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Gridding India's Population Futures for Climate Exposure

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Abstract

Sustainability assessments need gridded population layers that reflect plausible settlement under heat, flood, coastal, water and infrastructure constraints. Yet gridding from national population and urbanisation totals can miss subnational demographic dynamics before allocation to cells: state differences in fertility, education, mortality, reclassification and migration corridors. We update a multidimensional India projection for 35 state and union-territory units by rural-urban residence, age, sex and education. In the baseline, India peaks at about 1.78 billion in 2076 and remains about 1.71 billion in 2101. Education-specific migration raises the 2101 urban share from 47.9% to 63.8% while changing national population by about 3 million. Motivated by urbanisation-linked warming, we show that replacing national gridding controls with subnational demographic controls reallocates about 203 million urban residents, or 28 per cent of projected urban growth. India illustrates why projection should be carried to the lowest defensible demographic-geographic level before gridding.

India's future population is a global sustainability question, not only because India is now the world's largest national population. The more difficult question is where people will live, what kinds of populations will live there and how quickly those populations move into urban, peri-urban and climate-exposed systems. Heat exposure, flood risk, coastal vulnerability, air-quality stress, housing demand, school demand, health-service demand and adaptation capacity all depend on subnational population composition. Age, education and residence also influence who is most vulnerable, so population is not the only denominator in hazard studies. That composition changes not only because people move, but because fertility, mortality, education and rural-urban transition differ across places. A smooth national projection can therefore be demographically correct at one scale while being weakly informative for many sustainability applications, especially when it is gridded directly from national totals.

India is a particularly strong case because its climate exposure is not organised around a single hazard or frontier. Himalayan and sub-Himalayan river systems, monsoon floodplains, arid western regions, long coastlines and deltas, and large northern, western and southern urban systems face different combinations of heat, flooding, drought, sea-level rise, cyclones, air-quality stress, water stress and infrastructure pressure. Urbanisation can also amplify local heat exposure: recent evidence from 141 Indian cities shows that urbanisation contributed about 0.2 degrees Celsius per decade, or 37.7 per cent of total urban warming, during 2003–2020[1]. These geographies also constrain future settlement and land-use expansion: coastal exposure, water scarcity, irrigation limits and declining agricultural viability can shape where population growth is sustainable. IPCC assessments identify South Asia and Asia more broadly as exposed to interacting risks from extreme heat, monsoon flooding, drought, glacier and mountain hazards, and sea-level rise[2]. The demographic question is therefore not only who is exposed, but where people exposed to one risk regime may move, and whether destination corridors lead toward safer, similarly exposed or newly stressed places.

This problem is especially important for India. The last census was conducted in 2011, while Census 2027 has been notified with a March 1, 2027 reference date for most areas[3]. Until new detailed tables are available, projections must combine the 2011 census base with more recent evidence on fertility, mortality, education, migration, urbanisation and sex ratio at birth. The 2018 multidimensional projection framework of KC, S. *et al.* [4] already established that India's future depends on heterogeneity by state, rural-urban residence, age, sex and education, but nearly a decade of new evidence now needs to be carried into the state space, and that work was prepared before the detailed 2011 Census migration tables used here were available for projection input[5]. We therefore use the 2018 framework as a starting point, while updating demographic evidence and shifting the emphasis from documenting heterogeneity to asking how that established heterogeneity changes gridded climate-exposure and sustainability analysis.

This builds on, rather than replaces, the Shared Socioeconomic Pathways (SSPs) demographic literature. The SSP framework was designed to combine qualitative socioeconomic narratives with quantitative drivers for climate-impact research[6,7]. KC and Lutz translated the SSP narratives into national population scenarios by age, sex and education for countries to 2100[8], and a new round of SSP demographic updates is now being developed as the scenario community prepares revised socioeconomic inputs[9]. Jiang and O'Neill extended the framework to national urbanisation trajectories, and later updates added revised global urbanisation estimates and uncertainty[10,11].

The next step is to connect those demographic inputs more directly to gridded exposure workflows. Spatial gridding studies have allocated national SSP populations and urbanisation assumptions across grid cells for applications such as exposure, land use and coastal risk[12,13]. Gao and O'Neill advanced this workflow by simulating SSP-consistent urban land surfaces to guide future urban growth locations[14]. Our contribution is to connect these workflows for India: building on the heterogeneity already demonstrated by KC, S. *et al.* [4], we ask how much is lost when India is entered into gridded exposure models as a single national total and a single national urban share, rather than as state-residence-age-sex-education trajectories. The same sequence can be extended elsewhere: carry population state spaces as far as defensible, then allocate them to gridded land, hazard and exposure surfaces.

The central claim is simple. Mechanisms that change India's national total are not the same as mechanisms that change the geography of future exposure. With the currently available data, we update the state and union-territory by rural-urban state space and use city warming as a worked sustainability motivation. We treat rural-urban reclassification as in-situ urbanisation, where settlements become urban without residents moving. We ask three questions. First, how do fertility levels, population momentum and education-specific fertility change the national trajectory while also generating in-place subnational growth differences before anyone moves? Second, how do internal migration, education-specific migration exposure and rural-urban reclassification reshape which states, cities and rural-urban systems absorb that population? Third, once population is projected to state-residence controls, how much does gridded exposure change when future urban growth is allocated from national controls, from subnational controls or from different SSP urban-land forms? This distinction matters because climate and sustainability analyses usually need denominators within places: people in heat-prone cities, coastal zones, floodplains, drought-prone regions, urban peripheries or infrastructure catchments.

Results

National Size And In-Place Subnational Growth

We first separate what changes India's population size from what changes the geography inside that total. The India Medium Baseline, defined in Methods, is retained as the population anchor. But the sustainability-relevant finding is not the national curve by itself. For climate-exposure applications, the more important question is how fertility, mortality, education and composition place births, cohorts and future urban populations across states before gridding.

In the current baseline, India's population peaks at about 1.78 billion in 2076 and remains about 1.71 billion in 2101. The low-fertility-ideals scenario lowers the 2101 population by about 62 million relative to the baseline, while slow education expansion raises it by about 142 million and delays the peak to 2086. These national totals are produced unevenly across states and rural-urban populations. States with younger age structures, slower education expansion or later fertility transition contribute differently from lower-fertility and more urbanised states. The same dynamics also change who is exposed, not only where exposure occurs: education expansion alters future human capital, while population momentum and survival reshape the age structure of states and rural-urban populations. The national curve, therefore, already contains an exposure geography prior to migration and gridding.

To separate in-place component change from redistribution, we decomposed the current baseline by switching off domestic migration, rural-urban reclassification and both spatial mechanisms while holding the starting population, fertility, mortality and education assumptions fixed. The current spatial mechanisms do not explain a higher national baseline. If anything, redistribution slightly lowers the national total by shifting exposure toward lower-fertility or otherwise different destination and urban regimes. Spatial modules should therefore be judged by where they locate births, school-age cohorts, workers, older persons and exposed urban populations, not only by their national effect.

Education-Specific Migration Changes Urbanisation

The second question concerns redistribution: which states and rural-urban systems absorb population once migration and reclassification are represented. The clearest distributional experiment is education-specific migration. In the baseline, the recalculated 2011 migration matrix varies by origin, destination, residence, age and sex, but not by education. The extension splits that matrix across six education groups using origin education composition and Census D-04 recent-migrant education profiles as calibration information[15]. D-04 provides observed education profiles of recent migrants, but the complete origin-state by destination-state by education matrix is not available in the released census tables. The extension should therefore be read as a calibrated mechanism experiment.

The experiment shows why education should not be treated solely as a fertility covariate or a human capital outcome. Educational expansion also changes the migration rates to which future cohorts are exposed. As cohorts move into higher educational attainment, more people enter groups with stronger urban-directed mobility profiles. The difference is already visible by 2051, when

the urban share is 44.6 per cent under education-specific migration compared with 40.3 per cent in the education-neutral baseline. By 2101, the gap widens to 63.8 per cent versus 47.9 per cent, adding about 273 million urban residents while changing the national population by only about 3 million. This widening redistribution effect is shown in Figure 1: panel a shows the divergence in urban share, while panel b shows that fertility changes little across the baseline and education-specific migration variants, except under slow education. Education-specific migration is therefore a climate-relevant redistribution mechanism: it changes the geography of future urban exposure while leaving the national curve almost unchanged.

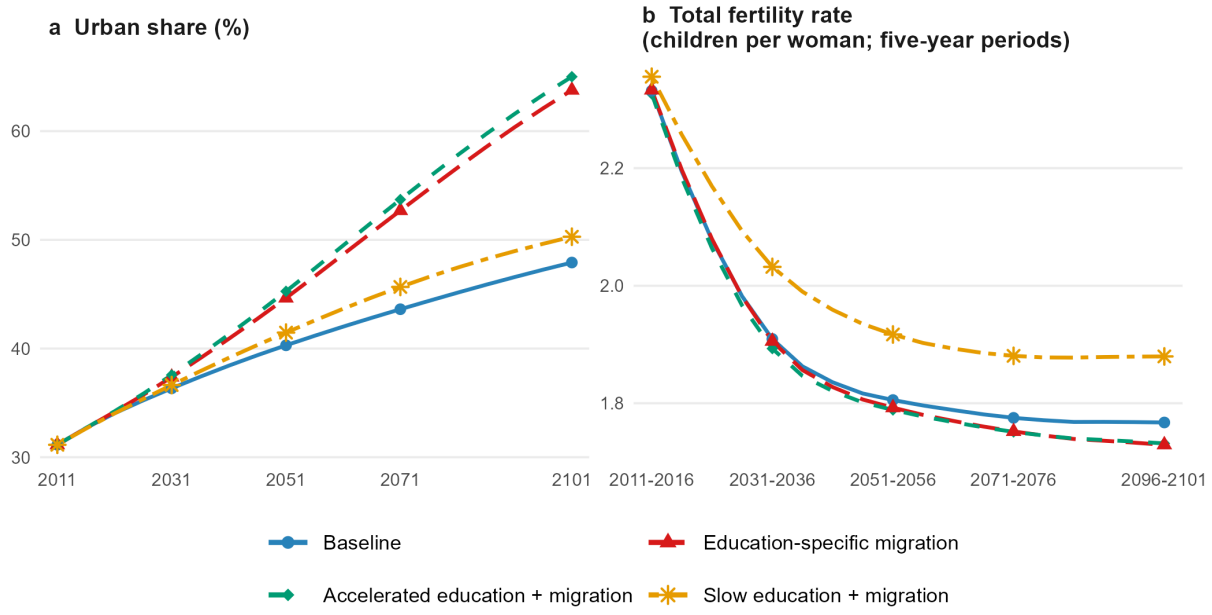


Figure 1: Education-specific migration changes urbanisation with little change in fertility. a, National urban share from 2011 to 2101 under the education-specific migration scenario family. b, Projection-implied total fertility rate, measured as children per woman over five-year periods from 2011-2016 to 2096-2101. The contrast shows that urbanisation can change substantially even when fertility trajectories remain similar, except under the slow-education scenario.

Corridors And Urban-Share Geography

Internal migration is also a corridor system. A climate shock, labour-market shock or urban housing shock is unlikely to redistribute affected populations randomly. Movement tends to follow family, marriage, labour, education and metropolitan corridors unless shocks are large enough to create new routes. The recalculated migration input shows this structure clearly: recent increases concentrate along a limited set of origin-destination links, especially into established receiving systems such as Gujarat, Maharashtra and the Uttar Pradesh-Delhi corridor. These destination systems are

not risk-neutral for sustainability analysis. Maharashtra includes coastal Mumbai, where flooding, storm surge and sea-level-rise risks are central planning concerns. Gujarat includes Surat, a lower Tapi River/coastal city exposed to flood risk. Delhi combines extreme-heat planning concerns with chronic air-pollution stress[16–19]. This is why the projection's origin-destination structure matters for climate adaptation: it links exposed populations to plausible receiving systems rather than treating redistribution as spatially uniform or as movement only to the nearest city.

The corridor comparison in Figure 2 links recent migration evidence to long-run urbanisation geography. Panel a shows the largest increases in expected interstate migrants when the migration input is recalculated with 2011 census evidence rather than the 2001-based input. Panel b shows projected changes in state and union-territory urban shares from 2011 to 2101 under the education-specific migration scenario. The comparison is not a mechanical extrapolation of 2001–2011 flows. It shows that future urbanisation has a geography connected to destination states, high-momentum origin regions such as Uttar Pradesh, Bihar and Madhya Pradesh, and the corridors through which population redistribution may occur.

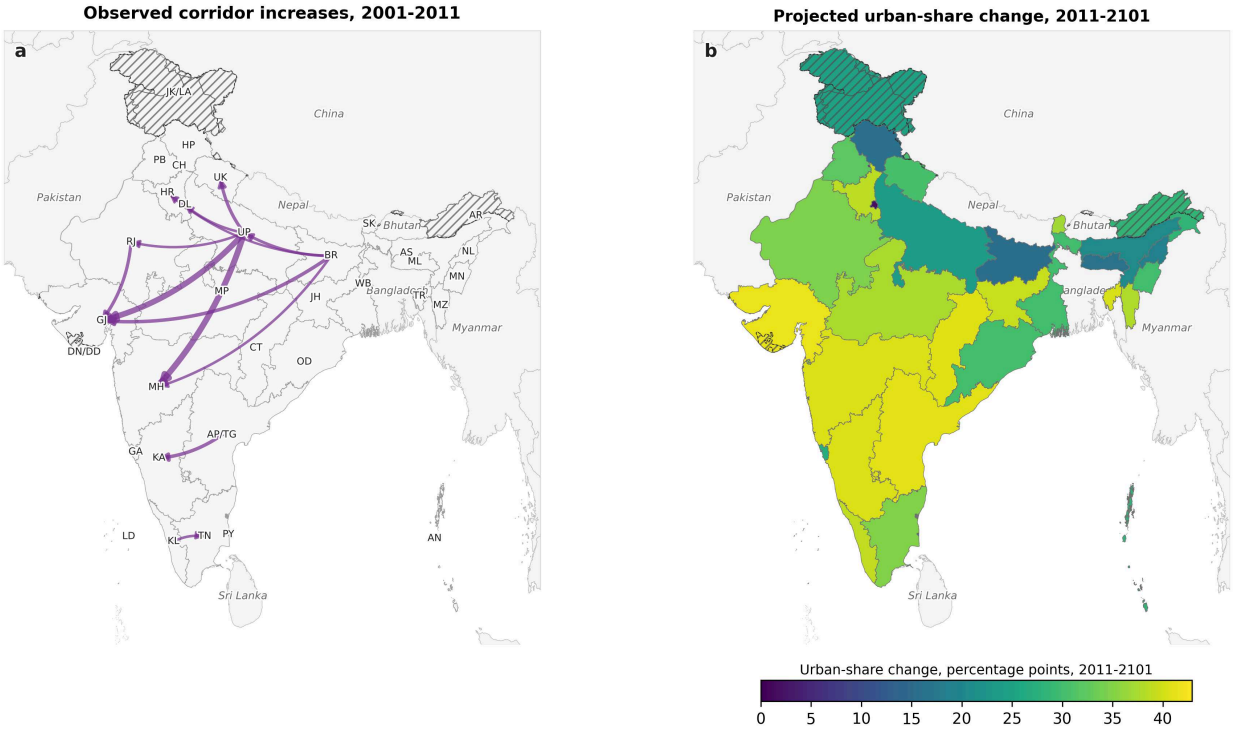


Figure 2: Observed migration corridors and projected urbanisation geography. a, The 12 largest increases in expected interstate migrants in the 2011 census-input comparison relative to the 2001-based input. b, State/UT urban-share change from 2011 to 2101 under the education-specific migration scenario. Hatched areas and dashed lines mark disputed areas and boundaries from Natural Earth. Boundaries are for visualisation only.

Cities, Heat And Gridded Exposure

In many gridded-SSP workflows, national population and urbanisation trajectories are allocated to grid cells using spatial development assumptions. Our third question asks what is lost when India is gridded this way rather than from state-specific rural and urban projection totals. Urban heat is a concrete test case because urbanisation-linked warming is already documented across Indian cities[1]. The issue is not whether a demographic projection predicts heat, but whether it gives climate-impact models the right population denominators for future urban exposure.

Demographic projections define the population side of exposure. Rural-urban redistribution and reclassification determine which people are counted as urban, which states absorb urban growth and which future populations need to be linked to city-scale or gridded climate layers. The current state-level projection cannot distinguish existing city cores, metropolitan edges, small towns and settlements that become urban in place. It does, however, improve the control totals that gridded

and settlement-level models need before more detailed urban-growth, land-suitability and hazard layers are added.

We therefore use a controlled gridding experiment. We build a common 2010 urban-population baseline from the Global Human Settlement Layer population grid (GHS-POP), mask it to urban and semi-dense classes in the Global Human Settlement Layer settlement model (GHS-SMOD), and calibrate it to the projection's 2011 state urban totals[20,21]. We then allocate only future urban growth in two ways, using the same Gao and O'Neill SSP2 2100 urban-land fractions as the growth-weighting surface[14]. The national-growth version allocates one India-wide projected urban increase across eligible 1/8-degree urban-land grid cells. The state-growth version constrains growth to projected state totals from the projection model and allocates within each state using the same weights. Because the baseline population surface, national growth total and urban-land weighting surface are identical, the difference isolates the value of carrying state-specific demographic totals through projection before gridding. This is not a full replication of the Jones/O'Neill population-gridding model or the Gao/O'Neill urban-land simulation, but a controlled counterfactual that holds the baseline surface and urban-land weights fixed while changing only the demographic control totals.

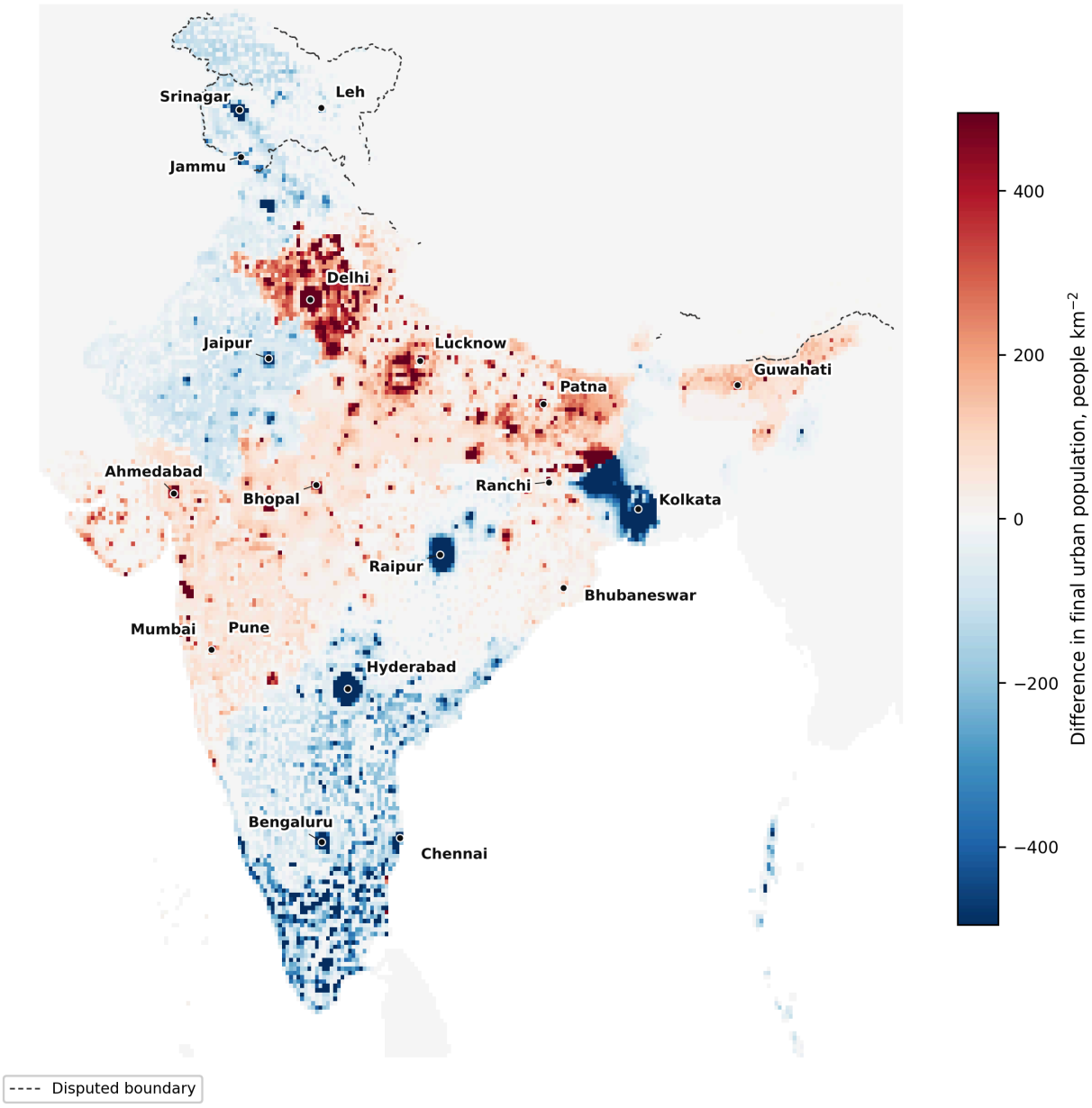


Figure 3: Difference in 2101 final gridded urban population across Gao/O'Neill 1/8-degree grid cells between state-growth and national-growth allocation after preserving the same GHSL 2010 baseline urban-population surface and allocating projected urban growth from 2011 to 2101. Red cells receive more projected urban growth when state-level demographic controls are used. Blue cells receive less. City labels are orientation points. Dashed lines mark disputed boundaries from Natural Earth. Boundaries are for visualisation only.

In the education-specific migration scenario, replacing one national urban-growth control with state-specific controls reallocates population across the same Gao and O'Neill 1/8-degree grid cells, roughly 190 km2 at the equator. Relative to the national-growth grid, state controls reallocate about 89 million people by 2051, or 23 per cent of projected urban growth. By 2101, this rises to about 203 million people, or 28 per cent of projected urban growth (Figure 3). The adjustment is uneven. Relative to the national-growth allocation, final gridded urban population is higher by about 62 per cent in Uttar Pradesh, 168 per cent in Delhi, 76 per cent in Haryana, 87 per cent in Bihar and 46 per cent in Jharkhand, with smaller gains in Gujarat (16 per cent) and Maharashtra (10 per cent). By contrast, the national-growth allocation places relatively more growth than the state-level projection implies in Telangana, West Bengal and Tamil Nadu, where final gridded urban population is lower by 41, 44 and 37 per cent, respectively, under state controls. Karnataka and Kerala are also lower by 17 and 27 per cent.

These are exposure-denominator changes: the same projected urban population is placed in different cells. For urban heat, the same hazard layer would be combined with a higher future urban population in parts of the northern and north-central urban system, including Delhi and the Lucknow-Patna corridor, and with a lower one in several southern and eastern cells, including around Hyderabad, Bengaluru and Chennai. City labels are orientation points rather than city-specific estimates: in Gujarat, Ahmedabad marks an inland heat and air-quality context, while Surat remains the relevant coastal and flood-risk example. The map shows what is lost when India is gridded from one national urban total. High urban-land weights can attract population growth to cells where projected state urban growth is lower, while high-momentum states can be underrepresented. This reflects migration and in-place differences in fertility, age structure, education and rural-urban transition. The same logic applies to sea-level rise, flood, drought, air quality and health impact studies.

A second gridding sensitivity asks whether the national-versus-state result depends on the spatial form of urban expansion. Repeating the same state-growth versus national-growth comparison with each Gao and O'Neill surface shows that the demographic-control effect remains large: by 2101, state controls reallocate 180 million people under SSP1 (compact/sustainable), 203 million under SSP2 (middle-of-road), 194 million under SSP3 (fragmented/regional) and 220 million under SSP5 (rapid/expansive), or 25 to 31 per cent of projected urban growth. The urban land surfaces also shift exposure placement relative to one another. Holding the population projection and state-growth totals fixed, Figure 4 compares each alternative urban land form against the SSP2 gridding.

Relative to SSP2, SSP1 reallocates 170 million people by 2101, SSP3 reallocates 123 million and SSP5 reallocates 138 million, equivalent to 24, 17 and 19 per cent of projected urban growth. Purple cells receive less population than under SSP2, while orange cells receive more. Together, these sensitivities show that exposure gridding depends on two choices that can be separated analytically: the demographic control totals used to place people and the spatial form assumed for urban expansion.

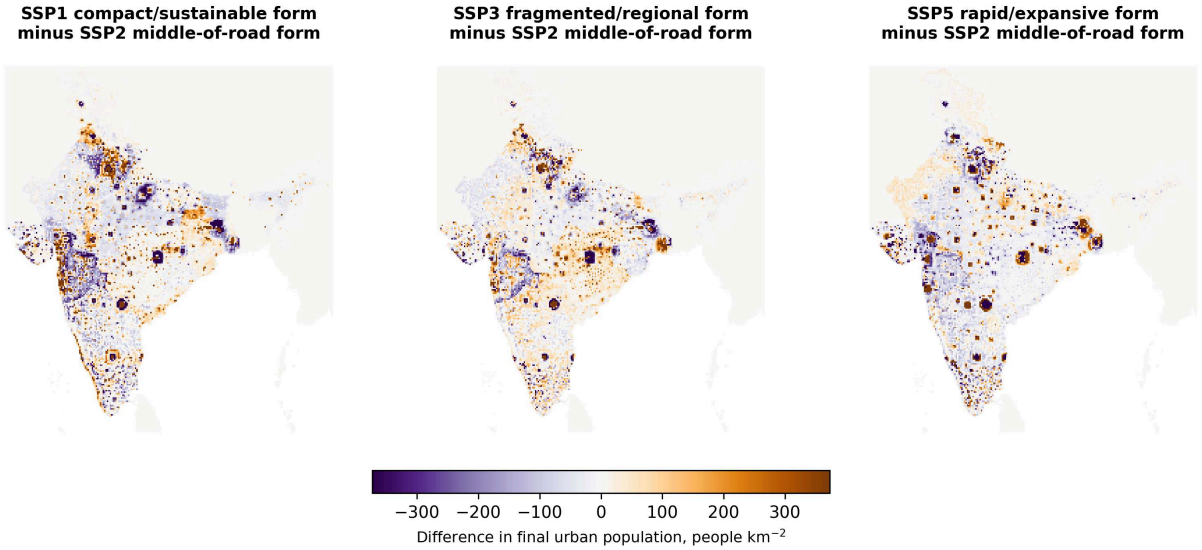


Figure 4: Difference in 2101 final gridded urban population across Gao/O'Neill 1/8-degree grid cells when SSP1, SSP3 or SSP5 Gao/O'Neill 2100 urban-land weighting surfaces replace the SSP2 surface, holding the same GHSL-calibrated 2011 baseline and the same projected state urban-growth totals. Purple cells receive less population than under SSP2. Orange cells receive more.

Together, the results show a chain of demographic choices that progressively change exposure denominators. Fertility, population momentum and education create state-specific growth before migration. Internal migration, education-specific mobility and rural-urban reclassification redistribute that growth across states and rural-urban categories. Gridding then translates subnational trajectories into exposure surfaces, where urban land form, physical geography and land suitability further shape plausible expansion. The information gained comes from carrying India into these workflows as a state-residence-age-sex-education system rather than as a single national total and one urban share[8,10,12,14,22].

Discussion

From Population Size To Exposure Geography

India illustrates a general scale mismatch in sustainability science. Climate impact and adaptation studies often require future population estimates on grids or within hazard footprints, but demographic projections are frequently reported as national totals. The 2018 India projection showed why subnational demographic heterogeneity matters for population futures. The present analysis shows why the same state space also matters before population is allocated to grid cells, cities, coastlines or other hazard layers.

This is especially important for climate-linked mobility. India contains many potential origin and destination systems within one national migration space: Himalayan and river-basin districts, monsoon floodplains, heat- and drought-exposed western regions, cyclone- and sea-level-exposed coasts, southern coastal and interior urban systems, and large metropolitan corridors. Some climate-affected households may move locally, some may move temporarily and return, and others may use established labour, education, marriage or family corridors to relocate within India rather than crossing an international border. The model cannot identify these future movements on its own, but it provides the origin-destination scaffolding for asking where displaced or climate-stressed populations could plausibly move under alternative hazard scenarios.

The most important conceptual distinction is between population size and exposure geography. Fertility and education-specific fertility determine much of the future number of births, peak timing and age structure. Because these components vary across states, residence and education groups, they also create in-place subnational growth differences before migration is applied. Migration and education-specific exposure determine where people move, while rural-urban reclassification changes which populations are counted as urban. These mechanisms can have modest national effects and large climate-relevant exposure effects.

Gridding As A Methodological Bridge

The city-heat example shows both the promise and the limitation of the current model. Urbanisation-linked warming is already documented across Indian cities, but the projection identifies only where urban exposure populations may grow by state and scenario. The gridding experiment preserves an empirical GHSL 2010 urban-population baseline before allocating future growth, but it does not yet distinguish existing city cores, expanding peripheries, settlements that become urban in place or smaller urban systems. Linking the state-space projection to settlement boundaries, reclassification histories, peri-urban land layers and gridded heat indicators is the next step.

The gridding experiment provides a first methodological bridge. Holding the national total and urban land surface constant shows that subnational demographic controls alone can materially alter the spatial allocation of future urban population. The urban-form sensitivity shows that compact, fragmented and expansive land patterns can also reallocate exposure when the population projection is fixed. National controls can obscure state-level demographic momentum, heterogeneity in component change, migration corridors and rural-urban transition. A single urban-form assumption can obscure sensitivity to the choice between compact and dispersed settlement growth. Geography adds a further constraint: sea-level exposure, water availability, irrigation feasibility, agricultural decline and infrastructure limits can make some allocations more plausible than others.

Demographic Infrastructure And Extensions

The model is best read as demographic infrastructure for coupled population-sustainability analysis. It does not itself forecast heat, floods, sea-level rise, air quality or infrastructure failure. Its contribution is to supply a projectable population state space in which age, sex, education, residence and location are treated as fundamental sources of demographic heterogeneity, not as post hoc descriptors. This logic is already central to education-specific human-capital projections, the SSP population and human-capital core, and the multidimensional India projection[4,8,23]. Once carried to grids or hazard footprints, the same state space can support analyses of who is exposed, who is vulnerable and how sectoral outcomes may feed back into mortality, mobility, schooling, fertility and settlement change.

Several extensions follow from this infrastructure. Rural-urban reclassification should be represented as in-situ urbanisation and peri-urban growth, not only as a residual transition from rural to urban categories, because exposure can change even when people do not move long distances. Migration scenarios should also vary corridors and population groups, because climate-linked mobility will likely follow family, labour, education and metropolitan networks rather than redistribute people uniformly. Finally, gridding should combine demographic control totals with suitability and constraint layers for coastlines, water, agriculture, infrastructure and protected or high-risk land, while preserving age, sex and education where possible. This would shift exposure analysis from average individuals in hazard zones to population groups whose vulnerability and adaptive capacity differ.

The broader contribution is to turn a known demographic insight from the 2018 India projection into a gridded sustainability implication. Exposure futures depend not only on national population size or national urban share, but on whether projectable heterogeneity by state, residence, age, sex

and education is preserved when population is allocated to cities, coastlines, floodplains, heat zones or infrastructure catchments. India is the motivating case because of its demographic scale, federal heterogeneity, rapid urban transition and climate exposure, but the argument applies more widely. Where subnational trajectories are available, climate-exposure models should carry population as far as defensible in demographic-geographic space before gridding, then combine that population surface with hazard, land-use and suitability layers.

Methods

Projection State Space

The projection updates the multidimensional India framework of KC, S. *et al.* [4]. Population is projected in five-year steps from 2011 to 2101 by 35 state and union-territory units, rural-urban residence, five-year age group, sex and six education categories. Crossing the 35 geographic units with residence gives 70 state-residence populations. The geography follows the 2011 Census state space so that later administrative changes can be harmonised to a common projection geography rather than treated as new projection units. Additional state-space definitions and harmonisation details are provided in the Supplementary Information.

Baseline And Scenarios

The India Medium Baseline is the anchor projection. Older pathway labels from previous model versions are retained only to track input histories, while the scientific comparisons are organised around mechanism-specific experiments. Fertility, mortality, education, sex ratio at birth, domestic migration and reclassification are updated or documented using available evidence after 2011. Scenario experiments ask how fertility levels, education expansion and population momentum alter national population size and in-place state-residence growth and how migration trends, education-specific migration exposure and rural-urban reclassification alter subnational distribution. Detailed scenario definitions, input checks and sensitivity summaries are provided in the Supplementary Information.

Migration And Reclassification

Domestic migration is represented as an origin-destination rate matrix over state-residence cells by age and sex. The recalculated 2011 matrix uses Census D-3 information on place of last residence, duration and reason for migration, together with D-12 age patterns for recent migrants, in a structure comparable to the earlier 2001-based legacy input[5,24,25]. Reclassification is represented separately from individual migration because settlements can become urban while residents remain

in place. International migration is not analysed as a subnational redistribution mechanism because its projected contribution is small and the released census tables do not provide defensible state-residence-age-sex-education flows. The education-specific migration experiment splits the 2011 domestic matrix across six education groups using origin education composition and Census D-04 recent-migrant education profiles by age, sex, education, destination and previous residence[15]. It is interpreted as a mechanism experiment because complete education-specific origin-state by destination-state migration tables are not available. The Supplementary Information reports the migration-input checks, education-specific calibration checks and international-migration sensitivity rationale.

Gridding Experiment

The gridding experiment preserves an observed baseline before allocating future growth. We construct a 2010 urban-population surface from GHS-POP and GHS-SMOD, intersect it with the harmonised state/UT boundary layer, and scale each state's baseline grid cells to the projection's 2011 urban total. We then allocate projected urban growth from 2011 to the 2101 comparison using Gao and O'Neill SSP2 2100 urban-land fractions on 1/8-degree grid cells as a common weighting surface. The national-growth allocation distributes India's projected urban increase across all eligible cells, while the state-growth allocation distributes each state's projected urban increase only within that state. The baseline population surface, total projected urban growth, time points, India boundary and urban-land layer are held constant. Cell-level differences therefore isolate the use of state-specific demographic growth controls rather than a new urban-land forecast. Formal allocation equations, implementation details and gridding checks are provided in the Supplementary Information.

A second gridding sensitivity holds the demographic projection and state urban-growth totals fixed, varying only the urban-land weighting surface. SSP2 is used as the reference, and the Gao and O'Neill SSP1, SSP3 and SSP5 2100 urban-land fractions replace the SSP2 weights within the same state-growth allocation rule. This tests whether compact, fragmented or expansive urban land forms alter exposure placement after the demographic-control problem has been separated. The experiments do not directly model physical suitability. Instead, they separate demographic controls and urban-land form from the later task of adding coastal, water, agricultural and infrastructure constraints to gridded exposure products.

Because the demographic-control comparison can also depend on the urban-land weighting surface, we repeat the national-growth versus state-growth contrast under SSP1, SSP3 and SSP5 surfaces. These additional results are reported in the Supplementary Information.

Data Availability

The analysis uses publicly available population, migration, settlement and urban-land inputs, including the 2011 Census of India migration tables, GHS-POP, GHS-SMOD and Gao and O'Neill SSP urban-land surfaces. Derived projection summaries, gridding summaries and figure-ready outputs will be deposited in Zenodo before publication [DOI to be added]. The released Census tables do not provide complete origin-state by destination-state by education migration schedules, and this limitation is described in the Methods and Supplementary Information.

Code Availability

Custom R and Python code used to prepare migration inputs, run scenario comparisons, generate figures and implement the gridding experiments will be deposited in Zenodo before publication [DOI to be added].

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Author contributions are withheld for double-blind peer review.

Competing Interests

The authors declare no competing interests.

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Materials And Correspondence

Correspondence details are withheld for double-blind peer review.

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