Las Vegas Native Species Climate Matrix v4.2: A Scoring Framework for Plant Selection Under 2030 and 2040 Climate Projections

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March 2026

Working Paper | Companion data: las_vegas_native_species_climate_matrix_v4_2.xlsx

Funding and Conflict of Interest Disclosure

This research was entirely self-funded by the authors. No external funding, grants, or sponsorship were received from any government agency, corporation, nursery, seed company, water authority, or other entity. The authors have no financial interests, consulting relationships, or other conflicts of interest related to any species, product, or organization discussed in this paper. All findings, scores, and recommendations reflect the authors' independent analysis of publicly available climate data, published literature, and field observations.

Abstract

Las Vegas, Nevada has warmed approximately 5.5°F since 1970, with nighttime temperatures increasing 2–3× faster than daytime maximums due to urban heat island amplification. This warming, combined with increasing drought stress from higher evaporative demand, is rendering many commonly recommended landscape plant species unviable for long-term use. This paper presents a standardized scoring matrix evaluating 222 plant taxa across four climate-tolerance factors—heat tolerance, warm-night tolerance, drought tolerance, and establishment resilience—weighted to reflect projected 2030 and 2040 climate scenarios. The matrix covers eight categories: wildflowers and forbs (58 species), shrubs (55), trees (73), cacti and succulents (12), grasses (5), vines (6), and roses (18 cultivated varieties), plus a companion analysis of a widely circulated but outdated 2005 UNR Extension planting guide. Results show 35% of taxa rate "Expand," 27% "Hold," 23% "Trial," and 15% "Phase Down." True Mojave natives dominate the Expand category. Thirteen species achieved a perfect score of 3.0. The matrix is intended as a practitioner planning tool for nursery programming, municipal landscape specification, habitat restoration, and homeowner guidance.

Keywords: *climate adaptation, desert horticulture, Las Vegas, Mojave Desert, native species, plant selection, urban heat island, warm nights, drought tolerance*

1. Introduction

Las Vegas, Nevada sits at the northern edge of the Mojave Desert at approximately 2,000 feet elevation, receiving 4.2 inches of annual precipitation. The Las Vegas Valley is home to over 2.2 million residents and has experienced explosive urban growth since the 1990s, creating one of North America's most pronounced urban heat islands—NASA's ECOSTRESS instrument has recorded surface temperature differentials of up to 24°F between the urban core and surrounding desert.

According to Climate Central (2022), Las Vegas has warmed approximately 5.5–6.0°F since 1970, making it one of the two fastest-warming cities in the United States. The University of Nevada, Reno's Nevada State Climate Office reports that nighttime temperatures are warming fastest, with summer nighttime lows increasing an estimated 8.5°F since 1970. This nighttime warming is the single most consequential climate signal for plant survival, as plants rely on cooler nights to close stomata, reduce respiration rates, and recover from daytime heat stress.

Despite this rapid warming, commonly available planting guides remain rooted in climate assumptions from the 1990s or earlier. A 2005 UNR Cooperative Extension tree booklet continues to circulate and recommends species such as yew pine (*Podocarpus macrophyllus*, matrix score 1.00), valley oak (*Quercus lobata*, 1.18), and eastern redbud (*Cercis canadensis*, 1.18)—species now demonstrably failing under current conditions. The purpose of this project is to provide a transparent, reproducible, species-by-species climate screen translating regional climate projections into actionable plant selection guidance.

2. Climate Context

2.1 Temperature trends

Annual average temperatures in Las Vegas have risen from approximately 67°F in the 1970s to over 72°F by the 2020s. The NWS Las Vegas station confirms 2024 tied 2017 as the warmest year in recorded history (72.3°F annual mean). Maximum temperatures have risen approximately 1.7°F per decade-average, but minimum (nighttime) temperatures have risen approximately 3.5°F over the same period—roughly 2× the daytime rate. The Clark County Climate Action Plan projects days exceeding 106°F increasing from ~4 per year historically to 23–30 per year by mid-century under RCP 4.5.

2.2 Chill hours decline

Chill hours—cumulative hours below 45°F during November through February—have declined from ~550 hours in 1970 to ~310 in 2025, a 44% reduction. Under RCP 4.5

projections, chill hours are expected to fall below 200 by 2040 and approach 160 by 2050. The minimum for even “low-chill” deciduous fruit trees (~300 hours) is being crossed now.

2.3 Drought and evaporative demand

All climate models agree on increasing evaporative demand for southern Nevada. Higher temperatures drive faster moisture loss from soils and plants, meaning that a species rated “drought tolerant” under 2005 conditions may not be so under 2040 conditions. The matrix weights drought tolerance at 30% for 2040 (vs. 25% for 2030) to reflect this trajectory.

3. Methods

3.1 Species selection

Species were drawn from four sources: (1) the author’s working list compiled from nursery availability, municipal specifications, and restoration practice; (2) the 2005 UNR Extension tree booklet; (3) the Nevada Division of Forestry species list for Clark County; and (4) forward-looking species recommended from Sonoran Desert analogue research and monarch butterfly habitat needs. Duplicates were reconciled taxonomically, and species were assigned to categories by dominant life form.

3.2 Scoring factors

Each species was scored on four factors using a 1–3 integer scale:

Heat Tolerance (1–3): Ability to survive sustained temperatures above 110°F including reflected urban heat. Score 3 = species native to or documented in 115°F+ environments.

Warm-Night Tolerance (1–3): Ability to maintain physiological function when nights remain above 80–85°F. This is the most differentiating factor for Las Vegas.

Drought Tolerance (1–3): Ability to survive on minimal supplemental irrigation under increasing evaporative demand. Score 3 = survives on natural precipitation once established.

Establishment Resilience (1–3): Ease of establishing new plants under Las Vegas conditions: alkaline caliche soils, low humidity, and high UV.

3.3 Composite scoring

2030 Climate Score = 0.30×Heat + 0.25×WarmNight + 0.25×Drought + 0.20×Establishment

2040 Climate Score = 0.25×Heat + 0.30×WarmNight + 0.30×Drought + 0.15×Establishment

Program Fit = 0.70×2040 Climate + 0.30×Local Fit (Mojave native=3, broader SW=2, non-native=1)

3.4 Action thresholds

Expand (≥2.6): plant more. Hold (2.2–2.59): continue, watch trends. Trial (1.8–2.19): use with caution. Phase Down (<1.8): stop recommending.

4. Results

4.1 Overall distribution

Of 222 scored taxa: 78 (35%) Expand, 59 (27%) Hold, 51 (23%) Trial, 34 (15%) Phase Down. The Expand category is dominated by Mojave/Great Basin natives; Phase Down is populated by species from humid, cool, or maritime climates.

4.2 Perfect scores

Thirteen species achieved the maximum Program Fit Score of 3.0:

Common Name	Scientific Name	Category
Desert marigold	Baileya multiradiata	Wildflower
Whitestem paperflower	Psilostrophe cooperi	Wildflower
Globemallow	Sphaeralcea ambigua	Wildflower
Burrobush	Ambrosia dumosa	Shrub
Creosote bush	Larrea tridentata	Shrub
Wolfberry	Lycium spp.	Shrub
Rubber rabbitbrush	Ericameria nauseosa	Shrub
Quailbush	Atriplex lentiformis	Shrub
Desert broom	Baccharis sarothroides	Shrub
Shadscale	Atriplex confertifolia	Shrub
Snakeweed	Gutierrezia sarothrae	Shrub
Mojave seablite	Suaeda moquinii	Shrub
Alkali sacaton	Sporobolus airoides	Grass

Table 1. Species with perfect 3.0 Program Fit Score. All are Mojave or Great Basin natives.

4.3 Category highlights

Trees (73): Widest score range (1.00–3.0). Native desert trees—whitethorn acacia, foothill palo verde, netleaf hackberry—cluster in Expand. Imported shade trees—valley oak, eastern redbud, hybrid columnar poplar—cluster in Phase Down.

Shrubs (55): Strongest native advantage. Nine of thirteen perfect-score species are shrubs. Creosote bush, the Mojave anchor, scores 3.0.

Wildflowers (58): Native Mojave wildflowers consistently Expand; California imports consistently Phase Down. Desert gold poppy replaces California poppy; desert bluebells replace California bluebells.

Cacti (12): All native cacti scored Expand—the highest floor score of any category.

Grasses (5): Alkali sacaton achieved 3.0. Big galleta anchors native grass restoration.

Roses (18): All non-native, irrigation-dependent. Even the best (Julia Child, 2.08) is Trial. Every rose entry notes: “IRRIGATION DEPENDENT—must be watered on EVERY day permitted under SNWA rules.” Annual water: 500–1,400 gal/plant.

4.4 Monarch milkweed program

Eight monarch host species arranged across a moisture/shade gradient ensure every Las Vegas site can support at least one host: rush milkweed (driest) through showy milkweed (wettest), plus Arizona milkweed (partial shade) and fringed twinevine (vine host in dry washes).

5. The UNR 2005 Caution Sheet

The 2005 UNR tree booklet remains in circulation. The companion “UNR 2005 Caution Sheet” tab cross-references all 51 species, flagging invasives (chinaberry, mimosa), emerging pest threats (emerald ash borer for all Fraxinus), Phase Down scorers (yew pine 1.00, eastern redbud 1.18, valley oak 1.18), and species in documented decline (Mondell pine dying across LV; screwbean mesquite range-wide die-off since ~2005).

6. Irrigation Considerations

SNWA limits drip to 4 days/week (summer), 2 days/week (spring/fall), and 1 day/week (winter). No watering 11AM–7PM in summer; Sunday always prohibited. Analysis of evening temperature curves, soil surface temps (UNLV burn study recorded up to 170°F), and evaporation rates indicates the optimal drip start time is ~30–45 minutes after sunset (8:00–8:30 PM in summer). At 7 PM, soil surfaces still exceed 115°F, causing partial flash evaporation. By 8:30 PM, surfaces have cooled 15–20°F and absorption efficiency improves. For most residential systems (1–2 GPH emitters), 60 minutes per session is appropriate. System aging from Las Vegas hard water reduces emitter flow 25–50% within 2–3 years; seasonal flushing and 3–5 year replacement are essential.

7. Discussion

7.1 The warm-night signal

The most important finding is the dominance of warm-night tolerance as the differentiating factor. Many species survive 115°F days if nights drop to 75°F. But when summer nights remain at 80–85°F, plants cannot reduce respiration, carbohydrate

reserves deplete, and chronic stress accumulates. The 2040 formula weights warm-night tolerance at 30%—the single heaviest factor.

7.2 The native advantage

Mojave natives disproportionately populate Expand because they carry adaptive traits—heat-shock proteins, CAM/C4 photosynthesis, deep tap roots, reflective leaf surfaces—not captured by individual factors but emerging from millions of years of desert evolution. The Local Fit bonus (30% of Program Fit) is a proxy for this unmeasured adaptive depth.

7.3 The Sonoran migrants

As winter minimums rise, Sonoran species—fairy duster, chuparosa, desert ironwood, elephant tree—become viable. Rather than fighting warming with stressed temperate species, practitioners can lean into it with species pre-adapted to the conditions Las Vegas is becoming.

7.4 Limitations

Scores are based on published literature and practitioner experience, not controlled trials. Within-species genetic variation, soil conditions (caliche, alkalinity, salinity), and factor interactions are not modeled. The 1–3 scale sacrifices resolution for simplicity. Users should treat scores as relative rankings, not absolute predictions.

8. Practical Recommendations

Municipal specifications: Require minimum Program Fit ≥2.2 for new installations. Prohibit species <1.8. Cross-reference 2005 UNR booklet against current matrix.

Nursery programming: Prioritize the 78 Expand species for seed collection and propagation. Phase out Phase Down species over 3–5 years. Package the 8-species monarch milkweed gradient as a product line.

Homeowners: Plant Mojave natives as landscape backbone. Roses and ornamentals are accent plants with proper irrigation and siting. Set drip to 8:00–8:30 PM, 60 minutes, every permitted day.

Restoration: Use the 13 perfect-score species as anchor palette for unirrigated projects.

9. Conclusion

Las Vegas is getting hotter, and the plants that defined its landscapes in the 20th century are increasingly mismatched to its 21st-century climate. The Mojave Desert offers a rich palette of beautiful, ecologically functional species that are not merely adequate for the warming future—they are *optimized* for it. The challenge is not a shortage of good species but a failure to update the planting guides, nursery inventories, and institutional specifications that determine what actually gets planted. This matrix is intended to accelerate that update.

Funding and Conflict of Interest Disclosure

This research was entirely self-funded by the authors. No external funding was received from any government agency, non-profit organization, commercial entity, nursery, seed company, water authority, or other source. The authors have no financial interests in any plant species, nursery, seed production company, or landscape contracting firm discussed in this paper. The scoring methodology and all species evaluations were developed independently by the authors based on publicly available climate data, published literature, and practitioner experience. The authors declare no conflicts of interest.

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References

Chestovich, P.J., et al. (2022). Temperature profiles of sunlight-exposed surfaces in a desert climate. J. Burn Care & Research, 44(3), 542–549.

Clark County. (2021). All-In Clark County: Climate Change Action Plan.

Climate Central. (2022). Hot zones: Urban heat islands.

Luedeling, E., et al. (2009). Declining winter chill for fruit and nut trees in California 1950–2099. PLoS ONE, 4(7), e6166.

Mills, L., Johnson, W.S., & O'Callaghan, A. (2003). The Rose in the Desert Southwest. UNR Extension FS-03-15.

NASA/JPL-Caltech. (2022). ECOSTRESS surface temperature imagery, Las Vegas, June 10, 2022.

NWS Las Vegas. (2021). 1991–2020 Climate Normals.

NOAA NCEI. (2022). Nevada State Climate Summary.

SNWA. (2026). Watering tips. snwa.com/landscapes/how-and-when-to-water/watering-tips.html

UNR. (2023). Quarterly Climate Report, Oct–Dec 2023. Nevada State Climate Office.

Appendix: Data Availability

The complete scoring matrix (las_vegas_native_species_climate_matrix_v4_2.xlsx) is available as a companion dataset on ResearchGate. The workbook contains five tabs. Two companion visualizations are also available: Las Vegas Chill Hours 1970–2050 and Las Vegas Nighttime Temperatures 1970–2060. A 26-slide public lecture (“Planting for a Hotter Las Vegas”) is available for community education use.