

A satellite image of Uttarakhand, India, at night, showing a dense network of yellow and orange lights representing urban areas and infrastructure. The lights are concentrated in the central and eastern parts of the state, with some smaller clusters in the west and south. The background is dark blue, representing the night sky and unlit areas.

Report *on* Nightlights Data *of* Uttarakhand

Prepared by

India Data Portal

Gross Domestic Product (GDP), historically has been a standard measure of economic activity. It records the value of all final goods and services produced within the country during a given period, net of the value of inputs. GDP data requires estimations and extrapolations because not all economic activities can be completely captured.

In recent time, night-time radiance, traced from outer space through satellites, has increasingly emerged as a pertinent measure for changes in economic activities irrespective of their sources (formal or informal sectors). It is also a more significant representation of economic activities in manufacturing and services, than agriculture. Farmers have lower access to electricity, and primarily use it for pumping water that doesn't generate nightlights. Ideally, an increase in luminosity eyes the essence of a country's developmental and its macro-economic indicators, for example - access to electricity, reliable power supply, increased electricity consumption, increased income level, industrial production, money and credit growth.

Nightlights has become a reasonable indicator for GDP at the national and sub-national levels, with a very high level of spatial granularity. It does not suffer from questions around data quality or manipulation, and its errors are considered to be free of political bias.

Ahead of assembly elections in Uttarakhand, we present nightlights data to enable a constituency-level comparison for the economic activities over six years, covering 2015 to 2020.

Nightlights as the Indicator of Growth in Economic Activity in Uttarakhand

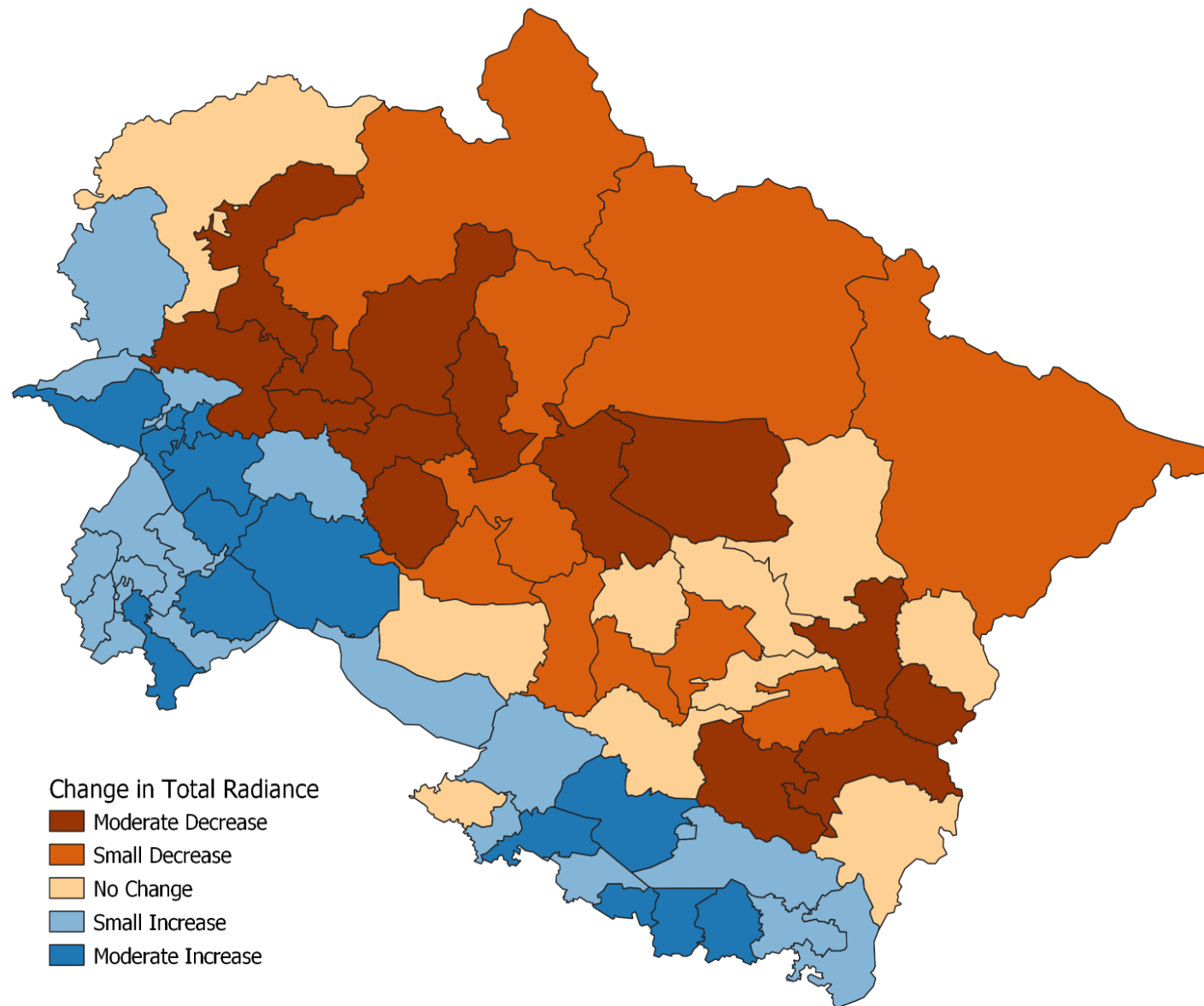
This report presents data and visualisations for the state of Uttarakhand, and provides pertinent insights from illustrations on the level and change in economic activity for all of its 70 assembly constituencies.

The three nightlight variables highlighted here include total radiance, change in total number of lit pixels and percentage change in lit pixels.

An increasing number of lit pixels suggests that economic activity is expanding to new areas, as previously dark pixels begin to show radiance in satellite images. On the other hand, total radiance denotes increasing economic activity without saying anything about its distribution over space. Looking at both total radiance and per cent of lit pixels provides a better picture of economic activity.

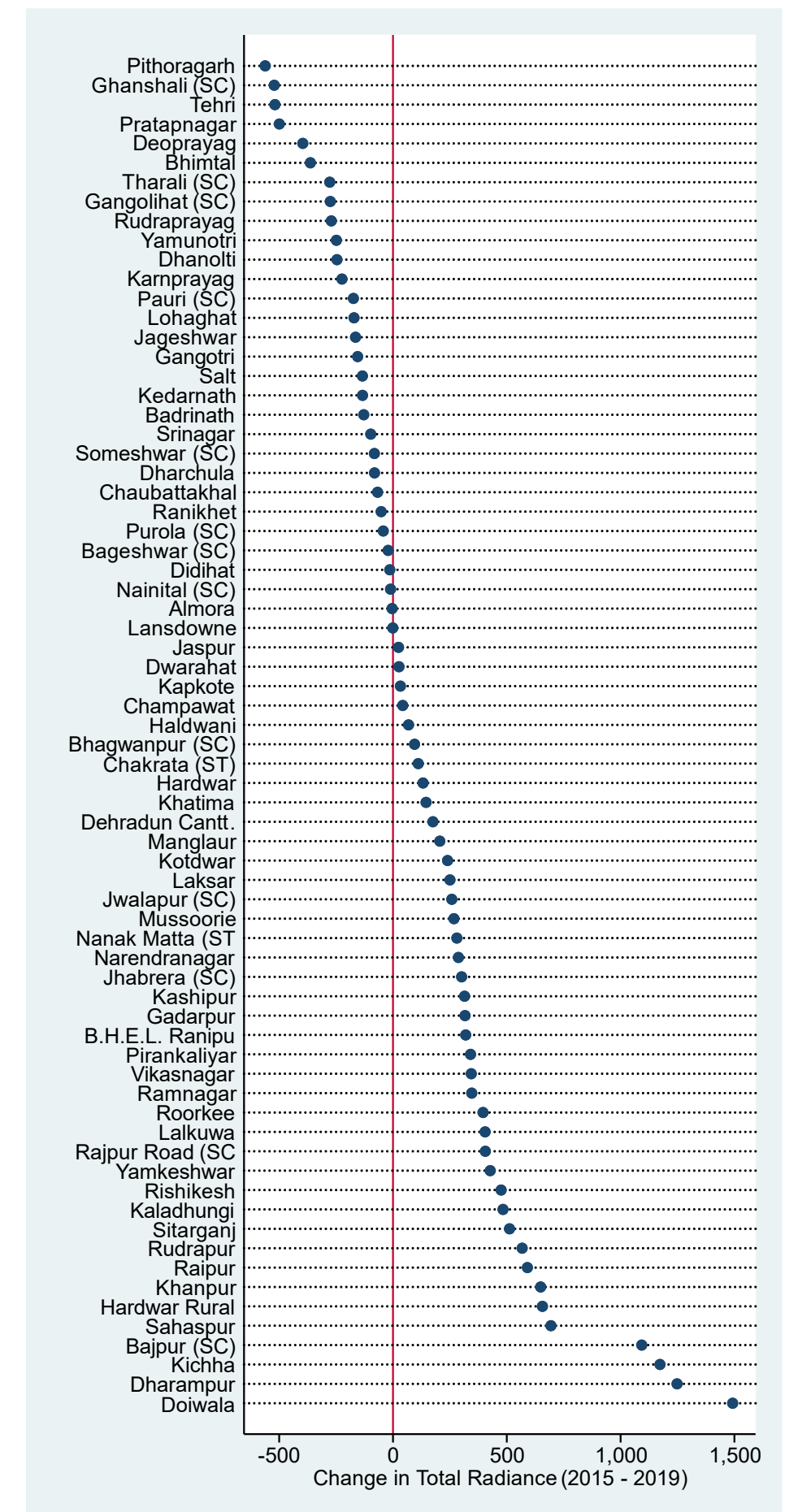
Image Source : NASA, Retrieved from <https://www.nasa.gov/sites/default/files/thumbnails/image/india-2016.jpg>

1. Growth Pattern of Total Radiance across constituencies from 2015 to 2019

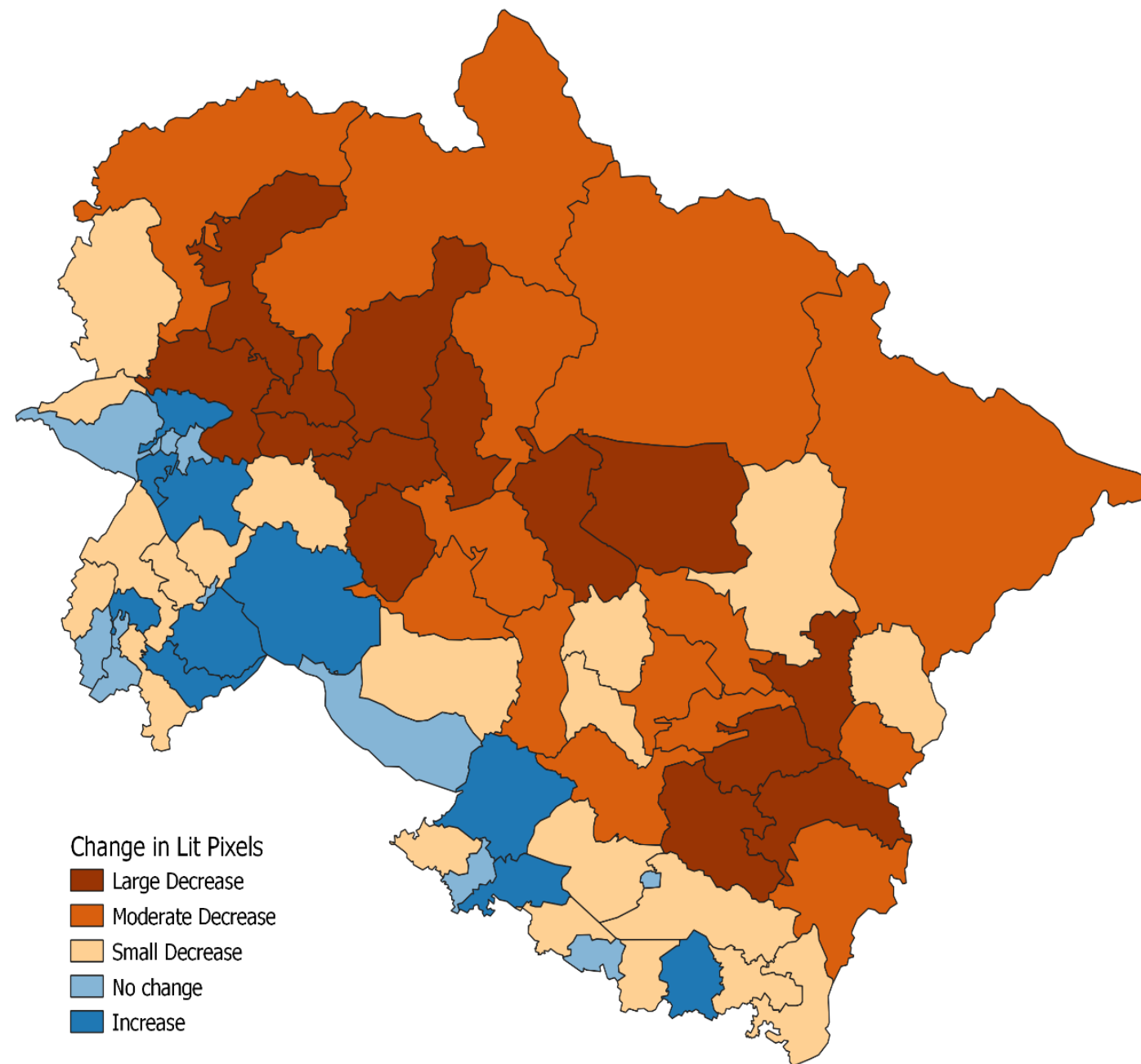


The visual here describes a five-year growth pattern in total radiance, from 2015 to 2019. 14 constituencies in the state have shown a moderate decrease in total radiance, and 10 constituencies have shown a small decrease in total radiance. 10 constituencies have not shown any change in total radiance. It is hence noted that 48.5% of the state or 34 constituencies depict no change or a decrease in radiance. Of 70, 14 constituencies have shown a moderate increase, and 22 constituencies have shown a small increase in total radiance. Highest increase in total radiance is noted in Doiwala.

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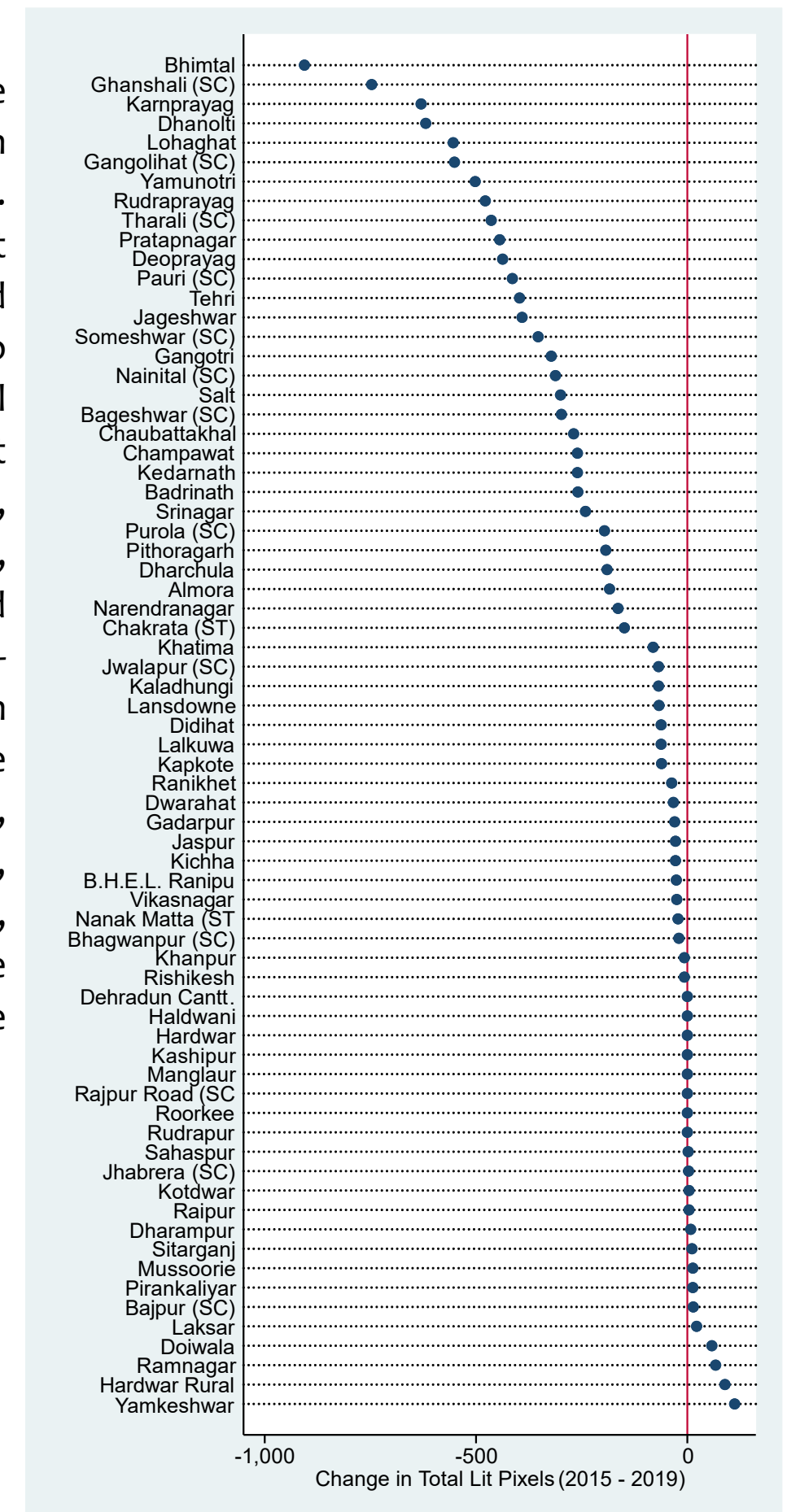


2. Growth Pattern of Change in total number of lit pixels across constituencies from 2015 to 2019 - Indicates the distribution of night lights in the assembly constituency area

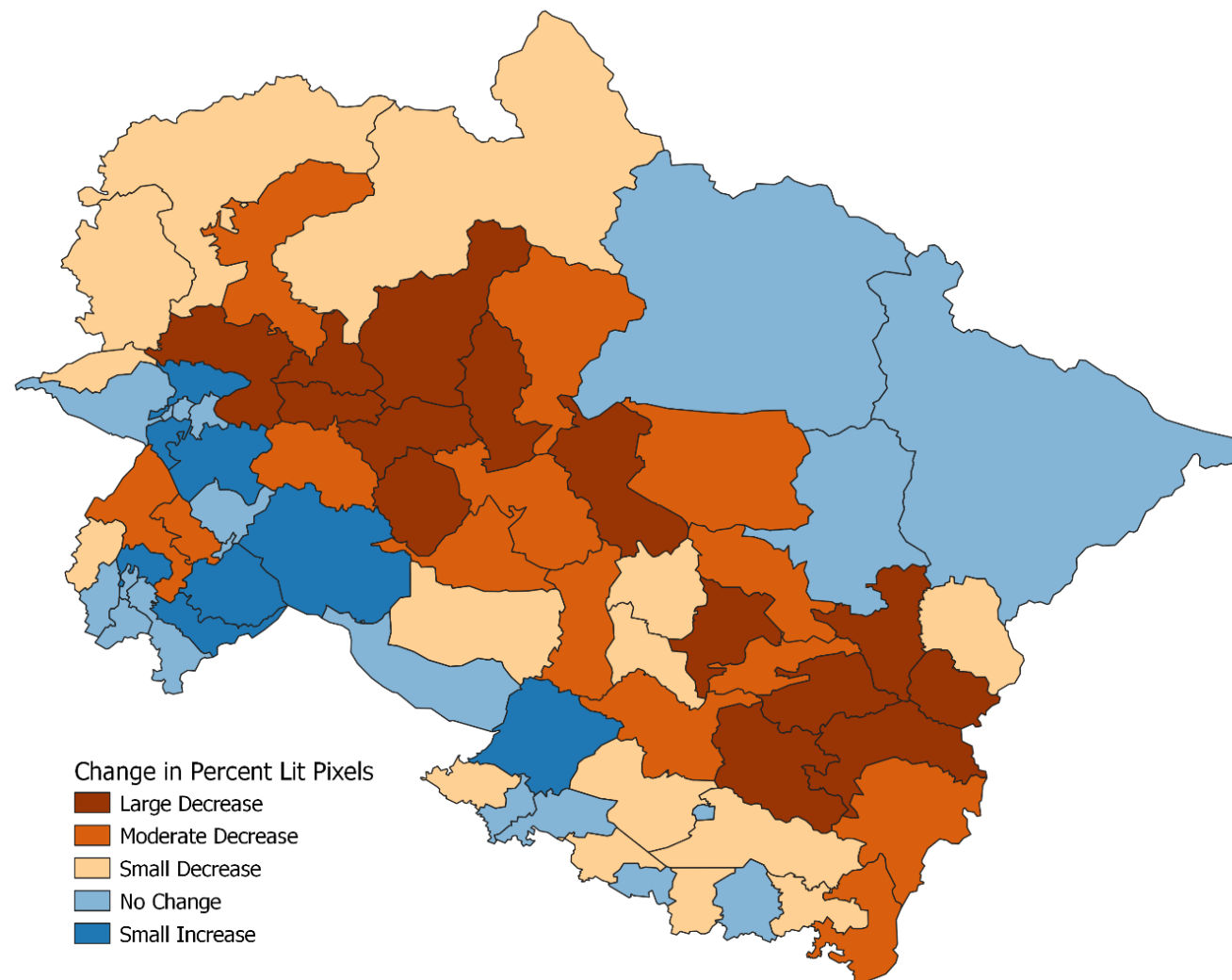


The present visual describes a five year change in lit pixels from 2015 to 2019 and represents economic activity in more detail than the total radiance. Here, constituencies Mussoorie (22), Dharampur (18), Doiwala (23), Piran Kaliyar (30), Laksar (34), Haridwar Rural (35), Yamkeshar (36), Ramnagar (61), Bajpur (64), and Rudrapur (67) i.e. 10 constituencies of 70 or 14.3% have shown an increase. 60 constituencies out of the 70 constituencies i.e. 85.7% of Uttarakhand has shown a decrease or no change in lit pixel, suggesting negative/no-expansion of economic activity to newer areas.

The visual on right indicates the constituency-wise change in total lit pixels from 2015 to 2019. It is pertinent to note that most constituencies in Uttarakhand have shown a decline or no change in total lit pixels. Bhimtal shows a negative 1,000 point change in lit pixels. Ghanshali, Karnprayag, Dhanolti, Lohaghat, Gangolihat and Yamunotri have a greater than (-)500 point change in lit pixels. In total, 10 constituencies i.e Yamkeshwar, Hardwar Rural, Ramnagar, Doiwala, Laksar, Bajur, Pirankaliyar, Mussoorie, Sitaganj and Dharampur have shown a minutely positive change lit pixels.

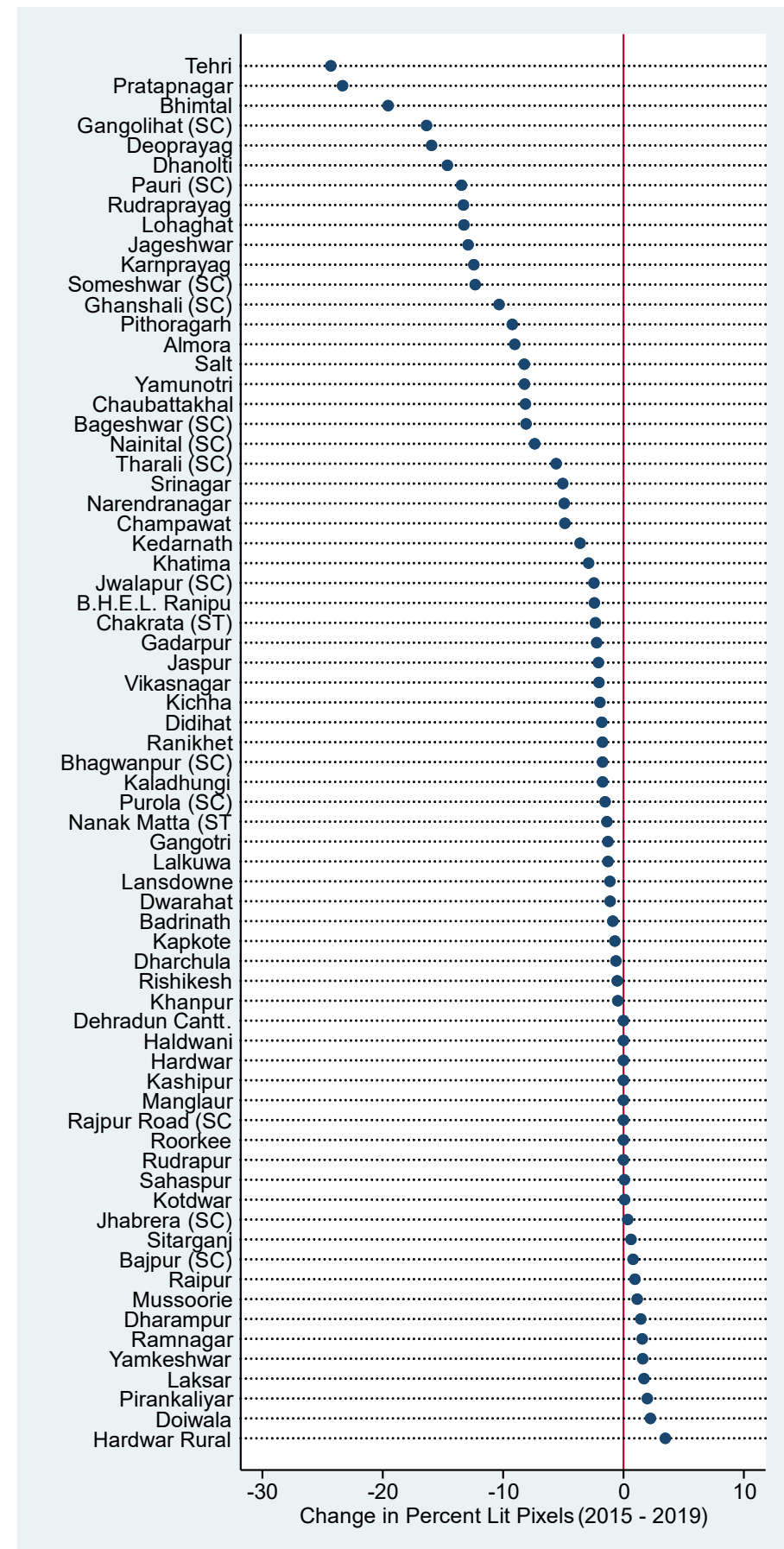


3. Growth Pattern of Percent change in lit pixels across constituencies from 2015 to 2019 - indicates the percent of lit pixels with respect to total pixels

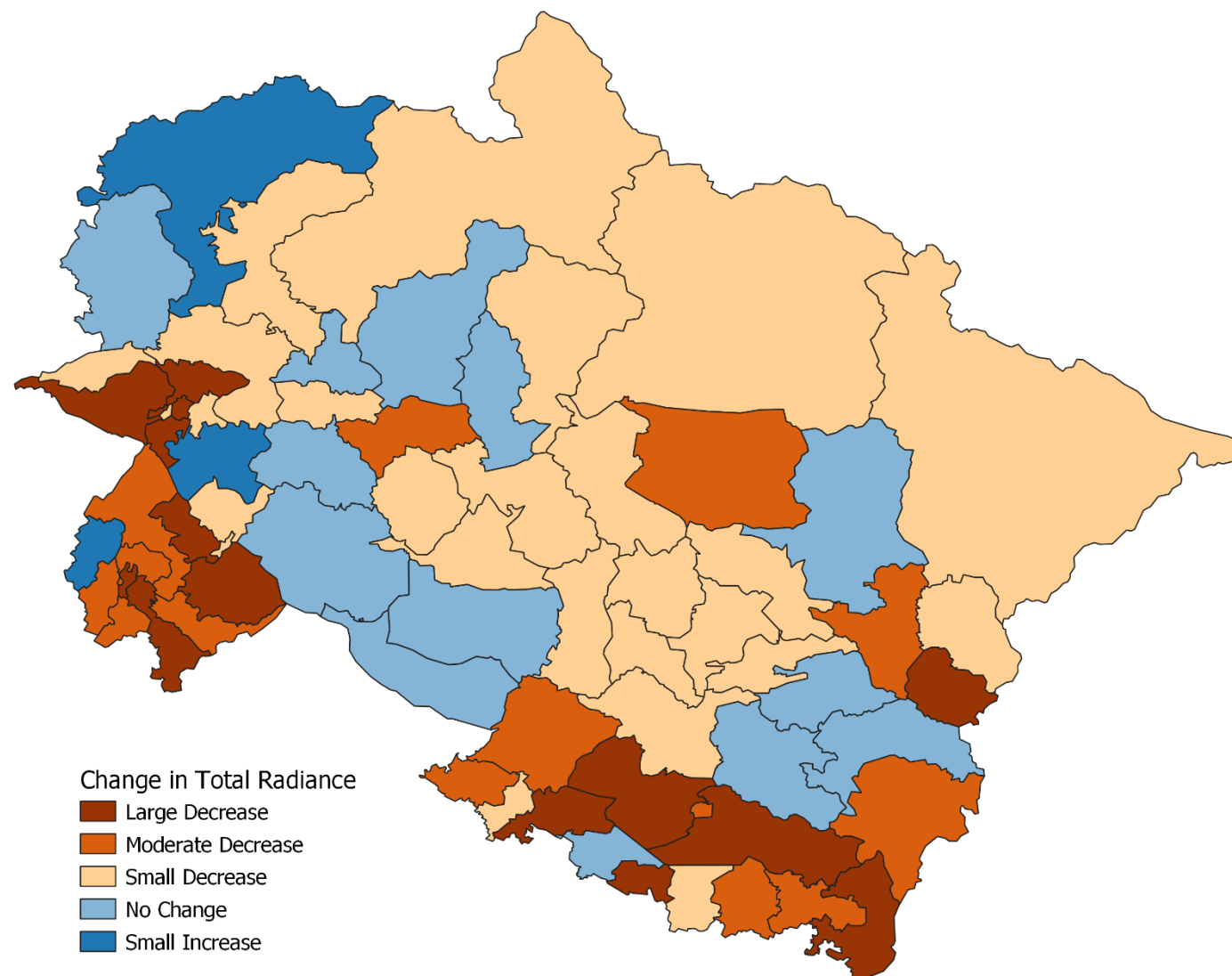


The visual represented above signifies that from 2015 to 2019, only 8 constituencies, i.e. Mussoorie (22), Dharampur (18), Doiwala (23), Piran Kaliyar (30), Laksar (34), Haridwar Rural (35), Yamkeshwar (36) and Ramnagar (61) have shown a small increase in percent change in lit pixels. 62 constituencies of the state have shown a decrease or no change in lit pixels, of 14 constituencies have shown a large decrease in percent lit pixels. This indicates a perceptible decline in economic growth in the state.

The visual on right represents percent change in lit pixels from 2015 to 2019 across all 70 constituencies of Uttarakhand. Here, it is evident that most constituencies show a negative or zero percent change in lit pixels. Highest negative percentage change of 25% is observed in Tehri. It is also noted that only 8 constituencies, i.e. Mussoorie, Dharampur, Doiwala, Piran Kaliyar, Laksar, Haridwar Rural, Yamkeshwar and Ramnagar have shown a small increase in lit pixels; of which Haridwar Rural denotes the highest increase in % lit pixels of almost 3%.



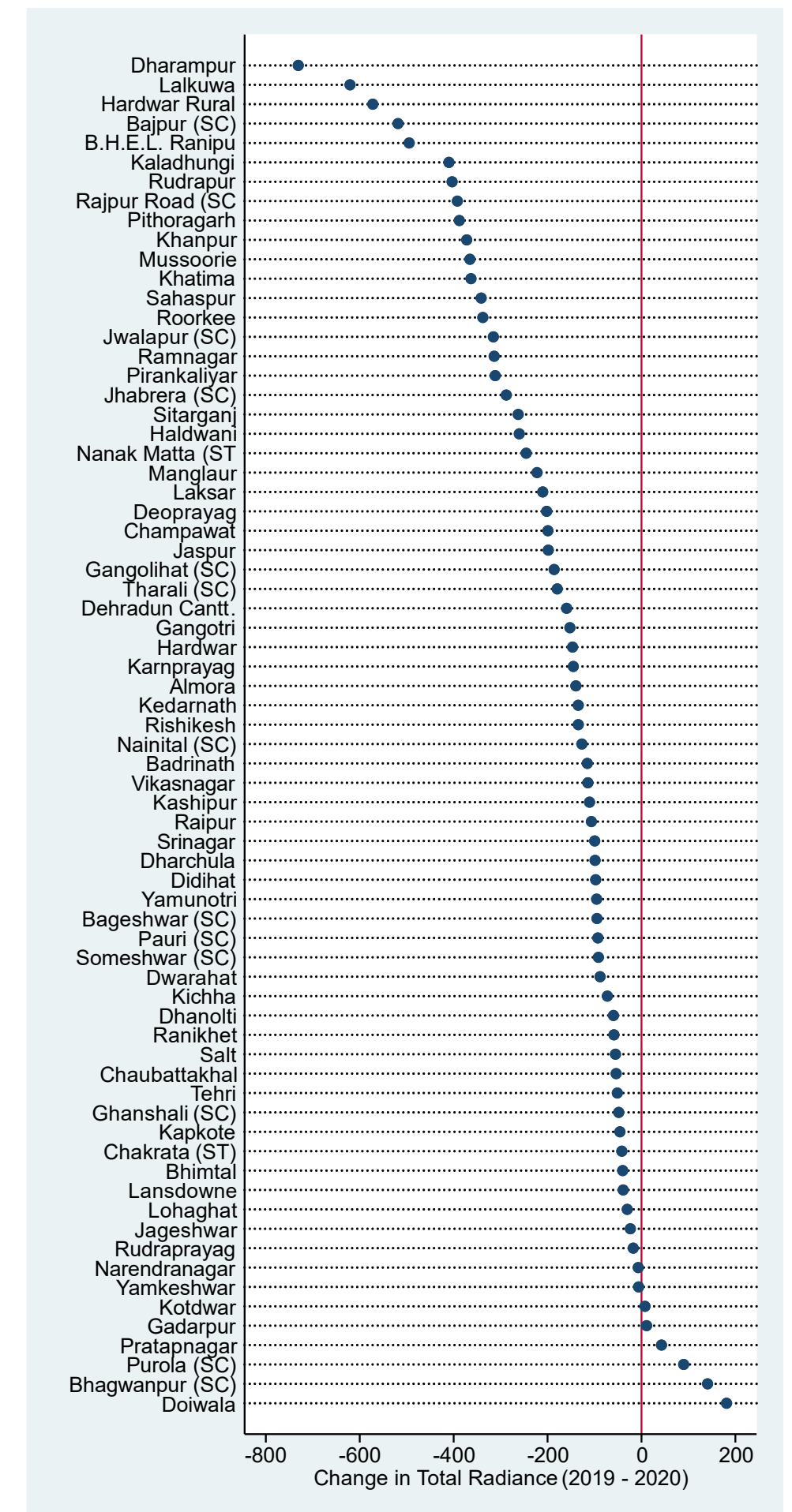
4. Pandemic Impact on Total Radiance across constituencies from 2019 to 2020



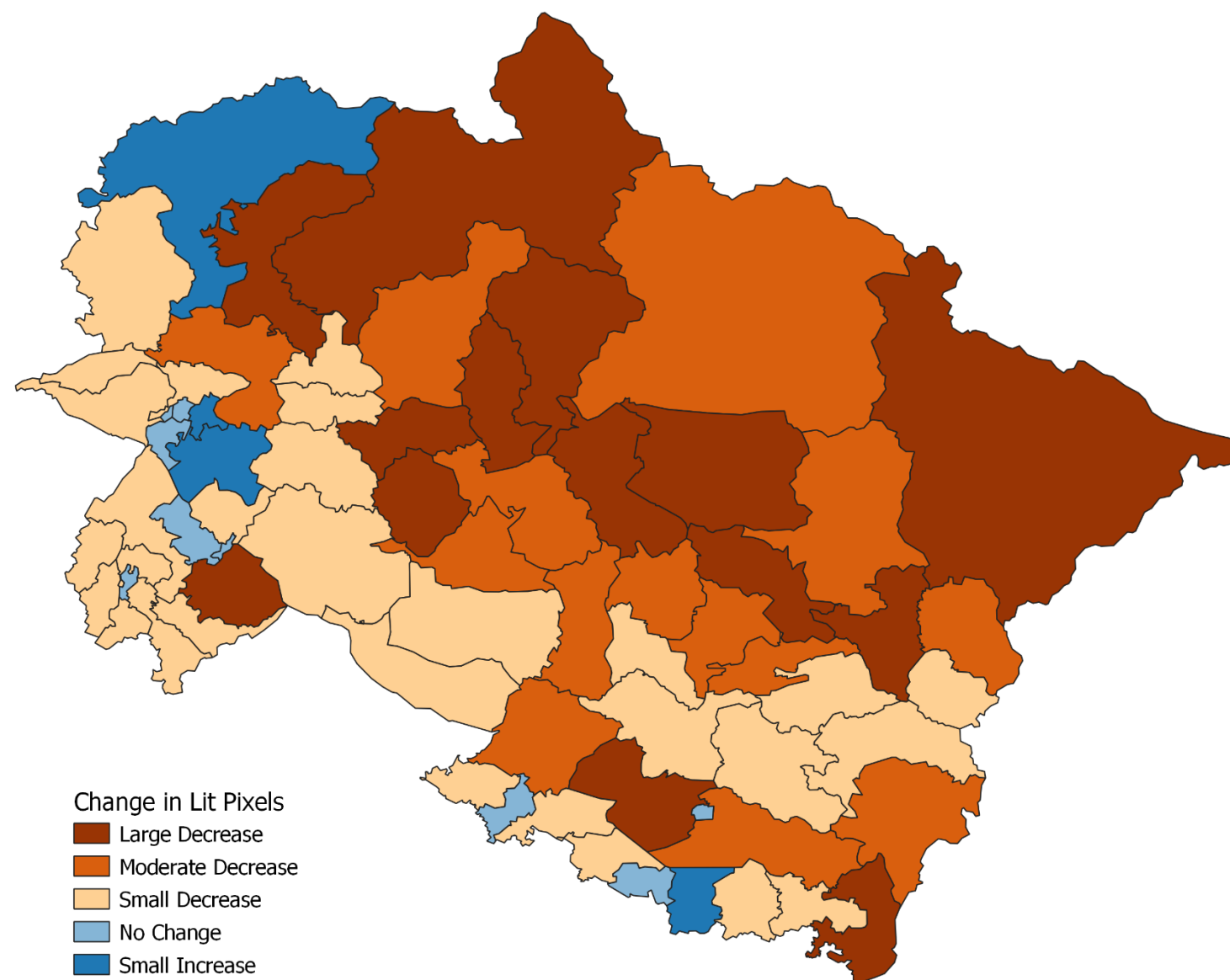
This visual describes the pandemic effect on change in total radiance, by comparing year 2019 with 2020. Out of 70 constituencies 11 showed large decrease in total radiance, 13 showed moderate decrease, 21 showed small decrease in total radiance. 19% of the constituencies showed no change and 4% showed small increase in total radiance. These varied categories elaborate the impact on the economic activity and only 23% of the constituencies remain immune to the pandemic.

The visual describes change in total radiance in Uttarakhand from 2019 to 2020, constituency wise. There has been a negative change in total radiance across 64 constituencies out of 70.

Dharampur, Lalkua, Hardwar Rural, Bajpur constituencies have highest negative change in total Radiance that varied from a range of -500 to -800 pixels, represent stalled economic activities in the pandemic year. For other 29 constituencies the change in total radiance varied from less than zero to -400 pixels. Only 8.5% of the constituencies have seen positive change in total radiance from 2019-2020. Doiwala constituency showed highest positive change in total radiance of approximately 200 pixels.



5. Pandemic Impact on Change in total number of lit pixels across constituencies from 2019 to 2020 - Indicates distribution of night lights in the assembly constituency area



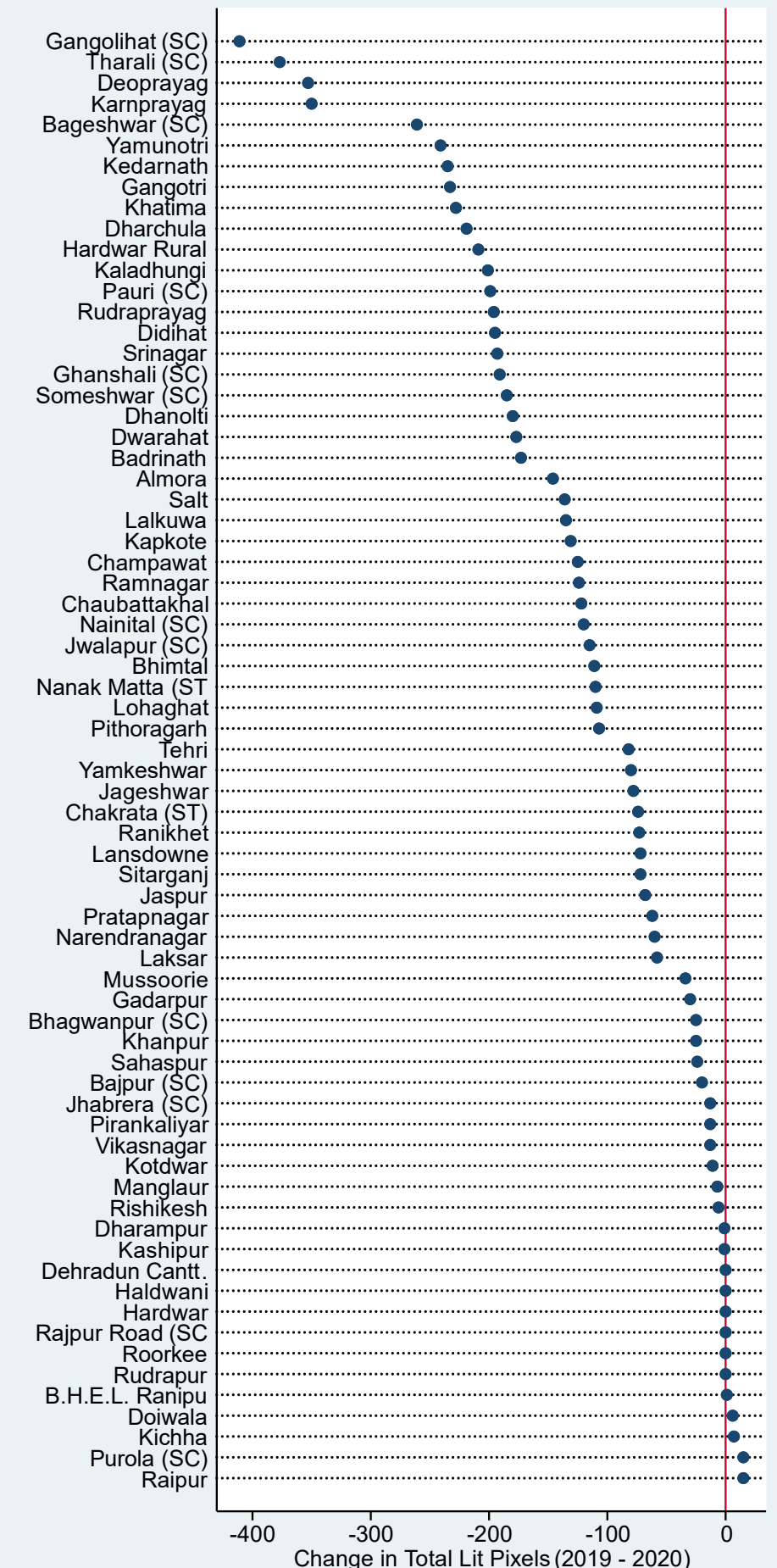
The visual describes change in total radiance in Uttarakhand from 2019 to 2020, constituency wise. Out of 70 constituencies 15 showed large decrease in total lit pixels, 14 showed moderate decrease in total radiance. While 8 constituencies show no change and only 4 constituencies show small increase in lit pixels owing to the pandemic.

While 11% of the constituencies showed no change in total radiance and 6% showed small increase in total radiance representing being unaffected by the pandemic.

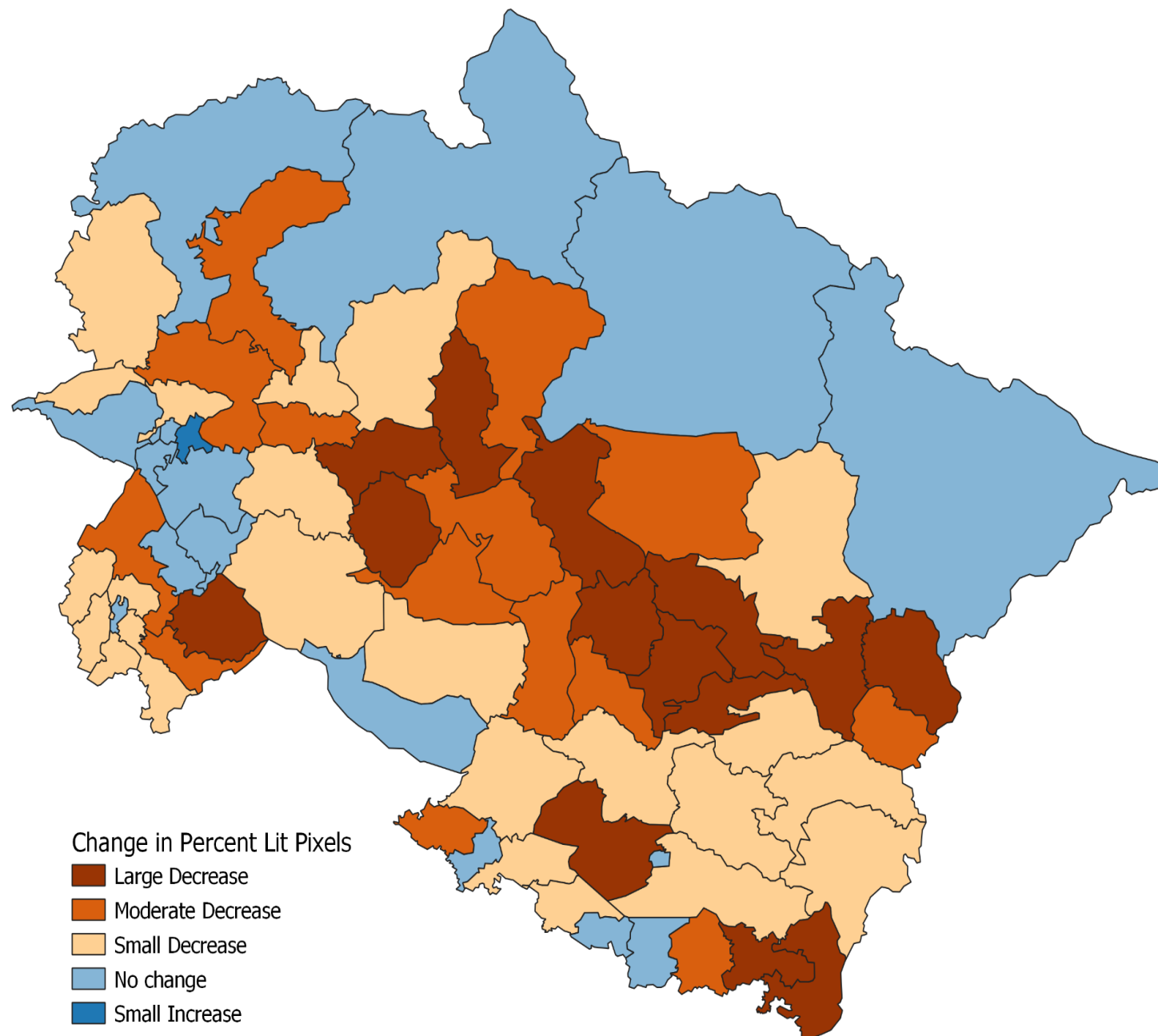
The present visual represents constituency-wise change in lit pixels from 2019 to 2020. We observe, constituencies of Raipur, Purola, Kichha, Doiwala show very small increase in change in total lit pixels.

8 constituencies of Dharampur, Kashipur, Dehradun Cantt, Haldwani, Hardwar, Rajpur Road, Roorkee, Rudrapur have shown no change in lit pixels.

While 82% of the constituencies showed negative change in lit pixels owing to the pandemic impact, Gangolihat, Tharali, Deoprayag, Kamprayag constituencies were the worst hit and showed the highest negative change in lit pixels, with a range from -350 to -400.



6. Pandemic impact on Percentage change in lit pixels across constituencies from 2019 to 2020 - indicates the percentage of lit pixels with respect to total pixels

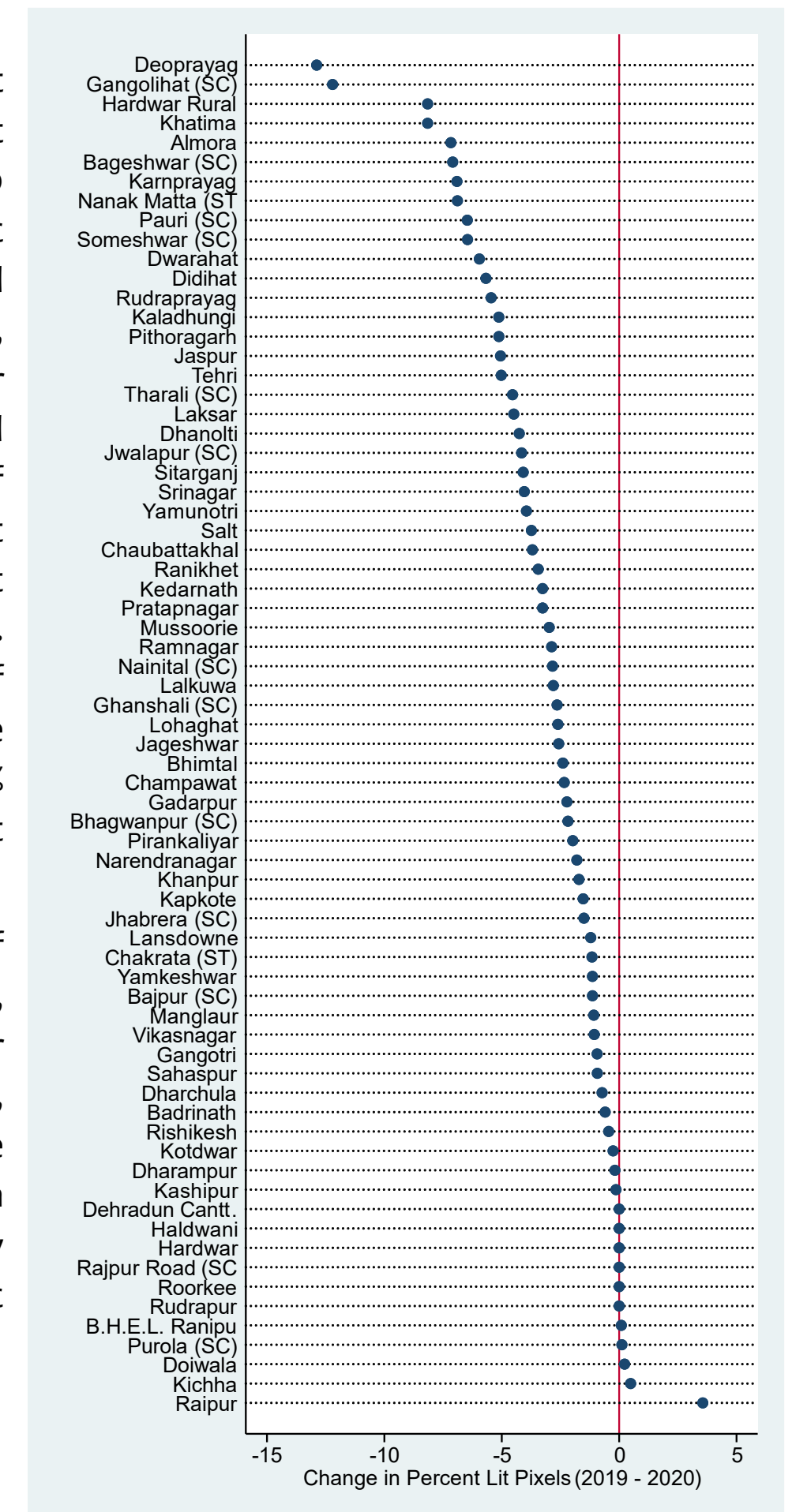


The visual shows large decrease in change in percent lit pixels in 20% constituencies, moderate decrease in 20% constituencies, and small decrease in 24% constituencies from 2019 to 2020.

While 20% of the 70 constituencies recorded no change, and only one constituency recorded small increase in percent lit pixels, depicted nominal impact of pandemic on these constituencies from 2019 – 2020.

The visual shows district wise change in percent lit pixels from 2019 to 2020 and records the pandemic impact on Uttarakhand economy. Devprayag, Gangolighat, Hardwar Rural, Khatima recorded highest negative change of -7% to -12% in percent lit pixel, depict the worst hit constituencies of the state. Only constituencies of Raipur and Kichha have recorded around 1-4% increase in percent lit pixels.

The constituencies of Doiwala, Purola, BHEL, Rudrapur, Roorkee, Rajpur Road, Hardwar, Haldwani, Dehradun Cantt have recorded no change in percent lit pixels, show minimal effect of pandemic on these constituencies.



Appendix

Uttarakhand Nightlights Data (By Assembly Constituency)

No.	Name	Total Pixels	Total Radiance 2015	Total Radiance 2019	Total Radiance 2020	Lit Pixels 2015	Lit Pixels 2019	Lit Pixels 2020	Percent Lit Pixels 2015	Percent Lit Pixels 2019	Percent Lit Pixels 2020
1	Purola (SC)	12859	295.0	252.2	342.1	598	402	417	4.65	3.13	3.24
2	Yamunotri	6102	1251.3	1002.7	907.2	1779	1277	1036	29.15	20.93	16.98
3	Gangotri	24819	1140.6	985.4	833.0	1515	1193	960	6.10	4.81	3.87
4	Badrinath	29053	1852.7	1724.2	1608.8	1773	1514	1341	6.10	5.21	4.62
5	Tharali (SC)	8303	1273.1	995.2	815.7	2094	1630	1253	25.22	19.63	15.09
6	Karnprayag	5066	1355.0	1130.8	985.7	2016	1386	1036	39.79	27.36	20.45
7	Kedarnath	7203	1454.9	1321.0	1186.3	1919	1659	1424	26.64	23.03	19.77
8	Rudraprayag	3594	908.7	637.7	620.1	1488	1010	814	41.40	28.10	22.65
9	Ghanshali (SC)	7226	1118.0	596.3	547.9	1767	1020	829	24.45	14.12	11.47
10	Deoprayag	2740	1762.9	1366.8	1164.9	1798	1361	1008	65.62	49.67	36.79
11	Narendranagar	3329	1191.3	1478.7	1471.8	1293	1129	1069	38.84	33.91	32.11
12	Pratapnagar	1902	1209.3	710.0	752.7	1495	1051	989	78.60	55.26	52.00
13	Tehri	1633	1956.0	1437.4	1385.9	1424	1027	945	87.20	62.89	57.87
14	Dhanolti	4231	963.3	717.1	657.4	1788	1169	989	42.26	27.63	23.38
15	Chakrata (ST)	6389	371.9	482.7	440.8	642	493	419	10.05	7.72	6.56
16	Vikasnagar	1225	1582.5	1926.3	1812.2	933	908	895	76.16	74.12	73.06
17	Sahaspur	2582	2742.1	3435.9	3094.5	1560	1562	1538	60.42	60.50	59.57
18	Dharampur	556	4373.8	5621.9	4891.0	404	412	411	72.66	74.10	73.92
19	Raipur	421	1741.4	2331.8	2225.1	355	359	374	84.32	85.27	88.84
20	Rajpur Road (SC)	163	2860.9	3266.6	2874.5	163	163	163	100	100	100
21	Dehradun Cantt.	47	751.9	927.2	767.7	47	47	47	100	100	100
22	Mussoorie	1142	2495.6	2763.3	2398.0	654	667	633	57.27	58.41	55.43
23	Doiwala	2590	2335.3	3827.6	4008.8	1382	1440	1446	53.36	55.60	55.83
24	Rishikesh	1346	2465.3	2940.4	2805.9	698	691	685	51.86	51.34	50.89
25	Hardwar	93	1092.3	1224.4	1077.7	93	93	93	100	100	100
26	B.H.E.L. Ranipu	1075	4313.5	4633.1	4138.3	603	577	578	56.09	53.67	53.77
27	Jwalapur (SC)	2769	2526.4	2784.8	2469.4	1701	1633	1518	61.43	58.97	54.82
28	Bhagwanpur (SC)	1146	2491.1	2586.1	2726.9	1093	1073	1048	95.38	93.63	91.45
29	Jhabrera (SC)	867	2076.4	2378.0	2090.2	860	863	850	99.19	99.54	98.04
30	Pirankaliyar	658	1920.9	2261.8	1950.2	638	651	638	96.96	98.94	96.96
31	Roorkee	165	1460.2	1855.9	1518.1	165	165	165	100	100	100
32	Khanpur	1460	2138.7	2787.6	2415.4	1069	1062	1037	73.22	72.74	71.03
33	Manglaur	648	1569.2	1774.9	1552.5	603	603	596	93.06	93.06	91.98
34	Laksar	1292	1423.4	1673.9	1463.6	976	998	940	75.54	77.24	72.76
35	Hardwar Rural	2562	2729.8	3386.4	2814.2	1599	1688	1479	62.41	65.89	57.73

Uttarakhand Nightlights Data (By Assembly Constituency)

No.	Name	Total Pixels	Total Radiance 2015	Total Radiance 2019	Total Radiance 2020	Lit Pixels 2015	Lit Pixels 2019	Lit Pixels 2020	Percent Lit Pixels 2015	Percent Lit Pixels 2019	Percent Lit Pixels 2020
36	Yamkeshwar	7029	1027.2	1454.3	1448.2	976	1088	1008	13.89	15.48	14.34
37	Pauri (SC)	3077	1141.0	967.1	874.2	1434	1020	821	46.60	33.15	26.68
38	Srinagar	4775	794.7	696.9	597.4	928	687	494	19.43	14.39	10.35
39	Chaubattakhal	3301	296.4	228.9	174.9	659	390	268	19.96	11.81	8.12
40	Lansdowne	5952	106.8	106.0	67.0	239	172	100	4.02	2.89	1.68
41	Kotdwar	4283	561.0	800.7	808.2	334	338	327	7.80	7.89	7.63
42	Dharchula	30165	353.6	272.6	173.8	667	477	258	2.21	1.58	0.86
43	Didihat	3437	326.8	312.8	215.2	604	542	347	17.57	15.77	10.10
44	Pithoragarh	2089	2240.4	1679.0	1291.1	969	776	669	46.39	37.15	32.02
45	Gangolihat (SC)	3367	1037.1	761.7	575.7	1856	1305	894	55.12	38.76	26.55
46	Kapkote	8551	235.7	268.4	222.5	514	453	322	6.01	5.30	3.77
47	Bageshwar (SC)	3681	635.2	613.8	519.0	1136	838	577	30.86	22.77	15.68
48	Dwarahat	2973	240.5	266.9	178.7	404	371	194	13.59	12.48	6.53
49	Salt	3639	338.1	203.9	148.5	687	387	251	18.88	10.63	6.90
50	Ranikhet	2118	462.1	410.3	351.7	420	383	310	19.83	18.08	14.64
51	Someshwar (SC)	2865	403.6	321.7	230.1	852	499	314	29.74	17.42	10.96
52	Almora	2037	768.4	764.4	624.7	824	640	494	40.45	31.42	24.25
53	Jageshwar	3029	301.0	136.5	112.8	662	271	193	21.86	8.95	6.37
54	Lohaghat	4178	485.9	314.7	284.4	986	432	323	23.60	10.34	7.73
55	Champawat	5341	1075.4	1118.3	919.0	1059	799	674	19.83	14.96	12.62
56	Lalkuwa	4812	2537.9	2942.7	2322.1	1382	1320	1185	28.72	27.43	24.63
57	Bhimtal	4633	976.9	614.1	574.1	1830	924	813	39.50	19.94	17.55
58	Nainital (SC)	4230	1138.4	1127.7	1000.8	1265	953	833	29.91	22.53	19.69
59	Haldwani	130	1022.9	1091.2	831.0	130	130	130	100	100	100
60	Kaladhungi	3922	1453.0	1936.3	1526.3	1506	1438	1237	38.40	36.66	31.54
61	Ramnagar	4311	1758.6	2104.6	1790.9	1507	1574	1450	34.96	36.51	33.63
62	Jaspur	1346	2204.1	2228.4	2029.9	1231	1203	1135	91.46	89.38	84.32
63	Kashipur	741	3195.7	3510.2	3399.6	739	739	738	99.73	99.73	99.60
64	Bajpur (SC)	1760	4385.2	5477.9	4959.4	1674	1688	1668	95.11	95.91	94.77
65	Gadarpur	1348	1854.1	2170.7	2181.6	1269	1239	1209	94.14	91.91	89.69
66	Rudrapur	812	4389.4	4956.9	4553.6	812	812	812	100	100	100
67	Kichha	1429	3339.2	4512.3	4439.6	1356	1328	1335	94.89	92.93	93.42
68	Sitarganj	1761	2236.0	2748.1	2485.5	1305	1316	1244	74.11	74.73	70.64
69	Nanak Matta (ST)	1597	1845.8	2126.5	1881.0	1493	1471	1361	93.49	92.11	85.22
70	Khatima	2795	1446.9	1592.2	1229.0	1549	1468	1240	55.42	52.52	44.36