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Nepal COVID-19 Economic Vulnerability Index

Overview and Technical Guidance

NEPAL COVID-19

ECONOMIC VULNERABILITY INDEX

Technical Guidance, September 2020

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COVID-19 effects

The COVID-19 pandemic is a multi-dimensional crisis that affects countries around the world differently. As a medical crisis, it has stretched the capacity of national healthcare systems, leading to substantial loss of life; as an economic crisis, national travel bans, shelter-in-place orders and the subsequent widespread disruptions to normal economic activity have worsened an already precarious situation for the world's poor, while work stoppages have pushed millions more into poverty and vulnerability. The crisis also has an important food security dimension: food availability is at a higher risk if countries restrict food exports, while the loss of income and livelihoods can affect individuals' ability to access food.[1] The crisis has also proved a societal one, as prolonged lockdowns have created fundamental changes in working arrangements, movement, and inter-household relations.

A UN report[2] emphasizes that international actors' responses to the COVID-19 crisis must, in addition to being cross-sectoral, also work to support and strengthen existing systems that contribute to putting populations at risk in the first place: social protection schemes and the labor sector, particularly exposed industries, but also social inequality and disfunctions, must all be addressed alongside the immediate needs of those most affected.

Low income countries are particularly concerned by the economic fallout, with their combination of large populations living in poverty and limits on their ability to engage in fiscal stimulus and social protection measures. Responses must also be fast, working to prevent a spiral of lower income that leads to low consumption, further weakening producers and retailers and devastating national industries.

Vulnerability in Nepal

Nepal is expected to be among the hardest hit countries economically, owing to its low-income status and combination of high dependency on imports of food and other essential commodities with high dependency on the export of labor and remittances.[3] This multi-faceted vulnerability could mean that Nepal faces a "double or triple burden" from the economic impact of COVID-19.[4]

In Nepal's case, a nationwide lockdown, starting on the 24th of March and extended through July, has placed large restrictions on the movement of people and goods throughout the country. This has led to work stoppages and barriers to the transportation of essential items including food. Furthermore, nationwide lockdown in India has resulted in work stoppages and income losses for Nepal's labor migrants in India while also causing some disruptions to the import of food and raw materials used in other industries. Similar situations in other countries have affected the ability of Nepali foreign labor migrants to earn money and send remittances home and have also had a direct impact on the tourism sector in Nepal, as international travel has been greatly restricted.

Economic shocks from these above factors are touching a highly-exposed population. A majority of Nepal's labor force—62% or 4.4 million people—works in the informal sector and 59% of enterprise laborers are in micro-enterprises[5], often with low or nonexistent social insurance coverage. The effects of the above factors may be worsened by large scale returns of migrants abroad. An estimated 1.5 million

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[1] World Food Programme, Food and Agriculture Organization, International Fund for Agriculture Development. "Joint Statement on COVID-19 Impacts on Food Security and Nutrition," 21 April 2020.
[2] UNSDG. "A UN Framework for the Immediate Socio-Economic Response to COVID-19," April 2020.
[3] World Food Programme. "Economic and food security implications of the COVID-19 outbreak. An update with insights from different regions," 14 April 2020.
[4] World Food Programme. "COVID-19 Targeting and Prioritization Paper," 28 April 2020.
[5] Nepal Labor Force Survey. 2018-2019.

Nepalis are working in Gulf countries, a significant portion of which have not yet returned to Nepal. Seasonal labor migrants to India are harder to count, but an estimated several hundred thousand migrants have already returned from India since the start of the national lockdown[6], with additional returns continuing through May as India's lockdown has eased. A large-scale repatriation of labor migrant returns may put an additional strain on the government's emergency response, which includes provisions for employment-based conditional cash/food transfers, for example through the Prime Minister's Employment Programme. Other demographic factors, including the entry of some 500,000 youth into the labor market each year, are expected to further stretch the need.

Given the high levels of expected needs to ensure an adequate economic response and recovery, as well as the expediency of taking action in the short term, there is a need to identify areas in the country that are most vulnerable to the economic effects of COVID-19. This will support actors (WFP, but also other development partners and government) in (1) directing resources and programmes in the response, taking as reference a metric that considers multiple often counter-balancing data, and (2) estimating the potential scale of the issue, people and households most affected.

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[6] World Food Programme Nepal. Informal consultations with government, April 2020.

Economic Vulnerability Index

Rationale

Measures of poverty, deprivation, and food insecurity do exist in Nepal, borne from measuring undernutrition, poverty, household wealth and food consumption to name a few. Despite the presence of related indicators within the existing data toolbox, a new measure which identifies and prioritizes the economically vulnerable areas to COVID-19 in the country is needed for the following reasons:

- The COVID-19 crisis is revealing vulnerabilities which are not always captured in existing measures: fragility within the tourism industry, or within certain groups of salaried employment, are not generally considered in existing measures of deprivation.

- There are several dimensions to economic vulnerability COVID-19 (mentioned above), which may weigh against one another. It is important to emphasize a consolidated approach that considers and simultaneously accounts for different dimensions of vulnerability beyond, for example, the identification of particular groups (ex. all migrants) as being vulnerable, which may not simultaneously consider other factors such as poverty, or access to relief and support.

- Constrained resource availability both within the international community and Government of Nepal underscores the importance of efficiently allocating resources across the country, using a single consistent measure to compare across local governments. An index—with the caveats that come with the use of such tools—can provide such a measure.

- Updated measures of vulnerability (for example

from household surveys obtained in the first weeks/months of Nepal's nationwide lockdown), while relevant, are often only available at national or provincial levels, and not suitable to allocate resources across the country.

- Geographic targeting can help to understand larger trends in how communities are vulnerable, including in terms of ecological belt, trade routes and physical access and connectivity, and can inform thinking around longer-term responses and recovery.

This note proposes an index that ranks the vulnerability of municipalities to the economic effects tied to the COVID-19 crisis, as described above. While ultimately we are interested in the welfare of people, for practical purposes the municipality is considered the unit of analysis. It is also important to note that this index advances a relative ranking enabling hierarchies across municipalities, for example to prioritize a response, but does not try to measure vulnerability in absolute terms.

As with all composite indices, condensing multiple sources of data into a single number necessarily results in the loss of information. As such the results of any such work need to be considered not in isolation but together with other information: qualitative data, data that is updated as time passes and the situation changes, data that accounts for the response of government and development partners, and also information that is not as amenable to objective measurement, such as a political-economy analysis.

Framework

The framework for this vulnerability index is rooted in the conceptualization of vulnerability as a function of three elements: exposure, sensitivity and adaptive capacity, commonly adopted in the climate change and emergency preparedness literature.[7,8]

Here, we consider exposure to be the degree to which people in a given municipality are exposed to the mechanisms which can cause poverty and food insecurity, namely: job loss, loss of income, and the prevalence of socially marginalized groups. Sensitivity is the extent to which a municipality's people experience those adverse economic effects to which they are exposed. It is assumed that high rates of social deprivation mean that a municipality's people are more likely to experience additional poverty and food insecurity, that the extent of that poverty and food insecurity is likely to be higher than for municipalities that have low baseline levels of social deprivation. Adaptive capacity, finally, is the ability of the municipality and those within it to take steps to mitigate these negative economic effects— by supporting its out-of-work population through social protection schemes, by stabilizing market prices, or other means. There are several ways of defining the vulnerability function from these three elements. Here we use the formula:

$$V_i = \frac{E_i * S_i}{AC_i}$$

In which, for a given municipality i, V is denoted as the corresponding vulnerability score, E as the corresponding Exposure score, likewise S is the corresponding Sensitivity score and AC is the corresponding Adaptive Capacity score.[9] Exposure and Sensitivity combined are often referred to as the 'potential impact'.

For this index, an initial review of over 50 potentially relevant data sources was conducted, and an initial framework put together. This draft framework was then validated through initial consultations with experts in the WFP Regional Bureau Bangkok, followed by external consultations with UNICEF and UNDP. The framework was subsequently restructured to incorporate feedback received, and its variables revised down to 16. While multiple data sources exist which could potentially fit in the framework, there are very few which are both updated and at a low-enough level of aggregation to be used. Where possible, we make use of these. Older data is also used, providing it is relevant and can be reasonably considered to still accurately rank municipalities on a measure.

The framework, with data sources incorporated, is in the table below. It is comprised of 4 layers: the index, three sub-indices, 9 dimensions and 16 indicators. The makeup of each grouping (index, sub-index and dimensions), is informed by two criteria: the relevance of each indicator individually to the dimension (and of each dimension to the sub-index), and the sufficiency of the indicators together to the definition of the dimension (likewise with the dimensions and sub-indices).

Weighting and aggregation

Indicators (represented by variables) are represented by percentiles and summed within each dimension. The sum of these variables is then converted into percentiles to make up each dimension score. Dimensions are then summed within each sub-index,

[7] Brooks, N. *Vulnerability, risk and adaptation: a conceptual framework*. Tyndall Centre for Climate Change Working Paper 38 (University of East Anglia, Norwich, UK, 2003).
IPCC. *Climate change 2014: synthesis report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental*
[8] *Panel on Climate Change* (eds. Pachauri, R. K. & Meyer, L. A.) (IPCC, Geneva, Switzerland, 2014).
[9] Another common method is additive (V = E + S - AC). We prioritize a geometric relationship here mainly to emphasize the importance of high Exposure and Sensitivity measures occurring simultaneously.

1. Vulnerability Index Framework and Data Sources

Index	Sub-Index	Dimension	Indicator	Data source	Level
Economic Vulnerab ility to COVID	Exposure	Remittance dependency	Migrants to India	*World Bank, 2017*	*District*
			Migrants to other countries	*World Bank, 2017*	*District*
		Employment	Exposed sector employment rate	*Nepal Economic Census, 2019*	*District*
		Social marginalization	Marginalized caste %	*Nepal Census 2011*	*Municipality*
	Sensitivity	Poverty and food security	Poverty SAE	*Small Area Estimates of Poverty, 2011*	*Municipality*
			Food Poverty SAE	*Small Area Estimates of Food Security and Nutrition, 2014*	*Municipality*
			Stunting SAE	*Small Area Estimates of Food Security and Nutrition, 2014*	*Municipality*
			Kilocalorie intake SAE	*Small Area Estimates of Food Security and Nutrition, 2014*	*Municipality*
			Underweight SAE	*Small Area Estimates of Food Security and Nutrition, 2014*	*Municipality*
			Dependency ratio	*Nepal Census 2011*	*Municipality*
		Hygiene-nutrition	Wasting SAE	*Small Area Estimates of Food Security and Nutrition, 2014*	*Municipality*
			Diarrhea SAE	*Small Area Estimates of Food Security and Nutrition, 2014*	*Municipality*
		Job / income loss	COVID-19 'most affected' households	*WFP Consultations, Local Governments, 2020*	*Municipality*
	Adaptive Capacity	Access to basic services	Remoteness	*Aid Data 2016*	*Municipality*
		Socio-economic development	HDI	*Nepal Human Development Report 2014*	*District*
		Local support capacity	Locally generated funds	*MoFAGA, 2018-19*	*Municipality*

the resulting figure turned into percentiles to make up the score of each sub-index. Indicators are equally weighted within each dimension, and dimensions are equally weighted within each sub-index.

The assignment of equal weights is a common practice in constructing composite indices[10,11] though there are many ways of calculating weights, including by using expert rankings of variables' relative importance. Variables are assigned equal weighting *within each dimension* here because: (1) weighting based on expert ranking is generally not advised above 10 variables, yet we have 16 (2) there can reasonably be disagreements about which indicators to give additional weight to and how to weight them. The complexity of weighting methodologies can also impede the understanding of, trust in, and ultimately the use of the resulting index. Instead we benchmark the straightforward methodology used in the Surgo Foundation's COVID-19 Community Vulnerability Index of the United States[12] as well as the United States CDC's Community Vulnerability Index on which it is based[13], and make each dimension equally weighted within its sub-index.

Equal weighting within dimensions means that for the indicators, there is an implicit weighting applied as there are different numbers of indicators within each dimension. That is, given their equal weighting within each dimension, each indicator within a large dimension, such as that of Poverty and Food Security, will influence that dimension's score less than indicators within dimensions with only one or two indicators, such as Access to Basic Services or Remittance Dependency.

This is not a significant concern as we are focused on ensuring that the indicators which go into the dimensions are (a) theoretically defensible as a grouping, and (b) together, sufficient to represent the sub-index. This same work was done with the sub-indices when aggregating into the three measures (E, S, AC), although fortuitously each sub-index is made up of three dimensions.

Geometric aggregation[14] (in the formula specified above) was chosen as the function to aggregate the

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[10] Weis, S. W. M. et al. 2016. *Assessing vulnerability: an integrated approach for mapping adaptive capacity, sensitivity, and exposure*. Climate Change 136, p. 615–629.
[11] Organization for Economic Cooperation and Development. 2008. *Handbook on Constructing Composite Indicators*.
[12] https://precisionforcovid.org/ccvi
[13] https://svi.cdc.gov/
[14] Nardo et. al. 2005. "Tools for Composite Indicators Building," European Commission Joint Research Centre.

three sub-indices. This choice represents an understanding of how we should consider tradeoffs between variables (compensability). While linear aggregation also allows for compensability across sub-indices, we specifically want to limit the extent to which either exposure or sensitivity alone can drive variation in the vulnerability score, and emphasize the fact that they need to come together. As an illustration, an equivalent score of 50 out of 100 for both exposure and sensitivity, when multiplied, yields 2,500 and when added yields 100. In contrast a highly skewed score of 10/100 for exposure and 90/100 for sensitivity will yield 900 when multiplied and 100 when added. Linear aggregation rewards both measures equally, but geometric aggregation rewards the higher simultaneous presence of both indicators.

For a COVID-19 response, we want to minimize the extent to which the vulnerability index is simply capturing existing economic deprivation (high sensitivity scores) and highlight areas where both measures are higher, and therefore more relevant to our measure.

Sensitivity testing

It is important to understand to what extent the results obtained with the data used are a product of the methodological choices made. Sensitivity checks can help isolate factors with a high contribution to the final score and help rethink methodological choices. Four basic sensitivity tests were run and their results were each compared with the selected vulnerability index:

1. Imputing variables with missing values using the national median as opposed to the District mean;

2. Separating the migration remittance dimension into two (India and non-India migration);

3. Using an equal weighting scheme where all indicators (and not all dimensions) are equally weighted;

4. Using a linear aggregation scheme instead of a geometric one.

In the first two cases, the resulting quintile categories largely overlapped with the vulnerability index (the chosen measure's) quintiles. There was considerably less overlap for the third and fourth results. In the third case, only 52% of municipalities were in the same category according to both measures (compared with 86% and 93% in the first and second cases respectively).

A detailed look at the third case and the vulnerability index's comparison (see graph below) shows that Provinces had scores that were consistently either above (Province 5 and Sudurpaschim Province) or below (Province 1, 2 and Bagmati Province) their categories for the final vulnerability index. This is because the plethora of variables chosen under the Poverty and Food Security measure are placing inflated value on high chronically food insecure municipalities. Crucially however as these poverty

Sensitivity Check 3: Equal Variable Weighting

Sensitivity Check 4: Linear Aggregation

2. Sensitivity Analysis Confusion Matrices (number of municipalities)

VULNERABILITY INDEX QUINTILES

	Quintile	1	2	3	4	5
1. Alternative imputation	1	146	4	1	0	0
	2	5	137	9	0	0
	3	0	10	124	14	2
	4	0	0	16	113	22
	5	0	0	0	24	126
2. Separate migration sub-dimension	1	141	9	1	0	0
	2	10	137	1	3	0
	3	0	5	141	3	1
	4	0	0	7	137	7
	5	0	0	0	8	142
3. Equal variable weighting	1	116	35	0	0	0
	2	28	100	23	0	0
	3	5	14	114	14	3
	4	2	2	13	97	37
	5	0	0	0	40	110
4. Linear aggregation	1	110	30	9	2	0
	2	34	66	37	13	1
	3	6	40	59	39	6
	4	1	15	31	59	45
	5	0	0	14	38	98

and food security variables are highly correlated with one another, they are not necessarily adding a significant amount of new information to warrant being counted separately. For this method to be chosen instead of the one we have, the number of variables used would have to be carefully controlled to ensure that results are less informed by the simple number of indicators chosen to represent a dimension.

In the fourth case, additive aggregation results in 71% of municipalities retaining the same category. However a closer look (see graph top left, the 'flatter' yellow and brown lines) reveals that it is essentially Karnali and Sudurpaschim Provinces which see changes: many municipalities in these two provinces are being pushed towards the middle of the linear aggregation's distribution. This could mean that on one hand their low average adaptive capacity when compared to the national average is not penalizing them as much, and originally higher-vulnerability areas are scored as less vulnerable, while also, the high-sensitivity/low-exposure municipalities towards the bottom of the geometric aggregation's distribution are suddenly relatively more vulnerable and pushed up toward the middle of the distribution.

Using this method might then exaggerate COVID-related vulnerability in places simply because they have high sensitivity scores, or particularly low adaptive capacity scores. As the goal is to measure COVID-related economic vulnerability and not simply

existing vulnerability, this method shows the possible dangers of imbuing value to either sensitivity or exposure as opposed to valuing them when they are simultaneously present.

Validation

True validation of this measure can only be done through extensive field work, in consultation with national and local government and partners. As this is a necessarily ongoing and lengthy process, we propose to conduct a rolling validation of the index with a focus on evaluating the most-vulnerable quintile of municipalities, confirming or informing their status, and proceeding with adjustments from there.

Validation of the initial framework and concept was done through consultation with WFP's Regional Bureau Bangkok, with UNICEF Nepal and UNDP Nepal, which resulted in a revised framework and trimmed-down indicator list. Ultimately however changes in the way we understand the economic effects of COVID and how the crisis is unfolding in Nepal will guide future adjustments to this measure through a re-examination of the parts that make up vulnerability and how they interact.

Results and discussion

Overall, vulnerability in the country is concentrated in Karnali Province, Province 2 and Sudurpaschim Province, with notable municipalities within Province 1, Gandaki Province and Province 5 specifically classified among the most vulnerable. In many cases (but with several important exceptions), the map of vulnerability coincides in a general sense with that of both chronic food insecurity and malnutrition.

In the Far West of the country, vulnerability is driven by a combination of high sensitivity and low adaptive capacity. Exposure to the economic effects of COVID-19 is moderate to low in most of these locations, though many locations in the Far Western Province of Sudurpaschim are very highly dependent on migrant labor. Initial municipality assessments and tallies of 'most-affected' households (used as a variable in the framework under the Sensitivity index, Job/income loss dimension) identified the middle of the country and many parts of Province 2 as having highly affected households—however as additional labor migrants continue to flow into the country, especially in the Far West this may create an additional burden on districts like Doti in Sudurpaschim Province, and may call for a revision of the methodology.

Province 2 municipalities' vulnerability is among the highest in the country. Unlike in the West of Nepal, the lowland Terai areas of Province 2 are all considered highly exposed, with a unique combination of high proportions of marginalized caste households and proportion of work in high-exposure industries.

Decisively Province 2 has a very high population concentration, and relatively lower rates of local funds generation, along with a low District-level HDI compared to the national average, which work to push down the extent to which Province 2 could deal with large-scale COVID-related economic downturns.

The pockets of low-access municipalities in the mid-North and North-East of the country represent underserved areas where access constraints underscore many of the development challenges faced. The isolated nature of these locations can create market distortions, driving up the price of

food and necessary commodities and complicating the delivery of assistance.

While Kathmandu and Pokhara, two major cities, are among the lowest-vulnerable, this is not the case in all urban centers. Cities especially in the South-East of the country such as Janakpur, Rajbiraj and Biratnagar are all in areas of more elevated vulnerability. Urban areas are generally however in highly connected, highly accessible parts of the country, and those cities mentioned here are all on the Indian border and play pivotal roles in national trade.

The status of trade with India is a crucial variable in understanding vulnerability in Nepal as a whole moving forward. Despite both countries' extended lockdowns, Nepal has been able to keep importing food from India. While in the short term food stocks in Nepal are estimated to be sufficient for several months, and the start of the summer rice planting season has proceeded as normal, any longer-term disruption in cross border trade could render these urban centres, not just in the South East but also in the West, which depend on cross border trade for food and livelihoods, much more vulnerable.

It is important to note that the situation in Nepal is fluid and constantly-changing: as a large pre-lockdown exodus from Kathmandu in March 2020 brought hundreds of thousands[15] of domestic workers, students and others outside of Kathmandu and back to their hometowns, the topography of precarity in the country might well have shifted. Additional factors exist: new inflows of migrant labor returnees from India could create additional dynamics of vulnerability, as could the repatriation of the more than one million other labor migrants in Gulf Countries.[16] Crucially, Nepal's extended nationwide lockdown, if further prolonged, may well prove successful in addressing Nepal's rapid recent growth in COVID-19 infection rates[17], but may also generate additional areas of vulnerability through job and income loss, food and non-food item shortages and/or additional strains on the population. At the same time, decisive action by the government and partners and the mobilization of social protection measures to address the needs of the most affected and most vulnerable could also help significantly improve the situation.

Applications

The Economic Vulnerability Index is a tool meant to augment WFP Nepal and partners' existing toolbox of vulnerability analyses, targeting and programming assistance. This is all the more valid during the COVID-19 crisis, as prolonged restrictions on the movement of people and goods across the country have forced a re-thinking of data collection and analysis methods that rely on face-to-face interaction. The Index can be most effectively used in combination with and in support of tools such as household surveys, government consultations, and other sectorally-relevant secondary data.

The Index can be applied to targeting interventions—including those related to food security—to calculating numbers of population in need of assistance using methods similar to WFP's 72-Hour Approach[18], and can also be used as a basis to prioritize more in-depth inquiries/data collection.

The Index has been used, thus far, as a key component in the targeting of municipalities for WFP's Blanket Supplementary Feeding Programme (in combination with other factors including government consultation and child malnutrition

[15] Prasai, S. "The Day the Workers Started Walking Home," The Asia Foundation. 13 May 2020.
[16] https://kathmandupost.com/national/2020/04/22/with-hundreds-of-thousands-of-migrants-predicted-to-return-home-nepal-needs-to-brace-for-a-crisis
[17] https://kathmandupost.com/national/2020/05/28/nepal-reports-its-fifth-covid-19-death-and-156-new-cases-national-tally-crosses-1-000
[18] World Food Programme. The 72-hour Assessment Approach: A guide for vulnerability and spatial analysis in sudden-onset disasters. June 2018.

rates) in Province 2. It has also been used in WFP's Joint Proposal for COVID-19 Livelihood and Economic Recovery in Nepal, prepared with UNDP Nepal, to target areas of intervention. As the COVID-19 crisis continues to affect every part of life in Nepal, this tool may be adopted for further use within government and among partners to guide support to those most in need in a consistent, evidence-driven manner.

Results Mapping

Municipality-level Vulnerability Index

The continuous-variable vulnerability index and the three sub-indices are cut into quintiles at the national level and visualized below.

COVID Economic Vulnerability Index
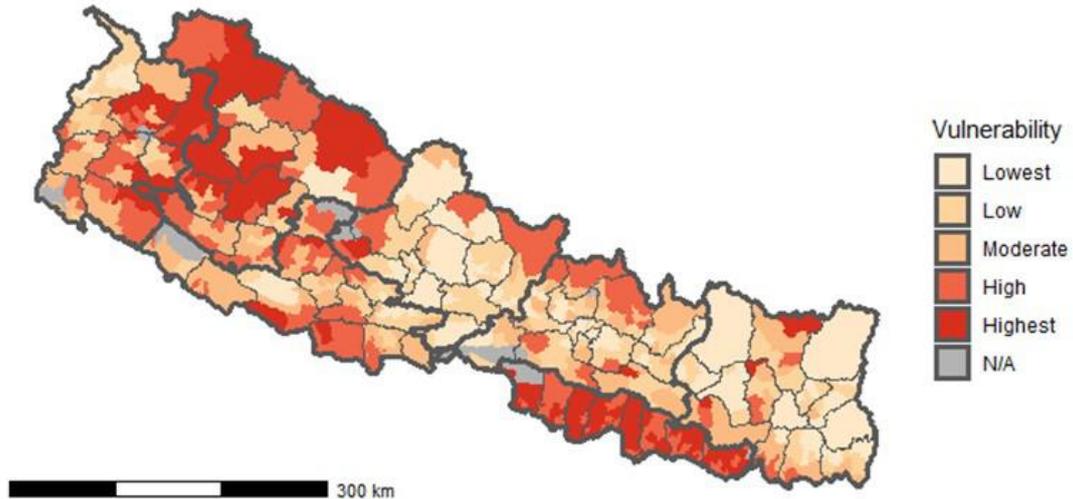
Exposure
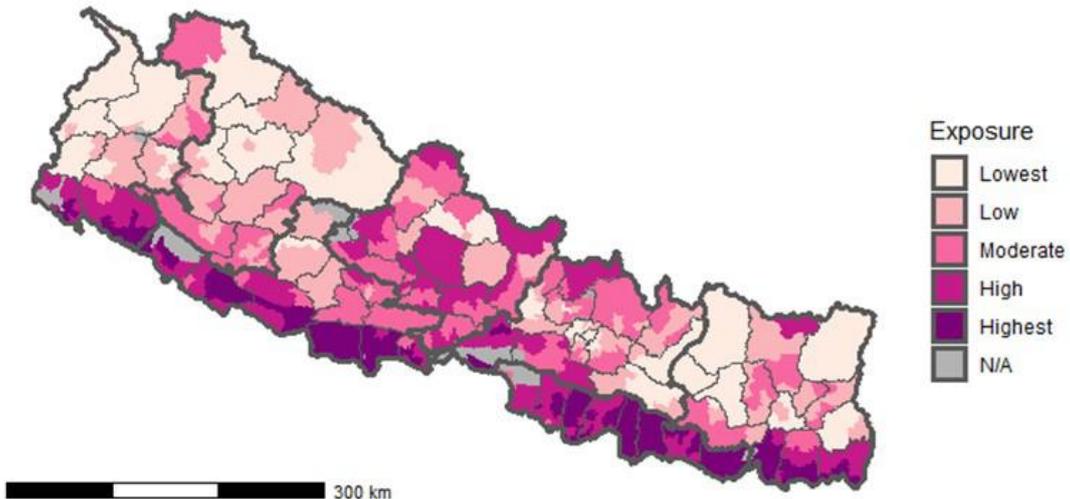
Sensitivity

Adaptive Capacity

Adaptive Capacity
- Lowest
- Low
- Moderate
- High
- Highest
- N/A

300 km
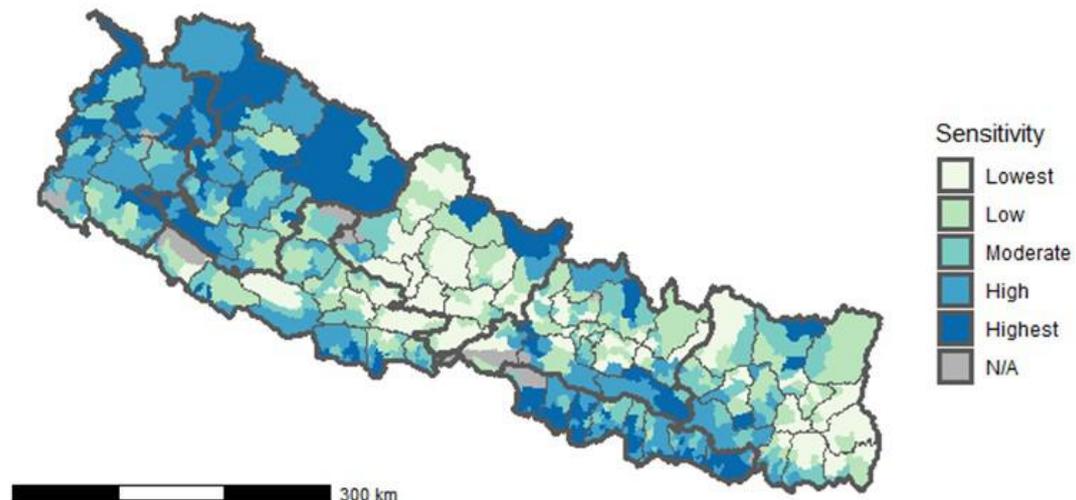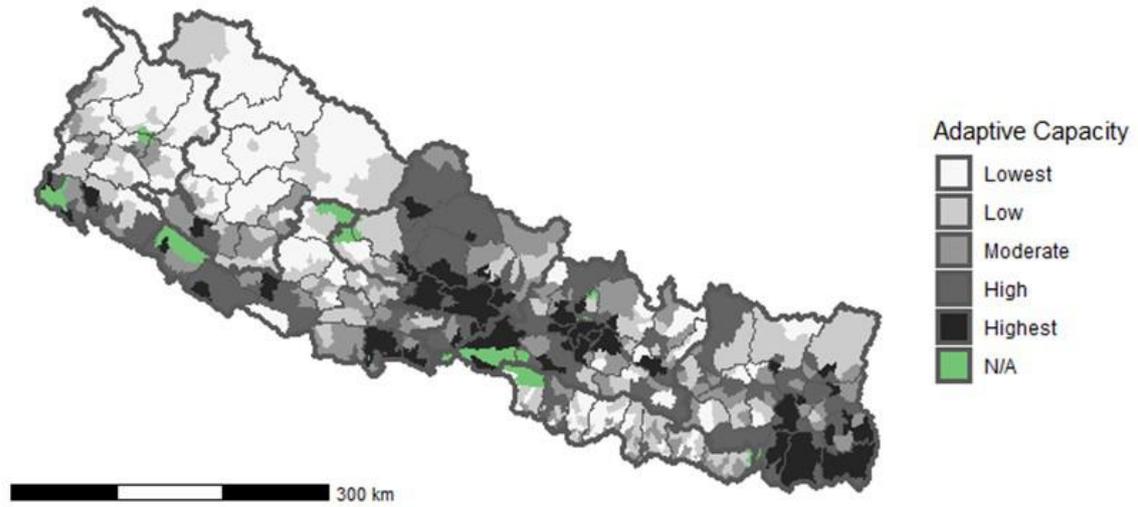
District-level Vulnerability Index

District-level measures were produced by population-weighted aggregation of municipality scores and ordering by quintiles.

Districtwise COVID Vulnerability Index

Vulnerability
- Lowest
- Low
- Moderate
- High
- Highest

300 km

Districtwise Exposure

Exposure
- Lowest
- Low
- Moderate
- High
- Highest

300 km
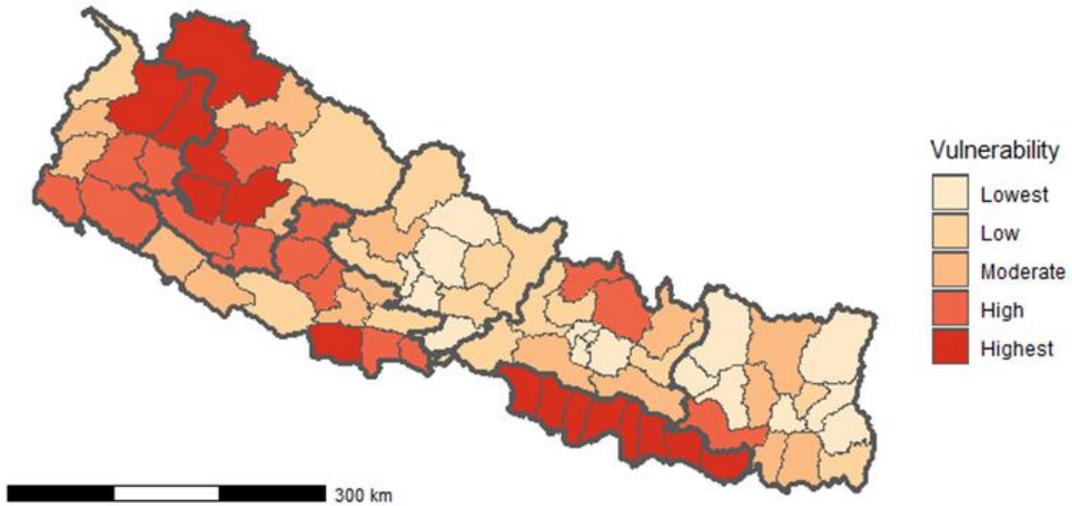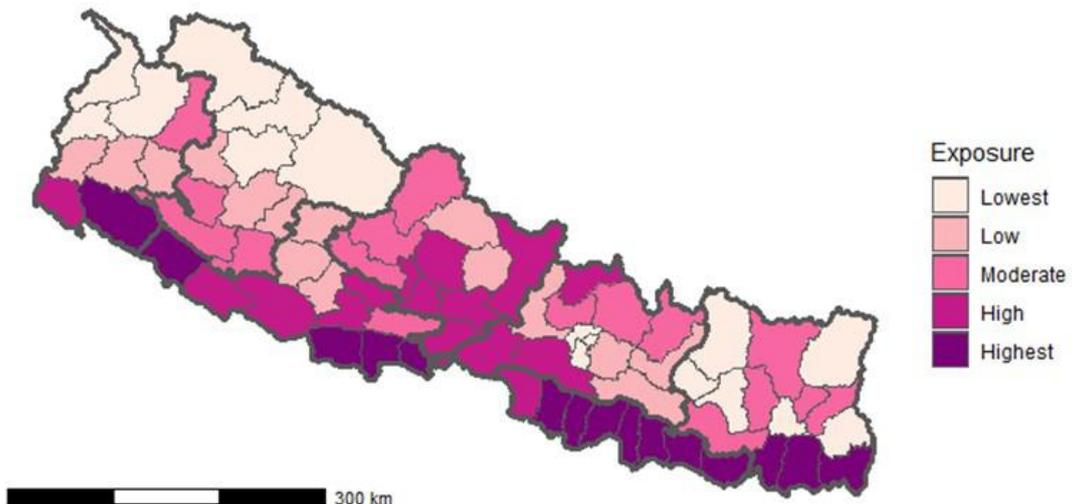
Districtwise Sensitivity
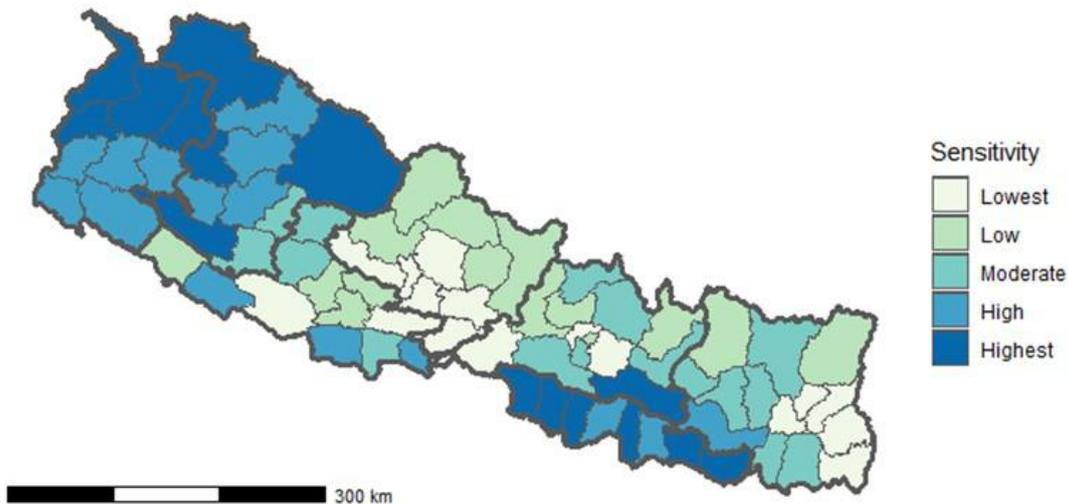
Districtwise Adaptive Capacity
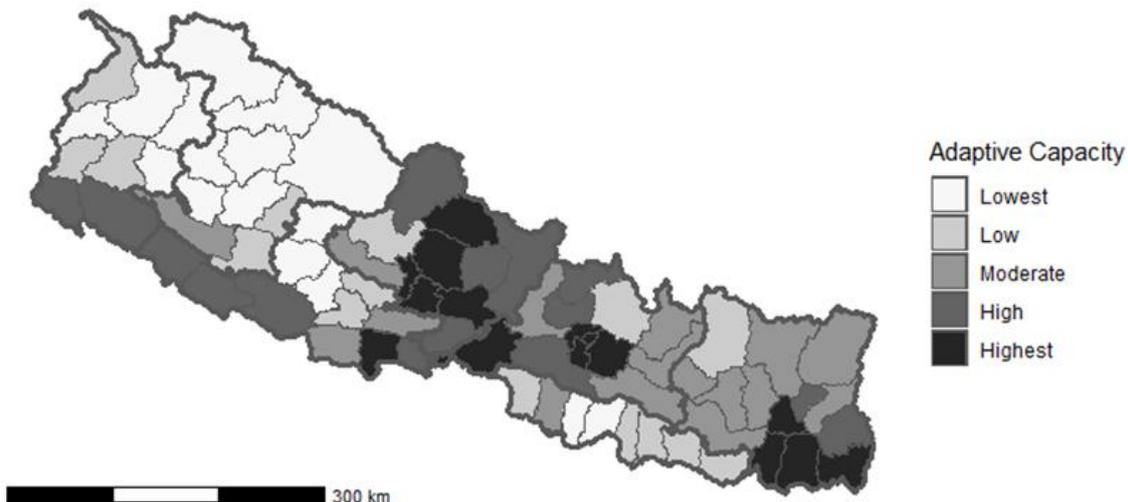
Within-Province Vulnerability Index

A within-Province ranking was also done to prioritize municipalities within each Province. The result ranks municipalities by priority in comparison only with other municipalities in the same province.


Province 1 COVID Vulnerability Index
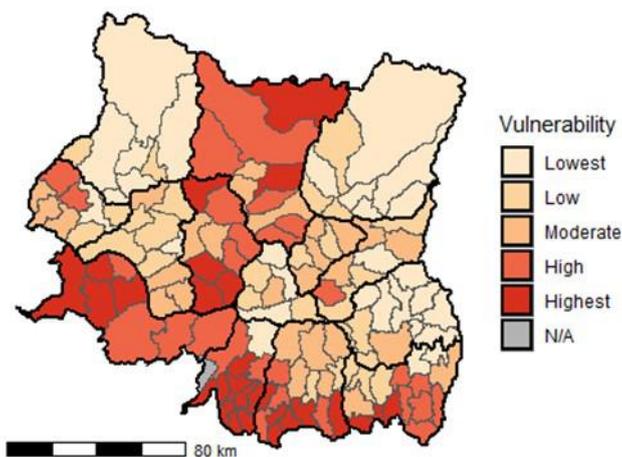
Province 2 COVID Vulnerability Index
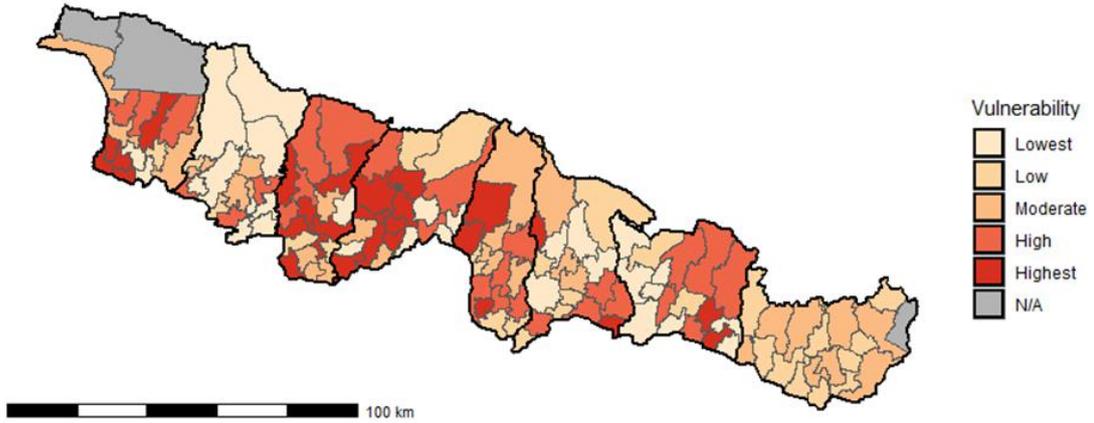

Bagmati COVID Vulnerability Index
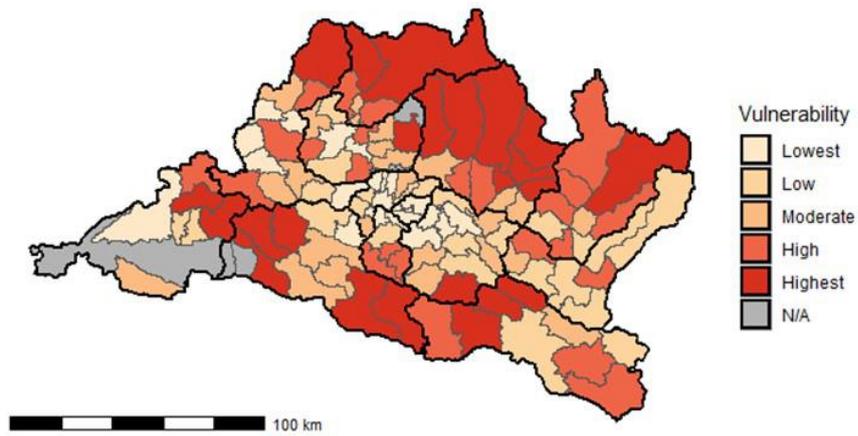
Gandaki COVID Vulnerability Index
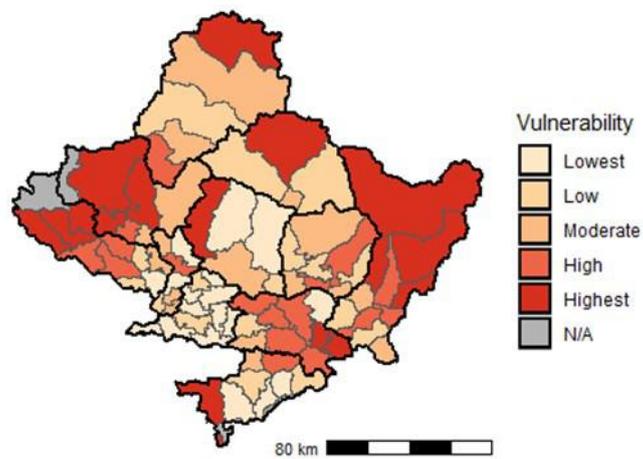
Province 5 COVID Vulnerability Index
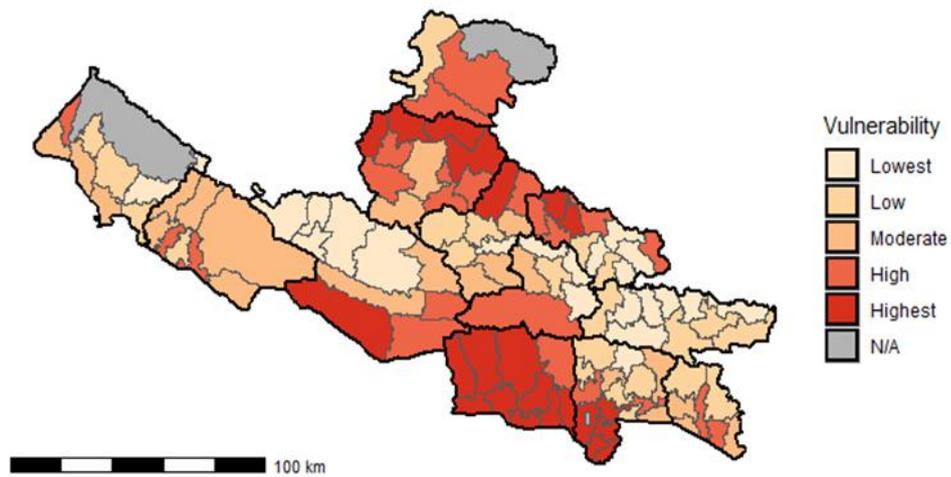
Karnali Province COVID Vulnerability Index
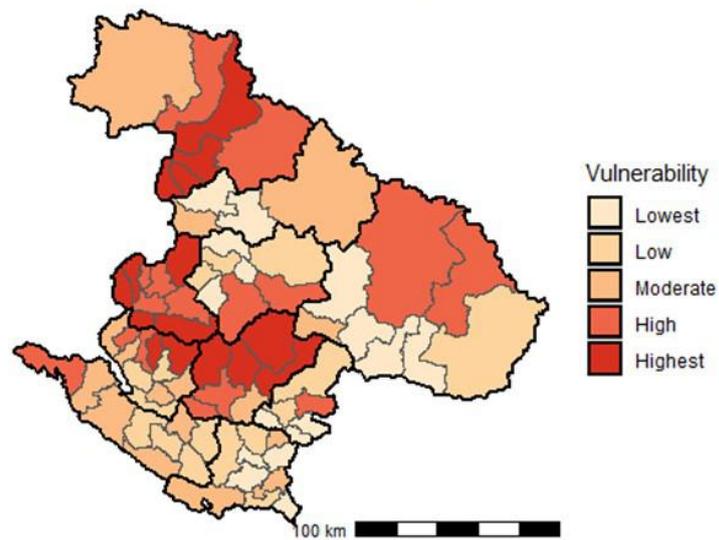
Sudurpaschim Province COVID Vulnerability Index

16