1. **Evaluation of spatial non-stationarity**

We assessed the spatial stationarity of our demographic change models by comparing the predictive power of GWR models (non-stationary) with ordinary least square (OLS) regression models (stationary). In order to detect potential spurious correlations between climatic and non-climatic variables, we contrasted the spatial patterns of variable influences between models with climatic variables (GWRC, OLSC), non-climatic variables (GWRNC, OLSNC), or both (GWRC+NC, OLSC+NC). We used Akaike Information Criterion adjusted for small sample size (AICc) [[1](#_ENREF_1)]to evaluate the fit of each model (Table S1). The figures in the main text are all based on the GWRC+NC models and the results from the GWRC and the GWRNC models can be found in Fig. S2 and Fig. S3.

Table S1. **Model selection with Akaike information criterion (AIC) of stationary (OLS) and non-stationary (GWR) regression models predicting demographic growth rates for 2728 U.S. counties in the 20th century based on climatic (C) and/or non-climatic (NC) predictors.** The AICc weigths of the GWRC+NC models were always one across all temporal horizons. The non-stationary nature of GWR was taken into account by adjusting the number of effective parameters (ranges of effective parameters across temporal horizons: GWRC+NC = 63.3-65.2; GWRC = 33.1-33.8; GWRNC = 22.9-39.8).

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| Predictive model | | 1901-1920 | | | 1921-1940 | | | 1941-1960 | | | 1961-1980 | | | 1981-2000 | | | |
|  | Adj-R2 | | AICc | ΔAICc | Adj-R2 | AICc | ΔAICc | Adj-R2 | AICc | ΔAICc | Adj-R2 | AICc | ΔAICc | | Adj-R2 | AICc | ΔAICc |
| GWRC+NC | 0.57 | | -14067 | 0 | 0.49 | -15767 | 0 | 0.55 | -17038 | 0 | 0.61 | -18581 | 0 | | 0.66 | -19629 | 0 |
| GWRC | 0.38 | | -13081 | 986 | 0.39 | -15316 | 451 | 0.38 | -16199 | 838 | 0.37 | -17271 | 1309 | | 0.37 | -17992 | 1636 |
| GWRNC | 0.49 | | -13674 | 393 | 0.34 | -15148 | 619 | 0.33 | -16003 | 1035 | 0.48 | -17724 | 856 | | 0.54 | -18829 | 799 |
| OLSC+NC | 0.37 | | -13075 | 992 | 0.21 | -14661 | 1106 | 0.27 | -15801 | 1237 | 0.39 | -17407 | 1173 | | 0.45 | -18403 | 1225 |
| OLSC | 0.17 | | -12346 | 1720 | 0.19 | -14580 | 1188 | 0.15 | -15420 | 1617 | 0.18 | -16618 | 1963 | | 0.20 | -17393 | 2236 |
| OLSNC | 0.35 | | -13020 | 1047 | 0.12 | -14373 | 1394 | 0.06 | -15132 | 1906 | 0.07 | -16316 | 2265 | | 0.13 | -17180 | 2448 |

Literature cited

1. Anderson DR, Link WA, Johnson DH, Burnham KP (2001) Suggestions for presenting the results of data analyses. Journal of Wildlife Management 65: 373-378.