Impact of Agroforestry on Physical Health and Screen Time: A Study in Garhwal Himalaya, India

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Abstract— *Contribution of agroforestry towards ecosystem services is being recognized globally. The benefit people gains from an ecosystem are crucial to community health serving as a bridge between nature and society. Forests and agriculture, particularly agroforestry, are some of the vital natural resources for rural and subsistence communities, offering a range of ecosystem services such as food, fodder, fuelwood, timber, medicines and other non-timber forest products. Cultural services are non-material benefits that people derive from ecosystems, contributing to physical health, spiritual enrichment, recreation, ecotourism, cognitive development, and leisure. Cultural services support physical, cultural and intellectual development, including arts, music, and other recreational activities. This study was conducted on people owning and managing Grewia optiva (Bhimal) based agroforestry systems of Garhwal Himalaya in Uttarakhand state of India and mainly focuses on physical health of elderly agroforestry farm owners in the form of physically active hours and reduced screen time. Nowadays, where maintaining health as well as physical activities are considered crucial, this study highlights the role of agroforestry in lifestyle of elderly people. An increase in active hours and a considerable reduction in screen time have been observed in elderly people from study area as compared to elderly people who were not involved in agroforestry practices. This is an important aspect of agroforestry besides climate change adaptation and mitigation which is yet to be analysed, quantified and studied*.

Keywords— Agroforestry, Ecosystem services, Physical activity, Screen time.

I. INTRODUCTION

Agroforestry is a land-use system integrating shrubs and trees into rural landscapes and agricultural lands to enhance ecosystem sustainability, productivity and diversity. It is a combination of modern and traditional land-use practices, including the management of trees alongside agricultural crops and livestock on the same unit of land [1]. Most abundant tree species on trees outside forests are *Grewia optiva* (Bhimal), *Quercus leucotrichophora* (Banj oak), *Mangifera indica* (Mango), *Ficus spp*., *Pinus roxburghii* (Chir pine), *Cedrus deodara* (Deodar) and *Cupressus spp*.. Among these, bhimal and banj oak trees are the most abundant tree species in rural areas [2]. *Grewia optiva* is a multipurpose tree species and is an important agroforestry tree that provides valuable resources such as leaf fodder, fiber, and fuelwood. It is highly preferred and generally retained by farmers, particularly for feeding livestock due to its high digestibility and preference among cattle [3, 4]. It is a very good source of fiber and used locally to make tokris, ropes and scrubs for cattle. The trees on farms are seasonally lopped for fuelwood. *Grewia optiva* in agroforestry systems significantly influence the socio-economics of the rural population of Garhwal Himalaya.

The tree based agroforestry systems not only provide direct benefits but also the indirect ones in the form of cultural, regulatory and supporting ecosystem services. Although the studies regarding cultural ecosystem services provided by agroforestry systems are there but most of them are very much limited to the recreational and tourism values. Past studies on physical and psychological health due to agroforestry systems are almost none and are an underexplored and underrated area of interest. Present study helps understanding the basic lifestyle activities of two people group in study area and how it may affect health outcomes in elderly people.

II. MATERIAL AND METHODS

District Tehri Garhwal, located in the Garhwal Himalayan region of district Uttarakhand, India, is characterized by its lush green mixed and coniferous forests along with pleasant summer climate, and cold winters. Agriculture is the primary occupation in rural areas, with most villages situated near forested regions. Agroforestry serves as a predominant land-use pattern, with agricultural fields and bunds often supporting fruit and forest trees, grasses, and livestock rearing. Local communities rely heavily on trees to meet their daily requirements for fodder, fuelwood, and small timber.

Six villages in district Tehri Garhwal, Uttarakhand with three elevation ranges (table 1) having *Grewia optiva* (Bhimal) based agroforestry systems were selected. Respondents aged above 60 years were asked question regarding their socio-economic status, existing physical conditions, illnesses, various physical activities they perform throughout the day as well as time spend on smartphone/television. Two groups of 50 respondent families each were selected and analyzed with one group actively managing agroforestry farm and livestock while other group with abandoned farms or inactive in agroforestry practices through questionnaire survey and personal interview. The respondents selected for the survey were healthy elderly people without any serious chronic or life threatening illnesses. Male and female respondents were surveyed separately from each family regarding their activities and involvement in agroforestry practices.

TABLE 1
DESCRIPTION OF STUDY AREA

Elevation range	Village	Latitude	Longitude
500-1000 m amsl	Bhandar gaun	78º 22' 06" E	30º 17' 07" N
	Khemda	78º 27' 58" E	30º 22' 31" N
1000-1500 m amsl	Dandasali	78º 23' 51" E	30º 21' 39" N
	Chatti	78º 28' 22" E	30º 18' 52" N
1500-2000 m amsl	Dargi	78º 24' 28" E	30º 19' 14" N
	Khatiyad	78º 23' 18" E	30º 18' 21" N

III. RESULT AND DISCUSSION

The observation regarding physical activities of elderly men and women dedicated to the management of agroforestry farm and livestock have been summarized in table 2 and table 3 respectively. Among all the elderly men involved in agroforestry management in all villages, most (51.67% were physically active for 35-49 hours per week followed by 21.67% of elderly men being physically active for 21-35 hours in a week as compared to elderly men not involved in agroforestry management with most elderly men (38.33%) being physically active in a week for 21-35 hours followed by 35% of elderly men who were physically active for less than 21 hours a week.

TABLE 2
NUMBER OF ELDERLY RESPONDENTS (MALE) WITH THEIR PHYSICALLY ACTIVE HOURS THROUGHOUT A WEEK

Parameters	Elevation	500-1000m amsl		500-1000m amsl		500-1000m amsl		Total	%
	Hours/week	Bhandargaun	Khemda	Dandasali	Chatti	Dargi	Khatiyad		
Elderly men involved in agroforestry management	Less than 21	5	7	5	3	8	7	35	11.67
	21-35	12	9	13	11	9	11	65	21.67
	35-49	27	24	22	29	30	23	155	51.67
	49-63	6	10	10	7	3	9	45	15
Elderly men not involved in agroforestry management	Less than 21	19	14	15	21	18	18	105	35
	21-35	18	22	20	18	21	16	115	38.33
	35-49	12	11	11	6	10	13	63	21
	49-63	1	3	4	5	1	3	17	5.67

Role of female in agroforestry is very significant as they spend much more time than men especially in the management of livestock. Even the elderly women had a fair share in agroforestry and livestock management. Among the elderly women surveyed in study area (table 3), most of the elderly women (47%) involved in agroforestry management were active for 34-49 hours in a week followed by 36.33% women active for 49-63 hours in a week. Majority (45.33%) of elderly women not involved in agroforestry were physically active for 21-35 hours a week followed by 26.33% women staying active for 35-49 hours a week.

TABLE 3
NUMBER OF ELDERLY RESPONDENTS (FEMALE) WITH THEIR PHYSICALLY ACTIVE HOURS THROUGHOUT A WEEK

Parameters	Elevation	500-1000m amsl		500-1000m amsl		500-1000m amsl		Total	%
	Hours/week	Bhandargaun	Khemda	Dandasali	Chatti	Dargi	Khatiyad		
Elderly women involved in agroforestry management	Less than 21	2	1	0	4	6	1	14	4.67
	21-35	8	7	4	8	2	7	36	12
	35-49	25	23	28	22	22	21	141	47
	49-63	15	19	18	16	20	21	109	36.33
Elderly women not involved in agroforestry management	Less than 21	10	15	11	9	16	10	71	23.67
	21-35	21	19	20	25	26	25	136	45.33
	35-49	17	16	16	14	5	11	79	26.33
	49-63	2	0	3	2	3	4	14	4.67

Another aspect contrasting physical activity is screen time. Among all surveyed elderly men involved in agroforestry (table 4), majority (41%) were having screen time less than 14 hours in a week followed by 39.67% spending 14-28 hours weekly. Among elderly men not involved in agroforestry, majority (45%) had a screen time of 28-42 weeks followed by 23.33% elderly men with less than 14 hours a week screen time.

TABLE 4
NUMBER OF ELDERLY RESPONDENTS (MALE) WITH THEIR SCREEN TIME THROUGHOUT A WEEK

Parameters	Elevation	500-1000m amsl		500-1000m amsl		500-1000m amsl		Total	%
	Hours/week	Bhandargaun	Khemda	Dandasali	Chatti	Dargi	Khatiyad		
Elderly men involved in agroforestry management	Less than 14	21	20	18	19	21	24	123	41
	14-28	20	20	19	21	17	22	119	39.67
	28-42	9	9	12	8	10	3	51	17
	42-56	0	1	1	2	2	1	7	2.33
Elderly men not involved in agroforestry management	Less than 14	12	13	12	10	14	9	70	23.33
	14-28	9	11	8	9	12	7	56	18.67
	28-42	21	19	24	22	22	27	135	45
	42-56	8	7	6	9	2	7	39	13

Among the elderly women surveyed (table 5), majority (52%) of women involved in agroforestry practices spend less than 14 hours a week screen time followed by 34% women spending 14-28 hours a week screen time with no women spending more than 42 hours per week screen time in study area. Out of total surveyed elderly women who were not involved in agroforestry, 39% spend 28-42 hours a week screen time followed by 25% women spending 14-28 hours screen time.

TABLE 5
NUMBER OF ELDERLY RESPONDENTS (FEMALE) WITH THEIR SCREEN TIME THROUGHOUT A WEEK

Parameters	Elevation	500-1000m amsl		500-1000m amsl		500-1000m amsl		Total	%
	Hours/week	Bhandargaun	Khemda	Dandasali	Chatti	Dargi	Khatiyad		
Elderly women involved in agroforestry management	Less than 14	26	28	27	24	28	25	158	52.67
	14-28	18	17	15	20	12	20	102	34
	28-42	6	5	8	6	10	5	40	13.33
	42-56	0	0	0	0	0	0	0	0
Elderly women not involved in agroforestry management	Less than 14	10	12	11	8	11	12	64	21.33
	14-28	12	11	12	14	10	16	75	25
	28-42	20	18	18	21	21	19	117	39
	42-56	8	9	9	7	8	3	44	14.67

Outdoor activities and physical health are positively interlinked phenomena in younger as well as elderly people with former benefitting in later. A decrease in medical expenditure with increased outdoor activities in elderly people has been observed [5]. Interaction with forest and nature has been linked to reduced stress in people [6]. Reduced stress levels were observed in peoples after short term forest bathing as compared to people in city areas [7]. A significant decreased levels of pro-inflammatory cytokines and stress hormones were seen in Elderly patients with COPD (Chronic Obstructive Pulmonary Disease) stating the positive health effect of forest bathing trip on elderly COPD patients by reducing inflammation and stress level [8].

On contrary to maintaining physical health and an active lifestyle, people overusing smartphones are prone to anxiety, irregular eating habits, blurred visions, sleep disorder and fatigue [9, 10, 11, 12, 13]. Excessive use of smartphone has been linked to reduction in sleep time, insomnia, lower sleep efficiency and fatigue. Use of smartphone in bed has also been linked to depression, anxiety and stress [14].

It can be inferred by the study that the elderly people involved in agroforestry management spend far more on physical activities as compared to elderly people not involved in agroforestry practices. Similarly, elderly men not involved in agroforestry practices spend their spare time taking walks or on their smartphones/television. Elderly women were comparatively more active than elderly men as they spend more time on farm and livestock management. Besides, women also collect fodder for livestock which is rarely done by men in study area. Elderly women spent far less screen time as compared to elderly men in both categories. This was because apart from physically active time, elderly women also spend more time as compared to elderly men in study area doing household Chores such as cooking and cleaning as well as caring for their grandchildren.

Study on linkage between forest/nature and human is very limited and have not been properly explored yet. Similarly, impact of agroforestry practices on human physical and mental health is an important and interesting aspect to study as it may help improve chronic physical and mental wellbeing of people. From the study it was also observed that people involved in agroforestry make more social connections to other nearby people just for helping each other such as helping during seed sowing, harvesting, soil working and even helping with livestock management. People often work on others farm for few days and in return others work on their farm when work is more hectic. As the role of agroforestry in climate change adaptation, mitigation and livelihood support is well studied however; large scale studies to identify the indirect role of agroforestry on people's lives should be conducted.

IV. CONCLUSION

From the forgoing result and discussion, it can be concluded that involvement of people with nature yields an increase in physical health and reducing the need of smartphone, television or other screen time. These studies need to be further elaborately conducted to know more about the impact of agroforestry on peoples' physical, mental and social status.

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