DEVELOPMENT INITIATIVES IN WATER SECTOR: LESSONS LEARNT BY NGOs

Symposium Proceedings

29 November 2006, Peradeniya, Sri Lanka

Editors

S. Pathmarajah
M.I.M. Mowjood

PUBLISHED BY

Cap-Net Lanka
Department of Agricultural Engineering
Faculty of Agriculture
University of Peradeniya, Sri Lanka

Network for Capacity Building in Integrated Water Resources Management

DEVELOPMENT INITIATIVES IN WATER SECTOR: LESSONS LEARNT BY NGOs

PROCEEDINGS OF A SYMPOSIUM

Editors

S. Pathmarajah

M.I.M. Mowjood

Symposium sponsors

Cap-Net Lanka, &
Postgraduate Institute of Agriculture (PGIA), Peradeniya

Proceedings sponsor & publisher

Cap-Net Lanka
Department of Agricultural Engineering
Faculty of Agriculture, University of Peradeniya
Sri Lanka, 2007

Development initiatives in water sector: Lessons learnt by NGOs. Proceedings of a symposium, 29 November 2006, Peradeniya, Sri Lanka.

Editors:

S. Pathmarajah, B. Sc. Agric. (Sri Lanka), M.Phil. Agric. (Sri Lanka), D. Tech. Sc. (AIT)
spathma@pdn.ac.lk

M.I.M. Mowjood, B. Sc. Agric. (Sri Lanka), M. Sc. Agric., Ph.D. (Iwata)
mmowjood@pdn.ac.lk

Department of Agricultural Engineering
Faculty of Agriculture
University of Peradeniya
Peradeniya, Sri Lanka

Panel of reviewers:

S. Pathmarajah, B. Sc. Agric. (Sri Lanka), M.Phil. Agric. (Sri Lanka), D. Tech. Sc. (AIT)
M.I.M. Mowjood, B. Sc. Agric. (Sri Lanka), M. Sc. Agric., Ph.D. (Iwata)
M.M.M. Najim, B. Sc. Agric. (Sri Lanka), M. Eng. (AIT), Ph.D. (Malaysia)

Cover page: S. Pathmarajah

ISBN: 978-955-589-098-4

Foreword

It was indeed a great pleasure for me to coordinate this symposium on behalf of Cap-Net Lanka. The intension was to provide a forum for the NGOs to share their "lessons learnt in water sector" for the benefit of others and to discuss water related issues.

NGOs are popularly known as humanitarian agencies due to their activities towards uplifting the standard of living of the poor and the marginalized communities all over the world. Apart from the relief and rehabilitation work, one of the aspects that brought credibility to the NGOs in the recent past was that their intervention in water and sanitation sector (WatSan). To name a few; watershed management, minor tank rehabilitation, operation and maintenance of minor tanks, groundwater development and utilization, rainwater harvesting, crop diversification under minor tanks, institutional linkage, organizational strengthening, farmer and partner capacity building, rural water supply, health and sanitation, gender and water and advocacy and policy issues.

The interventions have been target oriented, and the outputs, effects and impacts at various levels have been monitored and documented to satisfy the donors' needs. I view those interventions as participatory research initiatives, and value the outputs as beneficial beyond the NGO circle. Therefore, I strongly believe that sharing the lessons learnt could benefit a wider community. However, such findings, or the lessons learnt from such interventions have not been disseminated to the other actors and stakeholders in a systematic manner.

I am aware that sharing of information occurs at District levels to certain extent through NGO consortiums and Divisional and District level coordination meetings. But, it hardly occurs at national level; that is planners or policy makers level. I am saying it, not to undermine the work that NGOs do, but to give more credibility and visibility to their work. At present, those valuable findings or the lessons learnt go un-noticed.

Lessons learnt; whether +ve or -ve; have to be shared. Else, we will be re-inventing the wheel or end up in inventing too many wheels. It is already happening in NGO and GO circles. A few obvious reasons for this are: time constraints, short durations of the projects and lack of continuity resulting from high staff turnover. Moreover, dissemination is not an identified component in most of the NGO and GO projects. Therefore, what is required now is a kind of "wheel alignment" for those wheels that have been already invented. It is in this context that the idea of holding a symposium of this nature evolved.

I am very much thankful to those organizations and individuals who have invested their valuable time in documenting their lessons, and come all the way to Peradeniya to share their experiences with others. Though, unable to produce papers due to time constraint, I am happy that most of the institutions managed

to send their representatives to share their experiences. If not for this dedication and desire, this symposium wouldn't have been a success.

The scope of this symposium was restricted to the "water sector" as it is the mandate of Cap-Net Lanka. Altogether, eleven papers covering the areas of water and sanitation, minor-tank rehabilitation and watershed management were presented in the symposium. The presentation by the Chief Guest on "Importance of partnership and networking" is given in Appendix I.

The symposium attracted more than hundred participants from various institutions. The names and addresses of the registered participants are included in Appendix II.

It is hoped that this proceedings would provide readymade tools to the planners of both NGO and GO sectors to plan and implement water related activities in the future.

On behalf of the Cap-Net Lanka, I extend my gratitude to the Postgraduate Institute of Agriculture (PGIA), Peradeniya for allowing us to use their facilities for symposium activities. We are thankful to the Chief Guest - Dr. Paul Taylor, Director, Global Cap-Net and Guest Speakers - Prof. Athula Perera, Director, Postgraduate Institute of Agriculture and Prof. Budhi Marambe, Dean, Faculty of Agriculture for accepting our invitation and delivering guest speeches. I am also thankful to Dr. D.R.I.B. Werellagama, Dr. R.P.De Silva and Prof. C. Sivayoganathan for chairing the sessions.

I appreciate the service rendered by the reviewers who actually helped to improve the quality of this proceedings substantially. Special thanks are due to the Cap-Net Lanka for the generous financial support given to hold the symposium and print this proceedings. I appreciate the support extended by the academic and academic-support staff members of the Department of Agricultural Engineering, Faculty of Agriculture, University of Peradeniya and the students of the PGIA. My special thanks go to Ms. Princey Sivayoganathan, the Administrative Secretary of Cap-Net Lanka for all the logistic arrangements. Finally, I thank the symposium participants who actually made this event a success through their active participation.

S. Pathmarajah
Symposium Co-ordinator / Editor

Table of contents

Proc. Sym. on Development Initiatives in Water Sector: Lessons Learnt by NGOs,
29 November 2006, Peradeniya, Sri Lanka.

Sustainability of hygiene behaviours

Sugandhi Samarasinghe and Pallitha Jayaweera
COSI Foundation, Sri Lanka

Abstract

As water and sanitation facilities being vital factor for good hygiene behaviours, it expresses direct relation in most of the disease incidences. Diarrhea, worm infestation and eye and skin infections are diseases related to water and sanitation. Simple hygiene behaviours are key to improving health. Hygiene promotion is therefore recognized presently as an essential part of water and sanitation programmes if the maximum health benefits are to be gained from provision of improved facilities. This research was done in 6 countries; Kenya, Uganda, Ghana, Nepal, India and Sri Lanka targeting behaviours of hand washing, having and using latrines, safe disposal of infant excreta and storing drinking water safely. The main objectives were to assess the level of sustainability of behavioural change one to three years after a hygiene promotion intervention, to develop a methodology for simple, cost-effective long-term monitoring of behavioural changes, to gain insight into relationships between project approaches, external conditions and sustainability of changes in hygiene behaviour and to determine the policy and programming implications of the study finding. Samples were obtained in Ghana, India and Sri Lanka. In Kenya, Nepal and Uganda, random sampling was not practical because there were relatively a few households with latrines in the communities concerned. Therefore a purposive selection was needed. Results and observations were based on comparing with control groups, using baseline data and looking for direct evidence. Effects of external variables as access to water, duration of the project, education and socio-economic status were considered. Study was conducted in two ways: End dates (A comparison was made of projects that ended in different years) and Study Dates (comparison was made of data that was collected at two different times, one year apart). The results showed that hygiene interventions had an impact on aspects of hand washing practice and latrine use and maintenance. Sustainability of hygiene behaviours in terms of behaviour showed that the amount of time since the projects ended did not make much of a difference.

Introduction

The challenge in water and sanitation is indeed a challenge of monumental proportion. The figures are well known: globally over a billion people still lack access to safe and reliable water sources; another 2.4 billion do not have proper sanitation services, and more than 5 million people die each year from water related diseases. Though access to improved water supply and sanitation

facilities has been increasing, it is just sufficient to keep pace with population growth.

As water and sanitation facilities being vital factor for good hygiene behaviours it expresses direct relatedness in most of the disease incidences. Diarrhoea, worm infestation and eye and skin infections are diseases related to water and sanitation. About three million children die from diarrhoea each year. Each of the three common worms (roundworms, whipworms and hookworms) is estimated to infect more than 500 million people. Roughly 6 million people have become blind from trachoma, an eye disease. Good hygiene can help prevent much of this, saving lives and preventing illness. For example, it is estimated that washing hands with soap can reduce the risk of diarrhoea by more than 40%. Programmes to promote hand washing might save a million lives each year. Simple hygiene behaviours are key to improving health. Hygiene promotion is therefore recognized as an essential part of water and sanitation programmes if the maximum health benefits are to be gained from provision of improved facilities.

Our health-related behaviour is partly determined by a complex mix of our knowledge, beliefs, attitudes, norms and customs. Socio-economic determinants and even political factors also play an important role. Without the resources to construct and maintain water supply and sanitation facilities, it is difficult to attain levels of personal, domestic and environmental hygiene conducive to health.

As suggested by WHO, the behaviours such as hand washing, having and using latrines, safe disposal of infant excreta and storing drinking water safely were studied.

Research detail

Donors	:	European Union
Coordinator	:	IRC International Water and Sanitation Centre, The Netherlands,
Duration	:	3 years
Partners	:	Network for Water and Sanitation, Kenya (NETWAS);
		Water Aid Uganda (WAU) working in collaboration with Uganda Association for Socio-Economic Progress (USEP);
		Volta Region Community Water Supply and Sanitation Agency, Ghana (VRCWSA);
		Nepal Water for Health (NEWAH);

COSI Foundation for Technical Cooperation, Sri Lanka (COSI);

Socio- Economic Unit Foundation, Kerala, India (SEUF)

Objectives

The objectives were to:

1) assess the level of sustainability of behavioural change one to three years after a hygiene promotion intervention;
2) develop a methodology for simple, cost-effective long-term monitoring of behavioural changes;
3) gain insight into relationships between project approaches, External conditions and sustainability of changes in hygiene behaviour;
4) determine the policy and programming implications of the study findings as a basis for influencing future policy and increasing the effectiveness of programmes.

Methodology

Main research activities

Initial meetings were held with researchers to design the study, develop the hypotheses to be tested, and to make drafts of the collection tools and questionnaires. At this stage too the data input sheets were designed.

Preparatory fieldwork**,** which included activities such as translating the questionnaires into local languages, training research assistants, field testing and amending the data collection tools. In our studies the training of the research assistants was combined with testing of the tools. Initially the research teams needed to get permission from communities and, in some cases, from the project principals, to carry out the research.

Fieldwork, which included selecting the communities, sampling households, identifying community groups. Research assistants carried out the survey activities and recorded the data in the data sheets.

Analysing the information*,* which included checking the data sheets for mistakes and 'cleaning' the data, making totals for each question and item, entering these into spreadsheets for further analysis. Finally, potential relations among the factors were analysed.

Documenting, disseminating and promoting the use of research findings at the national and international levels have been carried out.

Sampling

Samples in the six-country study were done in Ghana, India and Sri Lanka. In other countries, Kenya, Nepal and Uganda, random sampling was not practical because there were relatively few households with latrines in the communities concerned. Therefore a purposive selection was needed to identify households with latrines so that an adequate sample size could be achieved. The sanitation data from these three countries therefore tells us about households with latrines rather than about all the households in the communities studied. Table 01 shows the detail of the samples in each country.

Results and observations

Comparing with control groups

(Comparing communities or groups that had hygiene education/ promotion with those that did not have the hygienic education)

In Sri Lanka, the intervention communities tended to perform better than the control communities in terms of:

Latrine cleanliness: (the floor free from faecal matter): 92% (72/79) for intervention communities versus 4% (1/22) for the control group.

Latrine shows signs of use: 96% (75/78) for the intervention versus 77% (17/22) for the control communities.

Child excreta is disposed in latrine: 47% (14/30) versus 17% (1 out of 6 households). Only the first of these three sets of figures is significant; however, the trend of each is in the expected direction, with the intervention households appearing to perform better.

In the Indian study, two large communities were selected. The communities had similar access to water supplies and both had latrine subsidies. One had a sanitation and hygiene project intervention lasting 7 years, with a hygiene promotion campaign and education classes. The other had no hygiene promotion or education activities. Comparing the two communities showed:

Hand washing skills: the demonstration of how to wash hands correctly (using soap/ash and rubbing both hands) was performed much better by the project group: 97% (113/117) versus 10% (10/102) for the control community.

Reported hand-washing practice: always washing both hands with soap and water was measured through pocket voting. This showed that the project households were significantly more likely to wash hands consistently: 86% (282/326) compared to 6% (14/222) for the control community.

Table 01. Samples in the six countries studied.

Country	Research Institution	Sample size	Remarks
Sri Lanka	COSI	6 communities 2001:110 HH* 2002:150 HH	In 2003, there were 4 projects (100HH) & 2 control communities (50 HH)
Ghana	VRWSP	10 communities 2001: 220 HH, 20 schools 2002: 220 HH, 20 schools	Sample had 5 communities where intervention ended in 1998; 5 communities ended in 2000.
India	SEUF	3 communities, 346 HH 2002: 10 communities, 345 HH plus informant interviews	Intervention ended in different years from 1993 to 2000.
Kenya	NETWAS International	2001: 6 communities, 215 HH plus 6 women's groups 2002: 112 HH plus 6 women's groups plus one control group, 29 schools	One half of 2001 households were re-surveyed in 2002. Individual survey of women's group members in 2002; group interviews in 2001.
Nepal	NEWAH	6 communities 2001: 77 HH 2002: 150 HH 2003: 242 HH plus focus group discussions	73 HH in 4 hill communities were dropped from the study. Because of security problems. Two of the remaining 6 had 2- year interventions and were surveyed 2 times. Four had one year Interventions.
Uganda	Water aid - Uganda	6 communities 2001:221 HH 2002:180 HH Plus group and informant interviews	2 communities in each of 3 ethnic groups

* House Holds

Location of soap: (for hand washing) within the household; the premise was that, if the materials for hand washing are conveniently located, it is more likely that people will wash their hands. In this study only the project households were likely to have soap and water convenient for hand washing: 93% (113/121) versus 0% (0/102) for the control community.

Household environment: the community with the hygiene project intervention had significantly cleaner household compounds than the control community. 97% (117/121) versus 35% (37/105).

An interesting finding was that there was no significant difference between the project community and control community in:

Knowledge of critical hand-washing times: (before eating and after defecation): 120/120 (100%) in the project households and 81/105 (87%) in the control households. Knowledge was clearly not related to hand washing skills or practice.

Latrine use and cleanliness: This was at the same level for the control and project community. Consistent latrine use was shown by pocket-voting: 95% (311/326) in the project community and 95% (211/222) in the control community. Latrine cleanliness was the same: 94% (117/121) and 92% (92/105 in the control households). This may indicate that promotional activities outside the project have been important.

Using baseline data

(Comparing hygiene behaviours before and later or after the intervention)

Number of households having and using a latrine before and after a project was studied. Baseline information for two communities in Nepal was collected during group discussions and group interviews (Table 02).

In the baseline study from India 'before and after' information was collected from several separate communities (Table 03). From these examples, it is clear that the project made a difference in latrine ownership.

Table 02. Latrine coverage Nepal

Community >	1	2
Initial latrine coverage (%)	0	1
Final latrine coverage (%)	43	55
Rise in coverage (%)	43	54

Table 03. Latrine coverage in India

Community >	Kal	Ang	Koip	Mar a	Kavo	Kap	Neen	Alap	Puth	Kaip
Initial latrine coverage (%)	52	15	55	43	39	18	41	24	32	38
Final latrine coverage (%)	72	41	85	75	72	55	87	71	87	100
Rise in coverage (%)	20	26	30	32	33	37	46	47	55	62

Looking for direct evidence

(Assessing whether people who participated in project activities had better hygiene behaviours than those who did not)

In our six country study, information was collected in communities where the project had ended two or more years earlier. We compared the hygiene behaviours of people and households that had or had not participated in certain hygiene promotion and education activities during the project.

Personal communication: People interviewed in Kenya said that they had heard about latrines and hand washing from other trained women's groups and neighbours had significantly better hand washing practice (p=0.037, OR=1.5).

Attending meetings: Attending small group meetings was one project activity that made a difference in the study in Ghana. People who reported to have attended meetings where hygiene was discussed were more likely to have better hand washing skills as shown by a demonstration (stratified by community: p=0.0014, R=2.20, CI 1.33-3.88).

Attending required hygiene classes: The study in India showed that women who remembered hygiene education classes between 2 and 9 years later were significantly more likely to:

1) have good hand washing practice (p=0.007, OR=2.04, CI 1.05 - 3.96);
2) know that washing hands before eating is important for health reasons (OR 2.9, CI 1.43-6.0); and
3) have household compounds that were clean, free of faeces and other waste (OR 2.8, CI 1.22-6.6).

This was not significant for men, as they did not usually attend the hygiene classes.

Overall exposure to hygiene promotion/education

In the Indian study, hygiene inputs were measured in 8 ways: participation in activities, remembering classes, video/slide shows, drama, competitions, women involved in organization, masons giving messages, and the number of home visits. All of these were shown to have positive links with the hand washing practices reported by all the women of the household, although only one (health education classes, OR 2.04, CI 1.05-3.96) was statistically significant. That these linkages are all in the expected direction itself is significant; the probability of it arising by chance is only about 1 in 50.

From this we can see that project activities such as hygiene classes, group meetings or encouragement by people who had been trained, have had an impact on hand washing behaviour. We can be fairly sure of this since it was studied two or more years after the main project activities ended. It was interesting to note that the more personal activities (attending meetings and classes, hearing from a neighbour) seemed to show more direct impact than the mass activities.

External variables

Access to water

It has been thought that providing water and sanitation services, including providing water in or close to the home can lead to better hygiene behaviours. In our study, we compared households with good and poor access to water. Access was measured in different ways such as the time needed to collect water (Kenya, Nepal), the distance to the source (Sri Lanka, India), the length of queues at water points (Ghana) or the reliability of the supply (Kenya, Ghana).

It should be noted that, in general, access to water supply was fairly good. However, in none of the six studies there showed any significant relation between access to water and hand washing knowledge, skills or practice, or latrine cleanliness and maintenance. Only in one country study, Ghana, did households with very poor access to water tend not to have water and soap conveniently placed for hand washing (Stratified by community: $p=0.046$, OR=0.57, CI 0.35-0.99). This indicates that providing a convenient water service is probably not, in itself, a sufficient inducement to good hygiene practices.

Duration of the project

In the Indian project the duration of the intervention did not appear to be related to behavioural outcomes in the two communities where it was measured. Here it was suggested that the project should last as long as needed to mobilize the community, to organize groups and to carry out the work well. Conversely the duration of the intervention did have some effect in the Nepal

programme. The two-year intervention communities performed better than those with one-year interventions in some elements of domestic hygiene, such as covering food ($p< 0.009$) and in hand washing skills, specifically, rubbing both hands ($p<0.022$).

Education and socio-economic status

In two countries the education of women was related to hygiene practices. Women with more education tended to have healthier behaviours. In Kenya better-educated women were more likely to have hand washing knowledge, skills and practice as well as consistent latrine use. The difference between women with more and less education was significant in all cases ($p<0.02$). In Nepal, women with more education tended to demonstrate better hand washing skills and more frequently placed soap conveniently for hand washing in the household (in both cases $p<0.01$). The indication was that more educated women do better in adopting hygienic practices.

Socio-economic status and behaviours were compared in two studies in India and Sri Lanka. In India, the hygiene behaviours of women were found not to be related to the socio-economic status of the community. Their behaviours were linked rather to the hygiene classes included in the project. Those classes were positively associated with hand washing reported by women (OR 2.04, CI 1.05-3.96), with their awareness that washing hands before eating is important for health reasons (OR 2.9, CI 1.43-6.0), and with their knowledge of the importance of cleanliness of household surroundings, which were free of faeces and other waste (OR 2.8, CI 1.22-6.6). However, in the same study in India for men, the above findings were opposite. Their latrine or hand washing practices showed no significant linkages with previous hygiene promotion activities but were closely linked to the socio-economic status of the community (as rated by the project staff and the government). Apparently the project had little impact on the habits of hand washing or latrine use by males.

The inference was that men who lived in richer communities were more likely to use the latrine consistently and to wash hands consistently. In this (Indian) project women were more involved in hygiene promotion activities than men. So it appears that there is a gender issue. We think that if both men and women had been involved in the hygiene promotion/education activities, there might have been a measurable impact on both men *and* women. Variables such as socio-economic status would then have become less important. As a result of the study the researchers suggested that, in general, if a hygiene (and community) intervention is intense, with a strong gender and poverty focus, these linkages to education and socio-economic status would be weaker.

Other findings

In two country studies, Nepal and Kenya, latrines that were considered easy to use tended to be better maintained. (Nepal $p=0.05$, Kenya $p=0.041$).

Skills are related to practice. People who showed how to wash hands correctly also tended to have better practice. In all three relevant studies the demonstration of good hand washing skills was associated with reported good hand washing practice (India $p<0.00004$, Kenya $p=0.00002$, Uganda for men only $p=0.038$ OR=1.93). Knowledge is not necessarily related to skills. The relation between hand washing skills and knowledge of critical hand washing times (after defecation) was mixed. Hand washing skills were linked with the knowledge of the need for hand washing after defecation for health reasons in Ghana ($p=0.00006$) and India ($p=0.002$) but not in Kenya, Nepal, Sri Lanka or Uganda.

Sustainability of behaviours

Sustainability of behaviours was investigated in relation to end date of the project and start date of the study.

End dates

A comparison was made of projects that ended in different years. In five countries, behaviours were surveyed in communities where the project interventions had ended 1 to 4 years previously. Specifically, data was collected in the Kenya, Nepal, Uganda and Ghana studies from communities where the interventions ended in 1998 and 2000. In one of these countries, Ghana, there were some follow-up visits to the communities by project staff so that the project did not fully 'end' at the specified date. In the sixth country, India, it was possible to collect data for 10 communities where the interventions had ended between 1 and 9 years previously. For the studies in five countries 25 comparisons were made between a behaviour and the end date of the project. The behaviours were: hand washing skills, hand washing practices (person washes hands with soap and water), location of soap/water in the household, latrine shows signs of use, person uses latrine consistently, latrine is the projects compared were 1998 and 2000.

The results show that only 2 out of 25 comparisons made, practiced safe hygiene behaviours more where the projects ended in 2000 than where the projects ended in 1998. This infers that the time elapsed after the projects ended did not make much of a difference. Hygiene behaviours were seen to be similarly sustained whether the projects ended 4 years or only 1 or 2 years before this study.

Study dates

A comparison was made of data that was collected at two different times, one year apart. In our studies, surveys were made in 2001 and 2002, about one year apart. The behaviours compared were the same as before: The data was analysed for four countries. In 17 cases, comparisons were made on hygiene behaviour changes between the two data collection dates. In only one of the 17

comparisons was there a significant change over the one year period, inferring that, in general, the improved hygiene behaviours were being sustained. One exception was in the Uganda where hand-washing skills decreased from 49% (42/86) in the 2001 survey to 35% (76/214) in the 2002 survey. This was significant at the 95% level (p=0.045, OR=0.58 CI 0.33-0.99) with changes seen in two out of three districts.

Conclusion:

Four ways to study the impact of programme interventions on hygiene practices were examined:

1) comparing results of intervention and control groups,
2) showing changes over time, using baseline information,
3) finding evidence of direct links between inputs during the project period in terms of hygiene activities and outputs after the project had ended in terms of hygiene practices,
4) examining some standard external variables such as improved access to drinking water, education and socio-economic levels.

All of this was studied after the projects had ended. This is more difficult than determining the impact of the project during or near the end of the intervention when activities are still fresh in the minds of people. However, evidence of impact was still found even several years after the interventions had ended.

The results showed that hygiene interventions had an impact on aspects of hand washing skills/practice and latrine use/maintenance. Hygiene promotion activities associated particularly with engendering new behaviours were those involving personal contact, attendance at group meetings, required hygiene classes.

The number of years of the intervention did not appear to be related to behavioural outcomes in the Indian project where it was suggested that the project should last as long as needed to mobilize the community and to carry out the work well. Conversely, duration of the intervention did have some effect in the Nepal programme where two-year intervention communities were better than those with one-year interventions in some elements of domestic hygiene and in hand washing skills.

The results indicated that just providing water is not enough to change behaviours, as there were no significant links between access to water and hygienic behaviours.

The results suggested that, if the hygiene promotion and education efforts are intense and with a strong focus on reaching the poor and reaching both men and women (poverty and gender focus), then certain external variables may

fade in importance. Specifically, the external variables that might then have less impact on performing hygiene behaviours may be: the education level of women, the socio-economic status of the community, the difference between women and men in hygiene practices.

Sustainability of hygiene behaviours infers that, in terms of behaviour sustainability, the amount of time since the projects ended did not make much of a difference. Hygiene behaviours were seen to be similarly sustained in projects that ended four years or only one or two years before the study. For the study in India, where the projects ended later, women were significantly more likely to wash both hands with soap and water and were significantly more likely to use the latrine when at home. In other words, hand washing and latrine use practice did seem to deteriorate with time. However, the fall-off was not very great. Even where the project had ended seven or nine years before the survey, about four out of five (80%) of the women were reportedly still consistently using their latrines.

Acknowledgement

This research was funded by European Union, which continued for a period of 3 years.

Innovative approaches to improve hygiene behaviour and access to water in peri-urban coastal areas

Rashika Nishshanka, Keerthi Sri Wijesinghe and Palitha Jayaweera
COSI Foundation, Sri Lanka

Abstarct

The project on 4WS (Women, Well-being, Work, Waste and Sanitation) was implemented in three pilot sites and three control sites in India, Bangladesh and Sri Lanka. The objectives were to (1) introduce cost-effective innovative and replicable approaches to excreta and solid waste management in low-income peri-urban settlements; (2) measurably improve sanitation conditions and practices; (3) scale up the tested approaches, and (4) strengthen interdisciplinary cooperation and implementation skills of the participating research and civic society institutions. All pilot and control sites were located in coastal zones with high water tables, saline water and water contamination by arsenic and iron, which made water supply a priority in all three pilot areas. This has created a need for an added component for water issues in the project intervention whereas there were no such provisions allocated. Thus the project could assist the research communities only with technology assistance. However due to the strong and effective hygiene education programme, communities realized the importance of drinking good quality of water and use a larger quantity of water for personal hygiene which motivated them to construct the facilities, taking precautionary measures using mainly their own financial resources and a limited funds from an another programme. Considering overall project resulted; cost effectiveness on sanitary improvement and solid waste management strategies; measurable improved latrine ownership, latrine usage, safe defecation, solid waste management, water access, environmental impact and gender impact.

Introduction to the research

The need for the action research 4WS (Women, Well-being, Work, Waste and Sanitation) derives from the problems faced by municipalities in densely populated and ecologically fragile coastal areas, to improve environmental conditions by the reduction of soil and water pollution, to cut off health risks to sanitation and water related diseases (still the second cause of death of children under five in developing countries) and to stimulate social and economic development. The absence of sanitation contributes significantly to the poor quality of life and the costs of living of poor households. The potential to collect recycles and reuse biologically degradable domestic wastes for reuse in agriculture has hardly been explored. Access to proper sanitation is low and sanitation programmes focus on containment and dumping and not recycling. Few peri-urban sanitation programmes use participatory approaches that are

gender and poverty sensitive and create employment for women in solid waste collection and recycling and the safe disposal of human excreta.

The project 4WS has concerned the planning and implementation of action research on alternative strategies of environmental sanitation and waste management for improved health and socio-economic development in peri-urban coastal communities in south Asia. The project used an experimental design of three pilot communities and three matched control communities. In the research, five universities and five NGOs from India, Bangladesh, Sri Lanka, The Netherlands and Finland[1] cooperate with local Government in six peri-urban coastal settlements.

The main objectives of the action project were:

1) To measure the cost- effectiveness of technically, socio-economically and environmentally innovative and replicable approaches to excreta and solid waste management in low income peri-Urban settlements in a part of Asia that has lagged behind in sanitation
2) To measurably improve sanitation conditions and practices in six pilot areas
3) To scale up the tested approaches through integration of lessons learned in sanitation policies and implementation programme of local and state governments
4) To strengthen interdisciplinary cooperation and implementation skills of the participating research and civic society instructions through knowledge exchange, cross-regional training and joint documentation of studies, interventions and results.

Methodology

The project used participatory methods to promote the adoption of improved sanitation, hygiene and water supply facilities on the request of the project communities. The research compared the cost-effectiveness of existing sanitation programmes and innovative approaches in the pilot interventions. The project assessed and documented the existing approaches, conditions and practices in six project areas and then introduced alternative ways to contain and recycle human excreta and domestic solid waste for rural-urban

[1] University of Engineering and Technology, Dhaka, Bangladesh; yola College of Social Sciences, Kerala; University of Peradeniya, Sri Lanka; University of Kuopio, Dept. of Environmental Sciences, Finland; O Forum, Dhaka, Bangladesh; Socio-Economic Units, Thiruvananthapuram, Kerala; COSI Foundation for Technical Cooperation, Kandy, Sri Lanka; and IRC International Water and Sanitation Centre, Delft, The Netherlands

horticulture in the three study areas. The matched other three areas did not get any intervention and served as control.

The project activities were started with the inception workshop and followed the selection of study (India; Allepuzha, Bangaladesh; Morelgani, Sri Lanka; Karukupane) and control communities (India; Trivandrum, Bangaladesh; Paikgacha, Sri Lanka; Udappuwa).

In each community, a baseline study was carried out through social surveys using a semi-structured questionnaire on attitudes, practices and conditions regarding environmental sanitation, water and hygiene. In Bangladesh and Sri Lanka, all households were interviewed. In Kerala, household samples covered 25% of the pilot community and 3.4% of the control community. This followed a post survey at the end of the project interventions and it was a replication of the base line survey and conducted November-December 2005 at the end of the project. Comparison of the baseline survey and post survey results acts as the impact assessment of the project interventions.

Baseline survey of the of the pilot and control communities

In Bangaladesh Morelganj and Paikgacha in southwest Bangladesh are areas of comparable size and density. Both are located in coastal zones with high water tables, saline water and water contamination by arsenic and iron. Thumbolly and Shanghumugham in Kerala, India are environmentally and socio-economically comparable low-income peri urban settlements. Both areas have a pipe born water supply with public stand posts. The water is treated and chlorinated, but residual chlorine is not monitored. The supply is irregular and many people depend therefore on a combination of tap and well water. Karukkupane and Udappuwa are fishing communities on the west coast of Sri Lanka. Lacking safe drinking water was the major problem. *Paliya* (sand dune well) is the main water source for drinking purposes. Economically strong people buy drinking water from a private sector water truck.

Summary of baseline conditions in the project communities on water supply is shown in Table 01.

Interventions

Technology - RWH

New technologies and designs were developed in all pilot sites. In Morrelganj, a new type of rainwater harvesting tank (RWH) was developed. This consisted of five rings used for latrines with a cover and piping. This is easy to construct and occupy less space than a large tank. Its costs are Th 3,500 for 1,000 litre storage. Large tanks are harder to pay as they require higher investment (Th 7,5000 for a reservoir of 3,200 litres). An innovation

contributed by the first householder to install the tank was a pet bottle inserted in the pipe just before it enters the tank. This makes it possible to observe when the diverted first flush becomes clear and the water can be guided into the tank for storage and use (Figure 01). In Sri Lanka, sand from the beach was used in the construction of RWH tanks (Fig. 02), which reduced the cost.

In Morrelganj ward no. 5, four women masons have been trained by those trained in Kerala to construct sanitary latrines, rainwater harvesting tanks and composting bins. Two of them have started their own business of a Village Sanitation Centre.

The project has introduced solar disinfection units (SODIS) in the sites in Kerala and Sri Lanka. Water quality tests have been carried out through cooperation of the national NGOs with Kuopio University. The water was analysed for total heterotrophic bacteria, bacilli, faecal clostridia, mycobacteria and algae, to check on risks caused by a dense population, high organic matter contents from vegetation, or contamination from animals and/or construction materials. The local laboratories have analysed the water for faecal coliforms.

Table 01. Summery of water supply conditions in project communities.

Bangladesh – Pilot community Morelganj	Control community Paikgacha
5) 53% of households use ponds and shallow tube wells for drinking water 6) 26% think this drinking water is unsafe 7) No safe source of drinking water is 100%	1) 93% of households use ponds and shallow tube wells for drinking water 2) 22% think this drinking water is unsafe 3) No safe source of drinking water is 100%
Kerala – Pilot community Thumbolly, Allepuzha	Control community Shanghumugham, Trivandrum
1) 90% depend on a combination of tap and well water 2) No safe source of drinking water is 56%	1) 70% depend on a combination of tap and well water
Sri Lanka – Pilot community Karrukkupane	Control community Udappuwa
1) 71% buy pipe born water from vendors	1) Own well 0.67% 2) Purchase from bowser 98.7% 3) Neighbours Well 0.67%

Fig. 01 Innovative RWH tank Bangaladesh.

Fig. 02 RWH tank Sri Lanka.

A first test of the sources at Karrukupone, Sri Lanka showed zero e-coli in the school well and rainwater, and 40 e-coli per 100 ml in the traditionally dug sand dune well. The SODIS sample showed a total of 5000 bacteria before treatment and 4400 afterwards at a temperature of 37 degrees Celsius, 900 before and 500 after at 50^{o} C and zero at a temperature of 60^{o} C. No e-coli were found. Self-testing with H_2S strips in 100 households showed 97% had an E-coli problem. This led to an awareness campaign with the ward, municipality and the media.

Water quality tests of the Pond Filter in the Bangladesh site have been carried out regularly. They showed a negligible number of Total Coliforms/Fecal Coliforms.

Awareness programmes

In all pilot communities the three national NGOs worked with local NGOs. Their staff mobilized and organized the communities to review their situations and identify problems, plan and implement improvements in sanitation and waste management, as well as improved hygiene practices. In the pilots of Morelganj and Karukapane, also improvements of water supply were started as this was a burning problem of the population and their first priority. In Morelganj there was only one Pond Sand Filter, insufficient to meet all water needs. In Karukapane, women and girls from families that could not afford to

buy water were patiently sifting sandy water from a sand well outside the village.

In Morrelganj, Project Management and Advisory Committees were set up and a Young Voluntary Group was formed. The latter was active in promotion work and wrote and performed a play "Death trap" on sanitation and social problems. The play was staged during a sanitation fair, at which community members could see the different types of sanitation hardware available on the market. Thumbolly saw the establishment of an Programme Management Committee, an Advisory Committee (13 members) and a team of ten Volunteers.

In Kerala a strong focus was placed on regular meetings arranged with local community and administration to improve the water and sanitation situation of the area. Local press have published several writings on the objectives and activities of the 4 WS project. Since no public land was available in this area some private property was found which was turned into a vermicomposting unit. The 4Ws programme in Kerala specifically facilitated the municipality to start a decentralized community solid waste management programme in other 5 wards. Booklets on community participation in solid waste management were prepared and distributed. A committee constituted by municipality chaired by district collector for planning solid waste management programme for the municipality authorized Socio-Economic Unit Foundation (SEUF) to prepare a leaflet regarding solid waste management system to be introduced in the municipality.

In the context of Sri Lanka, a strong focus was placed on strengthening self-confidence, motivation, leadership skills, and implementation skills necessary for the participating research and knowledge exchange in the community. Community participation was also clearly reflected in the "Green House" label part of the project. This entailed strong community participation so that each and every household in the pilot areas would eventually have a latrine, compost bin, safe drinking water: SODIS or rain water tank, and bins for the segregation of its household waste (organic and inorganic). A total of 150 households out of 320 have so far received the green label.

Self attempts by villagers to improve their water situation

In Morrelganj, the 4WS project brought a significant improvement in the local water conditions. By the time of the post study, 12 households had a RWH tank constructed by the project masons. Two households share six; so 18 households now have rainwater as a source. All tanks were constructed with 100% household financing. A new pond sand filter for communal use was constructed in the ward by the Bangladesh government. In contrast, the control community continues to have not a single safe water source (Table 02).

Table 02. Safe and unsafe water sources in the pilot and control area in Bangladesh

Source in HH		Morrelganj				Paikgachha			
		Baseline		Post study		Baseline		Post study	
		No	%	No	%	No	%	No	%
STW* /pump	Safe	0	0	0	0	0	0	1	0.3
	unsafe	0	0	266	62	0	0	97	26
PSF**		0	0	1	0.2	0	0	0	0
RWHS***		0	0	18	4.2	0	0	0	0
Well		0	0	1	0.2	0	0	0	0
No safe source of DW		417	100	143	33.3	370	100	275	73.7
Total		417	100	429	99.9	370	100	373	100

*Shallow Tube Well **Pond sand filter ***Rainwater harvesting system

In the pilot community safe use of drinking water grew from 44% before the project to 85% afterwards. Forty one percent of this improvement was due to the rainwater tanks and PSF, which the women masons built after the community people had stressed that the project should include water supply also. Sources of water for cooking were the same as for drinking at the start, but at the post study the number of households that used ponds for cooking had increased. It is however considered that this is not a problem when cooking implies the boiling of the food. In the control community drinking water use remained unsafe.

In Sri Lanka, the main change in drinking water supply are the introduction of RWH tanks (6 build with cost sharing between users and a disaster mitigation fund) and the great reduction in the use of the *paliya* after tests under the project had shown it to be contaminated. Most people now buy drinking water from a private sector water truck (Table 03). Water remains a primary need in the pilot as well as the control community.

Overall research output

Human excreta disposal

At the time of the baseline survey, 79% of the households (330 out of 417) in the pilot community in Bangladesh had a hygienic type of latrine. The post project study showed that at present 100% (septic tank (35.9%), off set toilet with single pit (10.5%) and off set toilet with twin pits (5.1%), direct pit pour flash latrine (48.5%)) of the households has hygienic latrines.

Table 03. Water sources for drinking in the project and control community in Sri Lanka.

	PILOT				CONTROL			
	Baseline		Impact		Baseline		Impact	
	No.	%	No.	%	No.	%	No.	%
Own well	206	32	206	29	2	0.7	2	0.6
Purchase from bowser	255	41	324	45	296	98	325	98
Neighbor's well	74	11	117	16	2	0.7	1	0.3
Public well	0	0	63	9	0	0	1	0.3
Tube well	0	0	7	1	0	0	3	1
Sea and other			5	0.7				
Paliya (sand dune well)	108	17	6	0.8	0	0	0	0
Rain water tank	3	0.4	6	0.8	0	0	0	0
Total	654	100	726	100	300	100	332	100

The situation in the control area is; initially, 42.4% (157 out of 370) had a hygienic type of latrine and this has dropped to 33.8% when asses at the end of the project. The actual use of the latrines grew to 100% for women and men in pilot site. The safe disposal of children's faeces also improved, by 46% to 90%. Sixty six percent of the households use potties now; none did this earlier. Difference of quality of construction and operation of latrines in pilot and control area is 47%.

In Sri Lankan percentage of households with toilets in the intervention village rose from 69% to 89%. Those who shared a toilet doubled from one quarter to half of the households without a toilet of their own. Reporting of excreta disposal being a problem fell from 31% to 16%. In contrast, latrine ownership in the control village rose with only 4% to 39%. In Sri Lanka, children on safe defecation increased by 32% to 83%. All hygiene indicators were better for the pilot community, except the presence of faecal parts in the water: 58% vs. 50%.

In Kerala ownership increased from 75% to 91% and the team did not study children's defecation. The percentage of quality of construction and operation of latrines was 6% less in the pilot area than in the control area.

Women's work

In Morrelganj four women masons have been trained by those trained in Kerala to construct sanitary latrines, rainwater harvesting tanks and composting bins. Two of them have started their own business of a Village Sanitation Centre. They have expanded construction to include also animal watering troughs and garden pots. From the construction yard they also ship these items to other parts of the town.

In Sri Lanka the project had more mixed results providing paid work in sanitation for women. From the trained girls, all of them are now not involve with mason works due to marriages, and due to the negative impression developed from the community for doing technical works by females. Project intervention was resulted the establishment of a Rural Ladies Development Society and it has conducted training courses on bridal dress making, regular dress making, knitting and cookery which finally creates income opportunities for women.

In Kerala the project has led to create a greater diversification of women's employment opportunities; paper bag making, selling worms and compost, growing and selling vegetables and flowering plants and doing masonry work.

Solid waste management

Waste management has improved considerably under the project. In Bangladesh, no one initially segregated waste and made compost, although 87% in the pilot are and over 90% in the control area knew about composting. Now, 68% of the households in the pilot area segregate waste and 29% make compost. In the control area segregation now happens in 14% of the households, but no one yet makes compost.

In Kerala, 500 women have taken up barrel compost making. One plant nursery has been established which uses vermi-composting. In the community of Karukkapane, the demand for cemented compost bins dropped, as people considered them as expensive. The project then switched to the promotion of stick barrels (a circle of sticks surrounded by old fishnets). These have been adopted by 90% of the population. The compost is used for home gardening or is sold to a nearby plant nursery.

Gender impacts

In Bangladesh, initially there was some doubt on whether women in a Muslim community can become leaders or represents a development committee. At first time under the project interventions women from the

community represents a development committee (Project Advisory Committee). Thus there was no women masons project could initiate first women masonry enterprise in area.

In Sri Lanka, trained women did not continue in the masonry work but involved to other work opportunities created through project. In the beginning only the women groups took part in the activities, the major reason being that the local NGO catalyst was a woman and all her contacts in the village were with women. Also as men are fishermen, mostly only women had free time for the project. But eventually, as the village became more aware of the project, and also due to the influence of the church, the males also got involved in the work including public cleaning campaigns at youth club level and small group level. Cleaning beach areas, abandoned land and public places happens at least once every two months.

Women in the project area in Kerala increased their status due to their new knowledge and skills. The greater attention to gender including to the training of men in hygiene has resulted in an increase in male participation in cleaning work from 2% to 11.5%.

Conclusion

Water was burning need of all research communities, pilot and control. Addressing the issues (quality & quantity) related to water were self-identified by the community it self. Though the project did not have funds for such intervention, communities reached to a level in which they've decided to spend their own money to improve the facilities. This was a result of the effective hygiene education programme carried-out. This tells us that the software can do wonders, when played appropriate.

References

Heinonen-Tanski, H., Snel, M., van Wijk-Sijbesma, C., Quazi, A.R., Mathew, K., Werellagama, I., Rahman, M., Rashid, S.M.A., Jayaweera, P. and Judith, H. (2006). Assessing of environmental quality in six areas in India, Sri Lanka and Bangladesh.

Dissemination of water treatment technologies at household level

Saman Amunuthuduwa and Palitha Jayaweera
COSI Foundation, Sri Lanka

Abstract

While long-term water distribution infrastructure might be a community's ideal, the reality is that the investment level needed is not always immediately present. Often, a water source is too far a distance from homes to make conventional pipe distribution feasible. According to the World Health Organization, one sixth of humanity currently lacks access to any form of improved water supply within one kilo meter of their homes. Fortunately, recent research demonstrates that simple, low-cost point-of use interventions at the household and community level are capable of dramatically improving the microbial quality of water stored in the home and reducing the risk of diarrhoeal disease.

Simple household-level water treatment and safe storage interventions can lead to dramatic improvements in drinking water quality and typical reductions in diarrhoeal disease — making an immediate difference to the lives of those who rely on water from polluted rivers, lakes and, in some cases, unsafe wells or piped water supplies.

This paper illustrates the intervention and dissemination of Solar Water Disinfection (SODIS) and Bio Sand Filter (BSF) treatment technologies among the household. .

Introduction

Access to safe drinking water a crucial for the livelihood of the people in rural and peri-urban communities. The contamination particularly microbial may be due to the use of unsafe storage vessels, improper water collection and transport and poor hygienic condition. Many people suffer from chronic poisoning from chemical pollutants such as arsenic and fluoride that comes from the geological nature of location, Effective technologies for household water treatment and storage, in combination with improved hygiene behaviour, can help reduce water-related diseases much more quickly than it will take to design and implement pipe born community water supplies.

Current estimates of the number of people using microbiologically unsafe water are probably low. This is because the water quality testing to assure the safety of water is carried out at the source or at the outlet of the treatment not the consumer handling up to drinking. Protected or improved sources, such as boreholes and treated urban supplies, can still be fecally contaminated during

the handling until it is consumed by people. Another reason for underestimation of the population served by unsafe water is contamination of water during distribution through pipe or vehicle distribution to homes. In some cases the water systems abstract unsafe water from unprotected or contaminated sources and deliver it to consumers with no or inadequate treatment, although these water systems are classified or categorized as improved and safe. Therefore, household level treatment is necessary in the case of uncertainties in the quality of water.

There are various household level water treatment methodologies available and COSI took the initiative to disseminate two such appropriate technologies, Bio Sand Filter (BSF) and Solar Water Disinfection (SODIS) in Sri Lanka

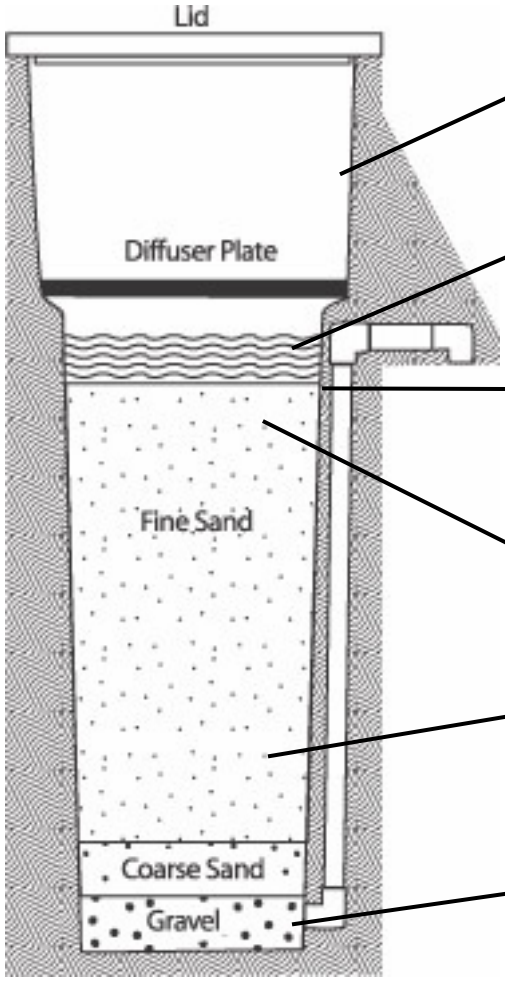
Bio-Sand Filter (BSF)

As shown in Fig. 01, the filter is made up of five distinct regions; the influent reservoir, the supernatant, the schmutzdecke, the biologically active zone, and the sand support and under-drain.

The bio-sand water filter is an invention that modifies the traditional slow sand filter in such a way that the filters can be built on a smaller scale and can be operated intermittently. These modifications make the filter suitable for use at the household or small group level. Household use would simply not be possible with conventional slow sand filtration because of the size requirements and the mode of operation. The specific function of the bio-sand filter is the microbiological filtration. The microbiological colonies must be kept alive for the filter to be effective. In a conventional slow sand filter, oxygen is supplied to the organisms through dissolved oxygen in the water. Consequently, they are designed to be operated continuously. Also, because the water moves through at a slow rate, the filter beds tend to be very large.

Water can be poured into the top of the Bio-Sand filter and the water simply flows through the filter and is collected in another bucket or container at the base of the spout. It normally takes a few minutes for the entire bucket to make its way through the filter. There are no valves or moving parts and the design of the outlet pipe ensures that a minimum water depth of five centimetres is maintained over the sand when the filter is not in use.

When water is flowing through the filter, oxygen is supplied to the biologic layer at the top of the sand by the dissolved oxygen in the water. During pause times, when the water is not flowing, the oxygen is obtained by diffusion from the air and by slow convective mixing of the layer of water above the sand. If this layer is kept shallow, enough oxygen is able to pass through to the micro-organisms to keep them alive and thus effective.



INFLUENT RESERVOIR – Volume above the filter media, which allows for a full pail of water

SUPERNATANT – The standing water layer present during pause periods - Oxygen can diffuse into the water

SCHMUTZDECKE – Layer of slime, mud and micro-organisms, which develops at the sand surface

BIOLOGICAL ZONE – 5-10 cm deep – living layer of micro-organisms

SAND BED – Contains virtually no living micro-organisms

GRAVEL – No living micro-organisms present

SOlar water DISinfection (SODIS)

The Solar Water Disinfection (SODIS) process is a simple technology used to improve the microbiological quality of drinking water. SODIS uses solar radiation to destroy pathogenic micro-organisms which cause water borne diseases. SODIS is ideal to treat small quantities of water. Contaminated water is filled into transparent plastic bottles and exposed to full sunlight for six hours.

Sunlight is treating the contaminated water through two synergetic mechanisms: Radiation in the spectrum of UV-A (wavelength 320-400nm) and increased water temperature. If the water temperature rises above 50°C, the disinfection process is three times faster

Project objectives

The overall objective of the project is to disseminate, facilitate & strengthen the use of BSF and SODIS among the community members and development of partners in Sri Lanka.

Specific Objectives:

1) Identify the communities/organizations who have the potential to use/likelihood to sustain these technologies in the long run
2) Provide backup support services to the BSF and SODIS users and the organizations involved in BSF and SODIS dissemination
3) Disseminate these technologies among non users and with other influential partners & monitor the progress
4) Influence the decision makers (especially the health authorities) to consider BSF and SODIS as a viable water treatment methods at household level

Training of trainers

Two 2 staff members each from 7 partner organizations who are currently engaged in the WATSAN sector (Water and Sanitation) were selected for the initial training for BSF and SODIS. The technology, dissemination strategies, training the community level staff were discussed and taught in the training.

Twenty-three PHI (Public Health Inspector) from Kalutara district and Regional PHI Training Centres also were trained on this issue.

Implementation, monitoring and follow up support

This technology is field tested in many of the developing countries and proved to be successful. However, in Sri Lanka, filed testing has just begun. Present interventions are coupled with awareness programmes as well as hygiene education programmes.

Several local organizations involved with SODIS project in central and southern part of the country were selected. The involvement of the schools in SODIS was promising and found as a better way of promoting since they adopt the method with a good understanding of the technicality.

Treating water before drinking was not common in most of the places. In some places, people said that they drink boiled water but they were not aware on how to boil water in order to destroy the germs. People were more concerning about the taste, odour and the clearness of water and not much aware of the bacteriological contamination and its consequences. Also, some people saw additional benefits of using SODIS such as reducing cooking time and the cost for fuel/fire wood. Poor quality of drinking water, immensity of

water related diseases and plenty of sunshine received were considered as positive factors to introduce SODIS.

COSI planned a target of 1010 SODIS regular users by the end of the project. This target was achieved without any difficulty by June 2006 and progressed better afterwards.

In addition to the above targets and partner organizations, another organization working in the Estate sector started SODIS with their small-scale water supply schemes in Tea Estates in Nuwara Eliya district. Further, several units of NWS&DB (National water Supply & Drainage Board) introduced SODIS in their rural water supply projects. For all these organizations, the training and training/promotional material were supplied by COSI.

COSI assists the partner organizations in supplying bottles, water quality tests, advisory services on technicalities and providing training, training/promotional materials in particular & when & where necessary.

Field visits, interviews and discussions with management, field staff and beneficiaries were carried out initially to monitor the progress. Further, a proper plan was developed for monitoring after the interactive discussion held in the mid–term review meeting.

Achievements

Usage summary

Total Target households = 1010 by June 2003 and 5000 by June 2004

Analysis of users (by September 2003):

1.	Households actually covered	2288	
2.	Regular users	2148	(93.9%)
3.	Irregular users	97	(4.2%)
4.	Non users	43	(1.9%)

The main reasons for the regular usage of SODIS are:

1. To be free from water related diseases
2. To reduce the cost for fuel/fire wood
3. To reduce Housewife's cooking time

Lessons learned

1) Making the state officials in the water and health sections at provincial level aware on SODIS is helpful in convincing people.

2) Introducing both glass bottles & PET bottles together and making the users to choose what is best is appropriate especially in places where the PET bottles are not abundant.

3) Though SODIS would be incorporated in other integrated projects, there should be at least one full time field officer only for SODIS recruited either by implementing agency (COSI in this case) or the partner organization.

4) SODIS activities should be started in parallel or initially with the schools in the area. Introducing SODIS in schools is more promising and this should be done by interactive discussion with students incorporated in similar subject matter like science, health.

5) Each advantage of using SODIS should be highlighted when promoting SODIS since reducing water related diseases in not the only fact that strike users accord.

Suggestions

SODIS and bio-sand filter is proved to be efficient but need further research and promotion. It is the responsibility for the government, NGOs, Universities and other relevant organizations to take this further, which will certainly improve the livelihood of the Sri Lankans.

Further technical information can be obtained from;

Bio-sand filter:	www.cawst.org
SODIS:	www.sodis.ch

Strategies adopted in a short-term rural water supply project in Matara district

J. D. Aubrey
GOAL[1]

Abstract

This case study examines an approach through which short- term international development agencies, prevalent in Sri Lanka in the aftermath of the tsunami, can undertake long-term rural development projects, typically associated with more permanent institutions. To do this, a rural water supply programme carried out by GOAL in just over one year is described. Here, GOAL has attempted to minimise the risk of failure, accompanying its short-term mandate, by adopting tried and tested principles derived from a well-established, home-grown rural development programme, namely the World Bank's Rural Water and Sanitation Supply Programme (1993-1998). To ensure the long term success and sustainability of the programme, GOAL has created partnerships with community based organisations (CBOs) which represent the communities in the development of the project brief and carry out the long term operation and maintenance of the programme. The case study evaluates the potential of partnerships with CBOs in the implementation of rural water supply programmes and discusses the value of replicating on a smaller scale, locally established development practices.

Introduction

Following the tsunami of Dec 2004, the international development agency GOAL came to Sri Lanka to undertake a tsunami recovery programme. GOAL intends to be in Sri Lanka for approximately two years. A strong component of the programme includes support to the 'shadow' tsunami affected community – i.e. those who are not directly affected by the tsunami, but indirectly affected through location, who are also experiencing poverty or neglect and are likely to suffer further inequity through the disproportionate level of assistance aimed toward those who are directly affected by the tsunami. Typically for such populations GOAL has implemented programmes for livelihoods support, water supply and housing support. This case study describes a rural water supply programme in Matara District where CBOs have played a central role at the planning stage and will take responsibility for operating and maintaining the water supply thereafter. The paper makes reference to the historic context of CBO activity in rural Sri Lanka and describes the World Bank funded Rural Water and Sanitation Supply Programme (from 1993) which forms the

[1] GOAL is an international development agency based in Dublin. It has been in Sri Lanka since December 2004 and mainly focussing on post tsunami assistance.

backbone of GOAL's smaller scale intervention. The paper then explains GOAL's project and discusses whether the approach of replicating an existing successful programme and partnering with CBOs may be a means through which short-term INGOs can implement successful development projects which would more usually be carried out through longer term partners.

Background

85.3% of Sri Lanka's population lives in rural areas. Only 14% of Sri Lanka's rural population has access to piped water. 70% of the rural population's domestic water is extracted from shallow wells, a large proportion of which are not protected against shallow water run-off. 43% of the rural population does not have access to safe water and the use of contaminated water such as unprotected wells and surface water leads to the transmission of water-borne diseases such as typhoid, cholera, diarrhoea, dysentery and viral hepatitis A (Abayawardana & Hussain 2002). Livestock and human settlements are the main source of this bacterial contamination.

In keeping with the UN's Millennium Development Goals, the Government of Sri Lanka aims to ensure access to safe drinking water for its entire population (just under twenty million) by 2025 and aims to provide safe drinking water to 85% of the population by 2015 (Hewage, 2005). Central to the government's plan for achieving this goal is the National Rural Water Supply and Sanitation Policy (2001), which embraces the following principles:

1) Demand-responsive and participatory approaches to service delivery
2) Beneficiaries contribution to capital costs and full responsibility for operation and maintenance
3) Behavioural change and hygiene promotion as an integral part of government programmes in the sector (World Bank 2003)

Context - The rural water supply and sanitation programme

These principles were developed through the World Bank funded Rural Water Supply and Sanitation Programme (RWSSP). RWSSP was initiated as a pilot project in 1993 and was rated by the World Bank in 2000 as its "best managed and implemented rural water supply and sanitation project worldwide" (Ediriweera, 2005). Following the success of the pilot programme, RWSSP is currently in its second phase and aims initially to provide safe water and sanitation approximately 940 rural villages in the Central and North West Provincial Council (World Bank 2003). Fundamental to the programme is its 'ownership' by CBOs who are assisted by facilitators from partner NGOs or the private sector. For each community, the project cycle is approximately 23 months. CBOs carry out participatory surveys where necessary information for planning is gathered by small groups within the community and analysed collectively. While being an effective method of identifying focus areas for

community action, Ediriweera (2005) the deputy director of RWSSP phase 2, notes that "analysing their own data encouraged (community members) to identify their own solutions and work collectively towards achieving solutions in a sustainable manner." Using the data as a basis for intervention, the CBOs prepare Action Plans for five components of the programme with active community participation in both planning and implementation.

1) Hygiene Education
2) Sanitation
3) Environment
4) Water Supply
5) CBO diversification.

The programme encourages a "Demand Responsive Approach" (DRA), which requires beneficiary communities sharing capital costs and covering operation, maintenance and future replacement costs through financial and labour input. Consequently, CBOs plan their proposed interventions within the framework of what communities can afford and what they prioritise.

In parallel with implementing community water supplies, the programme provides institutional support for the Government of Sri Lanka. This includes building the capacities of implementing entities from district and provincial level authorities to local authorities.

Sunil Silva, a consultant to the programme, attributes much of the success of RWSSP to the CBO culture that has existed in Sri Lanka's rural communities for centuries (Silva 2006). Historic community organisations such as Farmers Societies, Tank Societies, Funeral Assistance Societies and Community Credit Societies are still prevalent today. This established precedent allows relative ease in the formation of new CBOs and promotes a healthy level of trust in the approach from within the community. The CBO approach allows each beneficiary the opportunity to participate in decision-making and provides access to a forum though which her/his opinion can be made known. This makes for individual and collective empowerment to engage in issues that affect the community.

GOAL's Rural water supply programme

The selection of beneficiary communities for GOAL's water supply programme was based on a needs assessment carried out by GOAL in collaboration with the water board and the Local Authority community services officer. In some areas the terrain was such that mains water pressure would be inadequate to reach communities, rendering them unlikely to receive a water-board supply in the future. Such locations became a high priority for GOAL. Once villages were identified, GOAL prepared hydrology tests and contracted

local companies to dig boreholes. As GOAL had no previous experience in rural water supply in Sri Lanka, it was appropriate to contract a national consultant that could plan the programme and direct its implementation. As community participation would be a key element to ensure the sustainability of the programme, it suited GOAL to contract a single consultancy that could facilitate social mobilisation activities; more normally associated with NGOs, as well as provide technical and contractual services. It is interesting to note how through programmes such as RWSSP, private companies in Sri Lanka have extended their services to include social mobilisation activities. Experience with RWSSP or similar programmes implemented in partnership with CBOs became an essential factor in GOAL's selection of a consultant.

The consultancy service included the provision of a Community Development Officer (CDO). The CDO identified the village headman and leading figures of the communities such as teachers and religious leaders and discussed with them the intention of the programme and the need to work through a CBO. A meeting then took place in each community under the facilitation of the CDO where a CBO was voted in if not already in existence. In most communities a member of each family was represented in the CBO. The CBO then registered itself with the Local Authority Department of Social Services, set up a bank account and prepared a constitution. The constitution included a register of members, responsibilities of the office bearers and conditions under which each member is bound. All members then contributed to a start-up fund. To ensure transparency, annual general meetings and regular financial audits were timetabled.

The CBO collected data from each family to determine their water supply needs and their ability to contribute towards the operation and maintenance of the programme. With the assistance of the consultant, this data was translated into a programme proposal that was agreed through consensus by the CBO. Based on this, the consultant prepared a detailed design and a bill of quantities that was approved by GOAL prior to tendering to a contractor. Typically water is pumped from a borehole to a storage tank at high elevation via a de-ionisation plant where necessary and gravity fed to communal stand posts via a piped distribution network. In many communities the CBO preferred to have individual household supplies and contributed to the costs of providing metered yard posts. Typically families that were unable to contribute were subsidised by the CBO. Other than metered connections, GOAL funded the entire construction work and handed the completed work over to the CBO. In many communities the CBO agreed to allow the Local Authority to administer the water supply programme through the water board. In Sri Lanka the Local Authority has a mandate over water supply and regulates rates. In all cases the CBO took the responsibility of collecting rates. Where communal stand posts are used each family contributes equally and where metered supplies are in place, families pay in accordance with consumption. The first 15 units are charged at a rate of approximately 15 Sri Lankan rupees per unit and beyond

this are charged at 50 rupees per unit. This system aims to maintain affordable rates for poorer families and to promote modest consumption. Rates are generally in line with national water-board rates. Where the CBO took control of the water supply system, the consultant provided training to selected members of the community for operation and maintenance. The consultant also provided financial training for the CBO treasurer.

GOAL felt that the role of the CBO was significant for the following reasons:

1) The system allowed transparency which could otherwise be open to corruption if left to an individual within the community
2) The participatory approach was successful in that individual needs were represented
3) Responsibility and ownership was shared
4) The mechanism of consensus allowed the needs of the majority to be met
5) Where individuals were vulnerable or less able to contribute to capital costs (such as the metered yard posts) the CBO was usually able to support or subsidise
6) The system on the whole promoted cooperation and communication between members of the community
7) CBOs now formed had the potential fulfil other objectives such as further rural development initiatives or could implement other donor assisted programmes
8) A community fund was in place which could be put to use as an emergency fund in the instance of a natural disaster
9) The CBO is a political force and a mechanism for representation within the local political structure

The difficulties GOAL encountered with CBOs included the following:

1) CBOs were often difficult to form in a short space of time
2) CBOs often became demanding
3) In some instances CBOs could collectively act against individuals within the community, although in most cases the detailed constitution would protect against prejudice

Discussion

GOAL, as outsiders with a limited timeframe in Sri Lanka, has found advantageous the approach of getting acquainted with the research and

development carried out in country through local institutions and replicating or adapting well-established, tried and tested processes. This approach ensures the programme to be culturally appropriate and reduces the risk of errors or failure. Partnerships with organisations (NGOs, Government institutions and private sector) that have developed the principles or have extensive experience of implementing them have also proved successful. In other sectors GOAL has incorporated a similar approach. Tsunami housing reconstruction has been implemented in partnership with National Housing Development Authority (NHDA) and benefits from NHDA's experience of more than two decades in the owner driven Million Houses Project. Similarly a sustainable waste management programme has been carried out in partnership with Sevenatha, a local NGO, which draws on its wealth of experience and research locally.

Given time restrictions, there is a significant risk that programmes of this nature are not sustainable, as the donor/implementing organisation is not available on the long term to monitor, evaluate and offer post-completion support as may be required. GOAL has found in Sri Lanka the prevalence of the CBO culture a route to facilitate long-term management of development programmes. However, there were significant limitations in this programme, which arose as a consequence of the short timeframe in which the programme was implemented. These are discussed below.

The first limitation relates to under utilisation of CBOs. As previously stated, a "one-stop-service" consultant coordinating both engineering and community development services was attractive to GOAL. However, as the consultant's brief was to create a sustainable rural water supply programme, its facilitation of the CBO's activities was directed almost entirely toward this end. Silva (2005) in his paper Governm*ent, NGO and private sector collaboration for the successful implementation of CWSS projects points* out that the "key concept of the (RWSSP) project is to build institutional capacity through a community based approach so that the entire community is galvanised for a holistic development." As such the CBO should be a "development centre, which undertakes several development activities throughout their network and not only water and sanitation." He further notes that the sustainability of CBOs "is based on the diversification of its activities" (Silva, 2005). Here the two issues go hand in hand; a CBO has the potential to fulfil a vast range of community development functions and that through such diversification a CBO can become self-sufficient and therefore sustainable. The extent to which a community should rely on CBOs versus government and private institutions is beyond the scope of this study and is likely to vary with location, however, it would suffice to point out that through orientating a CBO towards a single function, an opportunity is missed for a community. This is not to say that CBOs created through GOAL's intervention will not be sustainable and that they will not in future diversify, but had appropriate capacity building been in place from the outset, the CBO could have been geared towards holistic development and could have existed to fulfil a wide range of development

activities, with water supply acting as a starting point rather than an end in itself. Given more time, this could have been possible, and it is likely that a community development based NGO would have been a more appropriate facilitator than a private engineering company whose mandate was purely to deliver a sustainable rural water supply programme.

The second limitation of the programme was its post-tsunami, short-term, quick spend nature. In order to complete the programme in a short time it suited GOAL to implement the construction entirely though contracted labour. In comparison, for RWSSP Phase 2, the World Bank funds only 61% of the physical investment (WB 2003) leaving a large proportion of the costs to be met by the beneficiary community through direct labour or financial contribution. While the scope of this study cannot extend to include a discussion of the merits of "sweat equity," the contribution to capital costs by the beneficiaries fosters a sense of community ownership and reinforces the ceiling of the donor's contribution. GOAL, in retrospect, found that not requiring contributions from the community for capital costs went against the spirit of participation that the programme should have promoted. Many CBOs, instead of actively building up their own capacity and resources, adopted a take-take attitude. In one village for example, GOAL perhaps mistakenly offered to buy land on behalf of the CBO on which to place the storage tank and associated plant. The CBO president, who conveniently owned the land, demanded way over the market value of the land and despite numerous CBO meetings to resolve the matter, the president would not back down. GOAL had to eventually withdraw its assistance to this community.

Lessons learnt

Lessons learnt by GOAL through this programme can be summarised as follows:

1) It is possible for international development agencies working in Sri Lanka on a short-term basis to implement programmes that are intended for long-term purposes through effective collaboration with CBOs.

2) CBO partnerships are likely to be more relevant if supported by through government institutions. The Rural Water Supply Policy advocates the roles of CBOs and formed an appropriate context for GOAL's intervention

3) Replicating or adapting an existing, well-established programme saves having to reinvent the wheel, and is therefore a useful approach for short-term agencies. This should ensure that methods of implementation are culturally appropriate and should minimise errors and failure.

4) Often only certain aspects of well-established programmes can be implemented through short-term programmes. It is therefore important to fully understand the original programme before making omissions. In this case a core feature of the RWSSP programme, which was to strengthen

CBOs to pursue holistic development, was only minimally achieved through directing the CBO towards a singular objective. Likewise, the spirit of participation was hampered through GOAL's willingness to cover the majority of capital costs.

Conclusion

The success of the RWSSP programme and the corresponding government policy on rural water supply is a strong indicator that CBO implementation is a significant way ahead for rural water supply programmes in Sri Lanka. RWSSP is well documented and through it capacity has been built in government institutions, private sector and NGOs for community-based intervention. Through adopting the principles of the programme and partnering with institutions experienced in its implementation, it is possible for a short-term international development agency to carry out smaller scale rural water-supply programmes in Sri Lanka. While doing this, care should be taken to fully understand the principles of original programme. Omissions from this, that are likely to be inevitable owing to the tight timeframe and smaller scale, must be carefully considered.

References

Abayawardana, S and Hussain, I. (2002). *Water Health and Poverty Linkages: A Case Study from Sri Lanka.* Paper prepared for the Asian Development Bank Regional Constitution Workshop on Water and Poverty, Dhaka.

Ediriweera, I.V.W. (2005). *Strategies Adopted for Sustained Water Supply and Sanitation through Community Participation in Sri Lanka*. Paper prepared for the 31st WEDC International Conference, Kampala, Uganda

Ediriweera I.V.W. (2006). Interview with Author

Hewage, T. (2005). *Development and Water Supply of Sri Lanka* Statement Delivered to the High Level Segment of the 13th Sustainable Development Commission on the Millenium Development Goals

Silva, S. (2005). *Government, NGO and Private Sector Collaboration for the Successful Implementation of CWSS Projects.* Paper prepared for the 31st WEDC International Conference, Kampala, Uganda

Silva S. (2006). Interview with Author

World Bank. (2003). Project Appraisal Document on a Proposed Grant in the Amount of $39.8 Million to Sri Lanka for the Second Community Water Supply and Sanitation Project.

Capacity building of farmers in the conflict affected areas of Sri Lanka

P. Puvaneswary
LIFT Project, CARE International Sri Lanka.

Abstract

The long-standing conflict in Sri Lanka has inflicted a heavy cost on people and institutions in the country, particularly in the North and East. The needs of people living in the conflict-affected areas are largely unmet. They face restricted movement, limited access to resources and services, little social capital, and almost no effective representation. The Local Initiatives for Tomorrow (LIFT) project, supported through CIDA, aims to improve the ability of Community Based Organizations (CBOs) to provide communities with the tools to access and manage local resources, and to empower CBO members to genuinely engage themselves in processes related to achieving basic human needs and rights. The primary approach used, that is, Farmer Field School (FFS), has its foundations in adult, non-formal education principles. It emphasizes learning by doing and empowering farmers to actively identify and solve their own problems. Small agriculture-related infrastructure and food production are two key components of LIFT. The focus is twofold in terms of building technical and institutional capacity. Agriculture groups address issues such as increasing production and reducing the cost of production. Water user groups rehabilitate minor tanks and agricultural wells (agro-wells) and develop forms of community management, which consider the multi-purpose, multi-user nature of water resources. Thus far key impacts include: a strong engagement of project participants, especially women, in community issues beyond those of agriculture and water resources; improved empowerment of women; the development of a diverse set of functional linkages; improved household economic performance through improved water resources and farm management; a decrease in local level conflicts and considerable increases in social capital; and local level advocacy by communities. While important in their own right, technical interventions and outcomes in water resource use and agriculture were key entry points to capacity building work that resulted in institutional strengthening. In collaborating with communities to develop and make more efficient use of resources, LIFT has focused more on people and local institutions than on the resources themselves.

Introduction

The long-standing conflict in Sri Lanka has inflicted a heavy cost on people and institutions in the country, particularly in the North and East. The physical and social needs of people living in the conflict-affected areas are largely unmet and their livelihoods suffer as a result of restricted movement,

limited access to goods and social services, no capital, and a lack of effective representation. The availability of technical services serves as another constraint. Massive and multiple displacements, as well as out migration, have also created confusion with respect to the availability and ownership of land. Displaced individuals and families often occupy abandoned houses and lands while many farmers cultivate the land and resources of others. Also, community-based organizations (CBO) have become very weak or even non-functional. This has directly influenced the level of poverty in those areas since community work that should have been carried has not been undertaken (Ekanayake, 2004). The current reality is that rural, civil society has become weak as a result of war, and this condition greatly impedes livelihood security.

The Local Initiatives for Tomorrow (LIFT) Project is supported through CIDA (Canadian International Development Agency), and is implemented by CARE International - Sri Lanka. It aims to improve the ability of community-based organizations to provide communities with the tools they need to access and manage local resources and to empower CBO members to genuinely engage themselves in processes related to achieving basic human needs and rights. The project is addressing a range of issues that constrain the most vulnerable communities in the conflict-affected areas of Jaffna, Batticaloa, and the Wanni.

Project environment

The project is implemented in areas that are characterized as the 'dry zone' of Sri Lanka. The rainfall is highly variable and erratic and farmers perceive this as a worsening trend. The dry zone is subjected to recurrent drought and flood events. Obviously, the availability of water is essential for food production both in *maha* (wet season) in terms of supplementary irrigation to minimize the impact of rainfall variability, and in *yala* (dry season) for crop production. Smallholder farmers in the target areas are generally beyond the reach of the major irrigation systems and depend on minor tanks and shallow agricultural wells (agro-wells) for irrigation. Where irrigation is not available, infrastructure has been destroyed and neglected, and poor water management is practiced, the crop yields remain low, and unstable.

The war has resulted in heavy land degradation including salt water intrusion and the clearing of land for cultivation and other purposes. For example, after the Jaffna peninsula was cut-off from other districts in 1990 and movement of goods and timber was restricted, all requirements for timber and firewood were met from within the district. A number of bunds and structures constructed for seawater exclusion were breached and large tracts of productive land were mined.

It is important to note that when the project was initiated in 2002, there were relatively few dynamic CBOs in the conflict-affected areas that could assist communities develop themselves socially and economically through

collaborations with various stakeholders to, in part, access local resources and technical services. Nor could these local organizations provide a voice for community members.

LIFT's key components

Agriculture and fisheries remain the chief, natural resource-based economic activities in the North and East of Sri Lanka. The majority of the population living in the rural areas obtains a sizeable amount of its income through agricultural activities. As a result of the conflict, the overall decline in the agriculture production in the North and East is about 40%, as compared with pre-conflict production levels (Arunathilaka, 2001).

Small, agriculture-related infrastructure and food production are two key components of LIFT. Food production partly addresses the food security constraints in target areas where limited crop surpluses for sale, limited markets, and low levels of household nutrition result in subsistence lives for farming families. The food production and infrastructure components focus on the following areas:

1) Low External Input Technologies (LEIT) for field crop production,
2) Bio-Intensive Home Gardening (BIG) to increase the production and variety of vegetables produced and consumed by households – the component focuses on women participants,
3) Develop farmers' technical and decision-making capacity and generate functional linkages to improve access to support services. Also to enable farmers to advocate on their own behalf, and
4) Develop a method to manage and maintain water resources in a setting in which there are multiple uses and multiple users of the resource.

The food production and agriculture infrastructure components are complementary and share the same approach, that is, field schools.

The purpose of this discussion is to share the lessons learned from interventions that focus on the capacity building of human resources and local institutions (through the farmer field school approach) as much as on physical infrastructure and technical assistance.

Method

The farmer field school (FFS) approach has its foundations in adult, non-formal education principles, and emphasizes learning by doing and empowering farmers to actively identify and solve their own problems. By analysing the observations in their fields and study plots, farmers develop the ability to make more effective management decisions. Over the FFS cycle, farmers assume responsibility for organizing the field school, developing its curriculum,

managing its activities, and developing its future. Farmer Field Schools can be thought of as having three outputs or products, which represent higher levels. First, a technical output provides farmers with enhanced technical skills. Empowerment is a second and higher-level objective. This would see farmers having improved analytical and critical thinking skills that would be used to identify and address agriculture issues with other farmers in the community. Further, these strengthened problem-solving skills allow farmers to address a wider range of issues. The third objective; social mobilization would have farmers collaborating with other members of the community to organize action relating to agriculture and potentially non-agriculture issues. The field school, at this stage, can become a local institution or resource. A description of the approach used in LIFT is provided in Rashid and Lewinsky, 2002.

The specific details of the field schools in LIFT are based on the analysis of the livelihoods context of the target group (for the most part, vulnerable, marginalized, and poor farming households). The project uses an intensive, one year process of capacity building that places much emphasis on commitment and action by villagers for their own mutual and individual benefit.

The steps in the field school approach LIFT employed are (Figure 01):

1) *The transect walk*: for approaching a village and talking about things of local importance. This is the initial step to develop rapport and build trust with the community.

2) *Community meeting*: to inform the community in greater detail about the project, discuss scope and major strategies, and to identify which members are keen to participate, through presenting the selection criteria

3) *Formation of Farmer field School*: starts the process of members getting to know each other, establishing group norms, clarifying the members expectations and roles, and entering into a learning contract

4) *Resources and risk identification/mapping*: identifies risks and available resources in the community. The resources and risks are mapped and there is an analysis of access and control of resources.

5) *Participatory Needs Assessment*: identifies problems/issues that the group members have been encountering, as well as the causes of the problems. Problem analysis is an important part of the PNA that helps the group to identify learning needs for the year. The emphasis is on the field school developing its own curriculum.

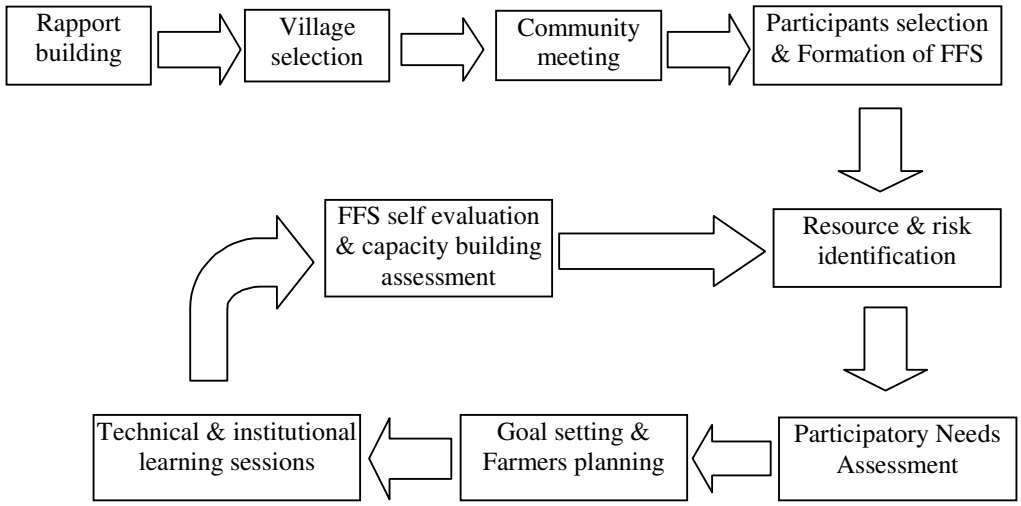
6) *Farmers' planning*: helps members to prioritise needs and develop an action plan for the year. In order to develop functional linkages and prioritise action points, the availability of local institutions are also discussed in the planning process.

7) *Learning sessions*: are designed to provide specific technical and non-technical knowledge and experience to the members. It helps them to learn about specific issues through analysing their own experience and using outside sources of knowledge. Several activities such as undertaking specific trials in study plots, visiting other farmers, and inviting local service providers to the community for discussion, are used.

8) *Participatory Monitoring & Evaluation*: is used to allow participants to set their own goals, and indicators of success. It allows them to discuss their results and the reasons behind them. It also allows the participants to manage their institution based on an analysis of what worked and what did not.

Learning sessions are held, generally twice a month with follow-up visits taking place in between. The follow-up sessions allow staff to provide technical assistance and evaluate how participants have understood the material covered in the learning sessions.

Figure 01: Field school cycle



Village selection and the formation of field schools

Village selection is initiated with detailed briefings and awareness discussions with relevant stakeholders such as Government Agent, Divisional Secretary, Grama Niladhari, the local authority, and other NGOs already working in the area. The final selection is confirmed with visits to the village through discussions with community members and leaders, and CBOs. The field schools management committees (or executive) are formed during field school formation.

Village selection criteria include the economic status of the community and its vulnerability and degree of marginalization; the potential for expanding areas currently under cultivation; number of potential beneficiaries; current condition of the seasonal tanks, wells, and related infrastructure; the ability for repairs to be carried out with limited external inputs; and other potential uses of the water sources.

Staff members having technical backgrounds in agriculture and infrastructure facilitate the programme. Since the capacity building of participants is a main objective, staff require excellent facilitation and analytical skills and, in actuality, these types of skills are more important than technical skills.

While the field school approach is used both for the members of food production and infrastructure components, the specific activities undertaken by each group differs. Water Users Group (WUG) members consist of both farmer field school participants as well as non-participants, that is, other members of the community.

Monitoring and Evaluation

Both primary and secondary data that are both quantitative and qualitative in nature are collected from the field at regular intervals to serve the project's monitoring and evaluation system. The system is composed of both a quantitative, logframe-based component and a participatory (participant-based) component. Methods include baseline/post intervention surveys, social mapping, household interviews, and case studies.

The Participatory Monitoring & Evaluation (PM&E) component is important as a monitoring tool that allows farmers to plan their activities, monitor and evaluate the results of their efforts during the season, and draw conclusions.

Results and discussion

Farmer Field School (FFS)

The FFSs are of mixed gender and consist of about 30 individuals. Thus far, the project has assisted communities develop 120 FFS that are benefiting about 3,567 primary recipients, of which 46.5% are women. The field schools focus on rice production as well as other field crops, with, the curriculum being determined for the most part, by the field schools themselves.

Through technically focused learning sessions, farmers enhance technical skills, especially those associated with Low External Input Technology (LEIT); for example, integrated pest management, use of organic fertilizers, composting, efficient water use, and inter-cropping, which has allowed them to decrease the average production costs from 3 to 42 %, depending on the crop.

The number of LEIT practices used by participants has increased by six, from the average baseline values. Discussions with participants clearly indicate that the environmental benefits associated with LEITs are an important consideration for them. The learning sessions and the use of study plots also improved farmers' analytical and critical thinking skills. This has given them the confidence to begin to identify and consider wider agriculture issues, such as marketing, in addition to non-agriculture issues, with other community members.

Critical to the field schools' impact are non-technical learning sessions that focus on subjects that include participatory planning, conflict resolution, decision-making and communication, leadership, gender, health and nutrition, and the community management of resources. A further important result of the field schools was the increase in functional linkages with service providers, including the local Department of Agriculture offices and the Agrarian Service Centres.

The bio-intensive gardening (BIG) programme, which is also based on the field school approach, is undertaken with women, as they indicated that this was an appropriate activity for them. Figures 2 and 3 indicate the increase in the number of varieties of vegetables harvested and consumed, respectively. The sale of excess produce contributes to household income whilst sharing vegetables with neighbours has increased community interest in BIG. Generally, 80% of the production is used for family consumption and 20% for sale. Income is used for savings, often in the form of gold as it is easily transportable and negotiable, and for the purchase of essential household items. This has been important since most of the villages have been displaced at least once during the conflict and have lost much of their less transportable assets, and consequently their wealth (Adair and Coomaeraswamy, 2006).

Further, women indicate that through their work in BIG the degree of social cohesion or social capital has increased. In fact, this is often stated as the most important benefit. They also state that they are able to channel more resources toward the education of their children. Thus, participants discuss the benefits of bio-intensive gardening as including nutritional, educational, economic, and social.

Water User Groups (WUG)

Farmers in LIFT's working areas in Batticaloa are more likely to rely on individual wells that are often used to irrigate small vegetable plots at their houses. These wells are often temporary structures known as "madu" which must be excavated prior to each cultivation season. As the villages consist of dispersed homesteads, two to six households share a common well for home gardening and domestic needs. In Wanni, shallow, large diameter wells with or without concrete structures are shared by one to three households, as homesteads are further apart from each other as a consequence of relatively

larger land holdings (than in Jaffna, for example). The depth of groundwater and diameter of the wells varies in Jaffna. Coastal areas have shallow wells with larger diameters while deep wells are present in the interior areas. Well water was normally shared with three to six families.

Water User Groups consist of both men and women and are limited to about 30 individuals, both from FFS and other members from the village. WUGs follow the same basic cycle as FFS. By the end of the project's fourth

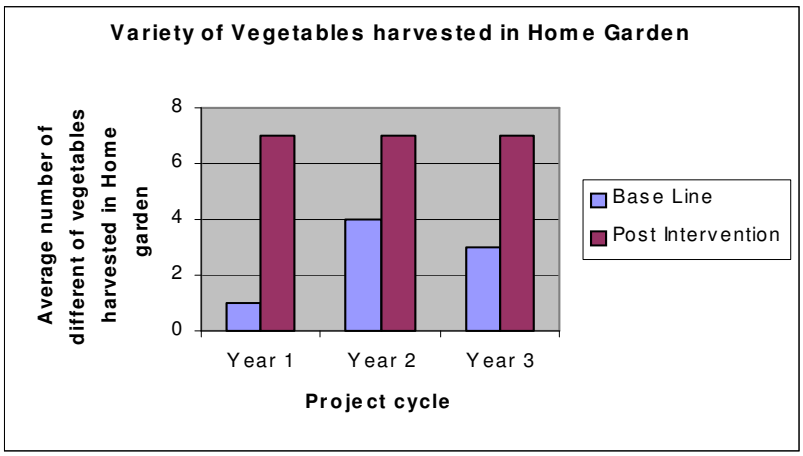


Figure 02: Average number of vegetable varieties harvested in home gardens.

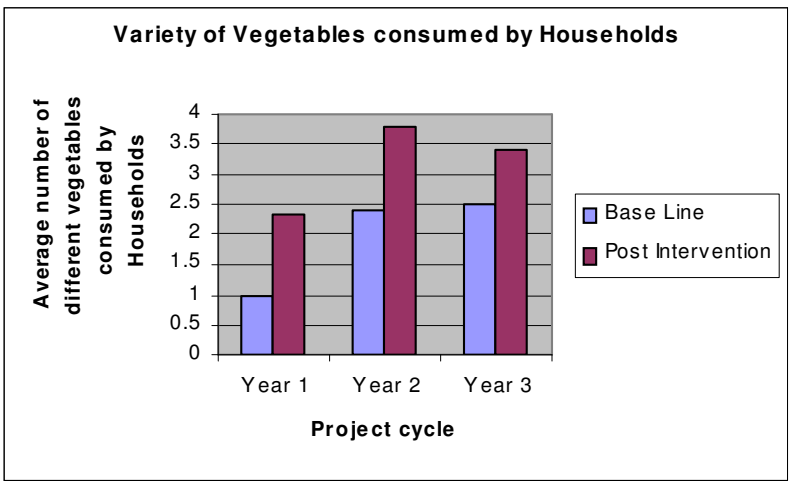


Figure 03: Average number of vegetable varieties consumed by households.

year, 85 WUGs have been formed. A total of 555 agro-wells and 14 minor tanks have been rehabilitated to increase the availability of water to expand agriculture production. WUGs can propose other structures for inclusion in their programmes as well.

Prior to renovation, tank utilization patterns are analysed. Uses generally include food crop cultivation, watering of livestock, drinking, bathing, washing clothes, and inland fishing. Management of the water resource in relation to the various uses is often not considered and the responsibility for use is not always clear. Hence, conflict over water usage is not uncommon.

After selecting the water resources to be rehabilitated, the field school sessions focus on planning the work and the management of water resources based on multiple uses by different water users. Key issues discussed include prioritising water uses, the management and maintenance of structures, conflict resolution, analysing resources and risks, communication, and leadership.

Detailed work plans, cost estimates, a schedule for mobilization of community resources, and monitoring frame works are developed by the groups, which work in collaboration with the Agrarian Service Centre. The WUG also schedule meetings to address all issues related to community water use, maintenance, and management.

The construction process employs labour from the community and households that will be receiving the benefits. The rehabilitation may include: de-silting of tank beds for increased storage; de-silting and repair of inlet and outlet structures; stabilization of tank bunds and in certain cases repair of breached bunds; minor repair of spillways; rehabilitation of grass waterways; turfing; and soil treatment for leakage prevention. It needs to be reiterated that a main consideration of the project is better water management and utilization of water resources through building local capacity. Physical improvements alone do little in the long term to address water resource issues. Hence, learning sessions focusing on organizational strengthening, similar to those used in the FFSs component, are conducted.

Table 01 shows the increase in land under irrigation and the number of families obtaining benefits after the renovation of minor tanks and agro-wells. Through the work of the WUGs, there has been an overall increase of 71% in the area of land under irrigation.

The WUGs focus on more efficient usage of water to partially address the need to continuously develop supply sources. The interaction between FFS and WUGs is important as the production of crops without planning affects the capacity of water bodies, the availability of groundwater as drinking water, and the base flow to rivers and streams. The WUGs appear to be playing an important role regarding minor tank rehabilitation and water resource management for food production, especially where Farmer Organizations are not functioning and government services are limited. Participants state that

there is less conflict over, and more efficient use of, water resources as a result of their collaborative efforts.

We also have observed that neighbouring villages also receive benefits, for instance when a tank channel travels through more than one village, the Periyakulam tank in Wanni being one case. Here, the adjoining community also uses the water supply, mainly for chili cultivation, which was not possible before tank renovation. Also, a specified area of the tank is allowed for watering livestock.

Table 01. Minor tank and agro-well rehabilitation

Land Under irrigation (acres)				Total number of families benefited	
Prior to renovation		After renovation		Prior to renovation	After renovation
Tank	Well	Tank	Well	Tank & Well	Tank & Well
330	429.5	519	779	1840	2895

Capacity building

As previously stated, capacity building of people and local institutions aimed at allowing communities to engage in their own development agenda, is the main aim of LIFT. Field schools are now seen, in many communities, as a useful form of representation. Field school activities have grown to include: the organization of meetings; assisting the village address a wide array of problems; improving communication between the village and district and regional levels; participation at divisional and district level coordination meetings; broadening contacts and functional linkages with service providers; improving collective decision-making; and conflict resolution. This broad set of functions is largely due to improved skills in analysis, prioritising issues, articulating their concerns, and negotiation.

Field schools are also playing an advocacy role in their communities, especially in terms of gaining access to basic services. With four years of experience, first year groups now clearly demonstrate an increased sophistication and resilience. They have also improved the project's initiatives by acting as learning resources for new field schools. These groups are able to create linkages with many service providers in their areas. For example, they have been able to address some of long standing issues such as access to land deeds, postal service, transport service, school infrastructure, health facilities such as mobile clinics, and access to better agricultural services from the

concerned departments (Adair and Coomaeraswamy, 2006). Members or field schools have thus become a strengthened element within civil society.

Conflict resolution

The executive committees of field schools (the structure of which varies between schools) assist in inter-personal and inter-community conflicts by linking people with local processes that address such issues. In some cases management committees also act as mediators. Conflict resolution not only includes issues that are related to water and agriculture, but also wider community concerns. The most remarkable achievement according to most groups is the unity and increased understanding among group members and between the group and the community. As such they see things in a more united way than ever before (Adair and Coomaeraswamy, 2006).

Participation and linkages

Field schools convene meetings with other stakeholders to discuss community issues. Decisions are taken, for example, on how to implement change, and executive committees are able to represent the village issues at higher administrative levels. Field school members sometimes give a written request, through the executive committee, to meet with other organizations or service providers in their area to voice an important issue. Community problems are also discussed at the Divisional Agriculture Coordinating meetings with action plans being developed and implemented. We estimate that about 80% of the field schools are socially, economically, or administratively involved in activities that represent initiatives that are of benefit to the communities of which they are a part.

The nature of participation does vary substantially. In some instances the leaders of a field schools undertake an action while in others, members volunteer or are requested to undertake an action based on their individual knowledge, interest or personal network that would facilitate results. This type of broad participation has led to field schools assisting villagers obtain identity cards, birth certificates, and land deeds. Most field school members also provide community services (*shramadana*) for cleaning roads, and school, hospital and temple premises. Some groups have made special contributions to children's education, care for elders, and preschool development (Adair and Coomaeraswamy, 2006). Hence, the variety of initiatives in which field school members participate, the manner of participation, and the types of linkages made, is quite diverse.

Women's empowerment

There was an impressive improvement in women's empowerment in terms of decision-making and leadership, and in men's respect for their roles in CBO management, contribution to family income, and organization skills. In FFSs

and WUGs, women held 51% and 50% of executive positions, respectively. Overall, women comprise 42.5% of the membership of WUGs and FFSs.

Women participants have gained an ability to speak up and present their ideas in public meetings and in mixed gender environments. They have developed an increase in enthusiasm and self-confidence to cope with difficult situations. In some instances women were able to change the attitudes of their husbands. For example, in some families men look after and feed the children when their wives are attending meetings. Women have also increased their decision-making role in their households and have become the mangers of family income.

Men are seeing the benefits and encouraging their spouses to further participate. In these households we could posit that the children will develop behaviours that foster gender equity. Women participants agree that their economic empowerment is the major contributing factor to their positions within the household. The project's interventions have not only contributed to a changing role of women but have also given women the confidence and knowledge to address issues within mixed gender groups, their families, and local society (Adair and Coomaeraswamy, 2006).

Role of CBOs in village development

Through representative farmers' bodies, it would be possible to conduct effective lobbying efforts and that would allow farmers to take the necessary steps to begin their development from the grassroots level (Mulwanda, 1999). In LIFT, we have seen the ability of communities, through FFSs and WUGs, to analyse issues, develop plans to address them, and garner the resources needed to improve their livelihoods in both economic and social terms. Local government has been responsive to the requests of the field schools and the developing collaboration between these and other village bodies and government agencies is a critical one that needs to continue to grow. CBOs as civil society organizations need to be strengthened so that they can also leverage additional development resources. They also, as we have seen, can contribute to the resolution of conflict at various levels.

Capacity building of civil society in the conflict-affected areas is a major need. Our experience indicates that interventions with a technical focus are effective entry points to wider sets of interventions that contribute to communities controlling their own development agendas.

Conclusion

We have observed that communities in the conflict-affected areas are more interested in development related initiatives, as opposed to strict relief assistance, than may be generally understood. The LIFT project works to improve the ability of local institutions to analyse problems and opportunities,

and evaluate potential options for their direct benefit; these skills represent a strengthening of civil society to engage in other, broader issues. While important in their own right, technical interventions and outcomes in water resource use and agriculture were key entry points to capacity building work that resulted in institutional strengthening. Stronger local institutions, in turn, can drive local development. In collaborating with communities to develop and make more efficient use of resources, LIFT has focused more on people and local institutions than on the resources themselves.

References

Adair, M. and Coomaeraswamy, C. (2006). Interim evaluation of CIDA Sri Lanaka's LIFT Project. CARE International Sri Lanka, 26 pp.

Arunathilaka, N. (2001). Economic, social & human cost of the war in Sri Lanka. Research studies: Macroeconomic policy and planning series (13): p.5

Ekanayake, E.M.S. (2004). A sociological study on the impact of the ethnic conflict on poverty: Examination of three communities in the Seruvila Divisional Secretariat Division, In: poverty and social conflict in Sri Lanka. Ed.by Asirwatham,R & Thalaysingam,P, 4th Annual symposium on poverty research in Sri Lanka. p. 128-129.

Mulwanda, D. (1999). Capacity building in Farmers' Association: Lessons from Zambia. Workshop documents on Agricultural Producer Organizations: Their Contribution to rural capacity building and poverty reduction, presented by World Bank, Washington p.6.

Rashid, A. and Lewinsky. T. (2002). Farmer Field School and Participatory Monitoring & Evaluation in CARE Sri Lanka. LIFT Project. CARE International, Sri Lanka. Pp. 37.

Acknowledgments

Acknowledgement is due to all dedicated field staff who have been working with great enthusiasm in the conflict-affected area as a team. Special thanks are also given to Greg, Project director, LIFT for his encouragement and support in numerous ways in editing and finalizing the paper. Thanks are also to the Country Director, CARE Sri Lanka, for giving permission to disseminate the project findings.

Integrated approach for small tank rehabilitation

Haritha Pushpakumara Wedathanthri, Bandula Wijesinghe and M.A. Lahiru Perera

Abstract

During the last three decades, several agencies have worked in isolation in irrigation development and vast amount of resources have been invested to improve the sector. However, the beneficiaries are still not satisfied with the output generated through these interventions. The situation has not changed even today due to poor collaboration among the stakeholders and the lack of integration of their interventions. The Community Network Project has identified a collaborative approach to intervene water resources management in the Kotawehera Divisional Secretariat Division of Kurunegala District in a pilot program.

The Community Network Project (CNP) established an institutional network to coordinate all the service providers in the area in order to provide better services to the farming community. The project launched a tank rehabilitation program aimed at ensuring the availability of water to reduce the incidence of regular crop failures. The program was designed to be implemented in two phases. Minor rehabilitation work on selected small tanks in Kotawehera was carried out under Phase I. Major rehabilitation works on selected small tanks were carried out under Phase II. Twelve small tanks were rehabilitated for the benefit of 280 farmers in 11 Girama Niladari (GN) divisions under phase I, and 13 selected tanks were rehabilitated in the phase II and benefited 855 farmer families in 13 GN Divisions.

Out of several lessons learnt from the programme, it is vital to highlight that from the beginning to the end of the tank rehabilitation program every activity was transparent. This was the main reason for the high contribution provided by the Farmer Organizations (FOs). Rural Coordinating Committees (RCCs) identified the most suitable tanks for the rehabilitation. Other Community Based Organizations (CBOs) besides the FOs were aware of the entire rehabilitation programme because of the RCCs. Such transparency prevented unnecessary problems. The Divisional Secretary's leadership to this programme was highly appreciated. However it is needed to ensure further participation of government officials in monitoring activities in the field.

Introduction

The small tank system in Sri Lanka is synonymous with the village tank system. According to the categorization of tanks by the Agrarian Services Department, small tanks are those where the command area is less than 80 ha or

200 acres. It is now clearly recognized that the large number of small tanks distributed across the undulating landscape of the dry zone are not randomly located and distributed as commonly perceived but that they are located in the form of distinct cascades that are positioned within well defined small watersheds or meso-catchment basins. Both traditionally, and even up to modern times, a diversity of production systems could be identified with a meso-catchment cascade basin. In order of importance these are: rain fed upland or *Chena* cultivation; lowland rice cultivation under small tank irrigation; homestead mixed gardens with some tree crops; cattle grazing and herding; and food gathering from tank bed and harvesting of non-timber products from the adjacent forest.

According to the 'Village Irrigation Survey – 2000' conducted by the Department of Agrarian Service, there are a total of 11,261 small tanks with a total command area of 546,900 acres distributed across 24 districts in the island. Approximately 40 percent of the small tanks are located within the North Western Province. In the Kurunegala district, more than 80 percent of the small tanks have a command area of less than 10 ha.

During last three decades, several agencies have worked in isolation in irrigation development and vast amount of resources have been invested to improve the sector. However, the beneficiaries are not yet satisfied with the output generated through these interventions. The situation has not changed even today due to poor collaboration among the stakeholders and the lack of integration of their interventions. The lack of a coordinated approach has resulted in the wastage of resources and has created dissatisfaction and frustration among farmers with relation to development agencies working in the area.

Access to water will be a major challenge for dry zone communities in near future and development agencies have a major role in assisting communities identify viable solutions. The Community Network Project has identified a collaborative approach to intervene water resources management in the Kotawehera Divisional Secretary (DS) Division in a pilot program.

The Kotawehera DS area is located in the western side of the Kurunegala District (Dry Zone) in the North Western Province of Sri Lanka. The total are is 155 square kilometres. Kotawehera consists of 31 Grama Niladhari (GN) divisions and 97 villages. These are divided into two Agrarian Service divisions. The area is totally depended on rainfall (mean annual rainfall is 1200 mm) for cultivation purposes. Changing weather patterns (i.e. increased drought) has affected the people immensely in meeting their day-to-day domestic and agricultural needs. The total number of families was estimated at 5,925 in the year 2002. The area consists of 296 small tanks located within different cascade systems. Most of the tanks are not functioning properly due to poor maintenance or sheer neglect. Such a situation has negative impact on food security in the area.

The Community Network Project (CNP) established an institutional network to overcome the vulnerable situation in the area and to coordinate all service providers in the area in order to provide better services to the farming community in the Kotawehera Divisional Secretariat division. Within the institutional network, Grama Niladari level coordinating committees were established and these are called the Rural Coordinating committees (RCCs)[1]. These RCCs meet once a month to discuss issues and to identify services required within the GN division. Through these RCCs, the Community Network Project clearly identified the poor supply of irrigation water as a major problem in the area. The Community Network Project launched a tank rehabilitation program aimed at ensuring the availability of water to reduce the incidence of regular crop failures. The program was designed to be implemented in two phases: Phase I and Phase II. Minor rehabilitation work on selected small tanks in Kotawehera was carried out under Phase I. Phase I was implemented, adopting a collaborative approach, from 25 September to 25 December 2003. Major rehabilitation work on selected small tanks was carried out under Phase II - This was implemented from 15 March to 15 October 2004.

The program focused on the following aspects:

1) Increasing the storage capacity of functioning tanks through desilting measures.
2) Re-furnishing existing working tanks with no modification to its storage capacity or command area. This usually involves carrying out deferred maintenance on bunds, sluices, cannels and spillways.
3) Carrying out operation and maintenance of tank head works and field canals.
4) Facilitating integration and coordination among the different agencies working for small tank rehabilitation and irrigation development.
5) Enhancing community participation for small tank rehabilitation and water management.

Objectives of the program as following:

1) To initiate an integrated rehabilitation program for the selected small tanks of Kotawehera
2) To coordinate and pool the financial and other resources of different agencies for small tank rehabilitation

[1] RCC consisted of Girama Niladaris, Samurdi Officers, Agriculture Research & Production Assistants, Leaders of the Community Based Organizations including Farmer Organizations, Local NGO representatives and other prominent people in the village like traditional doctors.

3) To increase community participation in the rehabilitation and operation and maintenance of selected small tanks

4) To improve selected functioning tanks by increasing water storage capacity and strengthening tank head works

5) To increase water and land productivity in each irrigation system

The following strategies were used to achieve objectives of the program:

The needs identified by the RCC were prioritized depending on the involvement and contribution of the community. The final selection of tanks, on a priority basis, has to be made by the RCC members of the GN division. The mechanism of the CNP was to implement the program and the Divisional Secretariat office (DS Office) was to coordinate the program. Partners and development agencies pooled their resources with the DS office to implement the program. Responsibility was given to the RCCs to facilitate and monitor the construction works. CARE International facilitated the implementation of the program.

The primary objective of this paper is to discuss the lessons learnt in small tank rehabilitation through the Community Network Project (CNP). The paper highlights some improvements in management of minor irrigation schemes (minor tanks) at Kotawehera through improved community participation as part of the Project (CNP) intervention. Thus, the results presented here are only preliminary. However, we believe they are of sufficient interest to merit this presentation.

Tank rehabilitation programme - Phase I

Appropriate small tanks were identified by the RCC for the rehabilitation of physical structures. Technical estimation of the rehabilitation of the identified tanks was obtained and the financial and other resources of different agencies (World Vision, CARE International-Sri Lanka and the Divisional Secretariat) were pooled at the Divisional Secretariat and a Memorandum of Understanding (MOU) was signed between respective agencies. Table 01 indicates the contributions by different partners and the in-kind contribution by the beneficiaries for Phase I.

The Divisional Secretary signed an agreement with the respective Farmer Organizations for construction work. The CNP facilitated and supported the Farmer Organizations to make an action plan to carry out construction and repair work. It organized and mobilized the relevant Farmer Organizations through RCC to obtain their contribution for constructions and repairs, and coordinated, organized and mobilized relevant partners to implement the planning activities. Farmer organizations carried out required small scale maintenance on tanks such as repairs to the sluice, sluice gate, spill, spill channel, channel systems and concrete structures, and replacement of damaged

Table 01. Partners' resource and in-kind contribution for Phase I.

Name of the Partner/ Development Organization	Inputs/ Recourses
CARE International – Sri Lanka	SLRs. 365,300.00
World Vision – Sri Lanka	SLRs. 280,000.00
Department of Agrarian Development	Technical inputs
Department of Agriculture	Technical inputs
DS Office - Kotawehera	Coordination/Technical inputs
Farmers & Farmer Organizations	Labour contribution

structures according to technical recommendations. Also, carried out required medium scale rehabilitation works on tanks such as reconstructing the sluice and strengthening the tank bund according to technical recommendations. The Divisional Secretary coordinated the implementation process. Table 02 indicates the progress of the activities of Phase I.

By the end of Phase I, 12 small tanks were rehabilitated to the benefit of 280 farmers in 11 GN divisions in Kotawehera. The total command area under these tanks is approximately 160 acres (Table 02).

Tank rehabilitation programme - Phase II

The CNP facilitated to establishes a Programme Implementation Committee. Two member of the committee was assigned to collected data and information on 45 tanks from 15 GN divisions (3 tanks in each division) with the consent of RCCs. By analysing collected data and information, the Programme Implementation Committee selected 13 tanks most suitable for major rehabilitation. Basic investigations were carried out for each tank in collaboration with farmers, RCC members, technical officers and CNP members to identify priority rehabilitation activities. Technical Officers in the Agrarian Services Department prepared the estimates and drawings according to details of the basic investigation. Ratification meetings were conducted with respective farmer organizations to discuses entire rehabilitation programme, estimations and identify farmer contribution as well. The Divisional Engineer checked and approved the estimates and designs. A Memorandum of Understanding was signed between Community Network Project and the Divisional Secretariat office for funding the programme. Contract agreements were signed between Farmer Organizations and the Divisional Secretariat office in Kotawehera. Table 03 indicates the contributions by different partners and the in-kind contribution by the beneficiaries for Phase II.

An awareness programme was held with contractors and Technical Officer to prepare the technical action plan to implement the programme. Technical Officer attached to the DS office provided technical guidance and supervised construction activities. RCC facilitated and monitored the implementation of the programme. The Technical Officer inspected progress and forwarded the payment reports to the Divisional Engineer for approval. The Divisional Engineer forwarded approved payments to the DS office and the Assistant Planning Director issued the payment after verifying field progress. Table 04 indicates the progress of the activities of Phase II.

Table 02. Physical progress of the rehabilitation program – Phase I

	Name of tanks	Village	Rehabilitation work	Physical progress
1	Thalgaswewa	Kumbukwewa	Minor repair of sluice and spill	Completed
2	Galkadawela	Mahamithawa	Construction of sluice	Completed
3	Mahawewa	Nawana	Repairs of sluice cut off wall	Completed
4	Ittegodawewa	Nagala	Construction of sluice	Completed
5	Kudawewa	Dodangollegama	Construction of sluice	Completed
6	Weerapulliyawa	Meewellawa	Repairs of sluice	Completed
7	Ambagaswewa	Galkadawala	Minor repair of sluice	Completed
8	Mudiyasewewa	Kudarawaliya	Construction of sluice	Completed
9	Sarakkuwewa	Digannewa	Construction of sluice	Completed
10	Kaluarachchiwewa	Ihalaweeradadana	Construction of sluice	Completed
11	Tibbotuwewa	Mahakirinda A	Repairs of sluice	Completed
12	Wattewewa	Monnekulama	Construction of sluice	Completed

Table 03. Partners' resource and in-kind contribution for Phase II

Name of the Partner/Development Agency	Inputs/ Recourses
CARE International – Sri Lanka	Rs. 1.7 Million
Department of Agrarian Development	Technical inputs
Department of Agriculture	Technical inputs
DS Office Kotawehera	Coordination/ Technical inputs
Farmers & Farmer Organizations (Labour contribution)	Rs. 0.6 Million

By the end of Phase II, 13 selected tanks were rehabilitated benefiting 855 farmer families in 13 GN Divisions and increased the irrigation water supply to approximately 900 acres.

Lessons learned

The beginning to the end of the tank rehabilitation program every activity was highly transparent. This was the main reason for the high contribution provided by the Farmer Organization. Member of the Farmer Organizations were very committed and contributed more than 20% of the total programme budget. They had sufficient knowledge and experience to carry out constructions. Farmer Organization was consulted for in the preparation of the rehabilitation programme. This helped in the identification of priority areas for rehabilitation. Few officer bears of some Farmer Organization tried to do the rehabilitation activities without following technical guidance and thus created unnecessary problems. Therefore, frequent supervision of construction works was required. The majority of Farmer Organizations were very supportive to the programme as they considered it to be the key priority work of their village. Members of Farmer Organization were very vigilant about the quality of the rehabilitation work since entire process was highly transparent. When they had doubts or identified mistakes they informed the relevant programme authorities without delay.

Rural Coordinating Committees (RCC) identified the most suitable tanks for the rehabilitation. These committees discussed and named the tanks. Facilitation, coordination and motivation of the beneficiaries and relevant officers were done by the RCC. Progress of the programme was continuously monitored and reported to the relevant parties and committees (Sub-Divisional Agriculture Committee and Divisional Agriculture Committee) by them. Others

Community Based Organizations (CBOs) besides the FOs were aware of the entire rehabilitation programme because of the RCCs. Such transparency prevented unnecessary problems. The Grama Niladhari and the Agriculture Production & Research Assistant took official leadership for the monitoring of the programme at the rural coordinating committee level. Their commitment was appreciated

The Divisional Secretary's leadership and commitment for this programme was very high and it should be appreciated. He inspected each and every site several times and motivated farmers and officers to get maximum output. However, the DS office did not do documentation of the program properly. The Assistant Planning Director inspected the site to make payments. Each payment was done according to the MOU. This process minimized payment irregularities and conflicts. Coordination between the DS office and the divisional engineer involved in the programme was poor. The divisional engineer did not carry out programme monitoring and field inspections

Table 04. Physical progress of the rehabilitation program – Phase II

	Name of tanks	Village	Rehabilitation work	Physical progress
1	Karihattikulama	Dehennagama	Sluice constructions	Completed
			Repairs to existing sluice	
			Construction of channel system	
			Construction of deviation boxes	
2	Rathmalea Ela	Aluthgama	Construction of feeder channel	Completed
3	Kelegama Maha Wewa	Kelegama	Construction of sluice	Completed
			Repairs to spill & spill way	
			Rehabilitation for channel system	
4	Meegahakepuwewa	Kumbukwewa	Bund forming and turffing	Completed
			Desilting tank bed	

5	Ottukulama Wewa	Palugolla A	Construction of sluice	Completed
			Desilting tank bed	
6	Dodangollegama Wewa	Dodangollegama	Bund forming	Completed
			Desilting tank bed	
7	Ambagaswewa	Galkadawala	Concrete lining to distributing canal	Completed
			Minor repairs to bund	
8	Kudawewa	Mahakirinda A	Repairs to existing sluice	Completed
			Bund forming	
			Desilting tank bund	
9	Andarakatawa	Kirinda B	Repairs to existing sluice	Completed
			Bund forming	
			Desilting tank bund	
10	Divulwewa	Digannewa	Construction of feeder channel	Completed
11	Welahinikalla	Digannewa	Repairs to existing sluices 2 Nos.	Completed
			Construction of concrete channel across the spill canal	
			Repairs to canal system	
12	Ehatuwewa	Nagala	Construction of sluice	Completed
			Repairs to canal system	
13	Siyambalagama Wewa	Ithewa	Concrete canal section	Completed
			Repairs to existing sluices 2 Nos.	

properly. Although time-consuming, estimation and design of rehabilitation work was done properly by the Technical Officer assigned to the DS office. The Technical Officer delay field visits and the provision of technical guidance due to other assigned duties. Farmers were therefore delayed in meeting repair schedules. It is necessary to assign a separate Technical Officers for rehabilitation programmes so that activities can be completed successfully within set time limits. Although the Agrarian Development Officer was very concerned about the selection of tanks, he paid little attention to monitoring rehabilitation activities and participating in field visits to construction sites. The involvement of the Agrarian Development Officer is necessary for this type of programme, therefore, steps should be taken to ensure the participation of relevant officials for monitor the process.

Suggestions and recommendations

1) Members of Farmers organizations should be consulted for the preparation of a tank rehabilitation Programme at the initial stage.
2) The whole rehabilitation programme should be transparent to members of the Farmer Organization.
3) Tank selection, facilitation of rehabilitation work, supervision and reporting to the relevant committees and officials should be done through the RCCs or village level monitoring body.
4) Other CBOs in the GN division should be informed of the entire tank rehabilitation programme through the RCC in order to obtain their cooperation and assistance to complete the programme successfully.
5) A programme implementation committee has to be formed at the Divisional Secretary level and should include relevant government officers such as the Divisional Secretary, Divisional Engineer, Assistant Director Planning, Assistant Director of Agriculture, Agrarian Development Officers, etc.
6) The programme implementation committee should be involved in planning, implementation, monitoring and evaluation of the total programme.
7) Appropriate technical guidance and supervision should be provided in a timely manner throughout the implementation period. Approved payments should be made without any delay.
8) Facilitation has to be done from the beginning to the end of the programme if it is to be completed within the time limit.
9) Continuous monitoring and evaluation as well as coordination with relevant authorities are necessary.

10) Partner awareness about the programme and their respective contribution should be done prior to launching implementation work.

11) Decision making and programme planning should be done in a timely manner

Reference

Department of Agrarian Service Development. (2002). Village Irrigation Survey, Colombo, Sri Lanka.

Wedathanthri H.P. (2003). Community Participation in Water Management of Small Tanks in Kotawehera. Proceedings of National Work Shop on Water for Agriculture and Rural Development in Sri Lanka, Hotel Club Palm Beach, Marawila, Sri Lanka, Ministry of Irrigation and Water Management, Food and Agriculture Organization and Japanese Institute of Irrigation and Drainage.

Somarathna H.M., Aththudawage W. and Chandrasoma H.M.A. (2004). Report of Final Evaluation, Community Network Project, CARE International Sri Lanka.

Proc. Sym. on Development Initiatives in Water Sector: Lessons Learnt by NGOs,
29 November 2006, Peradeniya, Sri Lanka.

An overview of minor tank rehabilitation process of Dry Zone Agricultural Development Project (DZADP)

G.D.D.T. Jayawardene, P.D.S.S. Kumara and B.R. Walisinghe
Care International Sri Lanka.

Abstract

The Dry Zone of Sri Lanka consists of interconnected minor irrigation tanks, which collectively referred to as a cascade and typically characterized by severe water scarcity. Care International Sri Lanka launched its Dry Zone Agricultural Development Project (1999-2006) giving special emphasis to increased agricultural productivity and income in command and catchment areas of minor tanks in the Dry Zone of Sri Lanka. The broad objective of this paper is to review the minor tank rehabilitation process as adapted by Dry Zone Agricultural Development Project (DZADP) for which twenty percent farmer contribution is rendered. The Project successfully rehabilitated a total of 44 minor tanks; 20 in Puttlam, 18 in Moneragala and 4 in Mannar districts of Sri Lanka. As a result, the cultivated area has increased by 592.2 ac in all the three districts. Increased cultivated area in maha and yala seasons were 477 ac and 326.6 ac, respectively.

A comprehensive study of the socio-cultural background of the focal community would be of much importance in the tank identification stage to profile the behavioural aspects of them that might act as a catalyst to the rehabilitation process. If the tank rehabilitation overlaps with the peak cultivation seasons the farmer contribution usually tend to decrease as the farming is the major income source for their living. Hence the rehabilitation process should be planed in a way that it would not disturb the natural flow of the rural lifestyle. The rehabilitation model adapted by DZADP is highly appreciated by the government and the other development agencies because of the intense farmer consultation throughout the process and twenty percent farmer contribution received in addition to the support of government and other NGO partners.

Introduction

The Dry Zone of Sri Lanka is characterized by prolonged shortage of water through out the history. The unreliable rainfall, hot dry conditions and high evaporation rates, the Dry Zone is subject to recurrent drought. The minor irrigation tanks have been designed basically to overcome the severe water scarcity of the area. The most precious water received via limited rain had been stored in tanks for future use especially for subsistence agriculture in the Dry Zone of Sri Lanka.

The Dry Zone of Sri Lanka consists of interconnected minor irrigation tanks, which collectively referred to as a cascade. A cascade is defined as "a connected series of tanks (irrigation reservoirs) organized within a micro-catchment of the Dry Zone landscape, storing, conveying and utilizing water from an ephemeral rivulet" and is considered as "one of the traditional land water management systems which has obviously been developed on the basis of catchment ecosystems" (Madduma Bandara, 1985). A tank or reservoir is formed by constructing an Earthen Masonry or concrete barrier across a stream and storing water in the valley above the dam. Surplus water is let out of the tank through a spill. The storage water is drawn out through a sluice for irrigation. The water thus drawn out will feed the command area through a distribution system.

Civilization based on tanks is uniquely highlighted in the history of Sri Lanka. The tank became the centres of village life and the interlinked concept of tank, temple and village recollected in tranquillity of the livelihood. It is easy to believe that a village's livelihood systems depended entirely on small tanks. Minor irrigation systems not only provide water for irrigation but also vital to ensure the supply of drinking water. Tanks are meeting points for bathing and for washing cloths. Their effect on local community extends far beyond the paddy cultivation (Sivayoganathan *et al*, 2003).

The total command area under minor irrigation systems has been reported as 609,213 acres in the country. As per the survey conducted by Department of Agrarian Development in 1999/2000 it was revealed that a total of 24,199 minor irrigation systems are being operational which encapsulates 11,257 tanks and 12,942 anicuts (DoAD, 2006). A considerable proportion lies in an abandoned state under forest cover (Madduma Bandara, 1985) and the reasons for the continued and present abandonment of these tanks are lack of adequate catchment area and lack of suitable agricultural soils for viable settlements. Sometimes, they are non economical and from an engineering perspective non-viable. Otherwise the irrigation systems lack approach roads, or are located far away from human habitation, or they are situated in forest reserves and nature reserves or wild life sanctuaries' (Abayasinghe, 1982).

Based on the command area, the irrigation schemes in Sri Lanka can be classified into three main groups as major, medium and minor irrigation schemes (Department of Agrarian Services, 1987). If the command area exceeded 1500 acres, the irrigation scheme belong to major irrigation schemes whereas those command areas of in between 200-1500 acres referred to as medium irrigation schemes. Tanks with command areas of less than 80 ha (200 acres) are referred to as minor tanks. (Agrarian Service Act of Sri Lanka 1979). Mostly, the poorest of the poor in the rural sector in Sri Lanka are living in the command and catchment areas of minor irrigation systems. Formally, the Department of Agrarian Development (DoAD) is the government agency responsible for the minor tanks in Sri Lanka. The DoAD with its limited

resource base in terms of funds, equipment, staff and transport facilities bears an unmanageable task beyond its capacity. Therefore, they seek for external agency support to continue with the tank renovation programme.

Care International Sri Lanka launched Dry Zone Agricultural Development Project (DZADP) in 1999 with the aim of increasing living standard in rural areas in selected Dry Zone districts. The purpose of the Project is to enhance productivity and income in command and catchment areas of minor tanks in the Dry Zone of Sri Lanka in a sustainable way. Its interventions mainly focused on four sectors such as Farming Systems Development (FS), Institutional Development & Organizational Strengthening (IDOS), Business Development (BD) and Water Resources Management (WRM). DZADP works in collaboration with service providers of Government of Sri Lanka (GoSL), Non-Governmental Organizations (NGOs) and Private Sector in implementing its activities. The rehabilitation of dilapidated minor irrigation systems is one of the main priorities of the WRM component. WRM component does not limit itself to the tanks but it focuses on the surrounding watersheds as well, both of the individual tanks and of the whole cascade system. In achieving the desired objective, creating a model for minor tank rehabilitation would be of much importance to uplift the living standards of the people in the area.

DZADP is currently operational in three selected districts namely, Moneragala, Puttlam and Mannar. In Mannar, out of the total of 64 minor irrigation systems, 57 have been abandoned for years. Similarly, 176 minor irrigations have been disposed in Puttlam out of 806 whereas it is 282 out of 610 minor irrigation systems in Moneragala. Therein, it points out that a significant number of minor irrigation systems are badly silted and are at a state of disrepair. In the case of Moneragala, 12,789 farm families benefit from the irrigation system while it is 20,307 and 1,437 in Puttlam and Mannar, respectively. Poor yields remain to be an overwhelming issue where minor irrigation systems are neglected and rarely renovated (DoAD, 2006). Therefore, It is vital to maintain and renovate the minor irrigation systems especially in the Dry Zone areas in order to preserve the limited water resource.

The broad objective of this paper is to review the minor tank rehabilitation process as adapted by Dry Zone Agricultural Development Project in the community development. The specific objectives are to disseminate the DZADP minor tank rehabilitation process, to present the outcome of minor tank rehabilitation process to identify the problems and constraints encountered during the minor tank rehabilitation process and to come up with suggestions to overcome them.

The minor tank rehabilitation process of DZADP

DZADP launched its minor tank rehabilitation process with the prime objective of physical development of its minor tank base in the Dry Zone of Sri

Lanka as well as to strengthen the Community Based Organizations (CBO) giving special attention to human capacity building while uplifting their institutional financial status.

DZADP introduced a unique model for the minor tank rehabilitation, which has successfully achieved its intended outcome. In achieving the objectives, DZADP followed a participatory approach where the farmers contribute to the rehabilitation process by discharging their human labour. The government of Sri Lanka played a major role, specifically the DoAD who is responsible for providing the technical expertise they own. In addition, the partners of local non-government organizations played a mediatory role by coordinating the tank rehabilitation process. The process consists of the following major steps as elaborated below.

1) Letter of Understanding (LoU)
2) Identification of tanks for rehabilitation
3) Selection of individual tanks
4) Approval of District Steering Committee (DSC) and Divisional Agricultural Committee (DAC)
5) Preliminary investigation of selected tanks
6) FO awareness and orientation
7) Surveying and levelling, estimating and mapping
8) Ratification meetings
9) DSC approval for final estimate
10) Agreement with FOs
11) Construction training on minor tank rehabilitation
12) Tank rehabilitation by FOs

Letter of Understanding (LoU)

This is an official agreement made between DoAD and DZADP in order to better implement the process with predefined framework. Thereby the DZADP would carryout its activities as per the government standards as stated in Agrarian Service Act.

According to the LoU, DoAD and DZADP should fulfill their assigned responsibilities to streamline the tank rehabilitation process. Preparation of Preliminary Investigation Report (PIR), submission of survey cost estimate, undertaking surveying and preparation of rehabilitation estimate, participation in ratification meetings and submission of the topographic plan, finalized estimate and measurement sheets are major tasks assigned for DoAD. Further DoAD is responsible in entering into agreements with respective FOs,

supervising the entire rehabilitation process and quality controlling. They should make sure to submit bills and vouchers to DZADP and need to act as facilitators in tank operation, maintenance and construction training to Farmer Organizations. In addition, the participation in monthly District Steering Committee (DSC) meetings held in District Secretariat is an important role of DoAD.

On the other hand, DZADP is responsible for the activities such as mobilizing and facilitating of Farmer Organizations, identification of capacity building needs of DoAD as well as to support them to become a leading partner in the development sector in the district. Moreover, DZADP is accountable in compiling the feedback and concerns and input in the planning process. One of the major responsibilities of DZADP is to issue required finance for PIR, surveying, estimation, and technical support in terms of supervision, quality control and farmer training.

Identification of tanks for rehabilitation

The aim of this step is to identify the most needed cascade eligible for rehabilitation subjected to available resource constraints. Individual tanks are identified for rehabilitation in the selected cascade system and the type of rehabilitation, which is most appropriate for intervention. The identification of tanks for DZADP rehabilitation is done by an outside technical expert. The cascades, which comply with the following two criteria, have been identified as the eligible cascades for development. The ratio of the total catchment area to the total tank water spread area of all presently operating major and minor tanks within the cascade should exceed 15. In addition, the ratio of total command area of all tanks within the cascade to the total water spread area of all tanks within the cascade should not exceed 2 (Panabokke and Amarasinghe, 2001).

After the identification of a suitable cascade, the next step is to identify individual tanks which are based on three key indicators namely, cropping intensity, the ratio between tank catchment and water spread area, and the ratio between command area and the water spread area. After a comprehensive review, the consultants provide a list of identified tanks to be rehabilitated based on their judgment.

Selection of individual tanks

After the submission of the identified list of tanks by the consultants, the individual tanks are selected based on a set of predefined criteria developed by DZADP.

1) Tank should be situated in the working area of DZADP
2) Catchment area, command area and reservation area should belong to the project area.

3) Members of the farmer organization belong to the tank should be permanent villagers in the area itself.
4) Selected farmer organization (FO/CBO) under the tank should be strong enough and they should be in a position to discharge 20 percent farmer contribution.
5) The command area of the tank should be more than 30 ac and less than 200 ac.
6) Selected tank should not have been rehabilitated during last 5 years under any project.
7) The tank should not be presently proposed for rehabilitation by any agency.
8) More than 1/5 of the command area should not belong to one person or one owner.
9) A government officer should not be an executive committee member (president, secretary, treasurer) in the farmer organization.
10) The farmer organization should take the responsibility fully to complete the rehabilitation activities as well as the post rehabilitation activities.
11) The FO/CBO should be a well functioning and be dedicated for the rehabilitation activities.
12) Farmer organization should agree to complete the rehabilitation activities on time.

The tank selection process is headed by a forum in which GoSL divisional level officers, FO leaders and representatives from DZADP staff involved where they finalize the tank list.

Approval of District Steering Committee (DSC) and Divisional Agricultural Committee (DAC)

The selected tank list is presented to Divisional Agricultural Committees (DAC) for approval. The DAC is the divisional level decision making forum chaired by Divisional Secretariat (DS) in which divisional level GoSL and NGO officers and FO leaders are represented. When the list got through from DAC, it is presented to DSC for district level recommendation. DSC is headed by District Secretary and represented by DZADP and heads of government and NGO partners. Thereby the transparency of the tank rehabilitation work is ensured at both divisional and district levels. In addition, DZADP makes the partners aware of the process and in turn they support smooth undertaking of the minor tank rehabilitation process.

Preliminary investigation of selected tanks

The technical officers of DoAD conduct a preliminary investigation after the site visit. Prior to the preparation of the report they investigate the present situation by interviewing the village farmers to identify the rehabilitation needs. Technical officers gather information from elderly, knowledgeable people in the command area to compile the Preliminary Investigation Report (PIR). The PIR consists of three main sections as technical data of minor irrigation tanks, agro socio-economic data followed by a recommendation and approval.

The PIR is an important document on which the decision depends either to proceed with further investigation or to drop the proposal. Hence it should contain accurate data and prepared legibly and neatly.

FO Awareness and orientation

FO awareness and orientation meetings are held for FOs of the selected tanks for which the DSC approval is granted. For the above meeting, officers from DoAD, DZADP staff and the members of the Farmer Organization are invited. The main objective of the meeting is to introduce the DZADP minor tank rehabilitation process as well as to introduce the GoSL and NGO partners to the farming community.

At the awareness and orientation meeting the Project is introduced to the community and makes the community aware of the DZADP tank rehabilitation process. The individual responsibilities of the three parties involved (DZADP, DoAD and Farmer Organizations) are stated clearly to the participants. Farmers' consent is asked for and they are allowed to decide the rehabilitation needs by their own. Thereafter, a priority list of rehabilitation activities is prepared and used for the surveying purpose. Farmers are invited to contribute to the proposed rehabilitation programme by contributing at least 20 percent of total cost by means of labour and/or money. At the same time the budgetary allocations and financial limits of DZADP for respective minor tank rehabilitation are brought forward to farmer consideration. The final task of the meeting is to set a specific date for tank bed survey and the farmers are requested to be prepared for the field survey.

Surveying and levelling, estimating and mapping

This task is essentially a technical component of the rehabilitation process and the major responsibility is borne by the DoAD. The Farmer Organizations supported the technical officers to conduct surveying and levelling at field level by means of clearing the required areas, giving side support to take the measurements and information input for the surveying. A draft estimate is prepared after completing the surveying, levelling and mapping by which DoAD can gauge the cost for the estimated tasks. At this point, DZADP plays a

coordination role between DoAD and FOs ensuring timely payments for DoAD for surveying, levelling and mapping.

Ratification meetings

The ratification meeting is represented by members from DoAD such as Assistant Commissioner, Chief Engineer, Senior Technical Officer, Technical Assistants, Divisional Officer, Agriculture Research and Production Assistant (AR&PA), as well as "*Grama Niladari"* of respective villages, DZADP officers and members of the Farmer Organization. Approximately, 75 percent of the beneficiary farmer participation is mandatory for the meeting.

The technical assistants of DoAD bring a detailed description on draft estimate forward to the audience of the ratification meeting. The farmers' viewpoints are highlighted in the draft estimate and inputs are forwarded for the final estimation. In addition, the assigned tasks and responsibilities are clearly distinguished and divided among the DZADP, DoAD and Farmer Organization. Most importantly, activities that require 20 percent farmer contribution are clearly demarcated. Those activities include earthwork in bunds and channels, turffing, clearing of jungle and removal of ant hills.

At the end of the ratification meeting, a draft action plan is prepared for future activities such as construction training, signing of agreements and commencement of construction.

DSC approval for final estimate

The finalized estimate prepared by DoAD is discussed in DSC and the approval is obtained for the implementation. This is to make aware the members of DSC on cost estimate for the construction work of the recommended tanks in selected locations.

Agreement with FOs

After finalizing the estimate, the agreement is made between DZADP and Farmer Organization who owns recommended tanks. The purpose of the agreement is to handover the minor tank reconstruction contract officially to the respective farmer organizations. The agreement carries terms and conditions that both parties need to adhere throughout the implementation phase.

At the time of signing the agreement the terms and conditions are read out for the public to make them aware of the process. Thereafter, the contract is made signatory by the DZADP being the first party of the contract whereas by the two official representatives from Farmer Organization as the second party. Witness is placed by Divisional Officer of the respective ASC division and Agriculture Research and Production Assistant (AR&PA) assigned for the FO.

Finally a copy of the original agreement is sent to DZADP, DoAD and the FO for reference.

Construction training on minor tank rehabilitation

The underlined purpose of the construction training is to offer the beneficiaries a quality technical training on construction and rehabilitation. The training covers the standards of various soil bunds, strip turfing, standards of concrete work, construction of rubble walls, construction of brick walls, laying rubbles, and the quality control of all the above technical aspects. Subsequently, the supply of resources and materials for construction work is identified for the uninterrupted construction. The intended outcome of the training is to give them a technical know-how to rehabilitate the minor tanks at their own will and according to the recommended standards. Thereby, the beneficiaries can use the knowledge and experience acquired during the training for future maintenance of the tank.

The major responsibility of the training is borne by the DoAD and technical officers conduct the training for the beneficiary community. During the training, an action plan is prepared for undertaking minor tank construction and key responsibilities are assigned to specific farmer groups in order to ensure the efficient and effective work done by the Farmer Organization. The assigned work for those groups consists of concrete and masonry work, construction of soil bund, material and machinery supply, site arrangement and logistics, site security and record keeping. Ultimately, a schedule is drafted to divide the tank bund among the members for clearing according to the acreage land holding size by them as an initiative for rehabilitation.

Tank rehabilitation by Farmer Organizations

This is the most crucial step of the rehabilitation process since it is the place where the actual implementation is carried out. The construction begins just after the construction training while a 20 percent advance payment of the total civil cost is released by DZADP with the recommendation of DoAD. The rest of the payment is issued to FOs in several instalments up to the final payment as per the DoAD recommendation.

Technical officers from DoAD frequently visit the construction site and assist the FOs to make the construction a quality work while a close supervision is placed by monitoring the outcome to complete the task within the time frame. The sub committees appointed at the construction training supervised the process to make sure that the assigned work is done on time. The follow up is continued until the process is completed. Meanwhile, the beneficiaries consult the DoAD technical officers and DZADP when ever necessary.

DZADP withhold 10 percent of the total construction cost as collateral until a minimum of three months after a physical construction of the tank.

During the three months period DoAD closely observe the construction work completed for damages. This is to compensate the improper construction and thereby using the retention fund to make sure that the damages are repaired. Having successfully completed the construction work, given that no damages and disrepairs at the time of inspection, DZADP release the retention payment to FO with the recommendation of DoAD.

An initiative is taken to establish and raise the maintenance fund for the FO while the construction work is on board. An awareness session is held for the FOs highlighting the importance of tank maintenance fund and activities coped in strengthening the tank maintenance fund.

The rehabilitation model adapted by DZADP was highly appreciated and incorporated into their activities by many of the government and NGO partners in the development sector.

Minor tank rehabilitation; Effect and impact level outcome

DZADP could successfully renovate a total of 44 minor tanks; 20 in Puttlam, 18 in Moneragala and 4 in Mannar districts. The total value incurred for rehabilitating the 44 minor tanks was Rs. 40,309,415 of which Rs.7,990,216 has been made as farmer contribution (approximately 20 percent). The following section discusses the immediate impact caused after the minor tank rehabilitation process in the Project districts. The cultivation related data were collected from all the FOs who rehabilitated their tanks under the DZADP tank rehabilitation process in Moneragala, Puttlam and Mannar districts.

Table 01 summarizes the cultivation status before and after the rehabilitation of the selected tanks in Moneragala districts. As a result of the rehabilitation the total cultivable area has increased by 142.2 acres and it is 13.0 percent as of before rehabilitation. Intensity of cultivation has significantly increased in six tanks up to two cultivation seasons in both *yala* and *maha* seasons. An extent of 165 acres has been added in the *yala* than before rehabilitation. Similarly, the *maha* extent cultivated has increased by 168 acres.

As illustrated in the Table 02, total cultivable area has increased by 334 acres and it is approximately 80 percent increase than that of before rehabilitation. People in the area cultivated an additional area of 233 acres in *maha* season with the abundant water supply whereas the total increment in the cultivated area during *yala* was 151.6 aces as a result of the rise in the command area. Cultivation has initiated in five tanks while there wasn't a single cultivation reported before renovation.

The total cultivable area has risen by 116 acres due to the rehabilitation in Mannar district (Table 03) and interestingly it is about 148 percent increment as of the previous situation. The farmers cultivated additional area of 76 acres in *maha* season with the increased water availability. Exclusively, area under

cultivation has doubled in *maha* season. In *yala*, the incremental area under cultivation was 10 acres.

Altogether the cultivable area has increased by 592.2 ac in all the three districts as a result of the rehabilitation. Increment in cultivated area in *maha* was 477 ac and during *yala* was 326.6 ac.

Table 01. Cultivation status before and after rehabilitation in Moneragala district

Name of the tank	BR Cultivatable area (ac)	AR Cultivatable area (ac)	Cultivated extent – BR (ac)		Cultivated extent – AR (ac)		BR Cultivatable seasons	AR Cultivatable seasons
			Yala	*Maha*	*Yala*	*Maha*		
Bibileyaya	20	48	10	20	25	46	2	2
Bidunukandiya	62	75	20	62	50	75	1	2
Degalhelayaya	38	38	10	37	10	37	2	2
Galamuna	32	32	4	31	25	31	2	2
Gurumada	18	23	.	18	23	23	1	2
Halabawea	38	50	.	8	.	8	1	1
Hawanarawa	120	155	120	120	155	155	2	2
Hawanpityiya	55	55	2	55	10	55	1	2
Indurugaswewa	148	148	48	48	48	48	2	2
Moragahamada	67	67	67	32	50	67	2	2
Niyadagala	98.8	99	37.5	37.5	37.5	37.5	2	2
Pokunuthenna	36	40	10	36	30	40	2	2
Saginiwewa	15	30	.	.	.	20	0	1
Singalegama	63	75	40	63	45	75	2	2
Thelulla	30	48	.	30	10	48	1	2
Usgala ara	22	22	.	.	.	.	0	0
Wattarama	150	150	65	150	65	150	2	2
Weerapitiya	80	80	.	80	15	80	1	2
Total	1092.8	1235	433.5	827.5	598.5	995.5		

BR- Before Rehabilitation, AR - After Rehabilitation

Table 02. Cultivation status before and after rehabilitation in Puttlam district

Name of the Tank	BR Cultivatable area (ac)	AR Cultivatable area (ac)	Cultivated extent – BR (ac)		Cultivated extent – AR (ac)		BR Cultivatable Seasons	AR Cultivatable Seasons
			Yala	*Maha*	*Yala*	*Maha*		
Habawewa	20	25	0	20	0	20	1	1
Helambawetiya wewa	10	32	5	10	23	23	2	2
Keselhena wewa	25	35	0	0	25.6	30	0	2
Mandapothana wewa	30	47	0	30	21	42	1	2
Aluth wewa	12	22	0	0	2	6	0	2
Pettigama Maha wewa	46	52	0	24	0	45	1	1
Ramankulama wewa	30	34	0	30	5	34	1	2
Sinna Kattakaduwa wewa	19	31	0	19	29	31	1	2
Wembuwewa	0	39	0	0	0	0	0	0
Gallewa wewa	15	34	0	0	0	12	0	1
Kuda wewa	3	30	0	0	15	30	0	2
Galkulama Aqeduct	40	40	0	0	0	0	0	0
Dangaswewa	0	30	0	0	0	11	0	1
Nungamuwa wewa	0	31	0	0	0	0	0	0
Pahalawagayamaduwa wewa	60	110	0	8	0	30	1	1
Kurunduwewa	30	34	2	10	6	30	2	2
Mediwewa	26	31	0	25	20	31	1	2
Attikulamawewa	15	29	10	0	0	0	1	0
Kudadodanattewa	10	30	0	12	12	30	1	2
Mahamullegama	30	39	0	5	10	21	1	2
Total	421	755	17	193	168.6	426		

BR - Before Rehabilitation AR - After Rehabilitation

Table 03. Cultivation status before and after rehabilitation in Mannar district.

Name of the Tank	BR Cultivatable area (ac)	AR Cultivatable area (ac)	Cultivated extent – BR (ac)		Cultivated extent – AR (ac)		BR Cultivatable seasons	AR Cultivatable seasons
			Yala	***Maha***	***Yala***	***Maha***		
Viravapuliyankulam	20	35	5	20	15	35	2	2
Kompansainthan	27	67	0	0	0	0	0	0
Karambaikulam	25	70	0	25	0	70	1	1
Narikalaichchan	6	22	0	6	0	22	1	1
Total	78	194	5	51	15	127		

BR - Before Rehabilitation AR - After Rehabilitation

Problems and constraints encountered in the course of minor tank rehabilitation

The problems were pointed out at the stakeholder workshop held focusing at tank rehabilitation review process with the participation of DZADP, DoAD, partner NGO and representatives from Farmer Organization. Some of the issues highlighted in this section were reported at the progress review meetings held for respective tanks while the rehabilitation is in progress.

Due to the delays in submitting documents like preliminary investigation reports, survey estimates, work estimate and work recommendations, the rehabilitation process is lagging behind. The time lag is mainly due to the lack of human resource capacity (especially Technical Officers) at DoAD. Most importantly, the government developmental activities are prioritised against DZADP activities. At the same time, other development initiatives might overlap with DZADP interventions. Therein, the DoAD officials get overloaded with different assignments leading to submission of incomplete documentation. As a result, the documents returned back pointing out mistakes, which takes a longer time to readjust.

In the tank identification process DZADP has given special attention to technical aspects rather than to socio-cultural aspects. Consequently, unintended impacts like leadership issues, institutional problems, disagreements among FO members have slowed down the construction work.

DZADP found that it was not possible to find a tank for rehabilitation that satisfies all the requirements as depicted in the selection criteria. Hence some of the tanks have been selected excluding few criteria. For example, the

catchment area and reservation area might be outside the Project area. Therefore, DZADP faced problems in post-rehabilitation intervention as it is beyond the control of specific Farmer Organization when the catchment area is outside the Project area.

Tank rehabilitation process takes more time than expected because DZADP has faced problems in getting the DSC members into a single forum so as to obtain the DSC approval to proceed with the process. Moreover, the DSC meeting is often postponed and cancelled due to government priorities and political interventions. It is of vital importance to get the DSC approval on time unless otherwise the rehabilitation might coincide with rainy seasons that would interrupt the rehabilitation activities.

Due to the busy schedules of the technical officers of DoAD, they simply visit the tank without prior notice and proper community consultation to prepare the PIR, Ultimately that does not really represent the reality. Hence it is questionable whether the PIR reflects a true and fair view of the tank and the social context of the community.

A striking pitfall reported in the FO awareness meetings, ratification meetings and in construction trainings on tank rehabilitation is the lack of active participation of beneficiaries. Most often, these sessions and meetings overlap with day-to-day farming practices for which beneficiaries give top priority. Thence the beneficiaries receive poor quality information and face with problems towards the later part of the implementation process. If the tank rehabilitation overlaps with the peak cultivation seasons the farmer contribution usually tend to decrease as the farming is the major income source for their living.

According to the views of some farmers, there is a tendency to over estimate the survey estimates very often with the objective of mis-using the budgetary allocation with the help of certain technical officers and the FO leaders. This might lead to severe internal conflicts within the FO instead of the FO become more strengthened and organized.

At times, some suggestions made by farmers at the ratification meetings cannot be incorporated into the finalized estimate as it exceeds the DZADP budgetary allocation. In a way, it might lead to miss a greater opportunity for the community to rehabilitate the tanks by some other party who could afford more funding for the rehabilitation. Because most of the developmental agencies are abide to focus on tanks, which are not being, rehabilitated for last 5 years at the point of selection.

The rehabilitation process is constrained by the unavailability of the fund in the farmer organization accounts as well as delays in recommending advance payments to commence the activities on time. As a result the FO members (mainly FO leaders) invest their personal money for the purpose and sometimes

they owe the informal moneylenders at a higher interest. That would create a mental stress in their personal life.

Suggestions and recommendations

In order to overcome shortage of human resource at DoAD, it is suggested to allocate the required staff according to the workload and the vacant positions that need to be filled immediately to compensate the turnover in the department. This can be taken up by DZADP at NSC level. It is advisable for the DZADP to work in collaboration with other organizations bearing required capacity with the consent of DoAD as to come up with a contingency plan.

DZADP need to carry out a comprehensive study of the socio-cultural background of the focal community at the tank identification stage to profile the behavioural aspects of them that might act as obstacles to the rehabilitation process.

It is underlined that the DZADP should not give equal weightage for the individual selection criterion in the selection of tanks. Instead, a set of mandatory criteria from the existing list should be screened to be fulfilled by each and every tank, which is selected for rehabilitation. Thereby, a uniformity of the selection process is ensured paving the way for FOs for better post-rehabilitation work.

The District Secretariat should take immediate action to call over the committee to obtain DSC approval for selected tanks on time for further processing, because the gathering of relevant DSC is most crucial than that of the others. If by chance a DSC is missed due to any unavoidable circumstance, it is advisable for the District Secretariat to grant a pending approval after informing other DSC members until the next meeting is called.

In order to develop a reflective PIR, the community should be made aware on preliminary investigation and the data collection need to be done from a sample that represents all the strata of the beneficiary community.

The DoAD could increase the participation of beneficiaries in FO awareness meetings, ratification meetings and in construction trainings via a wider spread of notice prior to the meeting within the community on program and importance of the program. Consequently, they can adjust their own schedules accordingly.

DZADP should accommodate a technical expert who is aware of the contextual information on surveying, leveling and estimation as well as who can negotiate with the DoAD officers for accurate estimation. This would help to reduce the overestimation.

Since DZADP need to adhere to the specific budgetary limitations, it is advisable to go for a complete rehabilitation of the selected tanks rather than to carry out minor repairs in a number of tanks. In addition, it is recommended to

work in collaboration with relevant line agencies in tank rehabilitation so that a complete renovation of tanks can be achieved even though DZADP could not afford to do it.

Apparently, the DZADP should speed up the release of advance payment and need to streamline the process coordinating with DoAD. On the other hand, DZADP should make arrangements to release the payment at several instalment based on the progress of the work done.

DZADP should prepare a programme plan in advance for tank rehabilitation with partners to mitigate the burden on farmers in order to ensure the maximum farmer contribution by avoiding the peak cultivation activities and rainy seasons.

Conclusion

The Project successfully rehabilitated a total of 44 minor tanks; 20 in Puttlam, 18 in Moneragala and 4 in Mannar district. As a result, the cultivated area has increased by 592.2 ac in all the three districts after the rehabilitation. Increased cultivated area in *maha* is 477 ac and during last *yala* 326.6 ac of additional area has been cultivated. The rehabilitation model adapted by DZADP is highly appreciated by the government and the other development agencies because of the intense farmer consultation throughout the process and twenty percent farmer contribution received in addition to the support of government and other NGO partners. Meanwhile, the government and other NGO partners in the development sector have incorporated the experiences and the strategies of the tank rehabilitation process adapted by DZADP into their tank rehabilitation activities.

In the tank identification process, DZADP has given special attention to technical aspects rather than to socio-cultural aspect. It is vital to address the socio-cultural context when dealing with the people component to better identify the community needs. The government technical officers need to work in close collaboration with the farmer community when preparing PIR and tank bed survey in order to obtain the maximum farmer contribution.

If the tank rehabilitation overlaps with the peak cultivation seasons the farmer contribution usually tend to decrease as the farming is the major income source for their living. Hence the rehabilitation process should be planed in a way that it would not disturb the natural flow of the rural lifestyle.

Bibiliography

Abayasinghe A. (1982). Minor Irrigation in Sri Lanka: Economic Review In: Somaratne P. G., Jayakody P., François Molle, and K. Jinapala, 2005. Small tank cascade systems in Walawe River Basin. Working paper, Colombo, Sri Lanka: International Water Management Institute.

Department of Agrarian Services. (1987). Technical Notes for the Guidance of the Technical Officers. Colombo: the Irrigation Branch of the Department Agrarian Services.

Department of Agrarian Development. (2006). "*Kethata Aruna Nil Diyawara*" : A Manual on Tank Development Programme. Department of Agrarian Development, Sri Lanka.

Madduma Bandara, C.M. (1985). Catchment ecosystems and village tank cascades in the dry zone of Sri Lanka. A time tested system of land and water resources management: In Lundqvst, J.; Lohm, U.; and Falkenmark, M. D. *Strategies for river basin management* Reidel Publishing Company.Dordrecht, Holland.

Panabokke C.R and Amarasinghe, L. (2001), Identification of minor irrigation tanks within selected cascade systems in Hambanthota, Dry Zone Agricultural Dvelopment Project, Care International Sri Lanka.

Sivayoganathan S., Devarajah K., and Robouchon G. (2003). Report on Impact Assessment of the minor Tank Development Programme working paper.

Identification of minor tanks for rehabilitation: Shift in selection approach

D.L. Chamila Jayashantha
Care International Sri Lanka

Abstract

Rehabilitation of minor tanks is one of the strategies frequently used to increase the water availability for agricultural development in the dry zone of Sri Lanka. Keeping this in view, Dry Zone Agricultural Development Project (DZADP) executed by CARE International has been rehabilitating minor tanks in five dry zone districts of Sri Lanka. Proper identification of minor tanks is the key for effective rehabilitation process, as not only an action of one community affects the water consumption of other community up or downstream, but also entire tank community held together by strong ties of kinship according to the traditional settlements.

Upon the unique social and scientific features of cascade systems, DZADP adopted cascade based approach in Puttalam district to select first batch of tanks for rehabilitation known as first generation. When DZADP stepped into the second generation, an impetus based on lessons learned during the first generation lead the process towards a shift in selection approach. Paper concludes that the shift in selection approach between two generations urged the need for more inclusive and pragmatic methodology, which could integrate lessons of the first generation. Wider representation in selection process helped to minimize potential conflicts, assure optimum benefits and forge partnership for sustainability and adaptability to different context. DZADP utilized the revised approach in both Puttalam and Mannar districts.

Introduction

CARE International-Sri Lanka launched Dry Zone Agricultural Development Project (DZADP) in 1999, funded by European Union. Project mainly intends to enhance agricultural productivity and incomes in command and catchments areas of micro tanks in a sustainable way, so creating a model that could be replicated more widely in the dry zone. Initially DZADP selected two dry zone districts; namely Hambanthota and Anuradhapura and it was later expanded to Puttala, Moneragala and Mannar. DZADP was implemented through government line agencies and other partners like local non-government organizations and private sector.

DZADP has rehabilitated more than 80 minor tanks with 20% of the total cost as farmers' contribution. Project adopted vigorous selection process to identify minor tanks by considering international standards as well as local conditions and knowledge. Purpose of this paper is to discuss the methodology

adopted during the identification of minor tanks for rehabilitation. The shifts occurred in the selection methodology for the second generation of tanks to incorporate the lessons from the first generation of rehabilitated tanks are also discussed.

Small tanks irrigation in the dry zone Sri Lanka

"Not even a single raindrop should be allowed to flow into the sea without having made use of it for the benefit of people" was a popular philosophical but statutory statement made by King *Parakramabahu* the great 1153-1186 AD. Tank is not just a water source for irrigation and has been an important part of the Sri Lankans' lives, historically. Irrigation was one of the main outcomes anticipated through harvesting rainwater extensively by using natural topographical and geological conditions. Panabokke (2002) explains "because this soil region has the essential attributes to holding up water in the form of tanks or reservoirs, it constitutes the heart of the RAJARATA tank civilization. Similarly, the narrow tracks of alluvial soils and some parts of the very clayey soils are also well suited for tank construction and water retention".

Over 40,000 tanks we have had in the past had been subjected to deterioration both qualitatively and quantitatively due to various socio economic consequences resulted from chronic political reasons like invasions. According to Gunasena (2000), there are about 12,500 small tanks scattered throughout the dry zone with an irrigation potential of about 100,000 ha. The water for these tanks are from rainfall and catchments runoff, hence the annual rainfall will determine the tank water supply.

In addition to the irrigation, maintaining the ground water table, feeding down stream tanks, domestic consumption of villagers, consumption by village livestock, and indigenous industries such as pottery, brick making, sedges products and inland fishery are some of the conspicuous uses from village tanks for the substrate community. Sivayoganathan *et al.* (2003) observed that minor tanks not only provide water for irrigation but also act as the centres of the village life. Minor tanks by regulating the local water table are vital for ensuring the supply of drinking water. They are owned by the local community. Tanks are points for bathing and washing clothes. Their effect on the local community extends far beyond paddy cultivation". According to Thennakoon (1986) tank is also a part of spiritual moral of the peasants live in ancient villages; "Tanks storage give farmers the confidence to commence farming early in the season provided that there is some rain just sufficient to prepare and grow paddy".

In spite of various water resources development programs, progress of extensive rainwater harvesting seems inadequate. According to Ariyabandu (2004), only 10% of the total direct rainfall is being used for domestic, industrial water supply and irrigation and nearly 30% goes as run-off to the sea.

Selection approaches for rehabilitation of minor tanks

Assessing the hydrological endowment has become dominant scientific and technical measure of selecting the tanks systems for rehabilitation. Murray & Little (2000) suggest, hydrologically well-endowed tank is the one with the greatest capacity for increasing cropping intensity above its present level. Further they state topographical classification method and tank water surplus method are often used to assess the hydrological endowment in identification of tanks for rehabilitation.

Development literature and hands-on experiences substantiate the importance of using participatory approaches in site identification. It adds value to the scholarly focus on scientific and technological aspects; also enrich the final selection with indigenous knowledge, which is absolutely useful in implementing the fieldwork. Jinapala *et al.*(1996) point out "Sri Lankan farmers have a good working knowledge of hydraulics and of the basic facts of the hydrology; the great majority of the 12,000 or so irrigation systems in Sri Lanka are built by and continued to be operated by farmers." They further argue that the community participation would also help to overcome lack of detailed information on cascade hydrology in case of all tanks that are not even shown on maps. On the other hand, in case of selecting tanks within a cascade system, the existing kinships have to be considered as access to lands and transferring of land ownership depends on it. Murray & Little (2000) recommends that the *purana* complex with its cluster of associated tanks should be the smallest logical unit for development intervention within the watershed as traditional settlements in the dry zone known as *'purana'* villages held people together by strong ties of kinship.

Participatory approaches were often used to imply and transfer the ownership and to mobilize the community about the available resources. Jinapala *et al.* (1996) suggests that a selection approach with community participation to mitigate potential conflicts among traditional settlements. This proposes mapping as a viable participatory tool for selection. Sivayoganathan *et al.* (2003) recommend that the selection criteria of tanks for development should be clearly laid down at the beginning and strictly followed. The vulnerability and poverty level of the beneficiary farmers should be laid down as one of the main criteria for such selection to promote more inclusiveness. Further they elevate a methodology comprising scientific and community consultation tool to assess the hydrological endowment of small tank cascades for planning process, which rely on combination of assessment of ordinance survey maps and farmer interviews; topographical classification method and cascade water surplus method. Sakthivadivel *et al.*(1997) suggested visiting the cascades selected in the initial screening and used rapid assessment methods to collect information on water resources, agricultural lands, cropping patterns, cropping intensities, population details and ground water use. Athukorala (1996) noted that the differing gender needs and contributions are recognized to

a considerable extent and incorporated into planning, operation and maintenance of rural water supply, but the same recognition is not accorded to gender considerations as an issue affecting capacity building in the irrigation sector.

Minor tank selection approach of DZADP

DZADP was keen to select the small cascade systems scientifically and also with an attention for the other social factors. At the same time DZADP kept an eye on the project limits through DZADP criteria that are used to fine-tune the consultant's proposal. Few other ground rules were also adopted; trusted that acquiring the farmers' involvement since the tank identification phase would help to transfer the ownership of these sites with respective groups. It would also mobilize the farmers for better maintenance and operation procedure. DZADP meant to work too closely with groups like, farmers organization, which are fundamental to participatory irrigation system management. Their main function is to deal with irrigation matters. Legislatively articles 82 – 1 & 2 of Agrarian Development act (No.46 of 2000) authorized farmers' organizations to be informed of any construction projects etc.

DZADP also paid a special attention over the level of potential strategic benefits for women. It was particularly recognized if significant women representation was attributed in the FO leadership to assure women's participation throughout the process.

At the beginning of 2003 DZADP selected eight tanks to rehabilitate as first generation. DZADP managed to incorporate the lessons learned during this first generation with the selection process adopted for second generation.

First generation

DZADP has selected two divisional secretary jurisdictions of *Puttalam* district, and stepped into the scientific selection which was to be done within following limits acted out by the project to minimize potential issues and to maximize the impact and cost effectiveness:

1) each selected cascade should consist of 8 tanks,
2) 70% of the tanks in the cascade are being used for agricultural purposes and
3) Selected systems should be geographically spread throughout the division.

Initially tank identification process adopted encompassed two main steps.

Step 01 - Scientific & technical screening

Following steps were followed in selecting tanks from *Mahakumbukkadawala* divisional secretary jurisdiction of *Puttalam* district by the consultant assigned.

Identification & selection of cascades

In this process two steps scoring system outlined in Table 01 of the IWMI research report No. 13 was adopted with some modifications.

1) Definition of hydrological characteristics of the cascade system including water surplus through three key indicators; ratio of tank Catchment Area (CAA) to tank Water Spread Area (WA) expressed as (CAA/WA), Ratio of tank Command Area (COA) to tank Water Spread Area (WA) expressed as (COA/WA) and *maha* season cropping intensity averaged over last five consecutive years (CI).

2) Preparation of maps using topographical sheets and Agriculture Based Mapping Project (ABMP) maps to demarcate main and sub watersheds with other base details like land use pattern, command area, homestead area, vegetation and soils.

Accordingly 15 cascades were initially identified and adhering to DZADP limits five cascades were selected. Then these cascades were further studied for water resources potentiality adopting the CAA/WA, COA/WA, and CI and selected only four.

Identification of individual tanks for rehabilitation

As previously used for cascades, the criteria outlined in Table 03 of the IWMI research report No. 13 to select individual tanks for rehabilitation within the boundaries of cascades screened in section 01 were used. In doing so, spilling history, physical status of tank, presence of functioning farmer organization and recent history of rehabilitations were collected at the end of the field study. Accuracy of the catchments boundaries on maps, water spread areas and proper locations of abandoned and partly utilized minor tanks were also checked.

Physical status scoring and ranking of tanks for rehabilitation

Again according to the proposed scoring system in Table 03 of the IWMI research report No. 13, five components namely, tank bund, situation of tank bed, condition of spill and sluice and cannel system were assessed.

Identification of the types of rehabilitation most appropriate for selected tanks

The types of rehabilitation assessed according to the five components explained in section 03 namely tank bund, situation of tank bed, condition of spill and sluice and cannel system were recommended. Out of the 67 initially identified tanks eventually, 20 tanks were selected with an average of 05 tanks per cascade. Out of this, 20, 07, 10 and 03 tanks needed low, moderate and heavy investment respectively for rehabilitation.

Step 02 - Final selection by using DZADP criteria

DZADP filtered the list of 20 technically feasible tanks using the following criteria.

1) Tank should be situated in a DZADP project village.
2) Catchments area, command area and the reservation area should geographically belong to the project area.
3) Members of the farmer organization belongs to the tank should be permanent villages in the area itself.
4) The selected farmer organization under the tank should be strong and they should be able to contribute 20% farmer contribution in kind.
5) Tank command area should be more than 30 ac.
6) The selected tank should not have been rehabilitated during the last 5 years under any project.
7) The tank should not be presently proposed for rehabilitation by any other development agency.

At the end of the selection process only 08 tanks were identified with an average of 02 tanks per cascade.

Second generation

The second (revised) selection approach was called “random selection”. By applying the random selection DZADP anticipated to minimize the negative effects of the cascade approach and to save time and cost in the rehabilitation process. Administrational limits acted out for first generation remained unchanged for the second generation as well. It also consisted of two steps.

Step 01 - Scientific & technical screening

1) Identification of minor tanks according to the stakeholders’ priorities.

DZADP obtained the existing prioritised information from line department (Department of Agrarian Development) and from farmers' organizations.

2) Assessment of hydrological characteristics of minor tanks including water surplus using the three key indicators.

   As previously used, hydrological potentiality (CAA/WA) and tank capacity (COA/WA) ratios together with CI values were figured.

3) Map preparation and desk study.

   Cascades, water spread areas, command area and local catchments were demarcated on 1:50,000 maps.

4) Cropping and social feasibility with physical status assessment.

   This step was used to do more detail field assessment than the 1st generation. Wider participation from various stakeholder levels was assured and following results were achieved.

   1) Command area details (CI, seasonal cropping patterns, land ownership, etc.)
   2) Water availability information about catchment area, water management pattern, availability of farmer organization
   3) Physical status; tank bund, tank bed, sluice, spill and channel system

DZADP utilized this approach for one division of both *Puttalam* and *Mannar* districts. Scientific and technical screening were concluded with recommending tanks.

Step 02 - Final selection by using DZADP criteria

Apart from the 07 criterions used during the 1st generation, four more were included, as the experiences showed that using the following criteria could avoid potential problems those can arrive.

1) More than 1/5 of the command area should not belong to one owner.
2) There should not be any government officer holding the major positions (President, Secretary or Treasurer) in the farmer organization.
3) The responsible farmer organization should take the full responsibility to complete the rehabilitation activities as well as post rehabilitation activities.
4) Farmer organization should agree to complete the rehabilitation activities on time.

Conclusion

Rehabilitation of minor tanks was one of the interventions of DZADP; a multi-sectoral project implemented by CARE International-Sri Lanka in the dry zone of Sri Lank. Initially DZADP adopted a "cascade based approach" to identify minor tanks for rehabilitation within the DZADP administrational limits. Output of the initial scientific and technical screening was subjected to filtering through DZADP criteria. However, DZADP observed a shift in this cascade-based approach upon certain practical reasons. Nevertheless, DZADP criteria were also were revised, incorporating lessons learned during the first generation rehabilitation.

The shift of selection approach between two generations highlights some concerns that should be considered in utilizing more inclusive selection approach. Even though DZADP adopted cascade approach to select tanks during the first generation, only one or two tanks could be rehabilitated from one cascade, hence the impact for whole cascade is very low. On the other hand previous selection approach inadequately interacted with community and other stakeholders in order to assess the social feasibility. Certainly, the selection process should not be ended until the awareness is done.

During the second generation, DZADP could assure relatively increased stakeholder consultation at the selection process, particularly during setting the selection tools together with project's staff and consultants, if outsourced. The "cascade based approach" could have been more resource-effective if project limited all other sectoral interventions to the cascade boundaries.

A reasonable attention should be paid to analyse potential post rehabilitation implications like potential benefits and harms across the various groups of the community. For instance, selection tool should be enriched with techniques like mapping the power relations of the community, PRA etc.

A result oriented selection process is time consuming task. Unrealistically limiting the time would result incomplete selection, which would lead towards problems at construction and post rehabilitation stages.

References

Amarasinghe L.A., Pannabokke C.R. (2003). Identification of Minor irrigation tanks with in selected cascade systems in Puttalam district.

Ariyabandu. R. De S. and Aheeyar, M.M.M. (2004). Secure water through demand responsive approaches: The Sri Lanka experience. Overseas Development Institute.

Athukorala Kusum. (1996). The need for gender analysis in strategic planning for effective water management in Sri Lanka, International Journal of water resources management, Volume 12, Number 4/December 1.

Gunasena H.P.M. (2000). Food Security and Small Tank Systems in Sri Lanka : Proceedings of the Workshop Organized by the Working Committee on Agricultural Science & Forestry NSF Sri Lanka.

Jinapala K, Brewer Jeffrey D, and Sakthivadivel R. (1996). Multi level participatory planning for water resources development in Sri Lanka, Gatekeeper series No. 62, International institute for environment and development.

Ministry of Agriculture and Livestock. (2003). Sri Lanka National Policy on Agriculture and Livestock 2003-2010.

Murray F.J, Little D.C. (2000). The nature of small-scale farmer managed irrigation systems in northwest province, Sri Lanka and potential for Aquaculture, working paper SL 1.3.

Panabokke C.R. (2002). The small tank cascade systems of the *Rajarata:* Their setting, Distribution patterns and Hydrography, Mahaweli Authority of Sri Lanka.

Sakthivadivel R, Fernando Nihal, Brewer Jeffrey D, 1997, Rehabilitation planning for small tanks in cascades: A methodology based on rapid assessment.

Sivayoganathan S, Devarajah K. and Robouchon G. (2003). Impact assessment of the minor tank development program, working paper 56, Integrated Food Security Program, Trincomalee.

Socialist Republic of Sri Lanka (Department of the Government Printing), Agrarian Development Act – No.46 of 2000, 2000.

Thennakoon M.U.A. (1986). Drought hazard and Rural development, Central Bank of Sri Lanka.

Proc. Sym. on Development Initiatives in Water Sector: Lessons Learnt by NGOs,
29 November 2006, Peradeniya, Sri Lanka.

Post minor tanks rehabilitation work of DZADP in Monaragala

P.D.S.S. Kumara, I.P.P. Gunawardana and A.M.S.K. Abeysinghe
Care International Sri Lanka.

Abstract

Dry Zone is the breath of agriculture in Sri Lanka, and minor tanks play an important role in the development of Dry Zone agriculture. Minor tanks have been abandoned for a long-time in the country due to political instability and hydrological situation in the past. The rehabilitation of minor tank is a timely need for the improvement of the country's socio-economic set-up. Care International Sri Lanka carried out a minor tank rehabilitation programme with the launch of Dry Zone Agriculture Development Project (DZADP) in five main agricultural districts namely Anuradhapura, Hambanthota, Moneragala, Puttlam and Mannar. This paper focuses on assessing the post minor tank rehabilitation activities during the project implementation period. The feedbacks were obtained during the project implementation activities through review workshops of minor tank construction, stakeholder workshops for minor tank rehabilitation, and annual collaborative planning workshops with stakeholders. Final survey and evaluation were conducted among the farmer organizations of the 18 rehabilitated minor tanks in Moneragala district. Several adjustments have been made in the present post-rehabilitation process of minor tanks and a few recommendations have been made in the process for future use in the sectors by other developmental agencies and projects that are engaged in minor tank reconstruction programs.

Introduction

As the Sri Lankan history portray the situation of the minor irrigation, tanks became worst with the abolition of the traditional "*Rajakariya System*" by the British Administration Rules in 1832 without introducing any alternative methods for repairing and maintaining of minor tanks. The "*Rajakariya System*" was a disciplinary, collective effort of farmers in the form of labour contribution under the order of the *"Velvidane"*. During the British Rule, there wasn't any legal or community agent for the maintenance of minor irrigation systems, thus lead to a gradual decline of the traditional water management and farming practices in the dry zone of Sri Lanka. Since 1887, Provincial Irrigation Boards were responsible for the maintenance of both major and minor irrigation systems. The Ministry of Agriculture introduced a cultivation committee in 1958 under the *Paddy Land Act*, which lead to further breakdown in the management and maintenance of the minor irrigation system. Thereafter, the responsibility of the minor irrigation system was transferred to Department of Agrarian Services (DAS) and then to the Territorial Civil Engineering

Organization (TCEO) with the enforcement of the *Agricultural Productivity Law No 2 in 1972*. After the dismantling of the TCEO, minor irrigation works were handed over to the Irrigation Department and again to DAS in the same year because of the poor attention paid by the Irrigation Department on minor irrigation since they had been loaded with construction work of major irrigation systems. (Panabokke *et al.*, 2002)

With the enforcement of *Agrarian Service Act No 59 of 1979*, DAS was empowered for water administration and management in 1979 ensuring the sustainability through many ways. Those included *"Kanna"* meetings (seasonal meetings), efficient management of irrigation systems, elimination of customs affecting wastage and proper timing of agricultural operation, timely cultivation of paddy and joint measures for soil conservation. After the administrative and management changes, although several government and non government organizations started to engage in renovating village tanks in Sri Lanka the tanks continued to be abandoned because, the expected impact could not be achieved. Even though the management procedure adapted by DAS seemed conceptually sound, some loopholes were found at the implementation stage.

In 2002, DZADP instigated its activities in two divisional secretariat divisions namely Thanamalwila and Siyambalanduwa in the Monaragala district. Water Resource Management was one of the key components to achieve the initial goal of DZADP enhancing the household income of farmers living in the dry zone of Sri Lanka.

Water Resource Management (WRM) component aims to develop a sustainable agricultural system through rehabilitation of minor irrigation systems in the area and to develop capacity of beneficiaries for better management of water resources. The minor tank renovation led to increase the availability of water for agricultural as well as non agricultural purposes. The storages provide water for *yala* and *maha* farming practices and elevate the ground water table. The minor tank renovation process consists of three stages as pre-rehabilitation, construction and post-rehabilitation. Feedback obtained through stakeholder and farmer consultation directed the Dry Zone Agricultural Development Project (DZADP) to give special emphasis on the post rehabilitation activities in designing the minor tank rehabilitation programme. The following section elaborates the post rehabilitation process of minor tanks in detail as adapted by DZADP.

Post rehabilitation process of DZADP

Recent studies have revealed that the physical rehabilitation of irrigation systems alone is not sufficient enough to increase yields, but a significant effort is needed to improve management as well (Shand, 2002). With the completion of the rehabilitation of tanks, Farmer Organizations (FO) were motivated to develop sustainable tank management plans through diverse trainings and non-training events which included;

1) Tank Operation and Maintenance Training (O&M)
2) Tank Maintenance Fund Establishment
3) Integrated Watershed Management Training (IWM)
4) Catchment Area Development Program
5) Crop Diversification

All post rehabilitation activities were designed in the planning workshops based on the appraisals of farmer organizations and government and non-government partner organizations. Prior to commencement of the post rehabilitation process, approvals were obtained from the District Steering Committee (DSC) chaired by the Government Agent (GA) and Divisional Agriculture Committees (DAC) headed by Divisional Secretariat (DS). Almost all the higher level and ground level government and non government officers were made aware of the process through DSCs, DACs and weekly coordination meetings in Agrarian Service Centres (ASC).

Tank operation and maintenance (O&M) training

Even though the tanks were rehabilitated by various organizations in the area, they were abandoned due to the absence of a proper tank maintenance programme. Understanding this real issue in the field, DZADP decided to prepare tank operation and maintenance plan with proper guidance and training for the farmers of respective tanks and for responsible Government of Sri Lanka (GoSL) partners. Those FOs that completed the training successfully and who implemented the prepared plan by themselves were expected to be rewarded with the matching grant for maintenance fund. At the end, DZADP expected to have proper long-term tank operation and maintenance plan for each rehabilitated tank by DZADP.

In this scenario, operation and maintenance training focused on the development of tank irrigation management plan and tank maintenance plan. Farmers were encouraged to participate in open discussions while defining the rights and responsibilities of the individuals on protecting tank and sharing the responsibilities among the farmer sub groups. In addition they were promoted to develop cropping calendars to minimize the crop damages and to use available water effectively. Monitoring of the implementation of O&M plan is expected to be done by the relevant GoSL officers. FOs were made aware to legalize the maintenance plan into the FO constitution. Implementation of prepared plans need to be monitored and reported by the Agriculture Research and Production Assistants (AR&PA) of the ASCs via FO meetings or the "Kanna meetings".

A common format was used to prepare the O & M plan for all the tanks (Annex 01). After the training, FO was assigned to complete the plan with the participation of all members. The copies of prepared plans were required to be kept with the Department of Agrarian Development (DoAD), Agrarian Service Center (ASC), DZADP and FO for further monitoring and implementation.

Tank maintenance fund establishment

Tank renovation procedure of DZADP was not limited to physical restoration of structures, but paid attention to develop sustainable operation & maintenance procedures. All FO have been trained on this aspect by the resource pool developed by the DZADP, and FOs have prepared the tank operation and maintenance plans to meet the above requirements. DZADP assisted to uplift their capacities in design and implementation of the tank maintenance plans and fund raising methodology. During the planning stages, the importance of assisting the FOs to develop the fund raising mechanism and further strengthening with a matching grant has been shown. The maximum amount of the matching grant was decided as Rs. 25000.00 and granted to be upon acceptable proposals. FOs were assigned to submit the proposals with the DoAD recommendations. The proposals had to be enclosed with the DZADP matching grant-releasing requirements.

Eligibility for the grant

According to the maintenance plans, FOs were promoted to organize fund raising events and to develop separate tank maintenance accounts. DZADP expected to assist the FOs who have developed their maintenance account up to the required standards of beyond 10,000/- LKR and implemented the prepared tank maintenance plan accordingly.

Farmer organizations were supposed to assure the best maintenance of the irrigation system after the DZADP's assistance. Once the maintenance fund is established, it is required to be respect to the following criteria.

1) Money should be deposited in a separate fixed account of a Government Bank.
2) Sub committees should be formed for various sections of tank maintenance such as tank bunds, sluice, channel systems etc…
3) Proper written guidance on tank maintenance
4) The utilization regulations of tank maintenance fund have to be formulated and need to be included in the FO constitution.
5) Maintenance fund management committee must be formed comprising of member from the each maintenance sub committee.
6) Identification and practicing of fund increasing measures
7) Divisional officer of DoAD should supervise the proposed maintenance fund.

Awareness creation of farmers on the importance of raising the tank maintenance fund was done by the partner organization through individual consultation of farmer leaders and FO meetings.

Integrated watershed management (IWM) training

Main purpose of the IWM training was to make aware the farming community on watershed management, to discuss the right and responsibilities of the community as well as government officers in sustainable management of land and water in the watershed. DZADP has developed a manual including three modules for trainers with the guidance of Natural Resource Management Centre of the Department of Agriculture (DoA). A resource pool was formed through a ToT series. The training pool consists of AR&PAs, local NGO field officers and several other partners.

The module one focused on awareness raising among farmers on IWM concept and different practices used by farmers with little or no understanding on the hazards that create on the watershed and the ways to minimize the negative impact of unfair practices on the catchment while demonstrating the efficient utilization of catchment resources.

The second module totally focused on rights and responsibilities of the community who is living in the catchment. This module required the maximum participation of the catchment-based communities. Ways of preparing the IWM plan and practical work were discussed in module three. The IWM plan was prepared in a separate day with the participation of community, government and NGO officers in the area. The plan aimed to ensure the proper management of watershed with the participation of the all parties' while entrusting the maximum eco friendly natural resource utilization (Annex 02).

Catchment area development program

With the increasing population, catchments of most of the village tanks were encroached by the farming community thus it caused deforestation leading to siltation. Farmers used these encroached lands in the catchment mostly for paddy cultivation and occasionally for Other Field Crops (OFC). Hence the responsible authorities lack in enforcing the proper legislations and catchment demarcation aspects to control over this illegal land use. Thus it is very difficult to rectify this situation.

The catchmnet area conservation activities of DZADP were commenced to demonstrate the bad effects of heavy tillage for seasonal upland cultivations and encourage farmers to cultivate perennials in the catchment.

DZADP initiatives for cathment conservation include the promotion of soil conservation practices, reforestation programs with farmer organization, perennial crop demonstration campaigns and district and divisional level discussion with all relevant parties to cater the need of reservations and watershed demarcation. A committee was formed to discuss with the farmers in the catchment to negotiate the problems and to get them involved into the catchment conservation process. The committee comprised of Grama Niladari (GN), AR&PA and farmer leaders. Once the committee proposed the activities

to be done, DZADP reviewed the proposal and assisted them accordingly. Facilitation of the events, material support, and technical backup and organizational support were entrusted.

Crop diversification program

Crop diversification is an explicit objective in the National Agriculture, Food and Nutrition Strategy in 1984 and this was to promote in all agro-ecological zones (Shand, 2002). Biological, technical and economic feasibility are needed to be considered for successful crop diversification. Although the respective Agricultural Instructor (AI) in the area instructs farmers to cultivate OFCs, farmers pay a little or no attention. So the initiative was taken by DZADP to promote crop diversification through establishing *yala* demonstration under the rehabilitated tanks with the aim of encouraging farming community to increase their living condition while diversifying their cultivation habits into high profitable way.

The overall objective of the event was to encourage farmers to involve in OFC cultivation in renovated minor tanks, to adopt the cost minimizing & profit maximizing methods in agriculture and to practice integrated pest management and low input agriculture. Further this was aimed to disseminate and demonstrate new technologies and income generating strategies to Dry Zone farmers, to increase the productivity of rehabilitated tanks by cultivating *yala* in addition to *maha* season, to increase the households' income of the beneficiary families in the rehabilitated tank and to create new ways to strengthen the tank maintenance funds.

The program has selected the tanks that were renovated by DZADP, and have poor acreage of cultivation during *yala* season and less water availability for *yala* paddy cultivation. The intervention was implemented in the form of demonstration during the *yala* season (Annex 03). Committed Farmer Organizations (FO) under rehabilitated tanks who have strong interrelation among FO members were selected for *yala* crop diversification demonstration program.

Selected farmers have to be active members of selected FO and need to have the land ownership in the command area. He is required to be a dedicated farmer and should have good cultivation records in the past. The demonstration abilities were considered while considering willingness to follow the technical guidance given by the Agriculture Instructors (AI) in the area.

The crop diversification program was implemented in both Thanamalwila and Siyambalanduwa DS divisions, which have two different climatic conditions. The crop selection was mainly done by AIs and the selected crops were recommended by the DoA.

Selected farmers abide to repay the DZADP contribution to the FO to strengthen their tank maintenance fund. An agreement has been made to ensure

the above condition. The DZADP funds were allocated for purchasing the inputs for the demonstration and crop insurance. Further, required technical inputs were provided through respective officers (AIs).

Lessons of post rehabilitation process

Tank operation and maintenance training

Collection of funds could not be achieved in some FOs as expected according to the O & M plan due to several problems such as unclear land ownership, poor attitudes of farmers, historical financial frauds of the FO and some loopholes in the constitution. Land tenure has severely affected seasonal collection, because the tenant farmers ("*Anda Goviya*") avoid giving his fee telling that he does not own the land. Though FOs are imposed by constitution and they approved the penalty systems, it has not been implemented due to humanity and culture. There are a few FOs who adhere to these penalties and implement it accordingly. Fine collection from the farmers who violates the pre set rules was the common practice whereas temporarily ceasing the irrigation was observed rarely. Farmers who violate the rules and neglect the penalty were subjected to discontinuation of the membership and abide benefits. For further investigation, the "Samatha Mandalaya" - a village level institution for resolving conflicts, inquired cases. Hence the Institutional Development and Organizational Strengthening (IDOS) sector developed the capacity of FO leaders and empowered them to certain extent to cope with all the difficult situations.

Changing of water master ("*Jala Palaka*") due to delaying payment and internal problems has caused poor water management in minor irrigations. Poor technical know-how with newly appointed water masters create always burden on farmers and the responsible government officers. High workload on divisional level government officers caused by National level different priorities led to decline of attention on monitoring of tank operation and maintenance. Constitutionalization of prepared O&M plan was delayed in several farmer organizations due to overlapping of peak harvesting and land preparation activities. Thereby the implementation of DZADP post rehabilitation process was interrupted.

Tank maintenance fund establishment

DZADP and FOs identified a few key issues in the establishment of maintenance fund. Conflict between tank beneficiaries and FO membership caused breakdown of the process in two ways. Some FOs refused granting the approval in the general meeting for a separate account for the tank maintenance because all the members are not getting the benefits. Some tank beneficiary groups were hesitating to establish tank maintenance fund under FO control thinking that the FO leaders will misuse the money. Mistrust on leadership and

FO due to internal problems also caused to disturb the smooth functioning of maintenance fund collection.

Integrated watershed management (IWM) training

DZADP expected to demarcate the tank reservation area with the help of government responsible officers according to prepared IWM plan. The process was delayed due to lack of required human and the financial resources. At least the reservation areas are not demarcated for 90% of the renovated tanks according to the standards, which should be identified by surveying.

The DZADP IWM training consists of three training events of two days each and a total of six days for the whole training. The length of the training created problem in ensuring the maximum participation for the activity to result the best out put of the training. This situation got worsen in the peak cultivation period of the seasons and generally affected the future processes of IWM planed by the project. According to the plan, DZADP expected to develop a cascade management plan while connecting the experiences collected via the individual IWM trainings. The process was delayed with the difficulty of completing IWM training in selected locations in the cascade due to lack of participation of farmers and poor attention paid by the ground level responsible officers.

In the implementation process of the prepared IWM plans, FOs had to face serious problems with illegal farming in the watershed and leap forward for legal action. Hence expected support and immediate action from the divisional and district level government officers were not received, as they failed to stop these illegal cultivations.

Catchment area development programme

DZADP had to work hard on changing the attitude of catchments farmers to convert their annual crop cultivation into perennials. Poor back up given by the ground level government officers due to political and personal interests caused to slow adaptation by farmers. The farmers who committed to the program had the problem of protecting the established plants and construction works from wild animal threats and drought.

Farmers and the FO in the command area has no or little control over the illegal land use of catchment area. Most Farmers who are living in the catchment area do not have lands under the tank. So it is important to demarcate the boundaries and resettle the farmers defining the land ownership equitably.

Crop diversification programme

In selection of tanks for the crop diversification program the farmers were unable to capitalize the opportunity due to internal problems among the

farmers, thus they missed the chance of establishing *yala* demonstrations. Only two FOs, which fulfilled all the requirements, were selected. After the establishment of the program, due to mixed cultivation in the command area some FOs confronted problems in water management. Especially the cultivation of paddy in well drained land in the command that required more water during the dry period creates unsuitable condition for other field crops due to excessive water in the soil. Hence the soil catena structure in the dry zone negatively affected the crop diversification and it should be highly considered in selecting suitable plots for OFCs.

Relevant government authorities also supported the DZADP crop diversification process. The approvals were needed from respective AIs to proceed and to decide the suitable crops. With the limitations of human resources during the processes, it got delay and DZADP was unable to provide required material support as expected at the beginning. Due to this type of delays some crops were difficult to manage with the changing field situation. The situation was further aggravated by the unexpected drought occured with high blowing of wind across the minor irrigation systems and the command areas. In addition some crop damages were experiences because of attack by wild animals such as elephant, wild boar and group of cattle in the vicinity.

Farmers' attitude of paddy as the major crop was difficult to change. Though the AIs recommended, some farmers were not willing to establish the crop due to their historical sense. Therefore DZADP was unable to meet the number of demonstrations expected and the expected impact from the program.

Introduction of crop insurance program totally failed with the inadequate support given by the District Agricultural Insurance Board due to lack of ground level, and divisional level officers for field visit and official documentation.

Suggestion and recommendation

Developing a common national level process for tank rehabilitation for the country and legalizing the procedures are recommended. Pros and cons of the DZADP minor tank rehabilitation could be used as a base.

Operation and maintenance programme

It is suggested to continue the program giving more attention on awareness of the public on tank operation and maintenance, their responsibilities and importance of the constitution against violation of the maintenance activities. A planned O&M procedure ensures the proper coordination among farmers, FO, ground level officers and the external authorities. Ensuring the self-sustainability of the FOs for the management of their village tank should be a key component of minor tank rehabilitation processes.

Formation of government forum on the monitoring and evaluation of the O&M activities and motivating FOs is needed. Monitoring of the whole process is needs to be done by the District Agriculture Committee. It is important to systematically link all agricultural related activities with FOs and strengthen the constitution of the FOs ensuring the sustainable management of irrigation system of the tank.

Tank maintenance fund establishment

Introduction of fund raising program is recommended to strengthen the tank maintenance fund such as resource centers, public contract, and inland fisheries. Auditing or close monitoring of the financial status of FOs by the relevant GoSL departments is important to entrust a sustainable fund raising and utilization.

Integrated watershed management (IWM) programme

Developing the awareness on the IWM concept is needed through continuation of the program with a reduced number of days of training from six to three.

Government support should be ensured from the district level to disseminate IWM concept. Strengthening and facilitating farmer organizations will be helpful to take legal actions against the illegal encroachment of catchment. Farming community in the catchment area should be made aware of the conservative measures and best management practices highlighting the long-term advantages for themselves.

Catchment area development programme

It is recommended to carry out more awareness programs by incorporating schools, universities and other academic institution in the activities that promote the catchment area development programs.

The government should pay the attention for catchment demarcation and transfer the land ownership. Land ownership should be clearly defined, as it creates lots of problems in the implementation of the programs. Fund requirement for catchment demarcation programs can be estimated by the district level government organization and the proposal can be submitted to the funding organizations or non-government organizations in the district to implement. In particular, the farmers are required to be more sensitive to the fire damages and the wild animal damages on catchments, and they must take immediate actions.

Crop diversification program

It is advisable to continue the program making aware the importance of crop diversification via cost benefit analysis, cross visits, case studies and

interactive dissemination programs. At the same time it is important to have higher-level promotion in collaboration with the government and introduce subsidy program to promote the OFC cultivation. The important part of the program is pre planning of the OFC promotional program with required technical and field level approval from the government officers.

Since it is difficult to grow upland crops in poorly drained low humic gley soils, OFCs should be promoted only in well-drained soils during the dry seasons. Better water management should be done.

Conclusion

DZADP post rehabilitation process can be replicated together with all minor tank rehabilitation efforts in Sri Lanka especially in the dry zone. Making the farmers more aware of the process is the most difficult step, but the most important effort to accomplish. It is recommended that a careful attention needed on farmer awareness events and activities that would help in developing a sustainable water resource management system of minor tanks. Furthermore, the water policies, and legislations should be in compliance with the ground level government interventions in solving issues of land ownerships and demarcation.

Reference

Panabokke C.R., Sakthivadivel R. and Asoke Dias Weerasinghe. (2002). Small Tanks in Sri Lanka: Evaluation, Present Status and Issues. International Water Management Institute. Colombo Sri Lanka.

Shand, Ric. (2002). Irrigation and Agriculture in Sri Lanka. Colombo. Institute of Policy Studies.

Annex 01

Tank operation & maintenance module

Title: Tank operation & maintenance mechanism for tanks rehabilitated by DZADP CARE International

Partner organizations: Department of Agrarian Development, Farmer Organization

Name of the schemes: 1.Eg. Bibilyaya tank
2.
3. etc…..

A) Initial information of minor irrigation system

Name :
GN Division :
DS Division :
ASC Range :
Road map to Irrigation System :
Watershed off area :
Catchment area :
No of farmers under tank :
Name of FO :
Registration No :
Dare of construction start :
Date completed the construction:
Funded organization :

B) Estimated works to be done:

Work / Activity	Expenditure		
	Funded organization contribution (Rs)	Beneficiaries contribution (Rs)	Total contribution (Rs)
1			
2			
3			
4			
5			
6			
7			

C) Situation report (inspection activity plan)

Year: Month: Date:

Activity		Present situation	Required maintenance or rehabilitation
A. Tank	1.Forest in catchment 2.Height of bund 3.Leakages 4.Side dam condition 5.Termite hall in dam 6.Terfing condition 7.Cracks		
B.Amuna	1.Sluice 2.Rust in sluice 3.Lover basin 4.Cracks in concrete 5.Amunu pliers 6.Concrat walls 7.Leaks		
C. Sluice	1.Leaks 2.Concreat 3.Sluice door		
D. Spill	1.Craks in concrete 2.Soil construction 3.Soil erosion 4.Srubs growth 5.Drainage channel 6.Drainage channel bund		
E. Irrigation channel	1.Jungle in channel 2.Sedimentation 3.Channel bunds 4.Leaks 5.Over flow		
F. Drainage channel	1.Over flow 2.Srubs growth		
G. Construction in channels	1.Concrete 2.Sluice gates 3.Wood doors 4.Iron parts 5.Special construction		

D) List of landowners under tank

No	Name of farmer	Membership No	Nature of ownership	Land (ac)			Total land (ac)
				Left channel	Rght channel	…….. channel	

E) Maintenance list

No	Name of Farmer	Length of bund to maintenance	Length of irrigation channel (maintenance)			Remarks
			Left channel	Right channel	…… channel	

F) Irrigation management plan

No group	Land area (ac)	Time allocated	Su	Mo	Tu	We	Th	Fr	Sa	Remarks

G) Member list of irrigation management plan

Irrigation channel	Group No	Name list o group	Remarks

H) Cropping calendar

Land extent: Season:

Activity	Time frame												Special concern
	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	

I) Annual tank maintenance estimate

No	Activity	Area ft/km/ unit	Unit price Rs	Amount Rs	Labour		Material cost	Remarks
					Man days	Amount Rs		

J) Annual maintenance plan

(1)	(2)	(3)	(4)	(5)	(6)	Time											
						J	F	M	A	M	J	J	A	S	O	N	D

(1) Sub no
(2) Channel construction
(3) Maintenance activity
(4) Area
(5) No of maintenance / year
(6) Responsibility

Type of crops recommended for year :
Variety :
Duration :
Land extend cultivated :
Tract :

K) Seasonal plan

1) Seasonal meting :
2) Clearance of bunds & channels :
3) First Irrigation event (land preparation) :
4) Land preparation - First plough :
   Second plough :
5) Initial fertilization :
6) Sawing & planting :
7) *Isnam badeema*
   (first irrigation after planting or sawing) :

L) Maintenance fund

1) Account No :
2) Bank :
3) Branch :
4) Account balance update :

Annex 02

Irrigation water management plan

No	Activity & Sub activity	Time frame (months)												Responsibility	Support	Expected output	Indicters	Remarks
		1	2	3	4	5	6	7	8	9	10	11	12					

Model estimate

No	Activity	Available resources	Required from outside	Required resources	Required resources (Rs)	Remarks

Annex 03

Yala demonstration calendar

Yala OFC Demonstration Calendar																							
Activity	Responsibility	April				May				June				July				August					
Tank selection	DZADP																						
Demo farmer selection stage	FO Members																						
Demo farmer selection	DZADP																						
Identification of potential crops	DoA, DZADP																						
Demonstration cost estimating	DoA, DZADP																						
Plan preparation and processing the required document	DoA, DZADP																						
Technical guidance	DoA																						
Financial allocation	DZADP																						
Seed selection	DOA																						
Crop insurance	AIB																						
Demo follow up Technical inputs	DoA																						
Record keeping and field follow up and reporting to DZADP	AIDF																						
Progress reviewing of the program	DoA, AIDF, DZADP																						

Proc. Sym. on Development Initiatives in Water Sector: Lessons Learnt by NGOs,
29 November 2006, Peradeniya, Sri Lanka.

Promotion of crop diversification under minor tanks during the *yala* season: A case study

D.L Chamila Jayashantha
Care International Sri Lanka

Abstract

Uncultivated yala season is often characterized under minor tanks in the dry Zone of Sri Lanka. One of the main reasons cited for this situation is competition for water among other reasons like poor community cohesion, land fragmentation, degrading of soils etc. Poor performance in irrigation management results lack of water for yala cultivation. Nevertheless, since paddy has been the historically dominating crop in Sri Lanka, it is not easy to promote other options even though they are profitable and advantageous in many ways. This situation stimulated Dry Zone Agricultural Development Project (DZADP) to think of a remedy that should be organized to combat attitudinal barrier whilst fulfilling some other factors like initial input assistance and service links. DZADP capitalized this mission with a farmers' organization under one of the recently rehabilitated minor tank in the Puttalam District.

Paper describes how this farmers' organization was refreshed in terms of management and mobilized to initiate the crop diversification program in order to increase cropping intensity for better agricultural productivity and income. It concludes the importance of inculcating improved irrigation management practices, assuring extension services, creating market linkages and providing reasonable input assistance for the initial stage.

Introduction

Tanks (man-made reservoirs) in Sri Lanka are classified into two categories, Major tanks and Minor tanks based on two factors; the size of command area and/or the size of water spread area. Major tanks are that irrigate more than 200 ac of command area or over 300 ac in water spreading. Minor tanks or commonly known as "village-tanks" have less than 200 ac command area and play a key role in irrigating rural agriculture in the dry zone of Sri Lanka, thus the rural economy entirely depends on minor tanks. At present over 12,000 minor tanks are in operation mainly in the dry zone. However, upon various limitations, socio-political and economic reasons, tank based cultivation systems being diminished and demonstrates no or less development.

Dry Zone Agricultural Development Project (DZADP) executed by CARE international Sri Lanka intends to increase agricultural productivity and income so creating a model that could be widely replicated in other dry zone areas. Hence, DZADP is mandated to rehabilitate the selected minor tanks in

operational areas. As an agricultural development program, DZADP believes that our mediation should deploy further than just renovation of tanks, where post rehabilitation activities like tank maintenance, irrigation management, catchment area development, etc should be assured with resolution of land ownership towards increased cropping intensity. It is manifest that farmers should expand their attitude beyond predominant paddy cultivation mainly during *maha* season as a mean of increasing agricultural productivity and income, which is left as a significant challenge. Efforts of promoting diversified cropping patterns also in line with the national agricultural and livestock policy (2003) reference as it states, "increased utilization of high quality seeds and planting materials, planning crop production at tract and village level, minimizing environmental damage and protecting bio-diversity, prudent use of land and water resources under crop specialization, increased consumption of pulses in family diet….".

Since 2004, DZADP continued its effort to promote other field crops (OFCs) during *yala* season under rehabilitated tanks in Puttalam district. Making the farmers aware of the advantages of this new cropping style together with incentives like improved varieties and other imperative technical facilities persuaded them. This paper describes one of the success stories experienced at *Mandapothana* tank situated at *Jayarajapura* village of *Mahakumbukkadawala* division in the Puttalam district.

Present situation of crop diversification under minor tanks

Historically, the dominant crop of Sri Lanka has been paddy. Other field crops (OFCs) like green gram, groundnut, gingerly, maize, finger and millet are also cultivated mainly with the blessing of seasonal rains. Mango, cashew nuts, pomegranate and guava are the prominent tree fruits in the dry zone. However, farmers show relatively less interest in cultivating OFCs in tank command areas despite a reasonable extent of immediate catchments area was used for OFCs in the past during *yala.* Sivayoganathan *et al.* (2003) brief one of their experiences in Trincomalee district; only paddy was cultivated in the command areas of all the 16 tanks both before and after development. It is worth noting that no farmer reported cultivating any other field crops. Before development of the tanks, paddy cultivation was undertaken during the *yala* season. After development paddy was cultivated under all these developed tanks during the *maha* season and only under three tanks during the *yala* season. Farmers less interest on harvesting in *yala* season has been reassured by Gooneratne *et al.* (1977) through a socio-economic appraisal that they have conducted with one of the early settlements *(Kurundankulama)* in Kurunegala district. Out of the 653 acres of total cultivable land, only 40% and 25% were cultivated during *maha* 1975/1976 and *yala* 1975, respectively. Various contributing factors have been discovered for the incidence of uncultivated *yala* season. Murray and Little (2000) argue, most farmers under seasonal and semi-seasonal tanks reported having almost abandoned *yala* cultivation. Reasons cited were reduced

water availability and competition for water, decreasing soil fertility, land fragmentation and institutional weaknesses of Community Based Organizations (CBOs). These factors have combined to reduce the useful productivity of land and lead to progressive abandonment of the *bethma* system, which is a traditional strategy for reducing risk by such communities.

Crop diversification was encouraged under the DZADP

Jayarajapura is a village of 134 families and 70 of them have obtained the membership of *Jayarajapura* farmer organization. DZADP selected to renovate the minor tank of this village named *Mandapothana* in 2003 with the technical support of Department of Agrarian Development (DoAD) and also with community participation. Out of the total rehabilitation cost, 80% (483,465.54 LKR) was born by DZADP and 20% (155,497.00 LKR) was born by farmers' as contribution–in–kind. It was observed that other than paddy no any other remunerative crops have been adapted, except for one *yala* season, which had been cultivated as a result of unexpected heavy showers in 2001. Table 01 depicts the cultivation pattern of *Mandapothana* tank before tank rehabilitation.

Table 01. Cultivation details of *Mandapothana* tank before rehabilitation.

Year	Season	Paddy (ac)		Other field crops (ac)	
		Cultivated	Harvested	Cultivated	Harvested
1999/2000	*Yala*	-	-	-	-
	Maha	10.0	10.0	-	-
2000/2001	*Yala*	-	-	-	-
	Maha	12.5	12.5	-	-
2001/2002	*Yala*	-	-	-	-
	Maha	48.0	45.0	-	-
2002/2003	*Yala*	17.5	15.0	-	-
	Maha	48.0	48.0	-	-

DZADP primarily anticipated to increase cropping intensity in a profitable way through these crop diversification efforts. Sakthivadivel *et al.* (1997) have suggested a methodology for planning the rehabilitation of small-scale irrigation systems in the dry zone of Sri Lanka. With their experience they suggested the importance of increasing cropping intensity (CI) as a parameter. This methodology has been designed to ensure that rehabilitation of a scheme

will be fruitful by ensuring that water is available to allow for increased cropping intensity. Income is the key to keep the project continued by farmers, where the interest of other responsible parties such as bankers and buyers would be retained. It is obvious that such a program will not be initiated automatically, despite many factors and conditions remain conducive. DZADP followed a series of steps at pre-cultivation stage to implement crop diversification program successfully. It started with training farmers on irrigation management and ended with providing planting materials. Following steps were adopted during the implementation of program.

Irrigation management training

Goonerathna *et al.* (1977) point out "absence of supplementary irrigation facilities to tide over the drought periods appear to be a major constrain for crop and livestock production. They also suggested the provision of supplementary irrigation facilities for farmers to engage in intensive cultivation of certain crops (e.g. Vegetables) during the *yala* season when labour is under-utilized, is another aspect that needs careful consideration. It is hypothesized that farmers are not competent and less interested in effectively managing the available water in their water sources like tanks. Thus the entire process started with delivering irrigation management training for farmers. Purpose of this training is to train them to rationally select potential crops, land extent according to the water availability.

Fifteen farmers of *Jayarajapura* farmers' organization participated for the irrigation management training. As a result of this input, farmers could be easily convinced over the advantages and potential risks of notion of "paddy only" during both seasons. Technical support for the training was given by the officers of the Department of Agrarian Development (DoAD) and it was organized by Agricultural Research and Production Assistants (AR&PAs) of the same department. Following topics were covered during this training;

- List of land owners with extent (Lot list)
- Estimation of tank water capacity
- Water issue tree
- Water issuing schedule

Refresher training for farmers on organizational strengthening

DZADP presumed that some of the additional conditions needed to be met to have best results of these crop diversification efforts. Farmers would enjoy a little at the end of the program if the social cohesion remain same. Hence DZADP prioritised the requirement of rejuvenating status of their farmers' organization. This refresher training comprised of two parts;

- Building the organizational skills like leadership and planning
- Market oriented crop planning.

Also more inclusive approach is essential to include women and youth to create more opportunities, which is also entirely inline with the 17th policy goal of the national agriculture and livestock policy. Besides, forming the farmer organization as a marketing body is important as they are supposed to sell together to enjoy the competitive advantages of bargaining for better price. With the involvement of all the grassroots level officers and divisional level officers this plan was formulated to assure their contribution. Twenty farmers participated for both refresher and market awareness training at *Jayarajapura*.

Raising the market awareness

Yala season crops such as chillies, pumpkins, gherkins, green gram and groundnut consume less water than paddy. However, because of the perishable nature of many of these produces, poor terms of trade were available to small producers. Many farmers have discontinued such production in favour of subsistence agriculture (Murray and Little (2000). DZADP sponsored many events to expose the farmers to potential markets and buyers, including exposure visits and training.

Providing inputs

Murray and Little (2000) urge the need of assuring support services with the collaboration of wide array of stakeholders for crop diversification programs. After handing over to farmer the NDF (National Development Foundation) and DAS (Department of Agrarian Services) gave necessary support for system management. The NDF organized relief credit from OXFAM for farmers to buy seed inputs. During *yala* 2006, crop diversification was introduced to them. DZADP provided seeds for farmers while farmers were supposed to match the next 50% of full project cost by fertilizer and also through their labour in land preparation weeding etc as contribution in kind to the project.

Results

Fourteen farmers agreed to join the project and cultivated 7.5 acres during the *yala* season. Table 02 shows the development they achieved as a result of this intervention.

Table 02. Cultivation details under *Mandapothana* tank after rehabilitation.

Year	Season	Paddy (ac)		Other field crops (ac)	
		Cultivated	Harvested	Cultivated	Harvested
2005/2006	*Yala*	17.5	15.0	7.5	7.5
	Maha	48.5	45.0	-	-

They earned 350,000.00 LKR at the end of two months as net income. Cropping intensity was increased by over 15% for that year and income per acre exceeded 46,000.00 LKR. It was the first time that they cultivated *yala* season in last 5-6 years. Following are the key advantages that they have enjoyed after their decision to diversify the crop during *yala*.

- Low water consumption – 1 to1.5 acre-feet water needed for one OFC ac
- Low production cost – farmers have expended only 11,500.00 LKR per ac
- Relatively low management cost
- Very high income per ac – Earned 46,600.00 LKR per ac
- Short crop duration (2 months)
- High market demand – No a single sweet melon left by the buyers, according to the villagers.

Conclusion and suggestions

OFC cultivation during *yala* season is an effective way of increasing agricultural productivity and income, especially for the farmers living in command and catchments areas of minor tanks in the dry zone, Sri Lanka. Programmers and/or extension workers those who are keen in such programs have to play a vital role, as there is no substantial interest from farmers end. One of the important lessons learned during the program is that the need for guiding the farmers until they enjoy the benefits of there effort. It is suggested that rough cost-benefit analysis for few dominant crops must be inserted for initial farmer training. Advocating for uninterrupted institutional support, especially from government line agencies like Department of Agriculture, Department of Agrarian Development is important, as it seems inadequate. Provision or facilitating the process of raising the market awareness, linking the necessary supports are also crucial for success of the program. Mediators have to play a key role in organizing the community level crop planning perhaps through traditional "*kanna* meeting" and strengthening the community organization using conflict sensitive approaches, as poor community cohesion was a detrimental factor, which was common for *Mandapothana*. It is also suggested that organizing field days or such events to share the results with neighbouring community would add a significant value for the program in communication and dissemination perspectives.

References

Gooneratne.W., Wickramasekara. P., Samad. M. and Wijeratne. C.M. (1977). Kurundankulama Dry farming settlement, A socio-economic appraisal

Ministry of Agriculture and Livestock. (2003). National policy on agriculture and livestock, 2003-2010.

Murray F.J., and Little D.C. (2000). The nature of small-scale farmer managed irrigation systems in northwest province, Sri Lanka and potential for Aquaculture, working paper SL 1.3.

Sakthivadivel R., Fernando Nihal and Brewer Jeffrey D. (1997). Rehabilitation planning for small tanks in cascades: A methodology based on rapid assessment.

Sivayoganathan S., Devarajah K. and Robouchon G. (2003). Impact assessment of the minor tank development program, working paper 56, Integrated food security program, Trincomalee.

Ecological restoration through community participation in Maragalakanda in the Moneragala district

Kamal Melvani,
Neo Synthesis Research Centre

Abstract

The destruction of forests in the mountainous areas of Sri Lanka has meant the loss of watersheds for many rivers. The lack of forest cover has caused incalculable harm to the productive capacity of watersheds in terms of the creation and retention of topsoils, the control and retention of water run-off, especially during the dry season. It has meant a massive loss of biodiversity and the absence of forest products used by villagers as an integral part of their lives. The lack of forest cover has resulted in rainfall directly impacting the soil, carrying it away as silt that clogs irrigation canals and fills irrigation reservoirs.

We proposed to reverse this process through the restoration of forests. Realising that the root of the problem was economic we first began to talk with the people who live on these mountains and suggested to them alternatives to the current, unsustainable land management practices they engaged in. We intended to work with the villagers to develop and initiate action plans that will improve water conservation, increase soil productivity and re-create habitat. We were also mindful that people must improve their livelihood in this process and design landscapes with tree crops that would bring about an increased income. Everyone must benefit from the restoration of these montane forests.

Introduction

In Sri Lanka, upper watersheds are of greater concern in terms of water resources, biodiversity and eco system. Natural montane forest in the upper watersheds ensures the flow of water in streams and rivers even during the dry season. It also prevents high surface runoff, floods, landslides and sediment loads. In the past few decades, the montane forests have been changed into monoculture plantation with exotic species (Eucalyptus, Pinus, Cypress and Acacia), grass land, intensive vegetable cultivation and bare lands. This changes result in various positive and negative impacts. In addition, destruction of natural montane forest cover has brought in loss of habitat and hence a massive loss of biodiversity even in the lower watersheds. The greatest impact that forest destruction has is on the people who live in the watershed. Restoration of degraded areas of watershed with people participation is very important to enhance the water resources, biodiversity while improving the livelihood of the people and eliminating the illegal felling of trees, forest fires and poaching.

This paper shares the experience gained from the restoration process in a model home garden and the subsequent restoration of upper lower mountain area with 51 villagers.

Project Phase I: The demonstration model established for the National Water Supply and Drainage Board in Wedikumbura

If we wanted to restore the forest cover in these scrub and *chena* areas, we would have to show people how to do it. The home garden of Jane Nona was selected as a demonstration model for restoration since it had several land use patterns within it. These features allow for the application of different types of treatments for restoration. In 2001, the first demonstration model in ecological restoration was established in the home garden of Jane Nona in the Wedikumbura/Aliyawatte area. This area was located on the tallest mountain in the range. Her 8 acre plot was almost bereft of any tree cover and had no shade at the inception. The land was bordered on two sides by secondary forest that the farmer was cutting down for the purpose of cultivating her *chenas* during the time of the northeast monsoon, as this was her only source of income. Her annual income in 2000/2001 did not exceed Rs. 7000.00! She had 5 children and could only afford to send her eldest child to school. There was no water source on the land but only three 'dead' gullies. Few animals and birds were to be seen. We discussed the problems faced by the farmer and identified possible solutions for the same.

If farmers living in these montane areas are given an alternative system of land management, one that increases their income, conserves water and soil, they would not venture into clearing forested areas. The project principally aimed to adopt the silvicultural technique of analog forestry. Analogue Forestry is a system of silviculture that seeks to establish a tree-dominated ecosystem that is analogous in architectural structure and ecological function to the original climax or subclimax vegetation community. It seeks to empower rural communities both socially and economically through the use of species that provide marketable products (Falls Brook Centre, 1997).

While the tree crops chosen would increase income and nutritional status of the farmer, they would also provide several trophic levels required in the creation of habitat for biodiversity. The creation of an analog forest in Jane Nona's garden would extend the range of the natural forest downwards. This would then enable the free movement of biota trough biological corridors. This newly established 'forest garden' would be composed of several tree species thus serving to lock more biological carbon through photosynthesis and act like a carbon sink. The increase in shade and corresponding increase in biomass would allow for the increased accumulation of surface water and decrease in soil erosion. It would also facilitate the recharge of the aquifers of the dead streams in Jane Nona's garden.

The restoration effort

As a preliminary step, the closest natural forest in the area was visited and the architectural structure, species composition and ecological functions of those species were sought. This information provided the basis for the proposed landscape design and management plan for Jane Nona's garden.

The key feature of the design was that native species were used in the areas adjoining the forest and in the riparian zones where conservation forestry was used as the method for restoration. The anthropogenic dominant area around the homestead was designed with both exotic and native species that would provide utility benefits to the farmer. At the end of 2004, over 5000 trees, shrubs and other plants were established.

Section 1: Describes the border of the land that adjoins a small patch of disturbed natural forest. This buffer zone was planted using native species from the forest itself. Trees like *Chloroxylon swietenia (Burutha), Diospyros ebeneum (Ebony), Dimocarpus longans (Mora), Antiaris toxicaria (Riti)* and *Mallotus phillipensis (Hama)* were some of the species used.

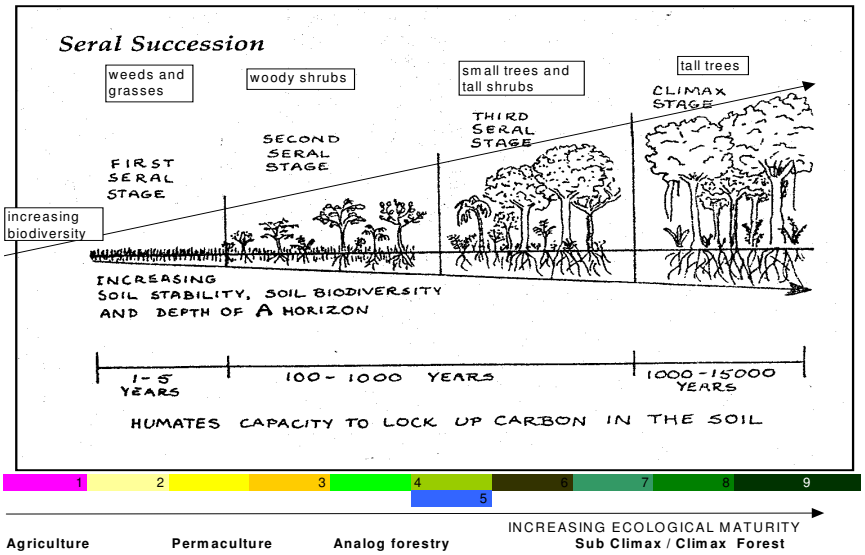
Section 2: This is the main agricultural production area in the garden. Soil conservation practices like the planting of shade, hedgerows and the digging of contour drains were engaged in. Further since there was no water source, water was diverted from the marsh area above the garden to feed a canal using the same flow pathways as the dead streams and networked through a series of holding ponds that would serve to increase the holding capacity of water in the garden. These ponds were gley lined (made of organic matter and clay) and would provide a good medium for the breeding of fresh water fish. It is hoped that water from these ponds will slowly seep out into the surrounding soils and percolate into the ground thus re-charging the dormant aquifers.

The easy availability of water for agriculture would result in the increase in the farmer's capacity to grow more crops and thereby increase her income. A vast array of crops was cultivated that Jane Nona could not grow before. The crops included both annual and tree crops that served a multitude of utility purposes. All the dry zone vegetable crops were grown using only organic regimes of cultivation and served to bring in income in the short term. The farmer's family also consumed a large portion of the vegetables and this enhanced nutritional diversity as well as reduced her daily expenditure. The tree crops cultivated were:

For food

Pineapple, Passionfruit, Goraka, Tamarind, Mango, Papaw, Rambutan, Ice Cream Bean, Coffee, Jak, Del, Cinnamon, Cashew, Weralu, Custard Apple, Cocoa, Ginger, Cardamon, Turmeric, Pepper, Coconut, Gal Siyambala, Pomegranate, Kitul, Katurumurunga, Date, Lemon, Lime, Orange, Mandarin, Grapefruit, Uguressa, Beli, Divul, Sapodilla, Jam fruit etc.

Annexure 1



A forest can be seen as a tree domininated phase of a succession of ecosystems, which usually gains biomass with maturity. While the successional process progresses with time, local or climatic events can arrest the process of maturity and hold a seral stage constant for long periods of time, a characteristic that has been utilised in human designed cropping systems.

For medicine

Pavatta, Aloe vera, Niyandha, Akkapanna, Tippili, Bin Kohomba, Sera, Nelli, Bulu, Aralu, Himbutu and Puwak.

Ornamental plants

Anthurium sp. Heliconia sp., Orchids sp., Cassia spectabilis, Spathodea campanulata, Tabebuia rosea and *Lagerstromia flos reginae.*

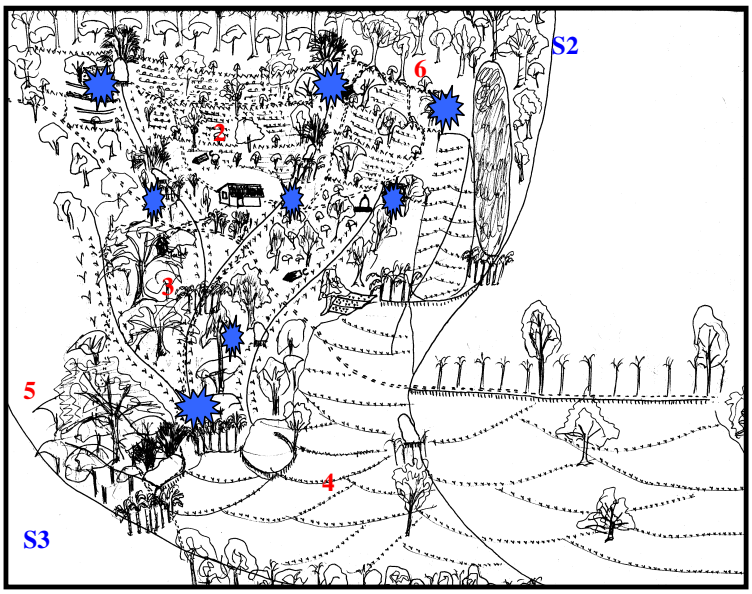
Hedgerows and soil conservation

Gliricidia maculata, Erythrina lithosperma, Pavetta indica, Malvaviscus sp., Elderberry*, Vetiver zizanoides, Cymbopogon citratus.*

Section 3: These are the riparian areas that include dead gullies where species like Kumbuk (*Terminalia arjuna*), Malaboda (*Myristica dactyloides*), Eriya (*Horsfieldia eria*), Puwak (*Arecha cathechu*), Kitul (*Caryota urens*) and Nelu (*Strobilanthes sp*) were used.

Section 4: Traditional rice varieties like Kalu heenati, Suwandel and Rathdel were grown in the paddy fields using the Nawa Kekulama method of rice cultivation. Traditional methods of pest management together with the concept of re-creating habitat for predators (for rice pests) were used by planting hedgerows on the bunds with species like *Gliricidia sepium* (Ladappa), *Croton laciferus* (Keppetiya) and *Pavetta indica* (Pavatta) while trees like

Madhuca longifolia (Mee) wetland species like *Pagiantha dichotoma* (Divikaduru) and *Dillenia retusa* (godapara) were planted in and around the (Threshing floor) kamatha area.



The landscape was divided in to 6 sections on the basis of the physical features of the land including the contours and the drainage pattern.

Macro level landscape design of home garden

	Holding Pond
1	Section One
2	Section Two
3	Section Three
4	Section Four
5	Section Five
6	Section Six
S3	Stream 3
S4	Stream 4

Section 5: This area is downstream of Jane Nona's garden where ornamental trees like Flamboyant (*Delonix regia*), Tabebuia (*Tabebuia rosea*). Cassia (*Cassia spectrabilis)* were some of the species that were planted along the canal bunds that ran through the downstream 'walk' area.

This area could be developed into a potential eco-tourist trail.

Section 6: This very rocky area was planted with fast growing trees, vines and succulents in order to establish a cover over them. A rock that is exposed absorbs heat quickly whereas a rock hat is covered with dense vegetation cools

and becomes a repository for attracting and trapping moisture. The name of the mountain range,

Maragalakanda implies that it is a very rocky area; the nature of the Project is to regard the mountain as a sentinel or Tower that needs to be adorned. Hence, trees like *Ficus hispida* (Kotadimbula), *Samanea saman* (Mara), *Tamarindus indica* (Siyambala), *Bridelia retusa* (Ketakela), vines such as *Pothos scandens* (Pota wel), *Calamus rotang* (Wewal) and *Passiflora edulis* (passionfruit) and succulents such as *Aloe vera* (komarika), *Sanseveria zeylanica* (Niyandha) and *Kalanchoe pinnata* (Akkapana) were planted in between the crevices of rocks.

Further to the landscape design of the farmer's land, the Project constructed a biogas unit since the farmer had 5 head of cattle. The slurry was used for making compost while the gas produced was used for cooking. This will make the system of land management even more sustainable.

The second phase of the project in Wedikumbura

The visible success of the demonstration model spurred the other farmers who lived in the area to request us to extend our work to include their lands as well. In 2002, we received support from the GEF/SGP to ecologically restore the greater Wedikumbura/Aliyawatte area..

Selection of beneficiaries

A meeting was held in Wedikumbura where the proposed project sought to restore all of the farmer lands in a similar manner to that of Jane Nona's garden and the participatory restoration of common stream areas. While many members of the communities who lived in the Wedikumbura and Aliyawatte areas attended the meeting, 51 farmers were identified as willing contenders and thus became the beneficiaries of the Project. 22 farmers were selected from the lower mountain area that was predominantly from the Sinhala community. 29 landholdings from the Estate Tamil community who occupied the upper reaches of the mountain were also selected. While the Sinhala members of the community had engaged in farming all their lives, members of the Estate Tamil community cultivated their lands only during the rainy season since most members of the community laboured in other people's lands. A preliminary survey was conducted on all beneficiaries as to their socio economic status, crops and land management that was then followed by a survey to assess their drinking water needs. The extension officers detailed to the Project interviewed every beneficiary and assessed their problems and requirements thereby establishing a rapport with them.

At the beginning in 2001

The demonstration model was extremely successful. After two years, 25% shade had been established on the land and the farmer had to change her cropping pattern from annual to shade loving crops like turmeric, ginger, coffee, pepper etc. Her income had risen and now all of her five children went to school. There was moisture retained in her soil even during the dry season and even frogs seen only in the rains had begun to make their appearance! Many species of birds and butterflies were now seen and the population of skinks seen on the land had exploded confirming further that the leaf litter or biomass in the soil had increased. The success of this model opened the eyes of the other farmers who lived in the Wedikumbura area.

Social mobilisation and group formation

The mobilization of the beneficiaries continued until the very end of the Project; monthly meetings were held to review the progress of the farmers at which time a platform was created for group discussion and the sharing of information. Several farmers preferred to work in groups where members worked in each other's gardens at different times. A total of 4 groups were formed; two from the lower, Sinhala dominant areas and two from the upper mountain areas dominated by Estate Tamil communities. This mechanism was extremely effective when establishing hedgerows, shade plants, weeding and the construction of soil beds and ponds. By the end of the Project lifespan, the members of the Project had come together to form a community-based organization named the Maragalakanda Watershed Restoration Organisation. They had drawn their manifesto and had initiated thrift and savings schemes.

The constitution of a village based organization lent to the Project strength that enabled the members to speak in 'one voice' and defend the mountain against any destruction. A salient feature of this 'strength' was manifest with the near cessation of illegal logging that had been a common feature prior to the inception of the Project.

The children of the Maragalakanda community were also mobilized to form groups and two children's groups, one from the lower region Sinhala dominant community as well as one comprised of children from the Estate Tamil community were formed. The Project staff devoted one day a week to teaching children about biodiversity, forestry, organic agriculture, sanitation, ethics and first aid. The children assisted greatly during the rainy season especially when common areas were planned for planting. The most important role played by certain children in the groups was that of monitoring the fish in the streams.

The same location after two years in 2004

One of the primary aims of the Project was to conduct research on biological indicators for stream water quality; here fresh water fish were surveyed for their frequency and distribution in 'good' and ''bad' water areas in streams. An art exhibition was held for the children and they were taken to the Sinharaja rainforest for a field visit. Prizes were distributed to the most promising children in an annual event that received great support from the community.

Sustainable land management

Inventory of flora and fauna

The initial steps taken by the Project was to collect baseline data on the flora and fauna found in the fragmented forests found in the greater Project area. The physiognomic classification of vegetation as devised by Kuchler and Zonneveld and later modified by Senanayake (F. Ranil Senanayake, 1989) was used to determine the growth forms and their associated height and structural categories. A simple inventory of birds, reptiles, butterflies and amphibians was the basis on which data on the ecological functions of the forests were formed.

Mapping and landscape design of project area

As a first step, a baseline map was drawn for the entire project area that portrayed the dominant physical features, drainage patterns, land use and

farmer land holdings. While some forest remained, the majority of the project area was used for *chena* cultivation or had been abandoned after successive seasons of cultivation. Most of these areas were eroded and lacked shade. There were several streams that flowed down the mountain out of which 22 were dead streams or 'mala arawas' in the greater project area. Some paddy lands and a number of productive home gardens were also part of the landscape.

Subsequently, baseline maps of each farmer garden were drawn; the baseline maps provided the matrix on which the landscape design of each garden was done. The landscape design of the farm garden was undertaken with the participation of the farmer and his family where focus was placed on planting in Production, Buffer, Riverine, Gully and Pond and rock laden areas. While care was taken to provide an adequate number of utility plants in the design, equal emphasis was paid to the needs of soil, water and biodiversity conservation. Sunlight and wind intensity were also critical factors. Plants that effect biofiltration were also incorporated into the design of those gardens that were located next to the streams. After the design was completed, the extension staff discussed and drew up the management plan for each garden, again on a participatory basis.

Base maps and landscape designs were drawn for all the stream pathways, specifically those that were bereft of riparian vegetation. In this case, the design purely mimicked the riparian vegetation seen in pristine areas and comprised only native species.

Establishment of nurseries and the procurement of planting material

In order to cater to the needs of the landscape designs drawn, 3 large plant nurseries were initiated by the Project. Prop gules were collected frequently where the fragmented forests served as arboreta for the seeds of native planting material. Utility species like fruit trees were propagated both in the Project and in farmer nurseries. In fact, over 75% of the planting material used for the larger project was propagated by the Project itself.

Organic cultivation of annual crops

Some farmers who showed a keenness to engage in annual cropping using strictly organic regimes of cultivation were taught how to construct elevated beds along the contour. Other tools of land management like biological pest control were also taught to farmers and many initiated ecological farming in their gardens. The availability of water was ensured by the construction of ponds for holding water. Much success was enjoyed by farmers who not only consumed a fair portion of the vegetables but also sold the excess at the local pola. Since organic seed was hard to obtain, the Project initiated a seed bank where farmers produced their own seed.

Planting during the rains

The execution of the landscape designs of both the individual farmer gardens and the stream/gully areas was undertaken with the advent of the monsoon rains in 2003 and 2004. While the Project staff assisted the farmers to plant their gardens, the stream/gully area planting was undertaken as a community effort where group members, children and even those not directly benefited by the Project participated. The base maps of all gardens are updated with the plants established and it is now referred to as the 'planted map'. Planted maps were drawn up for the stream/gully areas as well. A total of 155,776 trees, shrubs, climbers and other plants in 205 species were planted by the project in the two year span, 2003 to 2004**.**

Maintenance of plants

The drought was very severe in the area and since watering was impossible to do in the common planting areas, clay pots and mulching were used to protect the plants during the dry season.

Irrigation and water supply

With the degradation of forest cover, over 22 streams that flowed down the mountain went dry during the dry season. Few perennial streams remained and the three largest are given the abbreviations S1, S2 and S3. Since water was scarce during the dry season, both for drinking as well as for agriculture, the Project undertook the formidable task to set up a vast network of irrigation that tapped certain perennial feeder streams and water was carried through a pipeline and channelled along the contour into the dead gullies. 7 such irrigation networks were constructed such that every beneficiary was given water supply. In addition, 2 ferro-cement tanks were constructed in both, the no. 70 and stores line to provide potable water to the Estate Tamil communities. Holding ponds were dug in every garden that retained water; these ponds were gley lined and riparian vegetation was planted around them. The presence of ponds created suitable habitat for freshwater fish put in by most of the beneficiaries but also ideal habitat for aquatic fauna like frogs, dragonflies and other insects. The presence of these animals is essential in ecological farming since most act as predators for insect pests in agriculture.

Further, Silt traps were dug for severe soil erosion in gully areas. The sand from the Silt traps was used for nurseries.

Sanitation

Seventeen (17) beneficiary families did not have toilets thus posing a hazard to stream water. The problem is most acute in the upper reaches of the mountain, specifically in the line room areas of the Estate Tamil community. The Project constructed 17 toilets where the cost was borne by both the

beneficiary and the Project. Bricks, land and labour were contributed by the farmer while the Project bore the cost of all other materials like Cement, Roofing and other building materials.

Monitoring and the maintenance of log books

All the farmers are provided with log books to record their farming activities; if the farmer is illiterate, the log book is maintained by another family member. Internal audits are carried out by the Director after which the plan for the next week is drawn up. The analog forestry consultant visited the Programme quarterly to asses the progress made and to proffer advice on the Project.

Forest garden product certification and the marketing initiative

Farmers were able to gather harvest from crops like papaya, banana, kathurumurunga, passion fruit, rice and vegetables from those planted in their gardens. While no concerted initiative was launched, suffice it to state that that a sizeable quantity was actually consumed by the farmer's family themselves! However, it is important to note that with the growth of the soil, the weight and flavour of bananas for instance improved dramatically and many farmers began to fetch better prices for their products even at the village pola. Further, a pilot marketing venture initiated by NSRC in late 2004 collected almost all the produce from the Project and marketed it in Colombo. Presently, Companies like Lanka Organics are negotiating the purchase of pepper from the farmers and it promises to be a lucrative offer. NSRC is also planning to apply for Forest Garden Product Certification which if happens will render the products sold at a premium price.

Applied research

Increase in moisture retention in ecological succession

The Project also engaged the services of an undergraduate student from the University of Ruhuna to monitor the increase in soil moisture retention concomitant with the increase in ecosystem maturity. The research though simplistic in its methodology demonstrated that the increase in shade and biomass did indeed increase the potential for surface water retention and accumulation.

Distribution and frequency of fish fauna in the streams S1, S2 and S3 as indicators of water quality

Water quality in the streams that combine to form the Maragala Oya are faced with the threat of increased silt load, contamination of raw sewage, agro chemical residues and detergents. While conventional testing for water quality is expensive and difficult to gain access to at the village level, the frequency

and distribution of fresh water fish were found to be a good indicator of water quality. Out of the 14 species of aquatic fauna found in the streams only 3 species, namely *Channa orientalis, Garra ceylonensis* and *Puntius bimaculatus* were found to be indicators of good water quality.

Impacts of the project

Ecological

- An increase in the canopy closure (shade) up to 20% was seen
- Increase in the quantum of biomass in the soil by the addition of leaf litter;
- Increase in the moisture retained in the soil specifically in the forest gardens
- Re-creation of habitat for biodiversity evident in the increase in frequency, populations and species like birds, butterflies, amphibians, skinks and soil fauna seen in the areas restored.
- Re-emergence of springs in areas in Jane Nona's garden that had been planted with vegetation suggested that once dormant aquifers had re-charged and had come alive.
- Research conducted identify 3 species of fresh water fish as indicators of stream water quality identified though further research is necessary.
- The planting of several hardwoods, tree species in long cycles of growth would also contribute to the sequestering of carbon over an extended period of time.

Economic and poverty reduction

- The landscape design of the farm gardens included the planting of several utility species of plants that would provide food, fuelwood, fodder, medicine, timber etc to the farmer. These farmers who had previously depended on their rain-fed, *chena* crops like kurakkan (Eleuisine coracana), maize, chillies and bananas to provide them with income only seasonally were now in a position to generate income throughout the year. The diverse array of tree and annual crops could be harvested throughout the year thus pushing the farmer into a position of independence from seasonal cropping and the lack of risk.
- Increases in nutritional status of farmer with the availability of leafy and other vegetables, yams, tubers and an array of fruits.
- Increase in food security

- Income increases were seen initially from annual crops that were grown using organic regimes of cultivation and from bananas, pineapple and pepper. The increases in income generation were dramatic. The recorded increases for one farmer, Jane Nona for instance, was as follows:

Year	Annual Income
2000	Rs. 7,000.00
2001	Rs. 10,543.00
2002	Rs. 23,718.00
2003	Rs. 27,175.00
2004(up to March)	Rs. 16,350.00

Local empowerment

- The mobilisation and formation of a Community Based Organisation (CBO), namely the Maragala Conservation Organisation that is now registered with a constitution and a Board of office bearers.

Sanitation

- The project constructed 21 toilets for those who did not have any sanitation facilities.

Other impacts

- Near cessation of illicit felling and forest fires.
- Upliftment of social status of Estate Tamil community from labourer to farmer.

References

Werner, Wolfgang. (2001). Sri Lanka's magnificent Cloud Forests; Wildlife Heritage Trust Publication, Sri Lanka

Illangasinghe, Wasantha. (2000). Personal Communication; National Water Supply and Drainage Board, Sri Lanka

Chang, Mingteh. (2002). An Introduction to Water and Forests; CKC Press

Senanayake, F.R. (1997). Manual of Procedures and Standards for Forest Garden Product Certification; Forest Garden Product Certification System, Sri Lanka

Cooray, P.G. (1988). The Geology of Sri Lanka (Ceylon); National Museums of Sri Lanka Publication

Somasiri. (2005). Soils of the Intermediate Zone of Sri Lanka, Soil Science Society

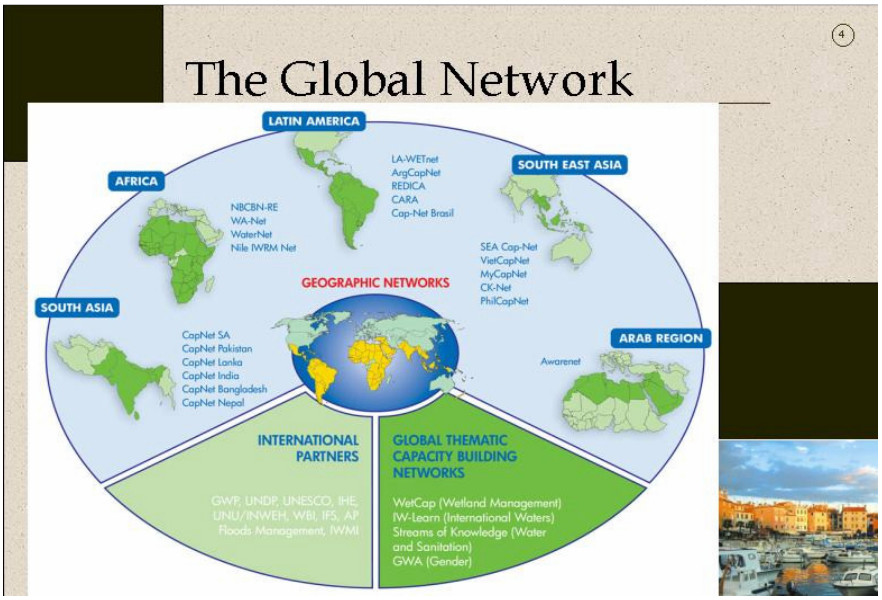
Survey Department. (1988). The National Atlas of Sri Lanka, Published by the Survey Department of Sri Lanka

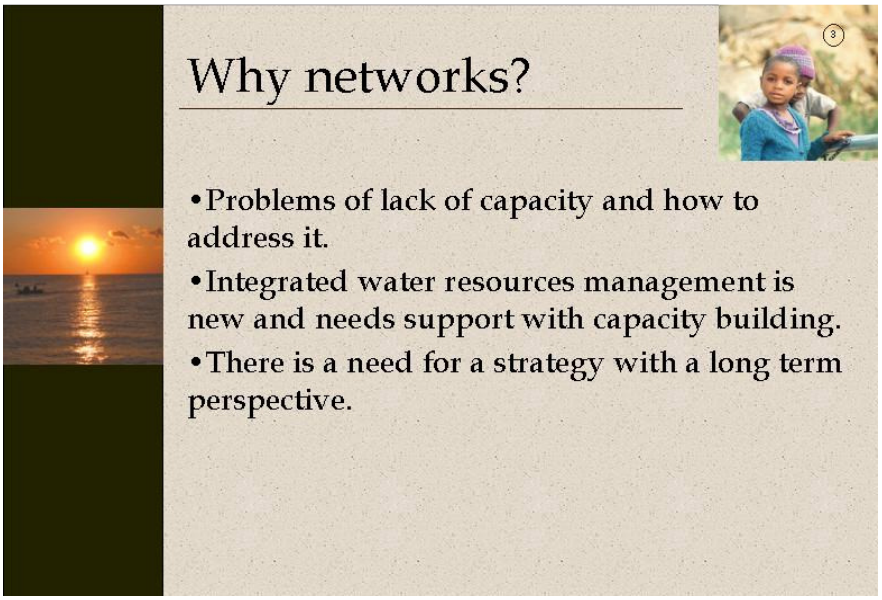
Fernando R.H.S.S., Gunatileke I.A.U.N., Bambaradeniya C.N.B., Ranawana K.B., Edirisingha J.P., Gunatileke C.V.S. and Abayawardhana U.T.I. (2006). Biodiversity of Moneragala, An Isolated Hill in the Lowland Peneplain of Sri Lanka: Results from a Preliminary Survey

Falls Brook Centre. (1997). Analog Forestry Manual

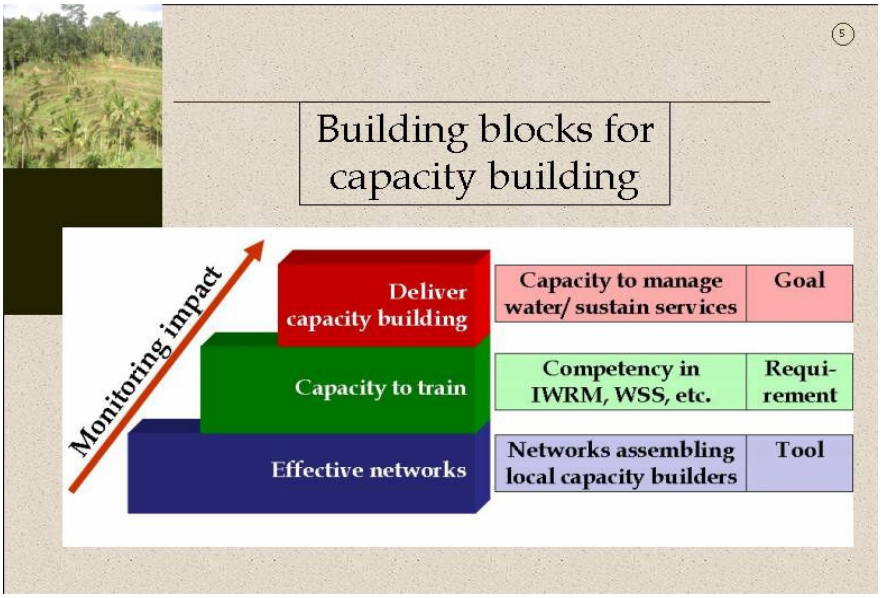
Appendix I

Presentation by the chief-guest


4
The Global Network
LATIN AMERICA
LA-WETnet
ArgCapNet
REDICA
CARA
Cap-Net Brasil
AFRICA
NBCBN-RE
WA-Net
WaterNet
Nile IWRM Net
SOUTH EAST ASIA
SEA Cap-Net
VietCapNet
MyCapNet
CK-Net
PhilCapNet
GEOGRAPHIC NETWORKS
SOUTH ASIA
CapNet SA
CapNet Pakistan
CapNet Lanka
CapNet India
CapNet Bangladesh
CapNet Nepal
ARAB REGION
Awarenet
INTERNATIONAL PARTNERS
GWP, UNDP, UNESCO, IHE, UNU/INWEH, WBI, IFS, AP Floods Management, IWMI
GLOBAL THEMATIC CAPACITY BUILDING NETWORKS
WetCap (Wetland Management)
IW-Learn (International Waters)
Streams of Knowledge (Water and Sanitation)
GWA (Gender)


3
Why networks?
•Problems of lack of capacity and how to address it.
•Integrated water resources management is new and needs support with capacity building.
•There is a need for a strategy with a long term perspective.


3
Core principles
1. Local ownership
Delivering capacity building from local resource centers to ensure sustainability.
2. Partnership among capacity builders
Build partnerships to assemble local skills and strengths, to overcome resources constraints and to increase efficiency.
3. Respond to demand for capacity building
Scaling up capacity building by improving linkages between implementers and capacity builders.


5
Building blocks for capacity building
Monitoring impact
Deliver capacity building
Capacity to train
Effective networks
Capacity to manage water/ sustain services
Goal
Competency in IWRM, WSS, etc.
Requi-rement
Networks assembling local capacity builders
Tool

5

Not so simple!

IWRM is too big. But it is necessary and brings challenges:

- Reaching stakeholders for meaningful input;
- Reforming power structures;
- Achieving greater equity (poor, gender, unserved).

NGOs have an important role to play.

8

Some NGO roles

- **Development projects on water**
  - But are IWRM principles followed?
- **Empowering local communities**
  - Knowledge for local management of water (and benefits)
  - Enabling participation upwards in water management structures.
- **Creativity and independence**
  - Can bring conflict with other actors.

8

8

Advantages of the Network approach

- ✓ Can provide the mix of disciplines necessary in IWRM;
- ✓ Can provide the coherent approach at all levels from higher education to community training;
- ✓ Link on the ground experience of NGOs with training at higher levels;
- ✓ Provides NGOs with better access to current knowledge.

11

Lanka Cap-Net

- Congratulate for its wide ranging support to sustainable management of water.
- Commend the partnership with NGOs, government, education and other bodies such as GWP.

NGOs

- Expect to see evidence of their wide ranging impact and importance on water.
- Hope they will learn from each other and Lanka Cap-Net.

Goal

- Improve access to services, equity and benefits, especially for the poor.
- Sustainable management and development of water resources.

Appendix II

List of registered participants

Prof. A. L. T. Perera
Director
Postgraduate Institute of Agriculture
University of Peradeniya

Prof. Budhi Marambe
Dean
Faculty of Agriculture
University of Peradeniya

Prof. C. Sivayoganathan
Head
Dept. of Agricultural Extension
Faculty of Agriculture
University of Peradeniya

Dr. Ranjith De Silva
Head
Dept. of Agricultural Engineering
Faculty of Agriculture
University of Peradeniya

Prof. C. M. Maddumabandara
Faculty of Arts
University of Peradeniya

Dr. D. R. I. B. Werellagama
Environmental Engineering Lab.
Faculty of Engineering
University of Peradeniya

Mr. W.A.M.W.K.S.B. Abeysinghe
Program Unit Advisor
Water & Environmental Sanitation
Plan Sri Lanka
532/3, Seibel Place
Kandy

Mr. S. Hariharathamotharan
Postgraduate Institute of Agriculture
University of Peradeniya

Mr. A.D.A. Rathnayake
Dept. of Agricultural Engineering,
Faculty of Agriculture
University of Peradeniya

Ms. K. Melvani
Managing Director
New Synthetic Research Centre
Polgasowita

Mr. Haritha Waidathanthri
Program Manager
Enter Growth, ILO

Mr. K.M.C.G.W. Bandara
91/5, Seevali Mw.,
Matale

Ms. Kumari Gopallawa
Executive Director
Vanith Services
1/37, Digana Road
Kundasale

Mr. Mansoor Hameed
Postgraduate Institute of Agriculture
University of Peradeniya

Mr. Chamile Jayaratne
Team Leader
Care International
Puttalam

Ms. G. G. L. Samarasinghe
HARTI,
No. 114 Wijerama Mw.,
Colombo 07

Mr. H.P.K.S. Pathirana
Engineer (P & D)
NWSDB
Getembe

Mr. Keerthi Sri Wijesinghe
Senior Program Officer
COSI Foundation
Katugastota

Mr. Mahinda Rathnayake
Program Manager
COSI Foundation
Katugastota

Mr. Dyfed Aubrey
Architech – Goal
3 A Hill Road,
Mt. Lavinia

Ms. P. Puvaneswary
Care International
8/8 A, Gregory's Road,
Colombo 07

Mr. S. Kirubanandan
Postgraduate Institute of Agriculture,
University of Peradeniya

Mr. J.P.D.A.K. Pathirana
NRMC
Department of Agriculture,
Peradeniya

Mr. M. Galahitiyawa
Lake House/S.L.B.C .
Alawathugoda

Mr. D.M.A.P. Gunathilake
Deerananda Society
Agra Bodhi Viharaya

Ms. Sujatha Mayadunne
No. 290/2, Ahugammana
Dematagoda

Mr. W.K.A.R. Fernando
Officer In Charge
World Vision Lanka
Puttalam Road
Nikkarawetiya

Mr. A. G. C. J. Gamage
Programme Coordinator
World Vision Lanka

Mr. A. S. Gamage
Programme Coordinator
World Vision Lanka
Nikkarawetiya

Mr. A. S. Senadheera
Programme Coordinator
World Vision Lanka
Nikkarawetiya

Mr. B.B. Gamage
Lecturer
AVC Quarters
Gannoruwa
Peradeniya

Mr. A. Saman
Programme Officer
COSI, Madawala Road,
Katugastota

Ms. Deepthi Samarakoon
No. 8, Pilawala
Kandy

Mr. J. Udayakumar
No. 3 2 3 D Baily Road,
Nawalapitiya

Mr. K. Bandara
Program Manager
Plan Sri Lanka
12/21, Kurunegala

Mr. A.W.G.N. Abeygunawardena
Postgraduate Institute of Agriculture
University of Peradeniya

Mr. T. M. W. Sunil Bandara
CE (NWSDB)
Getembe
Peradeniya

Mr. A. R. Ariyaratne
SC Development
University of Peradeniya

Mr. Prasad Neelaka
Mangalagama Molagoda
Kegalle

Mr. I. B. M.M. Sandaruwan
Faculty of Agriculture
University of Peradeniya

Mr. D. L. A. Indika
Agricultural Engineering
Faculty of Agriculture
University of Peradeniya

Mr. B. R. Ariyaratne
IWMI
Battaramulla

Mr. L. L. A. Peiris
Asst. General Manager
National Water Supply & Drainage Board
Getembe
Peradeniya

Ms. A. W. Abeygunawardena
Postgraduate Institute of Agriculture
University of Peradeniya

Ms. A. I. Arandara
Postgraduate Institute of Agriculture
University of Peradeniya

Ms. K. S. M. N. De Silva
Postgraduate Institute of Agriculture
University of Peradeniya

Ms. S. P.P. N. Gayani
Postgraduate Institute of Agriculture
University of Peradeniya

Ms. R. M. K. Kumarihamy
Postgraduate Institute of Agriculture
University of Peradeniya

Ms. I. H. Rajapakse
Postgraduate Institute of Agriculture
University of Peradeniya

Ms. W. S. C. Ranasinghe
Postgraduate Institute of Agriculture
University of Peradeniya

Ms. A. D. G. Udeni
Postgraduate Institute of Agriculture
University of Peradeniya

Ms. W. D. Warnakulasuriya
Postgraduate Institute of Agriculture
University of Peradeniya

Ms. Princey R. Sivayoganathan
Crossing Boundaries Project
Department of Agric. Engineering
University of Peradeniya

Ms. Janitha Ariyawansa
Postgraduate Institute of Agriculture
University of Peradeniya

Mr. H. N. M. N. Wijayasinghe
Postgraduate Institute of Agriculture
University of Peradeniya

Dr. W.A.D.P. Wanigasundara
Dept. of Agric. Extension
Faculty of Agriculture
University of Peradeniya

Dr. S. Pathmarajah
Dept. of Agricultural Engineering
Faculty of Agriculture
University of Peradeniya

Dr. L. W. Galagedara
Department of Agricultural Engineering
Faculty of Agriculture
University of Peradeniya

Dr. Anoma Ariayawardena
Dept. of Agricultural Economics
Faculty of Agriculture
University of Peradeniya