

Innovations Enhancing Sustainable Land Management

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Abstract

The in depth analysis of the root causes of land degradation in Malawi and the magnitude of the problem demanded that the solutions had to be innovative and creative. By and large the most significant driver to land degradation in the Shire River Basin has been the demand for an energy source especially for the fast growing urban areas. Hence the million dollar question was how to reduce the degradation while the energy demand is still growing unabated by the day.

Green charcoal/sustainable charcoal production replacing the evil charcoal that has destroyed our forests was seen as one entry point. This was through the introducing and domesticating the efficient charcoal kilns couple with innovative wood harvesting techniques to suit the required charcoal sizes in the market . Getting the green charcoal acceptable and establishing a governance structure and marketing systems that is conducive to the farmer might be a bigger hurdle to jump.

Introducing the green water credit scheme became a challenge both to the seller and the buyer of this God given resource. Using this Payment for Ecosystem Services (PES) approach to mitigate for environmental degradation and disasters has changed the perception that natural resources are a free gift from god to be abused anyhow.

Weather index based crop insurance applied as a measure of securing the food production system through the shifting of the weather risk factor from the farmer to an insurer became another key entry point. This would help sustain livelihoods, increasing food security reduces the amount and types of coping mechanisms that impinge on the sustainable utilization and management of the land. The bottom line will be how innovative do we need to be to make the farmer live a more comfortable life in a more friendlier way to the environment.

The SLM project continues to promote innovations in different ways because it believes this will ensure the present and the future for this country.

Background:

The land degradation in the Shire river basin ranges from deforestation, forest degradation, burning of the grass and trees through bushfires, sheet erosion, rill erosion and gully erosion as well as the soil fertility decline resulting from the excessive runoff washing away the topsoil, removal and burning of crop residues. All this degradation has resultant bad impacts like the siltation of streams, rivers and lakes, the eutrophication of water bodies which leads to the growing of the floating weeds like the water hyacinth, water lilies, papyrus and elephant grass etc. The silt in the river and the weeds move downstream towards the hydro electricity generation plants which results in increased cost for the production of electricity. It can therefore be observed that the problems are many and complex and they are multi-layer in nature.

The type and magnitude of the land degradation in the Shire river basin as well as the underlying causes to this degradation calls for the conventional ways of addressing it as well going beyond. It was therefore this aspect of being able to go beyond conventional ways and means that led this project to look for innovative ways of addressing the critical issues in the Shire basin. Therefore the Sustainable Land Management (SLM) project was designed with the general objective of “ being able to provide the basis for economic development, food security and sustainable livelihoods while restoring the ecological integrity of the Shire River Basin” by being able “ To reduce land degradation in the Shire River Basin through improved institutional, policy and Payment for Ecosystem Services (PES) arrangements”. This was further broken down into four(4) specific objectives as follows:

- i) Ensuring that the policy, legal environment and institutional arrangements are conducive for a basin-wide SLM implementation
- ii) Ensure that the private, public partnerships can provide financial incentives for SLM , ie through sustainable charcoal production and the green water credit scheme.
- iii) To improve knowledge and skills at all levels to support SLM implementation,
- iv) To design a weather based crop insurance to provide the basis for increased access to credits as well as increased use of upto date weather information in decision –making.

The types and magnitude of the degradation

This section identifies and illustrates the types of degradation that is encountered in the Shire River basin as well

as the magnitude of the problem in the area. These problems have culminated in the non-functionality of the basin like the silting of the basin, the burning of the bush just for mice, the eutrophication of the water resulting in fast establishment of floating weeds, etc needed the project to go beyond the ordinary because the people causing the destruction of the environment are doing it to make a living. The Figure 1 and 2 shows the extent and magnitude of the bushfires which are normal started by youth to clear the area while mice hunting resulting in barren landscapes that promote erosion of the landscapes and the siltation of the rivers and lakes downstream. These fires are predominant in the whole country between the months of May and November. Figures 3 and 4 shows how the trees are cut and converted into charcoal mainly during that same period of May to November each year. This practice is a popular off-season activity by a sizeable portion of the farmers to make some extra income for their family during this season, unfortunately the conversion ratio of the wood to charcoal using the traditional earth kilns is as low as 10 to 1 signifying a huge loss of wood to produce only one bag of charcoal. Figures 5 and 6 shows the extent of the erosion that results from all this excessive use of land and its resources and the resultant siltation of the rivers and lakes with fertile/ nutrient rich topsoil which gives way to floating weeds which get all their nutrients from the water.



The innovations or thinking outside the box

This section tries to illustrate how these innovative interventions complement the sustainable management of the land and its natural resources. Secondly these innovations try to change people 's perceptions about an issue ie. from negative to positive eg perceptions about charcoal use from bad destructive charcoal (**black charcoal**) to sustainably produced charcoal to meet the energy gap in a country ie **green charcoal**. It will also look at doing things differently or improving the way they are done, ie doing the usual in an unusual way. It will briefly look at three interventions that were termed innovative in the SLM project in Malawi ie.

- Turning Black Charcoal to green/acceptable charcoal
- Selling God's free gift ie payment for ecosystem services
- Shifting the farmer's production risks elsewhere ie crop insurance

The Innovations

a) **Turning black charcoal to green:** We had the choice to go "Business as usual" and looked at charcoal as an illegal commodity and assisted the government in enforcing the ban and the movement of charcoal from the rural areas where it is produced to the urban areas where it is required for cooking. Instead we decided to look at reality, which is the fact that charcoal is required by the majority of the people who live in urban areas, hence we had to make the illegal charcoal acceptable and not to continue burying our heads in the sand like an ostrich. Hence the introduction of efficient kilns was one way of doing that. The traditional earth kiln and the three improved charcoal kilns are shown in Figures 7,8,9& 10, which are under trial in Malawi from elsewhere and being adapted to the Malawian conditions before adoption by the communities and the business community. Figure 7 shows the local/traditional earth kiln with a lot of gases escaping making it less efficient.



The Cassamance kiln figure 8, is adapted from the Cassamance region in southern Senegal and can improve the wood to charcoal to 5 to 1 ie is doubling the efficiency of the traditional earth kiln. It looks similar to the traditional kiln but it is fitted with a chimney, hence the chimney is a moveable enabling the kiln to be built anywhere. The chimney is made out of usually 3 used cylindrical drums opened at the top and bottom and joined together to get a height of about 2.5 metres. The wood is cut into 1 metre lengths and stuck upright to increase air circulation during the carbonization with the assistance of the chimney

The Half Orange Kiln figure 9 also has the 1 to 1.5m wood stuck upright and has vents left at different heights to allow gases to escape as well as used as inspection holes. This kiln improves the carbonization ratio to

3.3 to 1 when used properly or a 30% efficiency roughly.

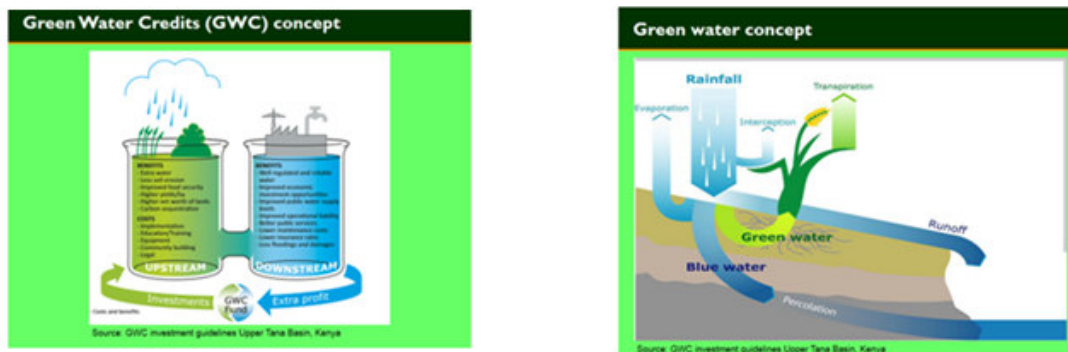
The Adams and Sam's retort figure 10 shows the Adams retort, it also uses 1 m long wood stuck upright. The Sam's retort has an external fire chamber and the wood only receives the heat which carbonizes it to an impressive ratio of 2.5 to 1 or 40% efficiency.

Our survey prior to the project had revealed that the city of Lilongwe requires 1 million metric tons of charcoal annually, which translated into 36 ha of Miombo woodland cut a day to satisfy this demand. Theoretically the introduction of these kilns will reduce the trees cut per day to 18ha for the Cassamance, 11,8ha for the Half Orange, and 9 ha for the Retort kilns a day. This would result in significant reductions in the cutting of trees for charcoal production since this is a demand driven commodity.

The second approach was to examine the charcoal production, use and acceptability of charcoal from slow growing hardwood trees species versus fast growing medium or soft wood tree species. This would allow the cities to grow their own charcoal plantations. The third aspect was to convince the charcoal makers to make charcoal from lopped branches and not cutting down the whole tree, since our survey show that the charcoal that is in demand/used is only 10cm diameter or smaller, otherwise the user has to crush the charcoal to smaller pieces. The type of tree species and the size of the wood used was correlated with the time it takes to carbonize the wood. This would allow a continuous use of branches for charcoal every two to three years. All the trials were producing the charcoal after only 42 to 48 hrs of the carbonization process as opposed to the traditional 96hrs to 120hrs resulting in most of the small pieces burning into ashes while still trying to carbonize the bigger logs. It therefore revealed that wood size separation was a critical factor in the efficiency of the charcoal production.

To tie it all up together we looked at the introduction of energy efficient cookstoves to use this sustainably produced charcoal in a more efficient way. Currently the stoves found in the market are reducing the fuel consumption by about 40% meaning that they will reduce the amount of charcoal or wood used by 40%, this would reduce the hectare for Lilongwe's requirement from the 9ha to 5.4ha per day theoretically. If this is done properly we would have reduced the cutting of trees for fuelwood and charcoal for Lilongwe to about 15% of the current cutting rate.

b) **Selling God's Free Gift:** The Green Water Credit is a concept of one community upstream nurturing their environment which then continuously discharge water for longer periods of the dry season, and this eventually benefits the communities downstream as is demonstrated by the two beakers connected by a tube representing the river while the beakers represent the upstream and downstream communities as shown on Figure 11.



The importance of this link between communities further reinforces the statement quoted in a number international fora that "Future wars will be fought over water". Figure 12 illustrates how the upstream communities stores/ bulks up this water termed the "green water" through the conservation of their environment and the natural resources. It is therefore this upstream community in Balaka or Mwanza that will want to sell this water to the cities of Blantyre and Limbe, ESCOM, the Tea Estates as the downstream communities. It is a difficult concept to understand because communities always assume that the water they get from the streams or rivers is free since the rainfall is free from God, so when one community talks of selling this "free commodity" to the other, the questions comes "who gives you that right to sell what does not belong to you?" It takes a lot of time and skill to make the downstream/ buyer community appreciate that the upstream community holds the string to their survival.

It was therefore the role of the SLM project through an NGO to set up a conducive environment for a dialogue between these communities and this was done through an NGO. There are several possibilities in these relationship, there could be a one seller to one buyer or one seller and several buyers or multiple sellers and multiple buyers.

Payments terms for the this water would have to consider the following issues and questions:

- who is paying and what are they paying for –the water or the protection of its source
- how long do they keep on paying for the same piece of improved land
- what should be the form of payment, should it be in cash or in kind, should it be to the community or to the individual farmers.

Due to these tough negotiations that are required a mediator is required and this is the role that NGO is playing. This concept has a lot of potential in the rehabilitation of the degraded Shire River basin to make it a self-financing venture. Currently six upstream communities have been surveyed for this Green Water Credit scheme in the districts of Balaka, Neno, Mwanza and Blantyre district while CURE has been engaged to run the negotiation trials with two communities in Balaka and Mwanza. This is a first PES for Malawi, and from the discussions and contracts being developed, it gives a sigh of hope for the rehabilitation of the Shire river basin using this approach.

c) Shifting the farmers production risk elsewhere: Weather Index Based Crop Insurance

As one of the objectives of the SLM project was to ensure food security in a hostile risky environment, the project looked at a crop insurance as a means of removing the risk of food production from the farmer to the insurer. The idea is to insure the food production system such that when the weather conditions, especially the rainfall falls below a certain agreed threshold the insurer will make a payout to insured farmers hence their livelihood would be secured.

The weather based insurance scheme would be based on automated weather stations (do not allow manipulation of data) and this would cover farmers within a 20km radius from the automated weather station. This could also be done using satellite data based on 3.3x3.3km pixels which increases the reliability of the weather conditions for a particular location. This methodology which uses relative humidity from evapotranspiration within the 3.3x3.3 km pixel proves to be a more reliable and more accurate way when it comes to payouts than the weather stations which are susceptible to micro-variability within the 20km radius, this one will only allow the variability within a 3.3 km square. Secondly the satellite data based system would be done at a small fraction of the cost of an automated weather station. The figure 13 shows the theoretical basis of the methodology while Figure 14 shows a the 20km radii from the existing rain gauges in the four districts which would have to be equipped with automated weather stations for this methodology to work at the cost of about USD 20,600.00 per each station. On this innovation only preliminary results are available and dry-run results for the 2014/15 season will be available by the end of the season to further reinforce its usefulness.

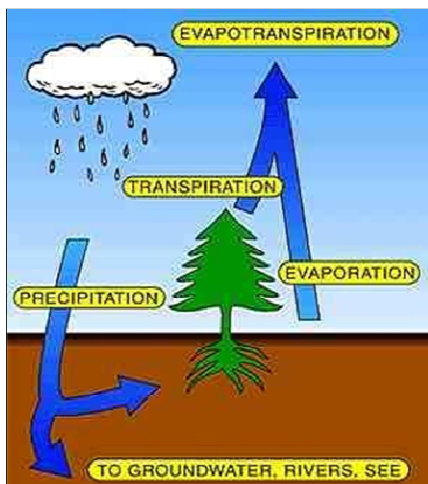


Figure 2: Visualization of precipitation and evapo-

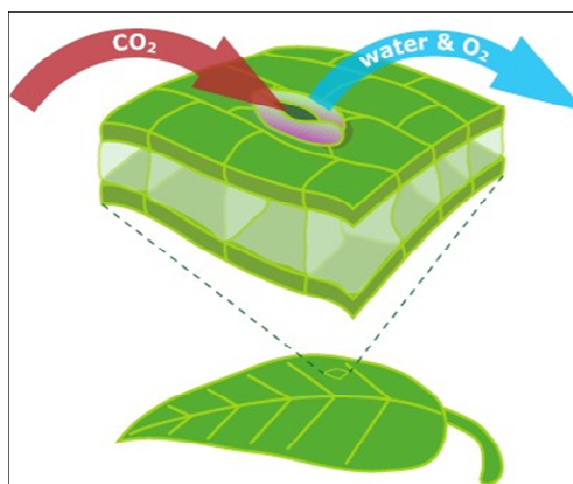
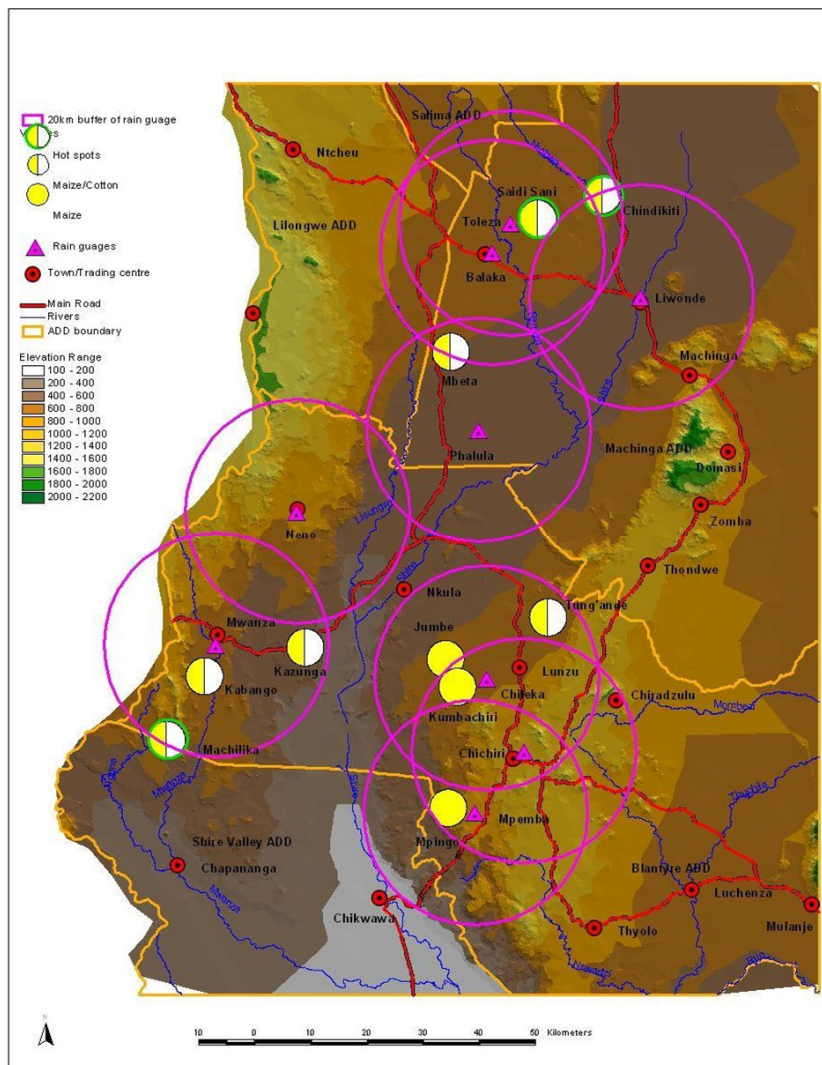


Figure 3: Visualization transpiration and CO₂ uptake



Conclusions

In conclusion these are some of the innovative interventions that this project has introduced in the communities and they have been tried and we are only working towards their adoption. The project continues to experiment with a number of other innovations that we feel would be instrumental in the pursuit of a sustainably managed Shire river basin.

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