Goals and Benefits of the Project

During the years 2002-2007 a series of large intense wildfires occurred in California. Seven of the nine largest wildfires in California's recorded history occurred during those five years. Four of those seven fires occurred in San Diego County. Fully 28% of the surface area of SD County burned during that period. Approximately 51 % of the montane mixed conifer forest (MCF) in San Diego County burned during those five years, almost all in large, high-intensity fires. In contrast during the entire 20th Century only 45% of the County's MCF burned (Wells 2001, Wells et al. 2004). No region wide analysis of the intensity and severity of these fires has been made. However, if we assume that the effect of the CEDAR fire on Cuyamaca Rancho State Park (CRSP) is typical of the impact of these fires, then it is likely that the regional biodiversity of San Diego County has been significantly impaired.

The goal of the Cuyamaca Rancho State Park Reforestation Project is to facilitate the recovery of the MCF at CRSP. To accomplish that goal the project will establish patches of native conifers at favorable sites throughout the extent of pre-Cedar Fire forest at CRSP. This approach will create a spatial pattern of patches of trees that mimics the landscape mosaic found after most fires. Once those trees mature the patches will act as centers of dispersal for propagules to recolonize the more severely burned areas.

The uniform high intensity of the Cedar Fire at CRSP was unprecedented. Minnich and Goforth (2008) determined that approximately 95% of the 4,035 ha MCF canopy in the Park was destroyed by the Cedar Fire. Franklin and Bergman (2011) estimated that 98% of the Park's conifer trees had been killed by the fire or had died shortly afterwards. This is unusual, even in large fires of great intensity it is not uncommon for patches of forest canopy to survive. Studies at Yellowstone National Park following the fires of 1988, found that even during the days when the fires spread most rapidly, that only about 50% of the forest canopy was destroyed (Turner et al. 1994). Studies of the Ponil Fire Complex that occurred near Cimarron, New Mexico in 2002 revealed that 40% of the area within the Fire's boundary burned at low severity (over 75% of trees in those areas survived) and 13% was completely unburned (Hayes and Robeson 2011).

Surviving patches of forest canopy contribute greatly to ecosystem recovery following fires. They provide sources for propagules that disperse into more severely burned areas. In the case of the Yellowstone Fires researchers found that:

> *The majority of severely burned areas were within close proximity (50-200 m) to unburned or lightly burned areas, suggesting that few burned sites are very far from potential sources of propagules for plant reestablishment*. (Turner et al. 1994)

In contrast following the Cedar Fire at CRSP Goforth and Minnich (2008) mapped the extent of stand replacement, surviving canopy, and opined that:

The massive extent of stand-replacement at CRSP exceeds the seed dispersal capacity of remaining live trees, and nearest-neighbor seed sources are distant within this severely burned forest.

Though there has been some natural conifer regeneration following the Cedar fire it has been limited spatially and in species diversity. Franklin and Bergman (2011) sampled the MCF in CRSP in 2008 and found pine seedlings that had become established following the Cedar Fire on 433 of 1271 sampled plots. These were predominantly *Pinus coulteri* (93%), which is to some degree serotinous (Borchert 1985, Wells 2001). A few *P. lambertiana* (5%) and *P. jeffreyi* (2%) were found in lightly burned areas. If the highly diverse, multi-species MCF at CRSP is to recover to any significant degree within our lifetimes it is apparent that human intervention will be necessary.

Biodiversity is considered to have two components: the number of species per unit area, and equitability, or the evenness of the numbers (or cover in plants) of members of different species. For example a forest that has three different species of pines where each species has approximately 1/3 of total cover, is considered to be more diverse than a forest where one species makes up 2/3 of the total cover. By either measure the biodiversity of the MCF at Cuyamaca Rancho State Park has been greatly reduced.

There are many benefits that would accrue along with the restoration of MCF at CRSP. The first is the maintenance of regional biodiversity. San Diego County is one of the most floristically diverse areas in the continental United States (Beauchamp 1984). The MCF is an important element of that regional diversity. Conifer forest and woodlands cover 37,037 ha in San Diego County (Wells 2001, Wells et al. 2004). However this total includes Pinyon pine and juniper woodlands, which occur at lower elevations than the MCF and generally are considered desert vegetation types (Schoenherr 1992). When these are subtracted the Montane MCF cover in San Diego county comes to approximately 21,589 ha (McKinsey pers . com.) located in "sky islands" scattered along the spine of the Peninsular Mountains. The 4,035 acres of MCF that existed in CRSP prior to the Cedar fire represented 19% of that total. In contrast chaparral, which is the most common vegetation type in the county, covers approximately 358,068 ha (Wells 2001, Wells et al. 2004).

The MCF provides habitat for protected species such as California spotted owl (*Strix occidentalis occidentalis*), and the purple martin (*Progne subis arboricola*), which were know in the park prior to the fire. Restoration of the MCF at Cuyamaca would greatly benefit these and other more common wildlife species such as mule deer and mountain lions, which had high populations in CRSP prior to the Cedar Fire.

It is unknown at this time, how the Cedar Fire affected populations of small forest animals in CRSP, including invertebrates and herpetofauna. Over much of the MCF litter and duff was completely consumed down to mineral soil (Goforth and Minnich 2008) and it is possible that local populations of small animals were extirpated. As the patches of planted trees grow they will create physical structure for the forest environment. If surveys show that ecologically important populations

of small animals are absent they can be reintroduced to the patches, and from there recolonize the MCF as it develops.

CRSP is a large portion of the watershed of Lake Cuyamaca, which is operated as a reservoir by the Helix Water District. The park is also the headwaters of the Sweetwater River, the main local source of water for the Sweetwater Authority, which provides drinking water for several San Diego suburban communities. The reestablishment of the MCF should help to control erosion and protect water quality in this important watershed.

Another important benefit of the reforestation project will be the sequestration of atmospheric carbon as the MCF recovers. The project has been registered at the Climate Action Reserve as the first forestry project on public lands.

Finally, the reforestation project will enhance the esthetic and recreational value of CRSP. Prior to the Cedar Fire Cuyamaca was the largest forested public park in San Diego County. Due to it's location it is easily accessible to the large urban and suburban populations of southern California, and hosted nearly 700,000 visitors a year. The reforestation project will help to reestablish the forested montane landscape that these visitors so greatly valued and enjoyed.

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