punjab geographer

A DOUBLE BLIND PEER REVIEWED JOURNAL OF APG AND ISPER INDIA INDEXED IN SCOPUS

VOLUME 16 ISSN- 0973–3485 OCTOBER 2020

PUNJAB GEOGRAPHER : ISSN- 0973–3485 **Volume 16** **October 2020**

ACCESS TO SOURCES OF LIGHTING AMONG HOUSEHOLDS IN RURAL INDIA

K.V. Chamar
S. K. Chamar

Abstract

Lighting is the deliberate use of any source of light for illumination. It includes the use of both artificial source of light as well as natural illumination by capturing day light. Proper lighting can enhance task performance and improve the appearance of an area. Hence, availability of proper light has positive psychological effects on the occupants of a household. The present research work is based on district-wise household data on sources of lighting obtained from Census of India, 2011. Percentage technique has been adopted to understand spatial variations in the use of different sources of household lighting at regional, state and district, levels in rural India. The study reveals that 55.31 per cent of rural households in India are dependent on electricity, while 43.15 per cent are using kerosene for household lighting. On the other hand, 0.53 per cent households do not have access to any source of lighting in rural India, hence still living in darkness.

Keywords: Households, Lighting, Electricity, Kerosene, Solar Energy, Other Oil.

Introduction

A house is one of the three basic human entitlements that provide shelter to its occupant. It is a social concept; its nature and cognition are varying with caste, class, religion and region (Unni, 1965). It is also the most important need of mankind where people sleep, take rest and carry on their occupational activities. As per Census of India, a 'household' is a group of persons who normally live together and take their meals from a common kitchen. The persons in a household may be related or unrelated or a mix of both. The important point in knowing whether it is a household or not, is a common kitchen. Thus, there is difference between a house and household, in the former, provision of shelter is a common point, while in the later it is the common kitchen which is at the central stage.

Lighting includes the use of both artificial source of light as well as natural illumination by capturing day light. Proper lighting can enhance task performance and improve the appearance of an area. Hence, availability of proper light has positive psychological effects on the occupants of a household. On the basis of sources of lighting, Census of India has grouped the households into six categories of having electricity, kero-

sene, solar energy, other oil, any other source and with no source of lighting.

Access to electricity also reflects a household's quality of life. It acts as a sign of social status and instrument for a better life among various social groups in modern life (Desai et al., 2010). Use of electricity reduces indoor pollution. The electricity is an efficient, clean and non-polluting source of energy. Use of electricity has close links to the quality of living space. Varied uses of electricity reflect upon the economic wellbeing and modernization of a society (Dave, 2018). Similarly, the solar energy being intermittent in nature is helpful in regional development and rural electrification (Ghosh et al., 2002). Solar energy can also be beneficial for rural households for lighting, providing comfortable level of illumination (Bhinde and Monroy, 2011). A solar home system needs to meet minimum household electricity requirements (Chaurey and Kandpal, 2009). Renewable sources of energy which need minimum maintenance are beneficial for agricultural and household sectors and are well suited for remote locations (Hiremath et al., 2009). Since, availability of household lighting is associated with standard of living of the people; therefore, this study has been taken up to access the distribution of various sources of household lighting in rural India.

Objective of the Study

The main objective of the present study is to highlight the access to different sources of lighting among households at regional, state and district levels in rural India.

Study Area

India extends from 8º 4' north to 37º 6' north latitudes and 68º 7' east to 97º 25' east longitudes, covering 32, 87, 263 km² of area. It is a union comprising of 28 states and 7 union territories. It has 640 districts as per 2011 census, out of which nine districts are without rural population. The total rural population is 833.75 million which resides in 168.61 million households. Out of the total population in the country, 68.85 per cent lives in rural areas and 31.15 per cent in urban areas. Similarly, out of the total households, 68.04 per cent are rural households and remaining 31.96 per cent are urban households.

Database and Methodology

The study is based on district-wise household data about different sources of household lighting provided by Census of India, 2011. The data in respect of sources of lighting such as electricity, kerosene, solar energy, other oil, any other and households without lighting have been calculated in percentages. To discuss the spatial variations at regional level, data have been processed considering the regions such as north-western, northern, eastern, north-eastern, western, southern and islands identified by Ahmed (1999). Similarly, data have also been processed to highlight the spatial variations at state level and spatial variations at district levels. Finally, maps have been prepared with the help of ArcGIS (ArcMap Version 10.2) and tables have been drawn to analyse and interpret the results.

Results and Discussion

Lighting condition in the households is one of the important indicators of the socio-economic development of any region. It has been recorded that more than half (55.31 per cent) of the households have access to electricity, while 43.15 per cent households are dependent on kerosene as source of

lighting in rural India. It has been found that about one per cent of the total rural households have access to three sources of lighting like solar energy (0.55), other oil (0.24) and any other source (0.22) in India. However, 0.53 per cent rural households still do not have any source of lighting, hence living in darkness. To highlight the spatial variations in the access of these sources of lighting, in-depth analysis has been carried out at regional, state and district level.

Spatial Variations at Regional Level

The access of lighting, across the broad regions, differs significantly in rural India. Among the regions, the north-western region of India has the highest access to electricity as source of lighting, where 90.50 per cent households are using electricity for household lighting followed by southern region with 89.64 per cent households and islands region with 80.21 per cent households. On the other hand, smallest proportion of households, using electricity, has been observed in eastern region (27.03 per cent households) followed by north-eastern region (37.19 per cent households) in rural India (Table 1). Kerosene is a major source of household lighting in eastern region (71.45 per cent, households), followed by north-eastern (60.43 per cent households) and northern region (55.49 per cent households). Kerosene has been least preferred as source of lighting in northwestern region (7.26 per cent households) and in southern region (9.42 per cent households). The use of solar energy, as source of lighting in rural households, also varies across different regions in India. The highest level of access to solar energy, among rural households has been found in north-eastern region (1.15 per cent households) followed by eastern region (0.78 per cent households) and in northern region (0.63 per cent households). On the other hand, lowest use of solar energy has been observed in southern region (0.20 per cent households) and Islands (0.21 per cent households). The maximum use of other oil, as source of lighting in rural households has been recorded in islands region of India. North-western region is leading in the use of any other source for household lighting. The study reveals that 1.33 per cent rural households of western region and 0.95 per cent of households in

Table 1
Rural India: Region-wise, Percentage of Households by Source of Lighting, 2011

Region	Sources of Lighting					
	Electricity	Kerosene	Solar Energy	Other Oil	Any Other	Without Lighting
North-western	90.50	07.26	00.35	00.23	00.71	00.95
Northern	43.07	55.49	00.63	00.28	00.21	00.95
Eastern	27.03	71.45	00.78	00.23	00.15	00.36
North-eastern	37.19	60.43	01.15	00.19	00.35	00.69
Western	77.77	19.96	00.31	00.27	00.36	01.33
Southern	89.64	09.42	00.20	00.21	00.07	00.46
Islands	80.21	18.52	00.21	00.39	00.11	00.56
National Average	**55.31**	**43.15**	**00.55**	**00.24**	**00.22**	**00.53**

Source: Compiled by Authors.

north-western and northern regions are still living in darkness.

Spatial Variations at State Level

State-wise spatial variations in access to various sources of household light have been discussed as under :

Access to Electricity as Source of Household Lighting

The access to electricity as source of lighting across the states varies from 10.37 per cent households in Bihar to 96.59 per cent households in Himachal Pradesh (Table 2). The very high access to electricity (more than 90 per cent, households) among households has been found in six states such as Himachal Pradesh, Goa, Punjab, Kerala, Tamil Nadu and Sikkim. On the other hand, very low access to electricity (less than 55 per cent, households) as source of lighting has been observed in the states like Meghalaya, West Bengal, Odisha, Jharkhand, Assam, Uttar Pradesh and Bihar. On the whole, 75 per cent states have recorded access to electricity as source of household lighting more than the national average, against only 25 per cent states having access to electricity lower than the national average of 55.31 per cent. Among the Union Territories (UTs), leaving aside Andaman & Nicobar Islands, all the UTs have more than 90 per cent households having access to electricity as source of lighting. Lakshadweep has highest percentage (99.76) of households with electricity as source of lighting among all the states and UTs.

Access to Kerosene as Source of Household Lighting

Kerosene is the second largest source of lighting being used by nearly 72.44 million households in rural India. In other words, 43.15 per cent rural households are dependent on kerosene for lighting. Inverse relationship has been found between the use of electricity and kerosene oil as source of household lighting, therefore as the access to electricity increases the use of kerosene decreases. The large proportion of households using kerosene has been found in the states where availability of electricity in the households is less than the national average. The highest use of kerosene has been recorded by Bihar state followed by Uttar Pradesh, Assam, Jharkhand, Odisha, West Bengal and Meghalaya states, where use of kerosene oil is more than the national average of 43.15 per cent. Except Meghalaya, all other states are those which have access to electricity as source of household light less than the national average. The lowest proportion of use of kerosene among households has been observed in the state of Punjab followed by Himachal Pradesh and Goa. Like states, the position of UTs using kerosene oil is also reverse in respect to the use of electricity as source of lighting as Andaman & Nicobar Islands has recorded highest use of kerosene oil and lowest by Lakshadweep (Table 2).

Access to Solar Energy as Source of Household Lighting

Solar energy is another source of lighting, being used by nearly 0.92 million households, which constitute 0.55 per cent of the total households in rural India. The access to solar energy as source of household lighting among states varies from 0.09 per cent households in Tamil Nadu to 3.86 per cent households in Arunachal Pradesh. At national level 0.55 per cent households are using solar energy for lighting. The states like Arunachal Pradesh, Mizoram, Manipur and Tripura located in north eastern parts of India have

Table 2
Rural India: State-wise, Percentage of Households by Sources of Lighting, 2011

States/UTs	Sources of Lighting					
	Electricity	Kerosene	Solar Energy	Other Oil	Any Other	Without Lighting
Andhra Pradesh	89.72	09.21	0.23	0.26	0.10	0.47
Arunachal Pradesh	55.46	23.59	3.86	0.39	2.74	13.96
Assam	28.36	70.38	0.87	0.14	0.06	0.19
Bihar	10.37	88.40	0.62	0.30	0.25	0.06
Chhattisgarh	70.05	28.18	1.12	0.20	0.15	0.31
Goa	95.62	03.44	0.22	0.06	0.04	0.62
Gujarat	84.98	12.85	0.21	0.31	0.29	1.36
Haryana	87.16	11.32	0.19	0.31	0.49	0.52
Himachal Pradesh	96.59	02.97	0.13	0.08	0.09	0.14
Jammu & Kashmir	80.68	12.63	1.35	0.26	2.52	2.56
Jharkhand	32.31	66.44	0.89	0.24	0.08	0.04
Karnataka	86.72	12.28	0.24	0.17	0.07	0.52
Kerala	92.10	07.43	0.27	0.10	0.06	0.04
Madhya Pradesh	58.25	40.88	0.33	0.22	0.09	0.22
Maharashtra	73.79	23.87	0.37	0.25	0.40	1.32
Manipur	63.48	30.18	2.43	0.44	2.75	0.72
Meghalaya	51.57	45.94	1.00	0.33	0.26	0.89
Mizoram	68.79	26.85	2.74	0.61	0.53	0.48
Nagaland	75.22	21.10	0.41	0.27	1.51	1.49
Odisha	35.55	62.79	0.39	0.10	0.11	1.05
Punjab	95.50	02.90	0.13	0.21	0.34	0.92
Rajasthan	58.25	39.30	0.80	0.38	0.31	0.96
Sikkim	90.16	08.74	0.32	0.13	0.09	0.57
Tamil Nadu	90.79	08.28	0.09	0.20	0.06	0.58
Tripura	59.49	37.67	2.20	0.24	0.04	0.35
Uttar Pradesh	23.77	75.02	0.55	0.28	0.23	0.14
Uttarakhand	83.05	14.53	1.69	0.19	0.20	0.34
West Bengal	40.31	57.79	1.17	0.22	0.07	0.43
Andaman & Nicobar Islands	79.37	19.30	0.22	0.41	0.12	0.58
Chandigarh	97.32	02.39	0.01	0.09	0.09	0.10
Dadra & Nagar Haveli	91.65	07.62	0.05	0.02	0.07	0.59
Daman & Diu	98.29	01.45	0.03	0.01	0.02	0.20
Lakshadweep	99.76	00.20	0.00	0.00	0.04	0.00
NCT of Delhi	97.79	01.44	0.08	0.17	0.31	0.21
Puducherry	95.77	03.56	0.02	0.12	0.02	0.51
National Average	**55.31**	**43.15**	**0.55**	**0.24**	**0.22**	**0.53**

Source: Compiled by Authors.

very high access to solar energy where more than 2 per cent households are dependent on it. However, none of the UTs could cross the national average in access to solar energy for household lighting (Table 2). Andaman & Nicobar Islands recorded highest use of solar energy with 0.22 per cent households depending on it. On the other hand, in Lakshadweep there is not even a single household with access to solar energy. It has been observed that three-fifth of the states and UTs have access to solar energy less than the national average. It may be noted that access to solar energy for household lighting is popular only in remote hilly areas where connectivity with electricity is not possible and supply of kerosene is also not available. Under such conditions subsidized or free solar lamps have been installed by the government for household lighting. Even in other parts of the country, subsidy is available on the installation of solar panels to meet the demand for household electricity as well as for production of commercial electricity.

Access to Other Oil as Source of Household Lighting

The households having no access to electricity, kerosene and solar energy have to depend on other oil for lighting. Other oil, as a source of lighting, includes both edible and non-edible oils used for lighting. Therefore, other oil is also a significant source of lighting used by about 0.41 million households which constitute 0.24 per cent of the total households in rural India. The use of other oil for household lighting among states varies from 0.06 per cent households in Goa to 0.61 per cent in Mizoram. At national level, 0.24 per cent households are dependent on other oil as source of lighting. It has been observed that in states such as Mizoram, Manipur, Arunachal Pradesh, Rajasthan, Meghalaya, Gujarat and Haryana, more than 0.30 per cent households are dependent on other oil as source of lighting. It is important to note that in 54 per cent of the states, the proportion of households using other oil is less than the national average. Similarly, apart from Andaman & Nicobar Islands, in all other UTs, the proportion of households using other oil as source of lighting is less than the national average. The households, generally with low income and living in remote areas, do not have access to electricity and kerosene oil; hence, have to depend on other oil as source of lighting being cheaper and availability of it at local level as compared to other sources of lighting.

Access to Any Other Sources as Household Lighting

Other sources of household lighting are those which are not covered under the above-mentioned sources of lighting. These sources are also significant and used by about 0.36 million households, which constitute for 0.22 per cent of the total households in rural India. Access to any other sources of lighting across the states varies from 0.04 per cent households in Goa and Tripura to 2.75 per cent households in Manipur. In Arunachal Pradesh and Jammu & Kashmir, more than 2 per cent of households are using any other sources for lighting. The households with very poor socio-economic conditions have to depend on any other sources of lighting which are available at local level. In about 54 per cent of the states, the percentage of households depending on any other sources of lighting is less than the national average. While, among all the UTs, only NCT of Delhi has the proportion of households depending on any other sources of lighting more than the national average (Table 2).

Lightlessness among Households

The household, that does not have any source of lighting, has been considered in the category of no lighting. It is important to note that nearly 0.89 million households in India still do not have access to any source of lighting. Hence, 0.53 per cent of the total households in rural India are living in darkness. It has been found that 13.96 per cent of households in Arunachal Pradesh are without lighting followed by Jammu & Kashmir (2.56 per cent households), Nagaland (1.49 per cent households), Gujarat (1.36 per cent households), Maharashtra (1.32 per cent households), and Odisha (1.05 per cent households). The households located at higher altitudes, dense forested areas, deserted areas, remote areas and border areas of these states, having very poor economic conditions, fall in this category. The states like Rajasthan, Punjab, Meghalaya, Manipur, Goa, Tamil Nadu and Sikkim also fall in the category where percentage of households without any source of lighting is above the national average (Table 2). Among the UTs, 0.59 per cent and 0.58 per cent of households of Dadra & Nagar Haveli and Andaman & Nicobar Islands are without any source of light, whereas none of the household in Lakshadweep falls in this category.

Spatial Variations at District Level

District-wise variations in access to various sources of household light have been presented as under:

Access to Electricity as Source of Household Lighting

The study highlights that about 92.85 million households constituting 55.31 per cent of the total households in rural India have access to electricity. The access to electricity as source of lighting across the districts varies from 1.26 per cent households in Arwal district of Bihar to 99.12 per cent in Hamirpur district of Himachal Pradesh. About one-fifth (21.87 per cent) of the districts in India are having very high level of access to electricity where more than 90 per cent households are using electricity (Table 3). It has been found that all the districts of the states like Punjab, Goa and Himachal Pradesh (except the district of Lahul & Spiti) and more than half of the districts of the states such as Kerala, Tamil Nadu and Haryana confined to large patches in rural India have very high access to electricity (Fig. 1). The access to high level of electricity has been found in 171 districts accounting for one-fourth (27.10 per cent) of the total districts. About three-fourth districts of Uttarakhand, Gujarat and Karnataka states and about half of the districts of states like

Table 3
Rural India: Levels of Access to Electricity for Household Lighting, 2011

Level of Access	Households (per cent)	No. of Districts	District (per cent)
Very High	More than 90.00	138	21.87
High	70.01-90.00	171	27.10
Moderate	50.01-70.00	87	13.78
Low	30.01-50.00	82	13.00
Very Low	30.00 and Less	153	24.25
India	**55.31**	**631**	**100.00**

Source: Compiled by Authors.

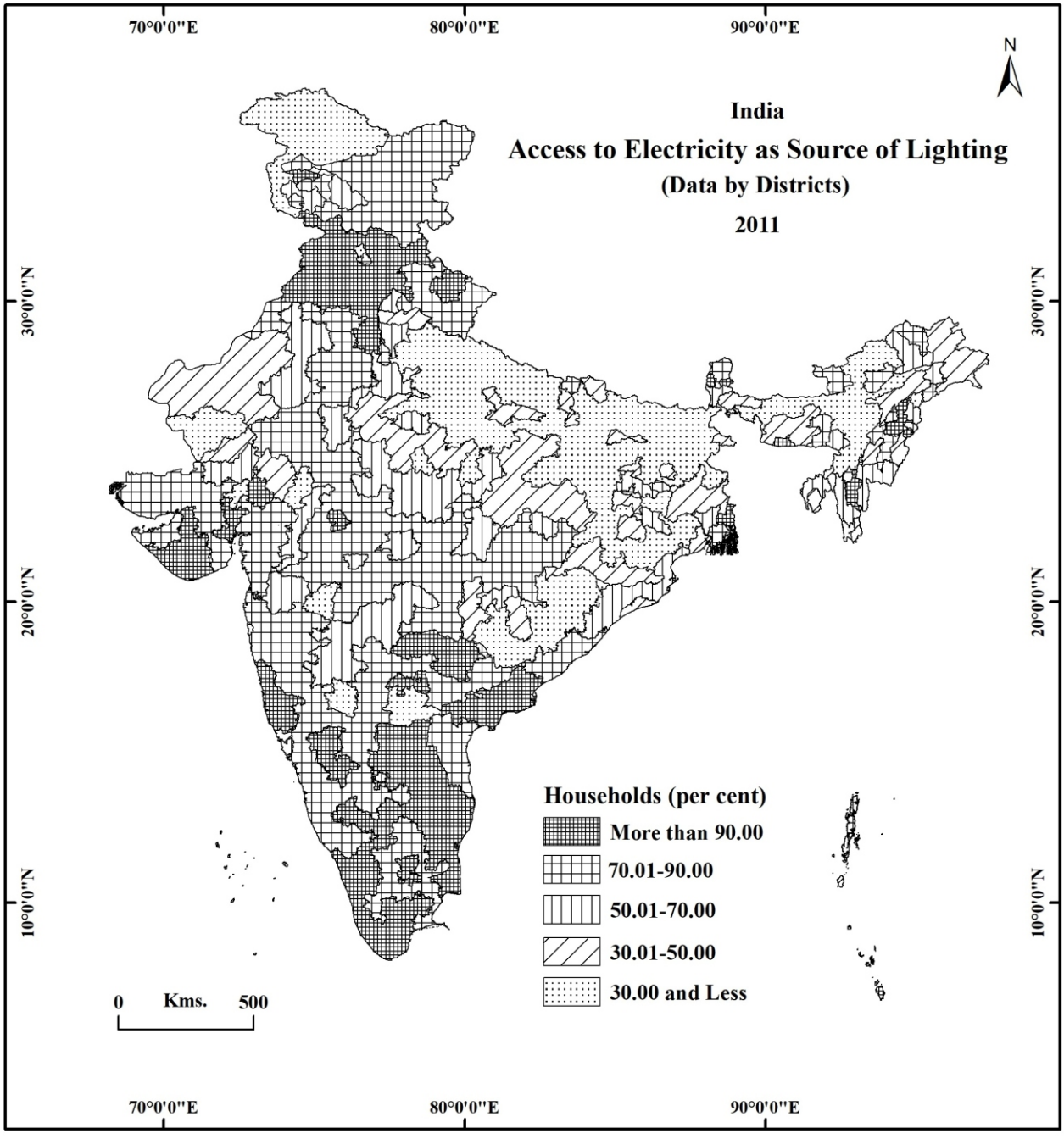
70°0'0"E
80°0'0"E
90°0'0"E
N
India
Access to Electricity as Source of Lighting
(Data by Districts)
2011
30°0'0"N
20°0'0"N
10°0'0"N
Households (per cent)
More than 90.00
70.01-90.00
50.01-70.00
30.01-50.00
30.00 and Less
0 Kms. 500

Fig. 1

Maharashtra, Jammu & Kashmir, Chhattisgarh and Sikkim fall in this category. The moderate level of access (50.01 to 70.0 per cent of households in a district) to electricity has been recorded by nearly 14 per cent of districts and most of the districts of this category are in the states of Madhya Pradesh, Maharashtra, Rajasthan and Odisha.

The districts where 50 per cent or less households are having access to electricity have been categorized as areas of low or very low level of access to electricity (Fig.1). Thus, 18.4 million households found in 235 districts accounting for 37.25 per cent of the total districts fall in this category. It has been observed that about 80 per cent districts of this category are found in only six states like Bihar, Assam, Uttar Pradesh, West Bengal, Odisha and Jharkhand located in northern and eastern parts of India. Within these states, all the districts of Bihar state, followed by Assam (93 per cent), Uttar Pradesh (90 per cent), West Bengal (80 per cent), Odisha (77 per cent) and Jharkhand (75 per cent) fall in this category. The households with very poor socio-economic conditions do not have access to electricity as source of lighting.

Access to Kerosene as Source of Household Lighting

Use of kerosene varies across the districts from 0.52 per cent households in Srinagar district of Jammu & Kashmir to 95.32 per cent households in Madhepura district of Bihar state. High to very high level of use of kerosene (that is more than 60 per cent households) has been found in 179 districts accounting for about 28 per cent of the total districts (Table 4). Nearly three-fourth districts of this category are confined in the form of large patches in the states of Uttar Pradesh, Bihar, Assam and Jharkhand (Fig 2). It has been observed that out of 25 first ranking districts, 19 are located only in Bihar state where more than 90 per cent of the households have to depend on kerosene as source of lighting. Most of the households in these districts have low literacy rate and are living under very poor socio-economic conditions. The moderate level of access to kerosene as source of lighting has been found in 83 districts and half of such districts are located in the states of Rajasthan, Odisha and Madhya Pradesh. Rests of the districts falling in this category are scattered in small patches in the central parts of India. While, low level of access, where 20.01-40.0 per cent households are dependent on kerosene has been recorded in 103 districts constituting 16.32 per cent of total districts. More than half (55 per cent) of such districts are found in the states of Rajasthan, Madhya Pradesh and Maharashtra only.

Table 4
Rural India: Levels of Access to Kerosene for Household Lighting, 2011

Level of Access	Households (per cent)	No. of Districts	District (per cent)
Very High	More than 80.00	81	12.84
High	60.01-80.00	98	15.53
Moderate	40.01-60.00	83	13.15
Low	20.01-40.00	103	16.32
Very Low	20.00 and Less	266	42.16
India	**43.15**	**631**	**100.00**

Source: Compiled by Authors.

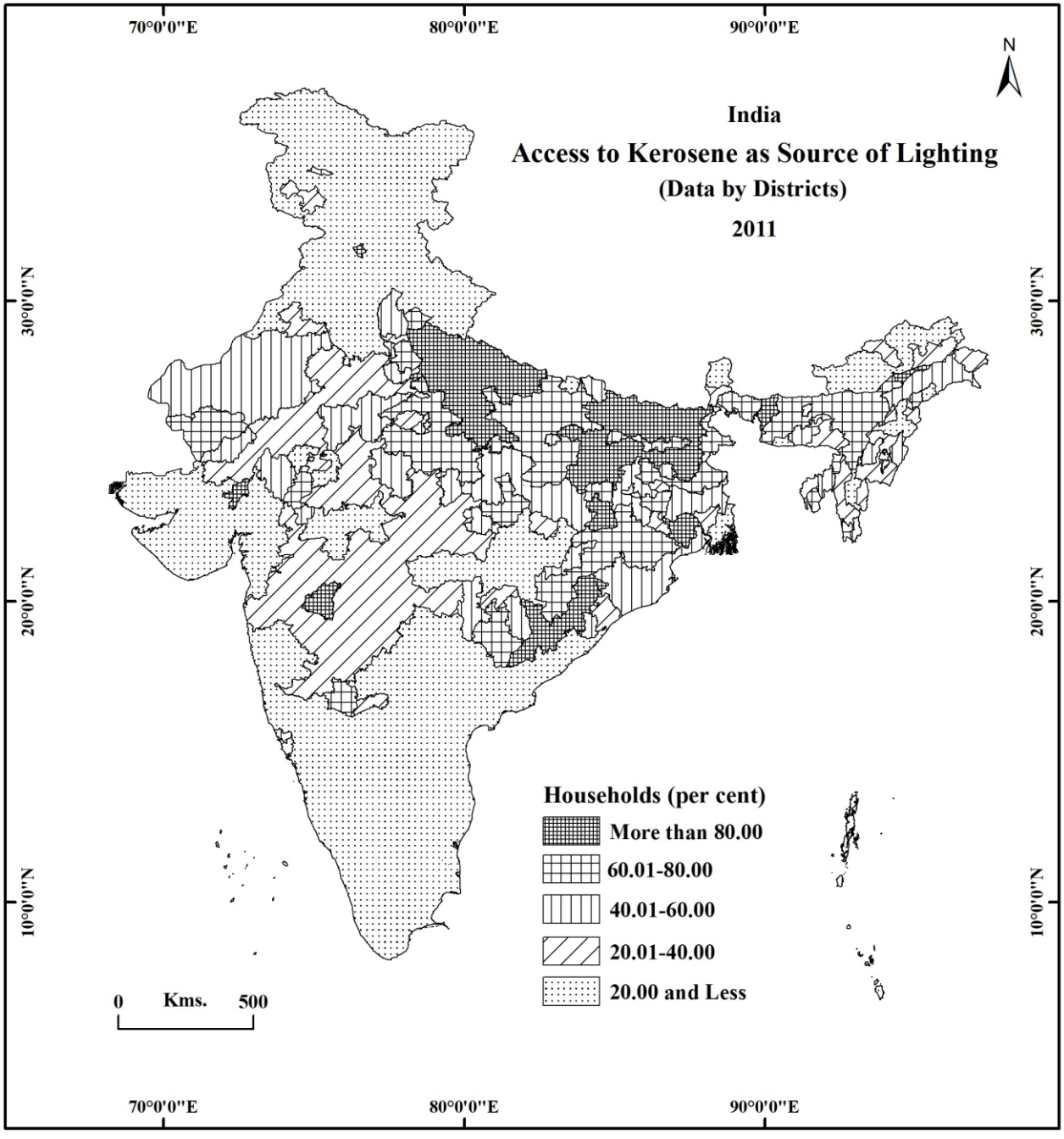
70°0'0"E
80°0'0"E
90°0'0"E
N
India
Access to Kerosene as Source of Lighting
(Data by Districts)
2011
30°0'0"N
20°0'0"N
10°0'0"N
Households (per cent)
More than 80.00
60.01-80.00
40.01-60.00
20.01-40.00
20.00 and Less
0 Kms. 500

Fig. 2

However, very low level of access to kerosene has been recorded in 266 districts comprising 42 per cent of total districts (Table 4). All the districts of Himachal Pradesh, Punjab, Sikkim, Andhra Pradesh, Kerala and Tamil Nadu states accounting for two-fifth (111 in number) of all the districts of this particular category are scattered in the form of very large patches in extreme north and southern part of the study area (Fig. 2). Besides that, all the districts of Jammu & Kashmir (except Reasi, Kulgam, Ramban and Punch districts) followed by Champawat district of Uttarakhand; Mahendragarh, Mewat and Palwal districts of Haryana; the Dangs, Banas Kantha, Dohad and Kheda districts of Gujarat and Yadgir and Bijapur districts of Karnataka state fall under this category of very low level of access to kerosene oil as source of household lighting.

Access to Solar Energy as Source of Household Lighting

The access to solar energy across the country varies from 0.03 per cent households in Thoothukkudi and Thanjavur districts of Tamil Nadu to 25 per cent households in Anjaw district of Arunachal Pradesh. Very high level of access to solar energy has been found in about 8 per cent districts where more than 2 per cent households are using solar energy for lighting (Table 5). Within this category, wide inter-district variations ranging from 25 per cent households in Anjaw district of Arunachal Pradesh to 2.02 per cent households in Latehar district of Jharkhand have been observed. There are eight districts such as Anjaw (25 per cent households), Dibang Valley (16.42 per cent households) and Lower Dibang Valley (14.17 per cent households) of Arunachal Pradesh; Leh (17.98 per cent households), Kargil (11.72 per cent households) and Kistwar (10.87 per cent households) of Jammu & Kashmir; Lahul & Spiti (11.23 per cent households) of Himachal Pradesh; and Tamenglong district (11.41 per cent households) of Manipur state where access to solar energy is in more than 10 per cent households. It is noticeable that most of these districts are located in northern and north-eastern mountainous states of India. The government has provided incentives like loan at very cheaper rate to the households in these areas for access to solar energy. Some districts of Rajasthan, Uttarakhand, Madhya Pradesh, Chhattisgarh, Jharkhand, Tripura and Nagaland also fall in this category of areas (Fig. 3).

The use of high level of solar energy i.e. 1 to 2 per cent of households in a district has been found in 50 districts comprising 7.92 per cent of total districts of India. These districts are spreading in nineteen states, but

Table 5
Rural India: Levels of Access to Solar Energy for Household Lighting, 2011

Level of Access	Households (per cent)	No. of Districts	District (per cent)
Very High	More than 02.00	53	08.40
High	01.01-02.00	50	07.92
Moderate	00.51-01.00	107	16.96
Low	00.26-50.00	138	21.87
Very Low	00.25 and Less	283	44.85
India	**00.55**	**631**	**100.00**

Source: Compiled by Authors.

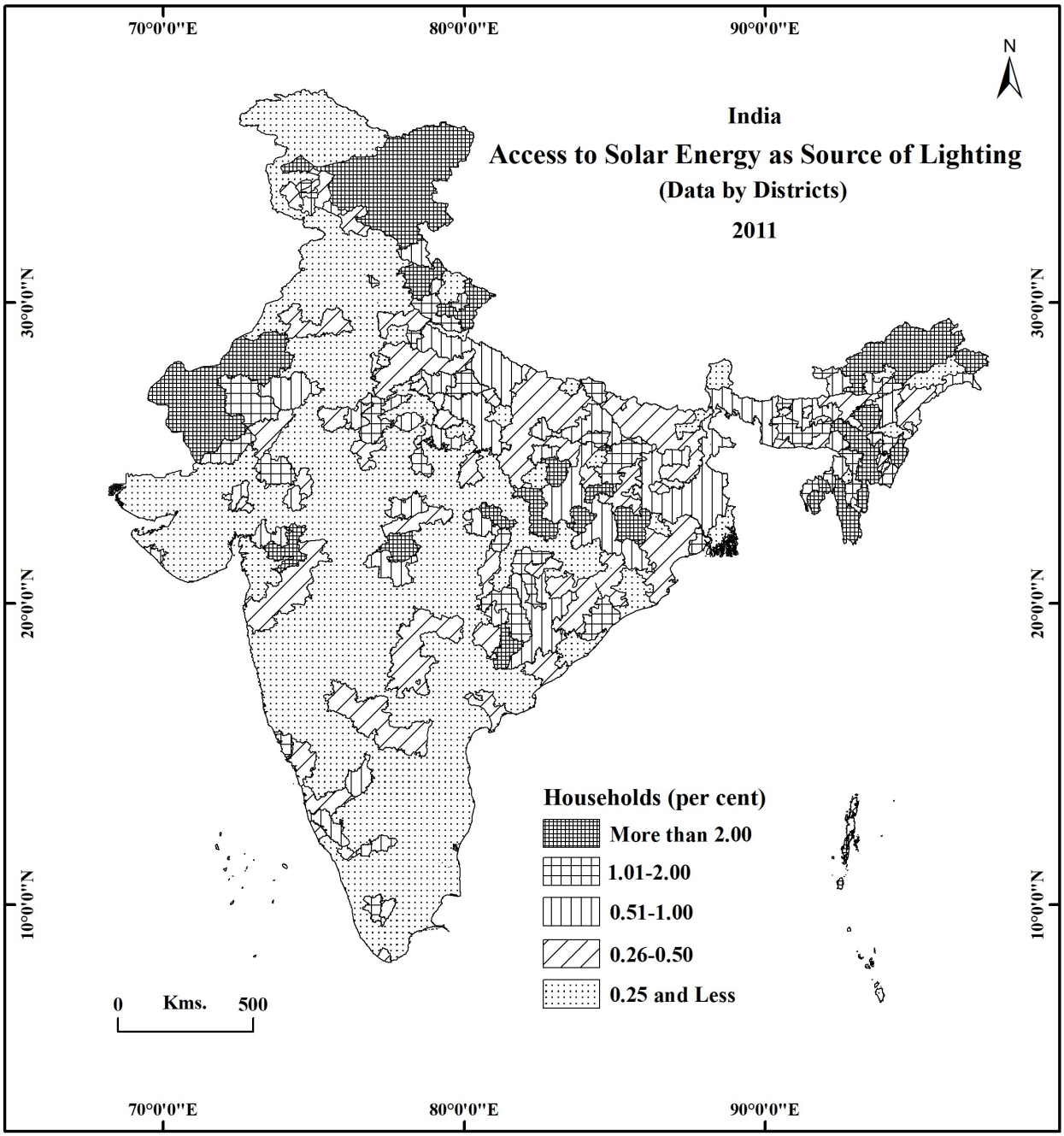
70°0'0"E
80°0'0"E
90°0'0"E
N
India
Access to Solar Energy as Source of Lighting
(Data by Districts)
2011
30°0'0"N
20°0'0"N
10°0'0"N
Households (per cent)
More than 2.00
1.01-2.00
0.51-1.00
0.26-0.50
0.25 and Less
0 Kms. 500

Fig. 3

most of the districts are confined to Bihar, Rajasthan, Uttar Pradesh, Chhattisgarh and Assam states in the form of small scattered patches. The moderate use of solar energy, that is where 0.51 to 1.0 per cent households are dependent on solar energy has been found in nearly 17 per cent districts, mostly located in the states of Uttar Pradesh, West Bengal, Assam, Bihar and Odisha. While, the use of solar energy among households at low level (0.26-0.50 per cent households) has been found in 138 districts (22 per cent), mostly located in the states of Uttar Pradesh, Bihar, Odisha and Jharkhand, confined to small scattered patches (Fig. 3). Access of solar energy at very low level (up to 0.25 per cent households) has been found in 45 per cent districts (Table 5). All the districts of Punjab, followed by Tamil Nadu (90 per cent), Gujarat (88 per cent), Himachal Pradesh (83 per cent), Kerala (79 per cent), Haryana (76 per cent), Madhya Pradesh (74 per cent) and Maharashtra (74 per cent) state come under this category. These districts are located in extreme north to south in the form of very large patches (Fig. 3).

Access to Other Oil as Source of Household Lighting

The use of other oil as source of household lighting across the country varies from 2.16 per cent households in Dibang Valley district of Arunachal Pradesh to Srinagar district of Jammu & Kashmir where not even a single household is dependent on this source of lighting. In India, only 16 districts are found where more than 0.80 per cent households use other oil for lighting. Apart from Dibang Valley district of Arunachal Pradesh, the highest percentage of such households has been observed in Banas Kantha district of Gujarat, Lunglei district of Mizoram, Anjaw district of Arunachal Pradesh and Bijapur district of Chhattisgarh where more than 1.25 per cent households used other oil for the purpose of household lighting. High level (00.41 to 00.80 per cent households) of access to other oil among households has been recorded in 9 per cent of the total districts which are mostly confined to north-eastern parts of India. Such districts are also scattered in patches in Rajasthan, Madhya Pradesh, Uttar Pradesh, Bihar, Jharkhand and Gujarat states (Fig. 4). The moderate level of use of other oil (0.21-0.40 per cent households in a district) has been recorded in 262 districts comprising 41.52 per cent of the total districts (Table 6). More than 60 per cent districts of this category are scattered in large patches in the states like Rajasthan, Uttar Pradesh, Bihar, Madhya Pradesh, Maharashtra, Gujarat and Tamil

Table 6
Rural India: Levels of Access to Other Oil for Household Lighting, 2011

Level of Access	Households (per cent)	No. of Districts	District (per cent)
Very High	More than 00.80	16	02.54
High	00.41-00.80	55	08.72
Moderate	00.21-00.40	262	41.52
Low	00.11-00.20	203	32.16
Very Low	00.10 and Less	95	15.06
India	**00.24**	**631**	**100.00**

Source: Compiled by Authors.

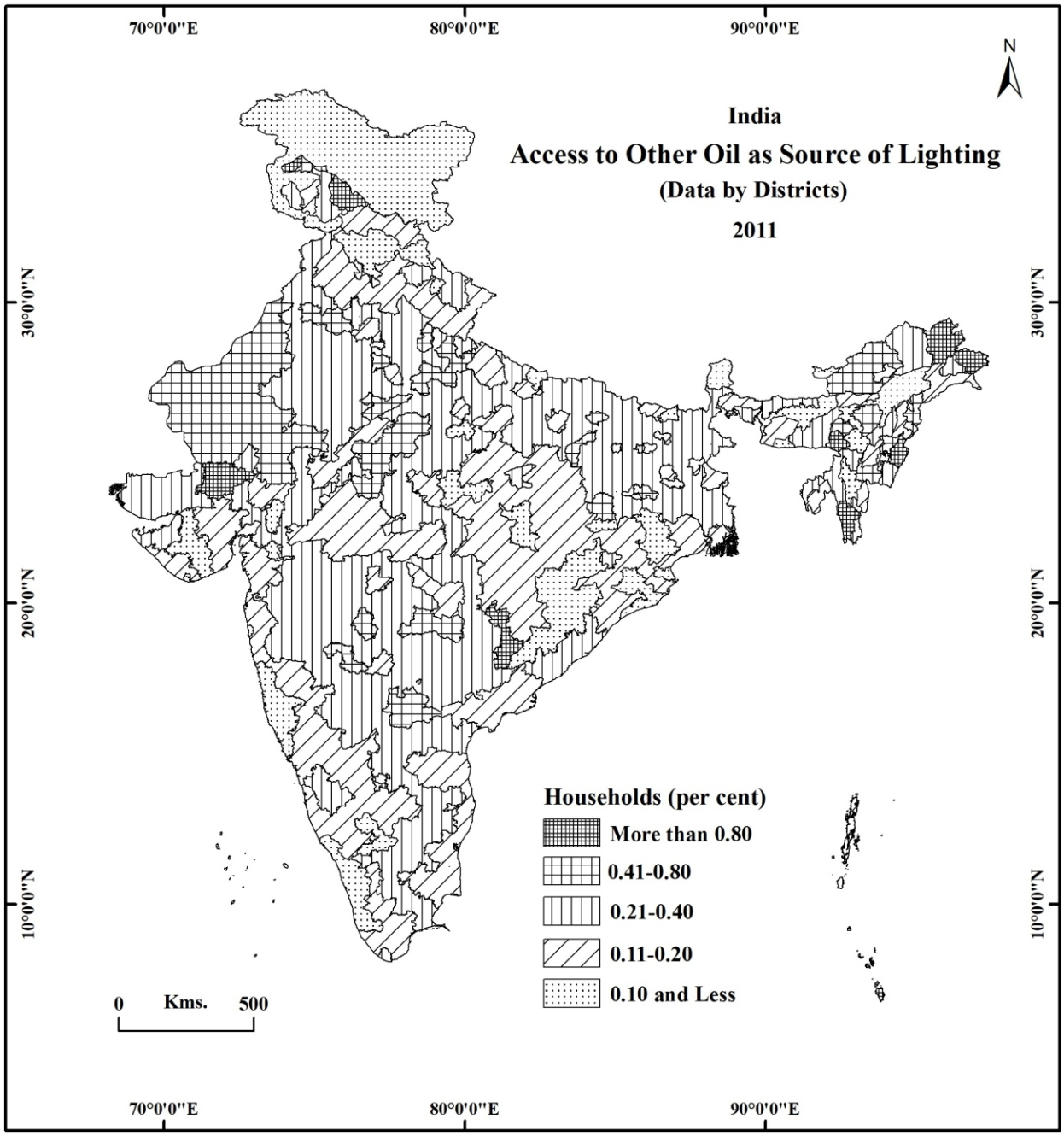
70°0'0"E
80°0'0"E
90°0'0"E
N
India
Access to Other Oil as Source of Lighting
(Data by Districts)
2011
30°0'0"N
20°0'0"N
10°0'0"N
Households (per cent)
More than 0.80
0.41-0.80
0.21-0.40
0.11-0.20
0.10 and Less
0 Kms. 500

Fig. 4

Nadu. Low and very low levels of access to other oils for household lighting has been observed in 298 districts (Table 6). About half of such districts are located in seven states such as Madhya Pradesh, Odisha, Karnataka, Assam, Gujarat, Tamil Nadu and Chhattisgarh by forming very large patches. Rest of the districts are scattered in whole of the study area in small patches (Fig. 4).

Access to Any Other Sources as Household Lighting

The access to any other sources of lighting, across the districts, varies from 0.02 per cent households in Kangra and Hamirpur districts of Himachal Pradesh, Serchhip district of Mizoram, Hailakandi district of Assam, Paschim Medinipur district of West Bengal, Purbi Singhbhum and Gumla districts of Jharkhand, Dindori, Harda and Anuppur districts of Madhya Pradesh, Ariyalur, Nagapattinam and Thanjavur districts of Tamil Nadu to 10.75 per cent households in Ukhrul district of Manipur. Very high level of use of any other sources for lighting has been found in about 9 per cent districts of the country where more than 0.80 per cent households are using any other sources (Table 7). However, within this category, wide inter-district variations ranging from extremely high level of 10.75 per cent households in Ukhrul district of Manipur to 0.81 per cent households in Bid district of Maharashtra have been noticed. Further, extremely high level of access where more than five per cent of households in a district are dependent on any other sources has been observed in six districts namely Ukhrul (10.75 per cent households) in the state of Manipur; Kishtwar (10.74 per cent households) in the state of Jammu & Kashmir; Upper Subansiri (9.79 per cent households) and East Kameng (8.93 per cent households) in the state of Arunachal Pradesh; Tuensang (6.09 per cent households) in the state of Nagaland and Chandel (5.03 per cent households) in Manipur state. It has been noted that nearly 70 per cent districts of this category fall in the states of Jammu & Kashmir, Arunachal Pradesh, Manipur and Nagaland and thus confined to hilly areas. High level of use of any other sources for lighting that is between 0.41 per cent to 0.80 per cent of households has been noticed in 48 districts which are mostly confined to Punjab, Haryana, Rajasthan, Uttar Pradesh, Gujarat and Maharashtra in the form of scattered patches (Fig. 5). Moderate level of use in which 0.21 to 0.40 per cent households are dependent on any other source of lighting has been found in about 17 per cent of districts. Out of these, three-fourth districts are located in the states of Haryana, Rajasthan, Uttar Pradesh, Bihar, Gujarat and Maharashtra.

Table 7
Rural India: Levels of Access to Any Other Source for Household Lighting, 2011

Level of Access	Households (per cent)	No.of Districts	District (per cent)
Very High	More than 00.80	59	09.35
High	00.41-00.80	48	07.61
Moderate	00.21-00.40	108	17.12
Low	00.11-00.20	149	23.61
Very Low	00.10 and Less	267	42.31
India	**00.22**	**631**	**100.00**

Source: Compiled by Authors.

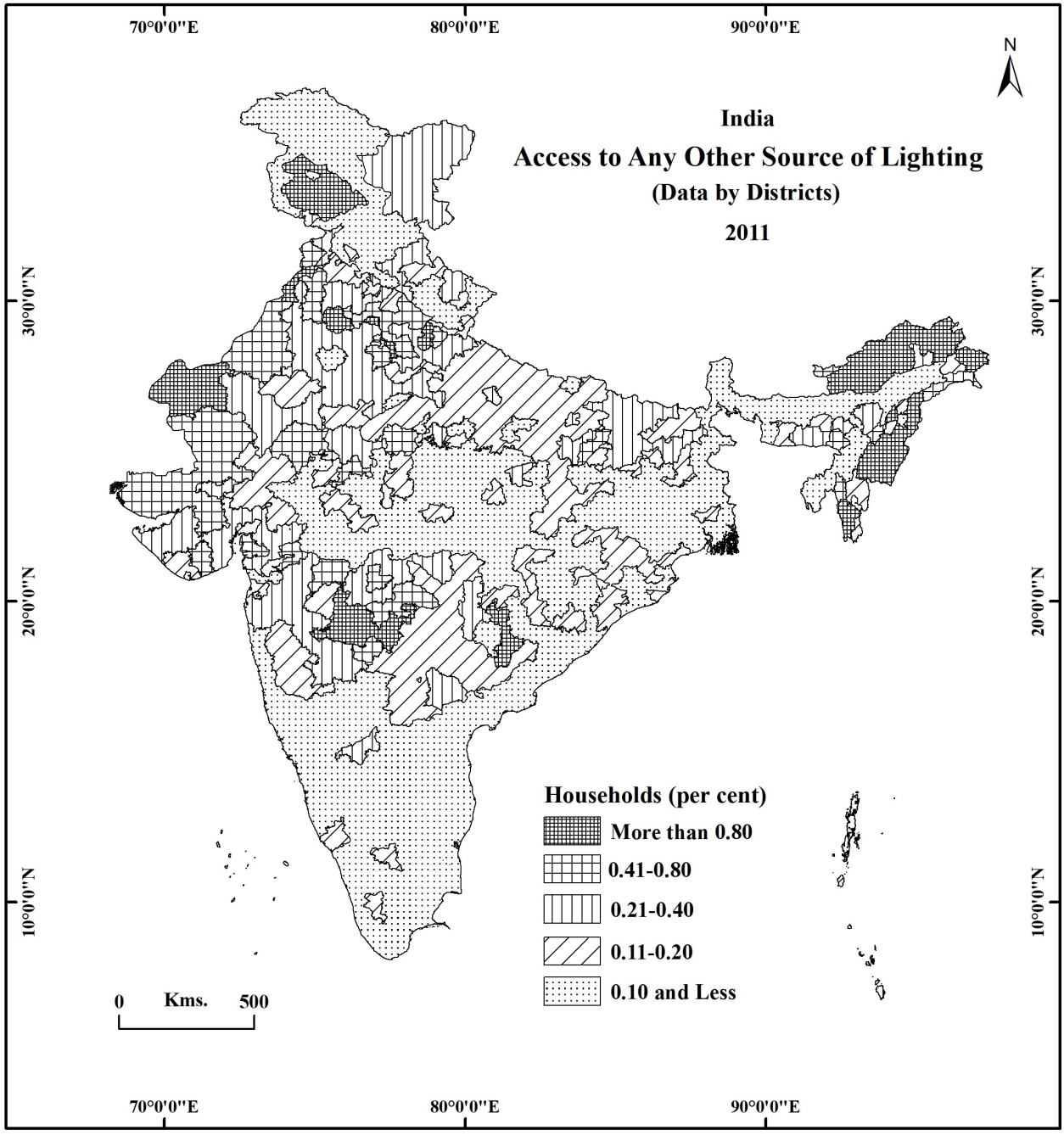
70°0'0"E
80°0'0"E
90°0'0"E
N
India
Access to Any Other Source of Lighting
(Data by Districts)
2011
30°0'0"N
20°0'0"N
10°0'0"N
Households (per cent)
More than 0.80
0.41-0.80
0.21-0.40
0.11-0.20
0.10 and Less
0 Kms. 500

Fig. 5

While the use of any other sources of lighting among households at low and very low level (up to 0.20 per cent of households) has been found in two-third (65.92 per cent) of the total districts. All the districts of the states of Tamil Nadu, Odisha, Jharkhand, West Bengal, Kerala, Tripura, and Goa accounting for about one-third (123 in number) of the districts of this category are scattered in the form of very large patches in extreme south, central and eastern parts of India (Fig. 5). Along with the above-mentioned states, notable number of districts in Uttar Pradesh, Bihar, Gujarat, Maharashtra and Rajasthan has been also using any other sources for household lighting. It has been noticed that all the districts of Sikkim state except south Sikkim district, Nalgonda district of Andhra Pradesh; Bellary district of Karnataka; Shimla and Kinnaur districts of Himachal Pradesh; Karbi and Anglong districts of Assam; Dehradun, Chamoli and Haridwar district of Uttarakhand; Mamit, Lawngtlai and Longlei districts of Mizoram; Narayanpur, Bijapur and Dakshin Bastar Dantewada districts of Chhattisgarh and Bhopal, Sidhi, Alirajpur and Shivpuri districts of Madhya Pradesh fall under this category.

Lightlessness among Households

Lightlessness among households varies across the country from 0.01 per cent of households in Madhepura district of Bihar and Garhwa, Khunti, Pakur and Saraikela-Kharsawan districts of Jharkhand to 57.41 per cent households in Kurung Kumey district of Arunachal Pradesh. Households comprising 0.53 per cent of the total, having various levels of lightlessness are confined to 631 districts of the country (Table 8). Very high level of lightlessness has been found in 39 districts constituting about 6 per cent of total districts where more than 2 per cent households are without any source of lighting (Table 8). Extremely high level of lightlessness, where more than 15 per cent of households are without any source of lighting has been observed in five districts such as Kurung Kumey (57.41 per cent), East Kameng (49.05 per cent), Upper Subansiri (32.20 per cent), Dibang Valley (23.67 per cent) and West Siang (15.64 per cent) of Arunachal Pradesh. These, districts are located in the remote areas adjacent to international border with China, where most of the households have only one room or without any exclusive room and living under very poor economic conditions. The districts where 2.01 to 15.0 per cent of households do not have access to any sources of lighting are mostly confined to the states of Jammu & Kashmir, Arunachal Pradesh and Maharashtra (Fig. 6). The areas recording

Table 8
Rural India: Levels of Lightlessness among Households, 2011

Levels	Households (per cent)	No.of Districts	District (per cent)
Very High	More than 02.00	39	06.18
High	01.01-02.00	68	10.78
Moderate	00.51-01.00	141	22.35
Low	00.26-50.00	134	21.24
Very Low	00.25 and Less	249	39.45
India	**00.53**	**631**	**100.00**

Source: Compiled by Authors.

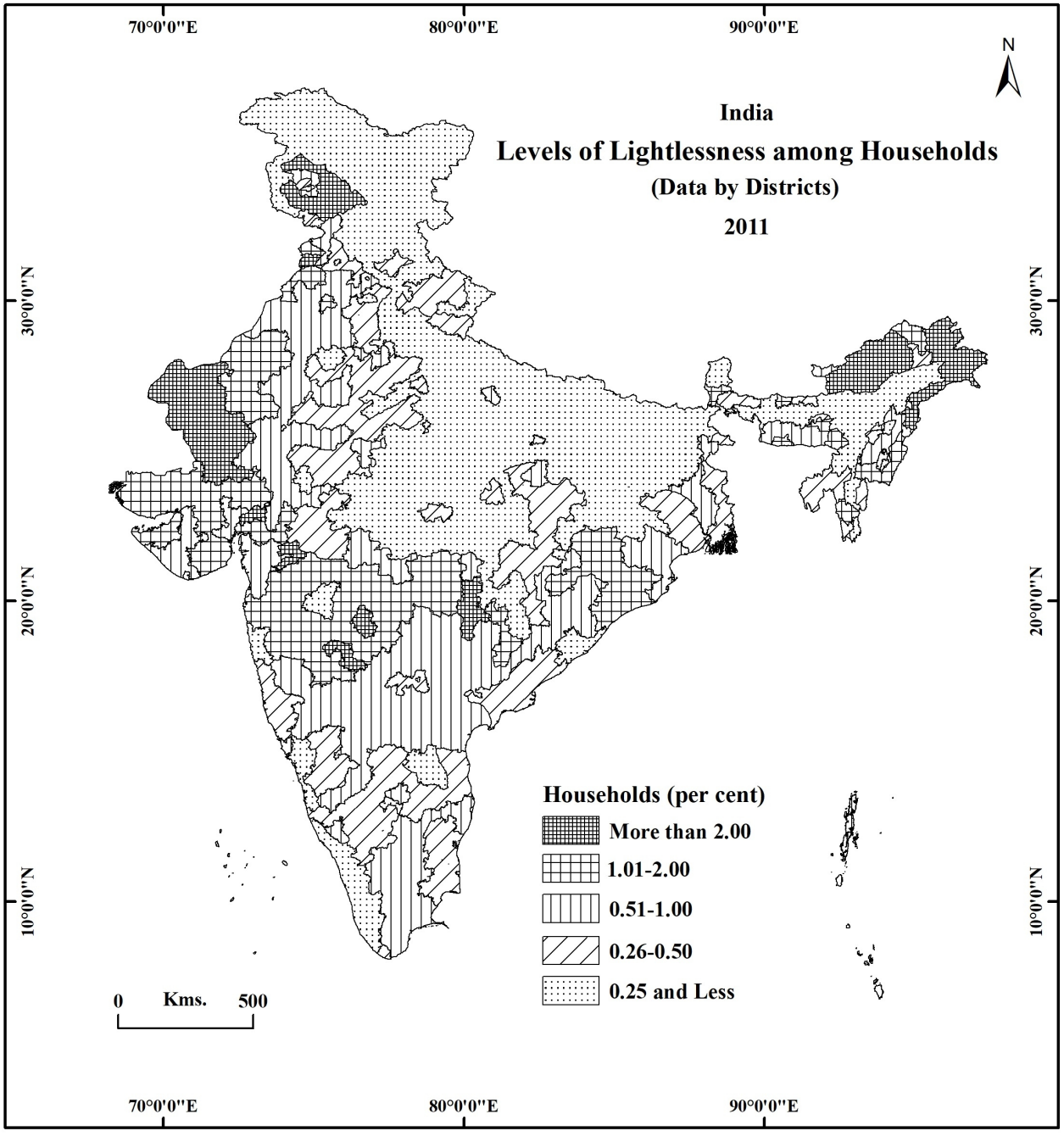
70°0'0"E
80°0'0"E
90°0'0"E
N
India
Levels of Lightlessness among Households
(Data by Districts)
2011
30°0'0"N
20°0'0"N
10°0'0"N
Households (per cent)
More than 2.00
1.01-2.00
0.51-1.00
0.26-0.50
0.25 and Less
0 Kms. 500

Fig. 6

high level of lightlessness, in which 1.01 per cent to 2.0 per cent of households are without any source of lighting have been found in 68 districts scattered in large patches in the states of Gujarat, Maharashtra and Odisha. Moderate level of lightlessness, in which 0.51 to 1.0 per cent households are without any source of lighting has been recorded in about one-fourth of the total districts. More than 70 per cent districts of this category are found in the states of Punjab, Haryana, Odisha, Rajasthan, Gujarat, Andhra Pradesh, Karnataka and Tamil Nadu. Low to very low levels of lightlessness has been found in 0.22 million households of 383 districts accounting for 60.79 per cent of the total districts (Table 8). It has been found that all the districts of Himachal Pradesh, Uttarakhand, Bihar, Tripura, Jharkhand, and Kerala states, Uttar Pradesh except Lucknow district; Mizoram except Lunglei district; Assam except Chirang district; Chhattisgarh except Narayanpur, Bijapur and Dakshin Bastar Dantewada districts; Madhya Pradesh except Singrauli, East Nimar, Ratlam and Burhanpur districts and major part of Jammu and Kashmir fall under this category of lightlessness (Fig. 6). The houses having dilapidated conditions and without any exclusive room are without any source of lighting, hence living in darkness.

Conclusions

Lighting condition in the households is one of the important indicators of the socio-economic development of a country. The present study highlights that more than half of the households have access to electricity as source of lighting followed by kerosene in rural India. High to very high level of access to electricity as source of household lighting has been found in states of Himachal Pradesh, Goa, Punjab, Kerala, and Tamil Nadu in the form of large patches. The inverse relationship has been found between the use of electricity and kerosene oil. The highest use of kerosene is recorded by Bihar state while its utilization is lowest in the state of Punjab. The areas of very high level of access to solar energy are located in northern and north-eastern mountain states of India. While the use of other oil, as a source of lighting, is mostly confined to north-eastern parts of rural India. On the other hand, north-western region is leading in the use of any other source for rural household lighting. It is important to note that 0.53 per cent of rural households in India, still do not have access to any source of lighting, hence living in darkness. The areas of very high level of lightlessness have been found in the districts which are located in the remote areas and households have only one room or without any exclusive room and living in very poor economic conditions. Such households are mostly confined to the states of Jammu & Kashmir, Arunachal Pradesh and Maharashtra. Finally, it has been observed that the use of electricity as source of household lighting is an index of better socio-economic development, while use of kerosene and other sources of lighting reflect the degree of deprivation. Since, household lighting is one of the basic necessities for healthy living, therefore it is suggested that 74.11 million households comprising 44.14 per cent of total rural households in India depending on kerosene or on any other source for lighting or living under darkness must be connected either with electricity or provided with solar lighting system.

References

Ahmad, A. 1999. *Social Geography,* Rawat Publications, Jaipur: 255-258.

Bhinde, A. and Monroy, C. R. 2011. Energy poverty: a special focus on energy poverty in India and renewable energy technologies. *Renewable and Sustainable Energy Reviews,* 15 (2): 1057-1066.

Chaurey, A. and Kandpal, T. C. 2009. Carbon abatement potential of solar home systems in India and their cost reduction due to carbon finance. *Energy Policy,* 37(1): 115-125.

Dave, B. 2018. *Mapping the Quality of Living Spaces in India,* Indian Research Academy, New Delhi: 77.

Desai, S. B., Dubey, A., Joshi, B. L., Sen, M., Sharif, A. and Venneman, R. 2010. *Human Development in India: Challenges for a Society in Transition,* Oxford University Press, New Delhi: 60.

Ghosh, D., Shukla, P. R., Garg, A. and Ramana, P. V. 2002. Renewable energy technologies for the Indian power sector: mitigation potential and operational strategies. *Renewable and Sustainable Energy Reviews,* 6 (6): 481-512.

Hiremath, R. B., Kumar, B., Balachandra, P., Ravindranath, N. H. and Raghunandan, B. N. 2009. Decentralised renewable energy: Scope, relevance and applications in the Indian context. *Energy for Sustainable Development,* 13 (1): 4-10.

Unni, K. R. 1965. Social factors in housing. In *Rural Habitat,* eds. Oakley, D. and Unni, K.R. The School of Planning and Architecture, New Delhi: 3.

Dr. K. V. Chamar, Professor,
Email: chamar_kv@yahoo.com
Author for Correspondence
Department of Geography,
M.D. University,
Rohtak (Haryana).

Dr. S. K. Chamar, Assistant Professor,
Department of Geography,
Govt. College, Julana,
Jind (Haryana).

punjab geographer