2026 Biennial Adaptive Management Report

FINAL

Contents

Tables

Figures

Appendices

Acronyms and Abbreviations

AMMP	Adaptive Management and Monitoring Plan
AMP	Adaptive Management Program
AMR	Adaptive Management Report
BCCE	Boulder City Conservation Easement
BGO	Biological Goal and Objective
DCP	Desert Conservation Program
MSHCP	Multiple Species Habitat Conservation Plan
Permit	Incidental Take Permit #TE34927-0
Permittees	Clark County; cities of Boulder City, Henderson, Las Vegas, Mesquite, and North Las Vegas; and Nevada Department of Transportation
USNVC	U.S. National Vegetation Classification

Section 1   Introduction and Background

This Biennial Adaptive Management Report (AMR) presents the Science Advisor Panel's independent review of the Clark County Multiple Species Habitat Conservation Plan (MSHCP) and associated Biological Opinion (USFWS 2000).

Permit Administration. Clark County coordinates compliance with Incidental Take Permit #TE034927-0, issued by the U.S. Fish and Wildlife Service (USFWS) in 2001 under Section 10(a)(1)(B) of the Endangered Species Act. The Permittees are Clark County, the cities of Boulder City, Henderson, Las Vegas, Mesquite, and North Las Vegas, and the Nevada Department of Transportation. Clark County serves as the Plan Administrator for the MSHCP on behalf of the other Permittees, with the Desert Conservation Program (DCP) representing Clark County in this role. The current Permit expires in February 2031.

Covered Species. The MSHCP covers 78 species: 15 reptiles and amphibians, 8 birds, 4 mammals, 10 invertebrates, and 41 plants (USFWS 2001). When the MSHCP was finalized in 2000, only the desert tortoise (*Gopherus agassizii*) and southwestern willow flycatcher (*Empidonax traillii extimus*) were listed under the Endangered Species Act. Since then, the Mount Charleston blue butterfly (*Icaricia shasta charlestonensis*) and western yellow-billed cuckoo (*Coccyzus americanus*) have also been listed.

Plan Area and Development. The MSHCP plan area includes Clark County and lands in Nye, Lincoln, Mineral, and Esmeralda counties that lie below the 38th parallel, are less than 5,000 feet in elevation, and are associated with Nevada Department of Transportation activities (Figure 1). The Permit originally allowed for the incidental take of MSHCP-covered species from 145,000 acres within the plan area, which has since increased by 22,650 acres (due to the credit provided by the creation of the Tule Springs Fossil Beds National Monument) for a total of 167,650 acres. The MSHCP covers all of Clark County; however, impacts are confined to the following area (referred to as the 'available development area' [synonymous with 'impact area'], Figure 1)

- Non-federal lands in Clark County; and

- Any federal lands within Clark County that may be designated by a federal agency for disposal and eventual transfer to non-federal ownership (i.e., Federal Disposal Boundaries).

Figure 1.   MSHCP Permit Area and Plan Area (Inset)
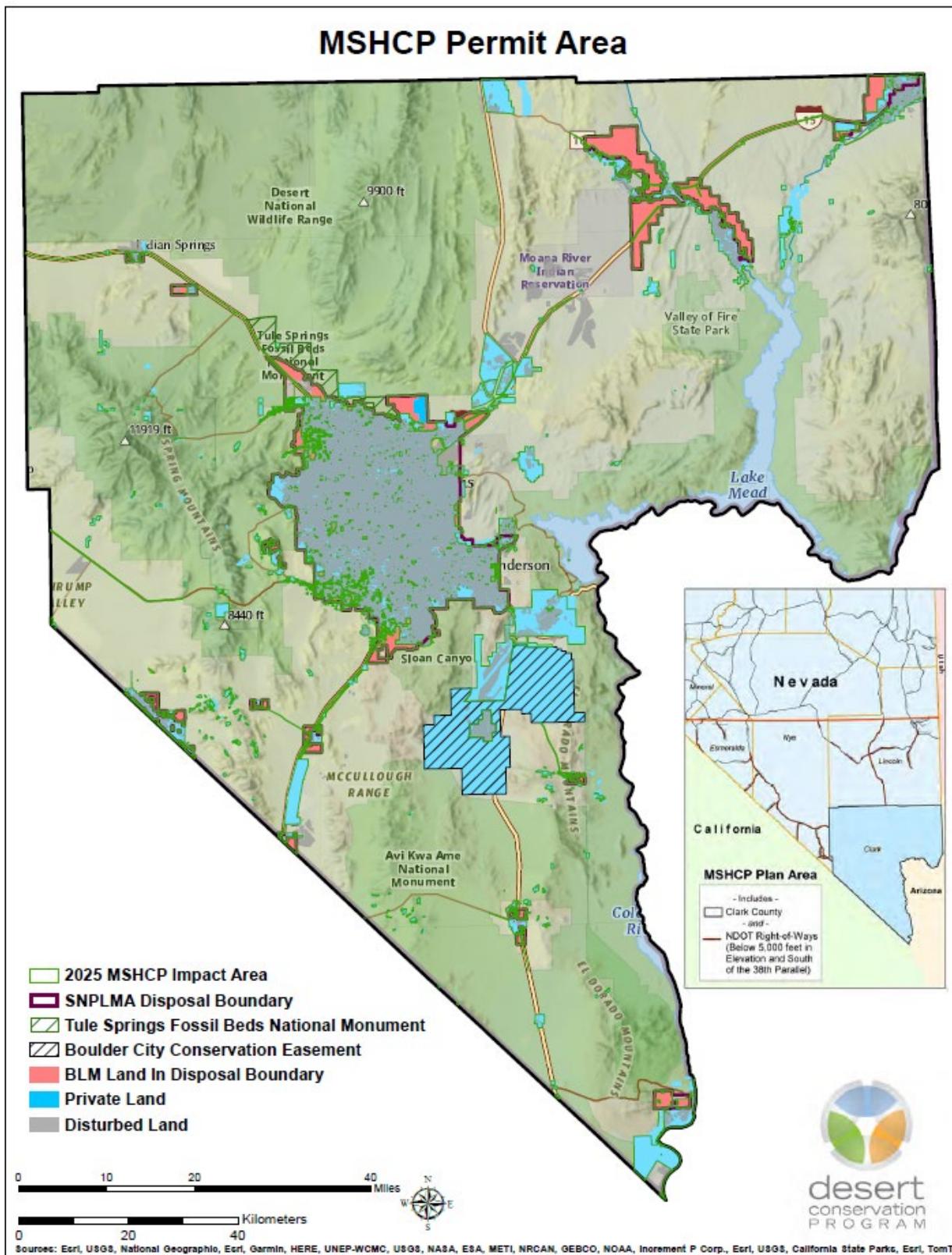
1.1   Purpose

The MSHCP and Permit require a science-based Adaptive Management Program (AMP), described in a Memorandum of Agreement with specific goals and guiding principles (Clark County 2000, USFWS 2001 and 2002). The AMP provides objective, quantitative evaluation of management actions through inventory, monitoring, and research to assess progress toward program goals (USFWS 2000).

The AMP requires an independent Science Advisor Panel to assess MSHCP implementation by conducting four evaluations (USFWS 2000):

1. Analyze land-use trends to ensure take and habitat disturbance are balanced with conservation (Section 2).

2. Track habitat loss by ecosystem (Section 3).

3. Evaluate the effectiveness of management actions in meeting MSHCP conservation and recovery goals (Section 4).

4. Monitor population trends and ecosystem health (Section 5).

This Biennial AMR documents the Science Advisor Panel's analyses, findings, and recommendations for improving the DCP's AMP and MSHCP implementation.

1.2   Previous Biennial AMR

The previous Biennial AMR was completed in 2024 and covered data from 2001 through 2023 (Alta 2024). This report summarizes those recommendations and DCP's responses on implementation progress (Appendix A) and provides new recommendations for the upcoming biennium (Section 6).

1.2.1   Summary of 2024 Biennial AMR Recommendations

The 2024 Biennial AMR included 5 recommendations for DCP implementation. Based on DCP responses (Appendix A), the Science Advisor Panel confirms that all recommendations have been or are being successfully implemented.

1.3   Significant Updates since the 2024 Biennial AMR

One significant update has occurred since the 2024 Biennial AMR: an AMP Lessons Learned application (hereafter 'the App') was developed for tracking adaptive management and project effectiveness.

Section 2   Land Use Trends in Clark County – Analysis and Discussion

The first assessment tool of the AMR states "*Analyze all land-use trends in Clark County to ensure that take and habitat disturbance are balanced with conservation*" (USFWS 2000). The Science Advisor Panel focuses on changes to ecosystems that may represent habitat loss for the 78 covered species. Under the MSHCP, "take" is measured by permitted acres and habitat loss (Clark County 2000).

This assessment uses data through June 2025 provided by DCP staff, including permitted acres as reported by the Permittees to DCP (DCP 2025). The Science Advisor Panel assumes the

data from DCP are accurate, complete, and current. Because mitigation fees are paid before habitat disturbance, actual habitat loss is expected to be less than expended permitted acres, which are used to track remaining development capacity.

Habitat loss is calculated from total developed acres on non-federal lands (private, municipal, and state) and federal disposal areas, serving as a proxy for impacts on covered species—with any disturbed habitat assumed to represent habitat loss.

This section summarizes permitted acres and habitat loss since the 2024 assessment (Alta 2024) and cumulatively since 2001. The assessment addresses two key questions about habitat loss discussed in the sub-section below:

- How many acres have been permitted for habitat loss?

- How many total acres of habitat loss have occurred?

2.1 Assessment of General Habitat Loss

The reported number of expended permitted acres was compared to ESA Sentinel 2a imagery (collected June 25-July 5, 2025) and the OPERA Land Surface Disturbance Alert (from June 30, 2025; https://www.earthdata.nasa.gov/data/catalog/lpcloud-opera-l3-dist-alert-hls-v1-1) to determine actual habitat loss to date versus permitted disturbance acres to date (see ECO 2016 and Appendix B for detailed descriptions of the aerial imagery and spatial analysis). County-wide aerial imagery is typically used to determine actual habitat loss, however it was not prepared and distributed to DCP at the time of AMR analysis. The results presented in this sub-section pertain to actual, realized habitat loss. General habitat loss discussed in this sub-section is irrespective of ecosystem. Habitat loss from permitted but currently undeveloped acreage, if developed in the future, will be captured in the 2028 Biennial AMR.

Through June 2025, a total of 130,567 acres have been recorded as disturbed under the MSHCP, including 15,000 municipal acres that were exempted from paying the per-acre fee. This is 90.0% of the total permitted acres under the MSHCP. Also, as of June 2025, a total of 128,671 acres of habitat have been developed (i.e., actual habitat loss; Table 1; Figure 2). This is 88.7% of the allowed acreage. From July 2023 to June 2025, 6,737 acres of development occurred, which is a habitat loss of 0.1% of all land in Clark County (Table 1, Figure 2). This is slightly less than the 7,463 acres of habitat lost to development in the previous biennium (Alta 2024). Habitat loss from 2023 to 2025 was 39.8% less than the average habitat loss across all previous bienniums (6,673 acres versus 11,085 acres, on average; based on the overall total acreage developed between 2001 and 2023). Habitat loss from 2023 to 2025 made up 4.4% of the total permitted acres (Figure 3).

Current and historic rates of habitat loss can be used to project potential future rates of loss. From 2001 to 2025 the average amount of development per biennium was 11,085 acres (average of 5,359 acres per year). At this rate, the remaining 16,393 acres permitted for development under the current MSHCP would be developed in 3.1 years from July 2025, or approximately in 2028. However, several recent bienniums have not experienced such high rates of development. With the average 6,616 acres of development per biennium (average 3,308 acres per year) from 2015 to 2025 (excluding the 2019 – 2021 development because of its relatively high rate of development), the remaining acres permitted for development would be developed in 5 years from July 2025, or approximately in 2030. For reference, the current permit is valid until February 2031. These calculations are for informational purposes only and do not represent projections of actual future rates of development. Actual development has been highly variable over time and is expected to continue as such in the future.

Table 1. **Total area, development area (habitat loss), and percent habitat loss prior to 2001, 2001 – 2023, and 2023 – 2025 in Clark County, Nevada**

Total acres in Clark County	Acres developed (habitat loss) within each time period[1] (% total acres[2] / % permitted acres[3])			Cumulative developed acres (% total acres / % permitted acres)
	Prior 2001	**2001 – July 2023**	**July 2023 – June 2025**	
5,159,738	180,754 (3.5% / NA[4])	121,934 (2.4% / 84.1%)	6,737 (0.1% / 4.7%)	309,425 (6.0% / 88.7%[5])

[1]Based on aerial imagery. The total developed acres are fewer than the number of acres permitted for development.
[2]Percentage of total acres in Clark County developed within time period.
[3]Percentage of MSHCP-permitted acres developed within time period.
[4]Not Applicable, as MSHCP began in 2001.
[5]Cumulative percentage of expended permitted acres developed is based on acres developed since the permit began in 2001 (128,671 acres).

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Figure 2. **Map of USNVC divisions and development in Clark County, NV, mapped with United States National Vegetation Classification divisions (2019)**
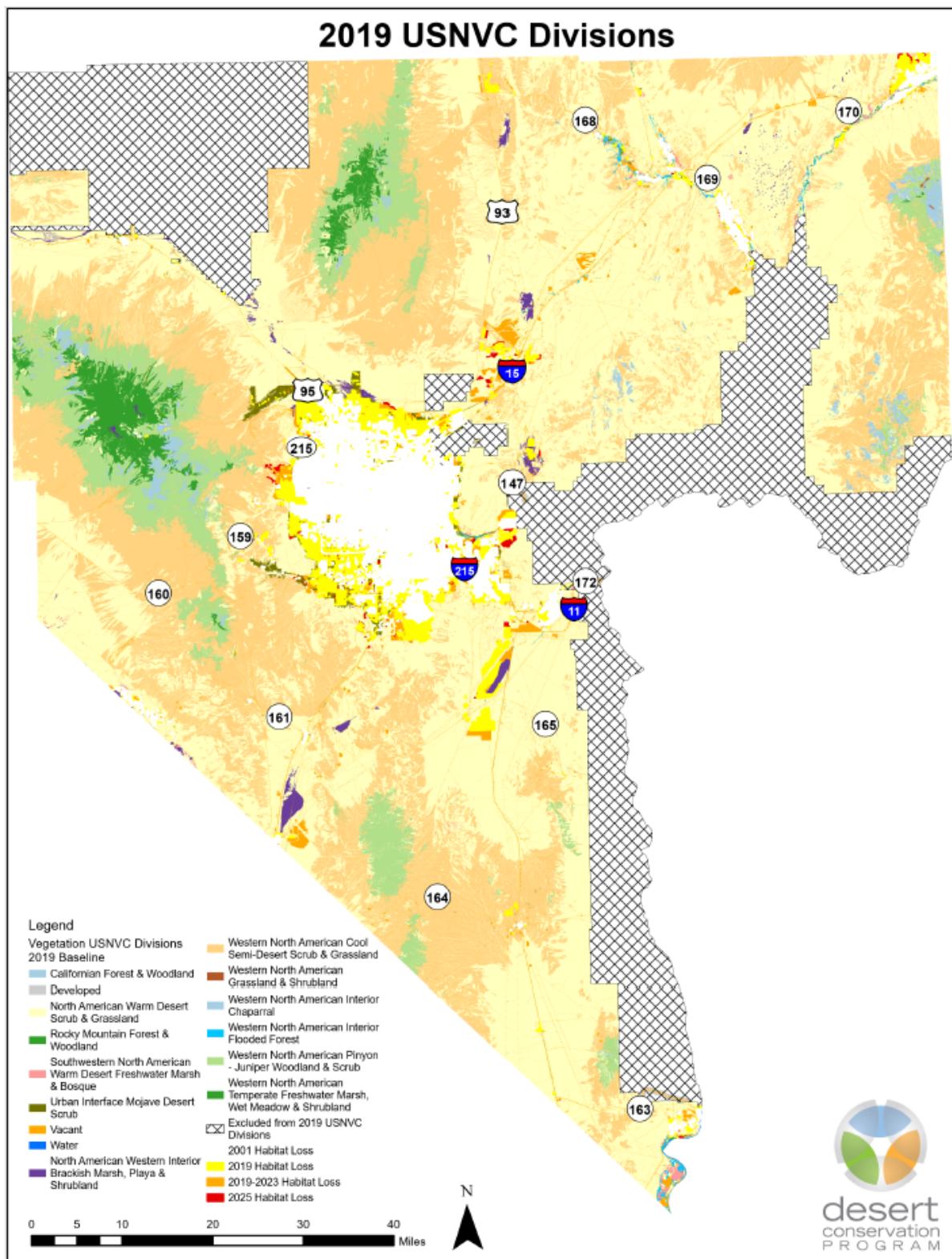
Figure 3.   Habitat loss as a function of total acreage, time period of development, and proportion of permitted acreage
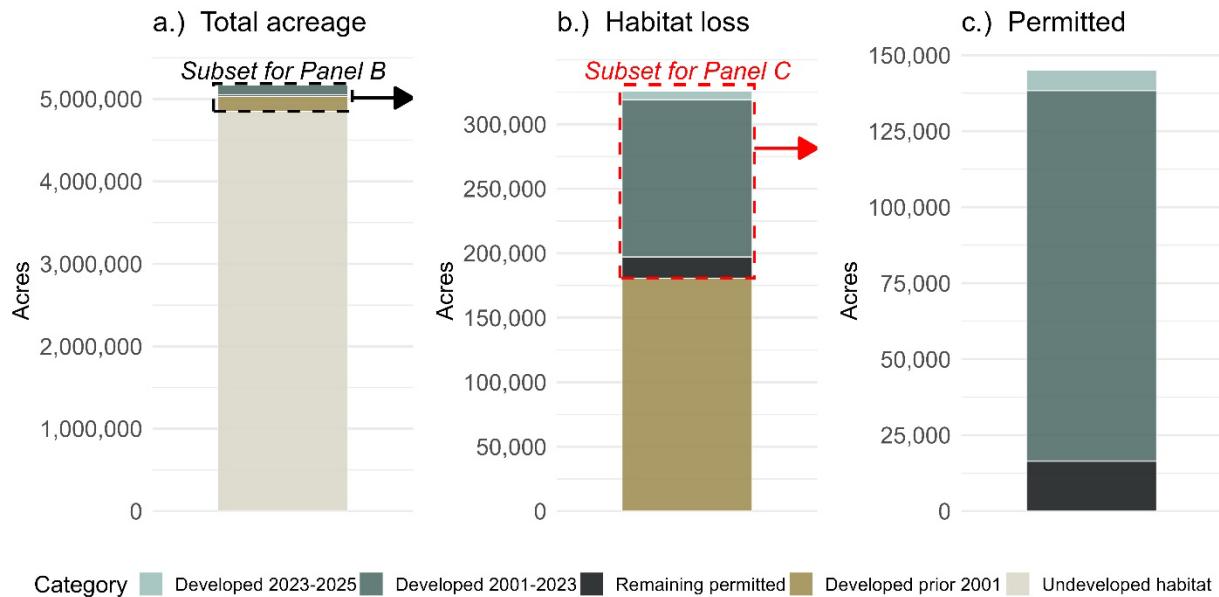
2.2   Conclusions and Recommendations for Land Use Trend Analysis

Based on the Science Advisor Panel's assessment of land-use trends (i.e., general habitat loss), **<u>conclusions</u>** are:

- General habitat loss is ahead of an annualized average (10% of permitted acres remain but ~20% of the permit period remains). However, annual rates of habitat take have varied tremendously over the duration of the MSHCP and may increase or decrease with changing economic conditions in the region.

- In a general sense, current conservation actions are balancing habitat take (USFWS 2000) because the Permit conditions are being met.

The Science Advisor Panel does not have any specific recommendations for the DCP to implement in this section.

Section 3   Habitat Loss by USNVC Division – Analysis and Discussion

In addition to tracking total habitat loss, the DCP tracks habitat loss by ecosystem or habitat (i.e. U.S. National Vegetation Classification (USNVC) division) as an assessment of development impacts (i.e., "take") on the 78 covered species. Sources and methods used to calculate habitat loss are included in Appendix B.

The dominant USNVC divisions within the mapped area are North American Warm Desert Scrub and Grassland, Western North American Cool Semi-Desert Scrub and Grassland, and Western North American Pinyon-Juniper Woodland and Scrub. Data from the 2019 USNVC division layer (Table 2) show that the majority of development in the most recent biennium (2023 – 2025) was in Urban Interface Mojave Desert Scrub (2,660 acres; 39.9% of development

this biennium) and North American Warm Desert Scrub & Grassland (2,637 acres; 39.5% of development this biennium).

Table 2.   Habitat loss by 2019 USNVC division

USNVC division	Total baseline acres in 2019 (% of mapped area)[1]	Available for development in 2019 (% prevalence)	Developed acres (i.e., habitat loss)		
			2019 – 2023	2023 – 2025	Cumulative 2019 - 2025 (% of USNVC division in county)
Urban Interface Mojave Desert Scrub	38,127 (0.9%)	30,536 (5.4%)	7,392	2,660	10,052 (26.4%)
Vacant or Cleared[2]	61,243 (1.5%)	24,872 (4.4%)	2,899	930	3,829 (6.3%)
Western North American Interior Flooded Forest	5,688 (0.1%)	2,408 (0.4%)	16	45	61 (1.1%)
North American Western Interior Brackish Marsh, Playa & Shrubland	18,385 (0.4%)	7,536 (1.3%)	168	0	168 (0.9%)
Southwestern North American Warm Desert Freshwater Marsh & Bosque	6,078 (0.1%)	2,327 (0.4%)	7	46	53 (0.9%)
Water	1,199 (0.0%)	668 (0.1%)	10	1	11 (0.9%)
North American Warm Desert Scrub & Grassland	2,139,051 (51.1%)	175,151 (30.9%)	7,683	2,637	10,320 (0.5%)
Western North American Temperate Freshwater Marsh, Wet Meadow & Shrubland	2,728 (0.1%)	248 (0.04%)	7	3	10 (0.4%)
Western North American Cool Semi-Desert Scrub & Grassland	1,217,744 (29.1%)	32,796 (5.8%)	138	351	489 (<0.1%)
Total	4,185,111[3]	567,520	18,320	6,673	24,993 (0.6%)

[1]USNVC data underwent additional accuracy assessment since the preparation of the 2024 AMR, so these data may vary slightly from previous numbers.
[2]Land classified as 'Vacant or Cleared', based on the 2019 data, indicate that the land appeared vacant at that time and does not exclude the possibility that it may have been cleared prior to the start of the MSHCP permit in 2001.
[3] Additional USNVC divisions without any development/habitat loss from 2019 – 2025 include Californian Forest & Woodland, Developed (i.e., existing disturbance that occurred prior to 2019), Rocky Mountain Forest & Woodland, Western North American Grassland & Shrubland, Western North American Interior Chaparral, and Western North American Pinyon-Juniper Woodland & Scrub. These categories comprise 694,868 of the 4,185,111 total acres and 290,978 of the acres available for development.

In addition to quantifying the absolute area of habitat loss for each USNVC division, an index of the acreage lost in relation to the acreage available (i.e., prevalence) was also calculated. If development occurs evenly with respect to USNVC division distribution, the loss of an USNVC division should be proportional to its prevalence within the available development area (in 2019: 567,520 acres; see Section 1 Plan Area and Development and Table 2).

We evaluated proportionality for each USNVC division across 2 development periods — in the recent biennium (2023 – 2025; Figure 4) and since 2019 (i.e., when USNVC divisions were first incorporated; Figure 5) — by plotting each USNVC division's development out of the total acres developed against that USNVC division's prevalence. Values close to a 1:1 reference line indicate loss proportional to prevalence.

Figure 4.   Proportion of acres developed in 2023 – 2025 versus existing prevalence (acres available for development in 2023) for USNVC divisions occurring in the MSHCP plan area
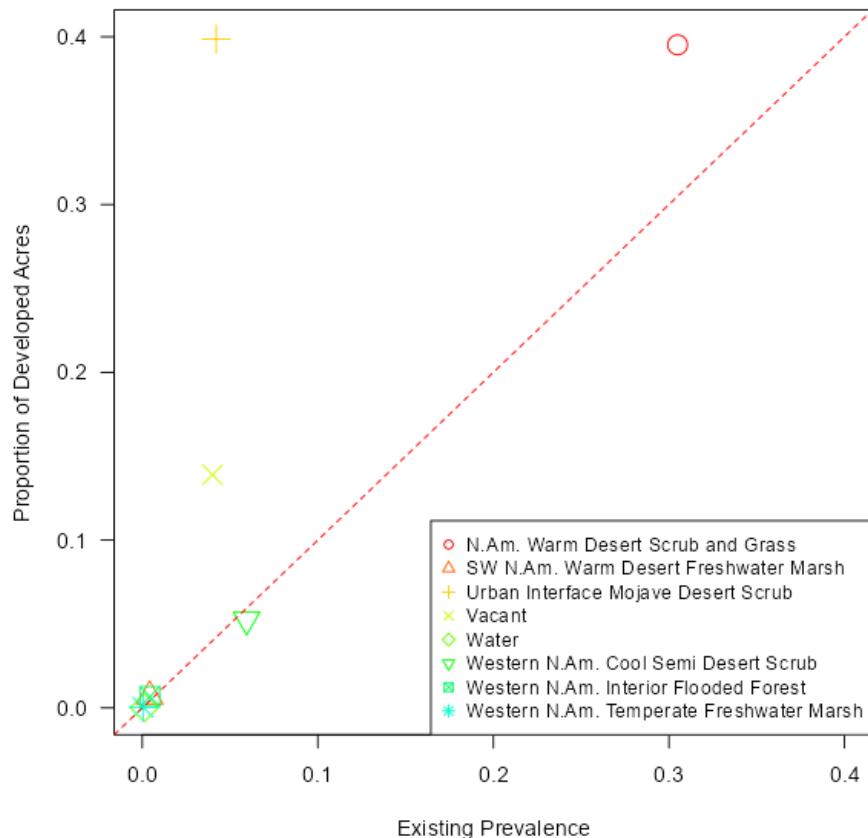
From 2023 – 2025, the USNVC divisions North American Warm Desert Scrub and Grassland, Vacant, and Urban Interface Mojave Desert Scrub were developed proportionately more compared to their prevalence (Table 2, Figure 4).

Figure 5.   Proportion of acres developed in 2019 – 2025 versus existing prevalence (acres available for development in 2019) for USNVC divisions occurring in the MSHCP plan area
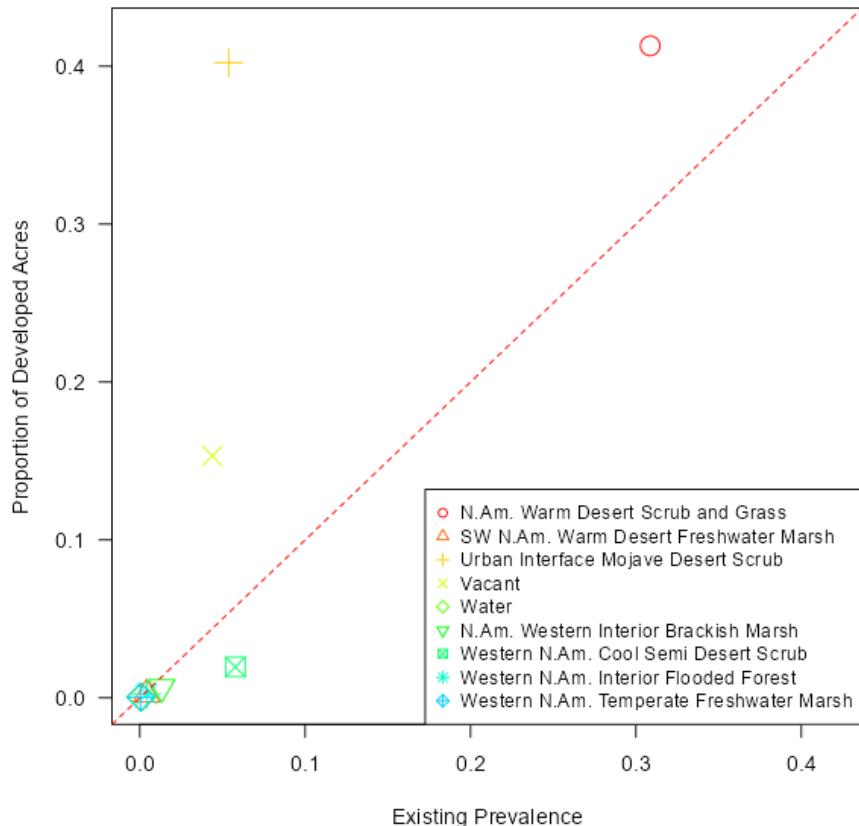
A similar pattern of development has occurred since 2019 as occurred in the recent biennium. North American Warm Desert Scrub and Grassland, Vacant, and Urban Interface Mojave Desert Scrub have been developed proportionately more than their prevalence, while Western North American Cool Semi-Desert Scrubland has been developed proportionately less (Figure 5).

3.1   Conclusions and Recommendations for Habitat Loss by USNVC Division Analysis

Based on the Science Advisor Panel's assessment of habitat loss categorized by USNVC division, **conclusions** are:

- Based on the 2019 USNVC division layer, North American Warm Desert Scrub & Grassland, Vacant, and Urban Interface Mojave Desert Scrub experienced the highest total habitat loss and were also developed at a disproportionately higher rate than their prevalence, both since 2019 and in the most recent biennium.

- The high disproportionate development of Vacant and Urban Interface Mojave Desert Scrub is interpreted by the Science Advisor Panel to be a positive conclusion with respect to which habitats are lost. Concentrating further development in USNVC

> divisions that are already experiencing disturbance is preferable over development in undisturbed USNVC divisions.

- DCP does not have control over which USNVC divisions are developed, or at what rate they are developed; therefore, a reasonable assessment of their attention to development trends lies in combining the assessments in Section 3 with the evaluation of ongoing project effectiveness in Section 4. Often, project descriptions and information available to the Science Advisor Panel for use in evaluating project effectiveness (Section 4) do not explicitly connect USNVC division to each project implemented. However, Appendix A includes DCP responses to how they have addressed previous recommendations to place conservation attention on USNVC divisions that are being developed at both high overall rates, as well as those being disproportionately developed.

The following are **recommendations** from the Science Advisor Panel that are intended for DCP implementation:

- Continue to develop conservation actions for those USNVC divisions undergoing the highest total loss and the highest disproportionate loss. This includes **North American Warm Desert Scrub & Grassland** (Figure 4 and Figure 5).

Section 4   Effectiveness of Management Actions – Analysis and Discussion

The third assessment tool in the AMR states "*Evaluate the effectiveness of management actions at meeting MSHCP goals of conservation and recovery*" (USFWS 2000). Management actions are projects implemented by the DCP (see Biennium Progress Reports for descriptions, budgets, and timelines, available here: [DCP Biennium Progress Reports](#).

The DCP has recently developed an internal software interface to link specific project objectives, progress, and outcomes to the 2023 Biological Goals and Objectives (BGOs; Alta 2023). The AMP Lessons Learned App allows for a more quantitative assessment of project effectiveness by linking BGOs and performance measures to each overarching project and individual contracts.

The biological goals are to (see Alta 2023 for complete description and corresponding biological objectives):

> **Goal 1.** Maintain or improve habitat quality and quantity within DCP reserve system lands to promote resiliency, redundancy, and representation for covered species.

> **Goal 2.** Maintain stable or increasing populations of covered species occurring within DCP reserve system lands.

> **Goal 3.** Foster community and stakeholder engagement to maintain or improve covered species populations and their habitats.

To facilitate this assessment, the DCP provided the Science Advisor Panel with a list of 18 overarching projects and 35 contracts nested within the projects. Each project and contract was assigned specific objectives and linked back to the applicable BGO. In total, these projects and contracts worked to address objectives 134 times (Table 3). Status categories are:

- Achieved—The project or contract has successfully achieved the objective.

- Incomplete—The project or contract has not be completed, or is not far enough along to evaluate whether the objective has been met.

- Failed—The project or contract has concluded and subsequent evaluation determined that the specific objective was not achieved. Failed objectives are evaluated individually by DCP for adaptive management actions.

Table 3. **Tally of number of contract and project objectives and their status meeting BGOs.**

BGO[1]	Achieved	Failed	Incomplete	Total
1.1	3	0	6	9
1.2	0	0	0	0
1.3	3	2	25	30
1.4	1	0	4	5
1.5	1	0	8	9
1.6	1	0	0	1
1.7	0	0	0	0
2.1	21	0	16	37
2.2	0	0	1	1
2.3	5	0	10	15
2.4	8	0	9	17
3.1	1	0	4	5
3.2	0	0	5	5
Total	**44**	**2**	**88**	**134**

[1]Full descriptions of BGOs are included in the AMMP (Alta 22023).

4.1 Conclusions and Recommendations for Management Action Effectiveness

Based on the Science Advisor Panel's assessment of management action effectiveness, conclusions are:

- Overall, the assessment of the effectiveness of the DCP's management actions is positive because most BGOs have projects that are addressing them. The AMP Lessons Learned App does not include any current or recently concluded projects this biennium that address BGOs 1.2 and 1.7; however, discussion with DCP indicates progress for both BGOs. The BGOs, as described in the AMMP (Alta 2023) and DCP efforts to address each of them are below.

    BGO 1.2: *Acquire riparian acreage at an equivalent rate as take over the life of the permit. An 8-year lag after riparian acreage is developed is allowed to account for the willing-seller, willing-buyer basis of property exchange, within the life of the permit.*

    - DCP staff are working to obtain an easement to the 'Electric Avenue' parcel on the Virgin River. This work is not yet part of a specific project but illustrates DCPs continual efforts to acquire riparian properties.

    BGO 1.7: *Protect and enhance connectivity (i.e., road restoration, culvert placement) within DCP reserve system lands for desert tortoise and other high priority covered*

> *species. Review and report on the status of these projects quadrennially in every other AMR.*

- One project, 2023-UNLV-2395A, includes road restoration which does protect and enhance connectivity. DCP reviewed information in the AMP Lessons Learned App, and we anticipate this BGO will be captured in the data as they refine their use of the App.

- The Science Advisor Panel notes that this is the first AMR cycle using the new AMP Lessons Learned App. We anticipate that with each future AMR cycle, the App will contain additional projects, their related objectives, performance measures, and statuses. Thus, the app will provide a more complete, consistent, and quantitative dataset to assess effectiveness of management actions.

The following are recommendations from the Science Advisor Panel that are intended for DCP implementation:

- Continue to ensure that all BGOs are being actively addressed.

Section 5   Species Status and Population Trends

The MSHCP requires monitoring the status and trends of covered species and their habitats to prevent habitat loss or fragmentation and stabilize or increase population numbers in Clark County (Clark County 2000, USFWS 2002).

Monitoring serves two key purposes:

1. Evaluating the effectiveness of conservation actions implemented by the DCP
2. Detecting population declines that might occur despite MSHCP implementation

Current Monitoring Framework

The revised Adaptive Management and Monitoring Plan (Alta 2023) establishes the rationale and methodology for monitoring all MSHCP-covered species. This monitoring will:

- Track population and habitat trends
- Assess the impact of conservation actions on covered species
- Support the program-level adaptive management process

The adaptive management evaluation for populations and habitats occurs every 4 years, separate from the Biennial AMR (see Section 1.2.1). However, monitoring data must be synthesized and included in each Biennial AMR (Alta 2023). A checklist of species and habitats included for monitoring in the AMMP with a summary of DCP monitoring years is included in Table 4.

Table 4.   Species and Habitat Monitoring Checklist with Monitoring Years

Species / Habitat[a]	Monitoring Survey	Covered Species Group	Years Monitored
Desert tortoise	Occupancy sampling	Desert upland reptiles[a]	2013-present
Great Basin collared lizard			2015-present
Desert iguana			
Large-spotted leopard lizard			
Yellow-billed cuckoo	Federal protocol	Individual	2017-present
Southwestern willow flycatcher	Federal protocol	Individual	
Blue grosbeak	Point count / passive acoustic occupancy	Riparian birds	2017-present
Summer tanager			
Vermillion flycatcher			
Arizona Bell's vireo			
American peregrine falcon		Desert upland birds	2018-present
Phainopepla			
Silver-haired bat	Passive acoustic occupancy	Bats	2018-present
Long-eared myotis			
Long-legged myotis			
Sticky ringstem	Three-tiered sampling	Desert upland plants[b]	One time survey off reserve lands and incidental observation; monitoring will commence if species are observed on reserve lands
Las Vegas bearpoppy			
White bearpoppy			
Threecorner milkvetch			2023-present
Upland Habitat	AIM protocol augmented with remote sensing	NA	2023-present (AIM protocol)
Riparian Habitat	Remote sensing with ground truthing	NA	Contracting initiated; 1st monitoring event not yet completed.

[a]Species in **bold** are federally listed under the Endangered Species Act. MSHCP-covered species not included here are sufficiently rare, cryptic, or unknown as to whether they are specifically surveyed for; these species are assumed to be covered using desert upland or riparian habitat quality as a surrogate.

[b]Additional MSHCP-covered and proposed plant species should be included in monitoring as populations are located through targeted surveys.

5.1   Methods

5.1.1   Reptiles

Monitoring surveys for desert tortoises were conducted from 2013 through 2025 (excluding 2019). Incidental observations of other reptiles including leopard lizards (*Gambelia wislizenii*) and desert iguanas (*Dipsosaurus dorsalis*) were recorded during the desert tortoise surveys from 2015 through 2025 (excluding 2019).

A fully-parameterized dynamic occupancy model (i.e., estimated colonization, extinction, and detection parameters may vary independently from year to year) was fit to the desert tortoise data using the 'unmarked' (v1.5.1) package in Program R (v4.5.1). The estimated rates were then used to derive estimated annual occupancy rates. Because desert tortoises are often unavailable for detection even when truly present due to interannual variation in aboveground activity (Harju and Cambrin 2019), we present annual occupancy rates with the caveat that fluctuations in apparent occupancy rates may be an unobservable combination of variation in true occupancy and availability for detection.

Dynamic occupancy models were also fit to the data for desert iguanas and leopard lizards. The occupancy model for leopard lizards was fully parameterized, in that colonization, extinction, and detection probability rates were estimated separately for each year. However, because limited detections for desert iguanas prevented model convergence, a model with constant values for all parameters was fit instead.

5.1.2   Avian

Surveys for yellow-billed cuckoo and southwestern willow flycatcher were conducted each year from 2017 – 2025 following established federal survey protocols specific to each species. Protocol surveys included 4 – 5 visits within a breeding season to conduct callback surveys and visual point count surveys. Because new reserve unit properties were acquired within this window, not all units were surveyed each year. To standardize for unequal survey areas and unequal time spent in each unit (due to survey effort or unit size), detections of individuals were standardized as the number of individual birds of each species detected per hour of survey effort.

Point count surveys for all other avian species were conducted at riparian reserve units in 2017 – 2025 and at Boulder City Conservation Easement (BCCE) in 2018 – 2025. Surveys were 10 minutes in duration and survey stations were visited three times each year. Each avian species observed was recorded along with the estimated distance from the survey point. For the non-listed avian species for which there were sufficient data (Bell's vireo, blue grosbeak, loggerhead shrike, and phainopepla), we estimated annual occupancy rates using dynamic occupancy models and species detection/non-detection data with the 'unmarked' package (Program R v4.5.1). We fit fully-parameterized models to each species' data, which allowed colonization, extinction, and the probability of detection to vary independently from year to year. We then used these estimated rates to derive the estimated annual occupancy rates.

5.1.3   Bats

Passive acoustic monitors were deployed for 6 to 43 nights at each of 16 sites on the BCCE in May – July 2018, 2021, and 2023, and at 13 sites on riparian reserve properties in May – August 2019 and 2021. Passive acoustic data have been collected through 2025 but are not yet processed and available for analysis. We estimated occupancy of bat species with dynamic occupancy models in the 'unmarked' package in Program R (v4.5.1). We used the spreadsheet column 'FinalSpeciesID' as the definitive record on acoustic analysis and collapsed the

occurrence records to 1/0 (i.e., detected/not detected) for each survey station-night combination. We assumed no misidentification of bat species.

5.1.4 Plants

No covered plant species are known to exist on reserve system lands, and thus no species-specific plant monitoring is in place.

5.1.5 Habitat Monitoring

Assessment, Inventory, and Monitoring (AIM) and Forb Diversity sampling began at 7 plots on the BCCE on March 15, 2023. In March – April 2024, 7 additional plots were sampled, and in April 2025, another 7 plots were sampled (a total of 21 different plots over 2023, 2024, and 2025). The following standard AIM methods were implemented:

- Plot Characterization – soil description of a 70-centimeter (cm) soil pit, ecological site verification, and plot metadata, such as landform, slope, aspect, and other general information
- Photos of each transect line and soil pit
- Line-point Intercept (LPI) – including identification of *Artemisia tridentata* to sub-species
- Vegetation height at 2.5-meter intervals along transects; tallest woody and tallest herbaceous species within 30-cm diameter
- Gap Intercept with a 20-cm minimum gap size and both annual and perennial species "stopping" a gap
- Soil Aggregate Stability every 4 meters along transect lines
- Plot-Level Species Inventory for 15 minutes, with an additional 2 minutes added until no new species are observed
- GPS points collected at plot center and the beginning and end of each transect

Supplemental methods included:

- Forb Diversity – annual and perennial forbs recorded within a sweep of 1 meter every 2 meters along each transect

5.2 Results

5.2.1 Reptiles

The average probability of detection for desert tortoises from 2013 to 2025 was 0.21 (95% CI 0.12 – 0.34; Figure 6). Estimated occupancy rates of desert tortoises varied over time, ranging from a low of 0.13 (0.01 – 0.12 SE) in 2013 to a high of 0.52 (0.41 – 0.64) in 2015 (Figure 7). Probability of detection for desert iguanas was low at 0.05 (0.03 – 0.07). Occupancy rates of desert iguanas were generally higher than those of desert tortoises but appear to have declined over time, ranging from 0.71 (0.59 – 0.83) in 2015 to 0.21 (0.13 – 0.30) in 2025 (Figure 7). Probability of detection for leopard lizards averaged 0.03 (0.01 – 0.11) while occupancy rates ranged from 0.54 (0.24 – 0.31) in 2015 to 1.0 (0.77 – 1.0) in 2016 and 2017 (Figure 7).

Desert iguanas are not included in Figure 6 because the low number of observations did not allow for a model with full time-dependence across years. Occupancy estimates in subsequent years (Figure 7) were derived from the initial estimated detection rate and first-year occupancy.

Figure 6.   Estimated detection probabilities and 95% confidence intervals for Mojave Desert tortoises and leopard lizards
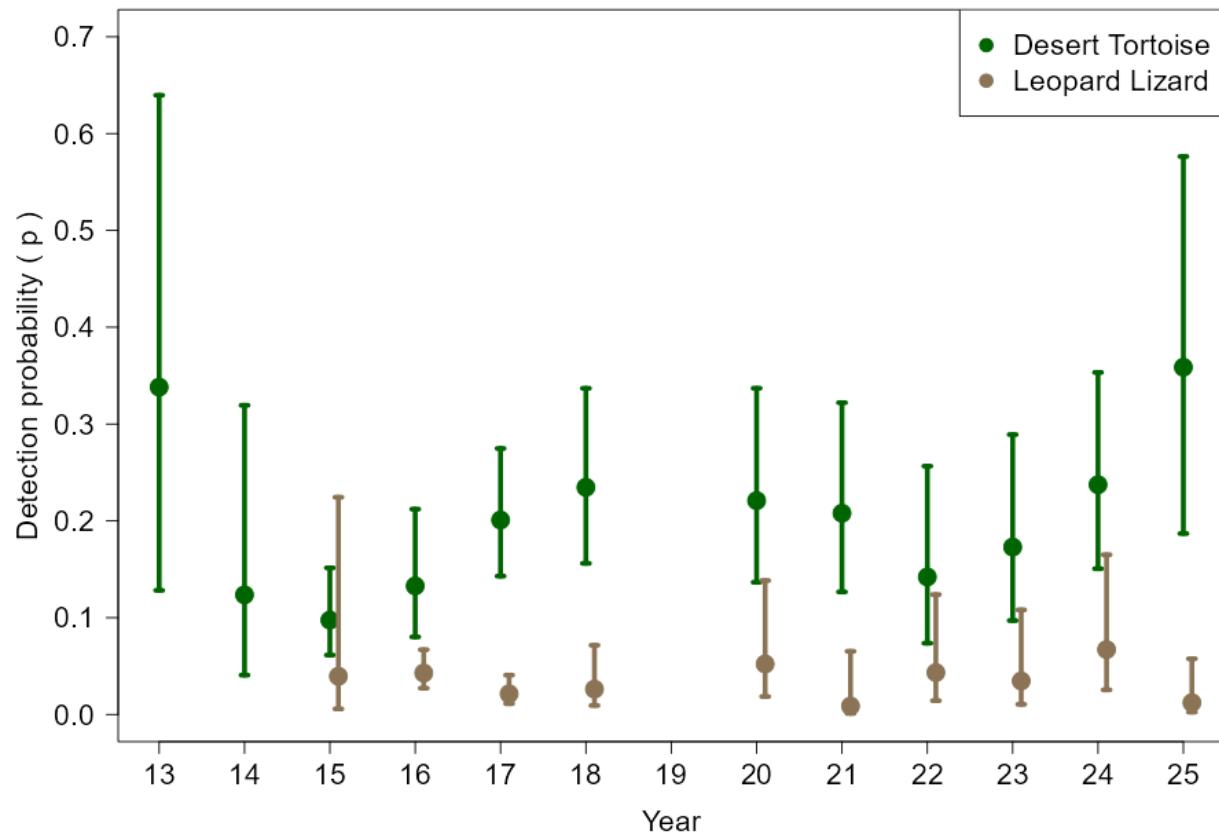
Figure 7.   Estimated occupancy rates (+/- 1 SE) for Mojave Desert tortoises, leopard lizards, and desert iguanas
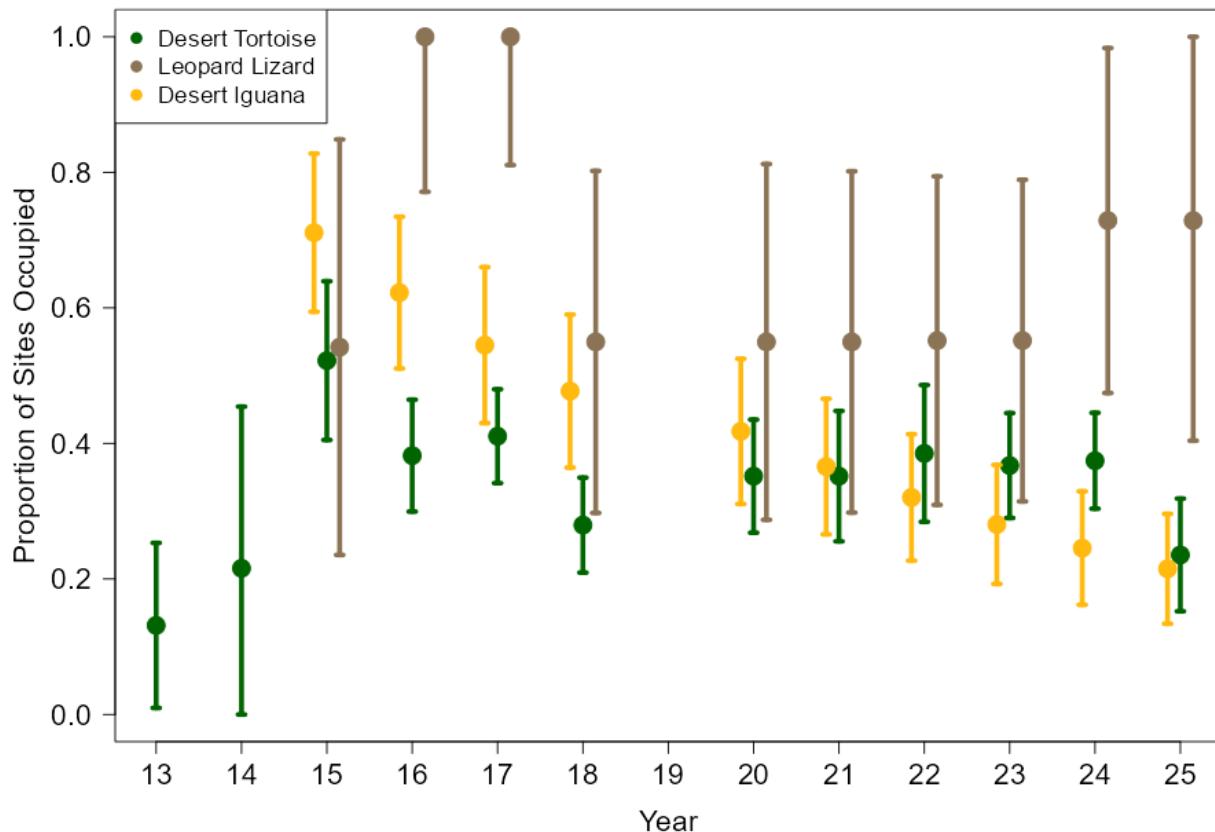
5.2.2   *Avian*

Individual birds detected per hour of survey effort increased from 2017 to 2025 for both yellow-billed cuckoos and southwestern willow flycatchers (Figure 8).

Throughout 2017 – 2025, the number of detections of non-listed birds on riparian reserve units and the BCCE varied greatly. On riparian reserve units, surveyors detected phainopeplas 74 times on 23 sites ($\bar{x}$ = 3.6 birds/site, max = 12 birds/site). Blue grosbeaks were observed on 147 occasions on 46 sites ($\bar{x}$ = 3.2, max = 10), and Arizona Bell's vireos were observed 321 times on 50 sites ($\bar{x}$ = 6.5, max = 28). Surveyors also detected vermilion flycatchers on 12 occasions, summer tanagers on 7 occasions, and peregrine falcons on 12 occasions. Throughout 2018 – 2025 on the BCCE, golden eagles were observed once, phainopeplas twice, and loggerhead shrikes 20 times, while LeConte's thrashers were observed on 41 occasions on 25 sites ($\bar{x}$ = 1.6, max = 3).

Estimated occupancy rates of phainopeplas in the riparian reserve units ranged from 0.51 in 2017 to 0.25 in 2023.

Estimated occupancy rates of blue grosbeaks in the riparian reserve units ranged from 0.60 in 2018 to 0.74 in 2024.

Estimated occupancy rates of Arizona Bell's vireos in the riparian reserve units ranged widely, from 0.23 in 2017 to 0.81 in 2018.

Estimated occupancy rates of LeConte's thrashers on the BCCE ranged from 0.47 in 2018 and to 0.99 in 2019 – 2021.

Figure 8.   Average number of southwestern willow flycatchers and yellow-billed cuckoos detected per hour of survey effort, 2017 – 2025
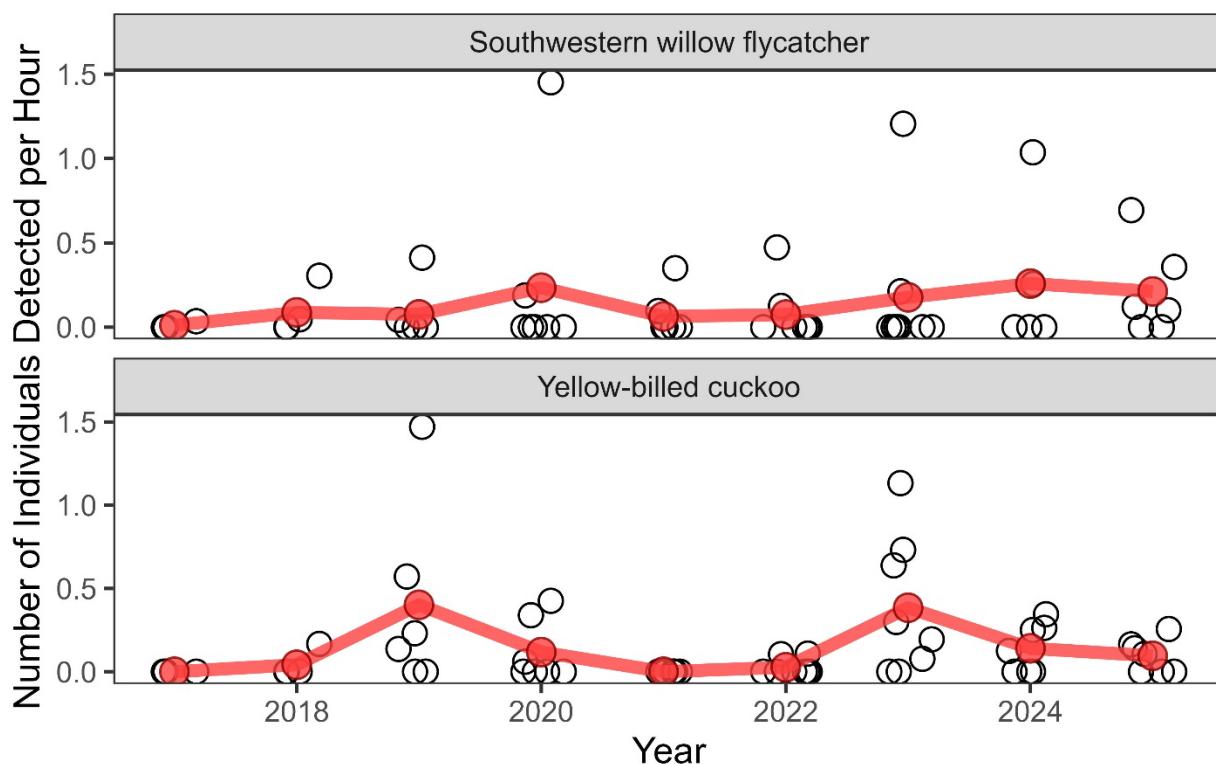
5.2.3   *Bats*

Of the five covered or proposed covered species, only silver-haired bats and Townsend's big-eared bats were detected using passive acoustic monitoring. Silver-haired bats were detected at 6 of 16 BCCE sites and at all 13 riparian sites. Townsend's big-eared bats were detected at zero BCCE sites and at 4 of the riparian sites.

The probability of detection for silver-haired bats was 0.69 (95% CI 0.49 – 0.84). Estimated occupancy rates of silver-haired bats ranged from a low of 0.11 (0.001 – 0.21) in 2023, decreasing from a high of 0.69 (0.45 – 0.94) in 2018 (Figure 9). Probability of detection for Townsend's big-eared bats was very low at 0.0003 (0.00 – 1.00; note that this estimate should be used with caution as such low rates of detection lend to model inaccuracies/low confidence). Occupancy rates of Townsend's big-eared bats were generally lower than those of silver-eared bats, ranging from 0.0003 (0.00 – 0.13) in 2018 to 0.15 (0.00– 0.49) in 2015 (Figure 9).

Figure 9.   Estimated occupancy rates (+/- 1 SE) for silver-haired (LANO) and Townsend's big-eared Bats (COTO), 2018 – 2023
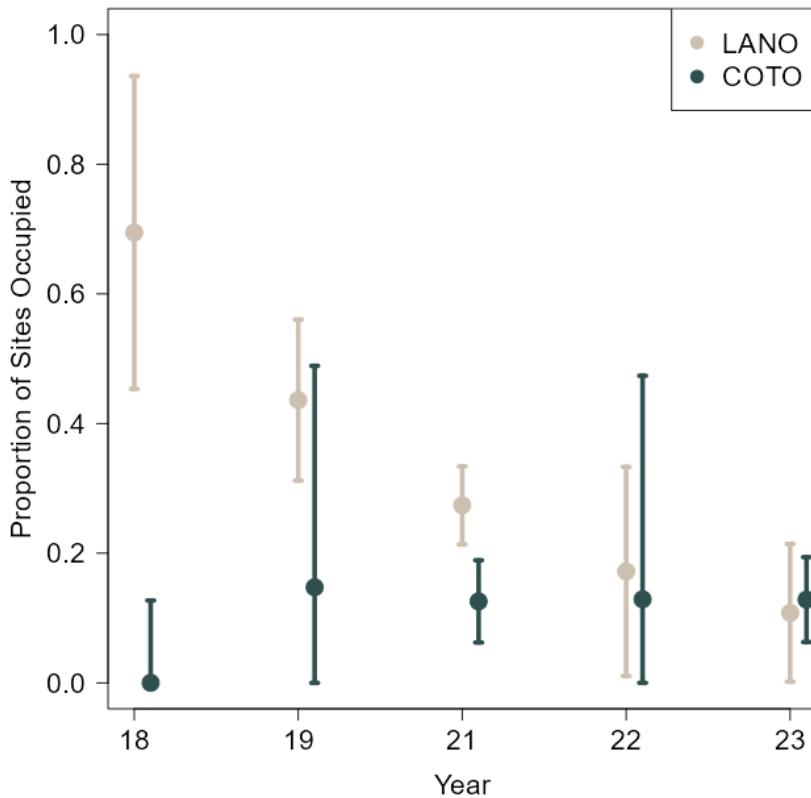
5.2.4   *Plants*

No trend analyses were conducted because no covered plant species occur within the reserve unit system.

5.2.5   *Habitat Monitoring*

AIM took place at 7 different sites each year: 2023, 2024, and 2025. The average number of plant species found across sites was 17.9 species. Average percentage bare ground in line point intercepts was 29.8% while the average percent foliar or canopy cover was 16.0%. Average woody height was 41.6 cm, and average herbaceous height was 8.6 cm. The average proportion of plots covered by canopy or basal gaps was 1.2% in the 25 to 50-cm category, 2.8% in the 51 to 100-cm category, 8.1% in the 101 to 200-cm category, and 78.9% in the >200-cm category. Average stability for all soil samples across sites was 2.3 (on a scale from 1 [low stability] to 6 [high stability]).

No trend analyses were conducted here because of the single year of data per plot. We anticipate that as additional years of data are collected, statistical analysis will be more practical and meaningful. The 2024 AMR recommended conducting statistical analysis prior to the 2028 AMR to help evaluate whether methods are appropriate/achieving the goal of monitoring ecosystem health.

5.3   Conclusions and Recommendations for Species Status and Trends

Based on the Science Advisor Panel's assessment of species status and trends, **conclusions** are:

- The existing monitoring program appears sufficient to establish stability or trends in the populations of most monitored species.

- Exploratory surveys for MSHCP-covered plants have been conducted off reserve unit lands; the AMMP specifies monitoring for MSCHP-covered plants if they are detected on reserve unit lands. Until such time as a MSHCP-covered plant species is detected on reserve unit lands, monitoring data are not expected to be collected.

The following are **recommendations** from the Science Advisor Panel that are intended for DCP implementation:

- Continue monitoring populations and habitats.

Section 6   Summary of Conclusions and Recommendations

This Biennial AMR describes the independent analysis and subsequent conclusions and recommendations from the Science Advisor Panel's assessment of land use trends, habitat loss by USNVC division, the effectiveness of management actions at meeting MSHCP goals, and population trends and ecosystem health. Conclusions are presented in Table 5 and recommendations are presented in Table 6.

Table 5.   **Summary of <u>conclusions</u> for all assessments performed by the Science Advisor Panel for the 2026 Biennial AMR**

Assessment section	Summary of <u>conclusions</u>
Section 2—Analyze all land-use trends in Clark County to ensure that take and habitat disturbance are balanced with conservation.	Habitat loss is outpacing what is expected given the percentage of habitat loss at this point in the timeline of the MSHCP under an assumption of constant, even development. Nonetheless, total habitat loss is within the constraints of the MSHCP and is being successfully mitigated by the requirements of the MSHCP.
Section 3—Track habitat loss by USNVC division.	North American Warm Desert Scrub & Grassland, Vacant, and Urban Interface Mojave Desert Scrub Divisions experienced the highest total and proportional habitat loss. The high rate of development for Vacant and Urban Interface Mojave Desert Scrub is interpreted by the Science Advisor Panel to be a positive conclusion. Concentrating further development in USNVC divisions that are already experiencing disturbance is preferable over development in undisturbed habitats.
Section 4—Evaluate the effectiveness of management actions at meeting MSHCP goals of conservation and recovery	All biological goals and objectives have projects that are either recently completed or are in progress.

Assessment section	Summary of conclusions
Section 5—Monitor population trends and ecosystem health.	The existing monitoring program appears sufficient for most species. Monitoring MSCHP-covered plants is not expected to occur regularly until such time these species are detected on reserve unit lands.

Table 6. **Summary of recommendations for all assessments performed by the Science Advisor Panel for the 2026 Biennial AMR**

Assessment section	Summary of recommendations
Section 2—Analyze all land-use trends in Clark County to ensure that take and habitat disturbance are balanced with conservation.	The Science Advisor Panel did not have any specific recommendations for the DCP to implement in this section.
Section 3—Track habitat loss by USNVC division.	Continue to develop conservation actions for those USNVC divisions undergoing the highest total loss and the highest disproportionate loss. This includes North American Warm Desert Scrub & Grassland.
Section 4—Evaluate the effectiveness of management actions at meeting MSHCP goals of conservation and recovery	Continue to ensure that all BGOs are being actively addressed.
Section 5—Monitor population trends and ecosystem health.	Continue monitoring populations and habitats

The Science Advisor Panel's overall appraisal, based on the above four primary assessments (Sections 2 - 5 and summarized in Tables 5 and 6), is that the DCP is successfully implementing the current MSHCP. General recommendations include improving project- and program-level tracking and reporting to allow for more quantitative rigor in future assessments, and the continuation/completion of several monitoring and planning efforts.

Section 7   References

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USFWS. 2002. Memorandum of Agreement among United States Bureau of Land Management, National Park Service, Unites States Department of Agriculture-Forest Service, United States Fish and Wildlife Service (Refuges), United States Fish and Wildlife Service (Ecological Services) and Clark County, Nevada in its Capacity as Administrator of the Desert Conservation Program Regarding Adaptive Management of the Clark County Multiple Species Habitat Conservation Plan. December 12, 2002.

Appendix A

Summary of Recommendations from Previous Biennial AMR

Assessment section	Summary of recommendations from 2024 AMR	DCP comment on progress since 2024 AMR
Section 2—Analyze all land-use trends in Clark County to ensure that take and habitat disturbance are balanced with conservation.	The Science Advisor Panel did not have any specific recommendations for the DCP to implement in this section.	NA
Section 3—Track habitat loss by ecosystem.	Continue to develop conservation actions for ecosystems undergoing the highest total loss and the highest proportional loss. These include Mesquite/Acacia, Salt Desert Scrub, and Desert Riparian ecosystems. Playa is excluded from this recommendation (See 2024 AMR conclusions and Appendix A).	Most of the work that was completed occurred within those habitat types which also corresponds to the North American Warm Desert Scrub and Grassland and wetland/riparian divisions.
	Determine which of the 2019 USNVC divisions warrant DCP conservation focus (e.g., Urban Interface Mojave Desert Scrub division had the second highest habitat loss in the recent biennium, but does an urban interface area warrant specific DCP conservation effort?)	
Section 4—Evaluate the effectiveness of management actions at meeting MSHCP goals of conservation and recovery.	Effectiveness worksheets should be implemented (implementation was ongoing but not complete at the time writing the 2024 AMR). By doing so, and collating in a spreadsheet, direct quantitative assessment within the next Biennial AMR should be possible.	All data from the previous biennium have been added to the new lessons learned database which is replacing the old worksheets
Section 5—Monitor population trends and ecosystem health.	Processing of bat acoustic detection data should be continued to yield several more years of species presence and abundance records.	We have bat data analyzed through 2023 with 2024 and 2025 will be completed for the next AMR. AIM data is being collected on the BCCE and imagery is available on the riparian properties.
	Continue monitoring upland and riparian habitats to evaluate trends.	
Adaptive Management Evaluation Appendix	Specific recommendations are included with each BGO and habitat sub-sections of Appendix B.	NA. DCPs progress and comments on the 2024 AM Evaluation recommendations will be requested for the 2028 AM Evaluation.

Appendix B

Habitat Disturbance Mapping Procedure

2019 USNVC Disturbance Mapping Procedure

The USNVC Divisions layer is derived from the Coarse level vegetation Map dissolving the features by the USNVC Division level of the taxonomy with the following modifications.

- Areas that were classified in the coarse level vegetation map as disturbed though did not appear to be developed and were not part of the 2019 DCP Disturbance layer were classified as "Urban Interface Mojave Desert Scrub". Or land that still contains characteristics similar to the USNVC Classification "North American Warm Desert Scrub & Grassland" though had been significantly disturbed due to the proximity to existing development.
- Multiple classes of vacant or cleared lands were combined as a single Vacant classification. Including dirt roads and tracks, cleared areas for transmission lines, denuded but undeveloped lots, etc.
- All land classified in the DCP 2019 Disturbance layer were reclassified as Developed to avoid conflicts.

Disturbance Mapping occurs every year based on updated aerial imagery obtained by Clark County or cooperating agency. This should follow a very specific procedure using specific layers.

Prior to starting:

Create a Local copy of the current Parcel.gdb

For Performance concerns this database should not be run over a network drive.

Load the Following Layers:

Vegetation_USNVC_Divisions_2019_Baseline 20230104

Disturbed{Current year}spr_priv_fed

(i.e. For 2023-2025 biennium the file is Disturbed2025spr_priv_fed)

Parcel.gdb\Parcel\AOParcels

Parcel.gdb\AOExtract

The following procedure are the steps to manually calculate the disturbance acres.

Procedure:

Step 1: Create a Join AOParcels

Inputs:

1: APN

2: AOExtract

3: PARCEL

Join Options:

Keep All Records

Step 2: Set the Layer Definition Query of the layer "AOParcels" as Follows

AOExtract.OWNER IN('USA' , 'USA BUREAU LAND MANAGEMENT' , 'USA BUREAU OF MINES' , 'USA BUREAU RECLAMATION' , 'USA CORPS OF ENGINEERS' , 'USA CORPS OF ENGINEERS ARMY' , 'USA DEPT OF AGRICULTURE' , 'USA DEPT OF TRANSPORTATION FAA' , 'USA FISH & WILDLIFE SERVICE' , 'USA FOREST SERVICE' , 'USA FOREST SERVICE ETAL' , 'USA FT MOHAVE INDIAN RESERVATION' , 'USA INDIAN SPRINGS AIR BASE' , 'USA LV INDIAN RESERVATION' , 'USA MOAPA INDIAN RESERVATION' , 'USA MOAPA PAIUTE INDIANS' , 'USA PARK SERVICE' , 'USA PARK SERVICE ETAL' , 'USA POSTAL SERVICE' , 'USA TRUST LAS VEGAS PAIUTE TRIBE' , 'USA TRUST LV PAIUTE INDIANS' , 'USA TRUST MOAPA PAIUTE INDIANS' , 'USA TRUST MOAPA PAIUTES INDIANS')

*This layer is now the Federal Land in Clark County Layer.

Step 3: Union
      Input Features:
            Disturbed{Current year}spr_priv_fed
            AOParcels(With Definition Query)
      Output Feature Class:
            Disturbed{Current year}_Union

Step 4: Set the Layer Definition Query of the layer "Disturbed{Current year}_Union" as Follows
      FID_Disturbed{Current year}spr_priv_fed <> -1
      This removes the features that are not disturbed.

Step 5: Select the layer "Disturbed{Current year}_Union" by Attributes with the following criteria
      FID_AOParcels_AOExtract =-1 AND Private NOT IN (1,2,3)

Step 6: Calculate Field in layer "Disturbed{Current year}_Union" 'Private' = 1

Step 7: Select the layer "Disturbed{Current year}_Union" by Attributes with the following criteria
      FID_AOParcels_AOExtract <> -1 AND Private NOT IN(1,2,3)

Step 8: Calculate Field "Disturbed{Current year}_Union" 'Private' = 3

Step 9: Select the layer "Disturbed{Current year}_Union" by Attributes with the following criteria
      'Private' = 1

Step 10: Clip D21_Final_Model_target_2_playa_Vector with Selected features from Step 10.
      Input Features: Vegetation_USNVC_Divisions_2019_Baseline 20230104
      Clip Features: "Disturbed{Current year}_Union" with applied selection "Private" = 1
      Output Feature Class: Disturbed{Current year}_priv_USNVC

Step 11: Run Geoprocessing "Dissolve"
      Input Features: "Disturbed{Current year}_priv_USNVC"
      Output Feature Class: Disturbed{Current year}_priv_ecos_Dis
     Dissolve Fields: Group
     Check Create Multipart Features

Step 12: Add Field to Disturbed{Current year}_priv_ecos_Dis
      Name: Acres
      Type: Double

Step 14: Calculate Geometry for "Acres" Field
      Property: Area
      Use Coordinate system of the data source: PCS: NAD 1983 UTM Zone 11N
      Units: Acres