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Introduction

Green economy is an approach that results in improved human wellbeing and social equity, while significantly reducing environmental risks and ecological scarcities (UNEP, 2010). It has been globally recognized as an important strategy to achieve the goal of sustainable development. It is alluring for Nepal, as it aims for poverty reduction and sustainable development. Nepal has immense potential to achieve a sustainable economic growth, since it has agriculture and natural resources-based economy, which accounts for one-third of the total gross domestic product (GDP) (MoAD, 2012). Nepal's hilly and mountain regions can contribute to the transition to a green economy through potential complementarities and synergies (Karki, 2014). The hill region shares 42% of the total land area of the country, of which, the forest blankets more than 50%. Agriculture, livestock and forest resources underpin the livelihoods of rural people in hilly areas of Nepal, but still many areas of hills are food insecure, as the majority of households have marginal land holdings. The over dependency of poor and vulnerable communities on forest resources for food, fuel and fodder, and the dominance of shifting cultivation in hilly areas have threatened agro-biodiversity, which is further aggravated by the climate change impact. So, realizing green economy as an approach to sustainable development, Nepal has adopted and promoted various green initiatives.

Nepal has emphasized community and leasehold forests to maintain the balance between conservation and consumption, which promotes sustainable use of natural resources. Besides, green growth would be built on energy saving and efficiency, dematerialization of production, and substitution (FES, 2010). So, renewable energy as biogas plants, improved cooking stoves, and solar technologies are getting wider attention among the rural poor, since they are energy efficient, environment-friendly, and also create green jobs. In true sense, green economy is not different to the practices adopted by the smallholder farmers in hilly areas of Nepal. However, the farmers are not well equipped with appropriate knowledge and skills to manage the farming operations on a sound basis, which has resulted in exhaustion of natural resources and environmental degradation. So there is a need to revitalize the farming system with the use of appropriate technologies and sustainable practices.

This action research aimed to promote the sustainable livelihoods through natural resource management and clean production technologies for improved food and nutrition security.

Material and Methods

The project initiated during 2012 in two hilly areas of Chitwan district, Nepal as Shaktikhor and Siddhi VDCs of Chitwan district. The project areas lie in the fragile Mahabharat range, which is geographically remote with steep slopes, at elevation ranging from 275 to 1,647 meter a.m.s.l (NGIIP, 2006). Chepangs are the largest marginalized ethnic group (Siddhi 87.1% & Shaktikhor 36.8% of total population) (CBS, 2011). They are resource-poor smallholder farmers. They highly depend on climate sensitive resources and shifting cultivation. The impact of climate change can be greater for indigenous communities living in the more remote and ecologically fragile zones and entirely depend on the natural resources for subsistence and livelihood (UNFCCC, 2004).

A Household Economic Analysis (HEA) and baseline assessment was conducted in 2012 to access the demographic, socio-economic and livelihood status along with prevailing situation of the available resources and its utilization. The study covered 1,513 households, whereas assessment was carried out with selected households by 5% random sampling method through semi-structured questionnaire, and both quantitative and qualitative information were generated. The acquired data and information were compared with the data accessed through the end line survey, which was conducted in 2015. For quantitative data interpretation, the findings were presented in the form of charts and graphs. Similarly, qualitative data were examined by thematic analysis. Besides, SWOT analysis was also used to access and evaluate the qualitative information.

Within the project period, the activities greatly emphasized on capacity building trainings, knowledge sharing, advisory, demonstrations and exposures, as a means to achieve the prerequisites to a successful transition towards a green growth. The interventions were mainly focused on five areas: (i) innovative green agricultural practices, (ii) renewable/clean energy-biogas, improved cooking stove, (iii) efficient water use technologies- rainwater harvesting, waste water recycling, drip irrigation, (iv) green enterprises/jobs-fishery, agro-farm forestry, and (v) value chain development. The good agricultural practices were promoted, which contributed to the conservation of ecosystems, especially with respect to agricultural biodiversity, soil fertility and water efficiency. Basically, Sustainable Integrated Farming System (SIFS) was promoted and up-scaled, as it is the concept developed from the idea of conserving nature through collaboration, multilayer arrangements, energy recycling along with integration of the diversified crops and livestock. Furthermore, it incorporates many green ideas for sustainable development. The study analyzed the outcomes and impacts of these green growth interventions in the community.

Results and Discussion

The findings show that some of the stimulus supports such as access to market, credit/loan facilities, irrigation services, provision of farm inputs, and other extension and advisory services

have influenced the farmer behavior positively. Some distinguishable changes identified within the study period are presented below, both in an analytical and descriptive way.

Biomass recycling

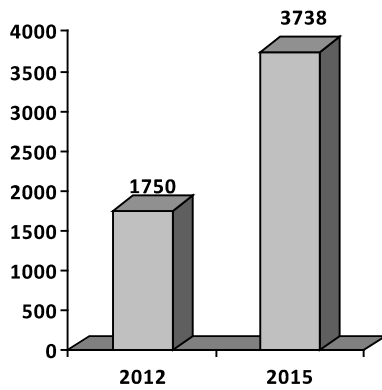


Fig 1. Recycled biomass per farm in kg

It is observed that the biomass recycling has improved considerably after the interventions. The data show that the quantity of recycled biomass during 2015 is higher than that of 2012 (Fig 1). Previously, biomass recycling was confined to use of cow dung as fertilizer, but it has now extended to crop waste, cow urine, poultry waste, crop residues, and weeds. These biomasses have been utilized for composting, bio-energy, liquid manure, cow-pat-pit manure, mulching and so on, which has reduced the external input. It implies that the community members have realized the reuse of agricultural wastes as a worth product.

Integrated farms

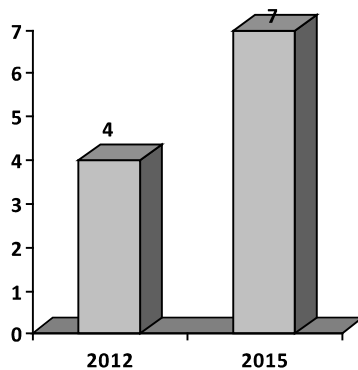


Fig 2. Number of sub systems

Fig 2 indicates that the farmers have developed a positive attitude towards the diversification of farm. On an average, the number of sub-systems were 4, which steadily increased to 7, within three years of duration. The change has reflected in around 70% of the farms, which have sub systems extended to 7. The subsystems include cropland, home garden, beekeeping, grassland, livestock, fishery, forest, poultry and others. With the extension of the sub systems, the fallow land get utilized and improved as well. It also indicates that the source of income expands along with farm diversification rather than getting stuck with one sub-system. Besides, the diversified production has contributed to improved food and nutrition security of the poor households.

Diversity of Vegetables

The data show diversity in vegetable production, with the course of time. On an average, the number of vegetable crops grown has increased to 7.2 from 3.5. They used to rely mainly on indigenous crops like *Gittha (Dioscorea bulbifera)*, *Bhyakur (Dioscorea pentaphylla)*, *Tarul (Dioscorea alata)*, *Tanki (Bauhinia purpurea)*, *Jaluko (Remusatia vivipora)*, *latte (Amaranthus spp.)* and other wild crops. The improvement was noticed on their nutritional habits after the promotion of vegetable cultivation and nutrition practices. They have started growing a variety of vegetables. Farmers have maintained diet diversity farm to avoid monotonous diet of indigenous crop during the lean period, and have a year round supply of diverse nutritious vegetables. This has a certain impact on the diet diversity score of the households, as they consumed more food groups than before.

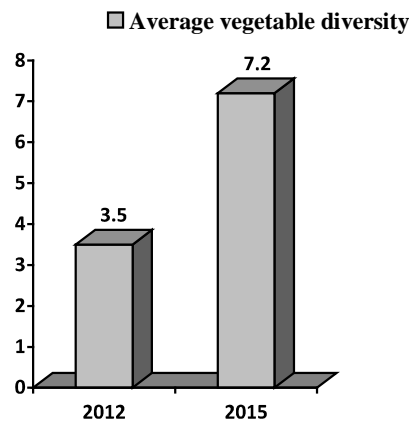


Fig 3. Average diversity of vegetables in the garden

Thus, farmers have enhanced their income and livelihood through enterprise diversification along with the use of sustainable practices. This has been successful due to the adoption of various innovative practices that use the locally available inputs. The use of efficient irrigation techniques such as drip irrigation, water harvesting and other techniques have helped to overcome the rain-fed farming and extended the cropping period. Likewise, strengthening of leasehold/community forestry user groups to maintain agroforestry has contributed to income diversification and biodiversity conservation as well. On top of all, strengthening of marketing value chain and community institutions, have promoted the economic opportunities to the smallholders.

Conclusions and Outlook

The study intended to promote the sustainable livelihoods through natural resource management and clean production technologies. It analyzed the positive outcomes of the green growth efforts in the community, and explored the potential factors to be considered while promoting green economy. It has been realized that the technology transfer is an effective approach to a green economy. Undeniably, the smallholder farmers have increased the adoption of improved techniques to maintain the integrated farming such as the use of compost and FYM, livestock – crops integration, agroforestry, kitchen fishery, beekeeping and other good agricultural practices, which diversify their income, nutrition, and contributes to the soil and water conservation as well. Thus, integrated farming system is considered as a risk minimizing practice, since it reduces dependency on climate dependent income source.

As a matter of fact, green economy is imperative for the communities, whose livelihoods are strongly linked to the natural resources, so a better up-scaling of the resource-conserving practices help to build the agriculture resilient community. More importantly, the promotion of local level green initiatives along with integration and strengthening of existing green economy policies could lead transformational shift to low-emission and resilient sustainable development. Various stakeholders as civil society, government line agencies, eco-clubs, and private agencies are up-scaling the green practices. So, mainstreaming the green strategies into the development policies, and coordinated and complementary efforts among the stakeholders from various sectors

could pave a path towards a greener economy. The study provides significant bases for future endeavors with integrating the given implications.

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