- Intensive Monitoring of Select Species and Abiotic/Biotic Attributes to Determine Health of Ecosystem
- Update Vegetation Communities and Wildlife Habitats GIS Layer and Map

Every 8 Years

- Change Detection for Vegetation Communities and Wildlife Habitats
- Evaluation and Feedback on Data for MSHCP Adaptive Management Strategy
- Evaluation and Feedback for Potential Modification of Monitoring Strategies

To create an effective Biological Monitoring Program, there must be a thorough baseline inventory on which to build the long-term monitoring program. Therefore, the initial inventory will be the emphasis of the Biological Monitoring Program for the first few years of the MSHCP. The initial inventory and assessment phase will consist of (a) mapping the Vegetation Communities and assessing Habitat quality; (b) baseline inventory field surveys of all Covered Species; and (c) updating and field verifying existing recorded species occurrences. Specific long-term monitoring sampling locations, methods, and survey intensity will be fully developed after analyses of the Habitat and species inventories.

5.3.4 Inventory, Monitoring, and Sampling Considerations

➤ Extent of MSHCP Conservation Area to Inventory and Monitor

Because the MSHCP Conservation Area will be assembled over time, there must be a process for including new lands into the inventory and sampling strategy for monitoring. The MSHCP Plan Area comprises the following categories of land (approx. acres):

a) The entire MSHCP Plan Area . . . . . 1,260,000 acres
b) MSHCP Plan Area that is undisturbed/undeveloped . . . . . 881,000 acres
c) MSHCP Plan Area that is Public/Quasi-Public Land or is proposed to be incorporated into the MSHCP Conservation Area (d + e) . . . . . 500,000 acres
d) MSHCP Conservation Area that is currently Public/Quasi-Public Land . . . . . 347,000 acres
e) Additional Reserve Lands to be added to MSHCP Conservation Area . . . . . 153,000 acres

Initially, inventory and monitoring will occur on category "d" lands and will focus on those Covered Species and Vegetation Communities considered the most underrepresented and/or most at risk in the MSHCP Conservation Area. For example, Covered Species that require additional demonstration of Conservation to be considered Covered Species Adequately Conserved and those Vegetation Communities that are most affected by environmental conditions (*e.g.*, coastal sage scrub, vernal pools) or with fewer acres included (*e.g.,* grassland) will be inventoried and assessed first. Sampling stations for long-term monitoring will be established on category "d" lands first, and the remaining stations added as lands are incorporated into the MSHCP Conservation Area.

The initial inventory and assessment of Additional Reserve Lands incorporated into the MSHCP Conservation Area (category "e") will occur within two years of conveyance of such lands. These lands would then be available for long-term monitoring under the Biological Monitoring Program. The entity to whom the lands are conveyed would be the responsible party for the assessment. The data to be collected are described in the Management Plan.

The presence and condition of Habitats (whether they occur inside or outside the MSHCP Conservation Area) will influence animal species distributions and population trends in the MSHCP Conservation Area. Consequently, as part of a comprehensive strategy that will aid the understanding of animal species trends over time, at least a general representation of the distribution and abundance of Vegetation Communities and Habitats in all of category "b" lands is important. The coarse-scale evaluation of Habitats on lands outside of the MSHCP Conservation Area would only occur through aerial and/or satellite imagery analysis and predictive modeling efforts.

➤ Development of Inventory and Monitoring Protocols

There are several existing inventory and monitoring protocols suitable for adopting essentially "as is" in the Biological Monitoring Program. For example, there are standardized protocols for typing Vegetation Communities and wildlife Habitats, as well as protocols for assessing aquatic species and certain suites of birds, small mammals, reptiles, and some amphibians. Other protocols, such as telemetry monitoring of large mammals and birds have been conducted for decades, and there are straightforward methods for collecting, analyzing, and interpreting the data. There are peer-reviewed and published protocols for some species, such as the southwestern willow flycatcher (Sogge, *et al.* 1997). Specific protocols that may be used are live-trapping, vocalizations/recordings, mist-netting, observation scans, search transects/ plots, remote camera-stations, and track monitoring.

In 2002, the CDFG Resource Assessment Program entered into an agreement with the Center for Conservation Biology at UC Riverside, to develop additional inventory and monitoring strategies/protocols and to initiate implementation of some aspects of the Biological Monitoring Program for the MSHCP. Other universities and agencies such as the USFWS, USFS, and USGS Biological Resources Division are developing, or have developed, scientifically reliable monitoring approaches that could be used in the monitoring program. Collaboration and peer-review among these entities will be sought in order to ensure that the best approaches are used. The Biological Monitoring Program will seek to develop protocols that take a multi-species, landscape approach.

➤ Sampling Design Considerations

A goal in designing sampling strategies is to minimize the variance of estimators and to optimize monitoring efforts. Designing a long-term monitoring program requires compiling existing information, particularly species distribution. Robust estimators will be sensitive to changes in species status, will detect change (or trend), and will provide information meaningful to Reserve Managers for Adaptive Management. The types of data collected will be a mixture of estimators and index level information.

Because of the patchy distribution of Public/Quasi-Public Lands, Habitat/Vegetation Communities, and rare Habitats and species, the sampling design needs to ensure species occupying rare Habitat/Vegetation Communities are adequately inventoried and monitored. Some level of stratification to deal with unequal probabilities of selection, most optimally on landscape strata unlikely to change over time (*e.g.,* geologic features, elevation, aspect, soil properties), will be needed. Despite the potential for structural vegetation changes over time, stratification by Habitat/Vegetation Communities may be used to sample rare Habitats (*e.g.,* riparian, alluvial fan sage scrub, vernal pool). Otherwise, species dependent on these rare, but critical components of the system could be inadequately monitored in any objective sampling scheme.

Data pooled and summarized at the entire MSHCP Conservation Area level, at the individual Management Unit level, and at an individual reserve level will be used for assessing species status and Vegetation Community trends. Heterogeneity among sites, as well as a diversity of human-induced impacts among sites, however, will affect among-site variability and inferential capability to pool results among sites. The scientific inferences that can be made with respect to the status of a species may be limited to the MSHCP Conservation Area and will not necessarily reflect the status

of species in other areas or of the population at a regional or range-wide level outside of the Plan Area.

➤ Establishment of Long-term Monitoring Sampling Stations

The information collected from the initial inventory and assessment phase will be used as supporting information to determine the number and placement of sampling stations for the long-term monitoring program. Points, plots, transects, arrays, and other sampling systems will be recorded using GPS receivers for repeatability over time. Additionally, opportunistic observations of species occurrences need to be recorded, and a simple data format for capturing such information will be developed that includes GPS locations of observations.

The establishment of sampling stations may vary between those used for the initial inventory phase versus those later chosen for longer-term monitoring. During the initial inventory phase, sampling for plant and animal species will be coordinated with the permanent stations established for the vegetation mapping effort (see "Vegetation and Wildlife Community Inventory and Monitoring" section below). The emphasis of this initial sampling strategy will be to establish preliminary field inventories of species distribution and abundance, develop species and Vegetation/Habitat Community associations, and refine Vegetation/Habitat Community boundaries and definitions.

For longer term monitoring efforts, the establishment of sampling stations will be based upon the analysis of initial inventories, subsequent final delineation of Habitat types, and boundaries of accessible areas. Sampling designs and specific protocols will depend on species suites (*i.e.*, amphibian, reptile, avian, etc.) and will incorporate scientifically credible and published methodologies.

The establishment of monitoring stations (plots/transects) will incorporate the stratified random sampling approach. The basis of this approach is to partition the suites of species, and populations, in such a way that the units within a stratum are as similar as possible. In those areas that are accessible, the primary stratification will be established by utilizing general Habitat/Vegetation Communities and the associated initial measures of species abundance/distribution. The number of sampling units (transects/plots) within each stratum will be determined using an optimal allocation of sampling effort model for stratified random sampling. This model can incorporate both the proportional and probabilistic aspects of stratum size and relative species distribution/abundance to

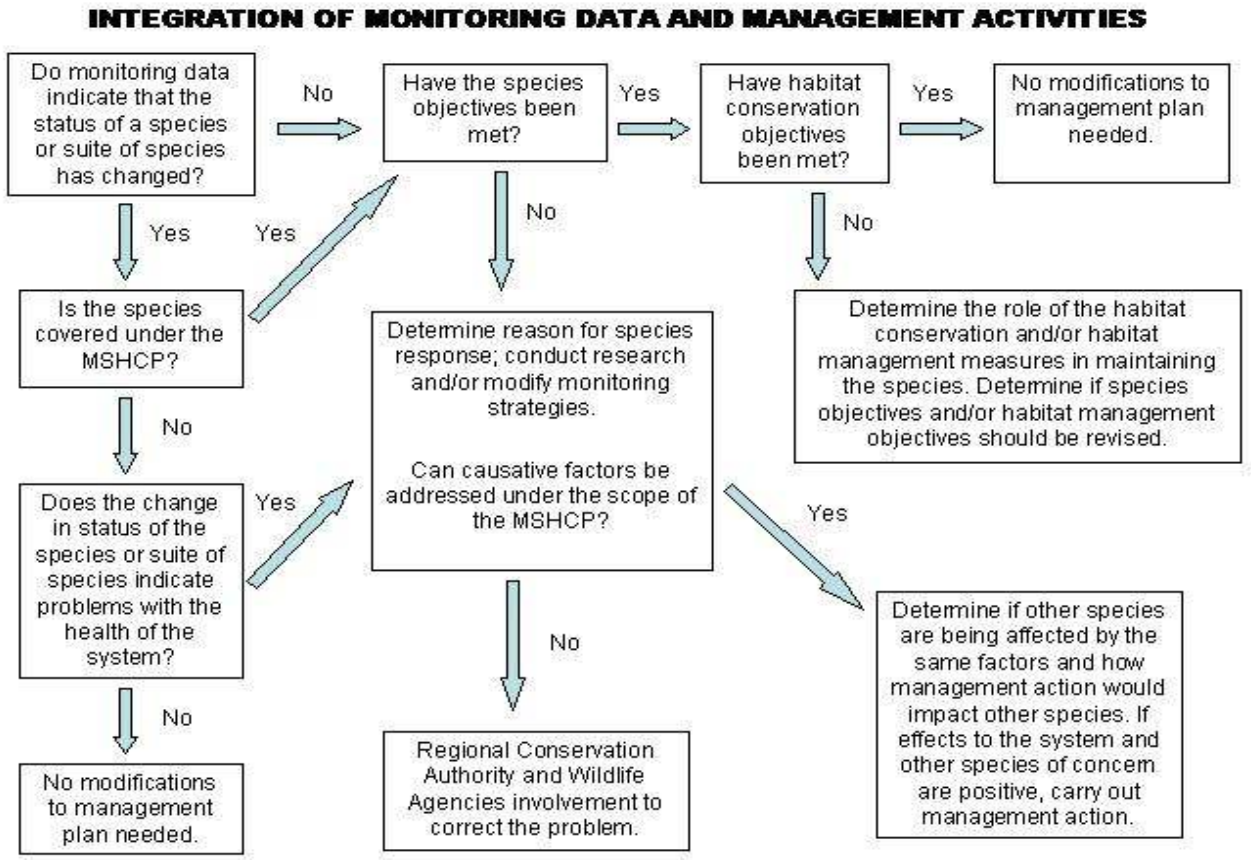
minimize the overall variance of measures of species status. The distribution and establishment of sampling stations will be done randomly to ensure that the measures are representative.

Replication of surveying the sampling units is important for measuring the variance of any point estimate (*e.g.,* species abundance) and for further ensuring that the measurements at the sampling stations are representative. This replication will occur within a particular season or year and depend on the species monitoring goals. Replication will be critical for having the appropriate statistical power to detect any change in species status.

The establishment of sampling stations must consider the problem of inaccessible areas of the MSHCP Conservation Area, either because land has not yet been incorporated or because of natural or human-made obstructions. As such, the MSHCP Conservation Area will be divided as follows: (1) areas that will never be accessible; (2) areas that may later become accessible; and (3) areas that are available to be monitored. Therefore, long-term monitoring estimates will formally measure species status in the accessible areas, and the incorporation of less formal estimates from the other areas may be the only means of deriving total estimates of the MSHCP Conservation Area. Monitoring stations may be randomly chosen ahead of time, by Habitat/Vegetation Community, in areas that may later become available to be monitored to facilitate their potential future incorporation.

The distribution and establishment of sampling stations will also consider other sampling methods (*e.g.,* cluster sampling). Other sampling strategies may be needed for some Covered Species, particularly endemic species, which are not adequately monitored using the stratified approach. Sampling stations will be distributed within each Management Unit in a manner that will allow for results to be analyzed at the individual reserve, Management Unit, and overall MSHCP Conservation Area scales.

The following *Sections 5.3.5 and 5.3.6* describe the methodologies for collecting and analyzing vegetation and species data. These data will provide inputs to the management activities described in *Section 5.2.* The chart on the following page depicts some of the ways in which monitoring data and management activities will be integrated.


INTEGRATION OF MONITORING DATA AND MANAGEMENT ACTIVITIES
Do monitoring data indicate that the status of a species or suite of species has changed?
No
Have the species objectives been met?
Yes
Have habitat conservation objectives been met?
Yes
No modifications to management plan needed.
Yes
Yes
No
No
Is the species covered under the MSHCP?
Determine reason for species response; conduct research and/or modify monitoring strategies.
Can causative factors be addressed under the scope of the MSHCP?
Determine the role of the habitat conservation and/or habitat management measures in maintaining the species. Determine if species objectives and/or habitat management objectives should be revised.
No
Does the change in status of the species or suite of species indicate problems with the health of the system?
Yes
Yes
No
No
No modifications to management plan needed.
Regional Conservation Authority and Wildlife Agencies involvement to correct the problem.
Determine if other species are being affected by the same factors and how management action would impact other species. If effects to the system and other species of concern are positive, carry out management action.