Supplementary Information

We developed a layer of average annual absolute minimum temperature (T_{nn}) for terrestrial lands at a ~4-km grid compatible with TerraClimate. This was done using daily summarized data from ERA-5 at a ~25-km resolution for the period 1981-2010. Specifically, we calculated the T_{nn} at the native resolution of ERA-5 and calculated the average minimum temperature for each month of the year. We calculated the difference between the average minimum temperature of the coldest month of the year and T_{nn}. Averaged across global lands, this perturbation was approximately 8.5 °C, albeit with substantial spatial variability with nominal differences in the tropics and values exceeding 18 °C in portions of northwestern North America and Russia (Figure S2). We then bilinearly interpolated and added this perturbation to TerraClimate grids of the coldest monthly T_{min} to create a first-order estimate of T_{nn} at the 4-km scale that is compatible with TerraClimate.

A simple validation of the resultant spatial layer was performed with T_{nn} observations at GHCN stations globally. We acquired data from GHCN stations globally that met the following requirements: (1) contained at least 40-years of data including at least 20 years of nearly complete (>90%) daily data for 1981-2010, and (2) were at least 100-km away from other stations. The latter was used to not oversample in regions with high station density. A total of 806 stations met these requirements. We did not perform additional screening of the daily data from the GHCN stations. Using these data we calculated T_{nn} at GHCN stations for the 1981-2010 period.

We compared the T_{nn} observed at GHCN stations to data from TerraClimate at the corresponding latitude and longitude of each station (Figure S3). We do not perform any additional adjustments for station siting or elevation, the latter of which can meaningfully impact

validation (e.g., Abatzoglou et al, 2018). The median absolute difference of T_{nn} from TerraClimate was 1.0 °C, with 82% of stations having absolute errors <2 °C. These results suggest that our methodology reasonably captures observed annual temperature extrema.

We apply an identical procedure for future climate which herein assumes stationarity in the temperature differences of the absolute coldest daily minimum temperature and coldest month of the year. Although some studies have shown amplified warming of T_{nn} versus average winter temperatures, we apply a more conservative route here given that warming temperatures will expand the suitability range.

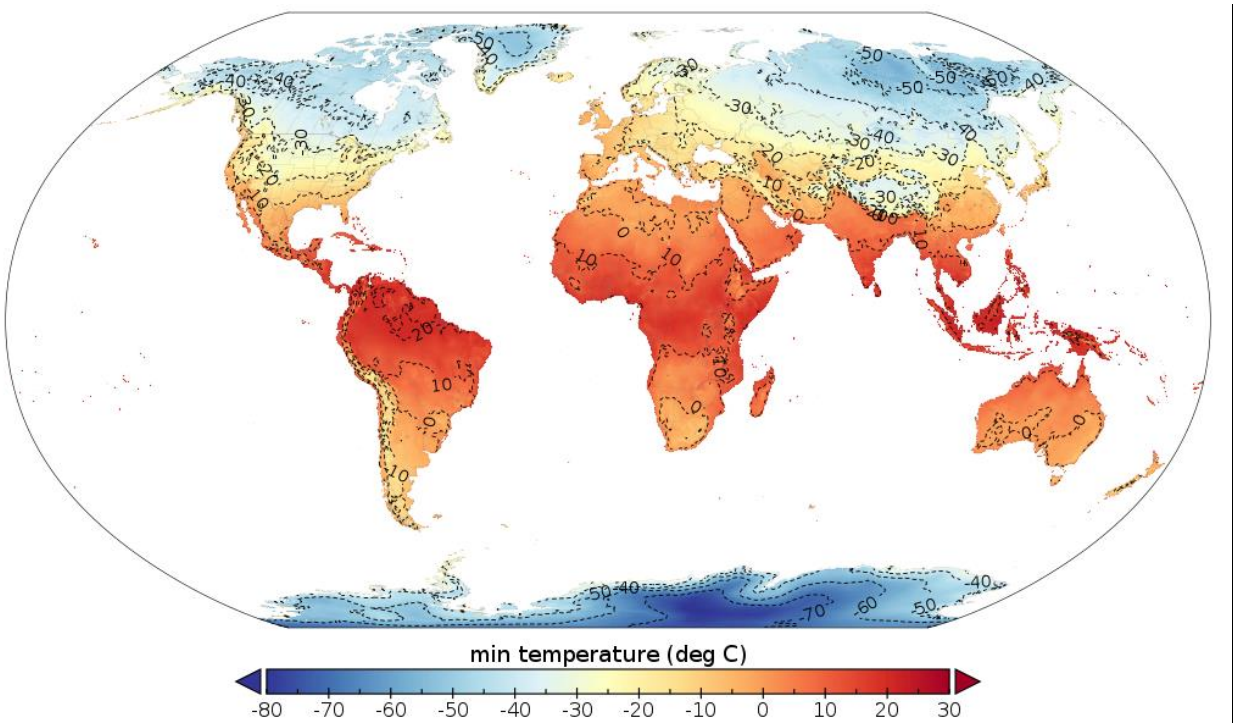
Supplementary Figures

Supplementary Figure S1. Absolute minimum air temperature (°C) mapped on 4km grid. Contour lines correspond to 10 °C increments, with -10 °C delineating locations where absolute minimum temperatures would kill *Agave americana.*

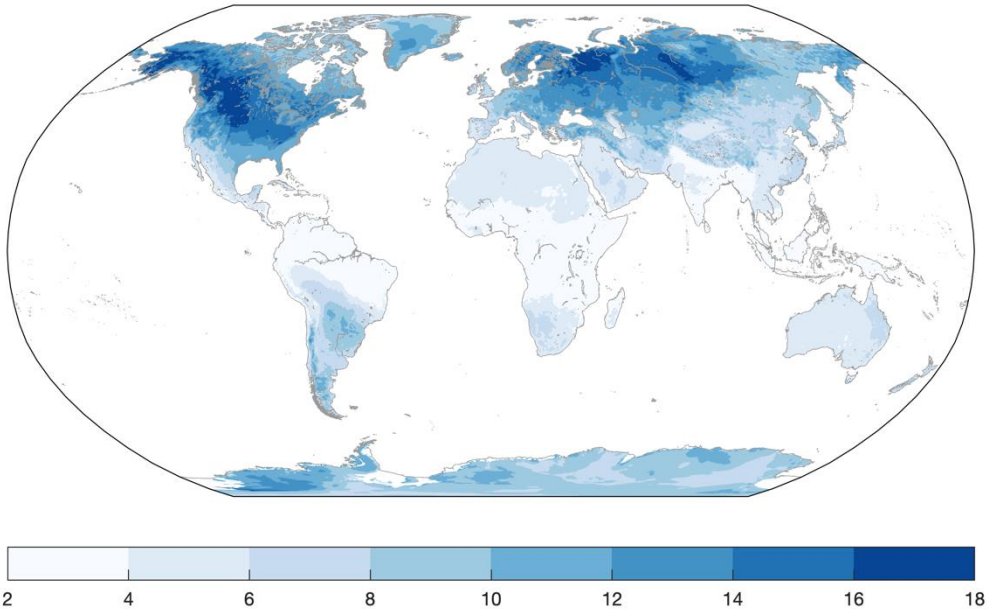
Supplementary Figure S2. Annual average difference of the average minimum temperature of the coldest month of the year and absolute annual daily minimum temperature for the period 1981-2020 calculated from ERA-5.

Supplementary Figure S3. Comparison of 1981-2010 average T_{nn} from (a) GHCN stations and (b) TerraClimate. The median absolute error of TerraClimate was 1.0C across the 806 stations examined.

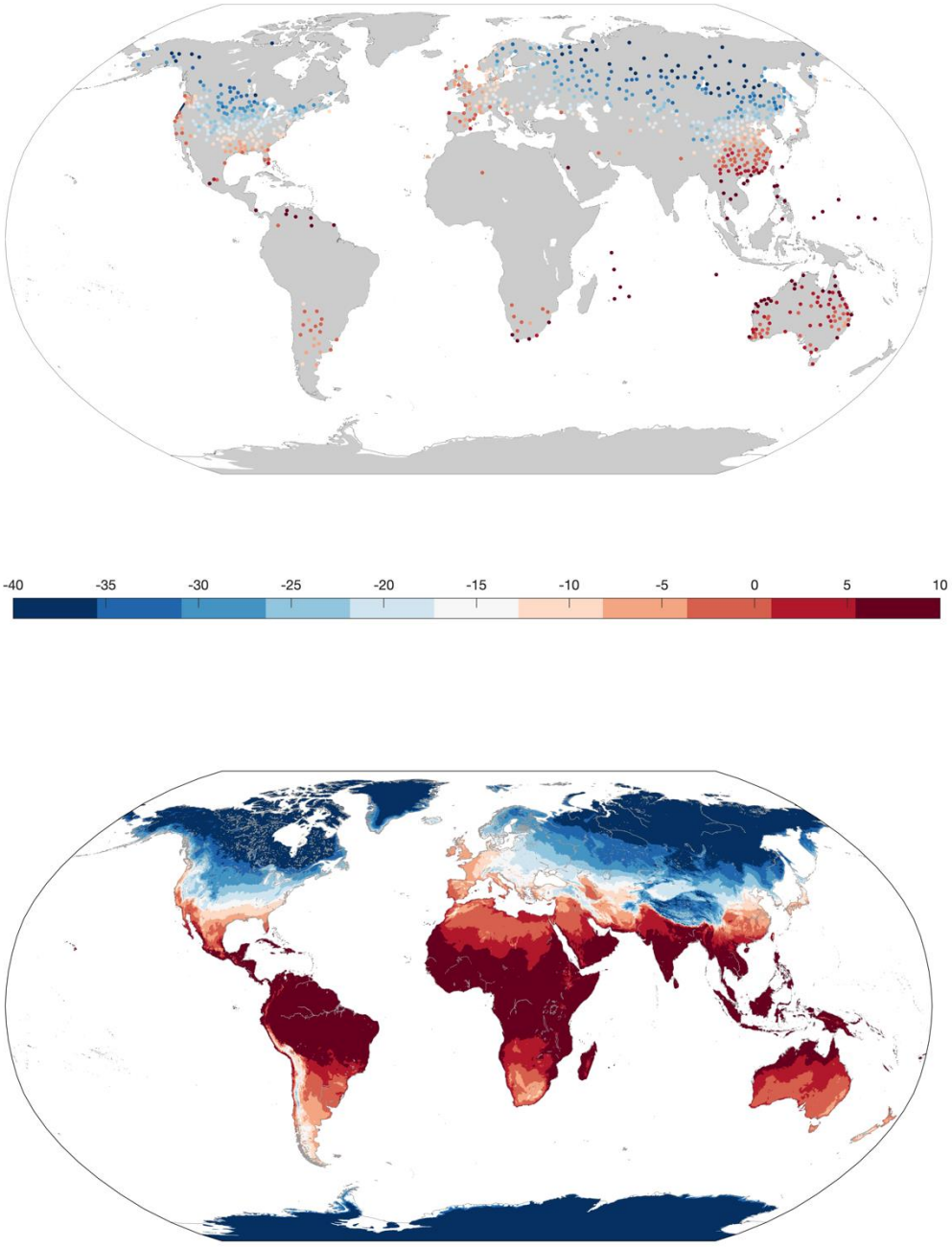
Supplementary Figure S4. Indices resolved on a 0-1 scale and mapped on a 4 km grid that constrain the growth of *Agave americana* due to incoming photosynthetically active radiation (a, light index), precipitation (b, water index), and temperature (c, temperature index).



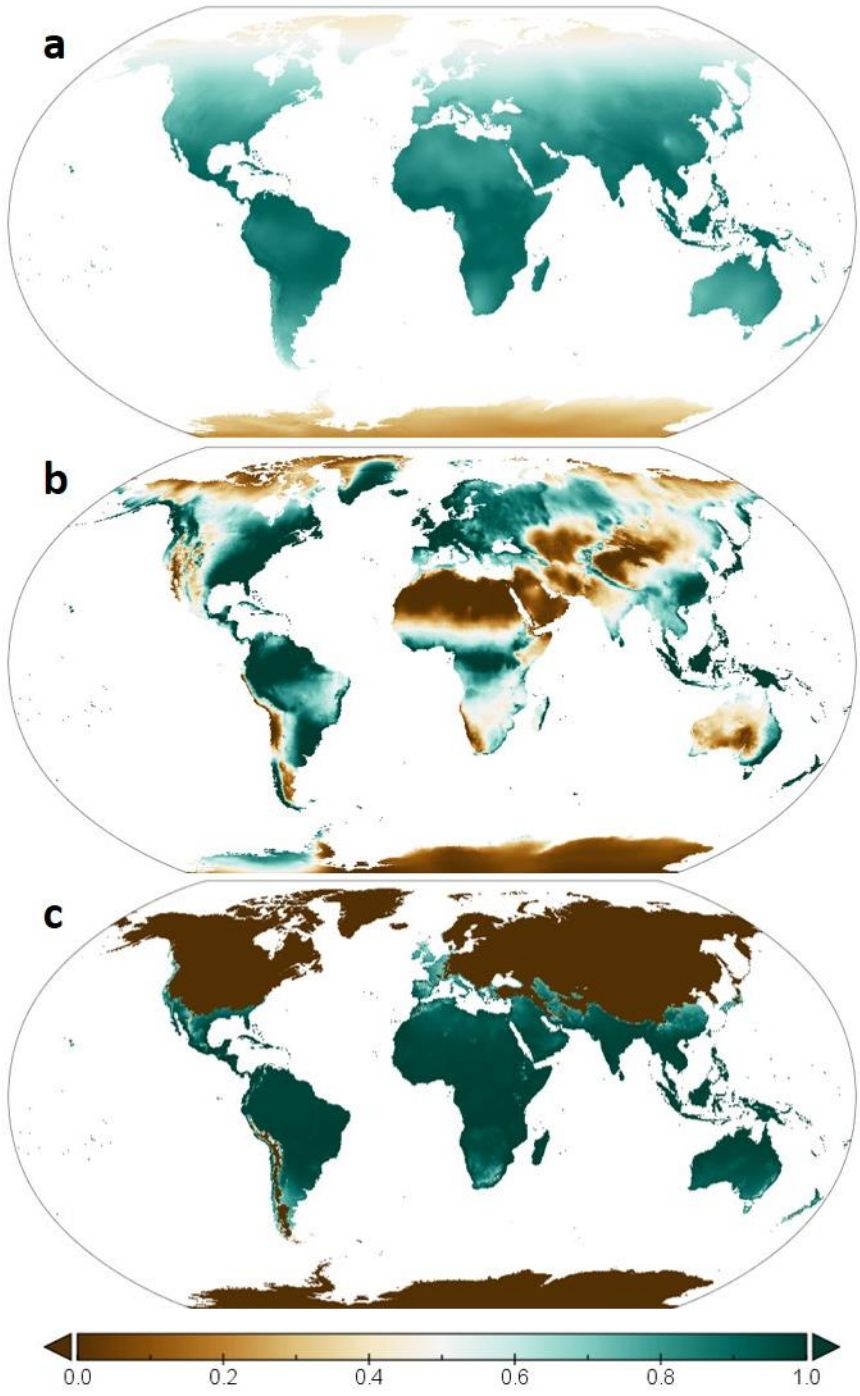
Supplemental Figure S1



Supplemental Figure S2



Supplemental Figure S3



Supplemental Figure S4