

A. Monitoring Framework. Data derived from monitoring forms the basis for evaluating the success of the Preserve System's goal and attendant objectives. Monitoring efforts need to be of value in providing insight to managers regarding the impacts of their management actions and to provide early warning of population declines that are outside "natural" oscillations. Hypothesis based monitoring that predicts population responses to environmental fluctuations, is the best design for achieving that measure. For long lived species, demographic population data fed into a hypothesis based design, provides the best opportunity to give the desired early warning to alert managers to needed actions.

Since 1986 preserve managers have been conducting non-hypothesis based monitoring of the relative CVFTL population on each of the three preserves (Barrows et. al 1995). Six transects were created initially to track CVFTL populations; four were on the Thousand Palms Preserve, and one each on the Willow Hole and Whitewater River Preserves. The transects were permanently located, non-randomly, on what was considered appropriate CVFTL habitat in 1986; each were 1000 m x 10 m belts surveyed simultaneously by two biologists. Each of these transects was censused six times in late spring (late May to early June).

In 1990 there was a change in the CVFTL monitoring protocol. Partially due to the difficulty in securing sufficient time from the various agency partners to participate in the surveys, and partially due to the recognition that the transects on the Thousand Palms Preserve all demonstrated the same annual oscillations (Figure 4), the number of transects on the Thousand Palms Preserve was reduced from four to two. Secondly, due to a desire to obtain better information on CVFTL demographics, a second series of surveys was conducted in the Fall (late September to early October). Due again to partner time limitations, only the two transects on the Thousand Palms Preserve were monitored in the Fall. These Fall data provide a measure of the CVFTL hatchling production. Coupled with the Spring census data, managers are then able to assess changing reproductive success and winter survivorship in relationship to environmental variables such as annual rainfall. The relationship between rainfall and number of First, due partially to the hatchlings seen in the Fall is very close (eight out of ten years) at the Thousand Palms Preserve (Figure 5), although at the Whitewater River Preserve that relationship appears to be more complicated (Muth and Fisher pers. com.)

Figure 4. Relative changes of *Uma inornata* population levels on two transects at the Thousand Palms Preserve.

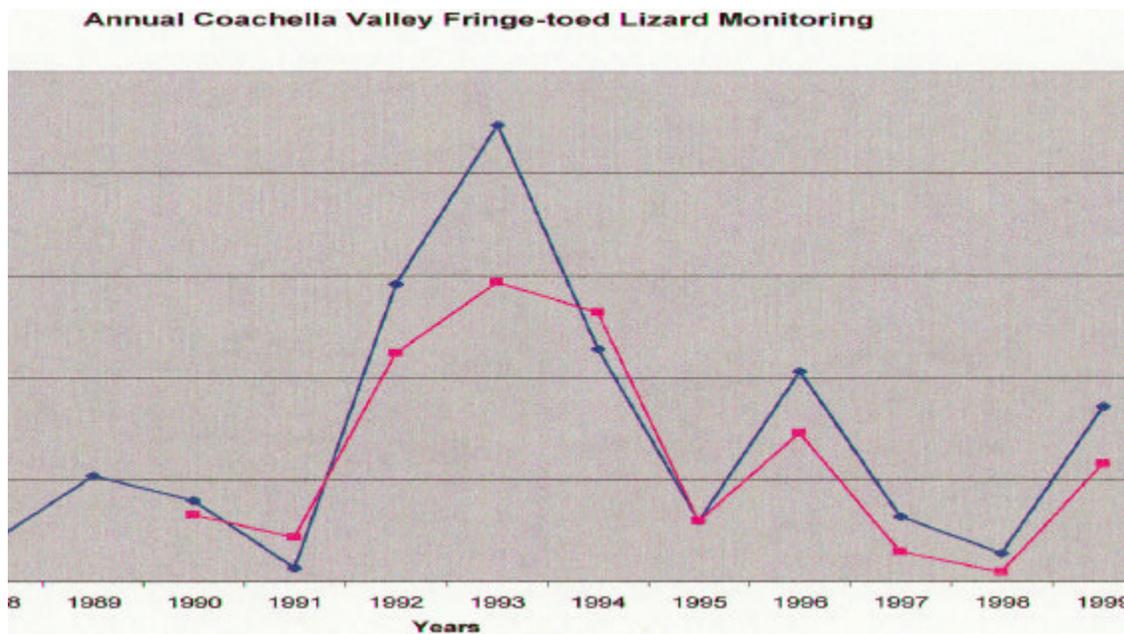
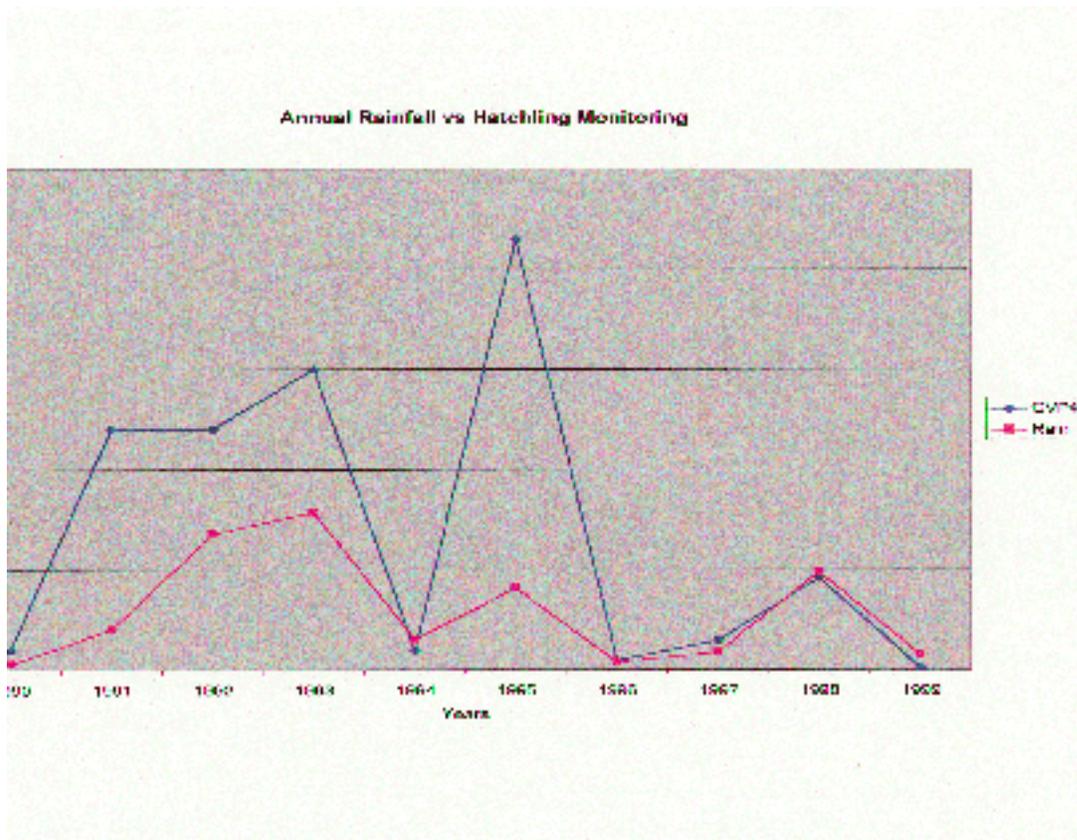


Figure 5. The relationship between annual rainfall and CVFTL hatchling numbers.



These monitoring data now provide the beginning of a baseline data set for assessing departures from expected CVFTL numbers and demographic relationships in the future. They do not offer insights into the habitat quality trajectories, causative factors for population declines if they occur, or a measurement of the sufficiency or appropriateness of management actions. This CVFTL monitoring program will be continued, but now will be coupled with additional environmental variables beyond just annual rainfall. These variables will include an assessment of the amount and quality of habitat available to the CVFTL, annual measures of arthropod (especially ant) abundance (ants are an important food item for the CVFTL), and exotic weed abundance and trajectories. A conceptual model of how these various environmental attributes impacts the CVFTL (and other aeolian species) is depicted in Figure 6. These additional variables will be measured through a combination of remote sensing via satellite imagery, with GIS analyses and synthesis, with ground truthing at a series of stratified random, GPS identified, points that

capture the abundance and diversity of habitat variation found on the preserves (Figure 7). Stratified random sampling offers substantial advantages over simple random sampling or systematic sampling because it allows for the recognition of distinct habitat types and for proportional random samples within those habitat types without an inordinate of samples (Hayek and Buzas 1997). This insures that all habitats of interest will receive adequate sampling, as opposed to simple random sampling which is only appropriate in more homogeneous habitats. The actual number of points that will be required will be determined after preliminary data allows some estimates of variance for the variables. At each point, or at some random subset of the points, exotic weed abundance, ant abundance (via pitfall trapping or mound counts), and sand compaction (and possibly mean sand grain size) will be measured. Based on observations and data gathered to date, hypotheses for how CVFTL numbers respond to these variables are as follows:

Reduction in native harvester ant abundance correlates with a reduction in CVFTL numbers, although when the CVFTL diets are more diverse (less focused on ants, lizard reproduction appears to be higher. Ants do provide an essential food source to allow the lizards to survive prolonged drought.

Increased sand compaction correlates with a reduction in CVFTL numbers. A reduced mean sand grain size may also be correlated with fewer CVFTL.

Increased exotic weeds reduces habitat quality and increase sand compaction, correlating with a reduction in CVFTL numbers.

Reduced total area of active aeolian habitat correlating with a reduction in CVFTL numbers.

Using the various measures of habitat quality and abundance, coupled with measures of CVFTL numbers and demographics, an early warning system of unnatural CVFTL population trajectories will be created. The monitoring program will be adaptive in the sense that we will continually ask whether the variables are in fact correlated with CVFTL numbers and whether there are other or additional variables which better correlate to threats to CVFTL population viability. If better metrics are available, the monitoring program will evolve to encompass those metrics. This allows for appropriate adaptive management to focus and evaluate management actions toward the control or mitigation of identified threats.

While conducting the CVFTL censuses and while measuring variables at the random habitat points, any observation of associated aeolian species will be recorded. Sand-treader crickets are captured during ant inventories, round-tailed ground squirrels will be heard giving their warning squeeks while traversing habitat, flat-tailed horned lizards will be encountered occasionally as will Coachella Valley milk-vetch. All these observations will be quantified and reported to the management committee along with CVFTL

monitoring data. While the recording of these associated animal species has value, they occur at such low densities, or are so difficult to locate that the data will be insufficient to allow change detection. We will have to rely on habitat model assumptions (unless substantially more management funds are allocated) that as long as we track sand compaction, native ant abundances, dune associated beetles (*Cryptoglossa laevis* and *Batulius setosus*), CVFTL, and weed variables, we will assume that other target species population numbers will correlate with those measured values. We will continually encourage any effort to validate those assumptions.

This monitoring program is considerably more ambitious than the monitoring conducted prior to this date. It will require the commitment of staff from all the partner agencies and/or the use of seasonal interns to complete. The monitoring program will be coordinated by CNLM with the strong support of all partners.

A second monitoring program has been created to assess progress at restoring a previous agricultural field on the Thousand Palms Preserve. This program includes sampling at a series of pitfall arrays in the restoration (6 arrays of six pitfalls each) and adjacent creosote bush - dune hummock habitat (4 arrays of six pitfalls each). The goal here is to identify those species most sensitive to habitat quality and then to track their abundance as the restoration area moves toward a more natural condition. Those species that have been identified to be good indicators, defined in terms of habitat affinity and whether they occur in sufficient numbers to allow change detection (Barrows 2000, Barrows et. al *in prep*), include:

Species	Dune - Dune Hummock Preference	Restoration Area Preference
Beetles		
<i>Cryptoglossa laevis</i>	+	-
<i>Batulius setosus</i>	+	-
<i>Niptus ventriculus</i>	+	-

The monitoring protocol recommended above (for looking at CVFTL habitat quality at a series of random points coupled with remote censusing) may also be sufficient to track the progress of restoration, since the random points will include the restoration areas. The random points include a pitfall trapping array as well, so similar data could be gathered. The sufficiency of the random point monitoring to replace the existing pitfall arrays will be evaluated in 2000 by using both methods simultaneously. If the pitfall arrays are found to be redundant, they will be discontinued.

B. Adaptive Management. The cornerstone of adaptive management is employing an appropriate monitoring program that allows for the evaluation of management strategies. The monitoring program described above provides a landscape scale evaluation of habitat conditions and change. While this sort of evaluation provides an invaluable baseline from which to evaluate management efficacy, any experimental management technique may require additional, focused monitoring to evaluate site specific effects. The protocols employed in an adaptive management scenario will, to the extent applicable, use the same protocols used in the landscape level monitoring. Candidates for adaptive management within the Coachella Valley Preserve System include:

If any exotic weeds that invade the preserve system are deemed through research to threaten the processes that maintain the habitat or directly negatively impact the CVFTL, an experimental control program should be developed.

If the amount of active dune and/or sand hummock habitat begins to decline in a unidirectional trajectory, various methods could be employed to stimulate more sand movement. Those methods include activating stabilized areas by removing vegetation and discing / excavating the sand surface layer. Test excavations have revealed stabilized aeolian sand may be many meters deep in some areas, and if activated could serve to supply CVFTL habitat with sand until a storm event brought more sand to the preserves through natural processes. This would be implemented in an experimental / adaptive manner at relatively small scales. Trucking in sand from non preserve areas or from sand and gravel operators has already been employed at a very small scale with apparent success. This program could be expanded if necessary, but would be difficult to increase to a level that would be meaningful at a CVFTL population level.

Sand fencing is planned to be installed to retard sand loss on the down-wind side of some preserves. If successful, this program could easily be expanded.

Additional adaptive management programs will certainly arise over time as new threats to the preserves become apparent. Satellite images at 4 m resolution, coupled with ground truthing will be a useful tool in evaluating the efficacy of any of these programs; if the results are not apparent at that resolution, then the strategy may not have sufficient benefits at the scale the preserves would require.

C. Research. The Coachella Valley Preserve System is available for, and encourages, research endeavors that are not antithetic to the goal and attendant objectives of the preserves. To the extent that funds are available, the Management Committee could authorize CNLM to provide funding for research projects that have a direct bearing on the ability of managers to meet our goal and objectives. Research that helps managers understand the impact of exotic species on CVFTL and their habitat, and research that develops control methodologies, would certainly meet that criteria.

Special use permits will be required to be obtained by any researcher. The landowner where the research is occurring will issue these permits.

D. Habitat Restoration Efforts. The majority of habitat restoration within the preserve will fall into three categories: removal of exotics deemed detrimental to the CVFTL habitat, removal of obstacles to the natural processes delivering aeolian sand, and if necessary, activating stabilized areas. All of these efforts would be conducted under an adaptive management program. No vegetation plantings to accelerate restoration of old agricultural areas are envisioned at this time.

E. Exotic Weed Control. All tamarisk trees will be removed from the preserve areas. A Section 7 consultation has previously been completed for this activity. Any large trunks, root masses or branches of tamarisk will also be removed to promote sand movement. In those areas where tamarisk trees are retarding downwind loss of sand off of preserve boundaries, sand fencing will be installed prior to removal of the trees. In Thousand Palm Canyon searches for, and removal of, newly established tamarisk seedlings need to be conducted annually.

The other known weeds, such as russian thistle, mustard and *Schizmus* have no known effective control methods. They are all annuals that have potential negative impacts only after particular rain amounts and timing of the rain events. Before control efforts are contemplated, research needs to verify long lasting negative impacts and then control methods will need to be developed. These efforts will be conducted under an adaptive management framework.

F. Guidelines for Sensitive Species. No activities will be allowed that knowingly impact CVFTL or their habitat negatively. Section 7 Consultations will be conducted for all new activities within CVFTL habitat. There is the potential for conflicts between managing for CVFTL habitat at the expense of habitat for Palm Springs pocket mice or flat-tailed horned lizards which either prefer or tolerate more stabilized aeolian habitats. For this reason, habitat manipulations will only be conducted under critical need scenarios, with consultations with the USFWS and the whole management committee, and with an evaluation of both short term and long term results / impacts.

All research and monitoring activities in CVFTL habitat must be conducted under the supervision of persons holding federal and state permits that allow those activities.

G. Public Use. Public education of the values the preserves provide and having the public consider the preserve system as a community asset are programmatic objectives for the preserve system. Public use can be a means to partially meet those objectives, as long as it is not in conflict with the ecological objectives for the preserve.

Public use in terms of passive recreation has been, and will continue to be, conducted almost exclusively in the non CVFTL habitat areas of the Thousand Palms Preserve. These areas are under the ownership of BLM, State Parks and the Nature Conservancy. A nature center has been created in a historic log cabin in Thousand Palms Canyon and from that point of contact visitors receive information on trails, preserve function and history, and rules for access. A volunteer docent crew serves as the primary contact with most visitors. Those docents are trained and managed by CNLM staff. Approximately 40,000 visitors from around the world visit the preserve in this fashion annually. Approximately 10-15 miles of trails are maintained for public access.

Rules of access include:

1. No pets
2. No smoking in the palm oases
3. No vehicle use off of paved roads (except for management purposes or special permit [Covered Wagon Tours])
4. Horses only on designated trails
5. No overnight camping except by educational groups in the designated group camp site in Thousand Palms Canyon and by pre-arrangement only.
6. Commercial tours must have written permission from CNLM and the agency landowner which will be available only after an agreement to abide by all of the rules above, and provide proof of adequate insurance.
7. Horses must stay out of palm oases.
8. No collecting of any natural feature without a permit from the agency landowner.
9. No unauthorized access to any dune or pond area (swimming or wading).

On the BLM owned lands at the Willow Hole Preserve, wind energy development is allowed. A section 7 consultation between BLM and the USFWS addresses provisions for wind energy development. Those provisions include avoiding construction and road development on CVFTL habitat.

For all the preserves, CVFTL habitat will be only accessible with a special use permit. Limited tours on CVFTL habitat for the public may be offered, but must be under the direct supervision of Preserve System staff. An elevated boardwalk may someday be constructed to provide the public with a “dune experience” but only if outside funds are available for construction (estimated cost in 2000 is \$55,000).

Standardized signs currently exist for marking the boundary of the Coachella Valley Preserve System, and individual land agencies may augment those signs with their individual agency’s sign. Any changes to the current sign will require the concurrence of all voting members of the Management Committee.

H. Cultural and Fossil Resources. There are many areas within the Willow Hole and Thousand Palms Preserves where evidence of past Native American use can still be found. During the late prehistoric and protohistoric periods, the Coachella Valley was inhabited by the Desert Cahuilla. Historic properties located within the preserves can be expected to include trails, milling features and artifacts, cairns, and camp or village sites.

All artifacts will be left in situ or avoided unless moved and recorded by a professional archaeologist under the permit and direction of the agency landowner. National Historic Preservation Act Section 106 review will be completed for all new activities within the preserves. Additional fencing around sensitive areas such as sand dunes shall be installed to minimize intrusions, and surveys shall be periodically conducted to check for newly exposed cultural sites within sand dunes.

There are scattered fossil remains found on the Thousand Palms Preserve. A fossil oyster bed can be found to the west of Willis Palms, and a State Park paleontologist discovered the remains of an imperial mammoth east of Horseshoe Palms. There are reports of widely scattered fossil camel and horse remains throughout the formation that includes the Indio Hills and the Mecca Hills. As with cultural remains, all such fossils will be left in situ unless removed by a professional paleontologist under permit and direction of the agency landowner.

I. Real Estate and Land Acquisition Issues. At the point when this plan was prepared there are still two private parcels within the original boundary of the Thousand Palms Preserve (10 and 5 acres) still needing to be acquired. The private landowners are not yet willing sellers, but mitigation funds are set aside to acquire them when they are available.

There is an acute need to acquire lands outside the original boundary of the preserve, within the sand corridor leading to the Thousand Palms Preserve. The USFWS is developing a Refuge expansion proposal that would allow the use of federal Land and Water Conservation Funds to acquire lands there. CDFG has developed a Conceptual Area Plan enabling use of state Wildlife Conservation Board funds in the same area. CVFTL HCP mitigation funds are also available, through an amendment to the HCP, for acquisition in the sand source as well. A state agency, the Coachella Valley Mountains Conservancy, has taken a lead in acquiring lands and coordinating funding sources there. At some point the lands will be aligned into USFWS and CDFG blocks to simplify ownership issues, but in the interim CNLM may accept ownership of particular parcels.

Additional land acquisition is important at both the Willow Hole and Whitewater River Preserves to both protect additional habitat and to protect sand source

corridors. If opportunities arise such as particular mitigation requirements for unauthorized habitat take, those opportunities should be targeted in those areas.

All privately held lands targeted for acquisition will be acquired through willing sellers at appraised fair market values (unless the landowners wish to make a charitable gift).

J. Coordination and Partnerships. The management of the Coachella Valley Preserve System is conducted under the supervision and approval of the Management Committee. The Management Committee is comprised of the of the federal (BLM, USFWS - Refuge Division) and state (CDFG, State Parks) land owners as well as the non-governmental organization (NGO) landowner/managers (TNC, CNLM). Each of these six members is a considered a “voting member”. The committee determines overall policy by consensus, and issues pertaining to a single agency landowner are decided by that agency. Additional to the six “voting members” there are advisory members to the committee which participants from the USFWS - Carlsbad Office, and the University of California Deep Canyon Desert Research Center. The committee meets as needed, usually about every 8 - 10 weeks. Meeting facilitation is handled by CNLM. Other agencies, including CVWD and staff from Riverside County are encouraged to attend meetings for information purposes.

Management Committee meetings are open to the public and the public is welcome to bring any items or issues to these meetings for the consideration of the committee. If so interested, the public should contact CNLM (760 343-1234) to be added to the agenda for the next meeting.