Supporting Information

McGuire et al. 10.1073/pnas.1602817113

SI Methods

Climate Linkage Mapper Toolbox requires that several parameters are set: distances between patches, temperature differences between patches, and temperature-distance weight. For two patches to be connected, we required the destination patch to be within 2–100 km. The low value, 2 km, is the shortest possible distance between two patches, given that we are working at a 1-km resolution. The high value, 100 km, represents a long, but reasonable, planning unit. We also calculated success rates using shorter, 10-km corridors because these lengths may be more realistic for some planning purposes.

We required that the average temperature of the pixels within a destination patch must be cooler than the pixels of the origin patch by 0.1 °C. This choice differs from the choice of Nuñez et al. (20), who required the minimum temperature (mean temperature − 2 SD) between patches to differ by at least 1 °C. Our approach was better suited to our climate-partitioned patches because we did not need to compensate for large temperature variation within patches. Moreover, requiring 1 °C temperature differences meant that thousands of patches would have been left unconnected (Fig. S6*A*). Thus, we compared the average temperatures within our climate-partitioned patches. We examined climate corridors in peninsular Florida to determine the minimum climate difference necessary to increase connectivity (Fig. S6*B*). Our goal was to maximize connectivity across the contiguous United States, therefore maximizing the opportunities for achieving climate connectivity. We lowered the threshold to 0.1 °C to allow as many patches as possible to be included in our ultimate network.

We selected the same temperature-distance weight of 50 km per 1 °C as Nuñez et al. (20). This weight penalizes temperature changes relative to the cost value for distance traveled, so that corridors avoid excessive temperature changes between origin and destination patches.

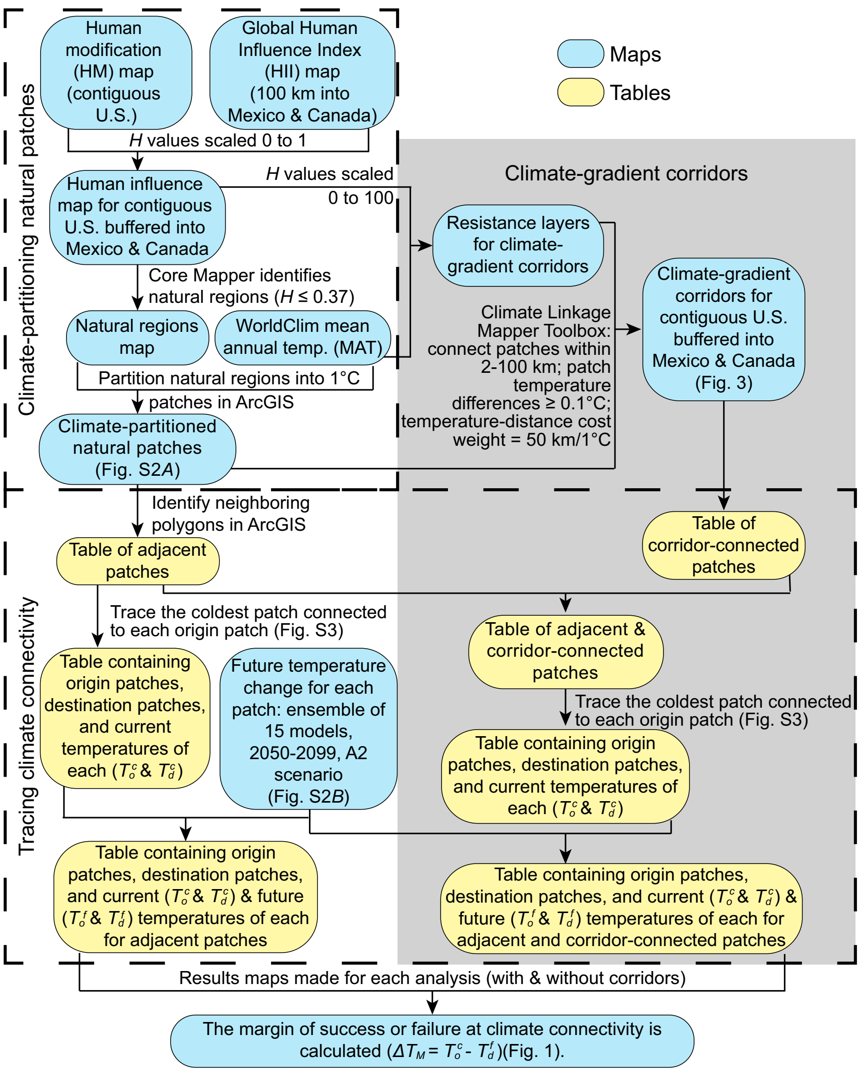

Fig. S1. Methods flow chart. Blue boxes are map products; yellow boxes are data tables. Dashed lines indicate major processing stages. Climate-gradient corridor creation and analyses are highlighted in gray.

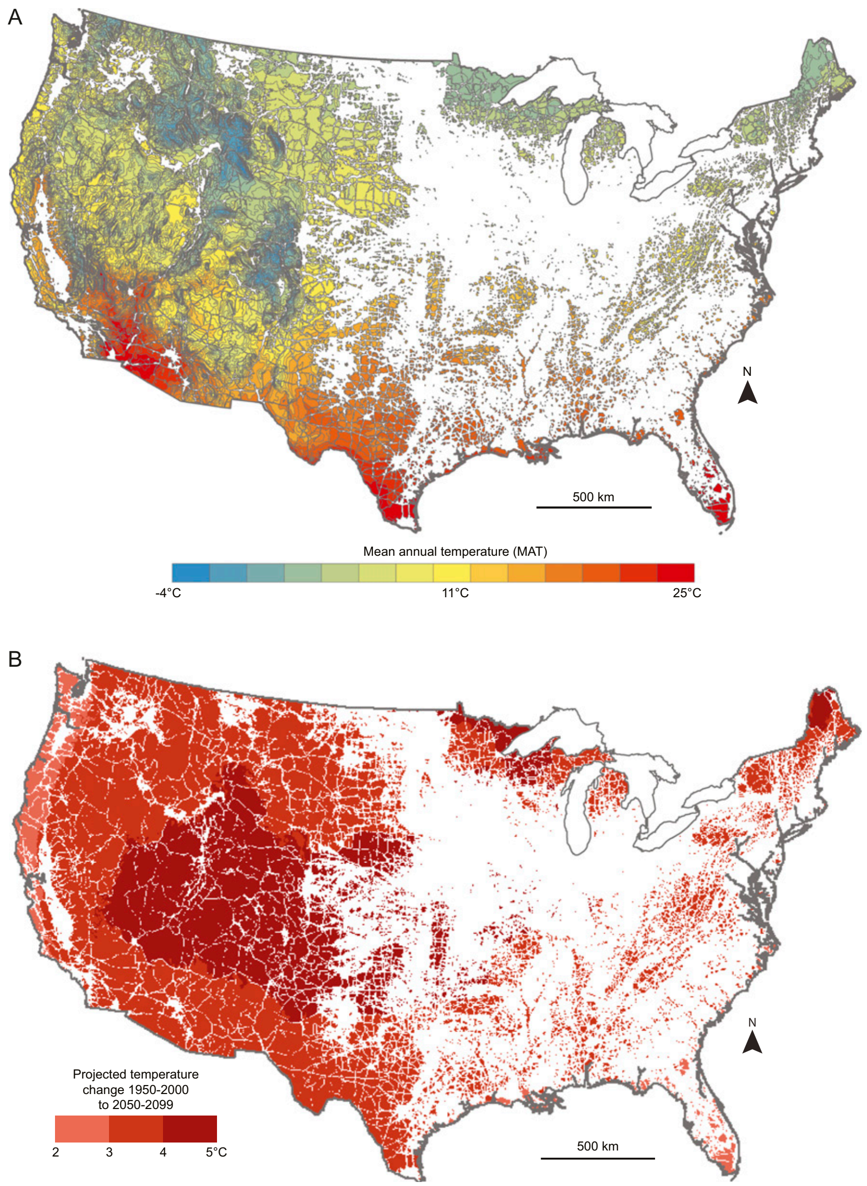

Fig. S2. Climate maps. (*A*) Final climate-partitioned, natural patches. (*B*) One hundred-year change in patch temperature. This map displays the difference between current (1950–2000) and future (2050–2099) temperatures. Temperatures are based on the mean ensemble of 15 climate projection models (19). Future models use the A2 emissions scenario (18).

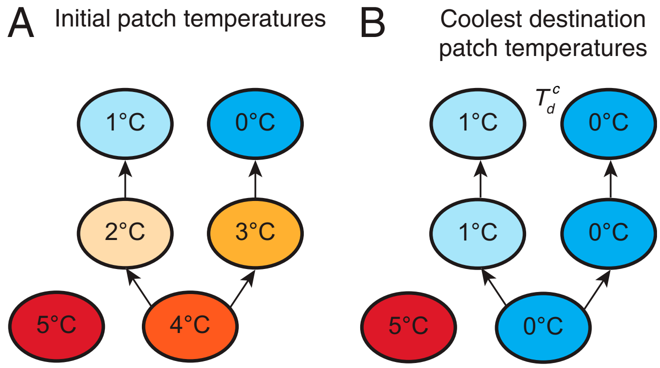

Fig. S3. Theoretical network of patches, demonstrating the calculation of coolest destination patch temperatures (T_d^c). Each oval represents a patch. The colors and temperatures within each oval represent the initial temperature (*A*) or the destination temperature (*B*). Movement is in the direction of the arrows, from hotter to cooler patches. (*A*) Program examines each patch in turn, going from the coolest patch to the hottest patch. (*B*) It determines whether that patch connects to a cooler patch, selects the coolest connected patch if it connects to multiple patches, and assigns the patch a destination temperature. Unconnected patches, such as the 5 °C patch, retain their initial temperatures, as shown in *A* and *B*.

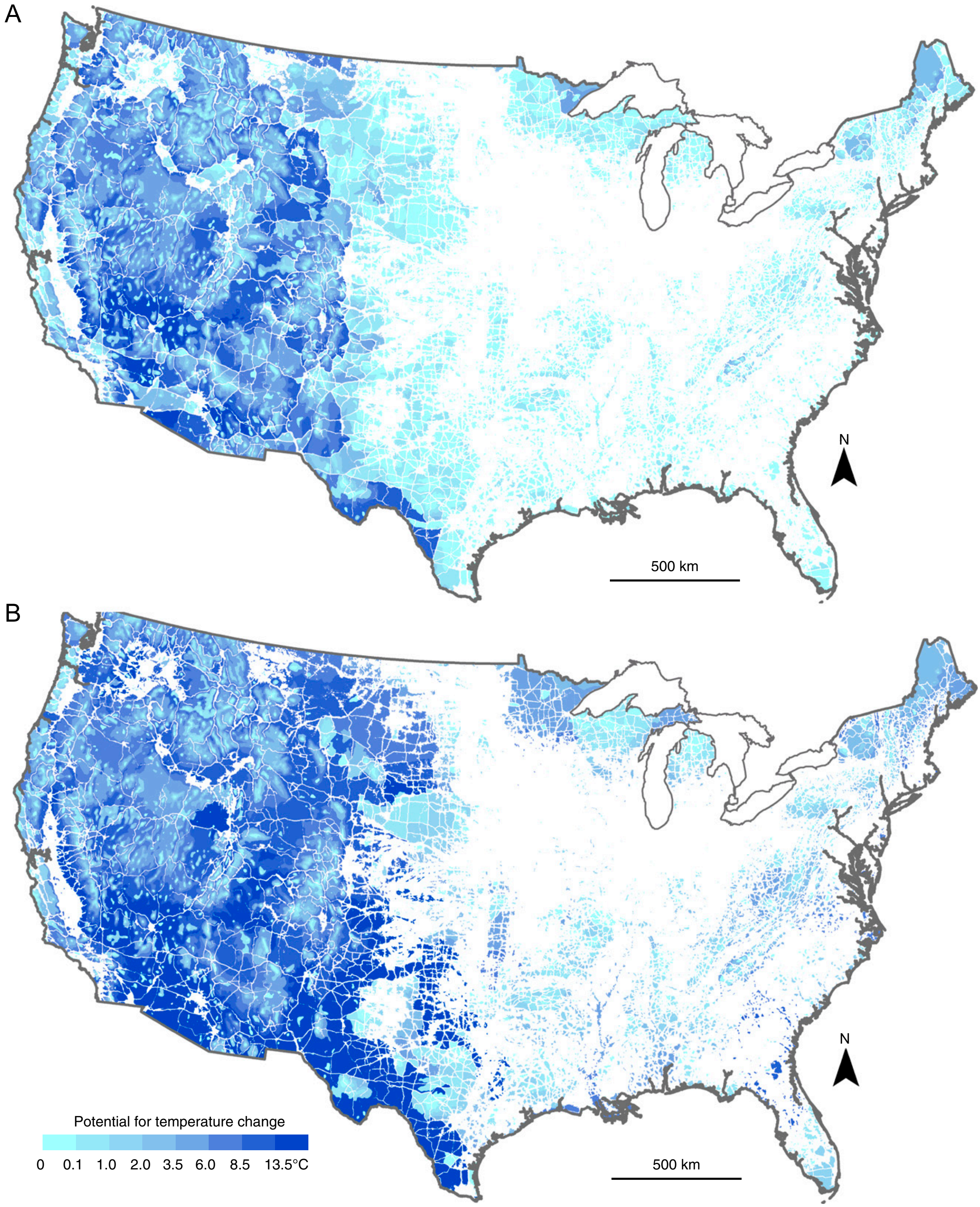

Fig. S4. Potential for temperature change (ΔT_P). The difference between the future temperature (T_o^f) of each patch and the destination temperature (T_d^f) of that patch based on connectivity, given hotter to cooler adjacent patches (*A*) and corridor-connected and adjacent patches (*B*).

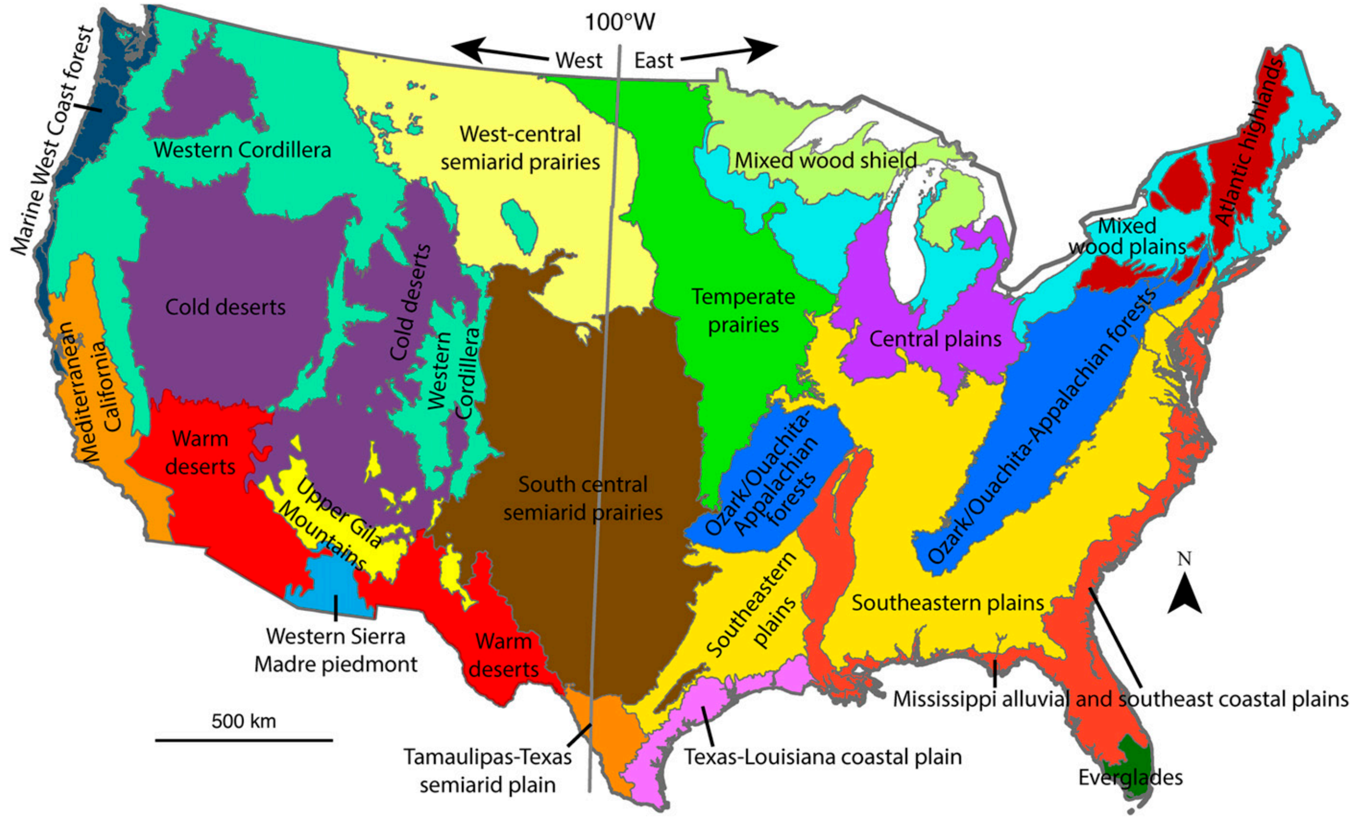

Fig. S5. Geographic and ecological divisions. We used the 100°W longitudinal line to divide the arid West from the moister, eastern United States. Colored divisions represent the 20 level II Environmental Protection Agency ecological regions used for analyses (47).

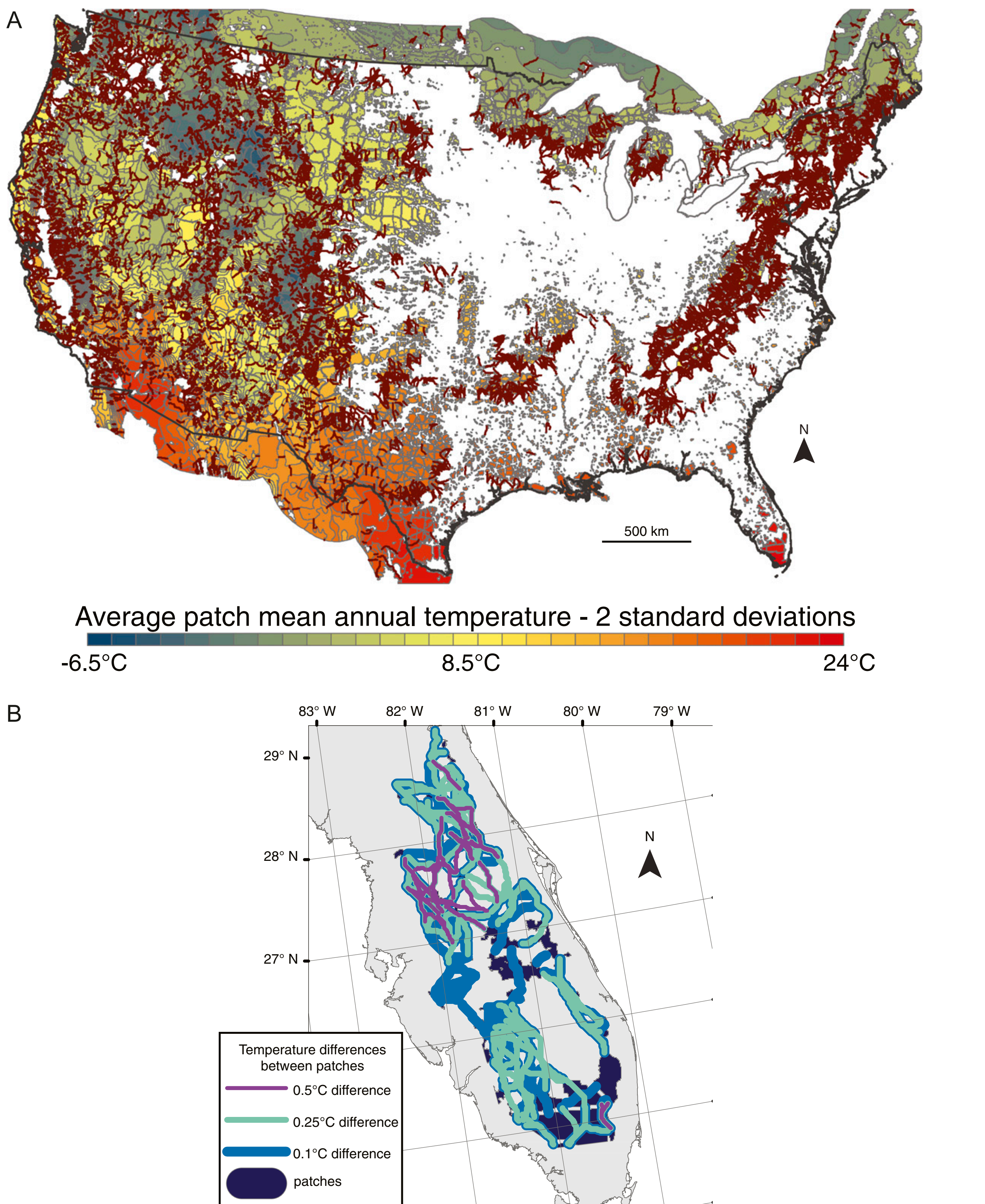

Fig. S6. Climate-gradient corridor sensitivity tests. (*A*) Climate-gradient corridor map that demonstrates the need to revise the default method (20) for designating temperature differences between patches. The map requires a 1 °C difference in minimum patch temperatures. Dark-red lines are least-cost climate gradient corridors. Note that many patches, particularly in Florida, Texas, and the Midwest, are isolated, without corridor connections or adjacent patches. (*B*) Florida sensitivity map of temperature differences between patches.

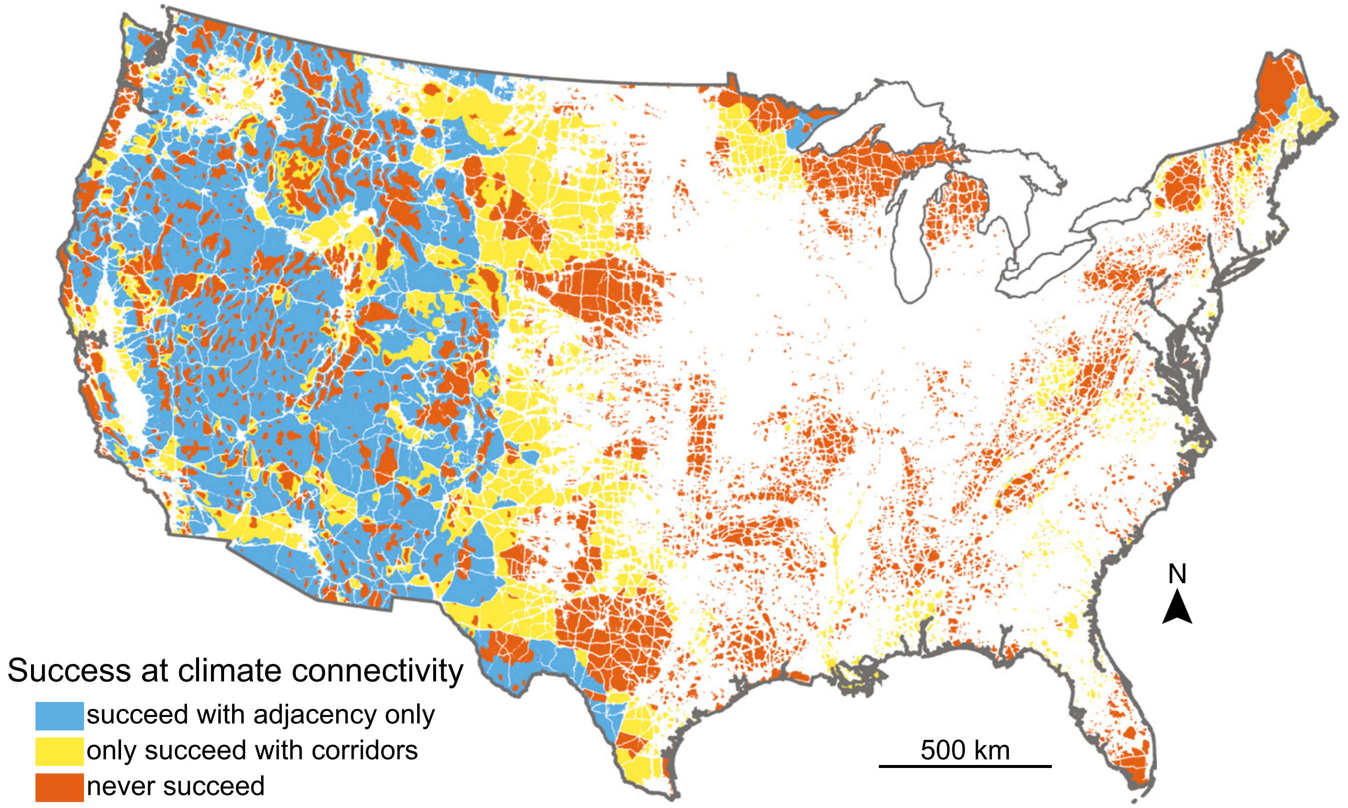

Fig. S7. Improvements due to corridors. Patches that never achieve success (orange), succeed with adjacency only (without the additional facilitation of corridors, blue), and succeed only if corridors are present (yellow) are shown.

Table S1. Percent climate connectivity success by natural area, given various climate scenarios

US patches	Adj A2, %	Adj 2.6, %	Adj 4.5, %	Adj 6.0, %	Adj 8.5, %	Cor A2, %	Cor 2.6, %	Cor 4.5, %	Cor 6.0, %	Cor 8.5, %
West	**51**	62	51	51	39	**75**	81	75	74	63
East	**2**	5	1	<1	0	**27**	43	25	21	12
Total	**41**	50	40	40	31	**65**	73	64	63	52

The margin is calculated as the current temperature of the origin patch (T_o^c) minus the future temperature of the destination patch (T_d^f) (Fig. S1). This table describes the percent area of all patches with positive margins, meaning they are successful at achieving climate connectivity. Adj indicates results for climate connectivity due to adjacency only. Cor indicates results for climate connectivity due to adjacency and corridors. The A2 emission scenario (bold) (18) is the mean ensemble of 15 projected temperature models for 2050–2099 (19). All others are RCP scenarios (RCP2.6, RCP4.5, RCP6.0, and RCP8.5) and are based upon a Model for Interdisciplinary Research on Climate 5 (MIROC5) model for each scenario (40).

Table S2. Median (first and third quartile) margin of success or failure at climate connectivity with and without corridors given various climate scenarios

US patches	Adj A2	Adj 2.6	Adj 4.5	Adj 6.0	Adj 8.5	Cor A2	Cor 2.6	Cor 4.5	Cor 6.0	Cor 8.5
West	**−1.7 °C**	−0.3 °C	−1.5 °C	−1.6 °C	−3.1 °C	**3 °C**	4.3 °C	3 °C	2.8 °C	1.2 °C
	(−3.6, 2.7)	(−2.1, 4.1)	(−3.4, 2.8)	(−3.4, 2.7)	(−5.1, 1.1)	**(−2.2, 7.1)**	(−0.9, 8.4)	(−2.1, 7.1)	(−2.2, 7)	(−3.7, 5.4)
East	**−3.7 °C**	−2.2 °C	−3.5 °C	−3.8 °C	−5.7 °C	**−2 °C**	−0.6 °C	−1.9 °C	−2.2 °C	−4.1 °C
	(−3.9, −3.3)	(−2.6, −1.9)	(−3.9, −3.1)	(−4.2, −3.4)	(−6.4, −5)	**(−3.2, −0.2)**	(−1.8, 1.1)	(−3, −0.1)	(−3.4, −0.5)	(−5.3, −2.4)
Total	**−3.4 °C**	−2 °C	−3.1 °C	−3.3 °C	−5 °C	**−0.7 °C**	0.7 °C	−0.6 °C	−0.8 °C	−2.7 °C
	(−3.8, −0.9)	(−2.4, 0.5)	(−3.7, −0.7)	(−4, −0.8)	(−5.9, −2.4)	**(−2.9, 4.4)**	(−1.5, 5.7)	(−2.8, 4.5)	(−3, 4.3)	(−4.8, 2.7)

The margin is calculated as the current temperature of the origin patch (T_o^c) minus the future temperature of the destination patch (T_d^f) (Fig. S1). Negative temperatures indicate a failure to achieve climate connectivity; positive temperatures indicate success. Adj indicates results for climate connectivity due to adjacency only. Cor indicates results for climate connectivity due to adjacency and corridors. The A2 emission scenario (bold) (18) is the mean ensemble of 15 projected temperature models for 2050–2099 (19). All others are RCP scenarios (RCP2.6, RCP4.5, RCP6.0, and RCP8.5) and are based upon a MIROC5 model for each scenario (40).