

Sustainable livelihood security in Uttarakhand state: A micro economic evidence of district level analysis

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ABSTRACT : The paper has estimated sustainability in Uttarakhand by computing Sustainable Livelihood Security Index (SLSI) for 13 districts of the state using secondary data on various indicators under the ecology, economy and social heads for the years 2016-17. The study has found that SLSI value for Nainital (0.59), Udham singh nagar (0.57) and Pithoragarh(0.50) districts respectively with high sustainable livelihood security status and remaining districts Dehradun (0.48), Haridwar (0.48), Pauri Garhwal (0.46), Rudraprayag (0.45), Champawat (0.44), Tehri Garhwal (0.40), Almora (0.38), Chamoli (0.32) and Bageshwar (0.30) were showed moderate sustainable livelihood security index with rank forth to twelve. District Uttarkashi (0.24) was come at last rank with value which showed that low sustainable livelihood security status. the value of ecological security index varies from 0.63 to 0.26, value of economic efficiency index varies from 0.71 to 0.11 and value of social security index varies from 0.79 to 0.33. The paper has suggested some measures for sustainability in the state in the years to come.

Key words: Ecology security, economy security, livelihood security, sustainable livelihood, social security.

Agriculture is the way forward for India to meet the long-term need for food security and livelihood security. It can maximize benefits through conservation of natural resources and maintenance of eco-system. It can also balance the environmental health and economic profitability to promote social and economic equity. A livelihood comprises capabilities, assets and activities which is required for means of living. A livelihood is sustainable when it can be cope with and recover from stress and shocks to maintain its capabilities and assets both now and in the future too (Chambers & Conway, 1991). The world summit on Social Development in 2005 identified sustainable development goals, such as social development, economic development, and environmental protection. This view has been expressed as an illustration by using three overlapping ellipses indicating that three pillars which shows that sustainability i.e. mutually reinforcing and they can not mutually exclusive. In fact, the three pillars are interdependent to each other and in the long run none can exist without the others. The three pillars have served as a various common ground for sustainability depends upon different standards in the food industry.

Agriculture and allied activities supports the livelihoods of nearly 90 per cent of rural population of Uttarakhand. In recent years, land based livelihoods of small and marginal farmers are increasingly becoming

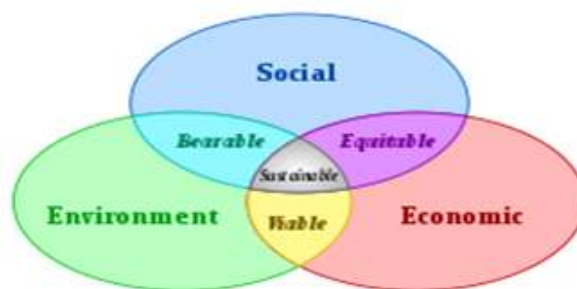


Fig.1: Three pillars of Sustainability

unsustainable since their land has not been able to support the family's food and fodder requirements for their cattle. The present study is estimated sustainability in Uttarakhand by computing Sustainable Livelihood Security Index (SLSI) of the state on the basis of various indicators under the ecology, economy and social heads for the years 2016-17 in the Uttarakhand state of India.

MATERIALS AND METHODS

The Sustainable Livelihood Security Index (SLSI) was calculated for 13 districts of Uttarakhand. The district-wise secondary data were collected from various published sources of Government of Uttarakhand; Directorate of Economics and Statistics, Uttarakhand, Directorate of Agriculture, Directorate of Animal Husbandry, Statistical Abstracts of Uttarakhand State etc

for the year 2016-17. The variables were grouped under three indicators viz. Ecology, Economy and Social heads for analysis and data were collected under these heads.

Ecological indicators

Ecological security index was assessed based on five variable, viz. proportion of geographical area under forest cover (in %), cropping intensity (in %), livestock density (in per km²), population density (in per km²), annual rainfall (in mm). The critical minimum forest cover is essential for maintain the ecological security does vary across the regions and cropping intensity is important indicator of extent of land use for cropping during a given year. Livestock provides employments, income and nutritional security to households. The population density was selected to reflect the extent of pressure on the overall resource of environment. The annual rainfall shows that significant impact to grow vegetation over the year. The '+' and '-' signs indicate the positive impact and negative impact of the variables on ecological security index given below.

- Proportion of geographical area under forest (%) (+)
- Cropping intensity (%) (+)
- Livestock density (per sq. km) (+)
- Population density (per sq. km) (-)
- Annual rainfall (mm) (+)

Economic indicators

Economic efficiency index is included four variables viz; food grain yield (kg/ha), Total oilseed yield (kg/ha), total milk production (tonnes), and irrigation intensity (%). Food grain are needed for household to, meet their daily food need. The yield level was influenced directly or indirectly by soil fertility, climate, irrigation, market performance etc. thus variable food grain yield was selected as economic efficiency variable. The milk yield reflects the potential for overall nutritional security of the districts. Irrigation intensity performed the optimum use of Water at the opportune time is an essential ingredient for increasing agricultural productivity. The economic efficiency indicators along with signs are listed below:

- Total food grain yield (kg/ha) (+)
- Total oilseed yield (kg/ha) (+)
- Total milk production (tonnes) (+)
- Irrigation intensity (%) (+)

Social indicators

Social security index is evaluated by variables such as Male literacy is a key to socio economic progress. Female literacy rate plays for woman empowerment and national development. So the variable taken literacy rate is capturing the social equity for sustainable development. Village electrified is also an important variable which concern if lack of reliable electricity supply dampens the growth impulses in different sector of the economy. Rural road connectivity also the important variable which says if poor road connectivity they show backwardness of that region. It is significant to address the important issues of rural infrastructure required for economic growth.

The selected indicator variables along with signs are listed below:

- Male literacy rate (%) (+)
- Female literacy rate (%) (+)
- Rural road connectivity (no) (+)
- Village electrified (no) (+)

Analytical tool

The Sustainable Livelihood Security Index (SLSI) was computed based on three indices, viz. Ecological Security Index (ESI), Economic Efficiency Index (EEI) and Social Equity Index (SEI) by using given formulae.

$$I_{ijk} = \frac{X_{ijk} - \min X_{ijk}}{\max X_{ijk} - \min X_{ijk}} \quad \text{eq. (a)}$$

$$I_{ijk} = \frac{X_{ijk} - \min X_{ijk}}{\max X_{ijk} - \min X_{ijk}} \quad \text{eq. (b)}$$

eq. (a) was applicable to variables having positive implications for SLS and eq. (b) was applicable to variables having negative implications. The numerators in equation (a) measure the extent by which the kth district did better in the ith variable representing the jth component of its SLSI as compared to the region showing the worst performance. The denominator is actually the range i.e. the difference between the maximum and minimum values of a given variable across districts, which is a simple statistical measure of total variation evinced by that variable. The denominator, in fact, serves as a scale or measuring rod by which the performance of each region is evaluated for a given variable.

Where

- i = variables (1, 2, ..., n)
- j = components (1, 2 & 3)
- k = districts (1, 2, ..., 13)

Where, I_{ijk} = index value of i^{th} variable of j^{th} component of k^{th} districts. ($i = 1; 2, \dots, n$ variables)

I_{jk} = index value of j^{th} component of k^{th} district. ($j = 1$ to 3 components)

$SLSI_k$ = sustainable livelihood security index of k^{th} district.

($k = 1, 2, \dots, 13$ districts.)

X_{ijk} = the value of the i^{th} variable representing the j^{th} component of the k^{th} district.

$$I_{jk} (ESI/EEI/SEI) = \sum I_{ijk} / n$$

$$SLSI_k = \sum I_{jk} / 3$$

Where n = total number of variable in respective components.

The SLSI is a composite index which was calculated by taking the arithmetic mean of ESI, EEI and SEI. The values vary from 0 to 1. A value close to zero shows low level of sustainability and value close to 1 denotes high level of sustainability. All the indices were classified into four category viz. low status (index value <0.25), moderate status (index value 0.25-0.5), high status (index value 0.5-0.75), and very high (index value >0.75). The relative index of sustainable livelihood security estimated from ecological security, economic efficiency and social security index.

RESULTS AND DISCUSSION

The SLSI with its three component indices for different districts of Uttarakhand is presented in Table 1. The district Nainital (0.59), Udham Singh Nagar (0.57) and Pithoragarh (0.50) showed high sustainable livelihood security index with first, second and third rank whereas district Uttarkashi showed low sustainable livelihood security index (0.24) with thirteen rank. The districts i.e. Dehradun (0.48), Haridwar (0.48), Pauri Garhwal (0.46), Rudraprayag (0.45), Champawat (0.44), Tehri Garhwal (0.40), Almora (0.38), Chamoli (0.32), Bageshwar (0.30) showed moderate sustainable livelihood security index with rank forth to twelve. Singh *et al.* (2009) reported the existing indicators of development and positions them within the environmental, economic and social dimensions of sustainable development. They constructed the sustainable livelihood security index (SLSI) at the district level in Gujarat. Ghabru *et al.* (2017) also reported agricultural sustainability in Gujarat by computing Sustainable Livelihood Security Index (SLSI) for 26 districts using secondary data of state on various indicators under the ecology, economy and equity heads for the years 2001, 2011 and 2013-14. They found that in the year 2001, the district Surat (0.584) ranked first in SLSI, while Narmada (0.265) ranked the last. Later in the year 2011, Rajkot ranked highest (0.589) in SLSI, while Porbandar (0.257) ranked the lowest.

The table also revealed that on the basis of average index values Uttarkashi was the only district falling under low status of Sustainable livelihood Security. District-wise SLSI was shown in Figure 2.

Table 1: The values of Sustainable Livelihood Security Index (SLSI) for districts of Uttarakhand in 2016-17

Districts	ESI	Rank	EEI	Rank	SSI	Rank	SLSI	Rank
Nainital	0.63648	1	0.56816	3	0.59114	4	0.59859	1
Pithoragarh	0.50743	2	0.34445	7	0.67159	2	0.50782	3
Udham Singh Nagar	0.45581	6	0.71356	1	0.55944	5	0.57626	2
Almora	0.42316	9	0.18003	10	0.55693	6	0.38672	10
Bageshwar	0.47757	4	0.11479	12	0.33531	13	0.30922	12
Champawat	0.31549	11	0.46289	4	0.54964	7	0.44267	8
Pauri Garhwal	0.48421	3	0.29609	8	0.61799	3	0.46610	6
Tehri Garhwal	0.36366	10	0.45246	5	0.39132	11	0.40248	9
Dehradun	0.47512	5	0.44313	6	0.53798	8	0.48540	4
Haridwar	0.43364	8	0.60715	2	0.41256	10	0.48445	5
Chamoli	0.31191	12	0.26127	9	0.41556	9	0.32958	11
Uttarkashi	0.26377	13	0.11414	13	0.35954	12	0.24582	13
Rudraprayag	0.45234	7	0.12141	11	0.79484	1	0.45618	7

ESI=Ecological Security Index,]

EEI=Economic Efficiency Index, SSI=Social Security Index SLSI=Sustainable Livelihood Security Index

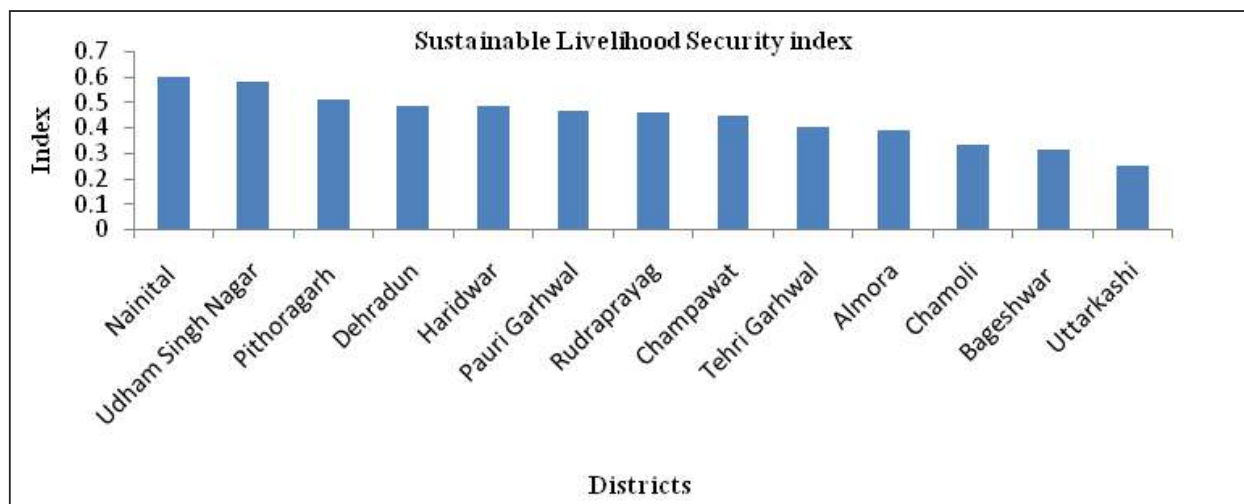


Fig. 2: Value of Sustainable Livelihood Security Index (SLSI) of different districts for the period of 2016-17

Table 2: Distribution of districts under SLSI and its components indices value

Status	Indices			
	ESI	EEI	SEI	SLSI
Low	None	Almora Bageshwar Uttarkashi Rudraprayag.	None	Uttarkashi
Moderate	Total(0) Udham Singh Nagar Almora Bageshwar Champawat Pauri Garhwal Tehri Garhwal Dehradun Haridwar Chamoli Uttarkashi Rudraprayag.	Total(4) Pithoragarh Champawat Pauri Garhwal Tehri Garhwal Dehradun Chamoli	Total(0) Bageshwar Tehri Garhwal Haridwar Chamoli Uttarkashi	Total(1) Almora Bageshwar Champawat Pauri Garhwal Tehri Garhwal Dehradun Haridwar Chamoli Rudraprayag.
High	Total(11) Nainital Pithoragarh	Total(6) Nainital Udham Singh Nagar Haridwar	Total(5) Nainital Pithoragarh Udham Singh Nagar Almora Champawat Pauri Garhwal Dehradun	Total(9) Nainital Pithoragarh Udham Singh Nagar
Very high	Total(2) none Total(0)	Total(3) None Total(0)	Total(7) Rudraprayag. Total(1)	Total(3) None Total(0)

Figure in parentheses indicates total no. of district belonging to respective status⁵

Distribution of district under SLSI and its component indices

Similarly Almora, Bageshwar, Uttarkashi and Rudraprayag fall under low status of economic efficiency

index. While, none of the districts falls under low status of ecological security index and social security index. The districts i.e. Almora, Bageshwar, Champawat, Pauri Garhwal, Tehri Garhwal, Dehradun, Haridwar, Chamoli, and Rudraparyag were falling under moderate status of

Sustainable livelihood Security. Similarly, Udham Singh Nagar, Almora, Bageshwar, Champawat, Pauri Garhwal, Tehri Garhwal, Dehradun, Haridwar, Chamoli and Rudrapur falls under moderate status of ecological security index. While, Pithoragarh, Champawat, Pauri Garhwal, Tehri Garhwal, Dehradun and Chamoli districts falls under moderate status of economic efficiency index. The district Bageshwar, Tehri Garhwal, Haridwar, Chamoli, and Uttarkashi falls under moderate social security index. The Nainital, Pithoragarh and Udham Singh Nagar districts were falling under high status of sustainable livelihood Security. On the other hand, Nainital and Pithoragarh fall under high status of ecological security index. However, Nainital, Haridwar and Udham Singh Nagar districts falls under high status of economic efficiency index and Nainital, Pithoragarh, Udham Singh Nagar, Almora, Champawat, Pauri Garhwal and Dehradun falls under high social security index. None of the districts falls under very high sustainable livelihood security, ecological security index, and economic efficiency index except Rudrapur which falls under very high social security index. Similar work also reported by the Agarwal, 2013.

CONCLUSION

Land based livelihoods of small and marginal farmers are increasingly becoming unsustainable because land has not been able to support their family's food and fodder requirements for their cattle. As a result, households are forced to look at alternative means for supplementing their livelihoods. Sustainability in Uttarakhand was measured by computing Sustainable Livelihood Security Index (SLSI) of the state on the basis of various indicators under the ecology, economy and social heads. The value of ecological security index varies from 0.26 to 0.63. The ecological security index of Nainital (0.63) and Pithoragarh (0.50) district was highest with first and second ranks followed by Pauri Garhwal (0.48), Bageshwar (0.47), Dehradun (0.47), Udham Singh Nagar (0.45), Rudrapur (0.45), Haridwar (0.43), Almora (0.42), Tehri Garhwal (0.36), Champawat, (0.31) Chamoli (0.31) and Uttarkashi (0.26) districts of the state. All districts showed moderate ecological security index with rank third to rank thirteen and none of the districts showed low as well as very high ecological security index. Three districts were found under high status of economic efficiency and these districts also showed better economic efficiency status and these districts were Udham Singh Nagar (0.71), Haridwar (0.60), Nainital (0.56). Six districts were found under moderate status of

economic efficiency as Champawat (0.46), Tehri Garhwal (0.45), Dehradun (0.44) Pithoragarh (0.34), Pauri Garhwal (0.29), and Chamoli (0.29) and four districts were found under low status of economic efficiency i.e Almora (0.18), Rudrapur (0.12) Bageshwar (0.11), and Uttarkashi (0.11). The districts Rudrapur, Pithoragarh, Pauri Garhwal, and Nainital were perform better Social Security index. Whereas none of the districts were showed poor performance in Social Security index. The districts performed better or poor in social security status in the state are different than the districts performed better or poor with respect to other security indices. The one district were found under very high Social Security Status i.e. Rudrapur (0.79). The seven districts were found under high status of Social Security status i.e. Pithoragarh (0.67), Pauri Garhwal (0.61), Nainital (0.59), Udham Singh Nagar (0.55), Almora (0.55), Champawat (0.54), Dehradun (0.53) However, districts Chamoli (0.41), Haridwar (0.41), Tehri Garhwal (0.39), Uttarkashi (0.35) and Bageshwar (0.33), were found under moderate status of social security. Out of total 13 districts, none of the districts were found under low status of social security. Sajjid *et al.* (2016) reported that the relative status and extent of social equity among the sampled farmers revealed that about 45 per cent of households had medium social equity nearly 77 per cent of larger farmers had medium social equity and medium and semi medium farmers had moderate social equity. Evidently, regional disparity exists among districts of Uttarakhand in terms of ecology, economy and equity. None of the districts has been found very high SLSI. In all the three indicators, especially ecological indicators which show continuance of huge pressure on natural resources. Therefore, the ecological resources need to be used adequately. The remote districts of the state lag behind in provision of better civic amenities and hence efforts must be directed towards increasing the economy and social equity of these districts.

Policy Measures

The district Pithoragarh showed high sustainable livelihood security index with rank third whereas district Pauri Garhwal shows moderate sustainable livelihood security index with sixth rank out of thirteen districts. The value of SSI and ESI value is more where as the value of EEI value is very low. So that the variables of the EEI viz. total food grain yield (kg/ha), total oil seed yield (kg/ha), Total milk production (tonnes) and irrigation intensity (%) were addressed properly by district administration. So that the value of these variables was enhance.

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