

APPENDIX G: Equations for calculating climate threat risk factor values

For each hydrographic area, we applied the following equations using the seven different LOCA models:

$$FC(j) = (1 - NORM_j) \times \frac{AVE_j \left(\sum_{\substack{0 \leq i \leq m \\ 0 < k < n}} f(SPEI(i, k)) \right)}{(m \times max_{spei})} \quad Eq. G-1$$

$NORM_j$ = normalized variance (VAR) of sums (Sum) for a hydrographic area j based on the observed maximum variance (MAX) =

$$\frac{VAR(sum_{1,j}, sum_{2,j}, \dots, sum_{7,j})}{MAX(VAR_{j=1}, VAR_{j=2}, \dots, VAR_{j=y})} \quad Eq. G-2$$

$$f(SPEI(i, k)) = \begin{cases} abs(SPEI(i, k)) & \text{for year } i \text{ and LOCA } k \text{ if SPEI is } \leq -1; \\ 0 & \text{otherwise it is 0} \end{cases} \quad Eq. G-3$$

Where:

$FC(j)$ = climate threat risk factor value in hydrographic area j that varies from 0 to 1

max_{spei} = maximum absolute value of the observed SPEI

$sum_{k,j}$ = temporal sum of SPEIs ≤ -1 from years 2022 to 2060 in hydrographic area j of LOCA k

y = number of hydrographic areas = 256

m = number of years = 38

n = number of models = 7

In Equation G-1, the first portion to the left of the multiplication sign accounts for the variability in SPEI between the different LOCA models. We used a normalized variance approach, described mathematically in Equation G-2. The second portion of Equation G-1 estimates the amount of drought conditions in the future and is normalized by dividing the raw estimate for each basin by the maximum observed SPEI. Equation G-3 specifies that SPEI values less than or equal to -1 (i.e., droughty conditions) are included in the calculation. Anything less droughty than -1 standard deviation have a value of 0 for that year and LOCA model in Equation G-3.

After the $FC(j)$ values had been calculated for all hydrographic areas, they were normalized again by dividing by the largest $FC(j)$ value. This resulted in the hydrographic area with the largest $FC(j)$ value (i.e., the hydrographic area with the highest risk) having a value of 1.0, the hydrographic area with the highest variance having a value of 0.0, and all other hydrographic areas having values in between these for the climate threat risk factor.

Example: $y = 2$ hydrographic areas, $n = 2$ LOCA models, $m = 3$ years of SPEI values

For hydrographic area A and two LOCA models 1 and 2 for 3 years of SPEI values

- LOCA model 1:
 - SPEI for year 1 = -3, SPEI for year 2 = -1, SPEI for year 3 = -0.5 $\rightarrow sum_{1,A} = 3+1+0 = 4$
- LOCA model 2:
 - SPEI for year 1 = -2, SPEI for year 2 = -1.5, SPEI for year 3 = 2 $\rightarrow sum_{2,A} = 2+1.5+0 = 3.5$
- Average = $(4+3.5)/2 = 3.75$
- Variance = $VAR(4, 3.5) = 1.125$

For hydrographic area B and two LOCA models 1 and 2 for 3 years of SPEI values

- LOCA model 1:
 - SPEI for year 1 = 1, SPEI for year 2 = -1, SPEI for year 3 = -0.5 $\rightarrow sum_{1,B} = 0+1+0 = 1$
- LOCA model 2:
 - SPEI for year 1 = -3, SPEI for year 2 = 2, SPEI for year 3 = 2 $\rightarrow sum_{2,B} = 3+0+0 = 3$
- Average = $(1+3)/2 = 2$
- Variance = $VAR(1,3) = 2$

Climate effect for hydrographic area A =

$$FC(A) = \left(1 - \frac{1.125}{MAX(1.125, 2)} \right) \times \frac{3.75}{(3 \times 3)} = 0.18$$

Climate effect for hydrographic area B =

$$FC(B) = \left(1 - \frac{2}{MAX(1.125, 2)} \right) \times \frac{2}{(3 \times 3)} = 0.00$$

If there were only these two hydrographic areas in Nevada, then the final normalizing process would make $FC(A)_{final} = 1.0$ and $FC(B)_{final} = 0.0$ after dividing both of the above values by 0.18, the largest $FC(j)$ value.

APPENDIX H: Maps of climate stressor risk factors to GDEs in Nevada

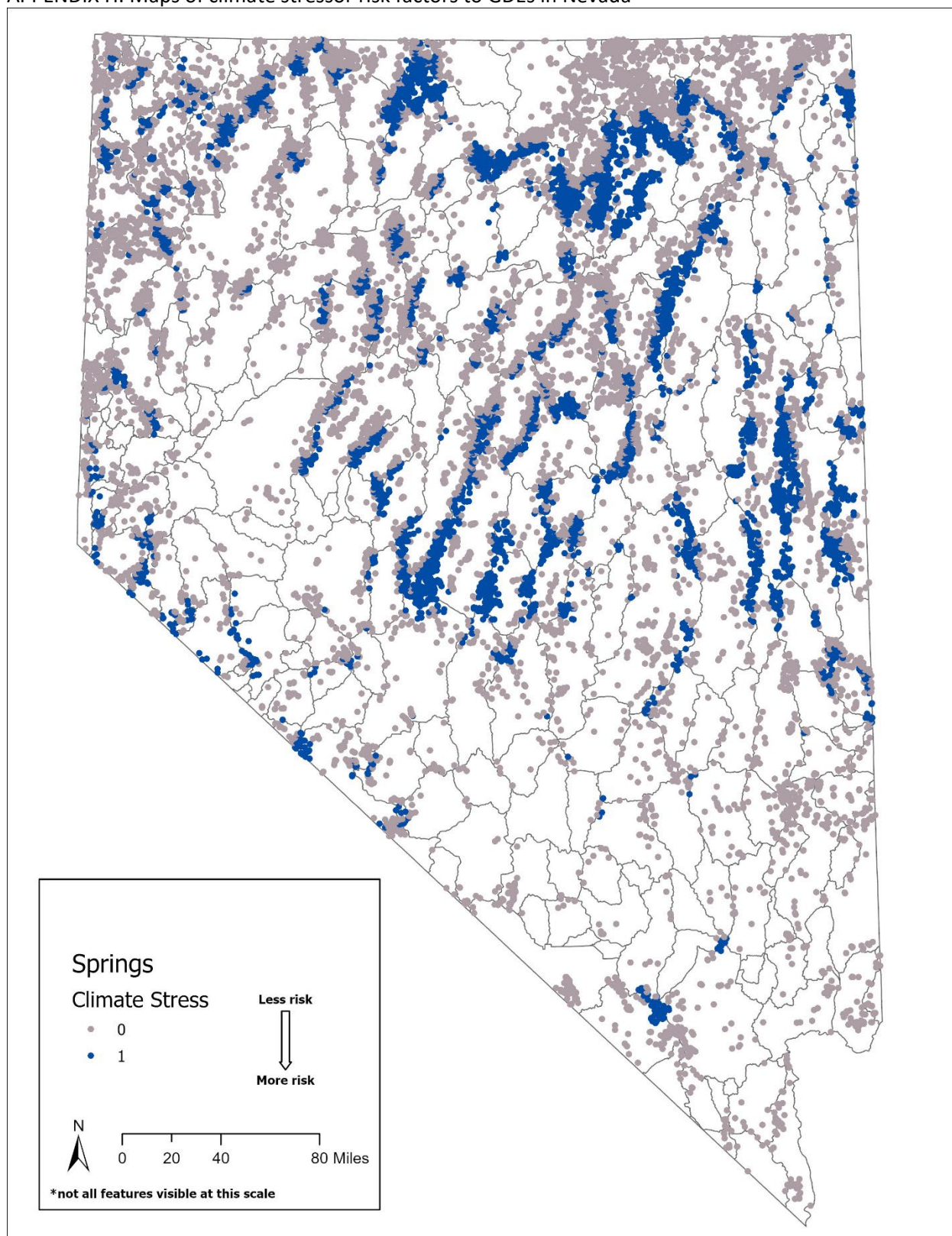


Figure H-1. Climate stressor risk factor values for GDE springs in Nevada. Ratings are from 0.00 (negligible risk) to 1.00 (high risk).

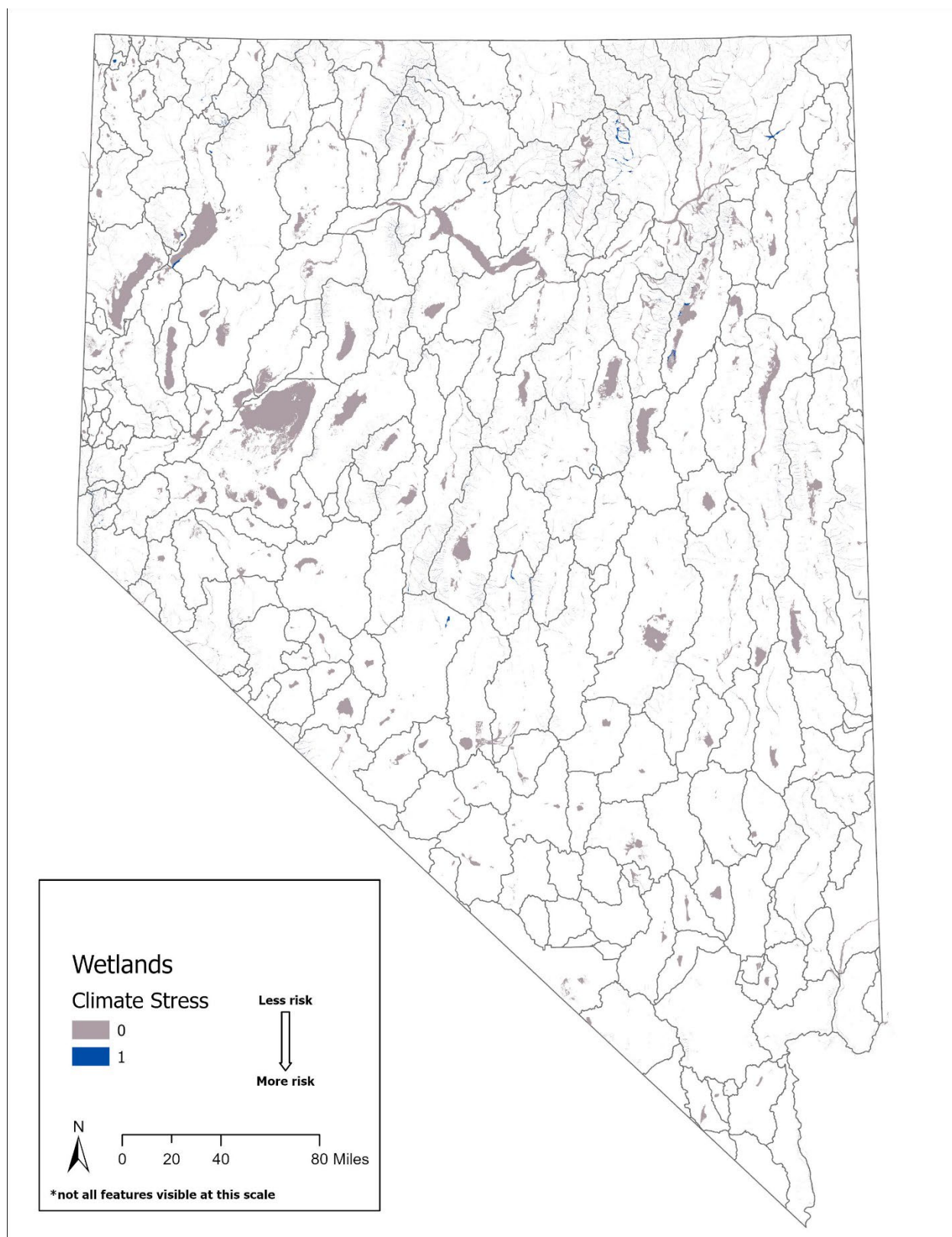


Figure H-2. Climate stressor risk factor values to GDE wetlands in Nevada. Ratings are from 0.00 (negligible risk) to 1.00 (high risk).

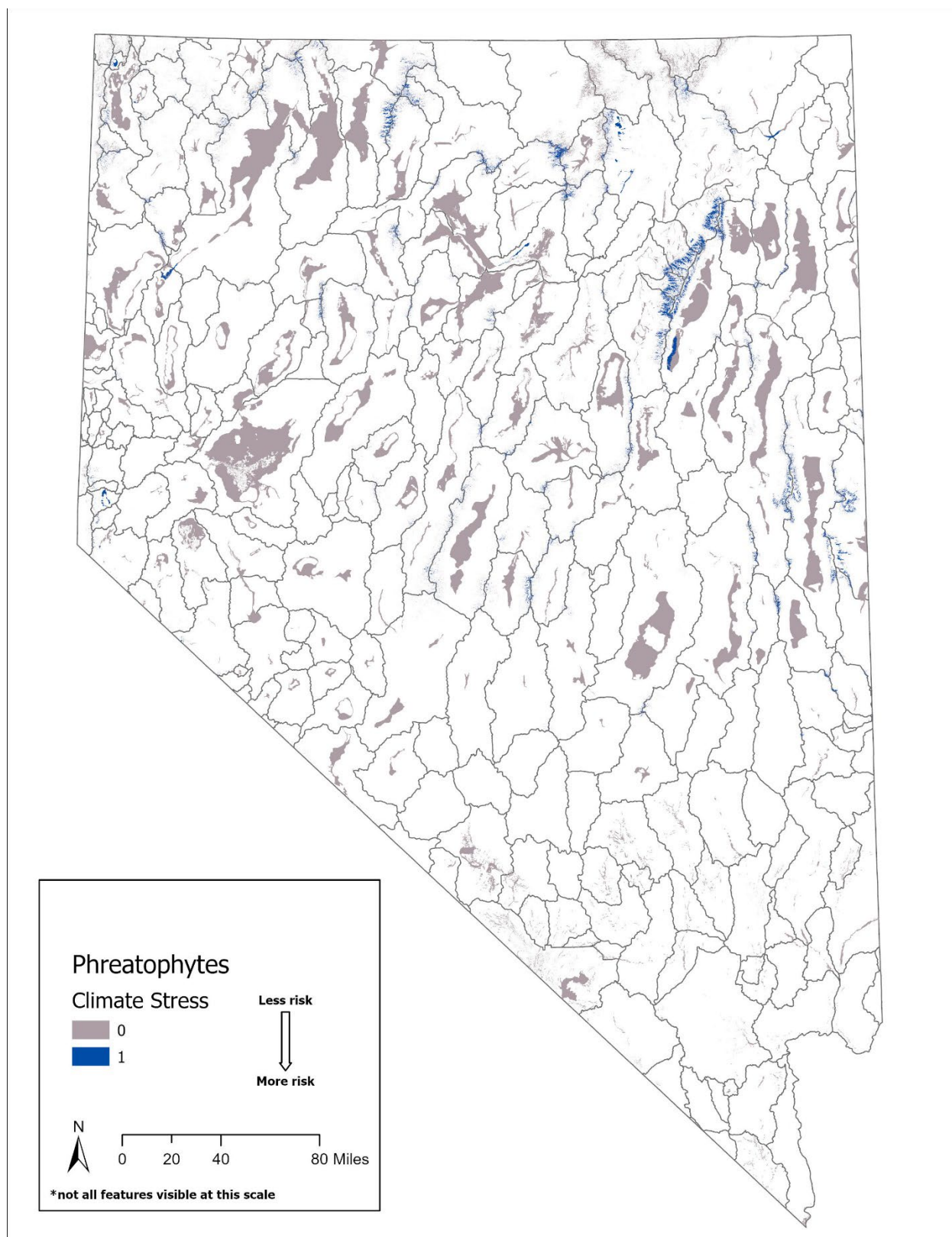


Figure H-3. Climate stressor risk factor values to GDE phreatophyte communities in Nevada. Ratings are from 0.00 (negligible risk) to 1.00 (high risk).

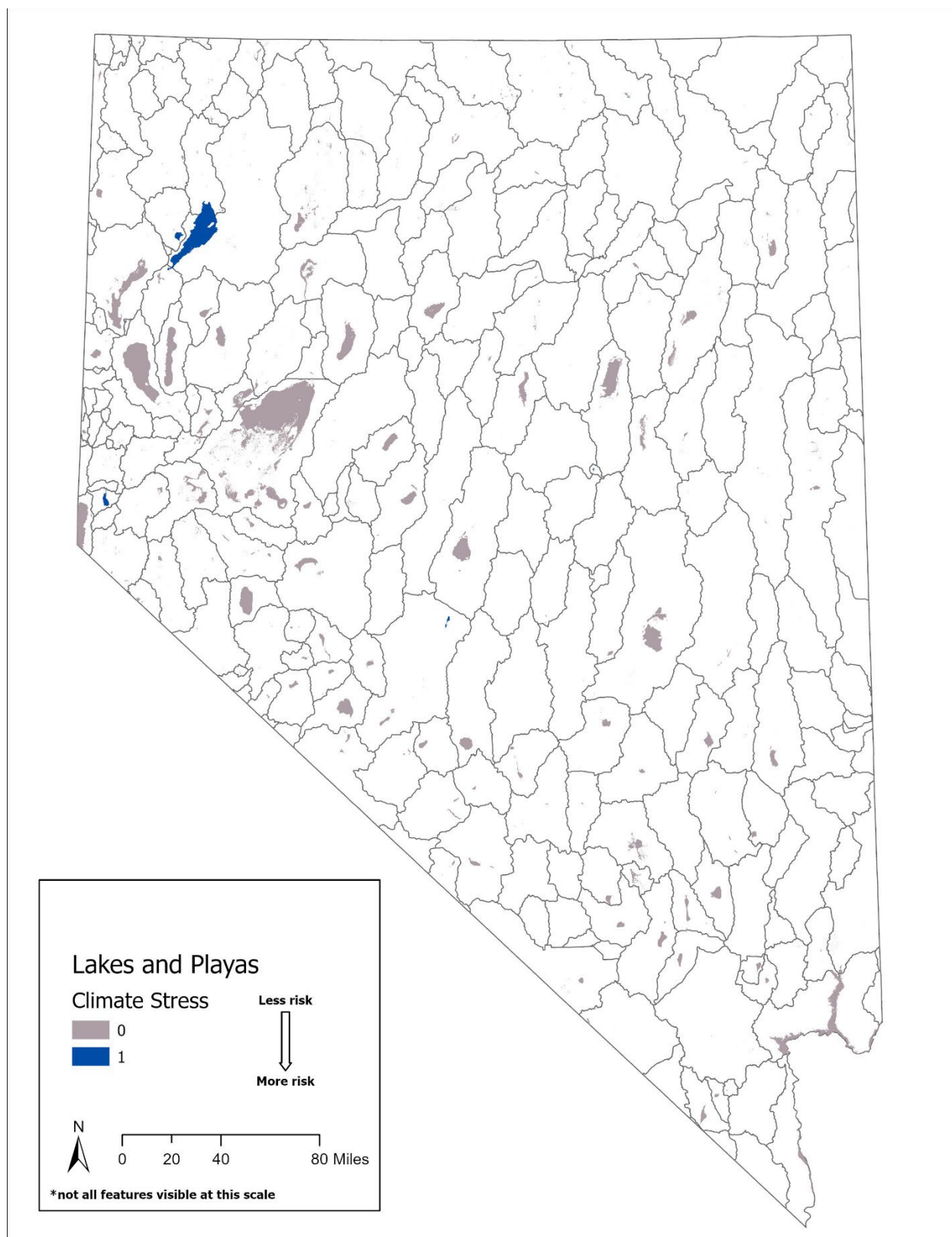


Figure H-4. Climate stressor risk factor values to GDE lakes and playas in Nevada. Ratings are from 0.00 (negligible risk) to 1.00 (high risk).

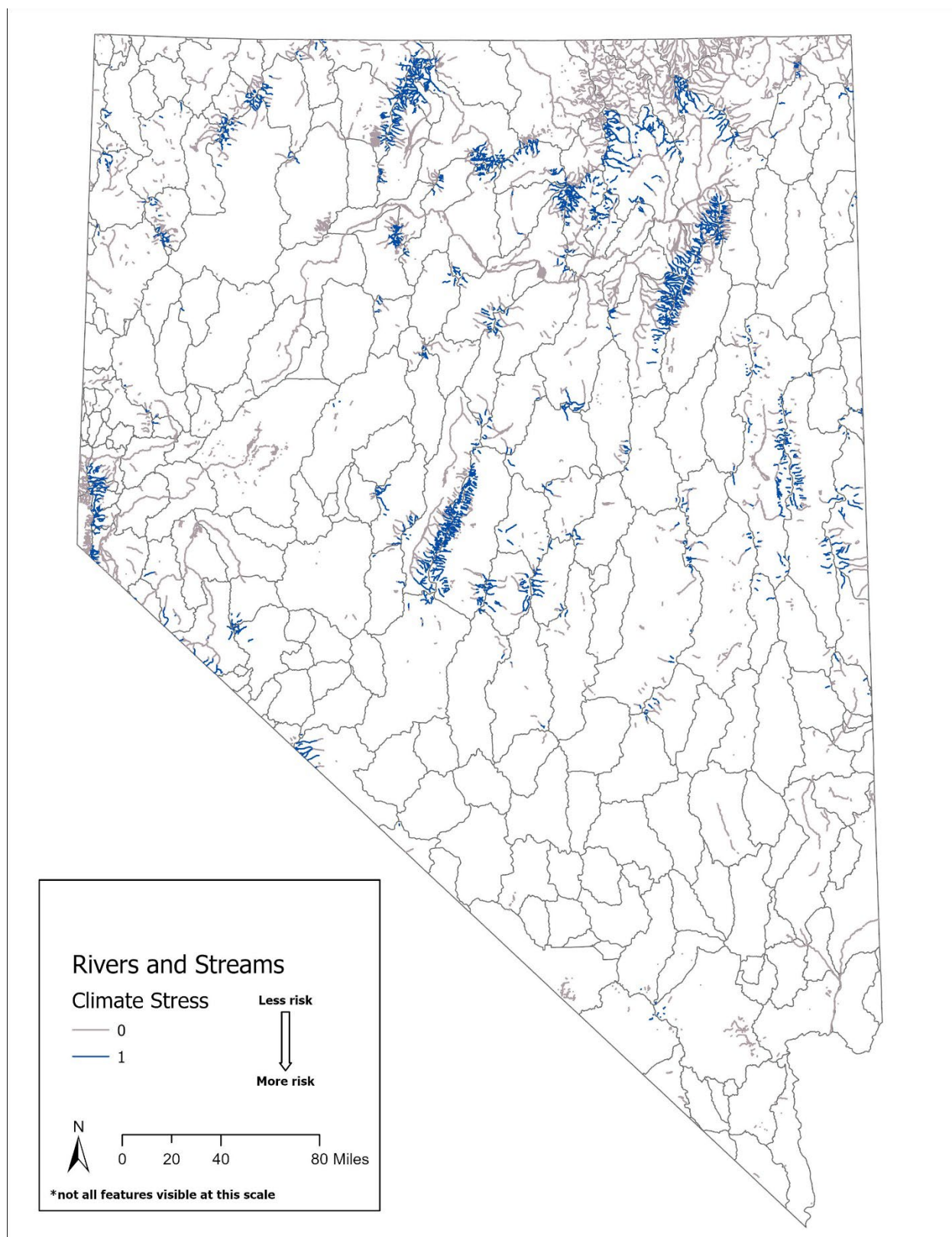


Figure H-5. Climate stressor risk factor values to GDE rivers and streams in Nevada. Ratings are from 0.00 (negligible risk) to 1.00 (high risk).

APPENDIX I: Maps of climate threat risk factors to GDEs in Nevada

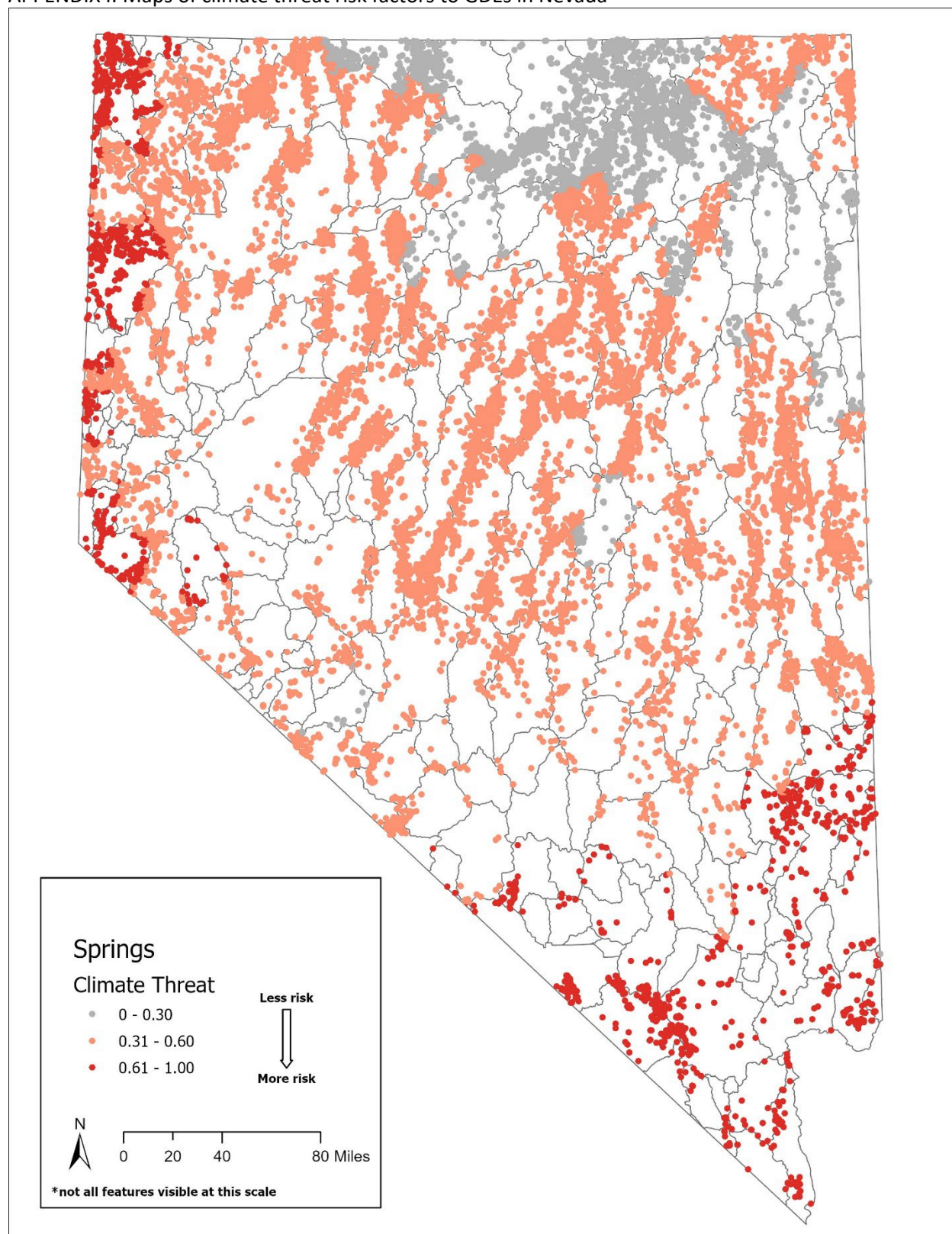


Figure I-1. Climate threat risk factor values for GDE springs in Nevada. Ratings are from 0.00 (negligible risk) to 1.00 (high risk).

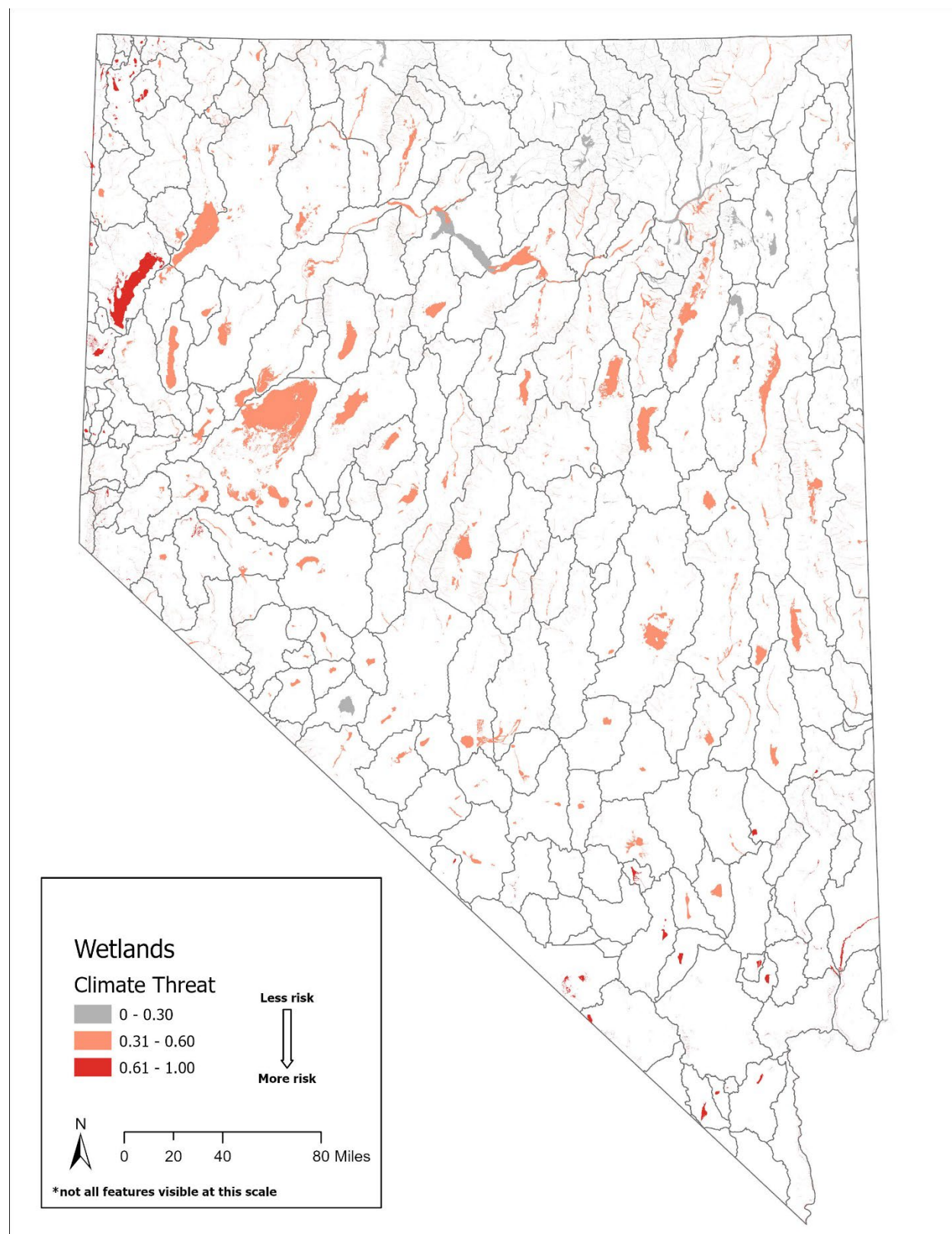


Figure I-2. Climate threat risk factor values to GDE wetlands in Nevada. Ratings are from 0.00 (negligible risk) to 1.00 (high risk).

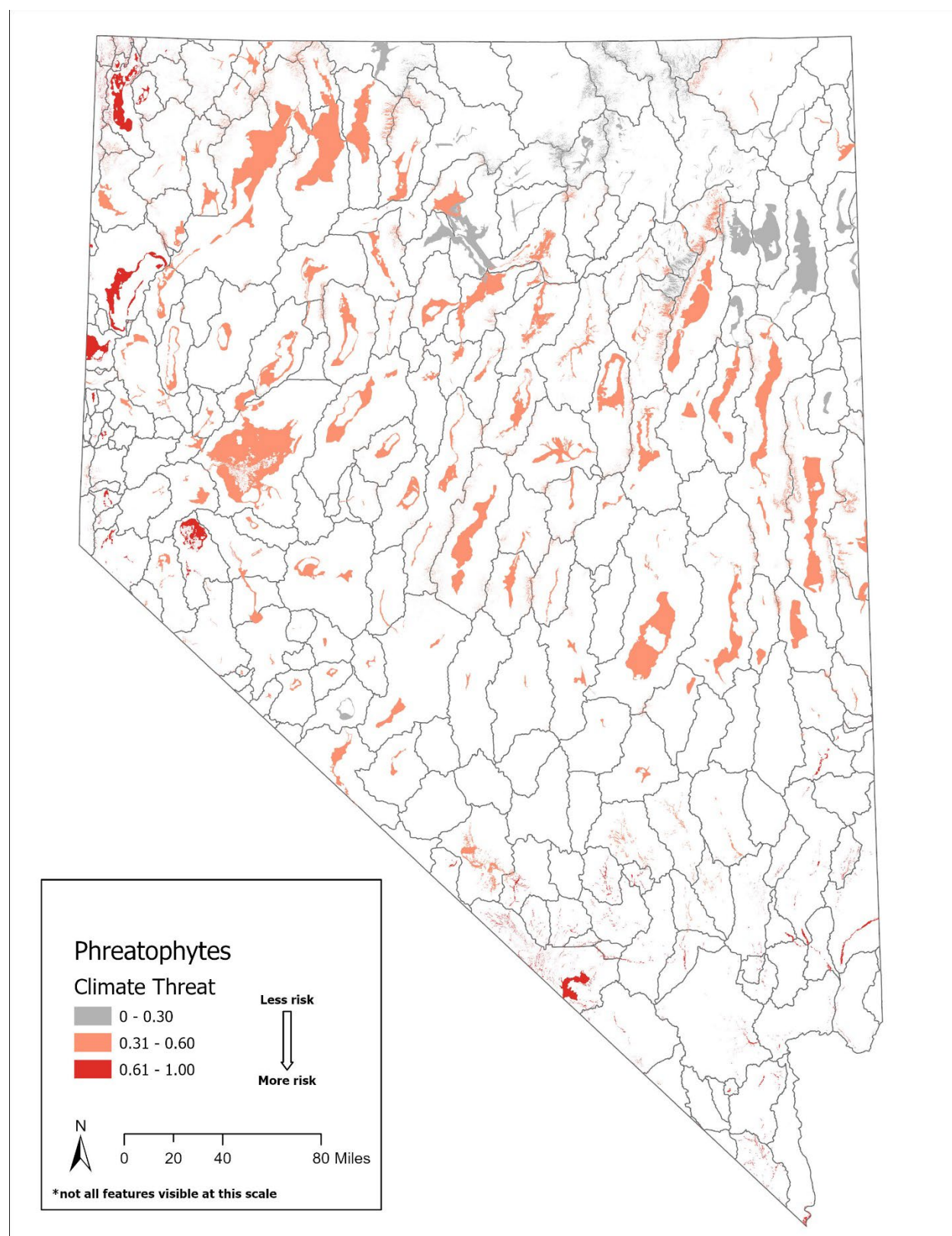


Figure I-3. Climate threat risk factor values to GDE phreatophyte communities in Nevada. Ratings are from 0.00 (negligible risk) to 1.00 (high risk).

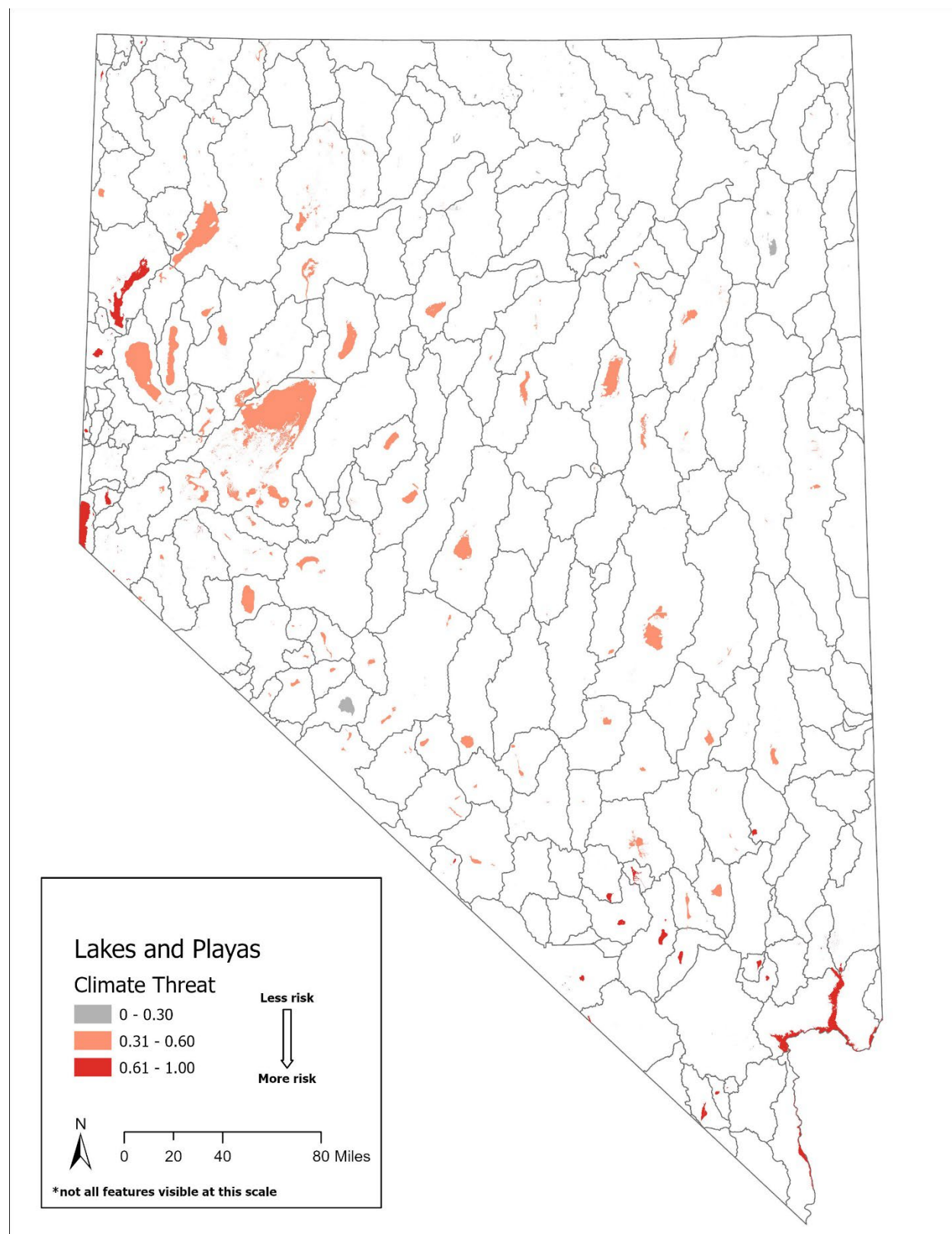


Figure I-4. Climate threat risk factor values to GDE lakes and playas in Nevada. Ratings are from 0.00 (negligible risk) to 1.00 (high risk).

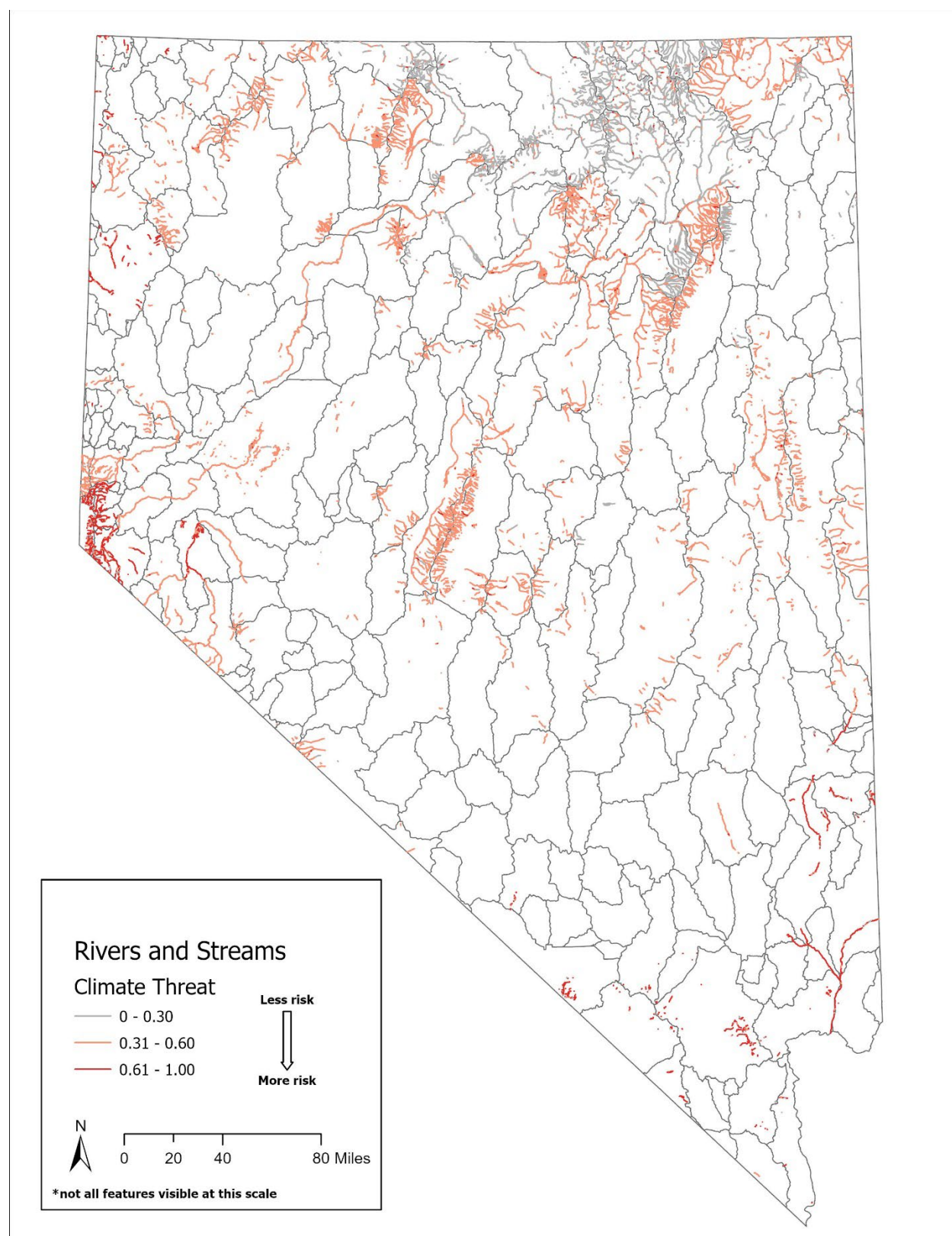


Figure I-5. Climate threat risk factor values to GDE rivers and streams in Nevada. Ratings are from 0.00 (negligible risk) to 1.00 (high risk).