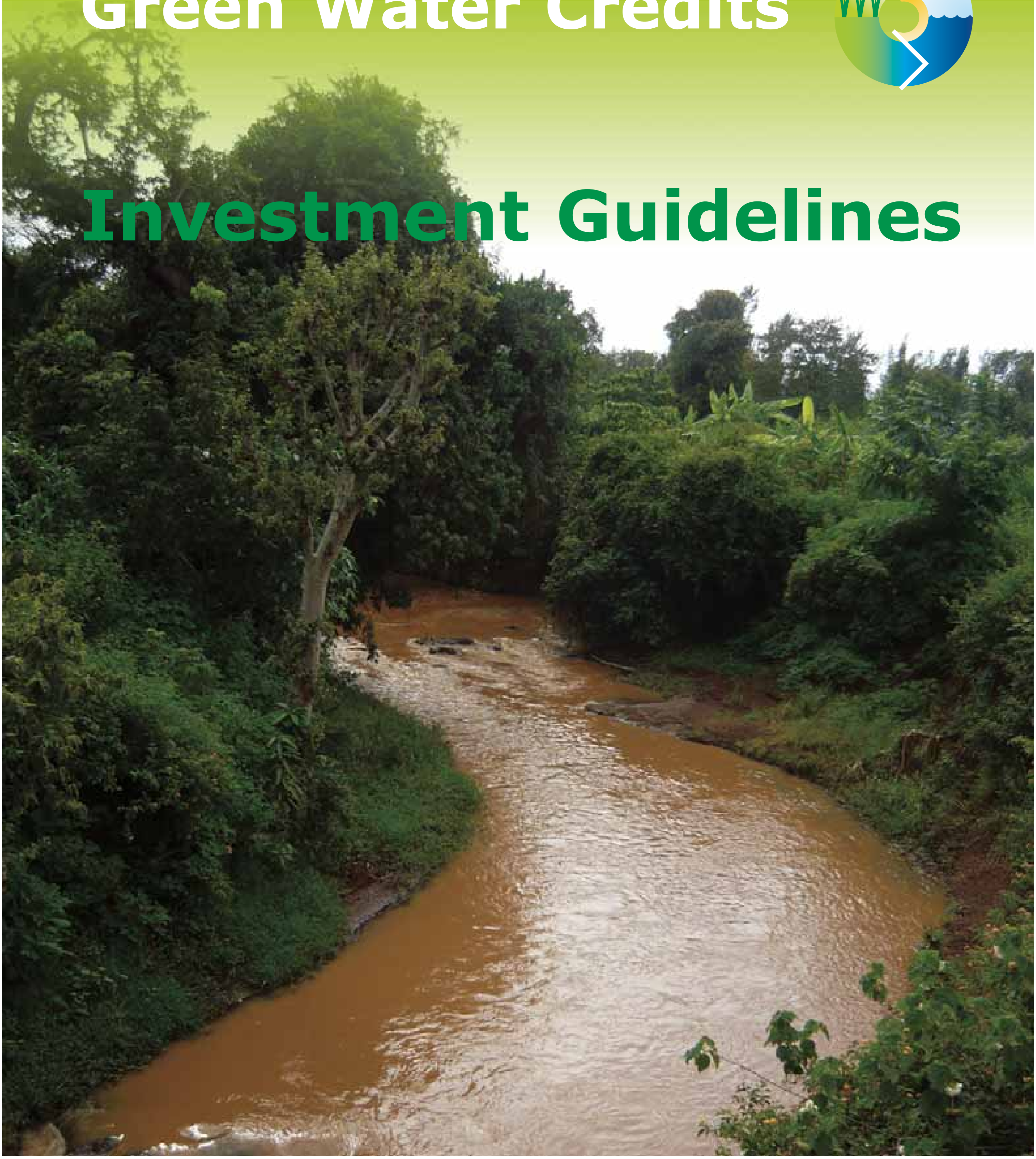
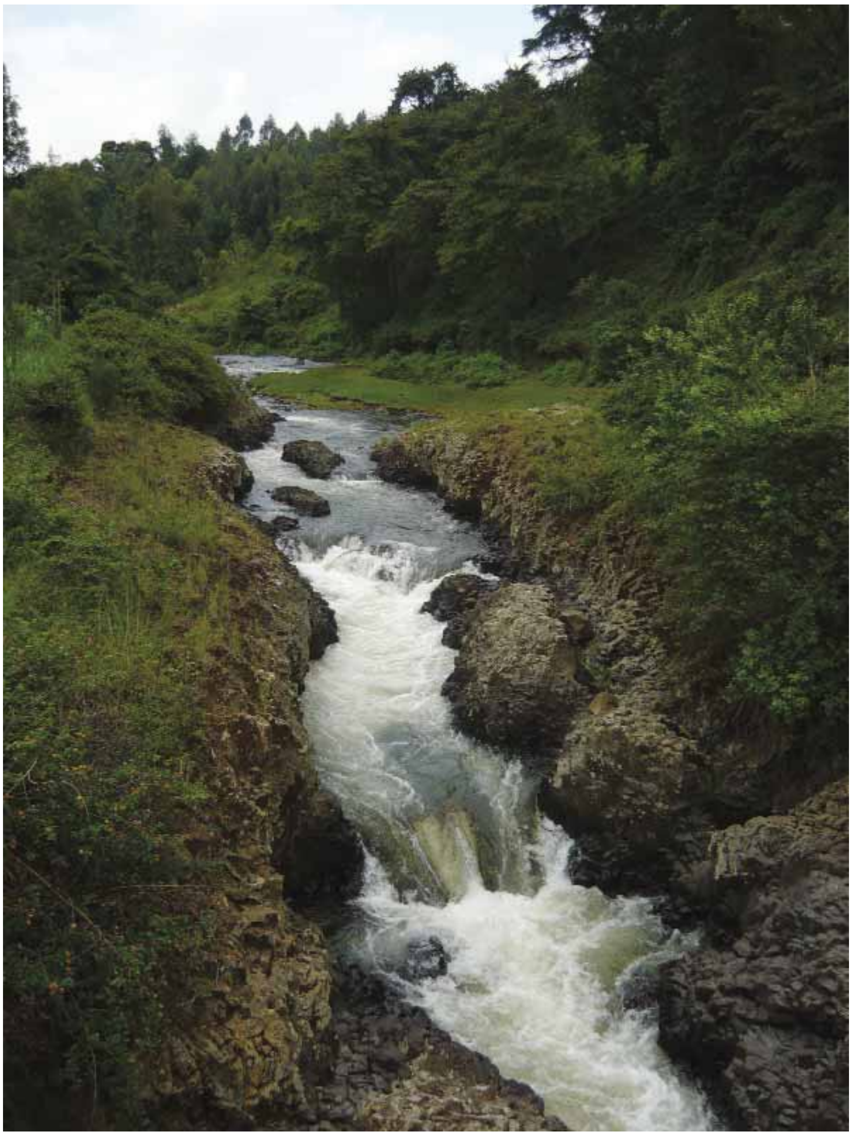
Green Water Credits

Investment Guidelines





The Tana River rises in the Kenya highlands and receives its water from two water towers, the Mount Kenya and the Aberdares Range.

Green Water Credits is an investment mechanism for upstream farmers to practice water management activities that generate benefits for downstream water users, which are currently unrecognized and unrewarded. Green Water Management induces carbon sequestration, and thus contributes to mitigate climate change effects. Joined operations of the stakeholders in the watershed safeguard water resources for all and generates a payment mechanism to sustain the common efforts. This initiative is driven by economic, environmental and social benefits.

1. Context

1.1 The problem

The Tana River rises in the Kenya highlands and receives its water from two main sources, Mount Kenya and the Aberdares Range. The rainfall strongly depends on elevation, with conditions ranging from humid at high altitude to semi-arid at lower elevations of the middle and lower Tana. A large part of the high elevation forests and woodlands has been converted into agricultural land.

Rain is the source of fresh water which is captured, stored and regulated by the soil. So every land use decision is, in effect, also a water use decision. Rainfed agriculture has increased dramatically over the last few decades in the Upper Tana catchment and now constitutes over 60% of the land use. These human land uses influence the hydrological regime and are the main cause for current water scarcity, but at the same time offer the best option for solutions.

Water scarcity is increasingly experienced by water users that rely on Tana basin water resources:

- Serious unsatisfied water demand is already being experienced in Nairobi in dry years, like in 2009, and will worsen as population is projected to double by 2030.
- Production on the irrigated land of 70,000 ha in the Tana basin is increasingly reduced by dwindling water supply. This jeopardizes the envisaged expansion of another 200,000 ha.
- Hydro-electrical power provides the nation with 50 to 80% of its electricity, of which 80% is generated by the 5 dams in the Tana River. The electricity generating capacity is endangered by floods, soil erosion and siltation that reduce reservoir capacity and damage turbines.
- Hydrological changes in the basin, e.g. permanent rivers that become seasonal and lowering of groundwater in boreholes, are eminent.

Flooding is a recurrent problem in the Tana basin. Climate change and erratic rainfall are blamed to cause the floods, while these are actually enhanced by excess runoff from farmers' fields.

1.2 Apparent competing interests do not conflict

Faced with a rapidly growing population of 2.75% per year, Kenya invests substantial amounts of money and resources to secure the ever growing demands for water for domestic consumption, industry and agriculture. These demands put conflicting pressures upon the management of water. What appears to be management of conflicts, dilemmas and bargaining power, can be resolved in a win/win construct through the Green Water Management approach.

1.3 Green Water Credits: The Kenya case

In 2007, the Tana River basin was selected to demonstrate the basic principles of improved Green Water Management, because the catchment faces severe challenges to meet increasing water demands. To get a catchment Green Water Management scheme up and running, proper financial arrangements need to be in place. The Green Water Credits (GWC) facility is designed to do that. In 2009, a Pilot Design for the Upper Tana was made that targets an area of about 400,000 ha involving interventions for an estimated 100,000 to 150,000 small holders. This design phase will evolve into an implementation phase lasting five to ten years, starting in 2012 (more information in section 4).

2. Green Water; its concept, potential and challenges

2.1 The Green Water Concept

Most of the rain falling on land is used by vegetation – *green water*. Worldwide, only one tenth of fresh water becomes accessible as stream flow and groundwater – *blue water*; the remainder is lost as storm peak flow.

Though regions may seem to be dry, absolute water shortage is in most cases not an issue. The issue is that much rainwater goes to waste; it runs off the soil surface as damaging surface runoff; with heavy rains it enhances flash floods downstream.

We can not generate more rain water, but green water resources can be better managed, enhancing downstream delivery of water, by increasing infiltration at the soil surface. This reduces destructive runoff and increases banking of the water in the soil. It also reduces the direct evaporation from the soil that is unproductive as it does not pass through the plants. Rainwater transmitted by the soil recharges groundwater and stream base flow (See figure 1 – partitioning flows).

The soil is the main buffer against drought, floods and climatic change as it stores water and carbon. Soil and groundwater are natural reservoirs that hold orders of magnitude more water than all existing or conceivable man-made reservoirs. These natural reservoirs should be better exploited.

Good husbandry of soil, water and crops (Green Water Management), increases groundwater recharge and stream base flow. Research shows that mulching can lead to a 65-90% reduction in runoff and to more than 25% reduction in unproductive evaporation. Conservation tillage in 30-90% reduction in runoff, and tied ridges, terraces and water harvesting in 50-100%. By arresting runoff, these practices conserve the soil and increase groundwater recharge and, hence, stream base flow.

As farmers in developing countries have poor investment opportunities and limited bargaining power, Green Water Management is outside their reach and most of the rain runs off their fields, which imprison them at poor subsistence levels.

Figure 6 gives examples of runoff and erosion in farm- and rangeland.

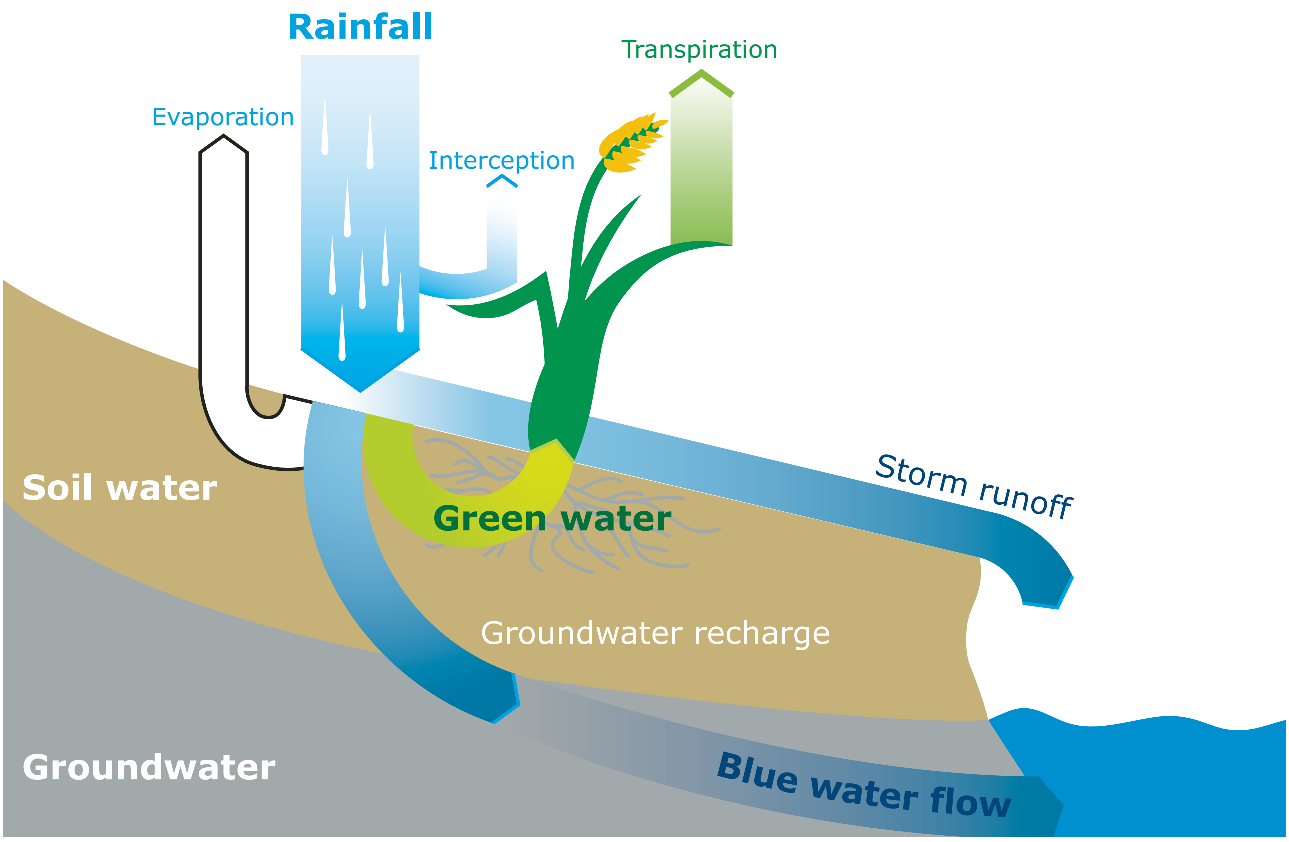


Figure 1 – Partitioning of rainwater into green and blue water flows

2.2 Green water management and climate change

Green Water management will enhance the absorption of green house gases, in particular carbon dioxide, because more green water means higher photosynthesis by plants and thus more biomass. With that more carbon dioxide is sequestered above and below the ground. Carbon dioxide captured in trees is a recognized and rewarded practice for carbon sequestration when trees are not cut or used for fuel wood. But improved Green Water Management results in higher soil organic matter content, which can lead to a stable carbon pool in the soil also[1].

2.3 The Green Water Management potential

Green Water Management implies making upstream (farmers) and downstream (industries/ water works) partners in river basin management.

With improved Green Water Management, rainwater can be harvested much more efficiently by farmers, while downstream delivery of water to public and private irrigation companies, water purification works, municipalities, etc., can be better regulated.

The knowledge and the practices to improve upstream management of arable, range land and forest land are available but need to be implemented more widely. Farmers need to be able and willing to make the necessary investments. The benefits of such investments to the downstream actors do not occur instantaneously, but with a large time lag. The effects of reduced upstream erosion will become apparent through reduced sedimentation downstream only after several years. An innovative financial arrangement is needed to deliver sufficient means and incentives to farmers to invest and implement the Green Water Management practices. The Green Water Credits mechanism balances costs and benefits for upstream and downstream parties and over time. The Green Water Credits facility is designed to provide a self-sustainable financial system.

[1] One quarter of the excess CO_2 in the atmosphere has come from the soil as a result of land use change in the last century; the best mitigation for climatic change would be to put it back again. R. Lal and others 2007 Soil Science 172, 12, 983-956

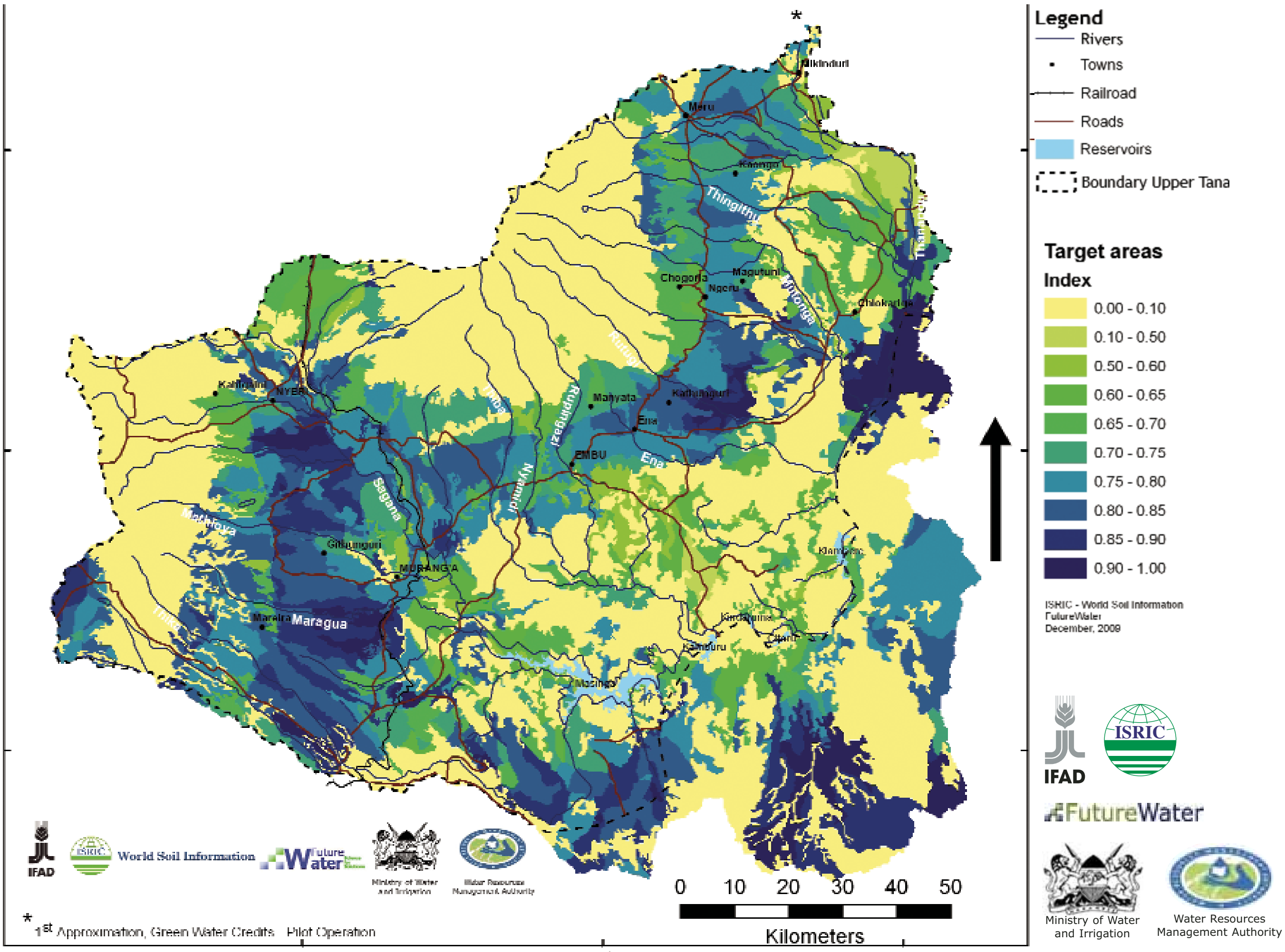


Figure 2 – Upper Tana: Target areas for improved management of water, soils, crops, trees and rangeland; first approximation, Green Water Credits Pilot Operation

2.4 Cost Benefit Analyses

In the Upper Tana basin in Kenya, preliminary estimates of annual benefits of full implementation of Green Water Credits are $12 to 95 million compared to annual costs of $2 to 20 million. With a 20% adoption scenario, the annual water benefits are $6 to 48 million compared with costs of $0.5 to 4.3 million – a ten-fold return on the investment. Half of this benefit comes from hydro-power generation; the increase in the value of that power at today's oil price makes the calculated benefits twice as much again (reference list).

The above estimates do not take into account savings on sediment damage to hydropower equipment, flood mitigation, higher crop yields, or other environmental benefits, such as securing enough water for natural ecosystems downstream. Also the additional benefits from carbon sequestration in agricultural land, both above and below ground are not included. These benefits are now being assessed in the current Pilot Design.

(See figure 3 – Costs and benefits)

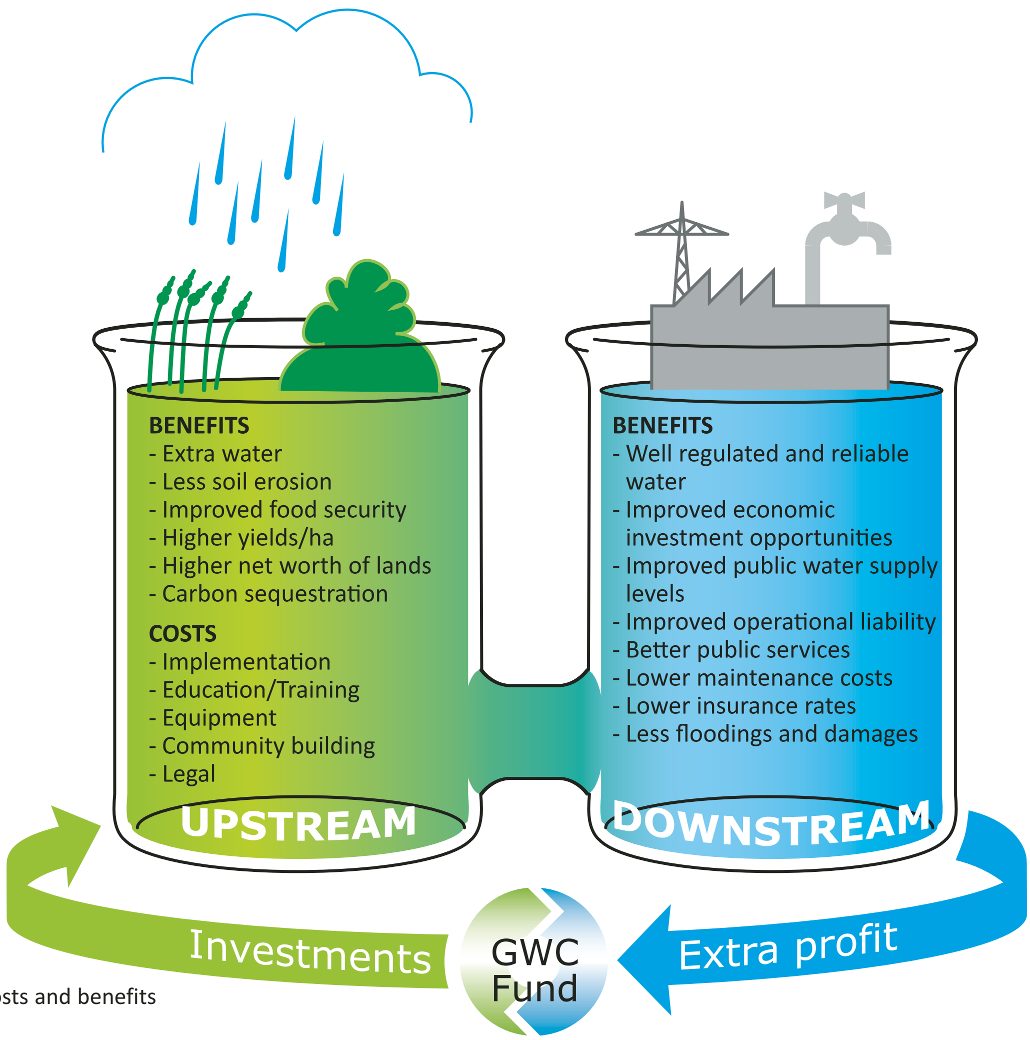


Figure 3 – Costs and benefits

3. What needs to be done?

3.1 Pilot design and implementation

Now that the Green Water Management principles have been successfully demonstrated in the Tana region in Phase I, the detailed Pilot Design is currently executed in Phase II. This pilot design, conducted by national parties and a consortium of international partners, with ISRIC World Soil Information Wageningen as the lead agency, considers:

- Operational aspects
  - Target regions in the catchment
  - Differentiation by rainfall characteristics per region
- Legal basis (contractual conditions, control mechanisms)
- Role and contribution of participants
  - Upstream farmers' community structure
  - Optimal number of parties per contract
  - Downstream utilities structures
  - Independent GWC fund management and control
- Financial instruments
  - Tax policies
  - Amounts needed
  - Short term credits (conditions, controls)
  - Long term funds
  - Sanctions

Phase II will produce a comprehensive design detailing these issues for the third (Implementation) phase of the Green Water Management and investment facility.

3.2 Measures of effectiveness

It is important to establish criteria or measures by which everyone can judge the effectiveness of Green Water Credits. For instance effectiveness of the Green Water Management might be documented thoroughly by measuring river base flow, groundwater and reservoir levels, water quality and sediment loads, as well as a reversal in land degradation. These should be monitored and corrected for environmental conditions. Actual water levels for instance are strongly determined by climatic variability and the levels of water abstraction, so that changes in trends can be verified in the medium term and/or corrected for the variability.

The impact on rural poverty is also hard to judge against ever-changing socio-economic conditions, but in the short term rates of adoption by land users, expansion of Green Water Management, and the proportion of funds that is actually passed on to the farmers will be good yardsticks.

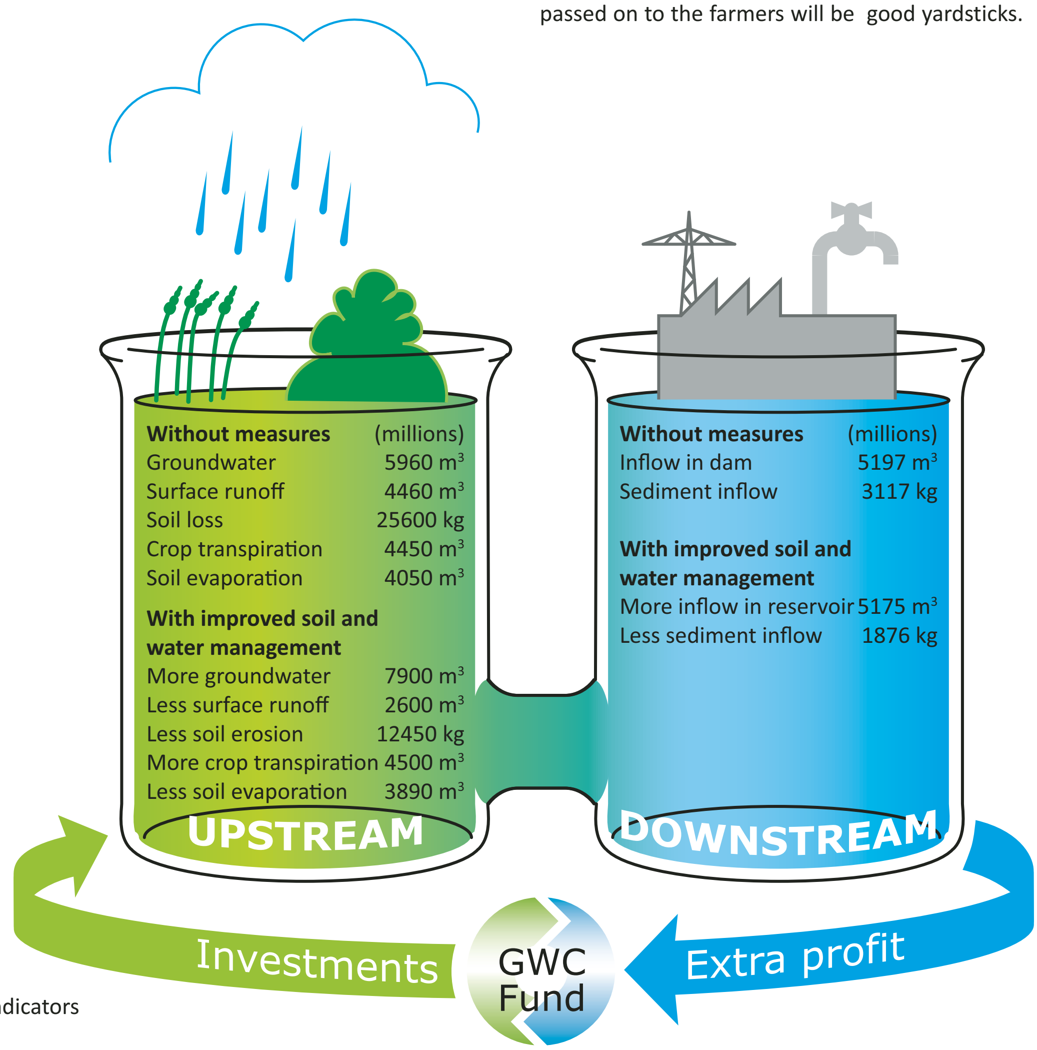


Figure 3 – Indicators

4. Operational challenges

4.1 The triangular construct around the Green Water Credits fund

The Green Water Credits approach is designed to tax the extra profits made as a result of the operational costs savings by downstream beneficiaries, such as less maintenance of the hydro power engines, and accrued income like increased production of electricity. These savings and additional income are a direct result of Green Water Management by upstream farmers.

These taxed extra profits are put in a GWC fund earmarked for training, investment and other costs necessary to implement and maintain the Green Water Management skills of upstream farmers and communities.

In order to function properly and to guarantee transparency and trust between parties, a professional entity will be charged with managing the GWC fund. As costs and benefits do not occur simultaneously due to time lags and between upstream (farmers) and downstream (industries/water works) parties, the revolving fund needs seed capital to be able to pre-finance the initial costs of the Green Water Credits system that will be made to:

- Educate and train farmers and leaders
- Strengthen regional/local communities
- Provide extra equipment to farmers
- Make legal arrangements between parties
- Allow communities to decide themselves on the desired investments, such as schools, hospitals and the like.

For the Upper Tana catchment, preliminary figures obtained during the Pilot Design phase, indicate that

- It takes 5 years to have the GWC-system fully implemented
- Total training/investment needed in these first 5 years amounts to 5x10 million US$
- Annual maintenance costs for the GWC-system for upstream farmers are estimated at 2 million US$
- Annual benefits for downstream partners in the GWC-triangular are estimated to be zero in the first 3 years. Starting with year 4, these benefits gradually increase up to the maximum of $33 million per year after 10 years (see figure 5 – Timescale)

Hence, to have the GWC-system up and running, a GWC fund should be in place to pre-finance the initial investments of 50 million US$ during the first 5 years. The maintenance investments in the second five years can be covered by the benefits in that period. It should be noted that these are benefits occurring at the basin scale. Direct benefits from Green Water Management such as increased crop yields have not been considered here. Also benefits from flood mitigation downstream has not yet been included in the current C/B figures. These benefits will be included in the detailed cost–benefit analyses of the current Pilot Design.

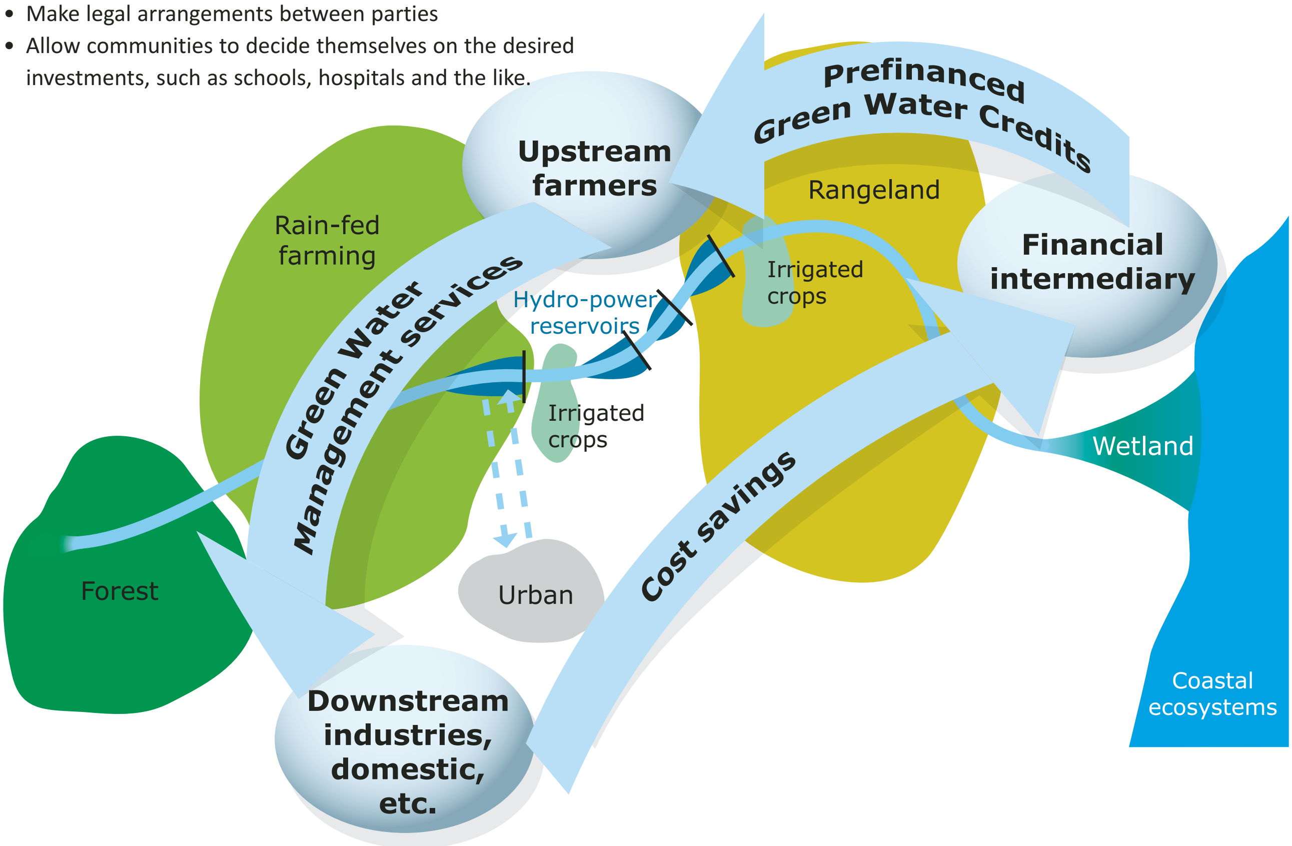


Figure 4 – Water user triangle

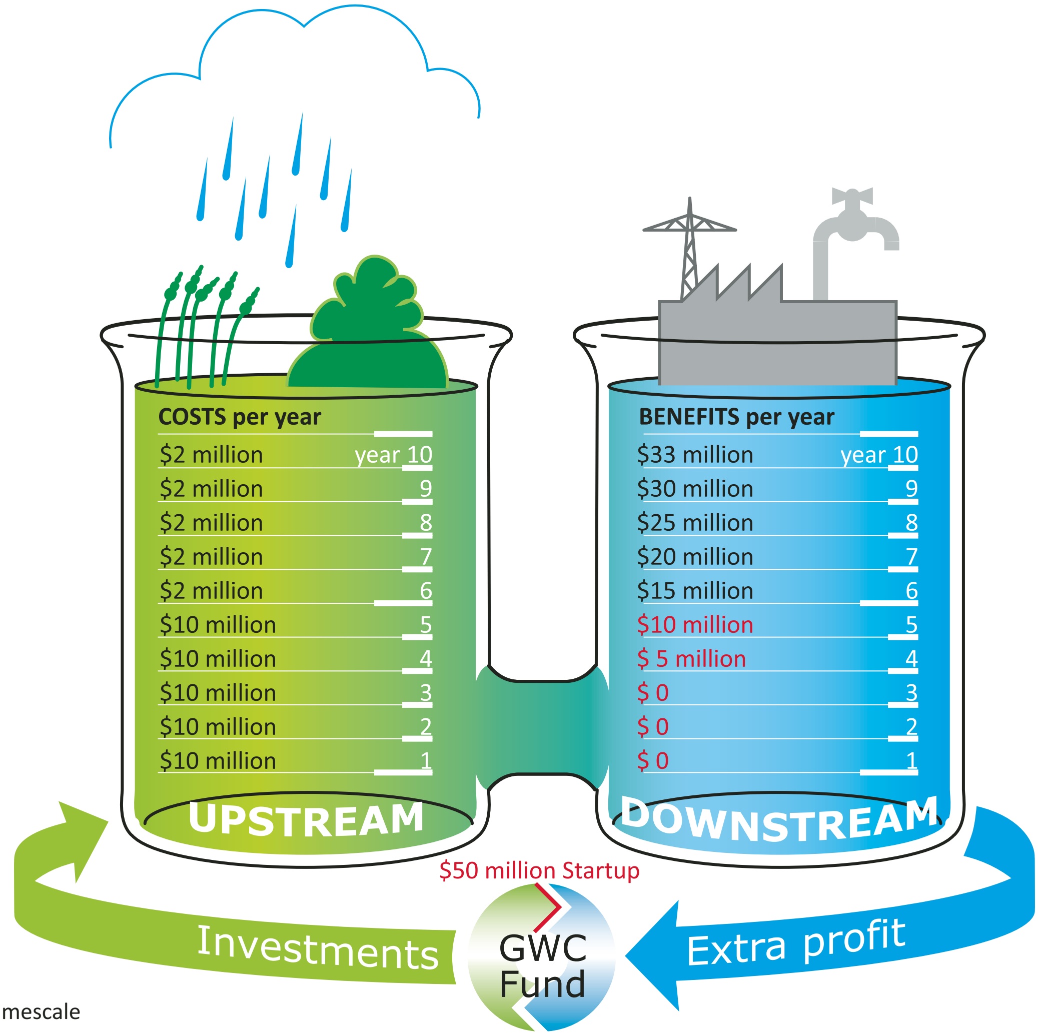


Figure 5 – Timescale

4.2 Financing GWC interventions

Although large in the absolute sense, relatively small sums are needed to get the GWC fund up and running.

The Government of Kenya, IFAD and international Consortium have invested in research and proof of principle of the Green Water Credits concept and the design of a Green Water Credits Fund as an effective financial arrangement to share the savings and revenues made by downstream beneficiaries with upstream farmers. This will encourage and enable the latter to invest in improved soil management. It will also ensure, over the long term, the provision of investments and therefore guarantees sustained and improved water supplies and water quality.

These investments are sourced from private funds – the extra benefits of the downstream water users – and from public funds. In particular in the initial stage public and international funds will be required to bridge the time lag between initial investments and the realization of benefits. In total 50 million US$ is needed to bridge this investment-return gap over the first 5 years. Now that the large scale demonstration of this system is at hand, the Government of Kenya strongly appeals to downstream private and public beneficiary parties, bilateral and multi-lateral international development agencies to contribute with funding and or in kind.

We suggest the following parties have the means and mandate to participate:

	General project		**Upstream farmers**			**Downstream industries**			**Financial intermediairy**
	Management	***Research***	***Training/ education***	***Inputs (material, crops, equipment, etc.)***	***Community building***	***Training***	***Legal***	***..........***	***Operational***
Governments	X	X	X	X					
International financial aid bodies	X	X							
Development agencies			X	X	X				
Banks and financial institutions						X			
Insurance companies						X			
Private funds			X	X		X			
Target									
50% share donors/partners	**$2 m**	**$4 m**	**$6 m**	**$30 m**	**$5 m**	**$2 m**			**$5 m**
GoKenya Associated projects Carbon Credits	**$25 m**								
TOTAL funds needed	**$50 m**								

Table 1 – Finance

Figure 6 – Erosion in farm- and rangeland in the Upper Tana catchment

Ministry of Agriculture | Water Resources Management Authority | Kenya Agricultural Research Institute | University of Nairobi | Ministry of Water and Irrigation

Green Water Credits is supported by the International Fund for Agricultural Development. The proof of concept was partly financed by the Swiss Agency for Development and Cooperation. The program is implemented by an international consortium that includes: ISRIC – World Soil Information, Stockholm Environmental Institute, International Institute for Environment and Development, and Agricultural Economics Research Institute.

In Kenya, national agencies responsible for Green Water Credits include: Ministry of Water and Irrigation, Ministry of Agriculture, Water Resources Management Authority, Kenya Agricultural Research Institute, and National Agriculture and Livestock Extension Program.

Further information

Ministry of Water and Irrigation, Kenya
Eng Peter Mangiti, Head Dept Donor Coordination and Head of Dept of Land Reclamation (pmangiti@yahoo.co.uk)

ISRIC – World Soil Information, The Netherlands
http://www.isric.org under current projects or http://www.greenwatercredits.net
Dr Ir Prem Bindraban MBA (Prem.Bindraban@wur.nl), Ir Sjef Kauffman (Sjef.Kauffman@wur.nl)