Supplementary Information:

Mapping Global Urban Land for the 21st Century with Data-Driven Simulations and Shared Socioeconomic Pathways

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Supplementary Figure 1. Global quintile map of per capita urban land area (m²) in 2000.

(Source data are provided as a Source Data file.)
Supplementary Figure 2. Global urban land maps: (a) base year 2000, (b) sustainability (SSP 1) 2100, (c) middle of the road (SSP 2) 2100, and (d) fossil-fueled development (SSP 5) 2100.
Supplementary Table 1. Urban land expansion of world regions over the 21st century.

When comparing total urban areas across regions, readers should bear in mind that the regions have different land areas.

| Region                | Base Year 2000 | Middle of Road Scenario: 2000-2100 Change |
|-----------------------|----------------|-------------------------------------------|
|                       | total urban land (km²) | per capita urban land (m²) | per capita urban land change (m²) | total urban land change (km²) | urban land change % | total pop change % | urban pop change % | 2100/2000 urban land ratio (range across scenarios) |
| North America         | 133,611        | 424                        | 686                         | 218,560                         | 164                       | 63             | 99             | 281 | 1.4 - 4.6       |
| South & Central America | 51,373        | 98                         | 203                        | 85,482                         | 166                       | 28             | 58             | 947 | 1.5 - 4.9       |
| Europe                | 144,173        | 248                        | 723                        | 275,285                         | 191                       | 0              | 30             | 321 | 1.6 - 5.0       |
| Russia                | 21,533         | 147                        | 490                        | 38,492                          | 179                       | -16            | 6              | 639 | 1.5 - 4.7       |
| North Africa & Middle East | 33,736       | 86                         | 143                        | 74,747                          | 222                       | 94             | 181            | 1,457 | 1.7 - 5.3     |
| Africa                | 46,067         | 69                         | 100                        | 193,215                         | 419                       | 260            | 744            | 10,340 | 2.5 - 8.0     |
| East & Central Asia   | 113,944        | 66                         | 397                        | 450,839                         | 396                       | -18            | 59             | 1,001 | 2.2 - 7.5     |
| South & Southeast Asia | 55,032       | 32                         | 125                        | 253,963                         | 461                       | 42             | 252            | 3,450 | 2.7 - 8.4     |
| Oceania               | 11,272         | 382                        | 460                        | 17,815                          | 158                       | 114            | 164            | 727   | 1.4 - 4.6      |
| Global Total          | 610,742        | 100                        | 246                        | 1,608,399                       | 263                       | 47             | 152            | 1,035 | 1.8 - 5.9     |
Supplementary Table 2. Urban expansion style evolution of example countries shown by historical data.

| Nation    | 1990-2000 | 2000-2010 |
|-----------|-----------|-----------|
| Nigeria   | 3         | 2         |
| China     | 3         | 2         |
| India     | 3         | 2         |
| Malaysia  | 2         | 1         |
| South Africa | 2     | 1         |
| Ireland   | 2         | 1         |

(3 – rapidly urbanizing; 2 – steadily urbanizing; 1 – urbanized)

Supplementary Table 3. Urban expansion style evolution projected for China.

|          | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | 2080 | 2090 | 2100 |
|----------|------|------|------|------|------|------|------|------|------|------|
| SSP 1    | 2    | 2    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| SSP 2    | 2    | 2    | 2    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| SSP 3    | 2    | 2    | 2    | 2    | 1    | 1    | 1    | 1    | 1    | 1    |
| SSP 4    | 2    | 2    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| SSP 5    | 2    | 2    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |

(2 – steadily urbanizing; 1 – urbanized)

Supplementary Table 4. Number of global countries following different urbanization styles in different scenarios.

|          | base year | SSP 2 | SSP 5 | SSP 1 |
|----------|-----------|-------|-------|-------|
|          | 2000 | 2050 | 2100 | 2050 | 2100 | 2050 | 2100 |
| urbanized | 113  | 179  | 208  | 205  | 214  | 188  | 214  |
| steadily urbanizing | 95  | 52   | 23   | 8    | 0    | 26   | 0    |
| rapidly urbanizing     | 23  | 0    | 0    | 18   | 17   | 17   | 17   |
Supplementary Table 5. Urban land expansion of sample countries over the 21st century.

|                          | Base Year 2000 | Middle of Road Scenario: 2000-2100 Change | 2100/2000 urban land ratio (range across scenarios) |
|--------------------------|----------------|------------------------------------------|---------------------------------------------|
|                          | total urban land (km²) | per capita urban land (m²) | per capita urban land 2100 (m²) | total urban land change (km²) | urban land change % | total pop change % | urban pop change % | GDP change % |                           |
| United States of America | 123,957          | 436                                      | 713                                      | 202,970                          | 164                  | 61                      | 97                      | 268         | 1.4 - 4.6                  |
| Brazil                   | 17,766           | 102                                      | 237                                      | 26,912                            | 151                  | 8                       | 26                      | 648         | 1.3 - 4.5                  |
| Germany                  | 24,220           | 290                                      | 1,048                                    | 45,514                            | 188                  | -20                     | 2                       | 182         | 1.5 - 4.8                  |
| United Kingdom           | 12,892           | 219                                      | 401                                      | 21,064                            | 163                  | 44                      | 71                      | 397         | 1.3 - 4.4                  |
| Russia                   | 21,533           | 147                                      | 490                                      | 38,492                            | 179                  | -16                     | 6                       | 639         | 1.5 - 4.7                  |
| Ethiopia                 | 1,086            | 16                                       | 63                                       | 10,993                            | 1,012                | 189                     | 1,096                   | 23,326      | 5.7 - 17.1                 |
| South Africa             | 11,148           | 249                                      | 630                                      | 25,700                            | 231                  | 30                      | 98                      | 1,004       | 1.7 - 5.3                  |
| China                    | 73,492           | 57                                       | 552                                      | 350,290                           | 477                  | -40                     | 35                      | 1,658       | 2.4 - 8.6                  |
| India                    | 21,631           | 21                                       | 97                                       | 134,480                           | 622                  | 54                      | 313                     | 4,535       | 3.3 - 10.2                 |
Supplementary Table 6. Comparing 2000-2100 urban land expansion (ULE) % and total population change (TPC) % for world regions across scenarios.

| Region                 | SSP1  | SSP2  | SSP3  | SSP4  | SSP5  |
|------------------------|-------|-------|-------|-------|-------|
|                        | ULE%  | TPC%  | ULE%  | TPC%  | ULE%  | TPC%  | ULE%  | TPC%  | ULE%  | TPC%  |
| North America          | 42    | 65    | 164   | 63    | 47    | -8    | 163   | 29    | 360   | 154   |
| South & Central America| 48    | -7    | 166   | 28    | 58    | 106   | 166   | 8     | 386   | -14   |
| Europe                 | 61    | -3    | 191   | 0     | 85    | -32   | 192   | -23   | 404   | 40    |
| Russia                 | 48    | -37   | 179   | -16   | 74    | 2     | 171   | -40   | 373   | -31   |
| North Africa & Middle East | 67  | 42    | 222   | 94    | 104   | 206   | 206   | 116   | 427   | 44    |
| Africa                 | 155   | 154   | 419   | 260   | 238   | 438   | 341   | 419   | 701   | 147   |
| East & Central Asia    | 121   | -35   | 396   | -18   | 214   | 15    | 326   | -18   | 652   | -34   |
| South & Southeast Asia | 175   | 4     | 461   | 42    | 300   | 124   | 406   | 14    | 741   | 2     |
| Oceania                | 40    | 96    | 158   | 114   | 46    | 60    | 155   | 103   | 358   | 192   |
| Global Total           | 84    | 13    | 263   | 47    | 129   | 107   | 238   | 51    | 491   | 21    |