Information Dissemination on Effectiveness of Alternative Energy Use and Biodiversity Conservation in Buffer Zones of Shuklaphanta Wildlife Reserve, Nepal

S. Thapa[a], A. Thapa[b] , S. Karki[a] and S.Bhandari[b]

[a] *Central Department of Environmental Science, Tribhuvan University*
[b]*Go Green Nepal, Kathmandu, Nepal*

Abstract

Alternative energy promotion among the locals residing in the adjoining villages of the parks and reserves has been a major conservation effort, as it reduces human pressure in the park and buffer zone forests. The educational program aimed at disseminating the information about effectiveness of alternative energy use and biodiversity conservation through direct Community Approach and indirect School Approach. People are part of the problem and education will be part of the solution. Effective outreach and awareness are essential for promoting conservation policy, changing people's behaviors. As part of the awareness campaign, various programs were held in between the months of September 2010 and January 2011 within schools and community groups of buffer zones of the reserve. Different promotional activities had been carried out to aware locals about the interrelationship between alternative energy use and biodiversity conservation. Activities like dissemination of promotional materials in schools, information campaign and interaction programs were held. The direct beneficiaries of the awareness campaign were the households using traditional cooking stoves and households with lower income which are unable to install biogas. Along with the stakeholders working in the sectors of biodiversity conservation, the second beneficiaries were the community which will benefit the effect of improved health and sanitation brought about by the implementation of the alternative energy technology.

Keywords : Alternative energy, Biodiversity conservation, Buffer zones, Community approach, School approach, etc.

1. INTRODUCTION

Fuel-wood cutting is the major threat to the forests in the Himalayan country of Nepal, where all the energy needed for households comes from fuel wood. As a result, the percentage cover of forest is declining day by day [1]. The forests are the only sources that have received heavy pressure as a result of meeting ever increasing demand of fuel wood. Forests, which are main resource of biomass energy, have already been exploited beyond their sustainable capacity and are becoming relatively scarce [2].

Forests are home to large number of flora and fauna, and the high fire wood consumption has exerted immense pressure on forest resources. In order to enhance the conservation activities and preserve the biodiversity, programs promoting alternative energy need to be implemented, that reduce pressure on forest resource [3]. Energy consumption patterns and the rise in demand, their sources, and ways in which they are harnessed and utilized have implications for the environment and natural resources, which ultimately affect overall development [4].The forest conservation and sustainable development is only possible through involving communities towards alternative source of energy. Population growth and deforestation linked with it are serious problems in Nepal [5].The extensive utilisation and increasing demands for forest products has led to its dwindling both in area and quality, which is seen in the forests of protected areas also. Our dependence on non-renewable energy is placing us in serious jeopardy. Climate change, global warming and an increasingly degraded environment are realities we urgently need to address. Clean, sustainable sources of energy already exist. The challenges to increasing their use are more logistical [6].It is imperative that locals should be made well aware. Effective outreach and awareness are essential for promoting conservation policy, changing people's behaviours [7]. As part of the awareness campaign, various programmes were held in between September 2010 and January 2011 within buffer zones of the reserve, with following objectives.

*Corresponding Author: Tel:
E-mail: sunilthapa01@gmail.com

1. To raise awareness and dispense knowledge of the benefits of alternative energy among the community people towards adopting alternative energy; and
2. To promote the use of appropriate and cost effective alternative energy technology, thus reducing pressure on forest for fuel wood.

2. SITE DESCRIPTION

Buffer Zones of SWR in Kanchanpur district of the Far Western Development Region of Nepal was selected as the site for the campaign. SWR lies at 80 25' E and 28 35' N. It was officially declared as a wildlife reserve in 1976 although it was protected since 1965 as a Royal Sikar (Hunting Reserve). It lies in the flood plains of Mahakali River with an area of 305 km^2. The Syali River forms the eastern boundary of his Reserve. The Reserve shares a common boundary with the Indian state of Uttar Pradesh in the South and West that formed by the Mahakali River and a major tributary of the Ganges. The northern boundary of the Reserve is covered with forest and cultivation [8]. The present program was confined at selected buffer zones circumscribing seven Buffer Zoness namely Daiji, Beldandi, Piplari, Jhalari Chandani, Dodhara and the Mahendranagar.

3. METHODS AND MATERIALS

Different promotional activities were carried out to aware locals about the interrelationship between alternative energy use and biodiversity conservation through means like dissemination of promotional materials in schools and VDC, information campaign and interaction programme. Outreach programmes were conducted for target groups such as community forest user groups, community leaders, school teachers, and students, youth and mothers groups.

The awareness program was basically based on two appraoches.

School Approach: Children are one of the means of sustainable social change that could play noteworthy role. Interaction and lecture programmes were held in various schools of the buffer zones of the reserve, in which large number students participated.

Community Approach: Direct community approach was incorporated. Community people were made aware on the issues of use of alternative energy and the role they could play on biodiversity conservation indirectly, along with the health, socio-economic benefits of alternative energy use. Awareness campaigns were conducted in various places among the locals in coordination with buffer zone management committees, forest users group, women groups which are an integrated part of the conservation. Huge number of locals participated in the programme.

Figure 1: Awareness program in a school of Chandani

Figure 2: Awareness program for CFUGs of Jhalari

a. Relation between Alternative Energy Use and Biodiversity Conservation: Information on following issues were dispersed to establish linkage between Alternative Energy use and Biodiversity Conservation:

i. less fuel wood consumption, hence protection of forest and associated habitat of flora and fauna
ii. renewable energy produces little or no waste products such as carbon dioxide or other chemical pollutants
iii. reduction in green house gas emission, thus lessen impacts of climate change
iv. reduction in chemical fertilizer use as bio-slurry is more nutrient rich, hence provide ecological benefit.

b. Role of grass root level people in Biodiversity Conservation: Locals were informed and encouraged to adopt suitable means of alternative energy and play a vital role in biodiversity conservation.

c. Health and Socio-economic issues: Beside raising awareness on various aspects of biodiversity conservation with in relation to alternative energy use; other benefits related to health and socio-economic issues were also relayed such as: benefits on hygiene, education, employment generation, gender benefits.

Table1: List of Campaign Location and participants

SN	Location	Target Group	Number of Participants
1	Sarada Saraswati HS School, Chandani	Students and Teachers	162
2	VDC Office, Chadani	BZMUG, Women Group, Local Leaders etc	44
3	Shree Laxmi HS School, Dodhara	Students and Teachers	146
4	Mahakali Hi-Vision Hall, Dodhara	BZMUG, Women Group, Local Leaders etc	74
5	Shree Saraswati Janata Ma Vi, Bhaiva	Students and Teachers	84
6	Shree Raileshwor HSS, Beldandi	Students and Teachers	92
7	Bageshwori BZUC Office, Rautheli Bichawa	BZMUG, Women Group, Local Leaders, CFUG etc	52
8	Kalikich BZUC Office, Beldandi	BZMUG, Women Group, Local Leaders, CFUG etc	46
9	Betkot BZUC Office, Daiji	BZMUG, Women Group, Local Leaders, CFUG etc	35
10	Shree Krishna CFUG Office, Jhalari	BZMUG, Women Group, Local Leaders, CFUG etc	57
11	Kalika Ma Vi, Pipladi	Students and Teachers	65
12	Laxmi HSS, Mahendranagar	Students and Teachers	74
13	Banjharia, Jhalari		34
Total			965

4. OUTCOMES

The awareness and information dissemination program was able to garner following outcomes:

i. Awareness among locals and school children about the use of alternative energy and importance of conservation of biodiversity
ii. Finding of the fact that improved cooking stoves the most demanded technology among the available alternative energy technology
iii. In the long term conservation of biodiversity is expected along with local participation.

5. CONCLUSION

The information dissemination program on effectiveness of alternative energy use and biodiversity conservation was held within selected buffer zones of Shuklaphanta Wildlife Reserve. The program was itself, first of its kind trying to interlink the alternative energy use and biodiversity conservation. Local people along with school children were the target group of the program. Large number of school children locals representing various sectors such as community forest user's group, buffer zone management committee, women group etc were directly made aware about the various aspects of biodiversity conservation and alternative energy.

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Role of Biogas in Easing Ecological Stress : A Case Study from Buffer Zone of Shuklaphanta Wildlife Reserve

S. Thapa[a,*] and Dr. K. Rijal[b]

[a]*Research Scholar, Central Department of Environmental Science, Tribhuvan University*
[b]*Associate Professor and Head, Central Department of Environmental Science, Tribhuvan University*

Abstract

Promotion of alternative energy has been a major component of biodiversity conservation, as it reduces human pressure in the park and buffer zone forests for fuel wood collection. The study was carried within the buffer zones of Shuklaphanta Wildlife Reserve to access the role of alternative energy use in biodiversity conservation in terms of reduction in fuel wood, kerosene and chemical fertilizer consumption. The information was collected using semi structured questionnaire. Altogether 192 HHs were visited and interviewed for the study, among which 96 HHs having biogas plants were visited. The average use of fire wood among HHs without biogas is 3006.81±471.02 kg/HH/year and with biogas is 1265.62±228.26 kg/HH/year, which shows significant reduction ($Z= 32.59$, $p<0.0001$) in fire wood consumption as source of energy. Furthermore usage of kerosene is also significantly reduced by almost 39.81 % from 21.20±3.58 lt/HH/year to 13.25±3.64 lt/HH/year ($Z= 15.25$, $p<0.0001$).The use of another factor, chemical fertilizer, analyzed as one of the indicators for easing ecological stress is more among HHs with biogas (144.08±9.32) compared to HHs with no biogas (127.82±9.68). Similarly from the estimated fuel wood reduction, the equivalent protection of forest area was calculated as 0.053 ha. And the total number of trees saved per year was calculated as 1113.6. The average number of cattle in HHs with biogas (4.39) is more as compared to non biogas HHs (3.75). There is potentiality for installment of biogas plants among the non biogas HHs, which could reduce the pressure on reserve forest exerted by those HHs for fire wood collection. The result showed that the alternative energy technology, especially biogas, has been able to reduce ecological pressure in terms of reduction of fuel wood and kerosene consumption.

Keywords : Biodiversity Conservation, Alternative energy, Fuel wood, Biogas, Ecological stress

1. INTRODUCTION

Increasing human population growth and persistent poverty in developing countries continue to influence ecological degradation, especially of forests around the world. Alternative energy, a sustainable renewable energy, has positive environmental impacts at local, national and global levels. From a national perspective, alternative energy systems have helped to reduce the pressure on forests. Biogas fuel helps to reduce greenhouse gas emissions by displacing the consumption of agricultural residues and kerosene. Different alternative energy sources to replace or reduce fuel wood use such as back-boilers, kerosene depots, small hydropower plants, solar water heaters, have been installed in Mountain areas; and biogas, electricity, improved cooking_stoves, and solar power in the Terai. Studies show that these have reduced fuel wood consumption and thereby increased conservation of forests and biodiversity [1,2,3]. Biogas provides an alternative renewable energy source, which has the potential to significantly reduce pressure on forest, soil and associated terrestrial ecosystems [4].

Several studies such as [5, 6, 7, 8, 9] discuss potential of biomass energy as an alternate source of energy and review the ecological, social, cultural and economic impacts of biogas technology. Many researchers also discuss different types of benefits of biogas such as health, education, employment generation, reduction in fuel consumption etc. However, the paper does not explicitly quantify these benefits. This study attempts to fill these gaps by assessing role if biogas in easing ecological pressure in terms of reduction of fuel wood, kerosene and chemical fertilizer consumption using qualitative as well as quantitative methods.

2. STUDY AREA

Buffer Zones of SWR in Kanchanpur district of the Far Western Development Region of Nepal was selected as the study area. SWR lies at 80 25' E and 28 35' N. It was officially declared as a wildlife reserve in 1976 although it was protected since 1965 as a Royal Sikar (Hunting Reserve). It

*Corresponding Author: Tel: + 977-9841604972
Email:sunilthapa01@gmail.com

lies in the flood plains of Mahakali River with an area of 305 km2. The Syali River forms the eastern boundary of his Reserve. The Reserve shares a common boundary with the Indian state of Uttar Pradesh in the South and West that formed by the Mahakali River and a major tributary of the Ganges. The northern boundary of the Reserve is covered with forest and cultivation. The present study was confined at SWR and its buffer zone circumscribing 6 VDCs namely Suda, Beldandi, Piplari, Jhalari Chandani, Dodhara and the Mahendranagar Municipality. The Buffer zone of the SWR in the Kanchanpur district has six different land use categories including agricultural land (69.98 %), forest (20.25 %), grassland (1.68 %), shrub land (0.93 %) and water bodies (7.16 %) covering an area of 152 Km2 [10].

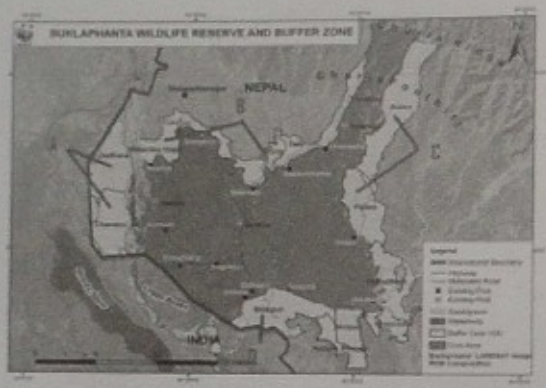

Figure 1: Map showing Study Area

3. METHODS

According to specific tasks and anticipated outputs, the methodology of this research was designed to comprise of four major parts, domestic and foreign literature review, collective discussions, individual interview, and on-site survey, respectively. All tasks were completed by the end of 2010. Interviews were conducted with 192 households to record data on perspectives on biogas plants, impact of biogas plants on local ecology, usage of forest firewood, chemical fertilizer, and kerosene among households with and without biogas. Although a total of 3259 biogas plants have been built in Buffer Zones of SWR as of 2010, only data on 192 biogas plants constructed after 2005 were included in the analysis. Data were analyzed through standard technique available such as MS- Excel and Statistical Package for Social Science (SPSS). For statistical analysis Z-test was used.

Table 1 : Consumption of Firewood , Kerosene and Fertilizer

Parameters / Site	Fire wood in kg/HH/year (Mean±SD)		Kerosene in lt/HH/year (Mean±SD)		Fertilizer in kg/ha/year (Mean±SD)	
	NBG HH	BG HH	NBG HH	BG HH	NBG HH	BG HH
M.Nagar-Suda	2412.8 ±412.59	1094.4 ±271.75	25.02 ±1.86	17.68 ±1.33	120.24 ±5.52	144.56 ±7.83
Chadani-Dodhara	2747.2 ±301.65	1209.6 ±174.58	26.24 ±1.88	18.28 ±1.64	121.04 ±6.51	133.2 ±6.48
Beldani	3337.5 ±6.51	1240 ±6.51	15.62 ±1.12	8.49 ±0.94	146.20 ±5.88	159.04 ±4.48
Piplan-Jhalari	3569.34 ±293.55	1540 ±157.28	17.33 ±1.60	8 ±0.80	123.86 ±6.29	159.34 ±6.54
Mean±SD	3006.81 ±471.02	1265.62 ±228.26	21.20 ±3.58	13.25 ±3.64	127.82 ±9.68	144.08 ±9.32

4. RESULTS

4.1. Average Fuel Wood, Kerosene & Chemical Fertilizer Consumption

The average use of fire wood in the HHs without biogas is 3006.81±471.02 kg/HH/year and with biogas is 1265.62±228.26 kg/HH/year ($Z= 32.59$, $p<0.0001$), which shows a significant reduction in fire wood consumption as source of energy. Furthermore, usage of kerosene is also significantly reduced by almost 39.81 % from 21.20±3.58 lt/HH/year to 13.25±3.64 lt/HH/year ($Z= 15.25$, $p<0.0001$). The use of another factor, chemical fertilizer, analyzed as one of the indicators for easing ecological stress is more in biogas HHs (144.08±9.32) compared to HHs with no biogas (127.82±9.68).

4.2. Equivalent Forest Area Protected

The biogas plants help to reduce the consumption of fuel wood as major source of energy. After the installation of biogas plants the annual average saving of fuel wood is 1.74 tones/HH/year. Similarly the equivalent forest area protected from the saving of fuel wood is 0.053 ha

4.3. Estimation of the Number of Trees Saved

The biogas plants reduce the consumption of fuel wood and protect the forest. From the study it is estimated that the surveyed biogas plants have potentiality to save about 1113 tress per year. This helps in conservation of habitat of flora and fauna.

4.4. People's Perception towards role of Alternative Energy in Forest Conservation

People perception on role of alternative energy in conservation of biodiversity has also been assessed. According to which 67 % of the respondents has perceived that after the installation of biogas in the buffer zone there has been increase in the number of wild animals in the reserve and there has been improvement in the

forest status as well. Whereas, 24 % of the respondents has perceived it to be decreasing.

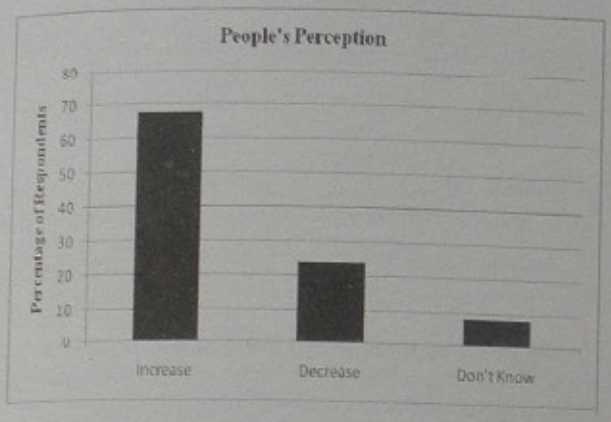

Figure 2: People's Perception on AE and Forest Conservation

4.5. Perception towards use of Alternative

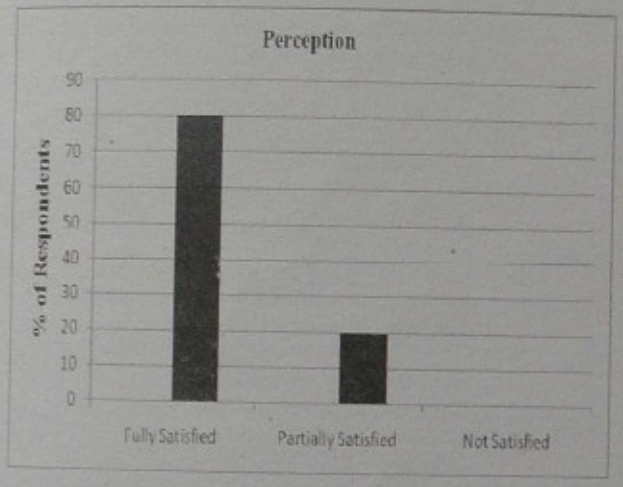

Figure 3: Perception towards AE

All the respondents who has installed biogas has benefited in various ways such as time and money saving; heath and sanitation improvement. About 80 %o of the respondents who has installed biogas in their household are fully satisfied with the plant whereas about 20 %of them are partially satisfied.

5. DISCUSSION

Excessive use of fire wood in rural area is known to cause forest decline in many developing countries and it was reported to account for nearly 54 % of all global harvests annually with a direct role in forest loss [11]. In Nepal, rural consumption of fire wood accounts for nearly 80 % with demand exceeding supply. Communities that live in remote parts of the country rely in forest resources, with majority of them using biomass as major source of energy [12, 13]. If the intensity of deforestation in the country increases in the future, the implementation of biogas plants in rural areas could certainly save enormous amount forest trees and biodiversity. Fire wood collected from forest areas still serve as the main fuel consumed in Nepal and peoples' dependency on firewood is major setback for local biodiversity due to the unsustainable removal of natural forest vegetation.

There has been considerable reduction in fuel wood among the households using biogas and those not using biogas. Before the establishment of biogas, locals used to depend on the fire wood collected from reserve forest and private land as well. But after the installation of biogas the fuel wood collection trend has decreased. The average fuel wood consumption in each non biogas HH was 3006.81 kg/HH/year. Similarly the fuel wood consumption among biogas using HH was 1265.62 kg/HH/year. The average reduction in fuel wood consumption among biogas and non biogas HH was 57.545%.

In the study area, each biogas plant saved about 1.74 tonnes of fuelwood annually and 0.053 ha of forest per year which was comparable to an annual saving of two tonnes of fuelwood per household and 0.061 ha of forest per biogas plant as studied by [14] and [15]. This was less comparable to the displacement of three tonnes of fuelwood by a biogas plant as studied by [16].

Biogas produces organic fertilizer that is high in Nitrogen, Potassium and Phosphorous contents. This organic form of fertilizer can be used in farmlands as an alternative to chemical fertilizers. It has been estimated that there is an annual saving of 4329 tons nitrogen, 2109 tons phosphorous and 4329 tons potassium due to installation of biogas [9].The use of chemical fertilizer in kg/ha/year was slightly more in case of biogas using HH (144.08) than in non user (127.82). The difference is not comparable to the study by [4] in India and [9] in Nepal. After the biogas plants were installed, the need for chemical fertilizers was not reduced and people were seen using the chemical fertilizer. If organic slurry is used as natural fertilizer for crop that enhances top soil health in agricultural areas promotes terrestrial ecosystem and easing ecological stress.

Kerosene is widely used in Nepal for cooking and lighting purpose. Due to installation of biogas plants, the use of kerosene ha s been reduced by almost 7.7 million litres per annum in Nepal [17]. The study showed, both Biogas Households and Non-Biogas Households used kerosene. The average kerosene consumption in the VDCs was 13.25 litres per year for Biogas Households and

21.20 litres per year for Non- Biogas Households. This showed in the study are, biogas has been able to contribute in considerable amount in reducing kerosene consumption. Which is less compared to study by [16], according which each biogas plant of 6 cu.m displaces 38 litres of kerosene annually.

The average number of cattle is more in HHs with biogas (4.39) as compared to those not having biogas (3.75). If it is possible to install the biogas plants in those HHs as well they could contribute to some extent in reducing the pressure for fuel wood collection; which in turn could help in conserving forest and associated habitat of flora and fauna.

Majority of the respondents (> 60 %) has perceived that biogas plants has in some way contributed in the conservation of biodiversity as they believed after the promotion of biogas in the VDCs, there has been decrease in deforestation. Biogas, being an eco-friendly technology, safeguards local biodiversity, ecological and forest resources.

6. CONCLUSION

The study was carried within the buffer zones of Shuklaphanta Wildlife Reserve to access the role of biogas in easing ecological stress in terms of fuel wood, kerosene and chemical fertilizer consumption among the biogas and non biogas using HHs. The average reduction in fuel wood consumption among the biogas and non biogas HHs was estimated to be 57.545%. Similarly from the estimated fuel wood reduction, the equivalent protection of forest area was calculated as 0.053 ha. And the total number of trees saved per year was calculated as 1114. The average reduction in consumption of kerosene was estimated at 39.815 %. According to [9] there has been considerable reduction in chemical fertilizer use among the biogas users, but the present study showed that there is no reduction in use of chemical fertilizer. The chemical fertilizer use trend is more in biogas user HHs by 11.4 %. The result showed that the alternative energy technology, especially biogas, has been able to reduce ecological pressure in terms of reduction of fuel wood and kerosene consumption.

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