

#### IV. Preserve Site Characteristics

**A. Ecosystem Processes.** The Coachella Valley is one of the driest regions of California. Nevertheless, the resources protected within the preserve system are tied to periodic, extreme rainfall events that erode and sort sediments out of the surrounding mountains and alluvial fans, depositing them in wind corridors (Lancaster et. al 1993, Meek and Wasklewicz 1993). The aeolian processes further sort the sediments, and move them further down wind where the sediments accumulate in dunes and dune hummocks which provide habitat for the CVFTL (as well as a large array of other species restricted to the dune environments). The CVFTL prefer loose, active dunes and dune hummocks with sand grain sizes between 0.1 mm and 0.5 mm diameter (occasionally up to 1.0 mm) (Norris 1958). Historically, prior to the development of roads and railroads through the Coachella Valley, there was approximately 100 square miles of nearly continuous dune habitat forming a “sand sea” here (Dean 1978, Ingrid Eleck pers. comm.) (Figure 2). The distribution of historic aeolian habitat, occupied by CVFTLs, is from Barrows (2000), is based on valley-wide surveys and U.S. Soil Survey maps, but is somewhat at variance from maps depicted in the CVFTL HCP (as are the number of acres of historic occupied habitat) (Anon 1985). This sand sea was fed by multiple sand sources, ranging from the San Gorgonio and Whitewater River channels, to Mission Creek, Morongo Canyon, the many canyons of the Indio Hills, and from portions of the Little San Bernardino Mountains. The many sand sources have created a complex dynamic of sand volumes and movement rates.

At the western end of the valley, in a region including the Whitewater River Preserve, rainfall levels are generally at least twice that of the central and eastern valley. The watersheds are also much larger in the western valley. The San Gorgonio River, the Whitewater River and Mission Creek are all sand sources for this region. The combination of these physical characteristics results in more frequent large rain events with more frequent sand deposition in the wind corridor as compared to other portions of the valley. This western region of the valley also has the highest wind velocities due to the venturi effect caused by the narrow San Gorgonio Pass. Taken together, the western end of the valley tends to receive more frequent sand input and at higher volumes, but transports that sand eastward faster, than other portions of the Coachella Valley. Much of the habitat in that area thus has an ephemeral character; CVFTL occur in relatively low numbers when the habitat is depleted and then expand dramatically when the habitat is replenished by a new storm event. These western aeolian habitats tend to be more cool and mesic than those further east, and tend to have a higher plant species richness. This species richness is expressed both in the number of species and abundance of individual perennial shrubs

accentuated by the occurrence of rare annual plant species. The endangered Coachella Valley milk-vetch, *Astragalus lentiginosus* var. *coachellae* appears to reach its highest densities there (pers. obser.). Reflecting this difference in vegetation patterns, CVFTL at the western end of the valley tend to have a larger plant component to their diet than do lizards further east (Barrows, *in prep*). Their reliance on perennial vegetation may be somewhat of a buffer to impacts (in terms of reproductive success) of single year droughts. Multiple year droughts degrade even the perennial vegetation, and the reproductive success of the lizards there declines.

The Willow Hole Preserve's sand source is primarily the Morongo Canyons and Mission Creek (Weaver 1981) (Figure 2). Storm events large enough to generate an influx of new aeolian sand occur rarely here, but sand entering into Willow Hole gets trapped by an extensive mesquite bosque, so the rate of sand leaving the site is relatively low. The amount of active aeolian habitat available to the CVFTL population there is considerably reduced from 1986 when the site was dedicated. A flood in the later part of that decade eroded nearly half of the habitat off the site and it has been very slow to recover.

The Thousand Palms Preserve's primary sand source has been identified in studies by Dr. Nicholas Lancaster (University of Nevada, Reno) and Dr. Norman Meek (California State University, San Bernardino) to be a series of relatively small canyons in the Indio Hills west of Thousand Palms Canyon (Lancaster et. al 1993, Meek and Wasklewicz 1993). Thousand Palms Canyon and the watershed above it was identified as a secondary, but important, sand source for this site's dunes (Figure 2). The relative importance of any of the sand sources is at least somewhat dependent on the stochastic nature of storm events, in terms of the storm's localized intensity. Storm events appear to be rare in all of these sand sources. The last significant input of sand into this site's dune field may have been prior to 1939. Aeolian movement here is not as fast as in the western valley where wind velocities are much higher, but the dunes of the Thousand Palms Preserve are still always moving toward the southeast (graphically depicted in Figure 3). This dune field consists of largely unvegetated active dunes, surrounded by a creosote bush - saltbush dune hummock area where aeolian activity varies from year to year. This site is the driest and hottest of the three preserves, and has the lowest perennial plant species richness and abundance. CVFTL diets here vary considerably from year to year, with a more diverse diet in high rainfall years, and an almost exclusive consumption of harvester ants (*Pogonomyrmex*) in dry years. The annual CVFTL reproductive success varies positively with annual rainfall here as well (Barrows *in prep*).

Taken together, the historic habitat quality of the Coachella Valley sand sea was probably far more consistent in the Valley's center, where the communities of Cathedral City, Rancho Mirage, Palm Desert, Indian Wells and La Quinta now exist. That is where much of the aeolian sand accumulated. The more peripheral areas to the west and north of the sand sea had (and have) a much more dynamic sand deposition and transport pattern. The more consistent habitat in the Valley's center is now either beneath cement and sod, or the

processes of sand transport have been permanently disrupted. Those more peripheral, dynamic habitats are still largely intact, and that is where the preserve system has been created (Figure 1). The historic size of the Coachella Valley's dune field, or sand sea, meant that while the local dynamics of this system changed the localized habitat quality for the CVFTL over time, there were always substantial areas within the sand sea where the lizards could thrive. El Nino years, or years with above average rainfall, increase the productivity of the dunes, but may cause localized dune stabilization due to increased plant cover. Prolonged wet periods promote higher nitrogen and phosphorus levels in the dunes due to decayed vegetation, which then fertilize and enhance subsequent years' plant growth (including exotic weeds), promoting increased dune stabilization. La Nina years, or years with far below average rainfall, result in overall reduced productivity on the dunes, but may have reactivated some of the previously stabilized areas due to the lack of annual vegetation cover coupled with strong winds (Lancaster et. al 1993). Development of the railroad, numerous roads, and now country club style developments have resulted in the irreparable stabilization of over 95% of the dune - sand sea of the Coachella Valley. In the fragmented dune system that now exists, the local dynamics become increasingly important. If the dunes within a given preserve become increasingly stabilized, or the sand is largely blown off the preserve before a new storm event can bring new sand to the site, the remaining CVFTL population may be at risk of local extinction. By designing the three preserves around separate sand sources with different dynamics, the chance that all sites would be at risk at the same time is reduced.

Although the focus of the Coachella Valley Preserve System is to protect CVFTL and their habitat, both the Willow Hole and Thousand Palms Preserves have important wetland habitats, primarily desert fan palm oases. Eleven different palm oases occur within these preserves. Their occurrence is due to groundwater brought to the surface along the San Andreas earthquake fault zone. Changes in the integrity of the fault zone due to earthquake movements affect the amount of water available to the palm oases, and so the size of the oases can change over time.

**B. Biological Resources.** There are six major natural communities protected within the Coachella Valley Preserve System. These include sonoran desert dunes (which could be sub-divided into active dunes, active or inactive dune hummocks, and ephemeral dune hummocks), mesquite hummocks, sonoran creosote bush scrub, desert saltbush scrub, desert fan palm oases, and sonoran cottonwood - willow riparian forests. Species occurring within the preserve system that are targeted in the Coachella Valley MSHCP effort and their habitat - natural community affinities are listed below, along with the CVFTL and other Coachella Valley restricted species. The preserve where each species occurs is also indicated (WWR = Whitewater River Preserve, WHP = Willow Hole Preserve, TPP = Thousand Palms Preserve). Bold type indicates particularly large populations at that site. The relative magnitude of the populations has been determined by extensive monitoring of the sites over the past 15 years and associated inventories (Barrows 2000).

Species	Habitat Affinity
Coachella Valley fringe-toed lizard, <i>Uma inornata</i>	Active dunes, active and ephemeral dune hummocks. WWR, WHP, TPP
Palm Springs ground squirrel, <i>Spermophilus tereticaudus chlorus</i>	Mesquite hummocks, dune hummocks WWR, <b>WHP</b> , TPP
Palm Springs pocket mouse, <i>Perognathus longimembris bangsi</i>	Inactive dune hummocks, sandy soils (not rocky) with creosote bush scrub WWR, WHP, TPP
Western yellow bat, <i>Lasiurus (ega) xanthinus</i>	desert fan palm oases TPP
Desert tortoise, <i>Gopherus agassizii</i>	creosote bush scrub - very rare, marginal habitat TPP
Flat-tailed horned lizard, <i>Phrynosoma mcallii</i>	dune hummocks (active and inactive) WWR <b>TPP</b>
Desert pupfish, <i>Cyprinodon macularis</i>	Riparian habitat (introduced) TPP
Least Bell's Vireo, <i>Vireo bellii pusillus</i>	Riparian forest, primarily in migration. WHP (one breeding record), TPP
Yellow Warbler, <i>Dendroica petechia brewsteri</i>	Riparian Forest - migration only WHP, <b>TPP</b>
Yellow-breasted chat, <i>Icteria virens</i>	Riparian forest - migration and breeding WHP, <b>TPP</b>
Southwestern willow flycatcher, <i>Empidonax extimus traillii</i>	Riparian Forest - migration only WHP, <b>TPP</b>
LeConte's thrasher, <i>Toxostoma lecontei</i>	dune hummocks, mesquite hummocks, desert washes WHP, TPP
Barrows' dune beetle, <i>Edrotes barrowsi</i>	Active dune areas <b>WWR</b> , WHP, TPP
Coachella giant sand treader cricket, <i>Macrobaenetes valgum</i>	Active dunes, active and ephemeral dune hummocks <b>WWR</b> , WHP, TPP
Coachella Jerusalem cricket, <i>Stenopelmatus caluilaensis</i>	Sandy washes, ephemeral hummocks WWR
Coachella Valley grasshopper, <i>Spaniacris deserticola</i>	Creosote bush scrub - primarily on <i>Tiquilia palmeri</i> WHP, TPP

Coachella Valley milk-vetch, <i>Astragalus lentiginosus</i> var <i>coachellae</i>	All active dune types. <b>WWR</b> , WHP, TPP
Mecca aster, <i>Xylorhiza cognata</i>	restricted to rocky areas in Indio Hills. TPP

**C. Existing Improvements.** The Thousand Palms Preserve dune habitat area is fenced, as is the entire Willow Hole Preserve.

Public use facilities exist on the Thousand Palms Preserve in Thousand Palms Canyon, including a historic log cabin used as a visitor center, restroom and picnic facilities, and nearly 10 miles of hiking trails (some of which are available to equestrians).

A series of 4 residences are owned by the Center for Natural Lands Management and are part of the Thousand Palms Preserve. Two of these structures are used by CNLM to house long-term volunteers who make a commitment to work at least 20 hours per week for the preserve, doing facilities maintenance, habitat management, and docent coordination tasks. One building serves as the preserve office for the CNLM staff associated with the preserve. Another building, sometimes referred to as the “hooch” is available to house shorter term volunteers or staff from any of the partner agencies. Storage for equipment and herbicides is available in one out building, and an equipment “bone yard” is also available.

#### D. Current Issues - Threats.

1. The most acute threat to the Preserve System is the lack of protection of sand sources and sand transport corridors to any of the three preserves (Barrows 1996). The sand source and transport corridor to the dunes of the Thousand Palms Preserve are in grave danger of being completely blocked by the expanding town of Thousand Palms. Single family dwellings already partially block the corridor, and there is an approved development that would further block sand movement into the preserve. Early versions of maps proposing designs for the Thousand Palms Preserve included the USFWS proposed critical habitat for the CVFTL which captured this sand source and transport corridor. This area was ultimately removed to reduce costs; this area had been designated in the CVFTL HCP for low density development zoning (Barrows 1996). An acquisition program has been initiated to purchase parcels in order to protect the sand corridor.

The sand corridor to the Willow Hole Preserve has also been partially blocked by single family dwellings and extensive planting of tamarisk trees. Development growth is also occurring north of Interstate 10, along Palm Drive, which will further block sand movement from the Morongo and Mission Creek Washes to the preserve. Land acquisition, to maintain this corridor, has also been approved.

Meek and Wasklewicz (1993) indicated that the percolation ponds west of the Whitewater

River Preserve may have a slight impact of aeolian sands being delivered to that preserve. They suggested that under low flow flood events the ponds could impede flows. Substantial sand deposition has occurred on the Whitewater Preserve in the early 1980s and the early to mid 1990s (Muth and Fisher pers. comm., Barrows pers. obser) both as a result of El Nino weather patterns, indicating that processes supplying sand to the preserve still function. Additional analysis by a fluvial geomorphologist may provide additional information on this issue.

2. Sand loss, due to natural down wind movement, while variable between preserves, is more or less constant within a site. A prolonged period with no large storm events bringing new sand into a preserve could result in sand depletion exceeding accumulation. That infrequent, stochastic nature of sand flow into the preserves, creates a potential risk to the CVFTL populations. Although the dynamics of the dune habitat at a given site is a natural process, the fragmented nature of the current habitat configuration is not. Having three separate preserves with separate sand sources buffers the risk somewhat, however losing even one site (in terms of CVFTL population viability) seriously compromises the goals of the CVFTL HCP and the ability to maintain CVFTL populations in perpetuity.

3. Several weed species pose a potential threat to the dune ecosystem. Exotic annual plants including Russian thistle (*Salsola tragus*), a mustard (*Brassica tournefortii*), and a grass (*Schizmus barbatus*), all commonly occur on the dunes and have a potential to reduce the habitat suitability of the dunes. The impact of these weeds is twofold. First, there is a concern that these weeds catalyze and accelerate stabilization of the dunes, and once stabilized inhibit reactivation of the dunes. Of these three weed species, *Schizmus* appears to have the greatest potential to promote stabilization. Its roots and above-ground structures remain intact, binding the dune surface, years after it germinated. It is not clear whether these weeds promote dune stabilization or take advantage of naturally inactive dunes and dune hummocks. Secondly, there is a concern that these weeds compete with and exclude native species, reducing the overall species richness of the dunes. In some years the *Brassica* forms a near closed canopy, and very well may inhibit native species, but it is not clear whether the impacts result in an unwavering trajectory to a loss of biodiversity. The control of any of these weed species will be difficult at best, and will depend on methodology not yet developed. It is therefore important to better understand the impacts of these weeds before devoting resources to their control. A study that included describing the response of CVFTL to various plants, including *Salsola*, indicated that the CVFTL do not avoid *Salsola* and that hatchling CVFTL often utilize it for cover (Barrows 1997). The relative value to CVFTL of *Salsola* versus *Dicoria canescens*, a native species with similar habits, has not been studied. The competitive interaction of *Salsola* and *Dicoria*, if any, has also not been studied. Still, there is no indication that initiating a *Salsola* control program is warranted at the densities of *Salsola* currently occurring on the preserves.

4. Off road vehicle (ORV) trespass on the dunes is one of the most severe threats to

CVFTL habitat (Luckenbach and Bury 1983). ORVs reduce native plant cover, reduce fossorial arthropods, (both reduce food resources for the lizards), and run directly over and kill CVFTL. Although initially a problem, ORV trespass in the Thousand Palms Preserve has been largely under control for nearly 10 years. This control was achieved through fencing, diligent repair of broken fences, and active patrolling from BLM and USFWS law enforcement personnel. ORV trespass on this preserve is now reduced to less than 10 incidents per year. ORV trespass at the Whitewater River and Willow Hole Preserves is still a significant problem. At these preserves fencing has been incomplete, fence breaks are infrequently repaired, and agency law enforcement personnel have been reduced.

5. Two species of tamarisk, *Tamarix ramosissima* and *Tamarix aphylla* occur within the preserve system. In the riparian habitats tamarisk has a higher water consumption than any of the native trees, and thus reduces the water available to native plants and surface water available to wildlife (Barrows 1993, 1998). Tamarisk is an aggressive competitor in riparian areas and will eventually dominate habitats to the exclusion of the native plant species. While some wildlife species tolerate tamarisk forests, numerous studies have documented that such forests are significantly depauperate as compared to riparian forests dominated by native species. Tamarisk was once abundant in all of the palm oases and riparian areas of the Willow Hole and Thousand Palms Preserves. It has now been controlled within the Thousand Palms Preserve (Barrows 1993), with the result of greatly expanded native riparian forests. Nearly a kilometer of new forest has become established since the tamarisk removal and new pools of water have formed where there was once only dusty tamarisk leaf litter. Annual search and removal of new tamarisk seedlings is still required here, but the effort is minimal. There are still many *Tamarix aphylla* occurring in and around the dunes on the Thousand Palms Preserve. This species rarely reseeds itself; the individuals here were transported in floods or were specifically planted during past agricultural efforts. These trees have in some cases served to slow aeolian processes and hold dunes on the preserve that would otherwise be lost to the southeast, but the dune stabilization that results renders these sites largely unsuitable for CVFTL. These trees also provide nesting habitat for CVFTL predators such as loggerheaded shrikes, greater roadrunners, and kestrels. While all are native predators, the tamarisk allow them to occur in areas they would otherwise avoid due to the lack of nesting opportunities. Tamarisk still occurs in low to moderate numbers at the Willow Hole Preserve as no efforts have begun to control it there.

6. A refugium population of endangered desert pupfish was introduced into the Thousand Palms Preserve in the late 1980s. In preparation for that introduction, many of the exotic resident fish species were removed. This eradication was largely successful, although one exotic fish species and several other exotic non-fish aquatic species remain today. Those exotics include mosquitofish, bullfrogs and a crawfish species. All of these species have been implicated in competing with and/or preying on desert pupfish, although more than 10 years after the initial introduction, the introduced pupfish continue to thrive. Aside from

the pupfish, these exotic species have, either individually or collectively, reduced the native amphibian community species richness in Thousand Palms Canyon. Canyon tree frogs, Great Basin toads, Woodhouse's toads, red-spotted toads and western toads have all been historically present in this canyon. Of these, only Woodhouse's toad appears to be currently present in large numbers, and the tree frog appears to have been extirpated (Barrows pers. obser).

7. As increasing urbanization surrounds the preserves it will fragment and isolate the preserves, impacting movements of area dependent wildlife such as kit foxes and bobcats. While not specific targets of the CVFTL HCP or the MSHCP, these species are sometimes thought of as indicators of complete, healthy trophic webs. None of the preserves are, by themselves, large enough to maintain a viable population of these species; their population viability is probably dependent on movements to and from larger conservation areas such as Joshua Tree National Park, and the San Gorgonio Wilderness. Increased urbanization brings with it loss of existing habitat corridors.

8. Feral pets, especially dogs traveling in packs, present a real threat to wildlife species on the preserves. Currently these dog packs are most common in the riparian and palm oases habitat on the Thousand Palms Preserve, but their tracks are also seen in the dune areas. Researchers at the Whitewater River Preserve see dog packs often. Domestic pets enter the preserves from surrounding urban areas, thus impacting wildlife within the preserves, at least initially, most intensely along that urban-natural community interface. Increasing urbanization surrounding the preserves is likely to increase the number of feral pets and the impact they have on the native wildlife.

9. An additional threat caused by increased urbanization is the concomitant increase in automobile traffic. As traffic increases there will be an increased wildlife mortality on roads surrounding the preserves.