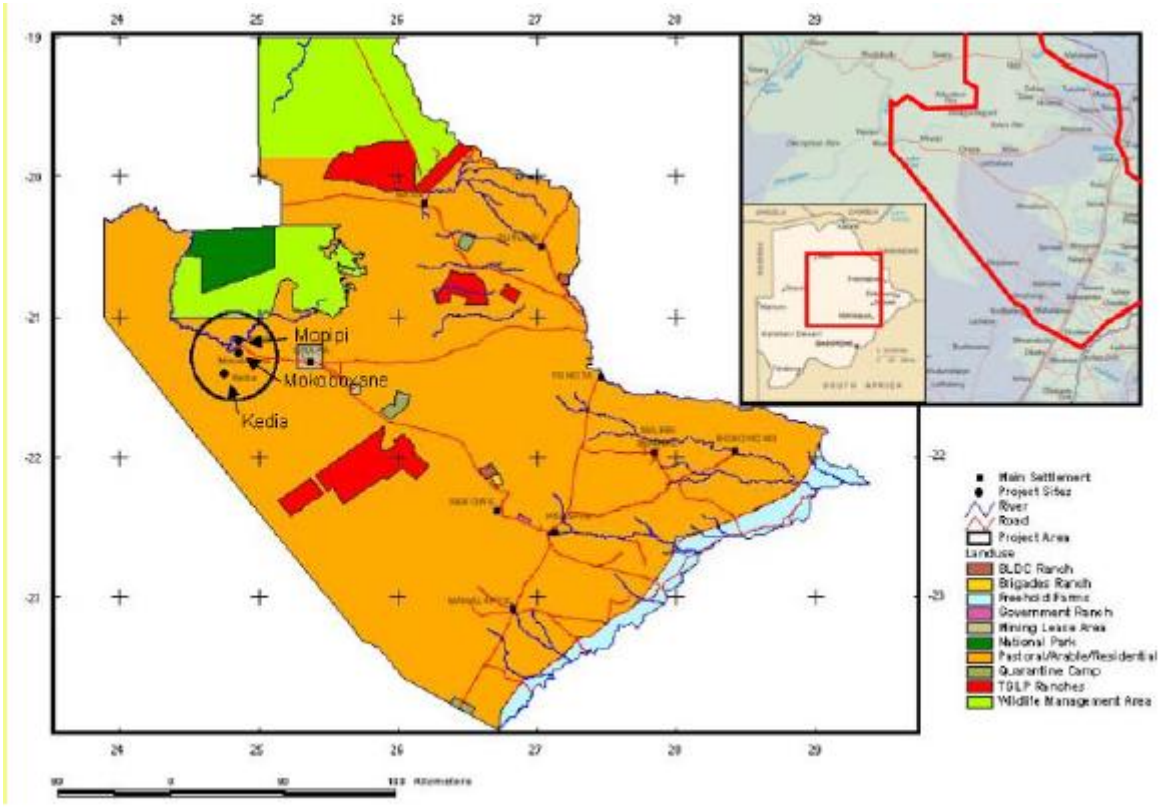
Boteti study site, Botswana

Highlights of work carried out in the DESIRE Project

Based on work at the University of Botswana

The study site

This site in the Boteti area was also the focus of Botswana's 1993 case study for the then Intergovernmental Convention to Combat Desertification (INCD). It was identified as a "desertification hotspot" and was also identified on the GLASNOD map as an area of extreme human induced wind erosion (Gov. of Botswana, 1994). The droughts in Boteti are endemic, with an estimated recurrence interval of 10-18 years, and land degradation driven by overgrazing and dry season wind erosion. Since 2002, has been one of the sites for the Indigenous Vegetation Project (IVP), a five-year Botswana Government-GEF-funded pilot project for "community-driven rehabilitation of degraded rangelands" which could be replicated "throughout the arid zones of Africa" (IVP flyer). The Ministry of Environment, Wildlife and Tourism through the Department of Crop Production and Forestry is the National Focal Point for the UNCCD. The Kalahari Conservation Society (KCS) (one of the leading NGOs in the country) is involved in conservation projects in the study area.



Botswana, is perhaps the most enduring successful post-independence democracy on the African continent, and has a fairly large body of legislation and institutions concerned with, or with a bearing on, environmental protection. This legislation and these institutions have not had the expected impact, largely because of lack of coordinated action and implementation capacity. The National Focal Point for the UNCCD is in the Ministry of Environment, Wildlife and Tourism, which is also charged with the implementation of the National Action Programme to Combat Desertification. The Government of Botswana has taken steps in the direction of coordinated action by adopting a National Conservation Strategy under which two institutions were created, namely, a 17-member National Conservation Strategy Advisory Board and the Department of Environmental Affairs. Through these institutions the Ministry of Environment, Wildlife and Tourism is expected to coordinate the activities of the various environment and natural resources institutions of the government. An Environmental Impact Assessment Act was enacted by parliament recently and an overarching environmental management Act is in the process of enactment. With these legal instruments the coordinating functions of the Ministry will be legitimized by the force of law.

Mopani forest zone

The Boteti site is situated in north-central Botswana, a sparsely populated, semi-arid country located in Southern Africa. Boteti has a population of approximately 20,000 people, and a mean annual rainfall of approximately 350mm, with a very high coefficient of variation. The dominant form of land tenure is communal, although private leasehold livestock ranching is emerging, and state land in the form of game reserves also exists.

Subsistence agropastoralism is the dominant livelihood source, but the portfolio of cash sources includes formal and informal employment, livestock sales, remittances and traditional beer sales. The dominant perception among the local population is that the climate has become drier, and that the land degradation noted in 1.1 above is largely due to the severe droughts and the assumed climate desiccation (Chanda, 1996). Correcting this perception is one of the major challenges for the implementation of sustainable remediation/rehabilitation measures.

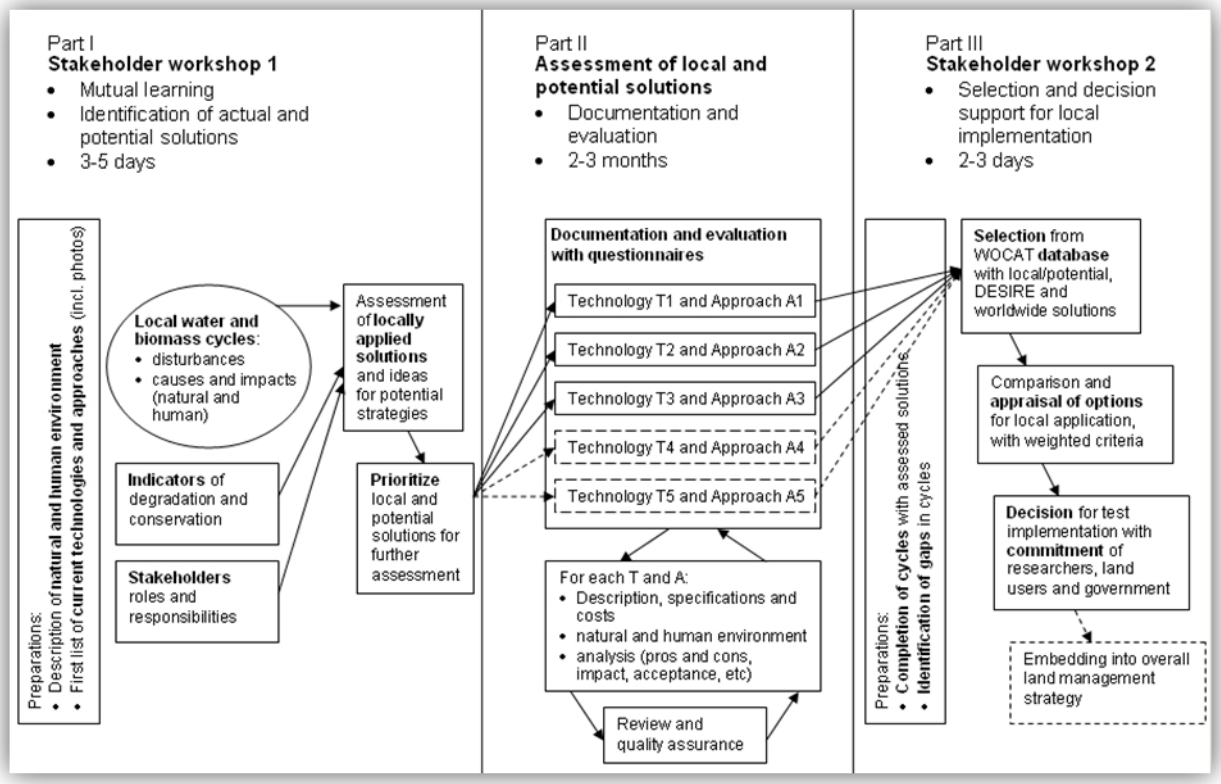
In order to safeguard land-based livelihoods, since 2002 joint efforts by the Government and the United Nations Environment Programme have been promoting community-based conservation of the land and indigenous vegetation. Mitigation strategies contributing to livelihood diversification and poverty alleviation will include water harvesting, harnessing of solar power, game ranching and biogas production and utilization. The communities have picked biogas production for piloting because of its potential to conserve vegetation and to promote small-scale bakery businesses.

Grassland zone

Drylands

Over-grazing

Workshops for researchers and stakeholders to select sustainable land management technologies



Researchers talked with local people and policy makers, and together they decided on the best options for sustainable land use. In the DESIRE Project the three Parts to WOCAT methodology were developed as outlined above. This provides decision support for choosing technologies suited to the local environment that includes social, cultural and economic factors as well as physical science.

In every DESIRE study site researchers and stakeholders held two workshops to arrive at their selection of approaches and technologies. At the first workshop stakeholders learned about how degradation happens, and how to avoid it.

Meetings of researchers with stakeholders were used to help break the cycle of desertification. Together they discussed and tried out suggestions to find the best ways of reducing the incidence and impact of land degradation while addressing goals for sustainability.

Biogas

Biogas technology is a very welcome technology in the urbanizing world, as it consumes food waste, chicken droppings and sewage. In Botswana, the technology is experiencing resurgence, with more plants in the near future. It is clear that biogas technology will add value to MDGs, sustainability, V2016, mitigating climate change (CDMs, REDDs).

The Boteti study area has overgrazing as the degradation challenge. The extent of overgrazing in pastures, woodland and settlements is fragile to critical. Firewood collection adds to the range degradation, thus alternative energy in the form of biogas has been proposed by the stakeholders.

Key issues – biogas technology in Botswana

- Biogas first started in 1980s in Botswana, with about 10 plants, supported by govt.
- The plants in 1980s were used for borehole water pumping (mainly), followed by cooking uses and bakery. Syndicates/institutions and in some cases, individuals were the owners. Most have since been abandoned.
- Biogas types tested included: floating drum digester (Indian); Fixed dome digester (Chinese) and Plug flow digester (S. Africa).
- The average per capita consumption of firewood (cooking, heating, boiling water) in rural areas is 3kg of wood per day. This daily capita = 13KWh, and this can be covered by a 2m3 biogas plant (Somolekae, 2009).
- A biogas with a volume of 2.8m3 can save 0.12ha of woodland each year (Green Power, India). This counters degradation/desertification.

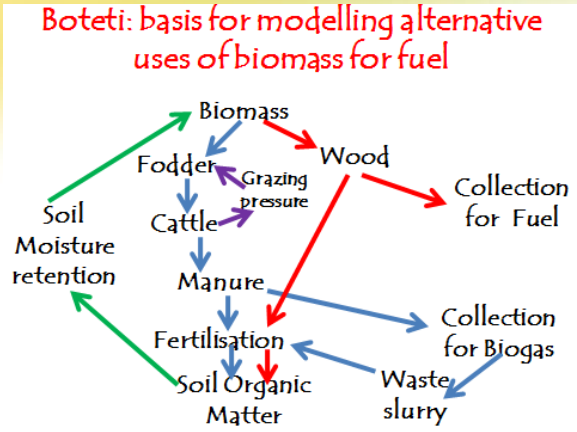
Study Site/Stakeholders model/output evaluation,

- There is keen interest on the project.

Based on analysis, the up-scaling should focus on building larger biogas plants, as opposed to several smaller units, the cost benefit analysis indicates the larger units to be more viable. Cotati, Botswana

Cow dung is being collected to convert to biogas. With this alternative source of fuel, brushwood will not be collected so extensively, and the natural vegetation can continue to protect the grazing lands from soil erosion. ▸Current commercial biogas plants: Cumberland Hotel – uses food waste. Richmark poultry – uses chicken dropping and has solar water heater that elevates the temperature of the mixture (source).

- Currently 2 individuals own biogas plants, one has fitted purifier. Food waste, cow dung used.
- Two new plants expected in Kgalagadi, to use sewage from schools.



BIOGAS INSTALLATION

The Boteti study area has overgrazing as the degradation challenge.
The extent of overgrazing in pastures, woodland and settlements is fragile to critical. Firewood collection adds to the range degradation, thus alternative energy in the form of biogas has been proposed by the stakeholders. Firewood is the main source of energy, not only in common households but also in schools and communal centers.
Since cattle is one of the main sources of income, biogass might be a valuable alternative. The generated gas is expected to reduce heavy firewood use and even promote socio-economic activities which will reduce poverty – perceived to be one of the main drivers of land degradation other than droughts.

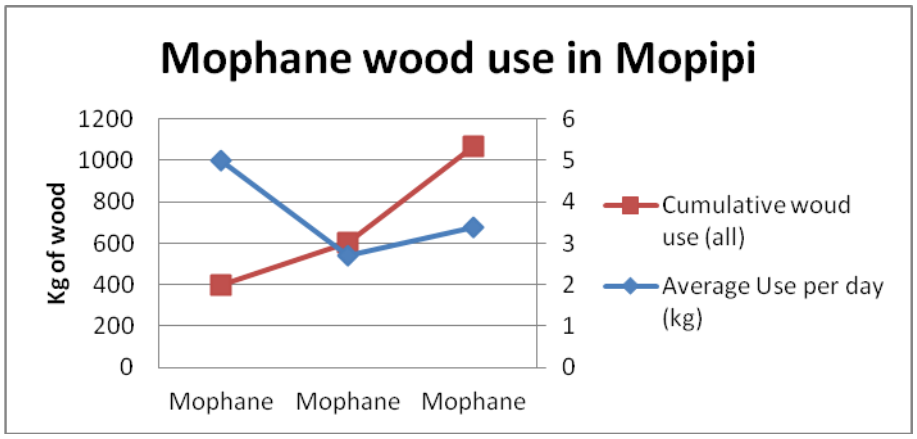
THE EXPERIMENT: BIOGASS TO CONSERVE BUSHLAND

At the very bottom is a digester, in which the cow dung is fed. The fermentation yields gas, which collects in the tank above. Pipes are used, to collect the gas for various uses e.g. cooking, heating and lighting. The amount of cow dung input, is measured, against the volume of gas generated. A biogas tank has a movable cover that adjusts to the amount of gas produced. Different design exist, and this design with the above gorund feeder pipe was maybe not the most easy. Alternatives are buried gas tank with a cover level to the surface and a feeder canal where water and dung are mixed are also at surface level. In any case biogass is relatively new in Botswana with only a few examples existing in the country.

RESULTS

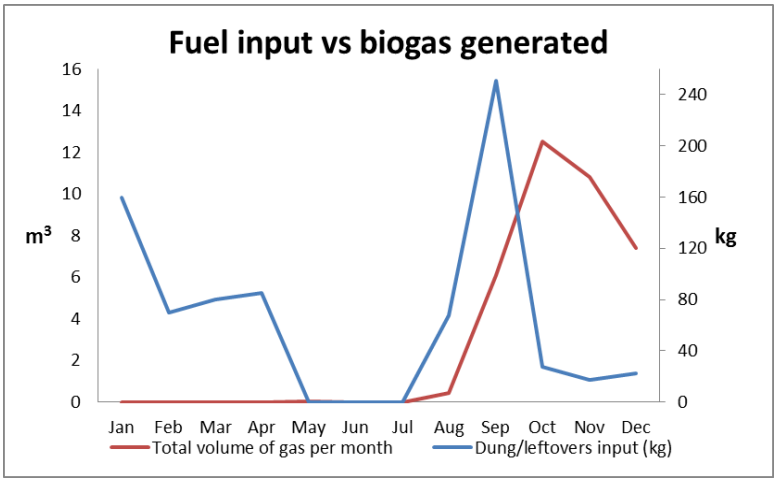
In the experiment the amount of fue lwood gathered by the village was monitored, and its use compared to the use of biogas (in cooking and heating activities of the household connected to the tank). There is sufficient cow dong present to use biogas on a larger scale.

The cumulative increase in firewood demand is apparent in households (see figure below). The same pattern applies for the local schools, where firewood demand is creating local conflicts over the resource. The Department of Forestry and Range Resources has conducted studies in the area, in response to the firewood and general degradation concerns.



Cow dung may be collected at water points, kraals and cattle posts. The distances to these vary, hence the costs. Within walking distance 10-50kg may be collected e.g. in a wheel barrow; but further away, donkey carts and vehicles may be used, which take on more cow dung quantities e.g. 250-450kg per load. However, as the experiment proceeded, food leftovers were introduced as the fuel. The response of the biogas was more immediate. The locals then introduced food leftovers from the secondary school to fuel the biogas. This has remained a very successful intervention – the results being very positive for August to December, 2011 (see below).

NB: 1kg cow dung produces 0.06m3 gas, which can feed a family of 4-6 (at 3 meals per day) for about 4 days.

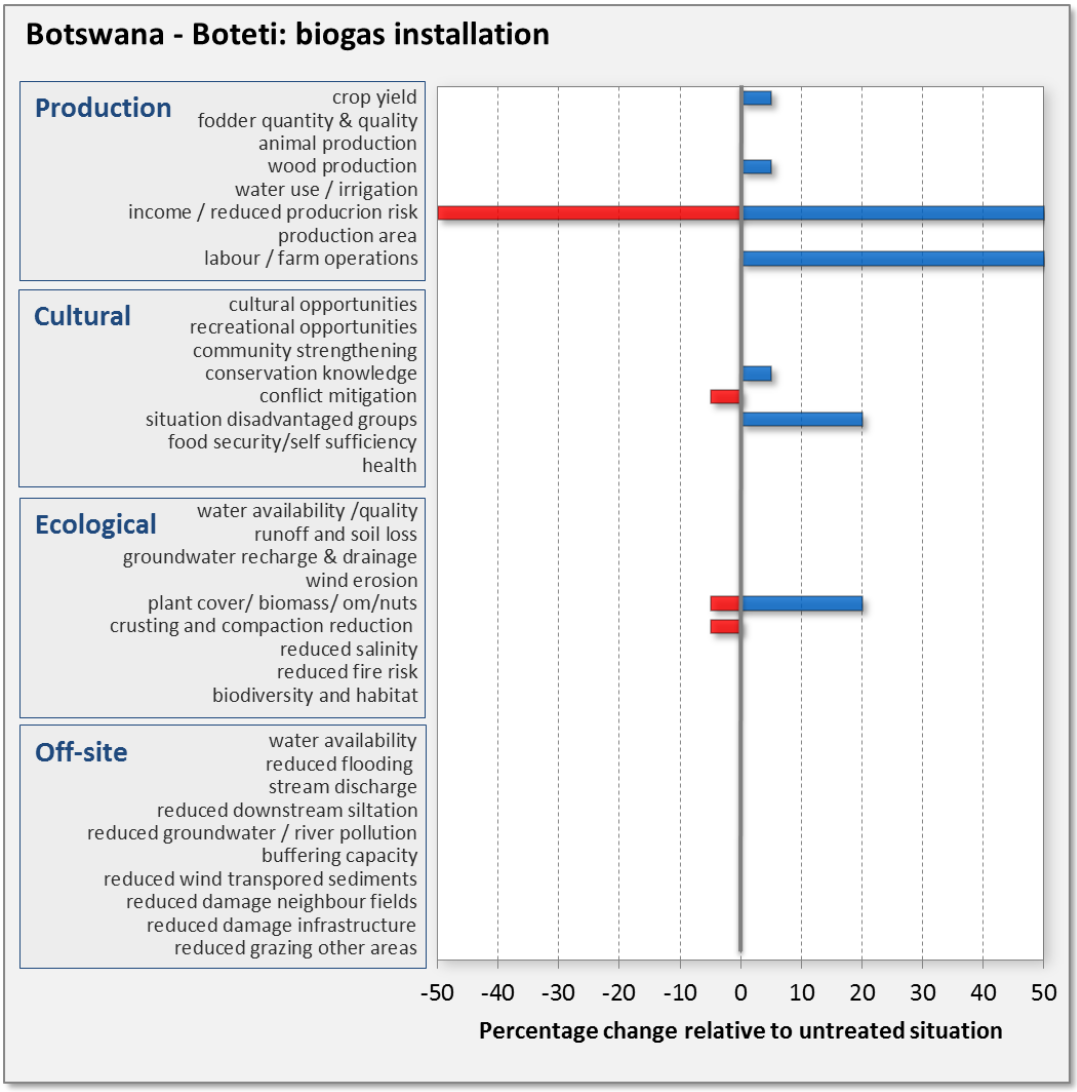


Challenges

a) Lack of transport to collect dung/leftovers from the secondary school which has offered to provide the leftovers. The school is about 3km away.
b) Transport of bio waste when from far becomes a bottleneck quickly
c) When schools are closed (limited leftovers) thus the biogas fuel (leftovers) are scarce. The biogas tank rises minimally, as a result.
d) The loose/free movement within the digester of the biogas tank and its lightness (not heavy), reduces the much needed pressure to push the gas towards the stove. Thus cooking is rather slow when using the stove. The top can be weighted down.
e)

EVALUATION

The results are evaluated from a production, socio-cultural and economic point of view. The bars express the estimated or measured percentage of change with respect to the reference situation. This change can be positive (blue) or negative (red). Note that this evaluation is based on the experiments, on the long term experience of the coordinating team in this area and on consultations with the farmers.



STAKEHOLDER OPINIONS

The impact of the biogas is too early to show, but schools, villagers – have all expressed interest, citing the limited energy sources as a major challenge. Interest ranged from using the gas for: cooking, powering a generator to produce electricity, to larger scale like providing energy for cooking i.e. to replace 19 truckloads that are needed every 3 weeks for each secondary school in the area.

CONCLUSIONS

The biogas is running well, and the results are beginning to show i.e. how much gas is generated from what quantity of cow dung or food waste. This will be the first time in Botswana, where exact performance measurements are done.

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➜ This project has been funded by the European Commission DG Research-Environment Programme
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During the period January 2007- January 2012, this work was carried out by:
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See: http://www.desire-his.eu/en/boteti-botswana for full details of DESIRE research