TECHNOLOGY: A TOOL TO IMPLEMENT THE SUSTAINABLE DEVELOPMENT GOALS

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Abstract

Himachal Pradesh is one of the mountain states of the NW Himalayan region with two third area under forests. Forest contribute to welfare of all well beyond the local population through climate, hydrological services, energy, agriculture, industry, livelihood at multiple economic scales. Halting deforestation, forest degradation, practicing sustainable forest management are important targets for limiting climate change, protecting biodiversity and freshwater supplies, providing raw materials for a minimum ecological footprint economy, and protecting the livelihoods of millions of people. The Sustainable Development Goals(SDGs) can be major drivers in efforts to halt deforestation and forest degradation in mountain states like Himachal Pradesh and to strengthen the positive contributions that forests play in the future of sustainable development. Himalayan Research Group (HRG) is instrumental in developing technology driven innovative solutions for efficient utilization and conservation of forest resources. HRG innovations for utilization of solar energy in domestic water and space heating, ex-situ propagation of high value endangered medicinal plants, improved fodder practices and alternate livelihood for forest dependent communities contributes to targets of the SDGs. Details of these technology applications were discussed and presented as tool to implement the SDGs.

Keywords: *Technology Models, Forests, Sustainable Development Goals (SDGs), Deforestation, Climate Change, Biodiversity, Mountain Communities.*

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I. Introduction

Agenda 2030 proposing 17 SDGs is of specific relevance to mountain states like Himachal Pradesh. Himachal Pradesh being the front runner on SDGs index developed by NITI Ayog (NITI Ayog SDG India Index, 2018) provides satisfaction at one hand and also a challenge to retain this status with increasing pressure of development. Dependency on forest resources of mountain communities in state like Himachal Pradesh is high and sustaining the resource with limitation of regeneration and resources necessarily warrant innovation and technological application to maintain sustainability. Ecosystem services provided by forests contribute to the welfare of people beyond local boundaries through regulation of the quality and quantity of drinking water, energy, agriculture, livelihood and harboring biodiversity hot spots. Sustainable management of forests in state like HP thus contributes to achieving the SDGs. Technology application is necessitated to maintain forest resources on long term basis to meet development challenges not only in the one state like Himachal Pradesh but all across the Himalayan region. Therefore analysis of selected four technology models developed and implemented by HRG Shimla under different programmes were analyzed in the SDGs framework to understand their effectiveness and explanation for incorporation in process of planning for achieving Agenda 2030.

II. Selected technologies and contribution to SDGs

Contribution of selected technologies was analyzed in economic, ecological and social front. Complete analysis is presented in Table-1 wherein it is depicted that selected technology models contribute in significant manner to strengthen the forest dependent communities to use forest resources in efficient manner to achieve targets of SDGs. Technology models developed and implemented with involvement of community as per their need, skills and market were observed to be more effective and sustainable in comparison to ones developed in institutions and lab with research and personal interests.

Table- 1. Contribution of selected technologies with major indicators				
S. No	Technologies	Indicators		
		Economic	Ecological	Social
1	Solar Energy for Water and Space Heating	3 days Wage @500/-day of rural artisan Involvement of women in econmic activity with saving of time in fuel wood/dung collection	Saving of 40% fuel wood/dung improve conservation productivity of forests/agriculture Mitigation 4.9MT/annum of household carbon emission. Conservation of habitat.	Women empowerment Women drudgery reduction Skill improvement Improvement in health and hyegine of houesehold members with reduced indoor pollution
2	Fodder Developme nt	25% improved econmic returns with improvement in qualtiy & quantity of milk	Stall feeding result in reduced grazing with imprvement in conservation of forests Regeneration of natural forest and pastures around village	Women empowerment Decent work with reduced risk and involvement in fodder collection from far of forests Women drudgery reduction
3	*Ex-situ* Medicinal Plants cultivation	High returns from sale of high value (Rs. 250-1000/- Kg) medicinal plants. Quality raw material for quality drug improves efficacy and returns of the	Reduced extraction form natural habitat Conservation of endangered medicinal plants.	Primary health care Decent work and imprved production of herbs for livelihood Quality drug for consumers

		pharma units		
4	Button Mushroom Cultivation	100-110% net profit from indoor household mushroom cultivation in 90-110 days	Mitgatation of carbon emission with reduction in burning of agriculture residues in punjab Use of spent compost as manure reduce forest improvement with reduced collection of forest biomass for farm yard manure preparation	Time saving in collection of forest biomass for farm year manure preparation Spent compost improve agriculture productivity Employmnet and livelihood of rural youth and women in decent work

Source: HRG, Shimla Primary

Practical feasibility in terms of economic, ecological and social levels of technology models is essential component of the sustainable management of mountain forest ecosystem services as was also described by Baralet al. 2017.

Analysis of the selected technology models with respect to addressing the different SDGs it was observed that four technologies contributed collectively to 12 out of 17 SDGs. Further analysis revealed that all four selected technologies contributed to Goals 5,8,12,15. This clearly explains that one technology can contribute to more than one SDGs and there is overlapping of targets. Analysis of selected technology models with contribution to different SDGs is presented in Table-2 & 3.

Table-2. SDGs and selected technologies

SDGs	Solar Energy or Water and pace Heating	Fodder Development	*Ex-situ* Medicinal Plants cultivation	Button Mushroom Cultivation	Technologies contributing to SDGs
1					2
2					2
3					2

5					**4**
6					2
7					1
8					**4**
9					3
10					1
12					**4**
13					1
15					**4**

Table-3. Common SDGs addressed by four technologies

Sr. No.	SDGs	Description of Target
1.	Goal 5	Achieve gender equality and empower all women and girls
2.	Goal 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
3.	Goal 12	Ensure sustainable consumption and production patterns
4.	Goal 15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manageforests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

All these technologies were developed and implemented to achieve sustainable development as the pressures on forest resources is increases day by day. This was also depicted in earlier studies conduct by Kesari, (2008) wherein direct dependence on forests for various forest indicating that 95 per cent of the total households demanded timber from forests under Timber Distribution Rights. Fuelwood was the next highly demanded forest product with 93 per cent of the households depending on forests for fuelwood collection. The percentage of households depending on forests for other non-timber forest products like fodder, wood for agriculture implements, fencing material, staking material and compost material was 64, 80, 79, 56, 78 and 50 respectively. Overall 50 per cent of the households collected minor forest produce like guchhi, kuth and karu from forest for economic returns through sale in the market. In addition, 71 per cent of the households grazed their livestock in the forests and 3 per cent of the households were engaged in indigenous practices like that of basket weaving and of blacksmithery and collection of wood material to be used as raw materials in these activities. Technologies described provide options for efficient usage of forest resources

and alternate for forest dependent communities with direct contribution to SDGs.

III. Technologies and contribution to targets of SDGs

Technology model application in terms of contribution to targets of SDGs was analysed and it was observed that solar energy application in water and space heating in mountian households contribute to 9 SDGs and their 27 targets. Fodder development model was observed to address 7 SDGs and 20 targets. Ex-situ medicinal plants cultivation contribution was observed for 6 SDGs and their 19 targets. Activity of button mushroom cultivation technology was observed with role in achieving 8 SDGs and their 18 targets. This kind of analysis was carried out for the first time with respect to technology application particularly in mountain households and provides robust input for the policy planners and development professionals to include such initiatives in mountain area development plans. Detail of the selected four technology model's contribution to targets of SDGs and common targets of all technology models are presented in Table-4&5

Table:4 Technology applications contributing to different targets of SDGs

SDG's	Solar Energy for Water and Space Heating	Fodder Development	*Ex-situ* Medicinal Plants cultivation	Button Mushroom Cultivation	Total Targets of SDGs addressed
1		1.5		1.1, 1.4, 1.5	3
2		2.1,2.2,2.3 ,2.4		2.3,2.4,2 .a	5
3	3.9		3.3, 3.8,3.6		4
5	5.1,5.5,5.b , 5.c	5.1,5.5,5.b	5.a, 5.b	5.5	5
6	6.2,6.4,6.6 , 6.b	6.6,6.b			4
7	7.1,7.2,7.3 ,7.a,7.b				5
8	8.2,8.3,8.5	8.1.8.2,8.3 ,8.5	8.2,8.3,8. 4,8.5	8.2,8.5	5
9	9.1,9.4,9.b		9.b	9.1,9.3,9 .5	5
10				10.1	1
12	12.2	12.2,12.a	12.2,12.8	12.5,	4

				12.a	
13	13.3,13.b				2
15	15.1,15.2, 15.4,15.5	15.1,15.2, 15.4,15.5	15.1,15.2, 15.4,15.5, 15.6,15.7, 15.a	15.1,15. 4,15.5	7
Total	SDGs-9 Target-27	SDGs-7 Target-20	SDGs-6 Target-19	SDGs-8 Target-18	51

Table-5. Common Targets addressed by four selected technologies

Sr. No.	Target	Description of Target
1	8.2	Achieve higher levels of **economic productivity** through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors
2	8.5	By 2030, achieve full and **productive employment** and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value
3	15.1	By 2020, **ensure the conservation**, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and dry lands, in line with obligations under international agreements
4	15.4	By 2030, ensure the **conservation of mountain ecosystems**, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development
5	15.5	Take urgent and significant action to **reduce the degradation of natural habitats**, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species

Four selected technologies were commonly addressing five abovementioned targets of SDGs which are related to economic productivity, employment, conservation and mountain biodiversity essential for sustainable development. Similar studies of Gratzer andKeeton (2017)also discussed (1) the potential of mountain forests to help achieve SDGs in mountainous regions and beyond, (2) the potential of the SDGs to help solve severe socioeconomic and ecological problems in forested mountain areas, and (3)

challenges and opportunities associated with implementing the SDGs. They establish a clear connection between sustainable use and protection of mountain forests and vital ecosystem services upon which many regions depend. Their further discussion on challenges of understanding interactions between goals and targets, and highlight the role of science in achieving the SDGs also approve the conclusions drawn in our studies depicted in Table-5. Target oriented approach to stress the urgent need for establishing a new narrative of socioeconomic transformation of forest dependent mountain communities with technology baking is necessary to achieve Agenda 2030.Technology need was also highlighted in Voluntary National Review Report India on the Implementation of SDGs presented in United NationsHigh Level Political Forum, 2017with focus on nurturing partnerships at the regional and global levels for ensuring a greater flow of finances and technology from developed countries in the context of the 2030 Agenda.

IV. Concluding remarks

Forests in Himachal Pradesh covers 66.52% of total geographical area. However 27.12% of the total geographical area support forest cover. State level vision for SDGs implementation needs to include application of technologies to sustain and achieve the target oriented performance in different developmental programmes. World Bank (2003) estimated 18.5 per cent of the 1.3 billion people living on "environmentally fragile lands" including arid zones, slopes and forest ecosystems suffer from extreme poverty, located in remote areas and often in relatively inaccessible upland and hilly areas, where reach new technological and market progress are inhibited or slowed. To address this linkages and networking of rural livelihoods and forests is important to maintain and strengthen diverse livelihood options with convergence with other sectors and extra-sectoral factors. These options include increased agricultural productivity with value addition, off-farm and non-farm employment opportunities, use of clean resources of energy with enabling conditions in marginal areas to reduce pressure on forests with increase possibilities for pro-poor outcomes (Angelsen and Wunder, 2003; FAO, 2003; Sunderlin, et al. 2005).Focus for improving documentation, validation, sharing and replication of good technology driven practices should be built in all sectors with specific target

of achieving the targets of SDGs. Strengthening of this kind of initiatives requires networking of resources, services and sectors to minimize the investment and maximize efficiency and effectiveness. State of Himachal Pradesh being front runner and performer in many of the SDG's will face the challenge to maintain this pace in coming years with increasing population and developmental pressures. Technology driven identified good practices will act as the tools to overcome this constraint if included appropriately in state planning and implementation strategy.

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