schools.

The sub-project contributes to the harmonisation of national policies, laws and institutional mandates.

The sub-project has an appropriate strategy for dealing with ethical issues, such as the storage and use of stakeholders' personal information, and for ensuring that women and minority groups are represented and actively involved in project activities.

The sub-project aligns with NELSAP primary objectives of poverty reduction, reversal of environmental degradation and economic development. The project meets the additional project selection criteria proposed by NELTAC (NELSAP, 2006): defined goals and anticipated measurable results, demonstrable benefits at a regional level, ability to be upscaled, demonstrable sustainable use of water resources, commitment to significant public consultation and stakeholder involvement, and economic and financial viability and sustainability.

Key stakeholder interviews also revealed some dissatisfaction with the traditional project lifecycle and funding arrangements. There were two main issues. Firstly, that sustainable outcomes could not be realistically achieved in a typical 3-4 year project, and that 12-16 years would be more reasonable: in many cases, the solution is known and the challenge is not demonstrating it works to the people concerned, which often takes 3-4 years, but rather the horizontal and vertical extension of that solution to other areas (the upscaling referred to in the

previous paragraphs). Secondly, the funding structure with outputs from the start of the project is not efficient: A typical development project takes 6-9 months to set up and get going once funds are available and it is unreasonable to expect the first outputs after just a few months. Instead, development projects needs to have a year 0 (or half year 0 for small projects) which would involve spend but enable all the logistical arrangements to be made so that a committed team was in place to work effectively from the start of year 1. Therefore, it is proposed that a mix of short and long projects is considered, each with an appropriate start-up period.

4.2 Identification of Potential Interventions

The wetland project selection criteria propose that the project activities contribute to the wetland strategic management framework presented in Section 4.1.1. However, there must be some flexibility because not all management objectives will be appropriate for all wetlands: in some cases, deliberate decisions may be made to enhance some ecosystem services at the detriment of other i.e. trade-offs. Therefore, it is unreasonable to insist that all sub-projects contribute to all aspects of the framework. It is also important not to have too ambitious aspirations with complex sets of tasks. Thus, two different types of wetland sub-projects are proposed:

- Sub-projects involving integrated watershed and wetland management plans for stakeholder-nominated, preferably transboundary, sites. For these "plan" projects, efforts would be made to develop a bespoke risk or vulnerability assessment and a management plan for the site, involving all aspects of the wetland strategic management framework presented in Section 4.1.
- Sub-projects investigating specific wetland management objectives at demonstration sites. For these projects, priority issues would be investigated, each in least two sites in at least two countries, though preferably at one site in each riparian country. Through in depth coverage of key issues, these sub-projects will aim to develop knowledge about wetlands, raise awareness about wetlands at all levels, and develop and build regional research capacity into wetland issues.

There are a range of management agencies and stakeholders to make rational decisions regarding the use and development of wetlands and their watersheds with full regard for wetland ecosystem services, the risk or threats to these services and interventions that can eliminate the risk or threats or mitigate the impacts, as well as highlighting existing strategies and actions that are consistent with the principle of wise use. Examples of potential activities and interventions are listed in Table 15, though this list is generic and many activities will be specific to an individual wetland.

Ramsar (2007) purports that a certain degree of sequencing is required between planning and management activities at river basin level and between management and user activities at individual wetland level. Difficulties in implementation of wetland management plans often occur when higher-level water resources planning, management and water allocation issues have not been adequately addressed prior to the design and implementation of wetland management plans. This reiterates the need for a fully integrated approach.

Table 15. Management objectives and examples of potential activities and interventions

1. Increase scientific understanding of wetlands and their management requirements
• Funded research into hydrology (including surface water-groundwater interactions) of wetlands and most appropriate flow regimes based on hydro-ecological requirements of lakes and marshlands
• Funded research into economic valuation of wetland ecosystem services
• Inventories, monitoring and surveys of key flora and fauna and their habitat requirements and threats, hydro-ecological character of wetlands, impacts of wetland users e.g. fisherman, tourists, livestock, etc
2. Maintain, or where appropriate restore, suitable hydrological regimes in wetlands
• Implement appropriate environmental flows to address water quality and biodiversity protection
• Determine how much water can be sustainably extracted from surface and groundwater sources without impacting on the environment
• Introduce water abstraction and waste discharge licences or permits for both surface water and groundwater
• Investigate options for optimising flood/water storage through appropriate management practices
3. Address adverse processes and activities causing wetland degradation
• Conduct wetland risk assessment
• Maintain livestock populations within prescribed limits agreed between all relevant stakeholders
• Ensure development of catchment and adjacent lands is consistent with conservation of ecological character of wetland and aspirations for its future status
• Conduct environmental impact assessment prior to any developments in wetland catchment
• Implement soil and water conservation measures in watershed to reduce soil erosion e.g. terracing, reforestation, etc
• Ensure all waste and sewage discharges within catchments surrounding wetlands are appropriately licensed and that licences are complied with
• Improve quality of waste and sewage discharges entering wetlands
• Re-vegetate/reforest priority areas to prevent erosion; use indigenous species on public land
• Control priority invasive plants and animals
• Undertake predator control programmes to protect resident water birds and other significant species
4. Manage wetlands within an integrated watershed management framework
• Develop integrated management plan for wetland and its watershed together
• Implement appropriate soil and water conservation measures to reduce soil erosion in wetland catchment

- Implement appropriate measures to reduce nutrient and chemical pollution of watercourses
- Coordinate invasive plants and animal control with adjacent landowners and management agencies
- Incorporate wetland management objectives in local and regional management plans

5. Manage wetland resource utilisation on a sustainable basis

- Funded research into thresholds for sustainable use of wetland resources and enforcement of thresholds
- Manage agricultural development in accordance with sustainable land use management principles and minimise loss of ecosystem services
- Invest in and maintain drainage and irrigation infrastructure in agricultural wetlands to optimise production
- Where practicable, construct fences to prevent access by livestock to areas of significant environmental value; if fencing is not practicable, manage grazing regimes to minimise impact on the most sensitive environmental areas
- Instigate/review grazing licences and develop grazing management strategies for licensed areas in consultation with all relevant stakeholders
- Develop routine assessment process to assess ecological conditions of grazing areas to improve ability to manage livestock numbers if ecological requirements dictate
- Manage commercial and recreational fishing and hunting in line with principles of ecologically sustainable development
- Manage apiculture in accordance with standard licensed conditions
- Investigate feasibility of sustainable urban drainage systems (i.e. artificial wetlands) to improve quality of waste water from urban areas entering watercourses

6. Protect, and where appropriate enhance, wetland ecosystem services

- Determine and implement appropriate strategies for long-term restoration of indigenous plant communities and habitats
- Protect roosting, nesting and breeding sites of endangered and migratory bird species
- Manage and, where appropriate, enhance habitats of threatened flora and fauna species
- Manage flora and fauna, including threatened, migratory and indigenous species, to encourage existence
- Investigate the feasibility of reintroduction of indigenous species no longer present in wetlands
- Adopt ecological burning and manipulative fire regimes where it can be demonstrated to be of value to wetland's natural ecosystem services
- Use incentive schemes such as polluter pays and payment for ecosystem services to encourage conservation and sustainable management practices

7. Encourage strong partnerships between wetland management agencies

- Establish appropriate communication and links between all relevant stakeholders and management agencies to improve management of both wetland and watershed as a whole

- Involve local communities in all aspects of wetland management and ensure that wetland management strategies do not conflict with or otherwise impact upon cultural and similar uses of wetland

8. Promote community awareness and opportunities for involvement in management

- Promote local community participation in habitat protection and enhancement works
- Encourage involvement of local communities in all aspects of wetland management and sharing benefits
- Establish wetland visitor centres with information, interpretation and educational programmes to promote natural ecosystem services of wetlands
- Promote community-based ecotourism and traditional craft opportunities
- Identify opportunities and encourage local community involvement in ecological monitoring activities
- Consult with local communities to ensure that wetland management strategies do not conflict with or otherwise impact upon cultural and similar uses of wetland
- Promote greater understanding, awareness and protection of wetland in extension and voluntary programmes to landowners and local communities through provision of educational and promotional material

9. Ensure recreational use of wetlands is consistent with protection of other services

- Protect cultural and similar uses of wetland in consultation with local communities
- Maintain and develop appropriate visitor facilities and services consistent with protection of natural, cultural and similar values of wetland
- Develop and, when appropriate, implement visitor management strategies
- Encourage visitors to practise minimal impact techniques and to adhere to recreational codes of conduct
- Monitor use of wetland for fishing and hunting and enforce regulations to control illegal practices
- Restrict boat use in environmentally sensitive areas to non-motorised or electric-powered craft

10. Develop appropriate monitoring and evaluation programmes for wetlands

- Develop on-going consistent programme to monitor ecological character of wetlands, measured in a statistically sound way and recorded in appropriate databases; factors such as frequency of flooding, water level, salinity, nutrients, algae, macro-invertebrates, flora and fauna should be measured
- Monitor effectiveness of conservation, restoration, re-vegetation and habitat protection interventions
- Record fauna species usage of wetlands and provide data to relevant databases
- Liaise with local communities regarding impacts of management interventions on cultural and similar values of wetlands

5. PROGRAMME FORMULATION

5.1 Introduction

This section outlines the KIWMP. It provides details of a portfolio of first round sub-projects that address watershed management issues such as land degradation, low agricultural productivity, stream sedimentation, livestock feed deficits and decreasing supplies of biomass fuels. It also includes an outline of some potential second round sub-projects that address wider areas of concern such as tourism and mining in relation to water supplies.

5.1.1 Scope of KIWMP

The preparation of a KIWMP requires a holistic approach and interaction between national and basin level studies. The programme addresses catchment degradation issues and optimal and sustainable integrated use of natural resources of the sub-watersheds, with minimal damage to the environment and for the benefit of the inhabitants of the watershed and the communities linked to them.

The KIWMP will strengthen riparian cooperation and coordination through a programme of Country-level Integrated Watershed Management Investment Projects and providing support to both country and trans-boundary Capacity Building and Institutional Strengthening.

The KIWMP aligns with NELSAP primary objectives of poverty reduction, reversal of environmental degradation and economic development. The KIWMP meets the additional project selection criteria proposed by NELTAC (NELSAP, 2006): (i) defined goals and anticipated measurable results; (ii) demonstrable benefits at a regional level; (iii) ability to be up-scaled; (iv) demonstrable sustainable use of land and water resources; (v) commitment to significant public consultation and stakeholder involvement; and (vi) economic and financial viability and sustainability.

It also contributes to the East African Countries' Vision and Strategy Framework for Management and Development of the Lake Victoria Basin, namely "a prosperous population living in a healthy and sustainably managed environment providing equitable opportunities and benefits".

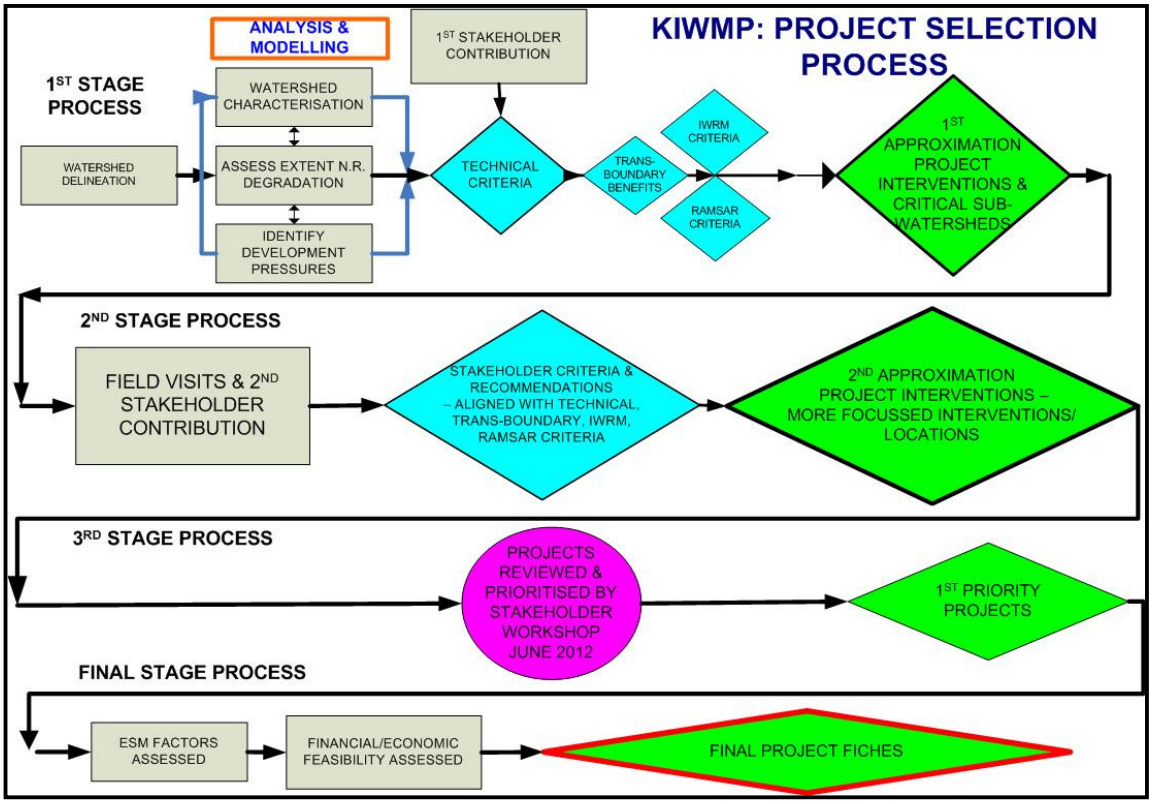
Finally, it is consistent with the national development strategies that are the Poverty Reduction Strategy Paper (PRSP) in Burundi, Economic Development Poverty Reduction Strategy (EDPRS) in Rwanda, the Poverty Reduction Strategy Paper (PRSP) in Tanzania, and the Poverty Eradication Action Plan (PEAP) in Uganda. These strategies emphasize healthy ecosystems, poverty reduction as well as economic growth and identify degradation of natural resources as a key constraint to attainment of results.

5.1.2 Projects selection process

Watershed delineation was undertaken using IWRM principles and based on topography and drainage. The consultants applied an ASTER digital terrain model with a 30 metre vertical resolution this resulted in defining 22 sub-watersheds. Preliminary analysis and modelling was then undertaken for each of the sub watersheds to enable their characterisation and this is presented in Annex F to this report.

The identification and formulation of projects followed three stages of approximation to arrive at a set of selected sub-projects – this is shown as a flow chart in Figure 3.

Figure 3. Project selection process



The process of identifying and selecting 1st and 2nd approximation sub-projects is detailed in Section 2.3 below as part of the watershed assessment explanation.

The 2nd approximation potential sub-projects formed the basis for discussion at a Stakeholder Project Selection Workshop. A full description of the Project Selection process was provided as a guidance document for the participants. At the Workshop the participants reviewed the projects and assigned them either to 1st or 2nd Priority categories. In addition, as a result of comments received at the Workshop a number of amendments to existing projects and a small number of new projects were identified.

The 1st. Priority sub-projects then went forward for screening via environmental and social management factors and financial and economic cost benefit analysis.

This three-stage approximation process therefore combines a range of specific qualitative and quantitative assessment techniques as well as being informed by; and open to; participatory inputs.

In order to provide a fully integrated approach of complementary activities the sub-projects were then formulated into packages to shape an overall KIWMP. This resulted in two main types of intervention – country programmes and transboundary wetland programmes. The bulk of projects were formulated into “country programmes” in line with the IWRM principle of adopting the most appropriate level of administration.

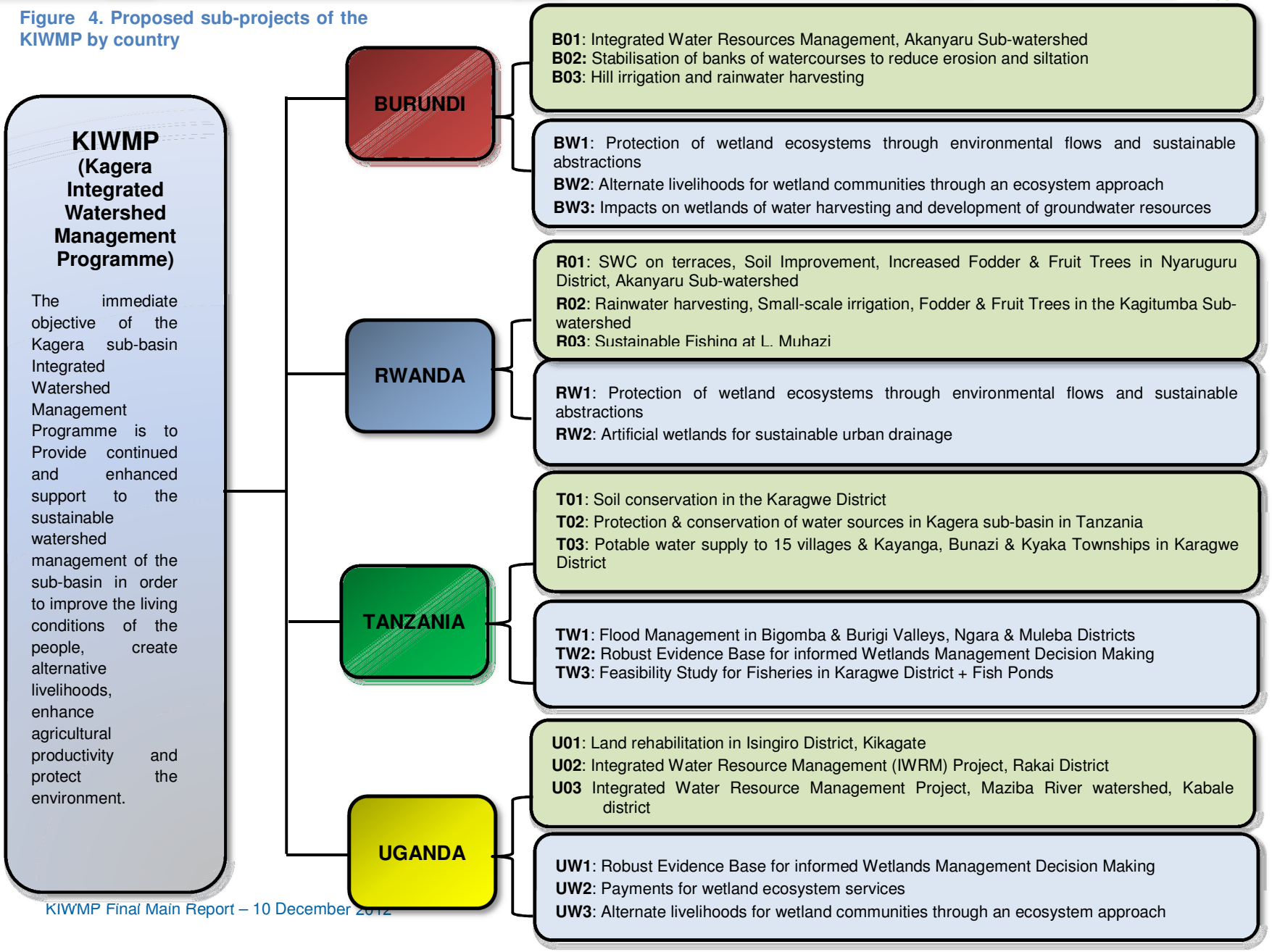
As will be shown, country level programmes could then contain properly integrated interventions that include optimised packages of watershed and wetland management components in order to realise the synergies between the types of interventions. Also at the transboundary level two specific sub-projects were formulated to address specific wetlands management issues. The process therefore aimed to achieve a workable balance between

those interventions which might be identified purely as a result of technical ranking, those which were of significant public interest and urgency and those which were recommended as a result of best practice and management principles. The validity of the resulting formulation does therefore not rest on any single set of technical criteria but on an integrated and participatory combination.

Appendix 2 of Annex A to this report contains a summary of priority 2 sub-projects for future consideration and Annex F contains raw and processed data including LANDSAT imagery, modelling outputs and GIS layers

As shown in figure 4 the KIWMP is comprised of both watershed and wetland sub-programmes, as wetlands are part of the watershed area.

Figure 4. Proposed sub-projects of the KIWMP by country



5.2 Watershed Management Action Plan and a Prioritized Portfolio of Sub-projects

5.2.1 Structure of the action plan

The KIWMP depicted in Figure 4 above and set out in Table 16 below which shows the different activities that will be undertaken under the four programme components, component budgets and responsibilities during the first 5 years per component. Responsibilities are elaborated further in Section 9.2. The detailed timing schedules of each component can be found in Annex A and the Annex A Fiches.

Table 16. Activities of the proposed KIWMP

COMPONENT	ACTIVITY	RESPONSIBILITY	WHERE	TOTAL BUDGET
Programme Management	Establish Regional and National Programme Steering Committees	NELSAP-CU	Basin wide	US$ 34,149,000
	Establish Programme Management Units in the identified the executing agency per country		Basin wide	
	Hire National Project Coordinators		Basin wide	
	Administer KIWSP		Basin wide	
	Prepare Project Implementation Plans (PIP's) from project identification Fiches (PIF's)		Basin wide	
	Seek funding sources for 1st Round Project using Project Implementation Plans (PIP's)		Basin wide	
	Monitor implementation		Basin wide	
	Prepare Project Implementation Plans (PIP's) from project identification Fiches (PIF's)		Basin wide	
	Seek funding sources for 1st Round Project using Project Implementation Plans (PIP's)		Basin wide	
	Integrated Watershed Management Project, Akanyaru		Burundi	
	Stabilization of water-courses and hillside afforestation (Ruvubu 1,2, Gitega)		Burundi	
	Hill Irrigation & Rainwater Harvesting Project (Cankuzo, Karuzi, Kirundo, Muyinga, Ruyigi)		Burundi	
	Protection of wetland ecosystems thru' environmental flows (Ruvubu National Park)		Burundi	

COMPONENT	ACTIVITY	RESPONSIBILITY	WHERE	TOTAL BUDGET
Country Integrated Watershed Management And Wetland Management Investment Projects	Alternative livelihoods for wetland communities thru ecosystem approach (Nyamuswaga wetlands)	PMUs in Executing agency per country and implementing agencies	Burundi	US$ 557,393,000
	Assessing impacts on wetlands of water harvesting & development of groundwater resources		Burundi	
	SWC on terraces, soil improvement, increased fodder & re-forestation (Akanyaru)		Rwanda	
	Soil conservation, rainwater harvesting, small-scale irrigation, Fruit & Fodder trees (Kagitumba)		Rwanda	
	Sustainable Fishing L. Muhazi		Rwanda	
	Protection of wetland ecosystems thru environmental flows		Rwanda	
	Artificial wetlands for sustainable urban drainage		Rwanda	
	Soil conservation in Karagwe and Ngara Districts		Tanzania	
	Supply of potable water supplies: 15 villages & 3 towns		Tanzania	
	Protection & conservation of water resources (Muleba and Biharamulo districts)		Tanzania	
	Flood management in the Bigomba & Burugi valleys		Tanzania	
	Robust evidence base to inform wetland management decision making		Tanzania	
	Feasibility study for fisheries Karagwe District & Fish Ponds in wetlands		Tanzania	
	Land rehabilitation in Isingiro District		Uganda	
	IWRM Project in Rakai District		Uganda	
	IWRM Project in Maziba Sub-watershed		Uganda	
	Robust evidence base to inform wetland management decision making		Uganda	

COMPONENT	ACTIVITY	RESPONSIBILITY	WHERE	TOTAL BUDGET
	Assessment for potential Payments for Environmental Services from polluting sources (Kagera 4).		Uganda	
	Soil conservation and rehabilitation, sustainable wetlands management and alternative livelihoods for wetlands communities through ecosystem approach (Ntungamo and Kagitumba).		Uganda	
Programme Of Trans-Boundary Wetlands Management Projects	Prepare Project Implementation Plan (PIP)	Executing agencies and implementing agencies	Classification of wetlands is basin wide. Management of RAMSAR sites is in Uganda and Tanzania	US$ 14,128,000
	Seek funding sources using PIP			
	Negotiate & sign contracts/sub-contracts			
	Coordinate and Monitor implementation			
	Prepare Project Implementation Plan (PIP)			
	Seek funding sources			
	Negotiate & sign contracts/sub-contracts			
	Coordinate and Monitor implementation			
Capacity Building & Institutional Strengthening	Commission and undertake policy orientated studies	NELSAP-CU	Basin wide	US$ 9,045,000
	Publish and disseminate results		Basin wide	
	Undertake workshops and training		Basin wide	
	Prepare work plan		Basin wide	
	Conduct technical on-the-job training		Basin wide	
	Conduct technical training workshops and seminars		Basin wide	
	Prepare work plan		Basin wide	
	Conduct technical meetings to address country-specific & technically specific issues		Basin wide	
	Conduct basin-level planning meetings to enhance cooperation & coordination		Basin wide	

COMPONENT	ACTIVITY	RESPONSIBILITY	WHERE	TOTAL BUDGET
	Conduct country-level planning meetings to support administration of country programme		Basin wide	
	Disseminate lessons learnt at Regional and international Meetings		Basin wide	
	Produce technical materials to promote/disseminate KIWMP knowledge and objectives		Basin wide	

5.2.2 Prioritized portfolio of watershed sub-projects

This section gives summaries of prioritised watershed sub-projects according to the process explained under section 5.1. The detailed project fiches can be found appended to Annex A.

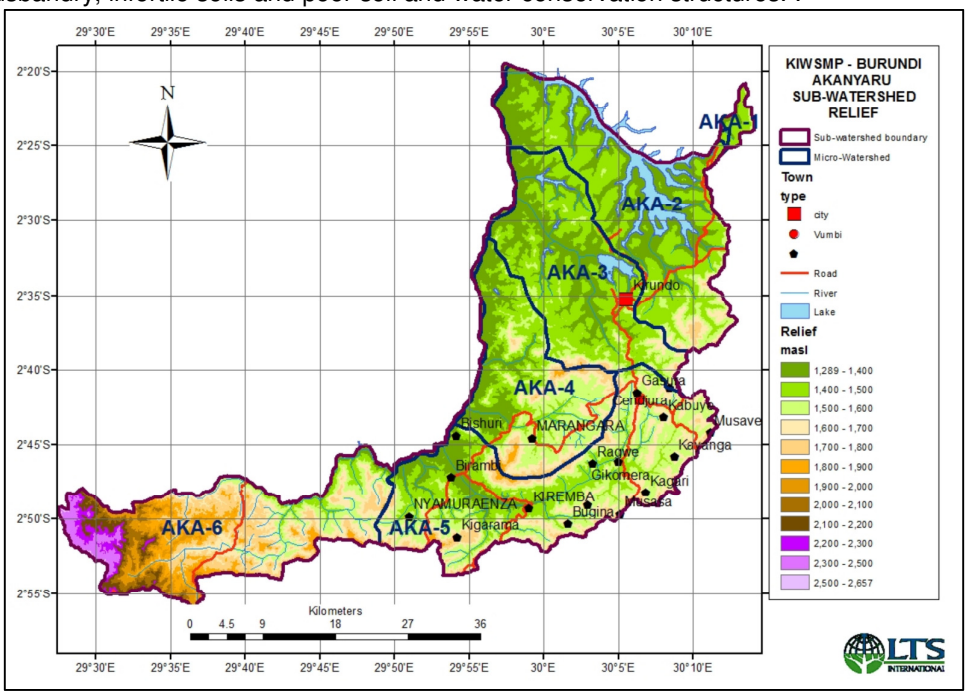
Country: **BURUNDI**

Project Name: Project B-01: Integrated Watershed Management, Akanyaru sub-watershed.

Total Project Cost: US$ 145.41 million (Foreign 11.6%)

Total Duration: Five years in Phase 1

Project Area The Akanyaru Sub-watershed in Burundi covers some 195,865ha and has been divided into 6 small watersheds. A key problem is the frequent flooding caused by rapid run-off from steep slopes. An integrated watershed management approach to this problem is proposed, which tackles the underlying problems of poor land and animal husbandry, infertile soils and poor soil and water conservation structures. .



Project area: Areas with high soil erosion risk

Project activities

On essential element of project implementation will be the involvement of local communities in the detailed planning and implementation. This will be undertaken at the *Sous Colline* level focussing on micro watersheds within each *Sous Collin*. Elected watershed planning committees would be established in each Sous Colline to organise planning and implementation with the support of the agricultural extension service.

(i) Soil and Water Conservation and Rehabilitation

- Soil and water conservation measures will include terraces, grass strips and where required radical terraces over an estimated 47,850ha. Participating households will benefit from increased crop yields and farm incomes. There will secondary positive impacts on reducing food insecurity.

- The primary approach in fertility enhancement on an estimated 75,700ha will involve short-rotation nitrogen fixing or phosphorus mobilizing shrubs and herbs, to develop a large biomass during a short

period (6-12 months). Organic matter and soil nutrients will be enhanced, while soil pH will also improve. The plant species to be used include *Tephrosia vogelii*, *Mucuna pruriensis*, *Sesbania sesban*, *Calliandra callothyrsus*, *Leucaena* species, and *Tithonia diversifolia*. The bigger shrubs (*Calliandra* and *Leucaena* species) will also be used to stabilize terrace risers. The germplasm of these plants will be procured from the Burundi Le Centrale des Graines. Herbaceous plants (e.g. *Mucuna pruriensis*) and small shrubs (e.g. *Sesbania sesban* and *Tephrosia vogelii) w*ill be planted as temporary cover, while bigger shrubs will be planted as hedges on terrace risers.

- The Project will provide logistical support to the Burundi Le Centrale des Graines to increase supply of tree and grass germ plasm.

(ii) Support integrated agro-forestry and animal husbandry

- The fodder trees or shrubs to be introduced are those which can tolerate drought and termites; grow fast and coppice; and produce quality fodder which can adequately supplement elephant grass. The sites selected would support *Calliandra callothyrsus* and various species of *Leucaena*, especially *Leucaena diversifolia* and *L. leucocephala*. All the plants to be introduced will be sourced from the Rwanda Agricultural Board. The niches for planting include boundaries, hedgerows between crops, buffer zones around lakes, marshlands and rivers, along public roads, or possibly as woodlots.

- Both the soil fertility improvement and the increased fodder production sub-components utilise tree species such as *Calliandra callothyrsus* and various species of *Leucaena*, especially *Leucaena diversifolia* and *L. leucocephala* that will also provide bio-fuels and contribute to the re-forestation on farmland sub-component.

- Assuming 30 percent of households (i.e. 73,000) will own one cow these households will benefit from increased milk supplies and sales and thus farm incomes.

- Support in the acquisition of agricultural and animal husbandry inputs and access to product markets;

- Build capacity in the practice of agroforestry in the watersheds, rainwater harvesting and fuel wood saving techniques;

- fuel wood saving techniques to reduce wood consumption using improved stoves for 30% of rural families (73,000 households);

(iii) River Bank Protection

There are approximately 400kms of tributary streams to the Akanyaru River. It is estimated that some 60 percent of these have bottomlands that have not been converted to agriculture and require river bank protection (240kms). Protection zones 30meter either side of the river will be exclusion zones and planted to trees and Napier grass. Some 1,440ha will be protected. Cut and carry of forage will be permitted by local communities according to locally established regulations.

(iv) Development of Irrigated Farming

- Develop irrigated farming on 5,000ha through the construction of small water harvesting or irrigation dams or dykes on the tributary rivers;

- Support the sustainable management of existing cultivated wetlands along the Akanyaru River through improved drainage and supplementary irrigation on 3,000ha.

- Provide technical support to determine optimum drainage and supplementary irrigation rates for a wide variety of crops.

(v) Development of Rural Infrastructure;

- Develop rural infrastructures including the rehabilitation of rural roads (300kms)
- Install 200 potable water supply systems,

- Connect 75 Sous Communes to electricity supply.

(vi) Trans-boundary Cooperation and Coordination

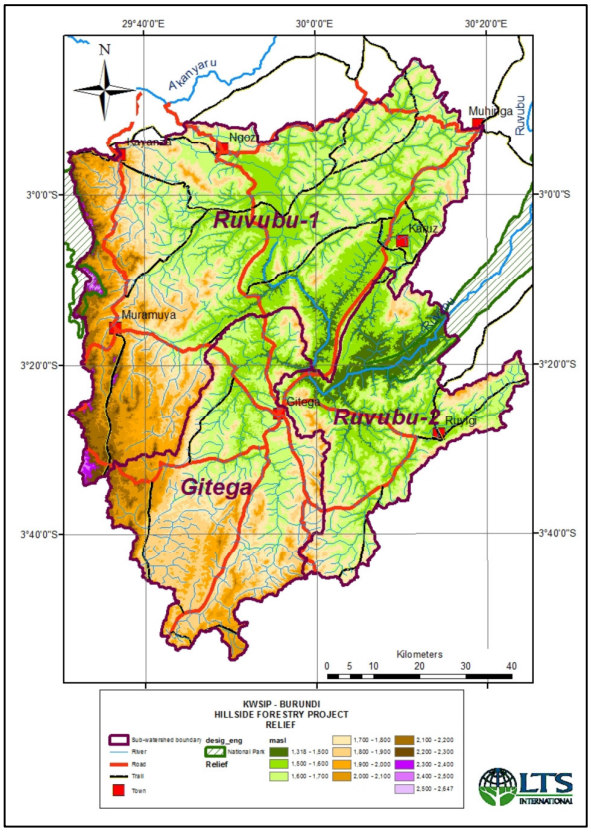
Resources are provided for collaboration with Rwanda in the implementation of the Integrated Management of Trans-boundary Water Resources of Lake Coyoha and Akanyaru Sub-watershed through regular implementation Workshops for sharing lessons learnt and experiences.

Country: **BURUNDI**

Project Name: Project B-02: Stabilisation of Banks of Watercourses and Hillside Afforestation to reduce erosion and siltation.

Total Project Cost: US$ 67.97 million (Foreign 1.1%)
Total Duration: Five years in Phase 1

Project Area: This Project concerns the Upper Ruvubu River which is densely populated and consists of several watersheds with a dense network of streams. The watersheds and wetlands are intensively farmed, without appropriate precautions to protect the environment. This has led to increased soil erosion, water pollution, and the siltation of the watercourses and lakes which are abundant in this part of the country. The project is intended to cover Gitega, Ruvubu 1 and Ruvubu 2 Sub-watersheds in Burundi. Hillsides will be planted to trees as part of runoff control and soil conservation measures and selected stream banks protected by 30 meter exclusion zones.



Burundi: River Bank Protection Project

Project activities

On essential element of project implementation will be the involvement of local communities in the detailed planning and implementation. This will be undertaken at the *Sous Colline* level focussing on micro watersheds within each *Sous Colline*. Elected watershed planning committees would be established in each Sous Colline to organise planning and implementation with the support of the agricultural extension service.

(i) Soil and Water Conservation and Rehabilitation

- The primary approach in fertility enhancement on an estimated 176,290ha will involve short-rotation nitrogen fixing or phosphorus mobilizing shrubs and herbs, to develop a large biomass during a short period (6-12 months). Organic matter and soil nutrients will be enhanced, while soil pH will also improve. The plant species to be used include *Tephrosia vogelii*, *Mucuna pruriensis*, *Sesbania sesban*, *Calliandra callothyrsus*, *Leucaena* species, and *Tithonia diversifolia*. The bigger shrubs (*Calliandra* and *Leucaena* species) will also be used to stabilize terrace risers. The germplasm of these plants will be procured from the Burundi Le Centrale des Graines. Herbaceous plants (e.g. *Mucuna pruriensis*) and small shrubs (e.g. *Sesbania sesban* and *Tephrosia vogelii) w*ill be planted as temporary cover, while bigger shrubs will be planted as hedges on terrace risers.

- The Project will provide logistical support to the Burundi Le Centrale des Graines to increase supply of tree and grass germ plasm.

(ii) Support integrated agro-forestry and animal husbandry

Some 176,290ha of agricultural land with slopes exceeding 15 percent will be treated.

- The fodder trees or shrubs to be introduced are those which can tolerate drought and termites; grow fast and coppice; and produce quality fodder which can adequately supplement elephant grass. The sites selected would support *Calliandra callothyrsus* and various species of *Leucaena*, especially *Leucaena diversifolia* and *L. leucocephala*. All the plants to be introduced will be sourced from the Rwanda Agricultural Board. The niches for planting include boundaries, hedgerows between crops, buffer zones around lakes, marshlands and rivers, along public roads, or possibly as woodlots.

- Both the soil fertility improvement and the increased fodder production sub-components utilise tree species such as *Calliandra callothyrsus* and various species of *Leucaena*, especially *Leucaena diversifolia* and *L. leucocephala* that will also provide bio-fuels and contribute to the re-forestation on farmland sub-component.

- Assuming 30 percent of households (i.e. 237,380) will own one cow these households will benefit from increased milk supplies and sales and thus farm incomes.

- Support in the acquisition of agricultural and animal husbandry inputs and access to product markets;

- Build capacity in the practice of agroforestry in the watersheds, rainwater harvesting and fuel wood saving techniques;

- fuel wood saving techniques to reduce wood consumption using improved stoves for 30% of rural families (72,000 households);

(iii) River Bank Protection

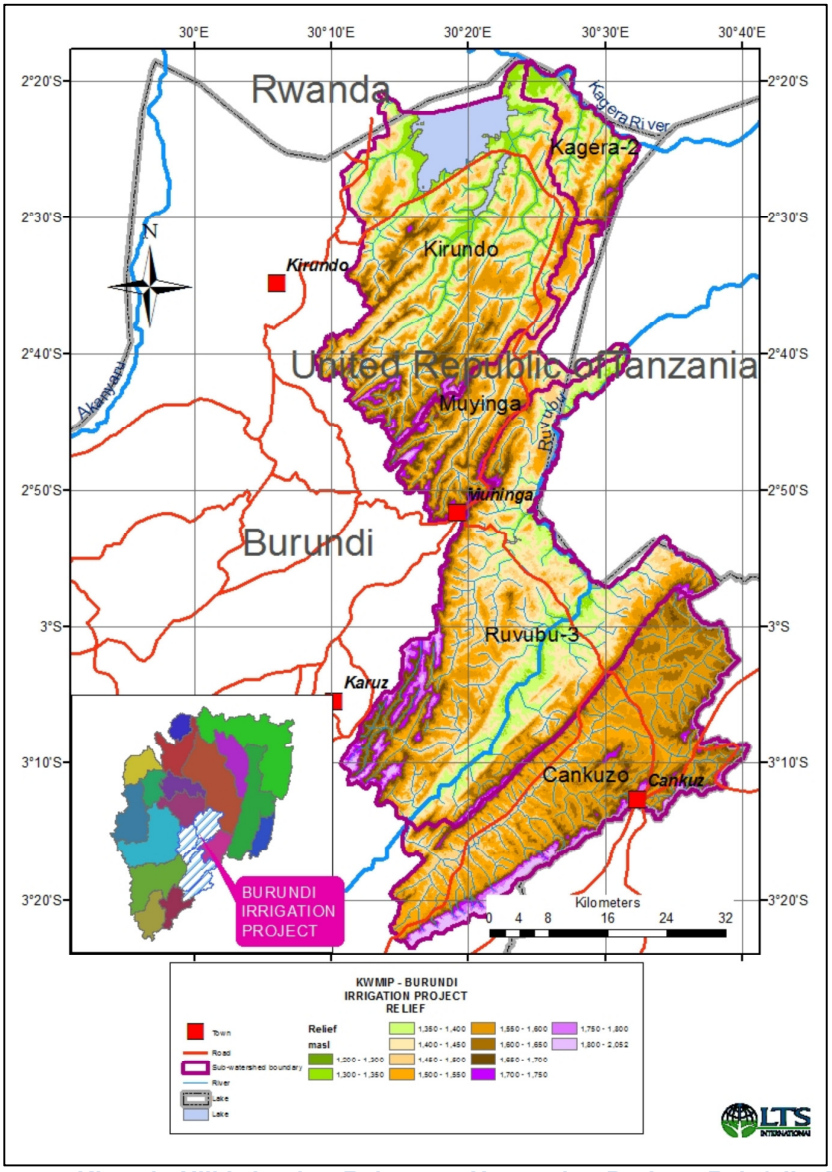
There are approximately 3,278 kms of river and stream bank). Not all streams and rivers will require protection zones. Where bottomlands have been converted to agriculture, side drains act as cut-off drains for sediment. It is estimated that only 50 percent of rivers (1,640kms) will require protection (9,800ha).

Country: **BURUNDI**

Project Name: Project B-03: Hill irrigation and rainwater harvesting in Cankuzo, Karuzi, Kirundo, Muyinga and Ruyigi Provinces

Total Project Cost: US$ 60.08 million (Foreign 10.3%)
Total Duration: Five years in Phase 1

Project Area: The project is located in the Cankuzo, Karuzi, Kirundo, Muyinga and Ruyigi Provinces of Burundi, in the Kirundo and Akanyaru Sub-watersheds



Kirundo Hill Irrigation-Rainwater Harvesting Project: Rainfall – PET

Project Activities:

On essential element of project implementation will be the involvement of local communities in the detailed planning and implementation. This will be undertaken at the *Sous Commune* level focussing on micro watersheds within each *Sous Commune*. Elected watershed planning committees would be established in each Sous Colline

to organise planning and implementation with the support of the agricultural extension service.

It is not possible at this stage to locate every dam/dyke or water harvesting structure. This can only be achieved through local level participatory planning and implementation utilising local knowledge and expertise. Estimates of numbers and areas are made within the parameters set in terms of existing bottomland utilisation and potential irrigable areas based on existing cultivation on slopes of less than 5 percent.

There are 10,000ha of bottomland currently under cultivation utilising simple raised beds without an integrated drainage system. The first stage in improving valley bottom wetland management is to install integrated drainage systems which allow for water table control. The next stage in improvement involves the installation of simple dykes across the valley bottom together with irrigation canals around the perimeter to permit supplementary irrigation into the dry season.

A further extension of the valley bottom irrigation is through the use of small motor pumps to left the irrigation water from small hand dug wells onto the valley foot slopes (of less than 5 percent) thus extending the area of irrigation out of the valley floor. There are a potential 22, 250ha of cultivated land suitable for this type of development. A similar system of small motor pumps can be used around the shores and foot slopes of Lake Rweru.

Major components of the envisaged project include:

(i) Sustainable Management of Wetlands with integrated drainage small-scale irrigation

- Sustainable development of valley bottom wetlands through the construction of integrated drainage systems covering some 2,000ha.

- Sustainable management of wetlands through the construction of small dams along valley bottoms at suitable sites (200 dams)and micro-scale irrigation works (2,000ha) at approximately 10 hectares per scheme;

(ii) Hillside Irrigation utilising small motor pumps

- the introduction of irrigation schemes on foot-slopes of less than 5 percent slopes along drainage lines and surrounding lakes, using fixed or mobile pumps (500 pumps) irrigating 2,500ha;

(iii) Rainwater Harvesting and Micro-scale Irrigation

- support to farmers for establishing rainwater harvesting infrastructure (mini-dams) along minor drainage lines (1,000 mini-dams) and micro-scale irrigation works for 2,000ha) ;
- the control of soil erosion on micro watersheds around dams and irrigation sites (10,000ha);

(iv) Village level potable water supplies

- There 1,009 Sous Communes in the project area. Provision is made for 1,100 village potable water supplies to be installed.

(v) Construction of Farm to Market Roads

Market access to the key to successful crop marketing. Provision is made of 1,000km of Farm to Market tracks to be constructed in Sous Communes selected for water harvesting and irrigation developments..

(vi) Awareness Enhancing and Capacity Building

- capacity building in relation to improved farming and rainwater harvesting techniques (30 demonstration sites) with field days and training;

(vii) Value chain addition (improved storage), Improved Market information and Market Linkages

- It is vital that any substantial increase in production is matched with increased storage facilities, improved market information to avoid gluts and improved market linkages between farmers and traders. The project will provide support to Farmer Groups in these fields.

(viii) Provision of Micro Credit

- Micro credit support will be provided for the acquisition of pumps and improved agricultural inputs (fertiliser, agro-chemicals and seed).

Country: **RWANDA**

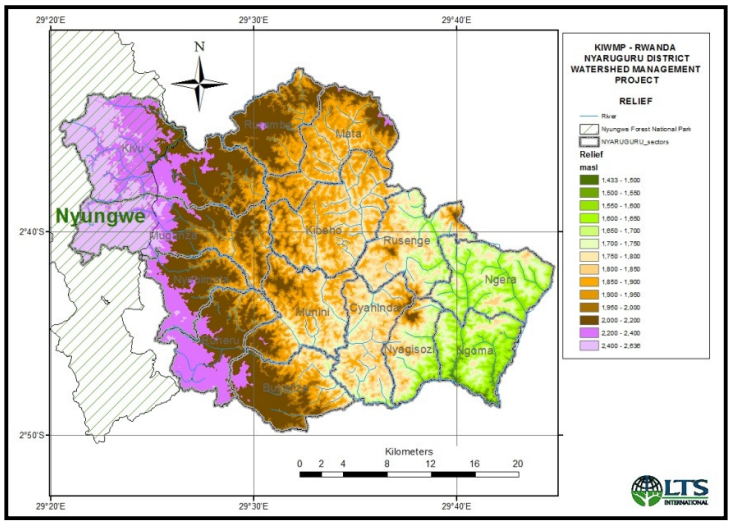
Project Name: Project R-01: Soil & Water Conservation, Soil Improvement, Improved Fodder Production and Re-forestation, Akanyaru Sub-watershed, Nyaruguru District.

Total Project Cost: US$ 50.71 million (Foreign 11%)

Total Duration: Five years in Phase 1:

Project Area: The project is intended to be introduced into selected areas of Nyaruguru District, Rwanda. Nyaruguru District represents the headwaters of the Kagera River within Rwanda. The sustainable management and utilization of the Kagera River must start at the very source. For this reason, a project on soil and water conservation, soil fertility enhancement and management, improved fodder production and re-forestation is proposed in Nyaruguru District, with the possibility to replicate it across the border into Burundi at a later stage.

The figure below provides supporting data on the relief and slope (%) distribution in Nyaruguru District and demonstrates the very widespread distribution of slopes greater than 30%.



Nyaruguru District: Relief

Project Activities

Ideally, development would commence in the upstream micro-watersheds and work downstream. The procedures to be followed are as follows:

(a) Sub-watershed selection based on pre-defined criteria that include community buy-in and degree of district ownership;

(b) Formation of a multi-disciplinary planning team, with participation of key stakeholders, such as female and male farmers' representatives, District officers and entrepreneurs, local experts and others;

(c) Community communication and sensitization on the options assessment (see below), based on developed communication strategy; (d) detailed socio-economic and technical survey and analysis;

(e) Drafting of a plan for site development; and community feedback and plan finalizations.

Options Assessment:

In determining the precise package of interventions per site, an options assessment will be conducted. The options assessment will lay out for project beneficiaries,

(i) the exact location of the hillside infrastructure;
(ii) the technologies that that can be developed (e.g. extent of land husbandry as compared to the extent of water harvesting and irrigation infrastructure) and used;
(iii) the selection process for agronomically suitable crops that can also be marketed on the project site.

The objective is to communicate to women and men project beneficiaries as much information as possible to provide meaningful buy in and to maximize their choice and participation in the development of the project on their land. The actual number of direct beneficiaries from this component depends on the final number and size of the sites selected for the operation, as well as the population density in those areas. Beneficiaries include female and male smallholder farmers producing either irrigated or rainfed crops within the project sites.

(i) Soil Conservation and Soil Fertility Enhancement

Soil and water conservation measures will include terraces, grass strips and where required radical terraces over an estimated 36,330ha. A total of 72,210ha would be treated with soil fertility enhancement interventions. It is estimated that some 24,700 households in will benefit from increased crop yields and farm incomes from both SWC and soil fertility interventions, and a further 24,600 households from soil fertility enhancement interventions only. There will secondary positive impacts on reducing food insecurity[30].

The primary approach in fertility enhancement will involve short-rotation nitrogen fixing or phosphorus mobilizing shrubs and herbs, to develop a large biomass during a short period (6-12 months). Organic matter and soil nutrients will be enhanced, while soil pH will also improve. The plant species to be used include *Tephrosia vogelii*, *Mucuna pruriensis*, *Sesbania sesban*, *Calliandra callothyrsus*, *Leucaena* species, and *Tithonia diversifolia*. The bigger shrubs (*Calliandra* and *Leucaena* species) will also be used to stabilize terrace risers. The germplasm of these plants will be procured from the Rwanda Agricultural Board. Herbaceous plants (e.g. *Mucuna pruriensis*) and small shrubs (e.g. *Sesbania sesban* and *Tephrosia vogelii) w*ill be planted as temporary cover, while bigger shrubs will be planted as hedges on terrace risers.

(ii) Improved Fodder Production and Increased Livestock Productivity

The fodder trees or shrubs to be introduced are those which can tolerate drought and termites; grow fast and coppice; and produce quality fodder which can adequately supplement elephant grass. The sites selected would support *Calliandra callothyrsus* and various species of *Leucaena*, especially *Leucaena diversifolia* and *L. leucocephala*. Napier Grass banks will provide a substantial increase in dry matter intake for livestock, with nitrogen supplemented by leguminous tree leaves to increase digestibility. All the plants to be introduced will be sourced from the Rwanda Agricultural Board. The niches for planting include boundaries, hedgerows between crops, buffer zones around lakes, marshlands and rivers, along public roads, or possibly as woodlots.

Both the soil fertility improvement and the increased fodder production sub-components utilise tree species such as *Calliandra callothyrsus* and various species of *Leucaena*, especially *Leucaena diversifolia* and *L. leucocephala* that will also provide bio-fuels and contribute to the re-forestation on farmland sub-component. The area will be supported by the one cow one family programme. Assuming 60 percent of households (30,000 households) will own one cow these households will benefit from increased milk supplies and sales and thus farm incomes.

[30] See Appendix 5 for estimation methods.

(iii) Water Harvesting Small Dams and Micro-Irrigation Schemes

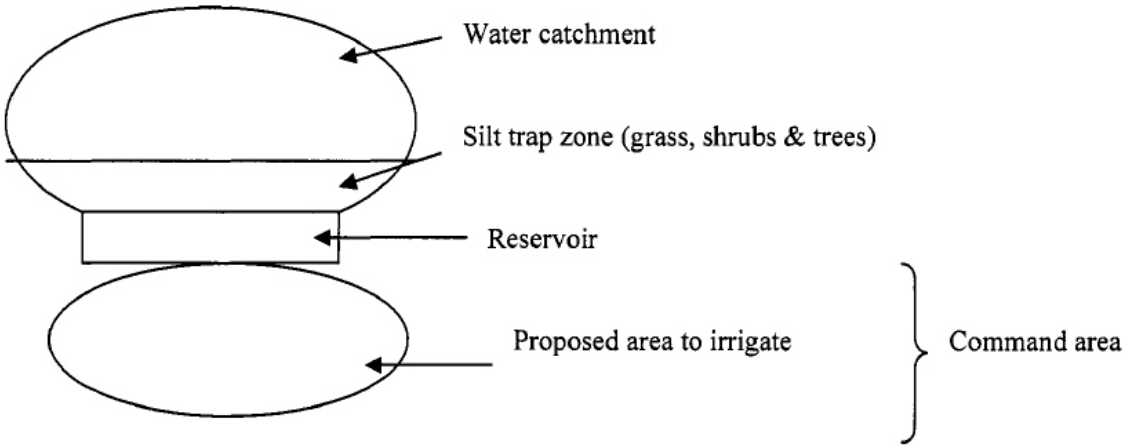
Rainwater harvesting would take place along small drainage lines. Rainwater harvesting dams will be constructed according to the guidelines and procedures indicated above. An estimated 50 small water harvesting dams would be constructed irrigating 1,250ha.

In addition small-motor pumps along perennial streams would be used for small-scale irrigation. It is estimated that there is potential for 50 schemes totalling 1,250ha. with one pump per 5 ha. (250 pumps).

(iv) Sediment retention Measures

The Figure below shows the agreed schema for small scale irrigation and water harvesting structures. An essential element is the silt trap zone to reduce sedimentation in the reservoir.

Figure. Scheme for small scale irrigation and water harvestings structures



(v) Reduced Fuelwood Consumption from Improved Stoves

The distribution of improved stoves will contribute to a significant reduction in fuelwood consumption. An estimated 15,000 households will adopt the improved stoves over the five year project life.

(vi) Construction of Farm to Market Roads

Market access to the key to successful crop marketing. Provision is made of 500km of Farm to Market tracks to be constructed in all Sectors.

(vii) Awareness Enhancing and Capacity Building

- capacity building in relation to improved farming techniques (14 Sectors) at demonstration sites with field days and training;

(viii) Value chain addition (improved storage), Improved Market information and Market Linkages

- It is vital that any substantial increase in production is matched with increased storage facilities, improved market information to avoid gluts and improved market linkages between farmers and traders. The project will provide support to Farmer Groups in these fields.

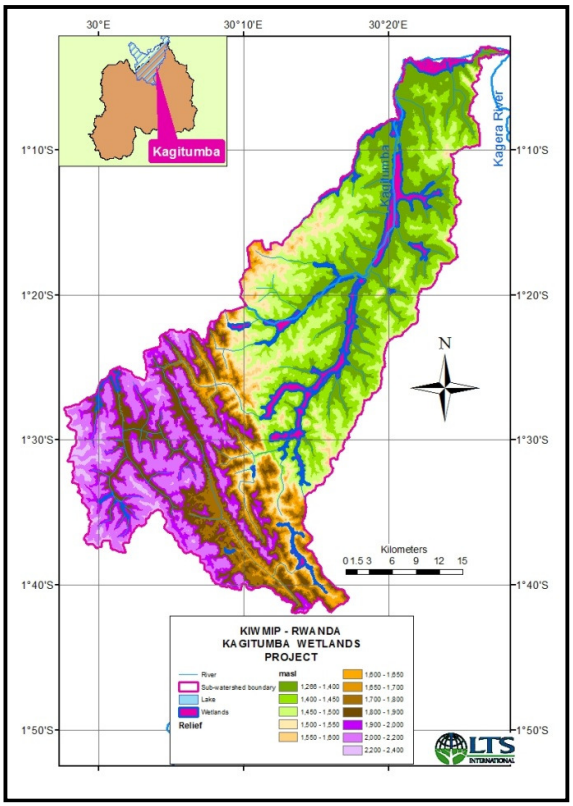
Country: **RWANDA**

Project Name: Project R-02: Rainwater water harvesting, small-scale irrigation, Fruit and Fodder trees, Kagitumba Sub-watershed, Rwanda.

Total Project Cost: US$ 63.04 million (Foreign 11.4%)

Total Duration: Five years in Phase 1:

Project Area: The project area is located in the lowlands below 1,500masl in the Kagitumba Sub-watershed as shown below.



Kagitumba Sub-watershed, Rwanda.

Project Activities

Actual site selection is guided by the common criteria being developed as part of the Common Framework for Engagement (CFE). Preliminary site selection for the Project used the CFE criteria which include (i) social criteria (responsiveness/Interest of beneficiaries; district leadership and ownership; level of social impact, including the number of beneficiaries on the site, the proportion of female-headed households therein, rainfall and livelihood factors such as flood risk and drought prevalence; and the number of displaced households relative to the site size); (ii) economic criteria (site-specific rate of return, year-round access to markets); and (iii) the technical and environmental criteria (sufficient 'water harvesting potential for command size; severity of soil erosion; a moisture regime where water harvesting and irrigation makes a difference, i.e. distribution of rainfall over the year, coincidence of excess rainfall and drought); and an environmental assessment. The procedures to be followed are:

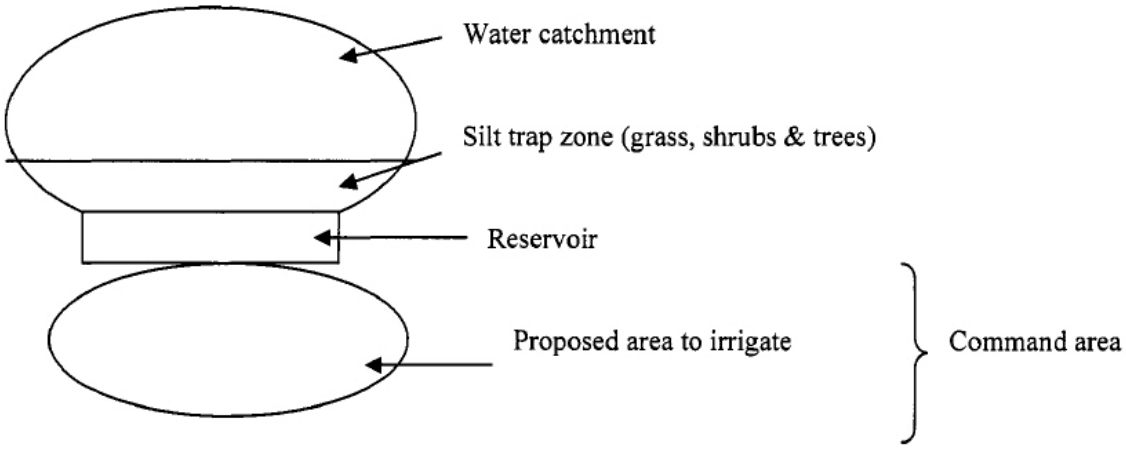
(a) Micro-watershed selection based on pre-defined criteria that include community buy-in and degree

of district ownership;
(b) Formation of a multi-disciplinary planning team, with participation of key stakeholders, such as female and male farmers' representatives, District officers and entrepreneurs, local experts and others;
(c) Community communication and sensitization on the options assessment (see above), based on developed communication strategy;
(d) Detailed socio-economic and technical survey and analysis;
(e) Drafting of a plan for site development; and community feedback and plan finalizations.

In determining the precise package of interventions per site, an options assessment will be conducted. The options assessment will lay out for project beneficiaries, (i) the exact location of the hillside infrastructure; (ii) the technologies that that can be developed (e.g. extent of land husbandry as compared to the extent of water harvesting and irrigation infrastructure) and used; and (iii) the selection process for agronomically suitable crops that can also be marketed on the project site. The objective is to communicate to women and men project beneficiaries as much information as possible to provide meaningful buy in and to maximize their choice and participation in the development of the project on their land. The actual number of direct beneficiaries from this component depends on the final number and size of the sites selected for the operation, as well as the population density in those areas. Beneficiaries include female and male smallholder farmers producing either irrigated or rainfed crops within the project sites.

The figure below shows the agreed schema for small scale irrigation and water harvesting structures. An essential element is the silt trap zone to reduce sedimentation in the reservoir.

Figure. Scheme for small scale irrigation and water harvestings structures



(i) Soil Conservation and Soil Fertility Enhancement

Soil and water conservation measures will include terraces, grass strips and where required radical terraces over an estimated 39,000ha. A total of 120,190ha would be treated with soil fertility enhancement interventions. With an average land holding of 0.95ha it is estimated that some 41,200 households in will benefit from increased crop yields and farm incomes from both SWC and soil fertility interventions, and a further 24,300 households from soil fertility enhancement interventions only. There will secondary positive impacts on reducing food insecurity[31].

The primary approach in fertility enhancement will involve short-rotation nitrogen fixing or phosphorus mobilizing shrubs and herbs, to develop a large biomass during a short period (6-12 months). Organic matter and soil nutrients will be enhanced, while soil pH will also improve from lime application. The plant species to be used include *Tephrosia vogelii*, *Mucuna pruriensis*, *Sesbania*

[31] See Appendix 5 for estimation methods.

sesban, *Calliandra callothyrsus*, *Leucaena* species, and *Tithonia diversifolia*. The bigger shrubs (*Calliandra* and *Leucaena* species) will also be used to stabilize terrace risers. The germplasm of these plants will be procured from the Rwanda Agricultural Board. Herbaceous plants (e.g. *Mucuna pruriensis*) and small shrubs (e.g. *Sesbania sesban* and *Tephrosia vogelii) w*ill be planted as temporary cover, while bigger shrubs will be planted as hedges on terrace risers.

(ii) Improved Fodder Production and Increased Livestock Productivity

The fodder trees or shrubs to be introduced are those which can tolerate drought and termites; grow fast and coppice; and produce quality fodder which can adequately supplement elephant grass. The sites selected would support *Calliandra callothyrsus* and various species of *Leucaena*, especially *Leucaena diversifolia* and *L. leucocephala*. Napier Grass banks will provide a substantial increase in dry matter intake for livestock, with nitrogen supplemented by leguminous tree leaves to increase digestibility. All the plants to be introduced will be sourced from the Rwanda Agricultural Board. The niches for planting include boundaries, hedgerows between crops, buffer zones around lakes, marshlands and rivers, along public roads, or possibly as woodlots.

Both the soil fertility improvement and the increased fodder production sub-components utilise tree species such as *Calliandra callothyrsus* and various species of *Leucaena*, especially *Leucaena diversifolia* and *L. leucocephala* that will also provide bio-fuels and contribute to the re-forestation on farmland sub-component. The area will be supported by the one cow one family programme. Assuming 60 percent of households (30,000 households) will own one cow these households will benefit from increased milk supplies and sales and thus farm incomes.

(iii) Water Harvesting Small Dams and Micro-Irrigation Schemes

Rainwater harvesting would take place in the Lowlands along small drainage lines. Rainwater harvesting dams will be constructed according to the guidelines and procedures indicated above. An estimated 50 small water harvesting dams would be constructed irrigating 1,250ha.

In addition small-motor pumps along perennial streams would be used for small-scale irrigation. It is estimated that there is potential for 50 schemes totalling 1,250ha. with one pump per 5 ha. (250 pumps).

(iv) Alternative Livelihoods

- Fruit trees for expanded livelihood strategies supporting 1,000 households. Fruit trees will include cash-crop fruit trees (especially oranges, mangos or avocados, depending on site suitability). These will provide an additional source of farm-income.
- facilitating the acquisition of any necessary equipment, and providing the required guidance through grants, extension services, etc.;
- implementing alternate livelihood trials including improved bee hives (1,000) and 500 fish ponds of $400m^2$;
- monitoring and evaluating the alternate livelihood schemes, including the quantification of the financial benefits of traditional and alternate livelihoods to both stakeholders and the environment;
- producing guidelines for full-scale alternate livelihood schemes;
- holding joint capacity building and management activities; and
- Assessing the wider ecosystem benefits of alternate livelihood schemes.

(v) Reduced Fuelwood Consumption from Improved Stoves

The distribution of improved stoves will contribute to a significant reduction in fuelwood consumption. An estimated 15,000 households will adopt the improved stoves over the five year project life.

- facilitating the acquisition of any necessary equipment, and providing the required guidance through grants, extension services, etc.;
- implementing alternate livelihood trials including improved bee hives (1,000) and 500 fish ponds of 400m^2 ;
- monitoring and evaluating the alternate livelihood schemes, including the quantification of the financial benefits of traditional and alternate livelihoods to both stakeholders and the environment;
- producing guidelines for full-scale alternate livelihood schemes;
- holding joint capacity building and management activities; and
- Assessing the wider ecosystem benefits of alternate livelihood schemes.

(vi) Construction of Farm to Market Roads

Market access to the key to successful crop marketing. Provision is made of 500km of Farm to Market tracks to be constructed in all Sectors.

(vii) Awareness Enhancing and Capacity Building

- capacity building in relation to improved farming techniques (37 Sectors) at demonstration sites with field days and training;

(viii) Value chain addition (improved storage), Improved Market information and Market Linkages

- It is vital that any substantial increase in production is matched with increased storage facilities, improved market information to avoid gluts and improved market linkages between farmers and traders. The project will provide support to Farmer Groups in these fields.

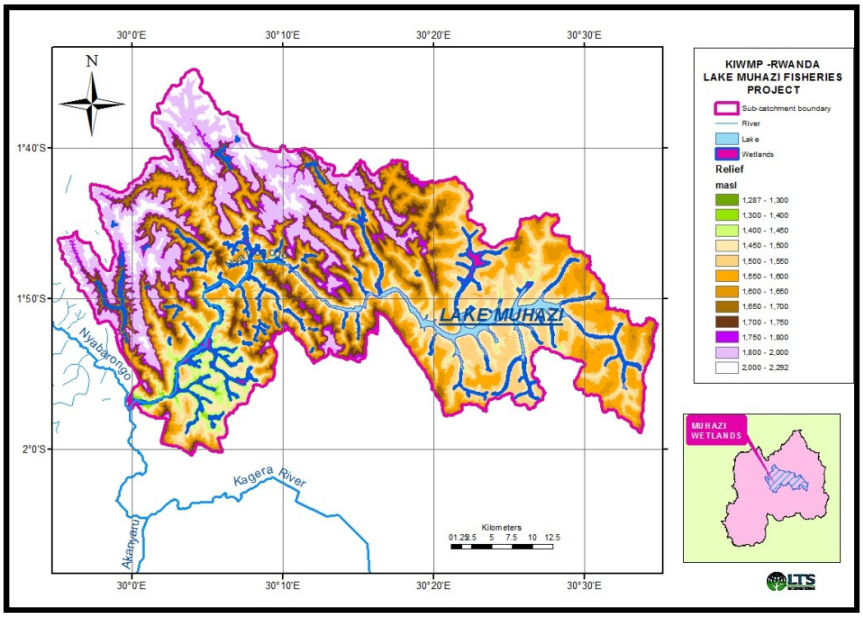
Country: **RWANDA**

Project Name: Sustainable fishing at Lake Muhazi.

Total Project Cost: US$ 0.576 million (Foreign 70%)

Total Duration: Five years in Phase 1:

Project Area: The project area is Lake Muhazi and its associated wetlands in the Nyabugogo Sub-watershed.



L. Muhazi relief

Project Activities

The main component is to develop with local fishery people a sustainable fishery management system that will enable fish stock stocks to increase. This will involve agreements on net sizes, fishing frequencies, closed seasons and numbers of fishing boats. This needs to be highly participatory process for it to succeed.

To meet the increasing demand for fish from Kigali it is prosed to develop a tank fishery with five tanks at the outlet of Lake Muhazi at the Rwesero site.

NB: This project was suggested by stakeholders during the project selection workshop. However studies have shown that the lake water has extremely high concentrations of lead and cadmium (> WHO standards). Thus the implementation of this project is **NOT** advised in Phase 1. However a soil restoration and management and pollution control project can be implemented in the area with further investigation into the high concentrations of lead being assessed and a thorough EIA being conducted before any fishery activities are conducted. This is to mitigate the negative impacts of biological magnification of heavy metals in fish and ultimately humans.

Country: **TANZANIA**

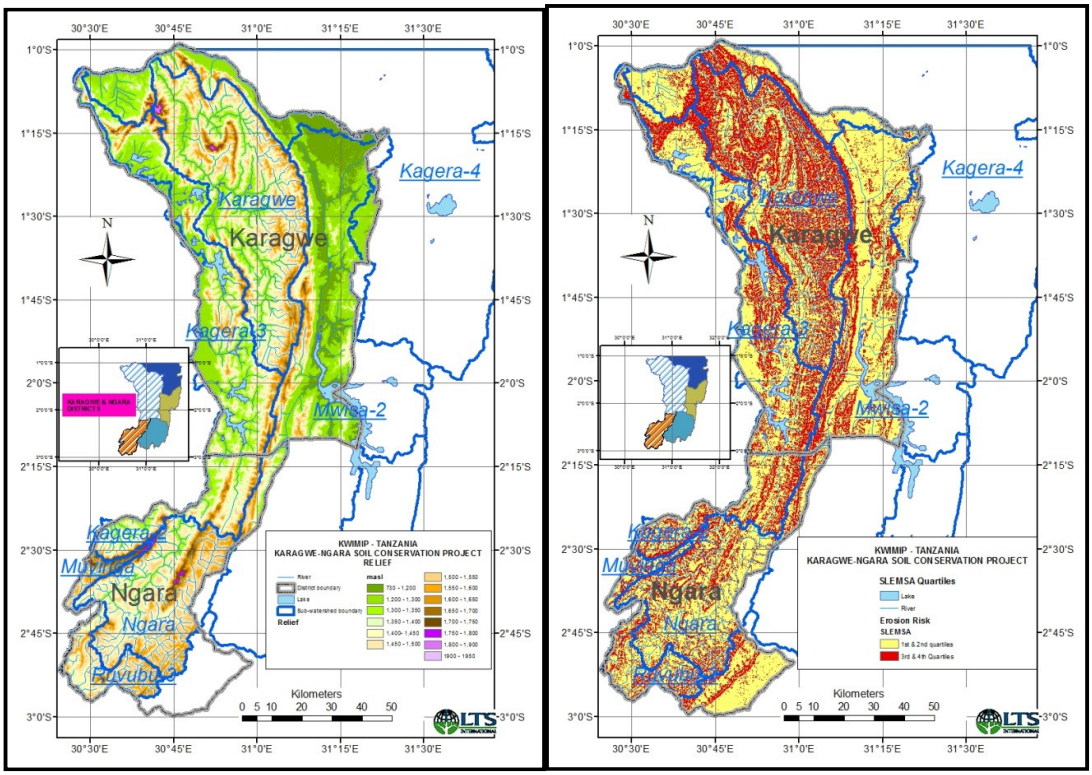
Project Name: Project T-01: Soil Conservation in Karagwe and Ngara Districts

Total Project Cost: US$ 33.45 million (Foreign 11%)
Total Duration: Five years in Phase 1:

Project Area: The project is intended to take place in the Karagwe and Ngara Districts.

There is cattle overstocking and savannah areas/grasslands are regularly burned with devastating effects on the resource base, giving rise to the loss of vegetation cover and biodiversity, soil degradation and erosion, and reduced ecosystem function. See figure below.

Karagwe District: Project Area (a) Relief (b) SLEMSA Quartiles



Project Activities
Activities proposed for the project include:

(i) Soil Conservation

- Raising awareness of the importance of restoring degraded landscapes, using video, theatre, newsletters and other media.
- The provision of technical training to show farmers which native species to choose for planting and restoration, integrating cropping with livestock through the use of crop residues and thus enhancing their own benefits.
- Close liaison with village governments and environmental committees, as well as with traditional institutions and the community assemblies that lay down customary law and supporting participatory land use planning.
- Soil and water conservation measures will include terraces, grass strips and where required

radical terraces over an estimated 52,230ha (Karagwe District) and 16,120ha (Ngara District)[32]. As well as improved farm incomes there will secondary positive impacts on reducing food insecurity.

- The primary approach in fertility enhancement will involve short-rotation nitrogen fixing or phosphorus mobilizing shrubs and herbs, to develop a large biomass during a short period (6-12 months). Organic matter and soil nutrients will be enhanced, while soil pH will also improve.
- The plant species to be used include *Tephrosia vogelii*, *Mucuna pruriensis*, *Sesbania sesban*, *Calliandra callothyrsus*, *Leucaena* species, and *Tithonia diversifolia*. The bigger shrubs (*Calliandra* and *Leucaena* species) will also be used to stabilize terrace risers. Herbaceous plants (e.g. *Mucuna pruriensis*) and small shrubs (e.g. *Sesbania sesban* and *Tephrosia vogelii) w*ill be planted as temporary cover, while bigger shrubs will be planted as hedges on terrace risers.
- The fodder trees or shrubs to be introduced are those which can tolerate drought and termites; grow fast and coppice; and produce quality fodder which can adequately supplement elephant grass. The sites selected would support *Calliandra callothyrsus* and various species of *Leucaena*, especially *Leucaena diversifolia* and *L. leucocephala*. The niches for planting include boundaries, hedgerows between crops, buffer zones around lakes, marshlands and rivers, along public roads, or possibly as woodlots. Estimated that 33percent of rural households 33,000 (Karagwe District and 26,000 (Ngara District).
- Both the soil fertility improvement and the increase.d fodder production sub-components utilise tree species such as *Calliandra callothyrsus* and various species of *Leucaena*, especially *Leucaena diversifolia* and *L. leucocephala* that will also provide bio-fuels and contribute to the re-forestation on farmland sub-component.

(ii) Restoration of abandoned Mining Areas

- the determination of the acreage of abandoned mining areas;
- community sensitization and awareness on environmental conservation and land rehabilitation (6 Parish demonstration sites);
- training in appropriate agricultural practices;
- community training on land rehabilitation;
- the establishment of tree nurseries (6 nurseries);
- land rehabilitation activities on degraded mining areas e.g. afforestation, terracing,

[32] See Annex A specific fiche for area calculations.

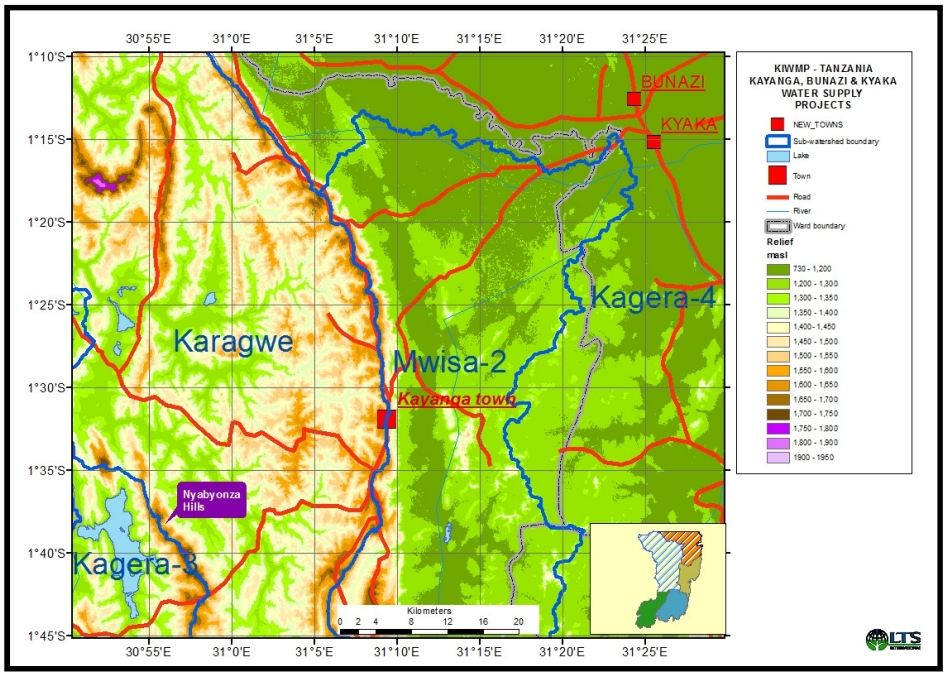
Country: **TANZANIA**

Project Name: Project T-02: Supply of potable water to 15 villages, Kayanga, Bunazi and Kyaka Townships in Karagwe and Bukoba Districts.

Total Project Cost: US$ 19.83 million (Foreign 35%)
Total Duration: Five years in Phase 1:

Project Area: The Karagwe and Bukoba Rural Districts are characterized by mountain ranges, which are separated by swampy valleys and wetlands. See figure below.

Location of Lake Mujunnju (Rwakajunju), Nyabyonza Hills and Kayanga, Bunazi and KyakaTownships



Project Activities

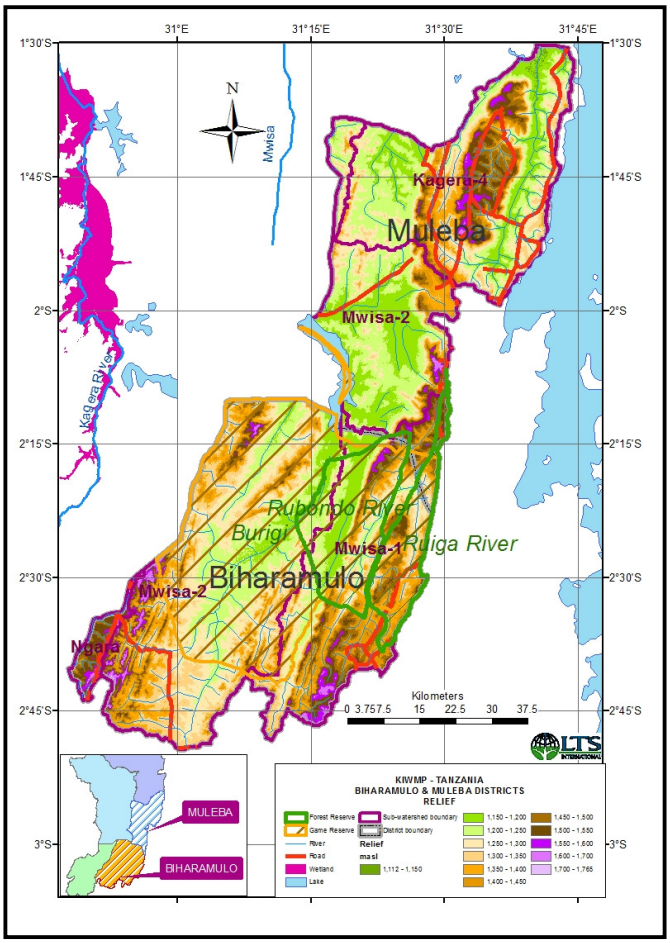
- The project shall include a Feasibility Study.
- Environmental Impact Assessment (EIA).
- A detailed design and procurement, contract award.
- Construction and construction management. The concept is to use Lake (Mujunju) .Rwakajunju as a source and pump water to the Nyabionza hills and then enable it to flow by gravity to15 villages and Kayanga Township in Karagwe District and onto Bunazi and Kyaka townships in Bukoba Rural District.

Country: **TANZANIA**

Project Name: T-03 Protection and Conservation of Water Sources in Muleba and Biharamulo Districts, Tanzania

Total Project Cost: US$ 23.56 million (Foreign 10.5%)
Total Duration: Five years in Phase 1:

Project Area: The project area comprises Muleba and Biharamulo Districts covering parts of Mwisa-1, Mwisa-2, Ngara and Kagera-4 Sub-watersheds (Figure).



Muleba and Birahamulo Districts: Relief

Project Activities

Activities proposed for the project include:

- Raising awareness of the importance of restoring degraded landscapes, using video, theatre, newsletters and other media.
- The provision of technical training to show farmers which native species to choose for planting and restoration, enhancing their own benefits.
- Close liaison with village governments and environmental committees, as well as with traditional institutions and the community assemblies that lay down customary law and