THE MONARCH PROJECT'S

CONSERVATION AND MANAGEMENT GUIDELINES

FOR PRESERVING THE MONARCH BUTTERFLY MIGRATION AND MONARCH OVERWINTERING HABITAT IN CALIFORNIA

A GUIDE FOR LAND MANAGERS AND COMMUNITY ACTIVISTS

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The authors dedicate these Guidelines
to the citizens of Pacific Grove,
who with determination and creativity are successfully leading
a campaign to restore and preserve the world-famous
monarch butterfly habitat in Butterfly Town, U.S.A.

And to

Dedicated citizens throughout California
who lobby public officials and educate children,
testify at hearings, and love monarchs.

Without you all, these habitats could not be saved.
Thank you for your inspiration.

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EXECUTIVE SUMMARY

THE MONARCH MIGRATION: A SPECTACULAR AND ENDANGERED PHENOMENON

The North American Monarch butterfly (*Danaus plexippus* L.) is unique among insects for its long-distance seasonal migration, rivaling bird and mammal migrations in predictability and distance. Each autumn, Monarchs fly from throughout the United States and as far north as southern Canada to overwintering sites in California or central Mexico. California is the only state in the United States that regularly supports these spectacular, large aggregations of overwintering Monarch butterflies.

The Monarchs remain in their overwintering sites from about October through February, then depart in the spring, flying north and east to search for the milkweed plants (*Asclepias* spp.) on which they lay their eggs (see fig. 1). Through spring and summer, Monarchs produce four or five successive, short-lived generations, building up a large population. The last generation of butterflies that emerge in the fall are the new migrants who will make the journey to the overwintering habitats.

The North American Monarch population is separated into an eastern and western migration (see fig. 2). The eastern Monarch population migrates to Mexico. Monarch butterflies overwintering in California migrate from summer breeding areas west of the Rocky Mountain Range. In 1983, the International Union for Conservation of Nature and Natural Resources (IUCN) classified the migration and overwintering behavior of the Monarch butterfly as a "Threatened Phenomenon." The California legislature in 1987 passed Assembly Bill #1671 to recognize the Monarch's migration and winter aggregation as a natural resource and to encourage the protection of its winter habitat. A year after its passage, California voters approved a bond issues allocation $2,000,000 to purchase critical overwintering habitat.

The overwintering forests are the Achilles' Heel of the Monarch migration. Although the Monarch butterfly is unlikely to become an endangered species since it persists in its tropical range, the vast numbers of Monarchs in North America, along with its migration and overwintering phenomenon, could be destroyed by the end of the century if extensive overwintering habitats in Mexico and California are not successfully protected (see Appendix L for a summary of legal precedents supporting Monarch conservation). California is particularly important to the preservation of the Monarch migration in North America. The Monarch migration east of the Rocky Mountains is perilously threatened and likely to be destroyed by continual pressure on dwindling forest resources in Mexico (Brower and Malcolm, 1991). Thus, California may become the sole North American steward of the Monarch migration. Working in collaboration, dedicated and creative land managers, local citizens, politicians, and biologists, can protect this world-famous and beloved butterfly and its migration in a harmonious balance with human use of California's coastal forests.

THE GOAL OF MONARCH CONSERVATION

The primary goal of Monarch conservation in California is to establish and maintain stable Monarch overwintering colonies that can survive indefinitely. Only a few of the many groves along the California coast have the necessary stand density, age, and configuration to support overwintering butterflies. Multiple sites and suitable habitats must be preserved and managed to persist through daily, seasonal, and occasionally catastrophic disturbances that seriously threaten California Monarch overwintering habitats. These disturbances include aggressive development, poor or neglectful management, tree aging and disease, and overuse by visitors.

Overwintering butterflies are generally founds in stands of Eucalyptus or Monterey pine that offer shelter from strong gusty winds, freezing temperatures, and prolonged exposure to direct sun (Leong, 1990; Leong, et al., 1991). The indiscriminate removal of one or more trees within or bordering overwintering habitat may adversely affect the sunlight and wind exposure for the roosting butterflies. The effects of such activities may make a suitable habitat unsuitable for overwintering butterflies, especially during storms. In addition, a grove of trees is a dynamic and ever changing system. It is conceivable that a winter grove, if left to the normal process of maturity, may become unsuitable for mass winter aggregation. Older groves (such as those in Pacific Grove) have taller trees that often lack lower branches, a product of natural thinning. The lack of natural understory foliage may increase wind movement through the grove and consequently increase the air's dryness. Scientists have shown that noncluster groves are characterized by more light and wind and less moisture in the air than overwintering groves (Leong et al., 1991).

Monarch conservation has succeeded best where citizens, local environmental groups, politicians, land managers, and biologists have joined forces to accomplish the multiple goals of conservation and land us on California's coastlands. The purpose of The Monarch Project Guidelines for Monarch Overwintering Habitat Management is to help land managers assess Monarch overwintering habitats in their jurisdiction and maintain colony stability over the long term. The Guidelines propose a conservation strategy for Monarch habitat in California. They describe what is currently known about Monarch biology, overwintering, and the environmental correlates of suitable Monarch overwintering habitats. They then offer management recommendations for shepherding these habitats into the next century.

A PROPOSED CONSERVATION STRATEGY FOR MONARCH OVERWINTERING HABITATS

Until recently, Monarch conservation was based largely on anecdotal information. As political pressure has mounted on the lucrative coastal real estate where the habitats are located, Monarch conservation has increasingly been plagued with fractious debates about the importance of individual trees, the size of habitats and their proximity to urban development, and the existence or non-existence of "microclimate" – in short, nearly every aspect of Monarch biology has been debated before elected officials who must sort through the conflict to arrive at a political decision regarding property use.

Because of the lack of solid, quantitative information on which policymakers can base their decisions, these conflicts have frequently been resolved to the detriment of Monarchs. The recommendations for designing and managing Monarch reserves, Section II of the Guidelines,

are predicated on the assumption that land managers and policymakers will be committed to generation quantitative scientific information on which to base conservation and development decisions that affect Monarch habitat. In cases of development, this can be generated through the environmental impact report. In other cases, and when management funds are restricted, land managers can devise simple, inexpensive monitoring techniques which can provide helpful data for management.

A broad conservation strategy for the western Monarch migration can be modeled on a conservation strategy for endangered species articulated by Dr. Dennis D. Murphy, Director of the Stanford University Center for Conservation Biology, and Barry Noon, Director, Redwood Sciences Lab, U.S. Forest Service. The following five rules of thumb (Murphy and Noon, 1992) can be useful in establishing conservation priorities that are designed to preserve the Monarch butterfly migration in western North America over the long-term future. These rules of thumb were employed by the Jack Ward Thomas Commission in devising its strategy for the long-term preservation of the threatened Northern Spotted Owl.

Rules of thumb for Reserve Design

1) Species that are well distributed across their ranges are less prone to extinction than species confined to small portions of their ranges.
2) Large blocks of habitat with many animals are superior to small blocks of habitat with smaller populations.
3) Blocks of habitat that are close together are better than blocks located far apart.
4) Contiguous blocks of habitat are better than habitat that is fragmented.
5) Habitats in a less disturbed landscape are more desirable than habitats in more disturbed landscapes.

Applying these rules to Monarch conservation, an effective Monarch conservation strategy should:

> Maintain the interrelationships between Monarch habitats by protecting a network of overwintering habitats in any given locale;
> Preserve a range of Monarch habitats along the length of the California coast that exhibit diverse vegetation and include varying population sizes and tenure;
> Protect all significant populations (either singly or in a metacolony); and
> Provide for effective long-term management

THE THREE MOST IMPORTANT RECOMMENDATIONS

Habitat management through grove modification (i.e. tree plantings or removal or plantings) is not an exact science. In most instances when Monarch overwintering habitat has been destroyed, the loss could have been prevented by these three recommendations:

Recommendation 1: Consult with a qualified Monarch biologist before making any decision that would alter a habitat, and follow his or her advice.

Recommendation 2: Gather baseline data on each protected habitat. Baseline data allows before and after comparisons to evaluate the effects of grove modification. See pages 16-19 for a discussion of recommended baseline studies.

Recommendation 3: Implement a low-key monitoring program. This information will help identify habitat disturbances and generate practical information to guide management decisions.

The following section, Reserve Design and Management, contains further recommendations for how to apply the knowledge scientists have gained about Monarch habitats, and how to solve practical problems.

MILKWEEDS

Figure 1

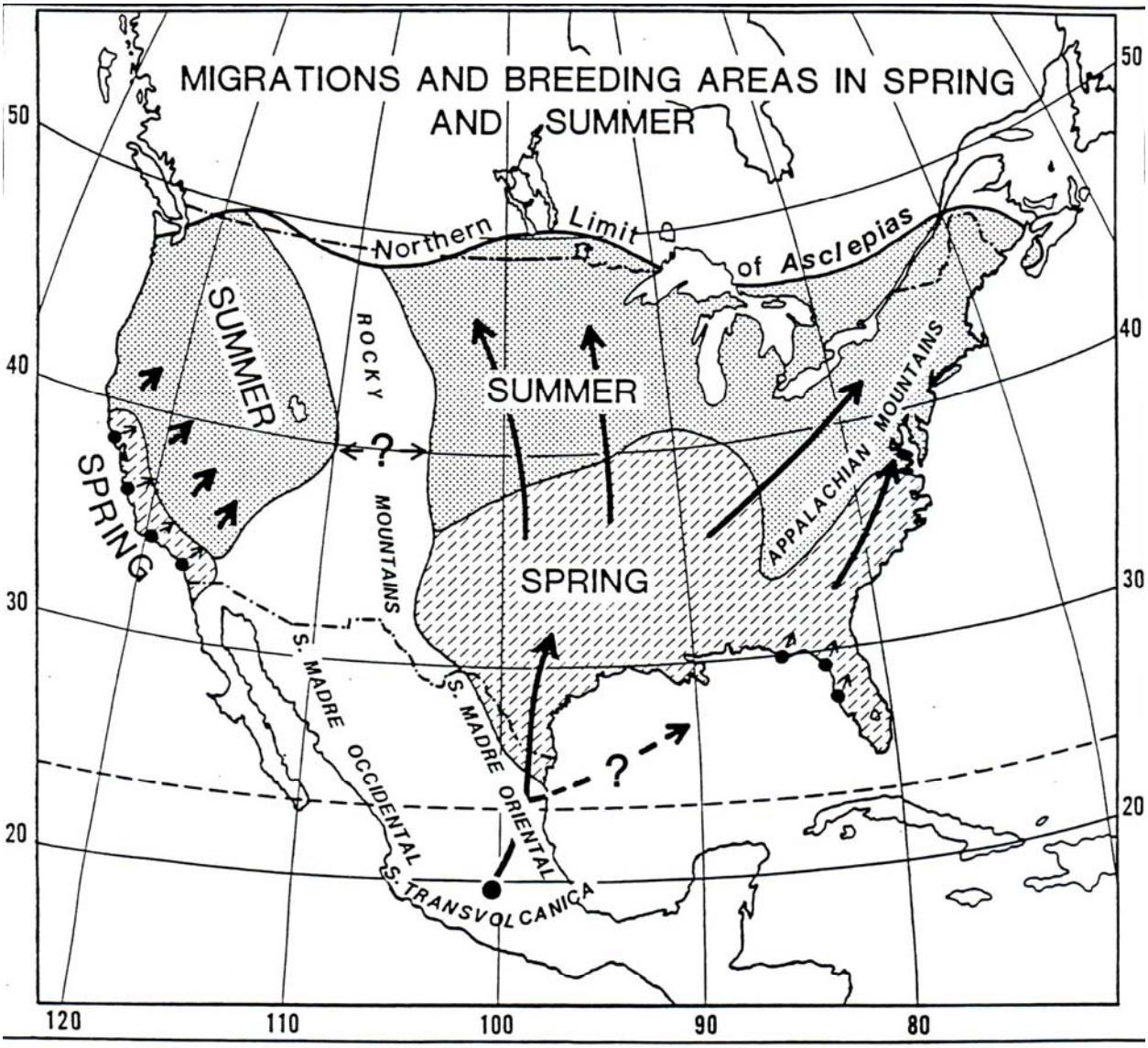
MIGRATIONS AND BREEDING AREAS IN SPRING AND SUMMER
Northern Limit of Asclepias
SUMMER
SUMMER
SPRING
SPRING
ROCKY MOUNTAINS
APPALACHIAN MOUNTAINS
S. MADRE OCCIDENTAL
S. MADRE ORIENTAL
S. TRANSVOLCANICA
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Figure 2

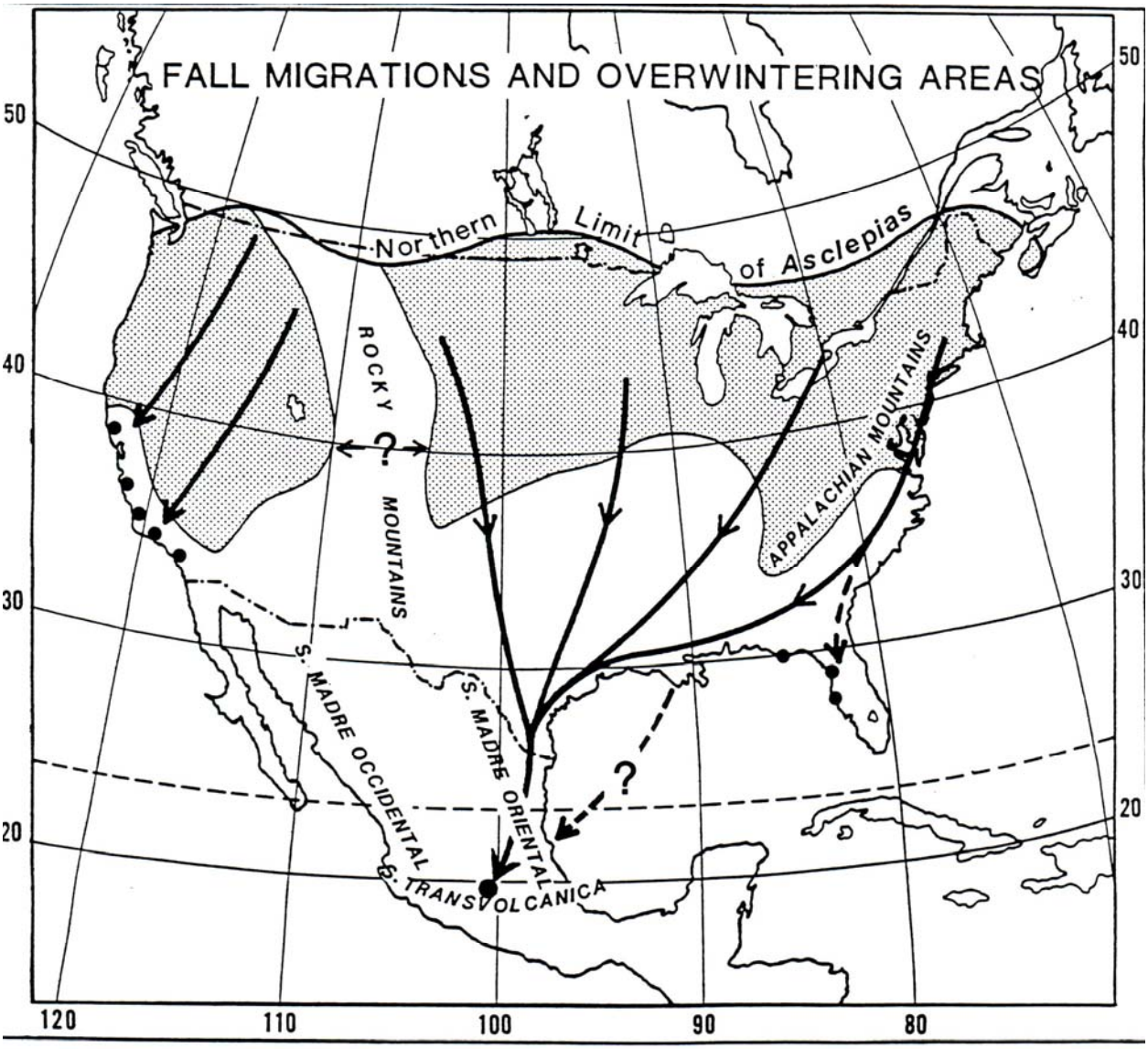
FALL MIGRATIONS AND OVERWINTERING AREAS
Northern Limit of Asclepias
ROCKY MOUNTAINS
APPALACHIAN MOUNTAINS
S. MADRE OCCIDENTAL
S. MADRE ORIENTAL
& TRANSVOLCANICA
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Figure 3

SECTION ONE

THE BIOLOGY OF MONARCH OVERWINTERING HABITATS

SPECIFIC ELEMENTS COMPRISING THE MONARCH OVERWINTERING HABITAT IN CALIFORNIA

Monarchs use well-sheltered areas as overwintering sites. The specific trees on which the butterflies aggregate are sheltered by adjacent trees, topographical features, and ground vegetation growing under the canopy or around the edge of the grove. All of this vegetation comprises the Monarch overwintering habitat. It is a common mistake, and one that has led to the destruction of many Monarch habitats, to assume that Monarch overwintering habitat includes only the trees on which the butterflies aggregate.

A decade of research in Mexico and several years of research in California has provided insights into what makes a successful wintering habitat. The forests and groves that support Monarch overwintering habitats are characterized by a very specific range of climatic variables. Together, these variables make up the "microclimatic envelope." Research shows that overwintering habitats have lower wind velocity, lower light and solar radiation intensities, and higher vapor pressure deficits than non-wintering groves (Leong et al., 1991; Weiss et al., 1991). Environmental parameters associated with suitable Monarch overwintering habitats do not vary between overwintering sites composed of different tree species (Leong et al., 1991; Frey et al., 1992). In California, overwintering tree species include Monterey Pine (*Pinus radiata* D. Don), Monterey cypress (*Cupressus macrocarpa* Hartw. Ex Gord.), the introduced Australian Eucalyptus species (*Eucalyptus globulus* Labill. and *Eucalyptus camaldulensis*), and others.

Despite the vast difference in elevation and latitude between the overwintering sites in California and those in Mexico, the California groves provide a microclimate remarkably similar to that in Mexico (Brower, 1985). Monarchs single out the same forests, even the same trees, every year. In both Mexico and California there are intact areas of forest that appear to have characteristics similar to Monarch habitats, but that do not support Monarch overwintering habitat. This suggests that suitable habitat for the butterflies is extremely limited by natural as well as human constraints (Brower, 1985; Brower and Malcolm, 1989).

Microclimate is determined by the same features that determine regional climate (latitude, altitude, and proximity to large bodies of water), but it is further modified by the local features of an overwintering grove. These features are the physical, or abiotic, aspects of the grove (direct and indirect sunlight, temperature, wind, and humidity) and the living, or biotic factors. (The biotic factors are principally the species composition and structural arrangement of trees, understory, and edge vegetation.) For the most part, the features that determine microclimate act to buffer or reduce the variability of temperature, humidity and sunlight within the overwintering grove.

The forest suitable for Monarch overwintering provide the butterflies with both shade and a minimal exposure to direct sunlight, buffered temperatures, high humidity, low vapor pressure deficit, and protection from wind and severe weather conditions. Overwintering habitats have extensive canopy cover with some gaps to allow direct sunlight into the grove. They typically have a developed understory which may include saplings or mid-level canopy as well as ground-level vegetation in some sites. Leafy, ragged, edge vegetation often surrounds the grove. Nearby nectar and water resources are frequently present and are probably critical.

Microclimatic data on California Monarch habitats were derived from research conducted at Montana de Oro State Park, Pismo State Beach, and Los Osos by Drs. Kingston Leong and Dennis Frey, Cal Poly, San Luis Obispo; in Santa Barbara County by Dr. Lincoln P. Brower, Dr. William Calvert, and Stuart B. Weiss under the auspices of the Stanford Center for Conservation

Biology; and at Natural Bridges State Beach and Moran Lake in Santa Cruz County by Elizabeth Bell and John Dayton, University of California at Santa Cruz. Data on microclimate at Natural Bridges in the mid-1960s and during 1991 were provided by Robert Brownlee. Population and tagging studies have been conducted by Walter Sakai, Santa Monica College. Overwintering and population studies have been done by Dayton & Bell. See Appendix K for the addresses of these authors.

This research has led to the identification of specific environmental parameters associated with successful Monarch overwintering. Table 1, page 3, is a list of environmental factors associated with habitat suitability, and therefore colony stability.

The suitability of a particular overwintering site is in large part determined by the options it presents to the Monarchs. (After all, the Monarchs make the final decision about where they want to be.) A suitable habitat must provide, for example, a choice between sun and shade, and protection from wind as the winds shift direction over the course of the season. Research strongly indicates that the distribution of Monarch clusters within grove is associated either with areas having favorable conditions, or with avoidance of adverse conditions (Leong, 1990). Monarchs need heterogeneous habitats, that is, habitats that provide a variety of conditions so they can shift their roosting location in response to the highly varied climatic conditions outside the grove.

Understanding, maintaining, and enhancing the habitat heterogeneity is probably the most important aspect of designing and managing a stable, thriving Monarch habitat reserve. The vegetational and forest canopy structure are measures of Monarch habitat heterogeneity and suitability that managers can both quantify and manipulate. Indeed, the management of forest structure is the only feasible means of modifying microclimatic conditions such as wind, exposure to sun, and relative humidity within a forest stand.

Quantification of key elements of forest stand structure, and the correlation of these elements with microclimatic variables such as light, temperature, wind, and humidity are valuable steps in the development of effective conservation and management plans for the Monarch butterfly (Weiss et al., 1991). Baseline studies of the microclimatic and biotic parameters, combined with a low-key monitoring program, can illuminate what creates habitat stability or contributes to habitat disturbance. When an environmental impact is required, funding is typically provided for these studies by the developer. In other cases, land managers can assess their needs and request aid from Monarch scientists in choosing studies that best provide needed information within the management budget. See pp. 14-17 for recommended studies that can aid long term management.

The following is a brief discussion of individual parameters characterizing overwintering groves.

TABLE 1: ENVIRONMENTAL FACTORS ASSOCIATED WITH HABITAT SUITABILITY

A. Microclimatic Conditions	Temperature
	Wind Velocity
	Wind direction, into and through the grove
	Indirect sunlight
	Direct sun exposure
	Humidity
	Vapor Pressure Deficit
	Sunlight Direction
B. Topography	Exposure
	Presence of fresh, clean water
C. Biotic Conditions	Size of Forest Patch
	Structure, or arrangement, or vegetation
	Species composition of vegetation
	Movement of butterflies within grove
	Population estimates
	Orientation of butterflies on trees
	Predation
	Human disturbances
	Nectar sources

THE OVERSTORY CANOPY: COVER AND INSULATION

The canopy is the uppermost spreading layer of branches of the forest. Forest canopy structure is a primary determinant of microclimatic conditions within forest stands (Weis et al., 1991; Calvert and Brower, 1982). Forests with extensive canopy cover are more humid and retain moisture better than open forests. Temperatures within these forests are significantly warmer at night and cooler during the day than in adjacent clearings or open canopy forests. An extensive canopy insulates the butterflies from wind that can dislodge them. Since Monarchs don't roost in the uppermost branches, the canopy shields the interior of the overwintering habitat from direct sunlight and makes excessive Monarch movement less necessary and less likely (Frey et al., 1992). Monarchs also are not found in fully-closed canopies that allow no sunlight to penetrate to the forest floor, since this would trap grounded Monarchs and make them more vulnerable to mouse, bird, and wasp predation (Sakai, in review). (see References, page 41 for publications describing the characteristics and role of the forest canopy.)

Nor do Monarchs thrive in excessively open canopies. Monarchs maintain a balance between expending and conserving their energy to fulfill two needs. They must conserve sufficient stored fat reserves to last through the winter and power their spring reproduction and remigration. And they must able to use stored fat as an energy source to power flight so they can escape predators and excessively cold ground temperatures, and obtain water and nectar when needed (Master et al.,1988; Chaplin and Wells, 1982). An excessively open canopy makes it more than likely that Monarchs will be (a) dislodged from their clusters by wind, (b) subject to greater predation from wasps, birds, and mice, (c) forced to expend valuable fat stores to fuel movement back to clusters, and (d) subject to overheating by exposure to direct sunlight, which causes them to use up fat reserves at a higher rate. (One theory is that they expend valuable fat reserves by taking flight to cool down.)

THE EDGE BARRIER AND UNDERSTORY: SUSTENANCE AND SHELTER

Many Monarch habitats are characterized by a raggedy edge of bushy trees or plants that create sheltered pockets within the edge of the grove. Some, not all, have understory plants, bushes, or grasses. A well-structured edge barrier and understory plants help regulate the microclimates by retaining heat at night, keeping the grove cooler during the day (Calvert and Brower, 1986), and reducing ground level air movement. They may also provide nectar sources. Monarchs use low-lying vegetation within and near overwintering habitat to crawl up when trapped on the ground by low temperature. Where visitors to Monarch overwintering sires are numerous, low vegetation limits visitor access and can help grounded Monarchs avoid being trampled to death.

Non-cluster trees, the edge barrier, and understory are too frequently underrated in the creation of a successful overwintering habitat. Edge barriers and understory should include a diverse collection of plants which have varying heights, so that the plant cover reinforces the protection provided by larger trees. Thus, as the large trees age and their lower branches become barren, the bushier edge and understory will still provide shelter and protection from winds.

TEMPERATURE

Cold temperatures serve Monarch colonies by keeping the butterflies inactive, so they conserve their stores of fat. In sites that become too warm, Monarch become increasingly active, cease clustering, become reproductive and leave to see nectar, using up fat stores (Masters et al.,

1988). Monarchs seek a narrow range of microclimatic conditions that are cool enough for them to remain inactive, but not so cold they can't survive.

Thinning or removal of trees has a direct effect on forest temperature. As one would expect, a more open forest is colder at night and warmer during the day. Thinning of critical windbreak trees, and sometimes even of critical individual branches can have devastating effects on Monarch habitats (see Appendix E).

Temperature plays a key role in butterfly mortality, and not only because it can directly cause their death. Temperature limits the ability of grounded butterflies to fly or crawl to safety and a long stretch of cold can put the butterflies at risk for dehydration. In California, dehydration and being stranded on the ground are greater mortality risks than freezing. (see "Environmental Correlates of Butterfly Mortality," page 6.)

The lowest temperature at which Monarch can fly is about 57 degrees Fahrenheit. The lowest temperature at which they can crawl is 34 degrees Fahrenheit. Ambient temperatures vary greatly from October through February, and so habitats that are more heterogeneous are more likely to provide a range of microclimatic conditions within the grove, contributing to suitability.

SUNLIGHT

The relationship of sunlight to the thermoregulatory needs of overwintering Monarchs is dynamic and changes as the ambient temperatures change during the winter. In the fall, when air temperatures are relatively warm, Monarchs generally avoid roosting in direct sunlight. By roosting in shady areas of the overwintering habitat, Monarchs can remain inactive during the midday heat, thereby conserving their fat reserves for the coming winter.

During the mid-winter's cold, when sunlight is at its lowest intensity, the butterflies roost in areas of the grove that receive direct sunlight for brief periods of time (Frey et al., 1992). Monarchs need sunlight on cold days to raise their body temperature in order fly in search of nectar or water, to relocate their clusters, or to regain their positions in the clusters if they are dislodged from the trees. Thus, a certain amount of sunlight penetration into a grove is essential to the survival of overwintering Monarchs during mid-winter.

Researchers believe the exact location of Monarch clusters on a particular branch has to do with their need to thermoregulate (Masters et al., 1988). Since the exact way the forest intercepts the sun is habitat-specific, the precise location of Monarch clusters is also habitat-specific. It is a mistake to assume that, in general, increasing the direct sunlight would enhance a Monarch grove. Habitats must be assessed individually when making management decisions.

HUMIDITY AND WATER

Humid air reduces water loss in roosting Monarchs, thus reducing their need to fly out in search of water. Many of the aggregation sites that support butterflies throughout the entire overwintering season in California are associated with coastal stream canyons that act as drainage basins for both rainwater and pools of cool moist air (Weiss et al., 1991; Calvert and Murphy, 1990). Understory and other vegetation, by increasing the surface area available for condensation and by adding moisture to the air through transpiration, help increase the water content of the air. If the air is not humid enough to provide condensed moisture on trees and plant leaves, the butterflies will be forced to fly out to obtain it from a nearby stream or lawn.

WIND VELOCITY

Wind is a strong factor in habitat suitability, and influential in the butterflies' choice of cluster locations and movements around the grove. Wind velocities associated with trees supporting butterfly clusters are often low. As the wind changes, the butterflies shift their cluster locations to avoid areas or trees exposed to gusts (Leong, 1990).

Windbreak trees are critical to all Monarch habitats, and may include groups of trees in which Monarchs never cluster, but which provide protection for the clustering areas. Because windbreak trees are so important, local ordinances protecting "Monarch trees" can frequently by ineffectual in that the trees providing wind protection are ignored in the process. If sufficient habitat is not protected, including trees the Monarchs are never seen clustering on, the site could as easily be destroyed as if the center of the grove were removed.

The overwintering site at the Pismo State Beach campground is a good example of the dilemma that arises when critical windbreak trees occur outside the immediate habitat area. On the opposite side of Highway 1 from the Pismo colony is a row of trees growing along the railroad tracks. These trees are not part of the protected park area, but they are essential windbreak for that Monarch habitat. The total Monarch habitat at any one site thus may not correspond to the land ownership or political boundaries, and protection of any one site may require the cooperation of several property owners.

NECTAR SOURCES

Nectar is the sugar source that the Monarchs use to make body fat, and nectar resources are an important element in most Monarch overwintering habitats. (see Appendix H for a list of common nectar sources.)

Physiological changes associated with sexual dormancy in Monarchs cause them to build up body fat before overwintering. Fat reserves are crucial to overwintering survival because Monarchs must fast for several months during the winter when nectar sources are absent or scarce. During their winter fast, Monarchs utilize about 50% of their body fat (Dayton and Bell, 1985; Brower, 1985). If butterflies do not have enough fat to last through this fasting period they may either starve to death or lack the energy to make the spring remigration and die en route.

Declining fat reserves are important in motivating Monarchs to leave the overwintering site in search of nectar. As winter progresses and nectar sources are less available, low fat stores are harder to replenish. The presence of onsite nectar sources in the later part of the season (January through March) can stabilize the colony by supplementing their fat reserves and reducing the need for the Monarchs to fly out in search of nectar (Dayton and Bell, 1985).

Nectar sources must be located close to the colony (within ¼ mile) in order to be useful in stabilizing the overwintering colony. Nectar sources located within the habitat contribute most to colony stability.

ENVIRONMENTAL CORRELATES OF BUTTERFLY MORTALITY

In California, mortality of Monarchs in their overwintering habitats is generally low. Winter storms tend to be the major cause of mortality, especially when they occur in conjunction with low temperatures (Dayton and Bell, 1985). Predation by birds, mice and ground-dwelling invertebrates also contributes to butterfly mortality in overwintering habitats (Tuskes and Brower, 1978; Sakai, in review).

Most butterfly mortality occurs when Monarchs are dislodged from the trees and stranded on the ground when temperatures are below the Monarch's flight threshold. The combined effects of sun exposure, temperature, wind, precipitation, and predators determine whether the butterflies will get back to the clusters.

During cold weather, the butterflies can elevate their body temperatures enough to fly back up to the trees by basking in the sun or by shivering. If Monarchs are too cold to fly, they may climb to safety upon any understory vegetation that is present. The probability of survival is much lower for butterflies on the ground, especially if there is little understory vegetation, if pavement underlies the overwintering colony, or if it receives a lot of visitors. This underscores the importance of wind protection from overwintering habitats, the presence of some light gaps within the forest canopy and the preservation of understory vegetation when it is present.

RANKING SITES TO DEVELOP CONSERVATION PRIORITIES

Ranking Monarch habitats is done essentially for political reasons rather than biological ones. Monarch conservationists rank habitats in order to allocate scarce research and acquisition funds and develop conservation priorities. Political and practical considerations dictate that conservation priorities must seek to preserve some percentage of the whole. But Monarchs have already lost a substantial number of habitats along the California coastline (see Appendix E). With the diminished number of habitats remaining, each potential new loss poses an increasingly greater risk to Monarch migration.

There are no quantitative data to show the minimum number of overwintering habitats needed to sustain the migration, but it is clear by the way that Monarch populations dwindled in key overwintering areas such as Pacific Grove[1] that aggressive coastal development and the attendant loss of Monarch habitats can diminish the migratory phenomenon in coastal areas.

Habitat rank is largely a subjective judgement providing a framework for conservation strategy and cannot substitute in environmental impact reports or management plans for scientific analysis of individual sites. Environmental impact reports that aim to assess the potential effects of intrusion into a Monarch grove by development must include appropriate population studies and quantitative microclimatic and forest canopy studies. These will provide a scientific means of arriving at the political decisions required to mitigate the development.

Habitat rank is achieved by weighing the characteristics of a site to determine its quality and its regional and statewide importance. Except, perhaps, for colony size, no single characteristic weighs substantially heavier in deciding rank than others. Monarch habitats are ranked by assessing the following essential characteristics in relation to other protected habitats in the same region and statewide. A discussion of some of the complexities involved in determining habitat rank follows this list:

Essential characteristics:

- Colony Size
- Average tenure (the length of time the butterflies stay during the winter, averaged over several years)
- Proximity to equivalent alternative habitats

[1] See Recommendation 72 for how Pacific Grove is protecting its Monarch overwintering habitat and how others can help.

- Function of the site with regard to its role in perpetuating the migration phenomenon (role of the site in the larger metacolony)
- Uniqueness of the site with regard to location, vegetative composition, etc.

The following secondary characteristics are also important:
- Microclimatic suitability
- Availability of resources: nectar, water, understory
- Size of forest
- Potential for funding and implementing management or manipulation
- Likelihood of public support for necessary maintenance and management

MONARCH HABITAT STATUS

Monarch scientists categorize overwintering habitats according to the length of time the butterflies remain at the site. Two types of Monarch roosting habitats are generally distinguished: autumnal roost sites and overwintering habitats. Along the coast of California, autumnal sites vastly outnumber the overwintering habitats.

(1) Autumnal roost sites generally host relatively small populations of Monarchs (hundreds to low thousands) during the fall, usually September though mid-November. Autumnal sites are often associated with fall-blooming nectar sources, especially English Ivy (*Hedera helix*). These sites may serve an important role as feeding habitats for Monarchs that are replenishing their fat reserves for the coming winter. The butterflies roost at these sites for a few weeks, but abandon them by mid-November, as the overwintering habitats are reaching their peak populations. Butterflies rarely re-occupy these habitats during the remainder of the winter.

(2) Monarchs inhabit overwintering habitats throughout the fall and winter, and they remain in most through the end of February, when mating and spring re-migration occur. A very small number of these overwintering habitats sustain Monarch colonies through about mid-December, when they apparently move on to other overwintering habitats for the coldest part of the winter. The number of Monarchs in overwintering habitats is highly variable and may depend on many factors, such as geographic location and site-specific attributes of the microclimatic conditions of the habitat. Some of these habitats support Monarch colonies comprised of more than 200,000 butterflies (Dayton and Bell, 1984). Overwintering habitats also typically have nectar sources, especially blue gum Eucalyptus and native willows (*Salix* spp.), which bloom during the latter part of the winter. Most of the research on overwintering Monarchs in California has been conducted in these habitats. Several prime overwintering habitats are on land owned by the California Department of Parks and Recreation.

THE BIOLOGICAL SIGNIFICANCE OF AUTUMNAL VERSUS OVERWINTERING HABITATS: THE METACOLONY CONCEPT

The significance of any given Monarch overwintering site depends upon a host of interrelated variables, and one of these is its interdependence with other surrounding Monarch sites. Recent research in southern California (Sakai, in prep.) suggests that individual overwintering sites do not support overwintering populations in isolation from other nearby

Monarch habitats; instead, groups of Monarch habitats act to support a "metacolony" of butterflies that move between these sites,

It is tempting to use the tenure of the site as the most significant determinant in ranking a Monarch habitat for conservation. And on this basis autumnal sites seem to be less worthy of protection, since they are not used as an overwintering site for the entire winter and since the colonies that inhabit them are typically smaller than overwintering sites. But autumnal and overwintering habitats each serve different functions and are each important for maintaining local Monarch populations. Because the level of inter-colony movement, particularly in southern California, suggests that a metapopulation of Monarchs depends on several sites in one areas, sites cannot be ranked strictly according to how long the butterflies use them. The ranking of Monarch habitat should consider colony size in combination with tenure, and should evaluate the level of inter-colony movement between local habitats. In many cases, the most effective conservation choices will reserve a network of habitats rather than individual sites.

Marking and tagging studies indicate that Monarchs move between nearby overwintering habitats (inter-colony movements) when conditions are favorable for flight. Some inter-colony movement is a response to the onset of winter. It is also possible that, early in the season, autumnal sites may provide better conditions for butterflies than do overwintering sites, particularly if they are providing nectar. Monarchs then leave autumnal sites in late fall or mid-winter to seek the more favorable microclimatic conditions of overwintering sites. In the northern part of the Monarch's overwintering range in California, inter-colony movement largely ceases by the end of November and Monarchs display relatively high fidelity to overwintering sites during most of the winter. In contrast, inter-colony movement appears to occur throughout the overwintering season in southern California.

Researchers have found that some sites serve as important nectaring bivouacs. They may support an autumnal colony during the fall flowering period or an overwintering site through the entire season. During the favorable conditions, these sites have a constant flow of butterflies in and out of the site as the butterflies refuel.

Preserving a network of habitats supports the metacolony of butterflies in the areas. Ranking the entire area's Monarch habitats can aid in deciding which should remain in a protected network. Protecting a number of colonies in an area is a practical guard against natural disaster, as well. Natural events such as chaparral fires in southern California and violent wind storms in central California can destroy even a large site. Other nearby sites must be available for the surviving butterflies to spend the winter.

THE IMPORTANCE OF EUCALYPTUS AS MONARCH OVERWINTERING HABITAT

Overwintering Monarchs have become highly dependent on the presence of Eucalyptus trees. Most Monarch overwintering habitats in California are located in mature groves of Eucalyptus, and almost all large overwintering colonies (more than 30,000 butterflies) occur in this type of habitat. It is thought that most of the original Monarch overwintering habitats comprised of native tree species have been destroyed or irrevocably altered by humans over the past several hundred years. The historical native habitats no longer exist, nor can they be recreated. Removal of the sites unusable, and could cause the virtual collapse of the western North American migratory Monarch population.

Eucalyptus groves are abundant along the California coastline, but only some of them have microclimatic conditions suitable for Monarch overwintering. In addition to providing shelter for Monarch colonies, blue gum Eucalyptus serves as a source of nectar during the winter, providing the butterflies a way to replace lost lipids at a time when their lipid content is likely to be depleted and when native plants do not bloom. The presence of winter-blooming Eucalyptus contributes significantly to colony stability.

Conflict between Monarch habitat conservation and Eucalyptus removal for native revegetation arises when the tree removal occurs in proximity to a Monarch overwintering habitat. Since the entire grove of trees serves as Monarch habitat, even selective tree removal around the margins of groves may have adverse effects on the habitat. At a time when current political and development pressures imperil Monarch habitats statewide, the butterflies cannot afford to lose these prime Eucalyptus habitats to a political battle between native and non-native species. Some native plant advocates assert the Monarchs will go elsewhere if their Eucalyptus habitats are destroyed. But the decline of Monarch populations in areas where Eucalyptus groves were developed suggests otherwise.

This issue is especially critical on state park lands, where the California Department of Parks and Recreation under the Public Resources Code is undertaking to remove Eucalyptus and other non-natives and replace them with native vegetation. Native habitat revegetation should not be accomplished at the expense of the unique coastal Monarch overwintering habitats. Eucalyptus groves should be understood as "major vegetation" within the definition of the Coastal Act and the removal of Eucalyptus trees from a Monarch habitat should be understood as "development" under the Act. The Monarch Project, Monarch scientists, and Monarch conservationists support the goals of native revegetation, but not where they compromise the integrity of overwintering habitats.

Although native nectar plants will not serve to replace the nectar available from Eucalyptus trees, they can enhance a non-native grove with native flora. Native willows (*Salix* spp.) are virtually the only native plant that provide mid-winter nectar, but there are a number of fall blooming and spring blooming natives (see Appendix H).

Statewide Monarch habitat conservation strategies should target habitats composed of several different tree species in order to broaden the diversity of protected habitats and reduce the vulnerability of Monarchs to Eucalyptus insect pests. Preservation of Monarch habitats located in Monterey pine and cypress is particularly important.

COLONY STABILITY DEPENDS ON HABITAT SUITABILITY

A varying forest age, structure and the plant species composition are prime contributors to habitat suitability and colony stability. In fact, heterogeneity is probably the single most important factor in the long term survival of Monarch overwintering habitats. The structure created by the trees, topography, and vegetation surrounding the overwintering habitat determine how suitable it is. A heterogeneous habitat and varied county-wide reserve designs which include nectar and water sources and other several Monarch colonies are key to sustaining Monarch populations. Monarch conservation has tended to focus on trees, but all the evidence points to the need for a broader approach that preserves the ecological system in which the trees must thrive.

Based on the information in these Guidelines about the specific elements that comprise Monarch habitats, optimal Monarch habitats provide:

- Suitable microclimatic conditions in a variety of mild to extreme weather conditions.
- Adequate wind protection
- A rich diversity of vegetation, providing dense and light areas, warm and cool areas, and dryer areas
- On-site nectar sources
- On-site water sources (particularly in the south, where humidity is lower)
- Protection from human disturbances, including adjacent land use and tourist impact

Butterflies shift locations in the grove in an effort to maintain the correct balance among various physiological needs, including conservation (and/or replenishment) of fat stores, and maintenance of body temperature within certain other words, Monarch may be choosing the cluster location based on how the site factors in that location compare with site factors in other locations in the grove. Their movement around the grove seems to be affected by the configuration of trees in each chosen site. Whether a colony persists over the long term may have less to do with a single factor than with the habitat heterogeneity of the grove overall.

Reserves should be designed and managed to provide suitable habitat through the chance catastrophic occurrences of a 50-year time-frame as well as the more benign annual winter storms. Long term habitat suitability and colony stability will also depend on minimizing disturbances and intrusions into the grove. Section Two of these Guidelines offers practical recommendations for how to design reserves and minimize disturbances in the grove.

TABLE 2: PRACTICAL QUESTIONS TO ASK IN ASSESSING YOUR MONARCH HABITAT

Based on data summarized above, here is a list of practical questions to ask in assessing the health of a Monarch habitat. Land managers can design a study and monitoring program to address these questions and build a base of applicable information about the habitat.

- Is the canopy too open? Too closed?
- Is there too much sunlight? Too little?
- Is there some direct sunlight in the winter and sufficient shade in the fall?
- Does the understory dill in bare areas sufficiently to provide extra wind protection and increase humidity?
- Is the habitat too warm overall? Too cold? Too dry? Too windy?
- Does the vegetation provide refuge from storms? Do Monarchs tend to seek shelter in other habitats during storms, or get knocked from the trees in large numbers?
- Does the grove contain a mix of vegetation heights and thicknesses, and a variety of sunny and shady conditions through the winter months? Or it is fairly uniform?
- Is there a water source?
- Are there fall and winter nectar sources within or near the grove?

SECTION TWO

GUIDELINES AND RECOMMENDATIONS

RESERVE DESIGN & RESERVE MANAGEMENT

LONG-TERM MONARCH HABITAT PRESERVATION REQUIRES ACTIVE MANAGEMENT

It was once possible to go by the old adage that the best management for a Monarch overwintering habitat is benign neglect: leave the sites alone and they will survive. Over many decades, as forests climaxed and became unsuitable for Monarchs, butterflies probably moved to new locations. Today there are Monarch habitats in Eucalyptus groves only 30 years old, so we know Monarchs continue to colonize new areas.

But benign neglect will not help Monarch habitats survive into the next century. With the rapid development of the California coastline, few forests remain for Monarchs to colonize. The dramatic loss of trees in urban areas shrinks potential habitat. Many Monarch habitats have already been lost and development chips away at the remaining sites. Moreover, the removal of Eucalyptus (the most widely used overwintering species) and its replacement with native vegetation is a primary goal of the California Department of Parks and Recreation and the California Native Plant Society. Monarch conservationists cannot count on a continued supply of these weedy, fast-growing forests to replace those lost to development.

It used to be that for a Monarch habitat to be "protected", it only need be legally barred from development. Now, as even "protected" habitats are stricken by disease or degraded due to tree senescence, tourism and poor management, owners and managers of Monarch habitat must view their role in a new light. They must work actively to preserve and sustain existing Monarch overwintering habitats. To ensure that Monarch habitats thrive, land managers must be active, developing programs for tourism control, tree planting, and tree trimming or removal when necessary.

The following information offers suggestions for developing baseline data on any Monarch overwintering habitat, for designing a Monarch reserve, and for solving common management problems or correcting habitat deterioration in Monarch reserves. Some material is equally applicable for both design and management, and land managers working with an existing design may benefit from some of the suggestions in the design section. Appendices listing helpful resources and individuals are cited throughout the text.

DESIGNING A MONARCH RESERVE OR RESERVE SYSTEM

A reserve can be a single Monarch overwintering habitat, or a system that includes a network of autumnal and overwintering habitats that Monarchs can move among throughout a winter season. Monarch conservationists seek to protect a variety of habitats along the coast, with a diversity of vegetation. Diversity shields the migration phenomenon from the sudden loss of an entire area or tree species due to natural disaster or disease, and contributes to heterogeneity within a habitat, which scientists believe is a key element in its long-term survival.

Recommendation 4 (recommendations 1-3 are on page 9): County and city governments should protect as many sites within one locality as possible, using wide buffer zones and making conservative initial decisions. Local governments establishing Monarch reserves should make conservative decisions, establish monitoring programs, and adjust the reserve design slowly over time as the data show appropriate means to do so. Use wide buffer

zones with little active management at first, unless the habitat is noticeably degraded and in danger of disappearing.

Recommendation 5: Design reserves or reserve systems with three basic goals in mind: 1) Conservation planning should address the systematic threats to Monarch Populations: habitat destruction, predation, and disturbances caused by humans. The habitat location must be secure, and legally protected from daily threats such as wood-gathering, fire-building, or motorized traffic before an appropriate reserve system can be designed and an active management plan adopted.

2) Reserve systems should cushion against catastrophic random events and regional climate change. Fire, disease, or massive erosion may threaten the persistence of otherwise stable populations. Regional climate change prompts Monarchs to move substantially throughout a large geographic area. Land managers can identify the metapopulation dynamics for their area, and design a reserve system that secures the ability of Monarchs to move between several habitats to insulate the population against the sudden loss of one.

3) Reserve systems should address the predictable environmental perturbations such as drought. A multi-age stand of trees, including some drought-resistant vegetation would enhance the long-term survival of the grove. (A classic model for reserve systems would also address demographic stochastity or deleterious genetic effects, but population in Monarch habitats are sufficiently large that these problems do not plague them.)

A competent baseline study can provide the information to accomplish these goals. Baseline data gathered onsite will reveal the strengths and weaknesses of the habitat and highlight the warning signs that indicate habitat degradation. A practical course of research can produce data useful in deciding where and how to modify the reserve over time; how to repair or enhance the grove in response to disturbances such as vandalism or downed trees; and how to plan for tree senescence.

Recommendation 6: Develop baseline data to quantify the characteristics of the habitat. Use the study to test the reserve design: The top priority is to establish minimum standards for the long-term survival of prime Monarch overwintering habitats. Baseline studies provide critical information for developing these standards. This information is also useful to politicians who must balance Monarch habitat preservation with development. Land managers will be able to apply the data to immediate practical decisions. They will not have to wait for the completion of lengthy studies.

Studies should be designed and implemented by a Monarch biologist, who can recommend what information should have top priority and how extensive each investigation should be. At least one full overwintering season is necessary to characterize the biology and dynamics of Monarch overwintering. The authors recommend an ongoing follow-up monitoring program, to be designed in consultation with the Monarch biologist.

The following studies are outlines for a competent database quantifying the microclimatic envelope in Monarch overwintering habitats. These studies examine population biology and the biotic and abiotic components of the Monarch habitat. A description of their practical application is included.

TABLE 3

Suggested Studies of the Abiotic Habitat

Record temperature, humidity, wind speed and direction, and rainfall inside the Monarch habitat. This can be done by setting up a weather station at the site.

Make temperature and humidity recordings at different heights from the ground up to the canopy, and at regular intervals inside and outside the Monarch habitat.

Measure and map direct and indirect light inside and adjacent to the Monarch habitat at regular intervals.

To gauge the broader influences on Monarch populations, onsite monitoring should include monitoring the variables that affect summertime reproduction

The Practical Application of These Studies

Monitoring temperatures inside and outside the grove will give an indication of the suitability of the grove and the expected butterfly behavior. Behavior that could not be expected based on ambient temperatures may be attributable to problems at the site, such as a lack of vegetation.

Establishing baseline measurements will allow land managers to begin characterizing the habitat, comparing the parameters of their study site with those at optimal sites, and analyzing potential problems.

Weather information is helpful. Research at Natural Bridges has shown rain affects the overall Monarch population throughout the state. Wide variations from the population expected at the study site may be attributable to site factors.

TABLE 4

Suggested Studies of Biotic Habitat

Use hemispherical photography with digital image analysis to quantify the forest canopy structure and the amount of direct and indirect sunlight.

Mark out a survey grid over the Monarch habitat. Catalogue tree and understory species, and measure densities, diameters at breast height, and basal areas of the trees.

Estimate age of the vegetation within the forest.

Map tree and understory distributions. The distribution, abundance and structure of understory species can be determined with standard botanical quadrant methods in relation to the survey grid coordinates.

Compare heights, distributions and sizes of Monarch clusters in relation to forest canopy and understory structure in the Monarch habitat survey grid and adjacent non-Monarch habitat survey grids.

The Practical Application of These Studies

Forest canopy structure is one of the few pertinent environmental measures of Monarch habitat suitability that managers can both quantify and manipulate. Indeed, management of forest structure with standard silvicultural techniques is the only logistically feasible means of modifying insulation, wind, and relative humidity within a forest stand.

Hemispherical photographs of the forest canopy can be digitized in a computer program, allowing researchers to "edit" trees, thus to assess impacts of tree removal on light conditions. By establishing the range of canopy structure that is correlated with Monarch butterfly aggregations, and correlating that with other site factors, a hemispherical photography study can help predict effects of changes in the canopy (thus presumably on habitat suitability) caused by tree growth, senescence, and human disturbance (Weiss et. Al., 1991).

TABLE 5

Suggested Studies of the Monarch Population Biology

Design a mark-release-recapture study to test explicit hypotheses related to specific environmental phenomena at the site that may bear on population persistence. Mark-release-recapture is a process of marking a specific number of butterflies and estimating the population size from the proportion of marked butterflies there are in each subsequent recapture.

Map the locations of clusters. Map the movement around the site through the overwintering season. Correlate this information with data on the microclimate. Studies should examine not just where the butterflies are at any given moment, but what is available to them during different conditions as the season passes.

Institute a tagging program to examine immigration to, and immigration from, the overwintering habitat.

Take small samples of overwintering butterflies for analyses of size, age, reproductive status, stored fat content, host plant origin, geographical origin, and capability of defense against predators. The multiple information that can be gathered from each butterfly includes: wing condition, wing size, sex, lean weight, percent of lipid, sexual condition, frequency mated, and defensive chemicals content.

The Practical Application of These Studies

Population size is an indication of whether the overwintering habitat is suitable and stable. But counting butterflies is relatively useless. Land managers who monitor their sites for changes in population need to have some idea whether an increase or decrease has to do with large issues beyond the control of management, or with small manipulations.

Overwintering is characterized by arrival and departure phases separated by a stable overwintering phase. Adult nectar feeding, clustering movement and reproductive behaviors will vary according to these phases and abiotic conditions. Mapping will help researchers examine the reasons for butterfly movement.

Tagging butterflies can indicate intercolony movement and aid in describing metacolony dynamics.

Fat and water content are indications of the health of overwintering butterflies. This and the other information gathered from the butterflies themselves can help determine the success and dynamics of Monarch overwintering at the study site, including the need for nectar, reasons for mortality, and the potential migration route of butterflies at the site.

Recommendation 7: Using information gleaned from baseline studies, establish an appropriate habitat area, with heterogeneous vegetation and sufficient buffer. Monarch habitat includes trees the butterflies cluster on and vegetation that provides the appropriate microclimate and protection from wind, rain, and storms. Monarch habitat is not just butterfly trees, but Monarch butterflies have what scientists call high fidelity, that is, they return predictably to the same groves. Some autumnal sites have high fidelity and some don't. Design the reserve to protect a stable network of autumnal and overwintering habitats.

A buffer will be partially determined by the direction and velocity of prevailing winds, and the proximity of disturbances that could affect the habitat. Monarch habitats vary greatly in size, and a buffer should be established with the help of a Monarch biologist.

Recommendation 8: Ensure the habitat is legally protected. Habitats may be protected in several ways. They may be owned by the state, a local government entity, or a land trust, any of which can be dedicated to protecting the area as a Monarch butterfly overwintering habitat. While most public agencies now managing Monarch habitats make a good faith effort to protect them, public ownership does not guarantee the habitat will survive. Monarchs have to compete for survival with other resources and with revenue-generating activities on some park lands. Park management plans should explicitly protect Monarch butterfly habitat and should provide for ongoing monitoring and active management.

Monarch habitats may also be protected legally with a conservation easement. (see Appendices C, D.) Conservation easements are a tool used frequently by land trusts to preserve property while the original landowner retains the title and some rights to the land. Easements can provide tax benefits to a landowner, and are a flexible and useful tool for preserving habitats over the long term. They may be donated by a landowner, or required as a condition of a development permit.

Recommendation 9: Establish a trail system. A designated trail system is essential to protect the overwintering trees, and prevent soil compaction and erosion. It also protects understory vegetation and ground cover, and prevents people from trampling on Monarchs. Trails can be designed to allow easy access and viewing.

A single access and return trail can be marked into the butterfly area with a viewing arena near the center of the overwintering tree area. The route of the trail should be chosen in consultation with a Monarch biologist to minimize damage to existing vegetation and limit possible exposure to wind.

The trail system will work well in conjunction with the five recommendations which follow, since these recommendations will encourage people to keep to the designated trails.

Recommendation 10: Mulch all paths to be used in trail system. A heavy wood-chip mulch can be used on areas intended for use in the designated trail system. The chips can be spread manually using snow shovels and rakes with rigid metal tines. Avoid using trucks or tractors to dump the chips, since these vehicles add to soil compaction and damage the grove.

Recommendation 11: Plant ground cover or mulch designated areas which are not used as trails. This will to relieve any existing compaction and prevent further compaction. If soil compaction is a problem, bark mulch can also be spread manually in areas that will not be used as paths. Avoid sawdusts that would deplete nitrogen from the soil.

Recommendation 12: Construct a fence around the perimeter of the reserve. Managing the entry points into the reserve interior will help control foot traffic and encourage people to keep to the designated trail system. Signs posted at each entry can inform people about the unique qualities of the reserve, and ask them to stay on the designated trails. Fences can be unobtrusive and designed to blend with the natural environment.

Recommendation 13: Construct a boardwalk and viewing platform in the Monarch overwintering habitat. A boardwalk and viewing platform for visitors will protect the forest floor f the whole butterfly viewing area. The viewing platform could contain benches and interpretive signs. Wet weather is common during the Monarch winter visit, and a boardwalk will enhance visitor comfort when the soil is wet and muddy.

Monarch groves cannot sustain unrestricted human use without becoming seriously degraded. The best and only hope that Monarch reserves will survive is if the most important areas are well-protected. The choice is between completely unrestricted use on the one hand, and the very survival of the overwintering groves on the other.

Recommendation 14: Design tourist information boards or signs. Interpretive signing in the overwintering habitat can increase the public level of environmental awareness and sensitivity toward local species and will encourage the public's respect for trails and boardwalks. See Appendix J for suggested language for the signs.

Recommendation 15: Institute more restrictive measures if necessary. The preceding recommendations are the least intrusive possible, and, if they are reinforced by a program of community education and honored by reserve visitors, should aid greatly in protecting the grove. If they are insufficient to control visitor use, progressively more restrictive measures have been applied in state parks facing the same conflict between resource preservation and multiple-use. These include: 1) eyebolt-and-cable path guides, as used at Point Lobos State Reserve; 2) wood beam fences, such as those recently installed at Pescadero Point in Del Monte Forest; and 3) docent supervision.

MANAGING A MONARCH RESERVE

Monarch science can describe the microclimatic conditions in optimal groves but does not currently describe in quantitative terms the precise minimum conditions Monarchs need. Monarch habitat management questions can only be answered site by site. The few rules that apply broadly to all habitats (i.e. don't remove vegetation from a Monarch habitat) are not useful in solving specific management problems. Monarch scientists recognize that tree hazards, winter storm blowdowns, and other management problems can require altering a Monarch habitat. But land managers should never alter Monarch habitats without consulting with a Monarch biologist. And the best way to reach decisions about altering a grove is to conduct a baseline study: the information generated can guide management decisions and serve to measure changes and plan mitigations. The following recommendations are broad guidelines land managers, in consultation with Monarch biologists, may find useful in preparing a management plan for a Monarch reserve.

Recommendation 16: Conduct baseline studies; use the suggested studies in Recommendation 6. The first step in managing a Monarch grove is the same as the first step in designing one: do a baseline study and follow-up with an ongoing monitoring program. The information is critical for determining the health of the grove and assessing its needs.

Recommendation 17: Conduct an ongoing monitoring program for microclimatic and population information. Once a weather station has been installed, information can be transcribed by interns or other interested citizens. If your park has a docent system, or collaborates with a local university, it may not be difficult ton continue gathering the basic temperature and humidity information year-to-year, and the information will be extremely useful for tracking changes in the grove.

Tagging is another program that has often relied on students and volunteers. Mark-release-recapture requires trained people, so may be more difficult to conduct in an ongoing fashion. It does, however, provide important information on butterfly population, and should be incorporated into long-term monitoring programs in a manner feasible for the managing agency.

Recommendation 18: Consult a Monarch biologist before limbing or cutting any trees or other vegetation in a Monarch habitat. Monarch habitats are destroyed and degraded every year by managers who remove even a small number of trees. See Appendix E, "A Butterfly's Hit List," for examples. The authors recognize the importance of removing hazardous trees from forests. But not every dead tree is a hazardous tree, and land managers must be committed enough to maintaining the Monarch overwintering habitat that they remove vegetation only when necessary and that they simultaneously seek to maintain and enhance the overwintering habitat.

Recommendation 19: When replanting a Monarch habitat, use a tree species compatible with those already present, even if it's non-native. If the habitat is in Eucalyptus, let it stay Eucalyptus. Monarch scientists don't know how to replace one species with another and sustain the habitat. It is not worth losing a Monarch habitat to gain one grove of native trees.

Recommendation 20: Identify and encourage the planting of nectar sources in and near the Monarch grove. Include both fall and winter nectar sources in the reserve design. Add nectar to marginal Monarch colonies as a possible way to improve them. Fall nectar will attract the butterflies, and winter nectar will sustain them through lean periods and may aid their survival through extreme weather.

To be useful to the butterflies, nectar sources should be located inside the colony or within one-quarter mile. Monarchs may actually use nectar sources as much as a mile or two away, but that causes them to burn needed energy. Nectar sources onsite with increase the colony's stability.

Recommendation 21: Remove factors that negatively alter the internal temperature and humidity in the grove. These may add heat to the habitat: a new paved path or road; materials stored under Monarch clusters that can collect heat and radiate it upward into the clusters (black culverts stored on the forest floor at Moran Lake had a noticeable detrimental impact on the Monarch clusters above the culverts); a wider opening to the south that allows more direct sunlight to penetrate the grove.

Recommendation 22: Reduce and discourage soil compaction and erosion. Soil compaction adversely affects the health of trees by stressing tree roots and preventing water and nutrients from penetrating the soil. Erosion is also a problem in some habitats where foot, bicycle or motorcycle traffic has worn down the understory or soil.

Although aerating the soil is a common treatment for soil compaction, aerating in some habitats – where trees are old or roots are close to the surface, for example – could damage the root systems of trees and promote weeds. In this case, avoid any disturbance to the root systems. See Recommendations 9-13 for ways to avoid and reduce soil compaction.

Recommendation 23: Develop a program for the identification and treatment of hazardous trees. Dead trees which could be classified as hazardous, posing a risk to the public, are a standard concern to land managers. This report does not attempt to develop a hazard tree policy since it is outside the scope of the project. However, a policy should be in place as part of a park's long term management program. The authors recommend that hazardous trees be removed or limbed by tree experts without driving heavy equipment into Monarch groves and that hazardous trees be removed or limbed between March and September, when the butterflies are not clustering. The authors of this report assume no responsibility associated with hazardous trees in Monarch groves.

Recommendation 24: When hazardous trees must be removed or limbed, consult with a Monarch biologist on the potential effects to the Monarch habitat and implement mitigations. Park managers have used constructed wind barriers to mitigate the impacts of tree removal. Planting new trees or vegetation may also be necessary. If the unavoidable removal of vegetation has degraded the habitat, institute a simultaneous and immediate program to enhance the habitat.

Recommendation 25: Allow downed trees and standing dead trees which are not hazardous to remain standing for wildlife use. In some Monarch habitats, other wildlife, such as cavity nesting birds, use standing dead trees. When a hazardous tree is taken down, a determination can be made on a tree-by-tree basis whether or not to leave it on the site as habitat for other wildlife.

Recommendation 26: Thicken the vegetation around existing roads and do not use roads to create open space in Monarch groves. The most stable and largest Monarch overwintering habitats in California are not over roads. There is ample evidence that roads can degrade a habitat and increase butterfly morality (see Appendix E). Butterflies knocked from clusters onto a road are more likely to drown, be crushed by traffic, or freeze to death than butterflies knocked onto a natural understory.

A road, even a winding road, is a significantly different form of canopy opening than a stream source or a clearing. It adds heat to the microclimate and takes out a wide swath of trees, leaving a clear sky overhead rather than a substantially closed canopy. Roads allow more wind penetration and can create wind tunnels, whereas prime Monarch habitats tend to be found in nearly windless areas.

Recommendation 27: Make monarchs the priority in the Monarch conservation area. Monarch conservation zones in national or stat parks can be established, within which

park rangers manage the flora differently than in zones where they manage for native plants. Such a policy would explicitly define Monarchs as the resource to be protected, and flora would be managed with the ultimate goal of sustaining the Monarch overwintering habitat through the long term future.

Recommendation 28: If prescribed burns are scheduled to occur near Monarch habitats, ensure that they don't disturb the clusters. Two Monarch habitats in Marin County are next to prescribed burn sites for the Golden Gate National Recreation Area. This situation may exist for Monarch habitats in other areas of the state. A problem arises if burning occurs when the butterflies are clustered in the groves and the prevailing winds carry the smoke in their direction. Since the optimal burning months in Marin are October and November, there is a potential conflict.

The best option is to burn before the Monarchs arrive. Local Monarch conservationists should work with park rangers to incorporate into burn regulations the policy that burning be done before the butterflies arrive, and if that is impossible, that it be done on a day when the prevailing winds won't send smoke into clusters.

Recommendation 29: Do not use controlled burning to encourage natural regeneration within the grove. Controlled burning and accidental fires have played an important role in natural regeneration in some forests. Controlled burning, however, also presents a potential threat to the Monarch habitat, and the authors recommend against it. Eucalyptus groves grow like weeds and need no extra encouragement, and Monarch groves of other species can be replanted manually if they are thinning out.

Recommendation 30: Incorporate the following policies into a fire management plan for the reserve. The following measures will aid in controlling the fuel load and providing adequate safeguards against the introduction of fire from outside the park. This is a not a complete fire plan, but includes information pertinent to the concerns of Monarch habitat management.

> Understory levels should be managed to prevent a localized buildup of dead plant materials. Only the excess dead materials and plant rubbish should be removed; live understory plants and grasses are valuable to the Monarch habitat and should be left alone.
> Over many years the build-up of live brush should be monitored. A Monarch biologist and the appropriate fire inspection staff should work together to advise managers about the removal of live brush build-up. Attention should be given to the understory requirements for Monarch habitat.
> Most open areas can be mulched to inhibit the growth of weed species.
> No vegetation other than grasses should be mowed.
> No chemicals such as Roundup should be used anywhere in the Monarch reserve.
> Fire breaks and other provisions should be developed by the managing agency and reviewed by a Monarch biologist.

Recommendation 31: Adopt the following list of restricted activities to preserve the natural character and health of Monarch reserves:

> Ban motor vehicles in the reserve.
> Allow pedestrians and bicycles only on a designated trail system.

> Ban spraying or other application of biocides (pesticides, herbicides, or insecticides). The area should be managed as a natural biotic community complete with a normal complement of insects.
> Ban fires.

Recommendation 32: Seek the advice of a Monarch consultant regarding the replacement of an exotic understory with a native understory. The Monarchs require vegetation for its nectar or as protective cover, and this can be provided equally by native or exotic species. Because Monarch habitats are so delicately balanced and because so many have been destroyed in recent years, it is essential to make Monarch habitat preservation the first priority and native vegetation the second.

However, recognizing that it is a goal of the California Department of Parks and Recreation to encourage native species, it may be possible to encourage native understory in Monarch habitats in a way that does not threaten the habitat. These plans should be developed only in consultation with a Monarch biologist, and should follow a baseline research program that examines the vegetational structure in the grove.

Recommendation 33: Management practices on autumnal and overwintering habitats can be essentially the same. Management practices will differ between colonies simply because there will be different problems to solve, not because they are autumnal or overwintering.

Recommendation 34: Maintain the configuration of the vegetation. In general, vegetation in Monarch habitats appears either as a semi-circle around an opening, a full circle, an oval, or an S-shape. Permanent overwintering sites are usually S-shaped or oval. The oval allows better sun exposure at both morning and afternoon, so when the Monarchs seek more sun exposure in winter the habitat can provide it. The S-shape allows better wind protection as well as exposure to both morning and afternoon sun. The sometimes ragged edges of a grove can be an important thermal blanket, and provide sheltered pockets for butterfly clusters. Pruning or limbing trees can alter the shape of the grove and may substantially disturb the habitat.

WORKING WITH THE LOCAL LAND TRUST

Land Trusts have tremendous resources for Monarch conservation, from expertise in land preservation and the ability to purchase or negotiate fee title or easement to volunteer networks that can monitor developments. A land trust is a non-profit corporation whose purpose is to protect land, usually some specific type of land or land in some specific area. There are not 800 land trusts across the country. The oldest one is 100 years old. They may be run by volunteers or have a paid staff. The basic goal of protecting land in a trust is to take the property off the market where it is a commodity that can be bought, sold, and developed. Instead the land trust holds those rights for perpetuity.

Land trusts negotiate purchases for themselves, or they can buy for government agencies. Since they are non-profit, land trusts do not have to pay full market value and can work out various types of tax benefits for landowners, some quite sizeable.

Recommendation 35: Get land trusts involved in Monarch habitat preservation negotiations. A local land trust can receive a conservation easement that is dedicated as a condition of a development permit. It can negotiate an easement or purchase of a Monarch habitat with a landowner who does not want to develop but wants to see the habitat protected in perpetuity. And it can help the state negotiate the purchases of Monarch habitat that are now being done with funds from Proposition 70.

Recommendation 36: Write conservation easements to protect other values on the property in addition to the Monarchs. Once a land trust obtains a conservation easement, the challenge is to ensure the habitat remains protected. Despite their good intentions, people can disturb or destroy Monarch habitats by activities like pruning trees, mowing understory or burning leaves. Some vegetation may need to be removed to prevent fire or tree hazards and will probably be allowed by the terms of the easement, but a Monarch biologist should be consulted so that removal of vegetation does not disturb the habitat. Certainly, no vegetation should be removed simply for cosmetic purposes.

It would be useful to write Monarch conservation easements for long-term protection of both the Monarch habitat for as long as the butterflies remain, and the other natural and scenic values of the land as well. It may happen occasionally that the butterflies will leave a site for a year or longer, and unless there has been a specific violation of the conservation easement which would trigger litigation, the property owner should not be held responsible for unexplained changes in butterfly behavior.

Recommendation 37: Train land trust volunteers in Monarch conservation. Land trusts have a corps of eager volunteers who are dedicated to protecting land in its natural state. Land trusts who become involved in Monarch conservation can find any of a number of projects for local volunteers, including: tagging butterflies; monitoring development projects; making regular visits to inspect protected sites; or testifying in favor of local Monarch preservation land use goals or ordinances.

PREPARING AN ENVIRONMENTAL IMPACT REPORT ON MONARCH HABITATS

The public process, and Monarch habitat preservation, has suffered from amateur treatment of Monarch habitats for environmental impact reports (EIRs). Having been an avid student of the butterflies does not qualify one to evaluate the potential effects of a development on a Monarch butterfly habitat.

In every other category of analysis, lead agencies insist that consultants be credible scientists in their areas of expertise. The authors urge state and local agencies to hold to no lower standard for Monarch science.

Recommendation 38: Lead agencies should require that Monarch biologists demonstrate their scientific competence to perform studies of Monarch butterfly habitats for environmental impact reports. The agency should evaluate the expertise of a potential Monarch biologist based on whether they have:

> Completed an advanced degree in biology with research experience on Monarch overwintering biology; or
> Designed and conducted a quantitative research program o aspects of Monarch biology and overwintering; or
> Published on Monarch butterflies in juried scientific journals.

Recommendation 39: Get the Monarch survey information for your jurisdiction and map it on local resource maps. Legislation approved in 1987 mandated a survey of all Monarch overwintering habitats in California. That list and maps are available to local planning departments, land trusts, and others involved in Monarch habitat preservation from the Natural Diversity Database, maintained by the California Department of Fish and Game. Call 916-324-3812 for information on how to order copies.

Recommendation 40: If the lead agency is unsure whether Monarch habitat is on the property, have a Monarch scientist do a site visit. The consulting firm can employ a biologist to do an initial site visit and determine whether there is a concern about Monarch habitat. Because Monarchs are present only in the winter months, the determination should be made enough in advance to authorize the biologist to begin a study at the start of the overwintering season.

Recommendation 41: When preparing an environmental impact report, conduct the Monarch habitat study for one full overwintering season. One full overwintering season is the absolute minimum acceptable length of time to study a Monarch habitat for the purposes of preparing an environmental impact report. An overwintering season runs from October 1 through February 28. (As is the case for all other sensitive species, site visits should be made when the species are expected to be present.) Monarchs shift throughout the grove during the overwintering season in response to climatic conditions. It is not possible to assess adequately the impacts of a proposed development on a Monarch habitat if the consultant has not been able to delineate the habitat based on the locations of the Monarch clusters throughout the entire season.

If the political process delays the beginning of the Monarch study past October 1, the lead agency should authorize the continuation of the study through the initial months of the following winter, so that the study covers one full overwintering season. An insufficient study sets up the lead agency for lengthy appeals and litigation.

Recommendation 42: Conduct the mark-release-recapture, microclimatic studies and mapping of clusters as outlined in recommendation 5 to determine the habitat boundary and mitigations that will protect the Monarch habitat from the impacts of the development. Counting butterflies and surveying the site visually are not sufficient to assess the impacts of development on a Monarch grove, and will only produce anecdotal information that can be too easily manipulated by people on all sides of a development conflict. Monarch surveys should be based on standard, quantitative science.

All environmental impact reports should examine not just where the butterflies are at any given moment, but what is available to them as the season passes. EIRs should examine how the proposed change is going to affect vegetational structure and how it could affect microclimatic parameters. Neither an increase nor a decrease in current conditions should be done without assessing the effects on the butterfly clusters.

Recommendation 43: Include, as a condition of the development permit. that a conservation easement be donated to preserve the habitat in perpetuity. A conservation easement is the minimum requirement for protecting Monarch habitat in conjunction with development. Monarch habitats can and do survive near developments. They do not have to be mutually exclusive, although in certain cases they are. A conservation easement, donated to a local lad trust or other appropriate agency, is the only guarantee that the Monarch habitat will remain protected, and any developer whose permit is approved should be required to ensure that Monarch habitat on the property will survive. An easement will also provide the legal structure for monitoring changes and managing the habitat.

Recommendation 44: Make mitigations specific, with a plan for how they will be implemented and who will do the follow-through. Mitigations must read "shall" and "always." Mitigations can and have included the following:

> Protecting the entire habitat area with a conservation easement.
> Providing a monitoring fund to ensure mitigations are implemented and to monitor changes in the grove.
> Planting trees as the perimeter of disturbed areas, along roadways, or to reinforce wind protection.
> Planting other understory or windbreak vegetation.
> Planting nectar sources, or other landscaping in and near the development which would benefit the Monarch butterflies.
> Banning or limiting wood burning fireplaces.
> Banning construction that could damage the habitat during months when the Monarch butterflies are present.
> Requiring that construction be done with methods that preserve the natural vegetation. For example, certain areas may be designated off-limits to large machinery, or certain vegetation may be marked that cannot be cut to allow passage of large machinery. Storage of woodpiles

and equipment, and parking space may be confined to specific areas outside the drip line of the grove.
> Restricting paving close to the Monarch habitat.
> Restricting the width of access roads. Further road improvements may be significantly restricted.
> Restricting management in the grove to what is minimally necessary for fire safety, and to protect homes and people.

It is possible that changes to the draft EIR recommended by other consultants could significantly change the project's potential impact on Monarch habitat. The Monarch scientist may want to revise his or her comments if the final plan significantly changes, for example, the location of buildings in relation to roosting sites.

Recommendation 45: Institute a monitoring program as part of mitigation and require a fund to implement it. Public Resources Code 21081.6 which was passed in 1988 as AB3180 requires monitoring of projects. This monitoring is not required to be part of an EIR, but it is required to be adopted at the time the agency acts on the project. Monitoring should be conducted by a Monarch biologist and should include:

> A simple weather station that can remain in place to measure temperature and humidity.
> A two-year mark-release-recapture program to provide basic information about whether and how the development has affected the Monarch habitat.
> Other monitoring that may address specific threats the development poses, as the Monarch consultant advises.
> A length of time long enough to mitigate the impact. If construction will last five years, the monitoring program should last seven.

These goals are enforceable, and can be quantified so compliance will be easily measurable. Planting of new vegetation can be conditioned on the results of the monitoring program.

Monitoring funds can be raised through home sales or room taxes. Data gathered in the monitoring program should be compiled to compare with other areas where development coexists with Monarch habitat, so that land managers and local governments can benefit from knowledge gleaned by other projects.

Recommendation 46: When mitigations protect one habitat out of several on the same property, the best habitat should be protected. Mitigations should never allow the destruction of a more stable, more functional habitat in favor of preserving a less stable, less functional one. Protecting a habitat somewhere else is not an acceptable mitigation, but on occasion a single property will include several habitats. The EIR should examine the interrelationships between them, preserving the most important areas for Monarch overwintering.

Recommendation 47: Do not attempt to create a new Monarch habitat to mitigate the loss of an existing Monarch habitat. It is scientifically insupportable to attempt to mitigate the loss of a Monarch habitat by creating a new one elsewhere. Monarch scientists do not know how to create Monarch habitats with any guarantee that it will be successful. Moreover, there

would be a 20 to 50-year gap between the time the trees were planted, and the time one discovered whether they developed into a suitable Monarch overwintering habitat or not.

Because the migration is so perilously dependent on the existing Monarch overwintering sites, Monarch conservationists cannot countenance the loss of a stable, well populated Monarch habitat on the off-chance that a new be could be created. The western Monarch migration simply cannot afford to lose more prime habitats.

CREATING NEW MONARCH HABITATS

Research suggests that someday it may be possible to create new Monarch habitats. Currently, however, Monarch scientists do not know how to do it successfully. Furthermore, research now is directed at establishing the minimum standards for preserving Monarch habitats, not at creating them.

Historical records do not show where Monarchs used to winter before the widespread and successful introduction of Eucalyptus species along the California coast. Monarch scientists lack data on how may sites there were, how big they were, and on their latitudinal extent along the coastline. Monarch scientists cannot recreate the forests that may have harbored Monarch clusters at the turn of the century. Nor is it possible to aim for whatever might have been the historical distribution of Monarchs. These questions are interesting from an historical point of view but researching them contributes little to reducing the immediate political and ecological threats facing Monarch habitats.

Recommendation 48: Launch an experimental habitat creation project. As a first step toward knowing how to create Monarch habitats, it would be helpful to attempt to re-create habitats where Monarchs once used to cluster but now do not. Monarch conservationists would enthusiastically support the creation of new habitats as experiments. Lighthouse Field in Santa Cruz would be an excellent location for an experimental re-creation of a Monarch habitat.

SECTION THREE

COMMUNITY INVOLVEMENT AND EDUCATION

Everything that has happened to further Monarch conservation in California has happened through the initiative of a person or an organization who took on the task, did the research, and went to the hearings to speak out for Monarch conservation. Be bold.

WORKING WITH THE LEGISLATURE

These ideas come from Assemblyman Sam Farr's office, an avid supporter of Monarch conservation.

Recommendation 49: When lobbying legislators, develop these attributes of a successful advocate:

> Be truthful. Don't be afraid to say you don't have the answer. Be sure to get it quickly.
> Anticipate the opposition and have a response.
> Be determined.
> Be enthusiastic.
> Be accurate. Don't exaggerate.
> Be interested in the people you work with on behalf of Monarchs.
> Remember to thank elected officials who voted on your behalf. They need to know you appreciate their efforts.
> Be patient. If it doesn't happen now, it might happen later.

Recommendation 50: Make use of legislative services. Get a roster of all members of the Senate and Assembly. Get a list of all committees and members. Call your district office for updates on legislation.

Recommendation 51: Get to know your district staff. They are the eyes and ears for your assemblyman or senator. Each member has one district office, several have two or three.

The interim period between legislative sessions (usually September to January) is the time to try out ideas for new legislation. When the legislature is out of session, make an appointment to meet the staff and, if possible, the member, who is more likely to be there. Bring your idea for new legislation. If it looks good, your member will assign a staff person to be in charge of researching the issue. The member then makes a decision about whether to carry a bill or pass the issue along to someone else to carry.

Do your homework before the meeting. Find our what committees your member is on, and what special areas of interest he or she has. Know which members are on the Natural Resources, Ways and Means, and Finance committees, which can be important committees for environmental concerns. Bring educational materials that illustrate and explain your issue.

Recommendation 52: Develop letters and petitions. When you are supporting legislation, it is important to write to all members of the committee hearing the bill, as well as to your own legislators and the member who introduced the bill for you.

Letters do count. The rule of thumb many legislators use is that for every letter they receive, there are 1,000 people who agree but did not write.

Recommendation 53: Keep track of your bill throughout the two-year legislative session. New legislation is introduced in January and February. Summer recess is about mid-July to mid-August. The legislature recesses in September, and reconvenes the following January. Bills must be approved by both House and Senate, and signed by the Governor.

Many bills take the full two years. Every step of the way a bill can be amended. It's important to track changes to the legislation, because amendments can significantly alter the bill.

About 4,000 bills are introduced in the Assembly every session, and about one-quarter of them pass. About half that many are introduced in the Senate. You have to be persistent.

Recommendation 54: Support the budget for your issue. The legislature develops the annual budget between January and June. By July 1, a budget should be on the Governor's desk and signed.

The Governor has a line-item veto, so lobby your legislator and committee members for your budget item. For example, if a committee is considering a Parks and Recreation budget which includes an allocation for Monarch habitats, there may be a number of hearings on the bill that have nothing to do with Monarchs. Show up when the Monarchs are on the agenda.

Recommendation 55: Build coalitions. Show the support of as many groups as possible to show that Monarch conservation has a broad constituency. Work with opposition groups to see if you can forge common ground and deflect a hearing-room battle.

WORKING FOR NEW LAWS AND PLANNING GOALS

Recommendation 56: Get Monarchs protected under the California Environmental Quality Act. The biggest gap in Monarch habitat preservation is that no statewide law explicitly requires that these habitats be protected under the California Environmental Quality Act. Local land use decisions are generally made on the local level. Although many city or county land use laws now require that Monarch habitats be protected, and others are in the midst of incorporating Monarch habitat preservation goals into land use goals, local governments are under tremendous pressure from developers. Too many Monarch habitats fall though the cracks. Protection often relies on the good will of local officials and the pressure local citizens can exert. California needs a statewide law protecting Monarch habitat under the California Environmental Quality Act (CEQA). See Appendix L for materials supporting the importance of the Monarch migration phenomenon.

Legislation providing legal protection for the Monarch was scrapped in 1991. Efforts continue to broaden the statewide coalition supporting Monarch habitat preservation and to protect and manage individual habitats. These efforts involve networking among local groups; legislative advocacy at the state level to establish a state policy and provide funding for Monarch habitat protection; advocacy at the local level to protect individual threatened habitats; dissemination of scientific information; and counseling of landowners and public agencies about their responsibility for habitat preservation. To lend your support, contact statewide coordinator John Ashbaugh at 805-544-8523.

Recommendation 57: Support the Monarch butterfly for National Insect. The Entomological Society of America (ESA) is the driving force behind a congressional resolution to designate the Monarch butterfly as America's National Insect. You can support the effort by circulating petitions, getting resolutions of support from your local city, county and state governments and organizations, getting your classrooms to write letters as a civics project, and sending copies of supportive articles to ESA.

For information or to lend your support, contact Doug Sutherland at ESA, 9301 Annapolis Road, Suite 300, Lanham, Maryland, 20706-3115.

Recommendation 58: Lobby your local park ranges. Go directly to the agencies managing Monarch habitat with your concerns or offers of help. Talk to the district rangers for state and national parks. Land managers take it seriously when they hear from local individuals.

About half the protected Monarch habitats (many of them large) are on public land, making planning with state agencies an important aspect of Monarch habitat conservation. State agencies have a formal process for developing land-use plans for parks and reserves in the state system. It is critical that information about Monarch habitats get into these plans from the beginning of the process. Once land-use plans are adopted, it is extremely difficult to alter them, particularly for species that is not listed as threatened or endangered. Be at the hearing and speak up for Monarch habitat preservation.

Recommendation 59: Work for the adoption of a Coastal Commission to protect Monarch habitats. Current Coastal Commission decisions have not protected Eucalyptus under the riparian zone policy because they constitute a "disturbed" habitat. At least one Monarch habitat, Encinal Creek in Malibu, has been lost because of the Coastal Commission policy and the lack of adequate protections in the Coastal Zone for Monarch habitats.

USING THE CALIFORNIA ENVIRONMENTAL QUALITY ACT

The California Environmental Quality Act (CEQA) prescribes actions decision makers can take to protect environmental resources. CEQA does not **ensure** a project will be denied even if it is an environmental disaster; but it gives the agency the authorization to deny it. And it gives the agency authorization to require habitat preservation. CEQA can be the best tool available for protecting Monarch habitat. Be familiar with your local land use process and use the law.

Recommendation 60: Provide evidence showing that negative impacts on a Monarch habitat are significant and should trigger an EIR. The Monarch Project has continually emphasized that projects which significantly affect Monarch habitat must trigger an environmental impact report. Since Monarchs are not an endangered species in federal or state law, and are not ever likely to be, you will have to use CEQA and your local land use laws to show why the impact is significant and requires and EIR.

The lead agency decides whether the project has a substantial impact and requires an environmental impact report. Use Appendix G of CEQA (Appendix G in this document as well) to show how a project impact on Monarchs is significant and should trigger an EIR. CEQA is clear that no matter who does the EIR, he lead agency has responsibility to certify the document.

If the EIR doesn't address Monarchs and should, urge the agency not to certify it and to require Monarch studies.

Recommendation 61: Make sure the environmental impact report addresses Monarchs. Environmental impact reports can be required for many reasons, and unless the lead agency is awe there is Monarch habitat present and requires the EIR consultant to include it, the habitat may be overlooked. Since Monarchs are only present during the winter, planners sometimes miss the butterflies when they draw up the scope of work for the EIR. Check to be sure the Monarch habitat will be studied and if it was overlooked, urge the lead agency to include it.

Recommendation 62: Be a consistent presence at hearings. Present your viewpoint clearly from the beginning and throughout the process. It's important to participate in every phase of the project. Get all your comments in on the draft EIR, attend hearings, and introduce expert testimony. State your objections or suggestions when the agency takes action, otherwise, you will not have standing to appeal.

CEQA is enforced through litigation by citizens or a responsible agency. It's a good idea to have an attorney in the background if you are considering litigation. But it may not serve your purpose to be litigious from the beginning. Particularly in the case of Monarch habitats, which are frequently small and located on only a portion of a larger development, it can be easy to work together with all parties to protect the habitat in conjunction with the development. Some developers will consider the Monarch habitat an asset to the project, and will want to protect it

Recommendation 63: Lobby your county or city to amend its local coastal plan and general land use plan to protect Monarch habitat. If your local government doesn't protect Monarchs explicitly, use the materials in Appendices B and L to lobby for changes that do.

Recommendation 64: Lobby your regional Fish and Game department, asking them to request your county or city to amend its local coastal plan and general land use plan to protect Monarch habitat. Fish and Game personnel review environmental impact reports, and can urge local jurisdictions to protect habitats, even if there is not a threatened or endangered species at risk. Give your Fish and Game department information about Monarch habitats in your area and urge them to back Monarch habitat preservation.

WORKING IN THE LOCAL COMMUNITY

Community involvement should be designed to be ongoing, inviting participation year after year from the whole community to protect their Monarch overwintering habitat for generations to come. Here are several ideas for programs you can do at the local level to encourage education and awareness of monarch habitat and enhance local habitats.

Recommendation 65: Promote butterfly gardens with special attention to Monarchs. Watching butterflies gives people a unique opportunity to observe the biological systems in their gardens at the level where, in the words of Xerces Society Scientific Advisor E.O. Wilson, "Splendor awaits in minute proportions." Flowers that attract Monarchs will probably attract other species as well. See Appendix H for resources on butterfly gardens.

Recommendation 66: Locate local milkweed patches and let them grow freely. If they are in local parks and it is park policy to pull them as weeds, re-educate your park staff. There are 101 species of milkweed in North America, and each grows in specific locations. Use your local species. Don't transplant milkweeds from far away, or order seed packets which could establish a non-native species in your area. Milkweeds provide the toxic chemical that makes Monarchs unpalatable to birds, and scientists can track the route of a butterfly's migration by the individual chemical in its wings. Diluting a strong native species could prove harmful to the long term survival of the butterflies. Dedicate your efforts to enhancing native plants.

Recommendation 67: Develop and distribute educational materials for the area grade and high schools. The Xerces Society's packet of educational materials for use in the schools in grades kindergarten through sixth is available through the three statewide Monarch butterfly resource centers: the San Francisco Insect Zoo, the Santa Barbara County Museum of Natural History, and the Insect Zoo of the Lost Angeles County Museum of Natural History.

Recommendation 68: Develop a speakers bureau. Speakers can make classroom presentations and lead educational field trips to area Monarch habitats. The Insect Zoo at the Los Angeles County Museum of Natural History coordinates classroom field trips and internships.

Recommendation 69: Use the speakers bureau to host educational gatherings for the community. Neighborhood gatherings in someone's home can promote adult education. The programs could include slide presentations, discussion of current events involving Monarch habitat preservation, or question-and-answer sessions. The gatherings could take place in individual homes, and be designed for small groups.

Recommendation 70: Develop new educational exhibits on the local presence of the Monarch butterfly. Develop museum exhibits for your local natural history museum. Develop a monarch butterfly section for your local library.

Recommendation 71: Establish a continuing education/University of California extension class. The extension service has had great success with natural history classes. An annual course on Monarch butterfly migration and biology would enhance local appreciation and extend local leadership for the preservation of Monarch overwintering habitats. The course would also interest and begin to train the Monarch conservation leaders of the future. Marin County has had great success with a similar endeavor called Environmental Forum, which trains interested people in biology and natural history, and places them in local conservation projects. Contact the Environmental Forum of Marin at 415-479-7814.

Recommendation 72: Promote fundraising activities which involve the business community, since in many areas this sector benefits financially from the presence of the Monarch overwintering habitats. A program to "Adopt a Monarch Butterfly" or "Adopt a Tree" is an idea that has been used effectively for other species. Try promoting a Monarch

month when the butterflies arrive, in which local businesses donate a percentage of their profits to benefit a local habitat.

Recommendation 73: Support the Monarch Habitat Restoration Fund in Pacific Grove. Monterey County residents and others who enjoy the Pacific Grove butterflies can help protect them by donating to the Monarch Habitat Restoration Fund to preserve and restore the oldest Monarch overwintering habitat area in California. The Pacific Grove non-profit organization, Friends of he Monarchs, successfully negotiated the purchase f one of the town's prime Monarch habitats, and is working to preserve and restore it. To find out the current status of the project or offer support, call the chair, Ro Vaccaro, 408-373-7047.

TABLE OF RECOMMENDATIONS

THE MOST IMPORTANT RECOMMENDATIONS IN THIS DOCUMENT

Recommendation 1: Consult with a monarch biologist before making any decision that would alter a habitat, and follow his or her advice.

Recommendation 2: Gather baseline data on each protected habitat to assist in evaluating the effects of grove modification.

Recommendation 3: Implement a low-key monitoring program to help identify habitat disturbances and generate practical information to guide management decisions.

DESIGNING A RESERVE OR RESERVE SYSTEM

Recommendation 4: County and city governments should protect as many sites within one locality as possible, using wide buffer zones and making conservative initial decisions.

Recommendation 5: Design reserves or reserve systems to address systematic threats to population persistence; cushion against catastrophic random events and regional climate change; and address predictable environmental perturbations.

Recommendation 6: Develop baseline data to quantify the characteristics of the habitat, and use the study to test the reserve design.

Recommendation 7: Using information gleaned from baseline studies, establish an appropriate habitat area, with heterogeneous vegetation and sufficient buffer.

Recommendation 8: Ensure the habitat is legally protected.

Recommendation 9: Establish a trail system.

Recommendation 10: Mulch all paths to be used in trail system.

Recommendation 11: Plant ground cover and mulch designated areas which are not used as trails to relieve any existing compaction and prevent further compaction.

Recommendation 12: Construct a fence around the perimeter of the reserve.

Recommendation 13: Construct a boardwalk and viewing platform in the Monarch overwintering habitat.

Recommendation 14: Design tourist information boards or signs.

Recommendation 15: Institute more restrictive measures if necessary.

MANAGING A MONARCH RESERVE

Recommendation 16: Conduct baseline studies; use the suggested studies in Recommendation 6.

Recommendation 17: Conduct an ongoing monitoring program for microclimatic and population information.

Recommendation 18: Consult a Monarch biologist before limbing or cutting any trees or other vegetation in a Monarch habitat.

Recommendation 19: When replanting a Monarch habitat, use a tree species compatible with those already present, even if it's non-native.

Recommendation 20: Identify and encourage the planting of nectar sources in and near the Monarch grove.

Recommendation 21: Remove factors that negatively alter the internal temperature and humidity in the grove.

Recommendation 22: Reduce and discourage soil compaction and erosion.

Recommendation 23: Develop a program for the identification and treatment of hazardous trees.

Recommendation 24: When hazardous trees must be removed or limbed, consult with a Monarch biologist on the potential effects to the Monarch habitat and implement mitigations.

Recommendation 25: Allow downed trees and standing dead trees which are not hazardous to remain standing for wildlife use.

Recommendation 26: Thicken the vegetation around existing roads and do not use roads to create open space in Monarch groves.

Recommendation 27: Make Monarchs the priority in the Monarch conservation area.

Recommendation 28: If prescribed burns are scheduled to occur near Monarch habitats, ensure that smoke does not disturb the clusters.

Recommendation 29: Do not use controlled burning to encourage natural regeneration within the grove.

Recommendation 30: Incorporate recommended policies into a fire management plan for the reserve.

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Recommendation 33: Management practices on autumnal and overwintering habitats can be essentially the same.

Recommendation 34: Maintain the configuration of the vegetation.

WORKING WITH THE LOCAL LAND TRUST

Recommendation 35: Get land trusts involved in Monarch habitat preservation negotiations.

Recommendation 36: Write conservation easements to protect other values on the property in addition to the Monarchs.

Recommendation 37: Train land trust volunteers in Monarch conservation.

PREPARING ENVIRONMENTAL IMPACT REPORTS

Recommendation 38: Lead agencies should require that Monarch biologists demonstrate their scientific competence to perform studies of Monarch butterfly habitats for environmental impact reports.

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Recommendation 40: If the lead agency is unsure whether Monarch habitat is on the property, have a Monarch scientist do a site visit.

Recommendation 41: When preparing an environmental impact report, conduct the Monarch habitat study for one full overwintering season.

Recommendation 42: Conduct the mark-release-recapture, microclimatic studies and mapping of clusters as outlined in recommendation 5 to determine the habitat boundary and mitigations that will protect the Monarch habitat from the impacts of the development.

Recommendation 43: Include, as a condition of the development permit, that a conservation easement be donated to preserve the habitat in perpetuity.

Recommendation 44: Make mitigations specific, with a plan for how they will be implemented and who will do the follow-through.

Recommendation 45: Institute a monitoring program as part of mitigation and require a fund to implement it.

Recommendation 46: When mitigations protect one habitat out of several on the same property, the best habitat should be protected.

Recommendation 47: Refuse to accept the attempted creation of a new Monarch habitat to mitigate the loss of an existing Monarch habitat.

CREATING NEW MONARCH HABITATS

Recommendation 48: Launch an experimental habitat creation project.

WORKING WITH THE LEGISLATURE

Recommendation 49: When lobbying legislators, follow the suggestions for being a successful advocate.

Recommendation 50: Make use of legislative services.

Recommendation 51: Get to know your district staff.

Recommendation 52: Write letters and petitions.

Recommendation 53: Keep track of your bill throughout the two-year legislative session.

Recommendation 54: Support the budget for your issue.

Recommendation 55: Build coalitions.

WORKING FOR NEW LAWS AND PLANNING GOALS

Recommendation 56: Get Monarchs protected under the California Environmental Quality Act.

Recommendation 57: Support the Monarch butterfly for National Insect.

Recommendation 58: Work with your local park rangers.

Recommendation 59: Work for the adoption of a Coastal Commission policy to protect Monarch habitats.

USING THE CALIFORNIA ENVIRONMENTAL QUALITY ACT

Recommendation 60: Provide evidence showing that negative impacts on a Monarch habitat are significant and should trigger an environmental impact report.

Recommendation 61: Make sure the environmental impact report addresses Monarchs.

Recommendation 62: Be a consistent presence at hearings. Present your viewpoint clearly from the beginning and throughout the process.

Recommendation 63: Lobby your county or city to amend its local coastal plan and general land use plan to protect Monarch habitat.

Recommendation 64: Lobby your regional Fish and Game department, asking them to request your county or city to amend its local coastal plan and general land use plan to protect Monarch habitat.

WORKING IN THE LOCAL COMMUNITY

Recommendation 65: Promote butterfly gardens with special attention to Monarchs.

Recommendation 66: Locate local milkweed patches and let them grow freely. If they are in local parks and it is park policy to pull them as weeds, re-educate your park staff.

Recommendation 67: Develop and distribute educational materials for the area grade and high schools.

Recommendation 68: Develop a speakers bureau.

Recommendation 69: Use the speakers bureau to host educational gatherings for the community.

Recommendation 70: Develop new educational exhibits on the local presence of the Monarch butterfly.

Recommendation 71: Establish a continuing education/University of California extension class.

Recommendation 72: Promote fundraising activities which involve the business community, since in many areas this sector benefits financially from the presence of the Monarch overwintering habitats.

Recommendation 73: Support the Monarch Habitat Restoration Fund in Pacific Grove.

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APPENDIX A: LAND USE PLANNING GUIDELINES FOR MONARCH BUTTERFLY OVERWINTERING HABITAT

The Importance of Monarch Butterfly Habitat

It is important to note that all North American Monarch wintering habitat, both in Mexico and throughout California, is critically endangered at this time; it is therefore essential to protect all remaining sites in order to preserve the Monarch migration itself and the very presence of the Monarch butterfly in North America. Increasing pressure on the Mexican forest Monarch sites due to the survival needs of the rapidly growing local human population makes it all the more imperative that we protect and properly manage the California sites. **California may be, by the end of this century, the sole North American steward of the Monarch migration.** Potential loss or degradation of any California site should therefore be taken seriously by local governments. The effect of losing any California site could mean reductions in the western North American Monarch butterfly populations. Eventually, this could result in so few sites that Monarchs would virtually disappear in western North America, save for a few year-round resident populations in parts of Southern California.

The California legislature passed Assembly Bill No. 1671 in September 1987, recognizing the value of the California Monarch winter roosts and the importance of protecting them. In part, the bill states "The government of Mexico, despite its current economic situation, recently took dramatic steps to safeguard the wintering grounds of the Monarch butterflies of eastern North America; therefore, the State of California should take similar action to protect the Monarch butterflies which migrate throughout western North America."

Congress is considering federal legislation sponsored by California Representative Leon Panetta to designate the Monarch the national insect. This legislation reads, in part, "...the Monarch is a unique representative of over 600 species of butterflies and nearly 90,000 other insects that are an integral part of he natural heritage f the United States;...the population of Monarchs is declining under pressure from urbanization and loss of habitat which results in the reduction of the host plant (milkweed) and overwintering groves of trees in California and Mexico;...the Monarch enhances the beauty of the environment and signals the need for protection and conservation of the natural wonders."

The North American Monarch migration has been categorized by scientists as an "Endangered Phenomenon" and cited as a "Threatened Phenomenon" in the widely respected, international Invertebrate Red Data Book published by IUCN. (IUCN is the International Union for Conservation of Nature and Natural Resources, based in Gland, Switzerland.)

The annual migration of the Monarch butterfly (Danaus plexippus) throughout North America is one of the world's spectacular natural occurrences. Covering thousands of miles on its migration, and journeying through Mexico, the U.S. and Canada, the migration is an international phenomenon and the Monarch butterfly is one of the best known North American insects. The winter roosting sites that support the western butterfly population are located almost exclusively along the California coast. Monarch butterflies, because of their beauty, their unusual migration journey and their historical presence in California, represent a unique natural heritage.

The Planning Goal: Protect Monarch butterfly overwintering habitat areas located within the state.

Program 1: All cities and counties with monarch habitat in their jurisdiction should maintain a list of Monarch sites and a Monarch site map based on the state of California's Natural Diversity Database. Survey information and USGS topographical maps of Monarch habitat are available, and can be sorted by county, from the Department of Fish and Game's Natural Diversity Database. To order, call 916-324-3812.

Program 2: Establish that any proposed development which could have a negative impact on a Monarch habitat requires an environmental impact report assessing the potential impacts of the project and recommending mitigations as required under the California Environmental Quality Act. The Guidelines for Managing Monarch Overwintering Habitats list an appropriate standard of review for conducting and reviewing environmental impact reports pertaining to Monarch habitats.

Program 3: Place signs on city-owned sites informing visitors of the importance of Monarch sites and the care that must be taken not to disturb the site or the butterflies. Within the boundaries of a city-owned Monarch site: prohibit cutting, thinning, pruning or removal of any tree or large shrub, except as necessary for safety of homes or persons; prohibit pesticide use; keep water sources clean;' protect the nectar plants used by the Monarchs; prohibit wood-burning fireplaces on new developments that are located close enough to the Monarch habitats that smoke will drift into hem. When, in case of emergency, vegetation must be removed from a Monarch site, require replacements of comparable vegetation.

Program 4: Encourage private landowners to protect Monarch sites voluntarily. Make biological management guidelines available to the public, and distribute them to owners of Monarch habitat, as determined by the city's site survey.

APPENDIX B: THE CALIFORNIA COASTAL ACT AND IT'S APPLICABILITY TO MONARCH HABITAT

Which sections of the Act apply?

Section 30240 of the Act requires:

(a) *Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on such resources shall be allowed within such areas.*

(b) *Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designated to prevent impacts which would significantly degrade such areas, and shall be compatible with the continuance of such habitat areas.*

Environmentally sensitive habitat area is defined in section 30107.5:

"*Environmentally sensitive area "means any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments.*

Example: Pacific Grove Land Use Plan

Each local government in the California Coastal Zone must conform its land use plans to these policies. For example, the city of Pacific Grove's coastal land use plan (LUP) defines "Environmentally Sensitive Habitats" as including "any areas which may be determined as essential habitat for monarch or Smith's blue butterflies." To protect monarch habitat, the LUP contains the following recommended action:

5. The City will seek expert assistance: a) to determine the location of feeding and overwintering areas for the Monarch butterfly within and functionally interdependent with the City's coastal zone (including an investigation of the abandoned railroad right-of-way); and, b) to identify appropriate development and habitat preservation standards for coastal development in such areas, to be incorporated in the City's Local Coastal Program implementation measures.

Within the most likely areas of habitat - an abandoned railroad right-of-way - the LUP requires the following:

...Identify and protect Monarch butterfly overwintering sites, buffer trees, nectaring and feeding areas within and adjacent to the former railroad route. Where developed for recreational trail, municipal golf course, or other uses, such Monarch butterfly habitat shall first be identified by appropriate experts approved by the City. The project shall then be designed to avoid any significant disruption of the identified Monarch butterfly habitat, and, where appropriate, the right-of-way shall be landscaped and permanently managed to enhance the habitat of this species.

On December 15, 1988, The California Coastal Commission certified the City's LUP subject to addition of he above policies. This was done by the City Council, and the revised LUP was received in its completed form on July 27, 1990. In its finding regarding the environmentally sensitive monarch overwintering habitat, the Coastal Commission states:

Stands of native pine and oak forest play a special ecological role by stabilizing the inland edge of the dune formation. The native pine forest also serves as a windbreak for inland residential areas and the "butterfly trees" -- overwintering sites for the migratory Monarch butterfly. While the butterfly trees used currently are just inland from the coastal zone boundary, use patterns historically have fluctuated and portions of the coastal zone comprise feeding/nectaring habitat for the massed butterfly populations. The buffering role of the native forest and the importance of the associated open space areas along the abandoned railroad right-of-way was not recognized at the time the LUP was written. The seasonal influx of the Monarch explains the City's nickname of "Butterfly Town, U.S.A."

Source: Lee Otter, Coastal Commission

APPENDIX C: IDEAS FOR WRITING A RESOLUTION TO BE ADOPTED AT THE CITY OR COUNTY LEVEL

WHEREAS, the annual migration of the Monarch butterfly (*Danaus plexippus*) throughout North America is one of the world's spectacular natural occurrences; and

WHEREAS, the Monarch butterfly is one of the best known North American insects, covering thousands of miles on its migration, and journeying through Mexico, the U.S. and Canada; and

WHEREAS, Congress is considering a resolution which would designate the monarch butterfly as the national insect: and

WHEREAS, the state of California has identified the monarch butterfly in legislation as a natural resource that should be protected; and

WHEREAS, the California Department of Fish and Game maintains a Natural Diversity Database which maps all California monarch overwintering habitats; and

WHEREAS, the winter roosting sites that support the western butterfly population are located almost exclusively along the California coast, in the counties of Mendocino, Sonoma, Marin, Solano, Contra Costa, Alameda, San Francisco, San Mateo, Santa Cruz, Monterey, San Luis Obispo, Kern, Inyo,, Santa Barbara, Ventura, Los Angeles, Orange, San Diego; and

WHEREAS, the migration has become threatened by the incremental loss of these overwintering sites, and the International Union for Conservation of Nature and Natural Resources has established a special category in its Invertebrate Red Data Book for the migration, termed "Threatened Phenomenon," and

WHEREAS, the city of _____ hosts _____ monarch overwintering populations, located _____; and

WHEREAS, Monarch butterflies, because of their beauty, their unusual migration journey and their presence in the city of _____, represent a unique natural heritage.

APPENDIX D: DRAFT LANGUAGE FOR CONSERVATION EASEMENT PROTECTING MONARCH HABITAT

THIS GRANT DEED OF CONSERVATION EASEEEEMENT IS MADE THIS _____ day of _____, 19____, by _____ and _____ ("Grantors") in favor of and enforceable by _____ ("Grantee"), for the purpose of protecting and preserving in perpetuity, for the public benefit, the natural and scenic beauty of the land and its conservation value and scientific and ecological significance. _____(Grantee's name)_____ is a nonprofit corporation, incorporated under the laws of the (state of incorporation), for _____(purpose of organization)_____, and having an address at _____.

WHEREAS, grantors are the sole owners in fee simple of certain real property in _____County, _____(state)_____, more particularly described in Exhibit A and attached hereto and incorporated by this reference ("the Property"); and

WHEREAS, a portion of the Property currently remains in a substantially undisturbed natural state and has significant ___*(describe values, e.g., aesthetic, scientific and ecological values)*_____(collectively, "conservation values"). This portion of the Property is described in (Exhibit X), and mapped in (Exhibit X), attached hereto and incorporated herein by this reference, "the Easement Lands,"; and

WHEREAS, in particular the Easement Lands...

(The easement Lands are described in this paragraph. The description includes tree species, the time period for overwintering, the number of years monarchs have been known to overwinter there, the value of the habitat in relation to other monarch habitats in the county or in California, and any further information about the habitat which explains why it is considered worthy of preservation.

An additional paragraph might address specific aesthetic, scientific and ecological values of the habitat.)

WHEREAS, the state of California has recognized the importance of protecting monarch habitat in California in Assembly Bill No. 1671, signed by the Governor on September 11, 1987; and

WHEREAS, the specific conservation values of the Easement Lands are documented in an inventory of relevant features of the Easement Lands, dated _____ and incorporated by this reference "Baseline Documentation," which consists of reports, maps, photographs, and other documentation that the parties agree provide, collectively, an accurate representation of the Easement Lands at the time of this grant and which is intended to serve as an objective information baseline for monitoring compliance with the terms of this grand; and

WHEREAS, Grantor desires and intends that the conservation values of the Easement Lands be preserved and maintained by the continuation of land use patterns _____(which may be here listed)_____ existing at the time of the grant, that do not significantly impair or interfere with those values; and

WHEREAS, Grantors further intend, as owners of the Property, to convey to Grantee the right to preserve and protect the conservation values of the Property in perpetuity; and

WHEREAS, Grantee is a publicly supported, tax-exempt, nonprofit organization qualified under Section 501(c)(3) and 170(h) of the Internal Revenue Code, whose primary purpose is _____(state purpose of organization _____; and

WHEREAS, Grantee agrees by accepting this grant to honor the intentions of Grantors stated herein and to preserve and protect in perpetuity the conservation values of the Property for the benefit of this generation and the generations to come;

NOW, THEREFORE, in consideration of the above and the mutual covenants, terms, conditions and restrictions contained herein, and pursuant to the laws of ____*(state where property is located*_____ and in particular _____*(specific state of statutory authority)*_____, Grantors hereby voluntarily grant and convey to Grantee a conservation easement in perpetuity over the Property of the nature and character and to the extent hereafter set forth ("Easement").

1. Purpose. It is the purpose of this conservation easement to assure that the Easement Lands will be retained forever predominantly in their ___*(natural, scenic condition)*_____ and to prevent any use of the Easement Lands that will significantly impair or interfere with the _____*(natural, scientific, and ecological values)*_____ of the Easement Lands.

2. Rights of Grantee. To accomplish the purpose of the Easement, the following rights are conveyed to Grantee by this Easement:

A. To identify, preserve, protect and, in consultation with Grantor, enhance the ___*(natural, scientific, and ecological features)*_____ of the Easement Lands, including , without limitation, topography, soil, water, vegetation and wildlife;

B. To enter upon the Easement Lands at reasonable times to enforce the rights herein granted and to observe, study, and make scientific observations on the Easement Lands, upon prior notice to Grantor, his or her heirs, successors or assigns, in a manner that will not unreasonably interfere with the use and quiet enjoyment of the Easement Lands by Grantor, his heirs, successors or assigns at he time of such entry;

C. To prevent any activity on or use of the Easement Lands that is inconsistent with the purpose of the Deed of conservation easement and to enforce the restoration of such areas or features of the Easement Lands that may be damaged by inconsistent activity or use.

3. Grantors intend that this Easement will confine the use of the Easement Lands to such activities, including, without limitation, those involving _____*(scientific research, public education, etc.)*_____as are consistent with the purpose of this Easement.

A. Prohibited Uses. Any activity on or use of the Easement Lands inconsistent with the purpose of this Easement is prohibited. Without limiting the generality of the foregoing, Grantors state that the following activities and uses are inconsistent with the Grantors' intentions and the purpose of this Deed of conservation easement and are, therefore, expressly prohibited:

i. The degradation or impairment of the conservation values of the Easement Lands, in particular, without limitation, the degradation or impairment of the Monarch habitat on the Easement Lands;

ii. The use of the Easement Lands in any manner or the conduct of any activity which would degrade, impair, disrupt or interfere with the scenic and predominantly natural character thereof;

iii. Any alteration of the surface of the land, including, without limitation, the excavation or removal of soil, gravel or water;

iv. Any use or activity which would cause or increase soil erosion or degradation or pollution of any surface or subsurface waters, or would substantially increase the risk thereof;

v. The exploration for or extraction of minerals, hydrocarbons, soils, or other materials from on or below the surface of the Easement Lands;

vi. The commercial or industrial use of the Easement Lands;

vii. The cutting of live trees or vegetation except where necessary to:

(a) Control or prevent disease, where such removal is deemed necessary by a registered tree surgeon to protect the overall health of the trees or surrounding vegetation; or

(b) control fire and carry out fire suppression management, as deemed necessary by any governmental agency having jurisdiction;

viii. The subdivision or de facto subdivision of the Easement Lands;

ix. The construction of any roads or structures; and, _____*(list other prohibited alterations, such as alteration of a roadway, other than routine maintenance, and alteration or manipulation of a creek bed located on the Easement Lands, or the removal of water thereof)*____;

x. The dumping, storing or disposal of any debris, trash, refuse or discarded objects, except a otherwise described in 3.B. (When Monarch habitats are located in Eucalyptus groves, landowners may want to expressly reserve the right to clear debris which would constitute a fire hazard.);

xi. The use of motorized vehicles on the Easement Lands; the parking of any motorized vehicle on Easement Lands;

xii. The erection or maintenance of any commercial signs or billboards; and

xiii. The above-ground installation of new utility systems or extensions of existing utility systems, including, without limitation, water, sewer, power, fuel and communication lines and related facilities

B. Reserved Rights. Grantors reserve to themselves, their heirs, successors or assigns all rights as owner of the Property, including the right to engage in or permit or invite others to engage in all uses of the Property that are not expressly prohibited herein and are not inconsistent

with the purpose of this Easement. Without limiting the generality of the foregoing, the following rights are expressly reserved:

(These reserved rights may include preserving public access, maintaining public road or access, clearing of debris which constitutes a fire hazard, and performing maintenance of the grove.)

The remainder of the conservation easement covers the following categories pertaining to the legal arrangements between Grantor and Grantee .

> Notice of intention to undertake certain permitted actions. Grantor's notice to Grantee, for certain actions only
> Grantee's approval
> Grantee's remedies, if Grantor is in violation of the terms of the easement
> Costs of enforcement
> Grantee's discretion
> Waiver of defense of laches, estoppel, or prescription
> Acts beyond Grantor's control
> Right of access by general public (usually specifically not conveyed)
> Costs and liabilities related to ownership of property
> Taxes
> Hold harmless clause
> Extinguishment
> Proceeds
> Condemnation
> Assignment
> Subsequent transfers
> Estoppel Certificates
> Notices (between parties)
> Recordation of Easement
> General provisions: Controlling law; Liberal construction; Severability; Entire agreement; No forfeiture; Successors; Termination of rights and obligations; Captions; Counterparts.

The schedule of exhibits following an easement should include the legal descriptions of Property and Easement Lands, Baseline Documentation, Maps, Identifications of Prior Mortgage.

APPENDIX E: NECTAR SOURCES FOR MONARCH BUTTERFLIES

Native Nectar Sources-Fall Blooming

>Mule fat
>Coyote Brush (*Baccharis pilularis)*
>Composites, such as daisies, sunflowers, and thistles

Native Nectar Sources-Winter Blooming

>Willows (*Salix* spp.)

Non-Native Nectar Sources-Fall Blooming

>English Ivy (*Hedera helix)*

Non-Native Nectar Sources-Winter Blooming

>Blue Gum Eucalyptus (*Eucalyptus)*
>German Ivy (*Senecio mikanioides)*
>Bottlebrush (*Callistemon* spp.)
>Pride of Madera (*Echium fatuoosum)*

APPENDIX F: DRAFT MONARCH RESERVE SIGN TEXT

Welcome to the _____Monarch Butterfly Reserve!

HELP THE BUTTERFLIES SURVIVE--YOU CAN MAKE THE DIFFERENCE

DON'T DISTURB THE CLUSTERS. Shaking branches or throwing objects threatens the lives of the butterflies. Monarch butterflies cluster to survive the winter. Clustering conserves their body fat and reduces the risk of being eaten by predators or dying from excessive cold. When the clusters are disturbed, the butterflies are forced to move and deplete important fat reserves. After being disturbed, the butterflies are not always able to form a new cluster; all these things endanger their survival.

STAY ON TRAILS AND BOARDWALKS. The natural vegetation protects overwintering monarchs from wind and rain, and creates the "microclimate" they need to overwinter. Even the groundcover is important; butterflies need something to climb up on when they fall from the clusters, so they aren't eaten by predators. Trampled underbrush can harm the butterfly habitat. Trampling compacts the soil, harming the root systems and preventing water and nutrients from reaching the trees.

LOOK DOWN AS WELL AS UP. Monarch butterflies on the ground are probably not dead, just too cold to fly. If their wings are shivering, they are trying to warm themselves enough to fly back to their clusters or to crawl off the ground. During January and February, pairs on the ground are courting and mating.

WHEN TO SEE THE MONARCHS: You can visit the monarch butterflies in their clusters anytime during regular park hours. A perfect time to see active, flying butterflies is on clear days from about 11 a.m. to 3 p.m., when they often leave their clusters to bask in the sun or to search for nectar.

HOW TO HELP FALLEN MONARCHS: If a butterfly falls to the platform and is too cold to fly back, you can pick it up gently, holding the two front wings between your fingers, and place it on a nearby bush It will be safe there from predators and people's feet until it is warm enough to fly back to its cluster. If you want to, cup the butterfly between your palms and warm it in your hands or gently breathe on it for about two minutes. This will raise its body temperature to the point where it can fly back into the clusters.

APPENDIX G: PRECEDENTS SUPPORTING MONARCH CONSERVATION

1. The California legislature passed Assembly Bill No. 11671 in September 1987, recognizing the value of the California Monarch winter roosts and the importance of protecting them. In part, the bill states "The government of Mexico, despite its current economic situation, recently took dramatic steps to safeguard the wintering grounds of the Monarch butterflies of eastern North America; therefore, the state of California should take similar action to protect the Monarch butterflies which migrate throughout western North America.
2. Congress is considering federal legislation sponsored by California Representative Leon Panetta to designate the Monarch the national insect. This legislation reads, in part, "...the Monarch is a unique representative of over 600 species of butterflies and nearly 90,000 other insects that are an integral part of the natural heritage of the United States; ...the population of Monarchs is declining under pressure from urbanization and loss of habitat which results in the reduction of the host plant (milkweed) and overwintering groves of trees in California and Mexico; ...the Monarch enhances the beauty of the environment and signals the need for protection and conservation of the natural wonders."
3. The North American Monarch migration has been categorized by scientists as an "Endangered Phenomenon" and cited as a "Threatened Phenomenon" in the widely respected, international Invertebrate Red Data Book published by IUCN. (IUCN is the International Union for Conservation of Nature and Natural Resources, based in Gland, Switzerland.)
4. The following jurisdictions have either incorporated Monarch conservation into their land use plans or are in the process of doing so: Marin, Santa Cruz, San Luis Obispo, Santa Barbara, and Ventura counties: Bolinas, Santa Cruz, Capitola, Pacific Grove, Malibu, San Clemente, and Laguna Beach cities; the East Bay Regional Park District, and Natural Bridges State Beach General Plan. See Appendices A & B for sample land use planning language and legal precedents set by government agencies.

NOTES - FOR REFERENCE OF TEXT ONLY

A decade of research in Mexico and several years of research in California has provided insights into what makes a successful wintering habitat. The forests and groves that support Monarch overwintering habitats are characterized by a very specific range of climatic variables. Together, these variables make up the “microclimatic envelope.” Research shows that overwintering habitats have lower wind velocity, lower light and solar radiation intensities, and higher vapor pressure deficits than non-wintering groves (Leong et. A., 1991; Weiss et. al., 1991). Environmental parameters associated with suitable Monarch overwintering habitats do not vary between overwintering sites composed of different tree species (Leong et al., 1991, Frey et al., 1992). In California, overwintering tree species include Monterey Pine (*Pinus radiata* D. Don), Monterey cypress (*Cupressus macrocarpa* Hartw. Ex Gord.), the introduced Australian Eucalyptus species (*Eucalyptus globulus* Labill. and *Eucalyptus camaldulensis*), and others.