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) | $$ED=\sum\_{j=1}^{m}e\_{ij}/A$$ | It is a measure of shape complexity. | C,L |
| Landscape Shape Index (LSI) | $$LSI\_{i}=0.25\sum\_{j=1}^{n}e\_{ij}/\sqrt{A}$$ | It measures the irregularity of landscape shape  | C,L |
| Aggregation Index (AI) | $$AI=\left[\frac{g\_{ii}}{max\rightarrow g\_{ii}}\right]$$ | 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) | $$CONTAG=\left[1+\frac{\sum\_{i=1}^{m}\sum\_{k=1}^{m}\left[(p\_{i})\left(\frac{g\_{ik}}{\sum\_{k=1}^{m}g\_{ik}}\right)\right]×\left[ln\left((p\_{i})\frac{g\_{ik}}{\sum\_{k=1}^{m}g\_{ik}}\right)\right]}{2ln(m)}\right]×100$$ | It measures the extent to which patches are spatially aggregated in the landscape, and describes the heterogeneity of a landscape. | L |
| Shannon’s DiversityIndex (SHDI) | $$SHDI=-\sum\_{i=1}^{m}(p\_{i}×lnp\_{i})$$ | 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 EvennessIndex (SHEI) | $$SHEI=-^{\sum\_{i=1}^{m}(p\_{i}×lnp\_{i})}/\_{ln⁡(m)}$$ | 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) | $$PLAND=P\_{i}=\frac{\sum\_{j=1}^{n}a\_{ij}}{A}×100$$ | It quantifies the proportional abundance of each patch type in the landscape, and indicates the landscape composition. | C |
| Clumpiness Index (CLUMPY) | $$CLUMPY=\left[\begin{matrix}\frac{G\_{i}-p\_{i}}{1-p\_{i}} for G\_{i}>P\_{i} \\\frac{G\_{i}-p\_{i}}{1-p\_{i}} for G\_{i}<P\_{i }; p\_{i}\geq 0.5\\\frac{G\_{i}-p\_{i}}{-p\_{i}} for G\_{i}<P\_{i }; p\_{i}<0.5\end{matrix}\right]$$ | 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.