Supplementary Material

**Supplementary Table 1.** Polynomial fittings between local cool island intensity and cooling distance of PGS.

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| No. | The polynomial fitting | R2 | *P* | MLCII (℃) | MCD (m) |
| 1 | y = -5E-10x4 + 5E-07x3 - 0.0002x2 + 0.0242x - 0.3348 | R²=0.4996 | P<0.01 | 0.6 | 84.0 |
| 2 | y = 1E-12x5 - 2E-09x4 + 8E-07x3 - 0.0002x2 + 0.0079x + 0.1249 | R²=0.7735 | P<0.01 | 0.2 | 22.6 |
| 3 | y = 5E-08x3 - 4E-05x2 + 0.0057x - 0.2793 | R²=0.8595 | P<0.01 | -0.1 |  |
| 4 | y = 7E-12x4 + 1E-08x3 - 1E-05x2 + 0.0015x + 1.4591 | R²=0.2188 | P<0.05 | 1.5 | 87.4 |
| 5 | y = 1E-07x3 - 9E-05x2 + 0.0215x + 0.9093 | R²=0.6712 | P<0.01 | 2.5 | 164.6 |
| 6 | y = -5E-10x4 + 5E-07x3 - 0.0002x2 + 0.0167x - 0.3218 | R²=0.3796 | P<0.01 | 0.1 | 50.8 |
| 7 | y = 8E-08x3 - 6E-05x2 + 0.0135x + 0.72 | R²=0.5972 | P<0.01 | 1.7 | 170.9 |
| 8 | y = 2E-13x5 - 6E-10x4 + 5E-07x3 - 0.0002x2 + 0.0226x + 0.1875 | R²=0.4612 | P<0.01 | 0.9 | 75.3 |
| 9 | y = 7E-08x3 - 7E-05x2 + 0.0193x + 0.8245 | R²=0.6703 | P<0.01 | 2.4 | 194.7 |
| 10 | y = 6E-08x3 - 5E-05x2 + 0.0104x + 0.2227 | R²=0.3983 | P<0.01 | 0.9 | 138.6 |
| 11 | y = 1E-07x3 - 9E-05x2 + 0.0234x + 1.7593 | R²=0.5356 | P<0.01 | 3.6 | 190.5 |
| 12 | y = 6E-08x3 - 6E-05x2 + 0.0128x + 0.102 | R²=0.743 | P<0.01 | 0.9 | 133.3 |
| 13 | y = 4E-08x3 - 4E-05x2 + 0.0116x + 0.8709 | R²=0.7597 | P<0.01 | 1.9 | 213.1 |
| 14 | y = 4E-08x3 - 4E-05x2 + 0.0112x - 0.0535 | R²=0.461 | P<0.01 | 0.9 | 200.0 |
| 15 | y = -4E-13x5 + 2E-10x4 + 1E-07x3 - 7E-05x2 + 0.0103x + 0.6088 | R²=0.3744 | P<0.01 | 1.1 | 98.5 |
| 16 | y = 3E-08x3 - 3E-05x2 + 0.0049x - 0.0949 | R²=0.4347 | P<0.01 | 0.1 | 95.3 |
| 17 | y = -2E-06x2 + 0.0002x + 0.2287 | R²=0.1739 | P<0.05 | 0.2 | 50.0 |
| 18 | y = 7E-08x3 - 4E-05x2 + 0.0027x + 0.5005 | R²=0.5971 | P<0.01 | 0.5 | 37.4 |
| 19 | y = 1E-12x5 - 2E-09x4 + 7E-07x3 - 0.0002x2 + 0.0116x + 0.3168 | R²=0.3115 | P<0.01 | 0.5 | 34.4 |
| 20 | y = 6E-08x3 - 6E-05x2 + 0.0163x + 0.8875 | R²=0.612 | P<0.01 | 2.2 | 190.0 |
| 21 | y = 4E-08x3 - 4E-05x2 + 0.0108x + 1.1383 | R²=0.6317 | P<0.01 | 2.0 | 188.0 |
| 22 | y = 6E-08x3 - 5E-05x2 + 0.01x - 0.3213 | R²=0.3541 | P<0.01 | 0.3 | 130.8 |
| 23 | y = 4E-08x3 - 5E-05x2 + 0.015x - 0.5305 | R²=0.5597 | P<0.01 | 0.8 | 196.2 |
| 24 | y = 2E-12x5 - 3E-09x4 + 1E-06x3 - 0.0002x2 + 0.0159x + 0.6132 | R²=0.2748 | P<0.05 | 1.0 | 61.5 |
| 25 | y = 1E-07x3 - 0.0001x2 + 0.0198x + 0.8813 | R²=0.5513 | P<0.01 | 2.0 | 120.9 |
| 26 | y = 6E-08x3 - 6E-05x2 + 0.0154x + 0.6109 | R²=0.7169 | P<0.01 | 1.8 | 173.5 |
| 27 | y = 6E-08x3 - 5E-05x2 + 0.0124x - 0.0726 | R²=0.6571 | P<0.01 | 0.9 | 186.8 |
| 28 | y = 8E-14x5 - 6E-10x4 + 6E-07x3 - 0.0002x2 + 0.0209x - 0.2497 | R²=0.8368 | P<0.01 | 0.4 | 75.1 |
| 29 | y = -1E-10x4 + 1E-07x3 - 6E-05x2 + 0.0104x - 0.1316 | R²=0.4169 | P<0.01 | 0.3 | 84.6 |
| 30 | y = 1E-07x3 - 9E-05x2 + 0.017x + 0.102 | R²=0.7897 | P<0.01 | 1.0 | 117.4 |
| 31 | y = -8E-06x2 + 0.0024x - 0.5331 | R²=0.6542 | P<0.01 | -0.4 |  |
| 32 | y = 1E-07x3 - 0.0001x2 + 0.0267x - 0.0562 | R²=0.8538 | P<0.01 | 2.1 | 184.6 |
| 33 | y = 7E-08x3 - 6E-05x2 + 0.0138x + 0.3833 | R²=0.5001 | P<0.01 | 1.3 | 159.5 |
| 34 | y = 1E-07x3 - 9E-05x2 + 0.0245x + 0.1483 | R²=0.894 | P<0.01 | 2.3 | 208.7 |
| ~~35~~ | y = 2E-07x3 - 0.0002x2 + 0.0281x + 0.2709 | R²=0.8274 | P<0.01 | 1.3 | 79.8 |
| 36 | y = 2E-14x5 - 1E-10x4 + 1E-07x3 - 4E-05x2 + 0.0067x + 1.9165 | R²=0.2946 | P<0.01 | 2.3 | 160.5 |
| 37 | y = 1E-07x3 - 0.0001x2 + 0.025x + 0.9554 | R²=0.8613 | P<0.01 | 2.8 | 166.7 |
| 38 | y = 6E-08x3 - 5E-05x2 + 0.0108x + 0.2373 | R²=0.4916 | P<0.01 | 0.9 | 146.8 |
| 39 | y = 7E-08x3 - 7E-05x2 + 0.0202x + 1.4535 | R²=0.7928 | P<0.01 | 3.3 | 211.2 |

**Supplementary Table 2.** The calculation and description of landscape metrics.

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| Landscape metrics | Calculation | Description | Level |
| Patch density (PD) | *PDi=ni/A* | It measures the spatial heterogeneity of the landscape. | C,L |
| Edge density (ED) |  | It is a measure of shape complexity. | C,L |
| Landscape Shape Index (LSI) |  | It measures the irregularity of landscape shape | C,L |
| Aggregation Index (AI) |  | It refers to the frequency with which differnent pairs of patch types (including like adjacencies between the same patch type) appear side-by-side on the map. | C,L |
| Euclidean Nearest Neighbor Distance (ENN\_MN) | *ENN=hij, ENN\_MN* is the mean value of *ENN.* | The nearest neighbor distance is defined using simple Euclidean geometry as the shortest straight-line distance between the focal patch and its nearest neighbor of the same class. It is used extensively to quantify patch isolation. | C,L |
| Contagion (CONTAG) |  | It measures the extent to which patches are spatially aggregated in the landscape, and describes the heterogeneity of a landscape. | L |
| Shannon’s Diversity  Index (SHDI) |  | A measure of patch diversity in a landscape that is determined by both the number of different patch types and the proportional distribution of area among patch types. | L |
| Shannon’s Evenness  Index (SHEI) |  | It is expressed such that an even distribution of area among patch types results in maximum evenness, and it measures the relative abundance of different patch types. | L |
| Percentage of Landscape (PLAND) |  | It quantifies the proportional abundance of each patch type in the landscape, and indicates the landscape composition. | C |
| Clumpiness Index (CLUMPY) |  | It shows the frequency with which different pairs of patch types (including like adjacencies between the same patch type) appear side-by-side on the map. | C |

Note: *ni* is the number of patches in the landscape for patch type (class) *i. eij* is the total length of edges. *A* is the total area of the landscape for patch type (class). *aij* is the area of patch *ij*. *hij*is distance (m) from patch *ij* to nearest neighboring patch of the same type (class), based on patch edge-to-edge distance, computed from cell center to cell center. *pi* is proportion of the landscape occupied by patch type (class) *i. Gi* is proportion of like adjacencies, *m* is the number of patch types (classes) present in the landscape*.* *gik* is the number of adjacencies (joins) between pixels of patch types (classes) *i* and *k* based on the double-count method. *gii* is number of like adjacencies (joins) between pixels of patch type (class) i based on the single-count method. C and L means the metrics are available at the class level and landscape level respectively. C, L means the metrics are available at both levels.