

Supplementary file

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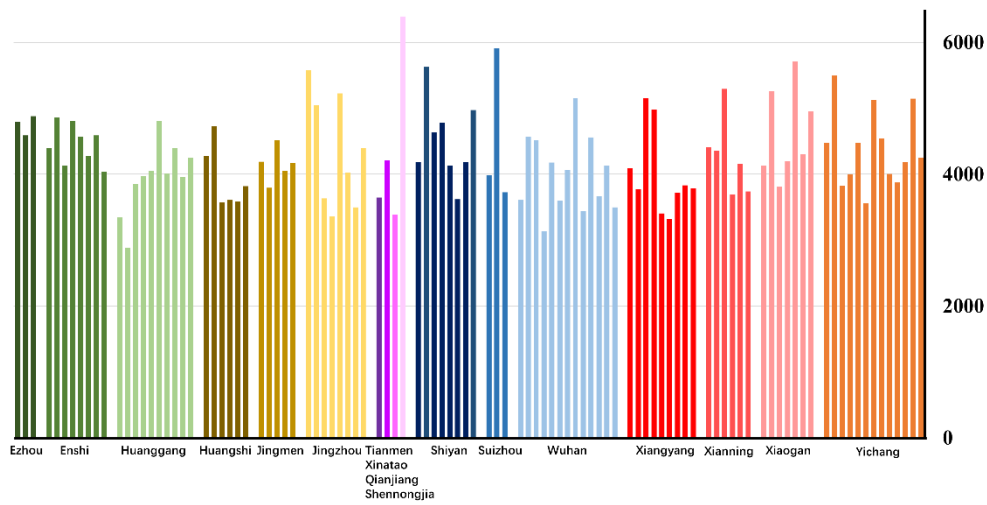


Figure S1 Sample size of 103 areas (17 cities).

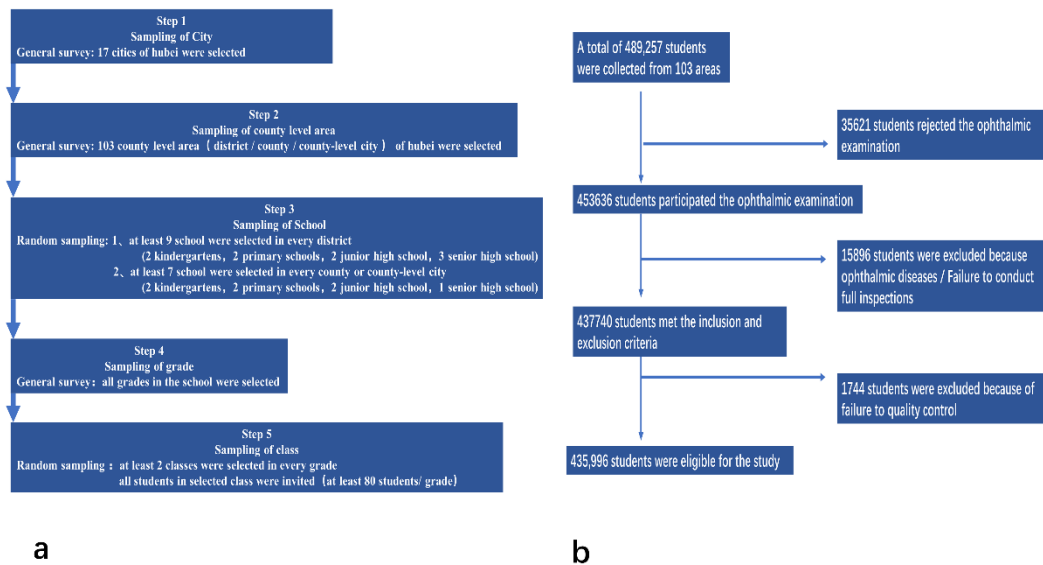


Figure S2 Sampling steps. (a) sampling methods; (b) flow diagram

- Sampling of cities: census, including 17 cities (103 county-level administrative districts) in Hubei
- Sampling of Schools: random sampling, the education and CDC departments of each survey site selected at least 2 kindergartens, 2 elementary schools, 2 junior high schools, and 1-3 senior high schools.
- Survey grades: census, all grades in each school were included.
- Survey Classes: random sampling, at least 2 classes per grade were selected. At least 80 people participated in each grade.

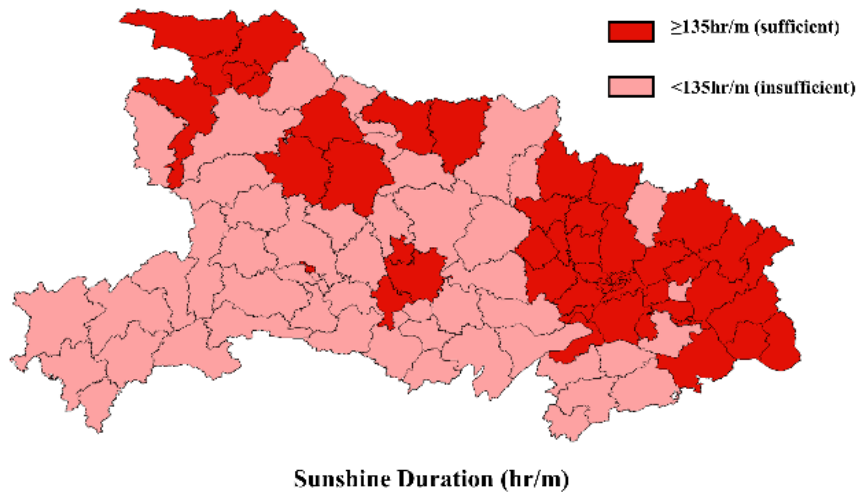


Figure S3 Distribution of sunshine in 103 county-level administrative districts in Hubei Province. Red areas show areas with good sunshine ($\geq 135\text{hr/m}$) Pink areas show areas with poor sunshine ($< 135\text{hr/m}$).

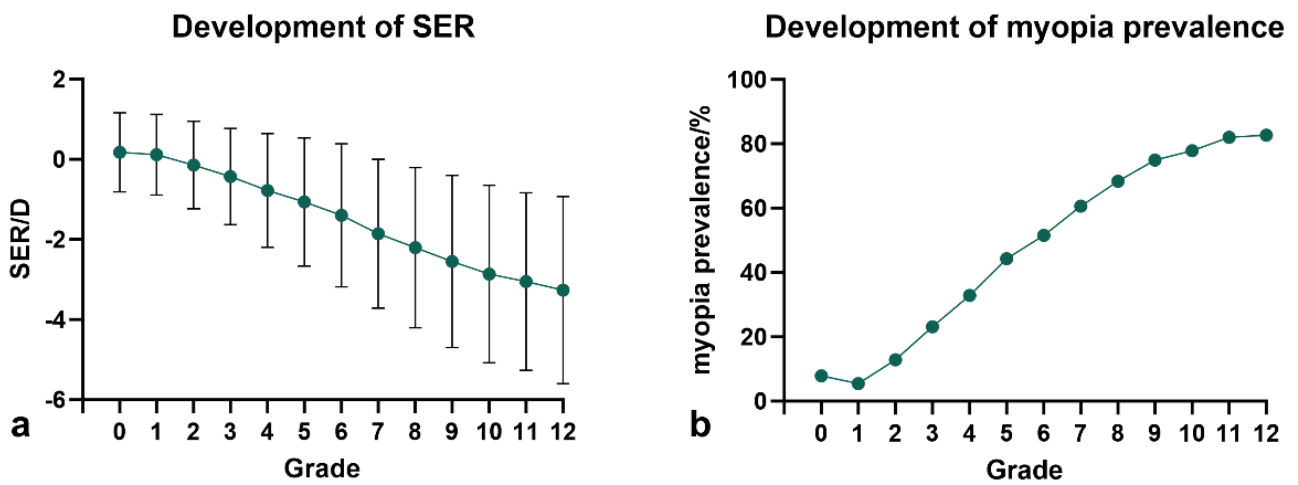


Figure S4 Development of SER and prevalence by grade. **(a)** SER; **(b)** Prevalence.

Table S1. Geographic and social information of 103 survey sites

| Area | City | Type | Long. /E° | Lat. /N° | Temp./ °C | Rain/ (mm/y) | Alt./ m | Per Cpita GDP /RMB | Sunshine Duration (hr/m) |
|--------------|-----------|-------------------|--------------|-------------|--------------|-----------------|------------|-----------------------------|--------------------------------|
| Echeng | Ezhou | District | 114.89 | 30.40 | 17 | 1282.8 | 28 | 100122 | 140.6 |
| Huarong | Ezhou | District | 114.73 | 30.53 | 17 | 1315 | 29 | 135155 | 143.1 |
| Liangzihu | Ezhou | District | 114.68 | 30.10 | 17 | 1330 | 53 | 64527 | 138.2 |
| Badong | Enshi | District | 110.34 | 31.04 | 17.5 | 1500 | 263 | 31328 | 100.8 |
| Enshi | Enshi | County-level city | 109.48 | 30.29 | 15.5 | 1450 | 477 | 34116 | 128.4 |
| Hefeng | Enshi | County | 110.03 | 29.89 | 15.5 | 1701 | 540 | 33063 | 93.7 |
| Jianshi | Enshi | County | 109.72 | 30.60 | 15.5 | 1700 | 580 | 29309 | 130.2 |
| Laifeng | Enshi | County | 109.41 | 29.49 | 15.8 | 1400 | 455 | 41003 | 106.4 |
| Lichuan | Enshi | County-level city | 108.91 | 30.21 | 12.9 | 1400 | 1083 | 21204 | 126.3 |
| Xianfeng | Enshi | County | 109.14 | 29.67 | 16 | 1320 | 821 | 32163 | 97.5 |
| Xuanen | Enshi | County | 109.49 | 29.99 | 15.8 | 1491.3 | 592 | 27447 | 91.2 |
| Hong'an | Huanggang | County | 114.62 | 31.29 | 15.7 | 1116.2 | 67 | 32160 | 131.5 |
| Huangmei | Huanggang | County | 115.94 | 30.07 | 16.8 | 1270 | 22 | 30053 | 141.5 |
| Huangzhou | Huanggang | District | 114.88 | 30.43 | 17.5 | 1233 | 22 | 55597 | 132.9 |
| Luotian | Huanggang | County | 115.40 | 30.78 | 16.4 | 1330 | 85 | 29656 | 143.7 |
| Macheng | Huanggang | County-level city | 115.01 | 31.17 | 16.1 | 1291.5 | 56 | 33763 | 146.2 |
| Qichun | Huanggang | County | 115.44 | 30.23 | 16.8 | 1341.7 | 25 | 41051 | 143.8 |
| Tuanfeng | Huanggang | County | 114.87 | 30.64 | 16.8 | 1233 | 18 | 31275 | 138.9 |
| Wuxue | Huanggang | County-level city | 115.56 | 29.84 | 16.8 | 1360 | 21 | 63208 | 137.8 |
| Xishui | Huanggang | County | 115.27 | 30.45 | 16.9 | 1300 | 17 | 34457 | 146.7 |
| Yingshan | Huanggang | County | 115.68 | 30.73 | 16.4 | 1403 | 133 | 32286 | 146.0 |
| Daye | Huangshi | County-level city | 114.98 | 30.10 | 16.9 | 1385.8 | 20 | 80701 | 134.9 |
| Huangshigang | Huangshi | District | 115.07 | 30.22 | 17 | 1382.6 | 32 | 86341 | 139.2 |
| Tieshan | Huangshi | District | 114.90 | 30.21 | 17 | 1382.6 | 91 | 62519 | 137.0 |
| Xisaishan | Huangshi | District | 115.11 | 30.20 | 17 | 1382.6 | 10 | 111603 | 137.5 |
| Xialu | Huangshi | District | 114.96 | 30.17 | 16.9 | 1382.9 | 40 | 29454 | 137.2 |
| Yangxin | Huangshi | County | 115.22 | 29.83 | 16.8 | 1389.6 | 10 | 32423 | 135.6 |
| Dongbao | Jingmen | District | 112.20 | 31.05 | 16.1 | 977.4 | 101 | 136555 | 134.6 |
| Duodao | Jingmen | District | 112.21 | 30.97 | 15.9 | 1089.68 | 126 | 79030 | 137.1 |
| Jingshan | Jingmen | County-level city | 113.12 | 31.02 | 16.3 | 1179 | 101 | 93663 | 134.4 |
| Shayang | Jingmen | County | 112.59 | 30.71 | 16.1 | 1025.6 | 38 | 56883 | 135.2 |
| Zhongxiang | Jingmen | County-level city | 112.59 | 31.17 | 16.2 | 1200 | 62 | 60529 | 134.4 |
| Gong'an | Jingzhou | County | 112.23 | 30.06 | 16.4 | 1125.2 | 29 | 37563 | 133.2 |
| Honghu | Jingzhou | County-level city | 113.48 | 29.83 | 16.6 | 1195.8 | 23 | 33248 | 131.1 |

| | | | | | | | | | |
|-------------|-------------|-------------------|--------|-------|-------|--------|------|--------|-------|
| Jianli | Jingzhou | County-level city | 112.90 | 29.81 | 16.3 | 1200 | 28 | 30618 | 128.5 |
| Jiangling | Jingzhou | County | 112.42 | 30.04 | 16.2 | 1000 | 30 | 35300 | 128.6 |
| Jingzhou | Jingzhou | District | 112.19 | 30.35 | 16.5 | 1094.5 | 34 | 49777 | 136.9 |
| Shashi | Jingzhou | District | 112.26 | 30.31 | 16.1 | 1141.5 | 31 | 121704 | 134.7 |
| Shishou | Jingzhou | County-level city | 112.43 | 29.72 | 16.3 | 1200 | 30 | 38687 | 125.4 |
| Songzi | Jingzhou | County-level city | 111.76 | 30.17 | 16.5 | 1175 | 61 | 45851 | 125.8 |
| Qianjiang | Qianjiang | County-level city | 112.90 | 30.40 | 16.1 | 1110 | 32 | 81338 | 101.0 |
| Shennongjia | Shennongjia | County-level city | 110.68 | 31.74 | 11.6 | 1219.9 | 1817 | 6877 | 130.2 |
| Danjiangkou | Shiyan | County-level city | 111.51 | 32.54 | 16.1 | 796.8 | 114 | 70935 | 132.3 |
| Fang | Shiyan | County | 110.73 | 32.04 | 14.2 | 914 | 441 | 25834 | 126.0 |
| Maojian | Shiyan | District | 110.81 | 32.59 | 15.3 | 884.9 | 220 | 87707 | 136.1 |
| Xunxi | Shiyan | County | 110.43 | 32.99 | 15.4 | 796 | 231 | 17090 | 143.2 |
| Xunyang | Shiyan | District | 110.81 | 32.83 | 15.8 | 824 | 179 | 24871 | 141.8 |
| Zhangwan | Shiyan | District | 110.77 | 32.65 | 15.25 | 1000.8 | 238 | 124462 | 140.7 |
| Zhushan | Shiyan | County | 110.23 | 32.22 | 16.7 | 905.2 | 287 | 27385 | 139.7 |
| Zhuxi | Shiyan | County | 109.72 | 32.32 | 14 | 1000 | 458 | 32524 | 130.9 |
| Zengdu | Suizhou | District | 113.37 | 31.72 | 15.7 | 967 | 72 | 80828 | 132.3 |
| Guangshui | Suizhou | County-level city | 113.83 | 31.62 | 15.5 | 990 | 74 | 44410 | 136.1 |
| Sui | Suizhou | County | 113.30 | 31.85 | 15.4 | 960 | 86 | 40417 | 133.0 |
| Tianmen | Tianmen | County-level city | 113.17 | 30.66 | 16.2 | 1101.4 | 26 | 49743 | 108.8 |
| Caidian | Wuhan | District | 114.03 | 30.58 | 17.1 | 1302.4 | 26 | 97223 | 138.9 |
| Dongxihu | Wuhan | District | 114.14 | 30.62 | 17.3 | 1107.3 | 28 | 162000 | 140.0 |
| Hannan | Wuhan | District | 114.08 | 30.31 | 16.5 | 1179.4 | 16 | 127998 | 136.9 |
| Hanyang | Wuhan | District | 114.22 | 30.55 | 16.6 | 1300 | 28 | 83488 | 140.1 |
| Hongshan | Wuhan | District | 114.34 | 30.50 | 16.3 | 1170 | 21 | 61232 | 141.2 |
| Huangpi | Wuhan | District | 114.38 | 30.88 | 17.3 | 1202 | 25 | 79048 | 143.8 |
| Jiang'an | Wuhan | District | 114.28 | 30.59 | 16.3 | 1224.2 | 15 | 129192 | 141.1 |
| Jianghan | Wuhan | District | 114.27 | 30.60 | 16 | 1300 | 27 | 209899 | 140.4 |
| Jiangxia | Wuhan | District | 114.32 | 30.38 | 16.8 | 1347.7 | 21 | 111474 | 137.9 |
| Qiaokou | Wuhan | District | 114.27 | 30.57 | 16.3 | 1300 | 31 | 129001 | 140.2 |
| Qingshan | Wuhan | District | 114.39 | 30.64 | 16.8 | 1170 | 29 | 164360 | 140.7 |
| Wuchang | Wuhan | District | 114.32 | 30.55 | 16.6 | 1269 | 18 | 136621 | 140.2 |
| Xinzhou | Wuhan | District | 114.80 | 30.84 | 16.7 | 1333.4 | 31 | 74787 | 147.8 |
| Xiantao | Xiantao | County-level city | 113.45 | 30.36 | 17 | 1238.6 | 24 | 77829 | 100.2 |
| Chibi | Xianning | County-level city | 113.90 | 29.72 | 16.9 | 1429 | 39 | 81382 | 129.9 |
| Chongyang | Xianning | County | 114.04 | 29.56 | 16.6 | 1395 | 56 | 32792 | 133.1 |
| Jiayu | Xianning | County | 113.94 | 29.97 | 17.3 | 1431 | 30 | 83331 | 146.4 |
| Tongcheng | Xianning | County | 113.82 | 29.25 | 17.1 | 1556 | 101 | 35180 | 132.4 |
| Tongshan | Xianning | County | 114.48 | 29.61 | 16.3 | 1500 | 143 | 34137 | 133.5 |
| Xian'an | Xianning | District | 114.30 | 29.85 | 17.2 | 1600 | 61 | 62058 | 131.4 |

| | | | | | | | | | |
|------------|-----------|-------------------|--------|-------|------|--------|-----|--------|-------|
| Baokang | Xiangyang | County | 111.26 | 31.88 | 15 | 934.6 | 437 | 61475 | 136.4 |
| Fancheng | Xiangyang | District | 112.14 | 32.04 | 15.5 | 878.3 | 69 | 85864 | 126.6 |
| Gucheng | Xiangyang | County | 111.65 | 32.26 | 15.4 | 1000 | 83 | 72456 | 138.7 |
| Laohekou | Xiangyang | County-level city | 111.68 | 32.36 | 15.3 | 838.1 | 93 | 83308 | 134.8 |
| Nanzhang | Xiangyang | County | 111.84 | 31.77 | 16 | 940 | 105 | 55324 | 137.1 |
| Xiangcheng | Xiangyang | District | 112.13 | 32.01 | 15.5 | 960 | 75 | 78808 | 126.5 |
| Xiangzhou | Xiangyang | District | 112.21 | 32.09 | 15.5 | 878.3 | 74 | 85894 | 140.0 |
| Yicheng | Xiangyang | County-level city | 112.26 | 31.72 | 15.5 | 900 | 54 | 71010 | 131.1 |
| Zaoyang | Xiangyang | County-level city | 112.77 | 32.13 | 15.5 | 840 | 115 | 58050 | 137.8 |
| Anlu | Xiaogan | County-level city | 113.69 | 31.26 | 15.8 | 1117 | 52 | 45525 | 144.7 |
| Dawu | Xiaogan | County | 114.13 | 31.56 | 15.4 | 1114.9 | 80 | 31704 | 143.1 |
| Hanchuan | Xiaogan | County-level city | 113.84 | 30.66 | 16.2 | 1224.9 | 25 | 55662 | 139.8 |
| Xiaochang | Xiaogan | County | 114.00 | 31.26 | 16.1 | 1130 | 60 | 26423 | 141.1 |
| Xiaonan | Xiaogan | District | 113.91 | 30.92 | 16.2 | 1146 | 36 | 36617 | 136.0 |
| Yingcheng | Xiaogan | County-level city | 113.56 | 30.94 | 16 | 1033 | 27 | 49882 | 141.3 |
| Yunmeng | Xiaogan | County | 113.75 | 31.02 | 16 | 1074.5 | 29 | 51475 | 140.4 |
| Dangyang | Yichang | County-level city | 111.79 | 30.82 | 16.6 | 992.1 | 66 | 129049 | 117.1 |
| Dianjun | Yichang | District | 111.27 | 30.69 | 16.8 | 1213.6 | 59 | 66467 | 120.4 |
| Wufeng | Yichang | County | 110.67 | 30.20 | 15.3 | 1652 | 351 | 33072 | 108.1 |
| Wujiagang | Yichang | District | 111.36 | 30.64 | 16.5 | 1198.1 | 63 | 92669 | 121.3 |
| Xiling | Yichang | District | 111.29 | 30.71 | 16.8 | 1164.1 | 87 | 75267 | 135.5 |
| Xiaoting | Yichang | District | 111.43 | 30.53 | 17.7 | 1102.5 | 108 | 206030 | 119.8 |
| Xingshan | Yichang | County | 110.75 | 31.35 | 15.3 | 1050 | 232 | 83305 | 123.8 |
| Yiling | Yichang | District | 111.33 | 30.77 | 16.7 | 1173 | 84 | 158677 | 120.7 |
| Yidu | Yichang | County-level city | 111.45 | 30.38 | 16.7 | 1235.4 | 61 | 194121 | 106.5 |
| Yuan'an | Yichang | County | 111.64 | 31.06 | 16 | 1050 | 114 | 122738 | 122.5 |
| Changyang | Yichang | County | 111.21 | 30.47 | 16.5 | 1366.2 | 141 | 35411 | 115.3 |
| Zhijiang | Yichang | County-level city | 111.76 | 30.43 | 16.5 | 1041.8 | 44 | 127143 | 124.8 |
| Zigui | Yichang | County | 110.98 | 30.83 | 16.8 | 1811.6 | 141 | 38773 | 120.6 |

Table S2 Demographic information

| Variables | N | Mean | SD |
|---|--|---------------------------------|------|
| Age | 435996 | 12.16 | 3.74 |
| Gender (Male/Female) | | 232527(53.33%) / 203469(46.67%) | |
| Spherical Equivalent Refraction (Diopters) | 435996 | -1.58 | 2.14 |
| Education levels (kindergarten/primary/junior/senior) | 24461(5.61%) / 195476(44.84%) / 100068(22.95%) / 115791(26.56) | | |
| Myopia prevalences (kindergarten/primary/junior/senior) | 7.9%/28.9%/67.8%/80.7% | | |
| Grade | 435996 | 6.32 | 3.68 |

Table S3 Geographic division of Hubei

| Area | City (N=17) |
|------------|--|
| Northeast | Wuhan, Xiaogan and Huanggang. |
| Southeast | Ezhou, Huangshi, Xianning, Jingzhou, Xiantao, Tianmen, Qianjiang |
| Northwest: | Suizhou, Jingmen, Xiangyang, Shiyan, Shennongjia |
| Southwest | Yichang City, Enshi |

Table S4 Comparison of Variables associated with the establishment of myopia

| Variables | Myopia | Non-myopia | P value ^a |
|--------------------------------|-----------------|-----------------|----------------------|
| Sample/N | 219749 | 216247 | |
| Age (year) | 14.12±2.87 | 10.16±3.44 | <.0001 |
| Gender (Male/Female) | 50.90% / 49.10% | 55.80% / 44.20% | <0.001 |
| Grade | 8.30±2.87 | 4.32±3.31 | <0.001 |
| Average GDP (RMB) | 71646 | 75128 | <0.001 |
| Living area (district / other) | 33.0% / 67.0% | 29.4% / 70.6% | <0.001 |
| SER (D) | -3.12±1.81 | -0.02±1.01 | <0.001 |
| Sunshine duration (hr/m) | 131.97±11.23 | 132.41±11.07 | <0.001 |
| Sunshine duration (≥135hr/m) | 52.7% | 56.7% | <0.001 |
| Longitude (°) | 112.70±1.79 | 112.94±1.72 | <0.001 |
| Latitude (°) | 30.87±0.87 | 30.77±0.82 | <0.001 |
| Altitude (m) | 137.84±211.78 | 119.52±201.99 | <0.001 |
| Temperature (°C) | 16.19±0.87 | 16.27±0.81 | <0.001 |
| Precipitation (mm/y) | 1194.03±212.22 | 1216.04±201.67 | <0.001 |

^a For categorical variables, a χ^2 test was used; For continuous variables, a t test was used.

Table S5 Comparison of SD under different geographic conditions

| Factors | Groups | Sunlight duration hr/m (median) | K-W | P value^a |
|-------------------------|---------------|--|------------|----------------------------|
| longitude/E° | W:108.5~111 | 126.30 | 44.14 | <0.001 |
| | C:111~113.5 | 131.10 | | |
| | E:113.5~116 | 140.08 | | |
| latitude/N° | N:31.6~33.0 | 132.42 | 4.06 | 0.132 |
| | C:30.3~31.6 | 136.91 | | |
| | S:29~30.3 | 136.08 | | |
| temperature/°C | <16 | 131.91 | 1.96 | 0.375 |
| | 16~17 | 136.46 | | |
| | >17 | 132.88 | | |
| altitude/m | <200 | 136.08 | 7.08 | 0.028 |
| | 200~500 | 129.65 | | |
| | >500 | 111.90 | | |
| precipitation/mm | <1000 | 134.80 | 6.47 | 0.0390 |
| | 1000~1500 | 136.46 | | |
| | >1500 | 125.43 | | |

^aP values were calculated using Kruskal-Wallis test.

Table S6 Global spatial analysis of geographic data and SD

| Factors | Global Bivariate Moran's I (Sunlight duration-factors) | P value^a |
|----------------------|---|----------------------------|
| longitude | 0.571 | <0.001 |
| latitude | 0.191 | <0.001 |
| temperature | 0.126 | 0.012 |
| altitude | -0.334 | <0.001 |
| precipitation | -0.204 | <0.001 |

^aP values were calculated using Z test.