

Re-thinking Lockdown: Categorization of Rural Districts for Selective Opening-up

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An “abridged” version of this article has been published in Economic Times on 16 April. In an Appendix to this article, we provide district-level disease-burden indicators for all (rural and urban) affected districts in India (calculated till April 13, 12 am), and colour-code the districts accordingly.

As the first phase of countrywide Covid-19 lockdown came to an end on 14 April, the Indian government immediately announced a second lockdown (till 3 May). While prolonging stringent lockdowns might indeed “flatten the curve”, there is no denying the inordinate economic costs this imposes upon the country in general, and upon its poorest citizens in particular. There is indeed truth to the assertion in a recent CEPR [report](#) that India’s lockdown “is not a choice between lives on the one hand and loss of economic production on the other ... it is a question of lives versus lives.”

Recognizing this, [many](#) have urged for selective relaxation of lockdowns. It has been [reported](#) that the government is collecting data to fine-tune district-level lockdowns by differentiating between red, amber, and green districts on the basis of Covid-penetration. This challenging exercise will need to balance a district’s disease-load and its projected growth against potential economic gains from relaxing lockdowns.

We focus on one part of this exercise by limiting attention to predominantly agricultural districts. Indian farmers are currently [struggling](#) to harvest and sell their Rabi crops, and will soon need to prepare for the Kharif season. While the agricultural sector has been exempted, country-wide lockdowns are nevertheless [impeding](#) farm activities – by restricting labour movement, access to farm machinery, and trading opportunities in *mandis*.

Our thoughts are predicated on four observations: (a) Covid-penetration in rural districts has been much lower than in urban districts, and there is significant variation in Covid-spread across districts (as noted by [us](#) and [others](#)); (b) district-borders can be sealed and interventions can be contained within districts (as revealed by the [Bhilwara](#) experience), (c) agriculture allows for relatively greater social-distancing than many manufacturing activities, and (d) marginal farmers and farm labourers constitute a large part of India’s economically vulnerable population.

We identify 481 predominantly rural agricultural districts of India (in each district, at least 60% of the population live in rural areas and the net sown area is at least 35% of total area), that contain 76% of India’s population. We find that 270 of these districts have not yet been penetrated by Covid-19 (our disease data is taken from [covid19india.org](#)), and are thus prime candidates for “unlocking”. For the 211 affected agricultural districts, we determine two district-level variables (as on midnight, 13 April): “disease-load” – that counts all infections in a district arising from contacts within India, and “disease-growth index” – that we calculate as a weighted average of 24-hour changes in disease-load over April 6–13, with greater weights on more recent changes to incorporate growth acceleration/deceleration.

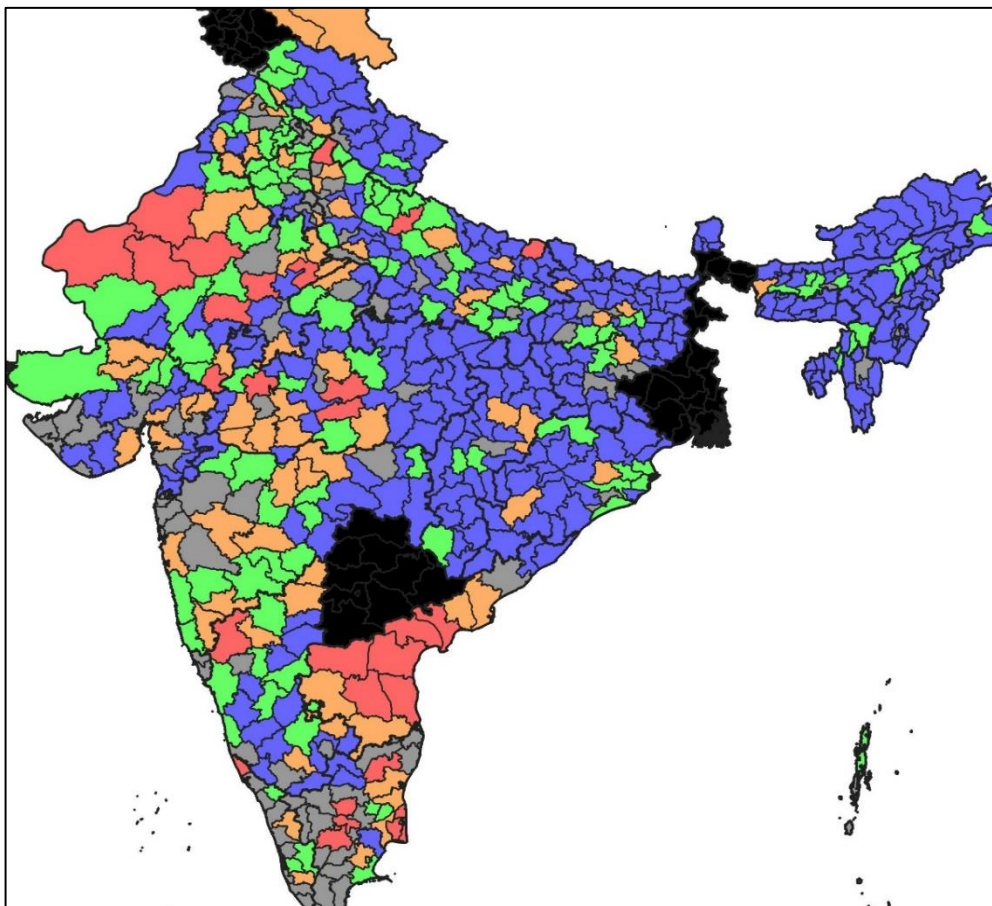
We place the districts into three categories – good, average, and bad – in each dimension. For disease-load, we consider districts carrying more than three times the average-load to be bad, and those carrying less than the average-load to be good. For disease-growth, we take all districts with growth-indices greater than 1 to be bad, and all with non-positive growth-indices to be good. Then, taking a conservative stance, we categorize a district to be “green” (candidate for mild lockdown restrictions) only if it is good in both categories, to be “red” (candidate for stringent restrictions) whenever it is bad in at least one category, and “amber” (candidate for moderate restrictions) in all other cases. The following table shows average magnitudes of disease-load and disease-growth for the affected districts in the three categories.

Categories of agricultural districts	Average magnitude of disease-load	Average magnitude of disease-growth index
<i>red districts</i>	52	2.23
<i>amber districts</i>	16	0.32
<i>green districts</i>	3	-0.25

The “districts colours” are depicted in the map below, where we distinguish between the blue disease-free districts (which, we think, require no lockdown restrictions) and the green mildly-affected districts (which do require some restrictions).

Map Categorized Rural-Agricultural Districts (using disease-data till 13 April, 12 am)

■ : disease-free; ■ : urban districts; ■ : complete district-data not available



The map identifies – among rural agricultural districts in India – the 111 green districts, the 72 amber districts, and the 28 red districts that arise from our categorization exercise.

We have focused only on the agricultural sector. But the identified districts do have (in some cases, substantial) industrial and urban areas. Appropriate lockdown policies for these areas have to be designed separately. Even within agriculture, the government needs to consider the following additional issues. First, the economic value of the increased agricultural output arising from lockdown relaxation from different districts needs to be imputed, so that higher-value green and amber districts can be “opened up sooner”. Second, recognizing the need for transporting perishable products to eventual buyers and less-perishable products to storage facilities, the government has to envision a freight network among rural and urban districts. Just as medical professionals and equipment are essential to fighting Covid-19, freight trains and associated personnel should also be considered essential. Third, unanticipated shocks will undoubtedly alter disease trajectories over time, and the administration has to be ready and willing to appropriately recategorize districts in response to such shocks.

Recognizing all the difficulties in implementing “selective lockdowns” on the ground, we have put forth some fundamental principles behind categorizing rural districts for lockdown relaxation. And while this categorization exercise is challenging, doing the same for the urban districts – all the grey areas in our map – will constitute a much bigger challenge (where more variables need to be incorporated in the cost-benefit analysis). Alas, playing God is never easy.

Appendix

In this appendix, we present a table that contains the list of all Covid-affected districts of India (as on April 13, 12 am) for which we have complete daily data. For each district, whether rural or urban, we report the magnitudes of disease-load and disease-growth (which are calculated following the procedure described in the above article). We colour-code (in green, amber, and red) the affected districts following our categorization procedure (we admit that colour-coding of the industrial districts ought to be re-done using more information). Finally, on April 16 the Health Ministry has declared 123 districts of the country to be “hot-spot districts (red zones) with a large outbreak”. In our table, we identify these districts by double-starring their names.

<u>State/affected district</u>	Disease Load	Disease Growth Index
<u>Andaman Nicobar</u>		
North/Middle Andaman	1	0.00
South Andaman	5	0.00
<u>Andhra Pradesh</u>		
Anantapur**	15	-0.75
Chittoor**	22	0.50

East Godavari**	15	-1.17
Guntur**	93	1.00
Krishna**	32	0.17
Kurnool**	84	-2.25
Prakasam**	40	0.33
S.P.S. Nellore**	55	0.33
Visakhapatnam**	18	-0.42
West Godavari**	23	-0.25
Y.S.R.**	31	-0.25
Arunachal Pradesh		
Lohit	1	0.00
Assam		
Cachar	2	0.00
Dhubri	3	0.33
Goalpara	3	0.00
Golaghat	1	0.00
Hailakandi	1	0.00
Jorhat	8	0.00
Kamrup	1	0.00
Kamrup Metropolitan	5	0.00
Lakhimpur	1	0.00
Morigaon	1	0.00
Nalbari	3	0.00
Salmara Mancachar	1	0.00
Bihar		
Begusarai	8	0.42
Gaya	4	0.00
Lakhisarai	1	0.00
Mungher	6	0.00
Nalanda	2	0.25
Nawada	3	0.00
Patna	3	0.00
Siwan**	20	0.92
Chandigarh		
Chandigarh**	16	-0.25
Chattisgarh		
Bilaspur	1	0.00
Durg	1	0.00

Korba**	21	0.67
Raipur	1	0.00
Delhi		
Delhi**	1494	45.67
Goa		
Goa	1	0.00
Gujarat		
Ahmadabad**	311	-0.25
Anand	9	0.33
Banas Kantha	2	0.50
Bharuch	11	-1.00
Bhavnagar**	23	-1.00
Chota Udaipur	3	0.08
Dahod	1	0.08
Gandhinagar	14	-0.25
Gir Somnath	2	0.00
Jamnagar	1	0.00
Kachchh	3	-0.50
Mahesana	2	-0.08
Morbi	1	0.00
Panch Mahal	2	0.25
Patan	14	0.00
Porbandar	3	0.00
Rajkot**	14	-1.08
Sabar Kantha	1	0.00
Surat**	31	0.33
Vadodara**	103	-7.58
Haryana		
Ambala	6	-1.00
Bhiwani	2	0.00
Charki Dadri	1	-0.08
Faridabad**	30	0.00
Fatehabad	1	0.00
Gurugram**	30	0.00
Hisar	2	0.00
Jind	2	0.00
Kaithal	2	0.08
Karnal	6	-0.33
Kurukshetra	2	0.00

Nuh**	45	-0.50
Palwal**	28	-0.75
Panchkula	5	-0.08
Panipat	3	0.00
Rohtak	1	0.00
Sirsa	4	0.25
Sonipat	2	-0.25
Yamunanagar	3	0.00
Himachal Pradesh		
Chamba	4	-0.33
Kangra	1	0.00
Sirmaur	1	0.08
Solan	9	0.00
Una	14	0.00
Jharkhand		
Bokaro	8	0.33
Giridih	1	0.25
Hazaribagh	2	0.00
Kodarma	1	0.00
Ranchi	11	1.08
Karnataka		
Bagalkote	9	0.33
Ballari	6	0.00
Belagavi/Belgaon**	17	1.00
Bengaluru Urban**	37	-0.25
Bengaluru Rural	4	-0.08
Bidar	13	0.50
Chikkaballapura	8	0.08
Dakshina Kannada	3	0.00
Davanagere	1	0.00
Dharwad	5	1.08
Gadag	1	0.00
Kalaburagi (Gulbarga)	12	-0.25
Mandya	8	0.83
Mysuru**	45	-1.67
Tumakuru	1	0.00
Udupi	1	0.00
Uttara Kannada	5	0.00
Vijayapura	6	0.00

Kerala		
Alappuzha	3	0.00
Ernakulam**	9	0.00
Idukki	8	0.00
Kannur**	31	0.33
Kasaragod**	76	-1.17
Kollam	6	0.00
Kottayam	3	0.00
Kozhikode	7	0.00
Malappuram**	11	-0.50
Palakkad	3	0.25
Pathanamthitta**	11	-0.08
Thiruvananthapuram**	8	0.08
Thrissur	10	0.00
Wayanad	2	0.00
Ladakh		
Kargil	3	0.25
Leh	10	0.00
Madhya Pradesh		
Barwani	14	-0.50
Betul	1	-0.08
Bhopal**	141	-5.75
Chhindwara	4	0.50
Dewas	4	0.50
Dhar	2	0.33
Gwalior	6	0.00
Hoshangabad**	15	1.75
Indore**	328	3.42
Jabalpur	4	0.33
Khandwa	6	0.42
Khargone**	17	0.25
Mandsaur	1	0.00
Morena	13	0.25
Raisen	5	1.08
Ratlam	1	0.00
Sagar	1	-0.25
Shajapur	1	-0.25
Sheopur	2	0.00
Shivpuri	2	0.00
Ujjain**	24	2.17
Vidisha	13	-0.50

Maharashtra		
Ahmadnagar**	24	-0.17
Akola	12	-0.08
Amravati	5	0.25
Aurangabad**	18	0.08
Bid	1	0.08
Buldana**	13	-0.25
Dhule	1	0.00
Gondiya	1	0.00
Hingoli	1	0.00
Jalgaon	2	0.00
Jalna	1	-0.08
Kolhapur	5	0.25
Latur	8	0.00
Mumbai**	1337	-10.33
Nagpur**	26	-1.50
Nashik**	30	3.33
Osmanabad	4	0.00
Palghar	28	0.25
Pune**	251	-11.75
Raigarh	10	0.00
Ratnagiri	4	-0.17
Sangli**	22	0.00
Satara	5	-0.17
Sindhudurg	1	0.00
Solapur	1	0.00
Thane**	182	-3.00
Washim	1	0.00
Yavatmal**		
Nagaland		
Dimapur	1	0.00
Odisha		
Bhadrak	2	0.00
Cuttack	1	0.00
Dhenkanal	1	0.08
Jajapur	1	0.00
Kalahandi	1	0.08
Kendrapara	1	-0.08
Khordha**	39	0.33
Puri	1	-0.25

Sundargarh	2	0.00
Puducherry		
Puducherry	6	0.00
Punjab		
Amritsar	9	-0.50
Barnala	2	0.08
Faridkot	3	0.00
Fatehgarh Sahib	2	-0.17
Hoshiarpur	7	0.00
Jalandhar**	23	0.25
Kapurthala	2	0.17
Ludhiana	11	0.25
Mansa	11	0.75
Moga	4	0.00
Pathankot**	18	0.00
Patiala	2	-1.50
Rupnagar	3	-0.17
S. Ajit Singh Nagar**	52	0.25
Sangrur	2	-2.42
S Bhagat Singh Nagar**	16	-0.25
Sri Muktsar Sahib	1	0.08
Rajasthan		
Ajmer	5	0.00
Alwar	5	0.00
Banswara**	59	-0.08
Barmer	1	-1.17
Bharatpur**	20	0.00
Bhilwara**	28	2.58
Bikaner**	34	-0.08
Churu	14	0.00
Dausa	11	-0.25
Dhaulpur	1	0.50
Dungarpur	5	-0.17
Hanumangarh	2	0.00
Jaipur**	366	2.58
Jaisalmer**	29	-5.58
Jhalawar**	15	-1.42
Jhunjhunu**	24	-0.33
Jodhpur**	81	0.17
Karauli	3	5.50

Kota**	49	-0.67
Nagaur	6	1.75
Pali	2	0.00
Pratapgarh	2	0.00
Sikar	2	0.00
Tonk**	59	0.42
Udaipur	4	0.00
Tamil Nadu		
Ariyalur	1	-0.08
Chengalpattu**	43	0.17
Chennai**	199	-3.17
Coimbatore**	126	-0.08
Cuddalore**	19	-5.00
Dindigul**	56	-0.25
Erode**	61	0.17
Kallakurichi	3	-0.42
Kancheepuram	6	-0.17
Kanniyakumari**	15	0.67
Karur**	40	-0.25
Madurai**	39	3.83
Nagapattinam**	29	3.58
Namakkal**	45	1.67
Perambalur	1	0.00
Ramanathapuram	5	0.00
Ranipet	37	0.75
Salem**	14	-2.17
Sivaganga	10	0.08
Tenkasi	2	1.08
Thanjavur	10	-0.25
The Nilgiris	9	0.00
Theni**	41	-0.67
Thiruvallur**	34	0.00
Thiruvarur**	16	1.08
Thoothukkudi**	26	1.17
Tiruchirappalli**	43	-1.08
Tirunelveli**	57	1.33
Tirupathur	17	0.33
Tiruppur**	78	0.25
Tiruvannamalai	8	4.42
Vellore**	15	0.42
Viluppuram**	27	0.92
Virudhunagar**	17	-0.75

Tripura		
Gomati	1	-0.08
North Tripura	1	0.00
Uttar Pradesh		
Agra**	139	1.17
Amroha	7	7.58
Auraiya	3	-1.25
Azamgarh	6	-0.25
Baghpat	6	0.67
Banda	2	0.00
Bara Banki	1	0.00
Bareilly	6	0.00
Basti	14	0.00
Bhadohi	1	1.00
Bijnor	1	-0.08
Budaun	2	-0.08
Bulandshahr	11	0.00
Etawah	1	0.00
Firozabad**	19	0.58
Gautam Buddha Nagar**	60	1.25
Ghaziabad**	25	0.92
Ghazipur	5	0.00
Hapur	6	0.00
Hardoi	2	-0.67
Hathras	4	0.00
Jaunpur	3	0.00
Kanpur Nagar	8	0.00
Kasganj	3	0.00
Kaushambi	2	0.67
Kheri	3	0.00
Lucknow**	30	-0.42
Mahrajganj	6	1.00
Mathura	7	-0.17
Meerut**	56	0.50
Mirzapur	2	-0.25
Moradabad**	2	0.00
Muzaffarnagar	7	0.33
Pilibhit	1	0.00
Pratapgarh	6	0.25
Prayagraj/Alahabad	1	-0.08
Rae Bareli	2	0.00

Rampur	6	0.00
Saharanpur**	39	0.25
Shahjahanpur	1	2.75
Shamli**	17	-0.42
Sitapur	10	-0.67
Varanasi	8	0.00
<u>Uttarakhand</u>		
Almora	1	-0.08
Dehradun**	15	-0.17
Haridwar	3	0.00
Nainital	8	-0.17
Pauri Garhwal	0	0.00
Udham Singh Nagar	3	0.00