

Mountain Lake: An Assessment of Its Potential as an Urban Open Space Area for Recreation and a Viable Native Habitat

Final Report to C'UEREC



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Executive Summary

The potential for Mountain Lake, located within the Presidio National Park in San Francisco, California, to serve as an recreational urban open space, while retaining value as a native habitat for plants and wildlife was investigated.

This report reviews the results of questionnaires, interviews and direct observations of uses of the Mountain Lake Area. Additionally, natural history data obtained from National Park Service, city personnel and university researchers, are mapped along with the survey data in a Geographic Information System. The habitat data along with the recreation use data are analyzed to ascertain the potential for conflicting uses at Mountain Lake and to provide recommendations for avoiding potential conflicts to insure the probability of successful multiple uses of the area.

Mountain Lake provides quality open space for a number of users and uses. Some of the more popular uses include: casual walking, playground activities for children, nature reflection, playing cards, tennis, basketball, and as an exercise area by many people throughout the week and on weekends. Activity appears to be high in the weekday early and late morning hours and highest on weekend afternoons. Park users include local and more distant residents of the city, who report that they value the park for its natural serene and tranquil setting within the city, its proximity to their residences and as a place to relax. They report that Mountain Lake strongly enhances the image of the neighborhood and makes the city a more livable place.

Due to the lack of data on specific species and habitat suitability, the compatibility analysis is limited to a general overview. GIS maps compare areas of high recreational use with the locations of native plant communities. At present, based on the data available, the impacts of recreational use are minimal compared to the accumulated disruption of the landscape caused by larger development projects, such as the construction of a highway and golf course. Once additional detailed data are obtained by the managing agencies, a more detailed on this aspect will be possible.

Much research has been completed on this area, however there appears to be a lack of coordination and integration in these projects. The dual management jurisdictions of the area often causes the area to be view in distinct management units based on political rather than ecological significance. The difficulty in trying to obtain and use previous work emphasizes the lack of a comprehensive database and site for research on the Mountain Lake area. If this trend continues, the management of the Lake will continue to be incomplete and fragmented. Along with this integration, a coordinated environmental education program is suggested to connect visitors and community members with the natural environmental. This will promote stewardship and maintain momentum for restoration during shifting priorities of governing agencies. Restoration efforts integrated with community partnership have the potential to recognize the new role of urban parks — a role that incorporates the often-conflicting objectives of recreation and habitat preservation.

Mountain Lake is clearly a useful and treasured resource and recreational facility within the city, and as part of the Presidio National Park has the potential to be a national jewel..

This study was partially funded by CUEREC. Additional funding and time was provided by San Francisco State University's Office of Research and Sponsored Projects. We appreciate the opportunity to research this treasure.

INTRODUCTION

Mountain Lake, located at the southern boundary of the Presidio, is one of the few remaining natural lakes in San Francisco and the only one within the Golden Gate National Recreational Area [GGNRA]. GGNRA is an area containing 74,000 acres of open space and historic sites, extending to the north and south of the Golden Gate Bridge. Mountain Lake is of great value because of its significant historical, recreational, and ecological importance. The city park and bordering national park offer a contiguous, multiple-use recreational area. Mountain Lake and its surrounding natural environment also provide potential plant and wildlife habitat, attracting many waterfowl and migratory bird species.

Fortunately, the uniqueness of this urban open space area within a neighborhood of San Francisco has been recognized by a committed neighborhood organization and the National Park Service, who have been the impetus for its restoration and preservation. Since the area around Mountain Lake contains both a recreation-oriented neighborhood park and wilder national park lands, it provides an opportunity to study some of the benefits, obstacles, and management strategies pertaining to urban open space, as well as the role and significance of strong community involvement. Urban open space refers to the "green space" that exists within a city and includes a wide range of landscapes from manicured park areas - "green deserts with lollipop trees" - to more naturalistic settings (Boerner-Ein 1991; Goode 1990). The underlying theme is that these green spaces "add to the quality of life in cities" and "enhance the city's livability" by providing relief from the built urban environment (Heckscher 1977).

In addition to problems associated with its location within the urban landscape, the management of Mountain Lake is further complicated due to the various jurisdictions of its borders: city park, state highway, national park (formerly the Presidio U.S. Army Base), and private golf course. Mountain Lake has experienced a severe degradation of its environment due to the intensity of use related to these diverse boundaries. These problems include an accelerated rate of eutrophication, algal blooms from increased nutrient levels, fish deaths caused by low dissolved oxygen levels, poor water quality due to contaminated runoff entering the lake from the adjacent highway and golf course, and loss of habitat for native plants and wildlife caused by aggressive non-native species.

The surrounding community has been very active over the years in park maintenance issues and obtaining funds and attention from city officials. The most recent restoration efforts began in October 1995 with the "Greening of the Presidio"; an environmental design charette organized to develop "models of sustainability" for several different management issues. Mountain Lake was the focus of the "Natural Habitat Preservation and Restoration" group because of its significant ecological value as the only natural lake within the GGNRA.

Participants included representatives from the various management jurisdictions and interest groups concerned with Mountain Lake's future, such as the National Park Service [NPS], San Francisco Recreation and Park Department [SFRPD], Golden Gate

Audubon Society, California Native Plant Society [CNPS], Presidio Golf Course, San Francisco Water Department, and Friends of Mountain Lake Park [FMLP]. The charette team outlined a three-phase approach of information gathering/community outreach, planning, and implementation, and organized a Steering Committee to coordinate restoration efforts. The initial phase of information gathering and community outreach concluded with a public forum in August 1996, which focused primarily on the problems associated with the decreasing lake depth and possible restoration alternatives.

Statement of the Problem

In this study, Mountain Lake's ability to function as a recreational area for humans while remaining a viable habitat for native plant and animal species is evaluated.

The objectives are to determine the ability of Mountain Lake and its surrounding natural area to function as both a recreational area and native species' habitat. To evaluate human use, the user groups and types of activities people participate in while visiting Mountain Lake are determined, and the factors influencing recreational use are identified. To evaluate Mountain Lake, the natural environment and human impacts are mapped, and the factors influencing native species habitat are identified.

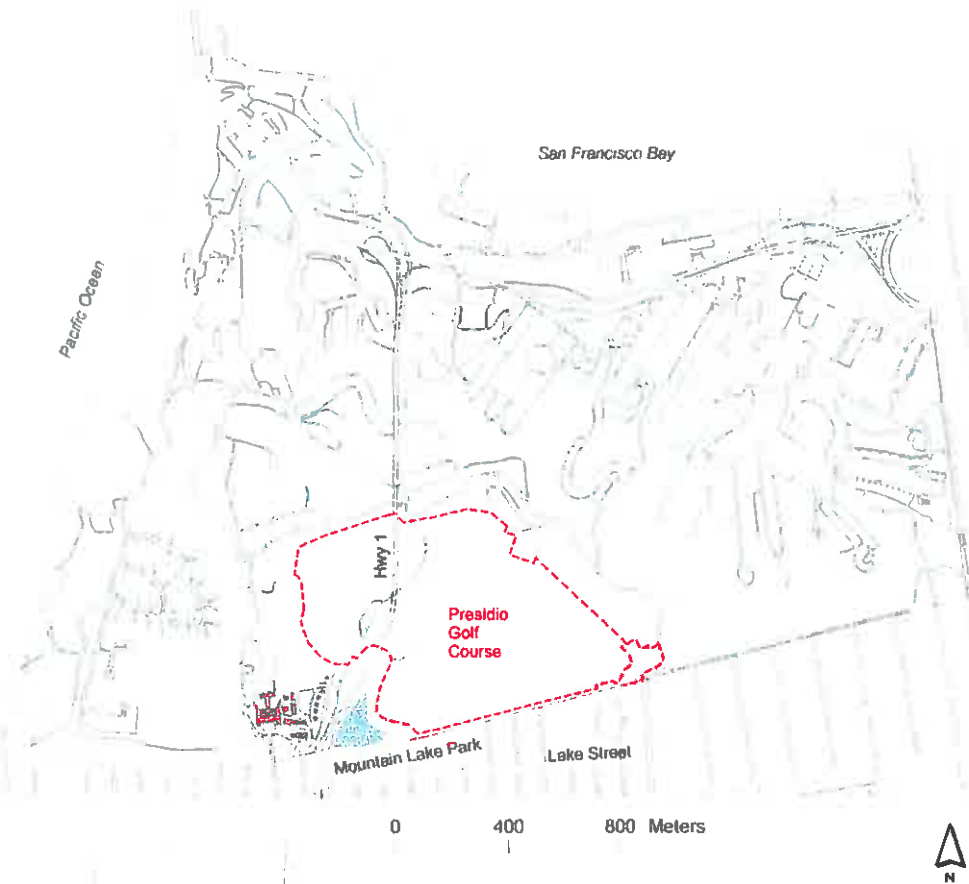
STUDY AREA

Mountain Lake (Figure 1) covers approximately four acres and is located at the southern edge of the Presidio of San Francisco. It is one of the few natural lakes in San Francisco and is fed by two subterranean springs. Although its hydraulic connections are not clearly understood, it is presumed that groundwater seepage maintains the lake's water level. The extent of the watershed of Mountain Lake has been determined to be at least 192 acres to the north and east of the lake including most of the Presidio Golf Course. A significant portion also extends to the south and encompasses the residential area of the Richmond District in San Francisco (Dames & Moore 1997).

Due to its location within the urban environment, the lake borders several different landuses. The most artificial boundary is with Park Presidio Boulevard/State Highway 1 to the west. A thin, sparse band of vegetation, mostly Arroyo Willows, serves as a partial visual and sound barrier between the two.

Mountain Lake Park, a highly manicured, recreation-oriented city park, is along the southern boundary of the lake. Cars are not permitted into the park, but there are six pedestrian entrances from 8th, 9th, 10th, 11th, 12th, and Funston Avenues. Lake Street, the closest east-west thoroughfare, is a two-lane road with no bus routes. The portion of Lake Street that parallels the park is mostly residential, and the houses on the north side of the street border the park (Figure 2).

Site Location Map for Mountain Lake



- Golf Course Fence
- Roads
- Mountain Lake
- Public Health Services Hospital
- Presidio National Park

Study Area

(NPS 1998)

C. Grosso, MGISC, SFSU

Figure 1 Mountain Lake is located at the southern boundary of the Golden Gate National Recreation Area, Presidio of San Francisco, which was a U.S. Army Base until 1995.

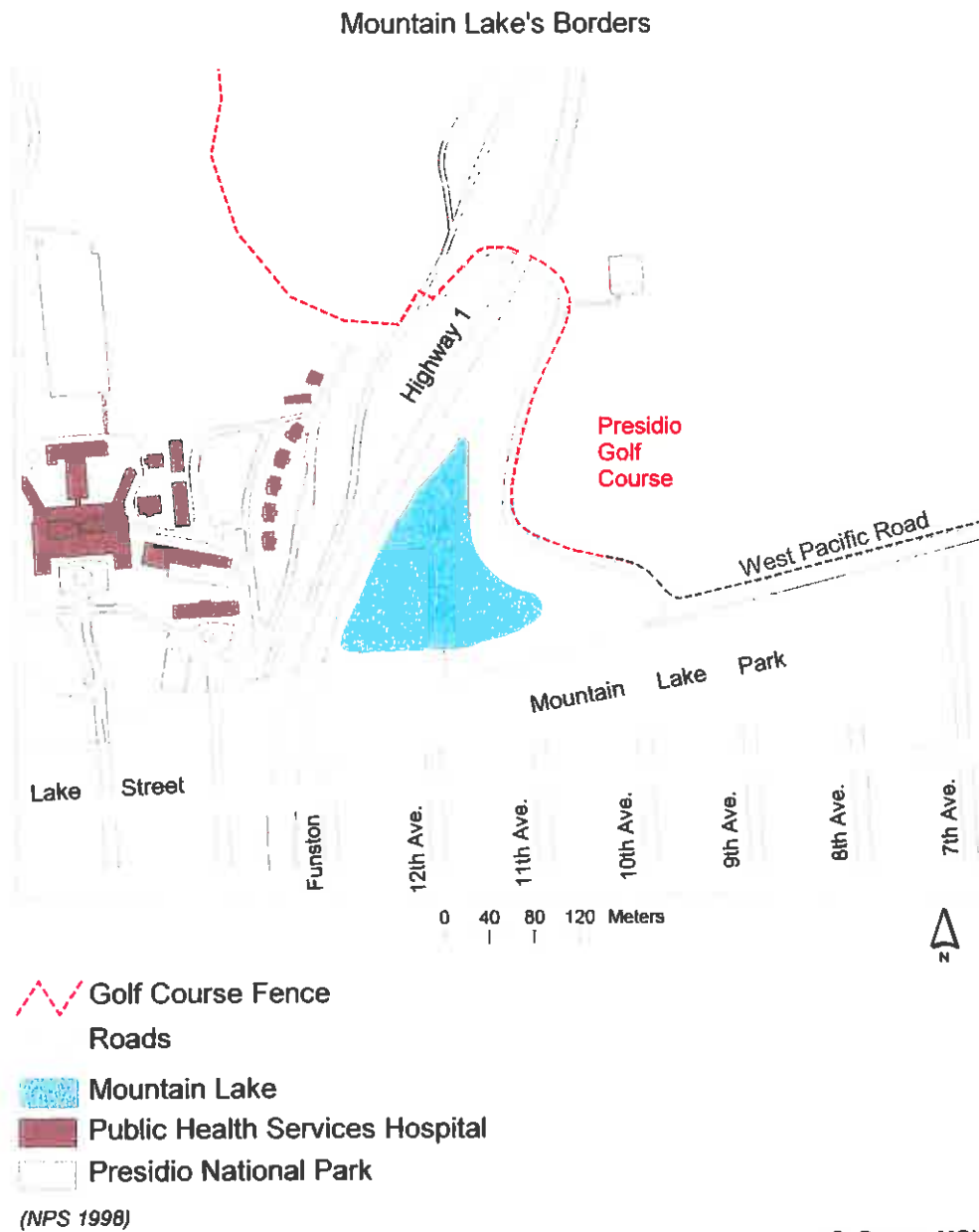


Figure 2 Mountain Lake Park is accessible by six pedestrian entrances off Lake Street and by West Pacific Road east of the lake.

Two dirt trails connect Mountain Lake Park with the adjacent Presidio National Park via West Pacific Road, a paved single-lane service road that extends between the two parks from the Presidio's Arguello Boulevard Gate to the Public Health Services Hospital. The trails intersect with West Pacific Road at the eastern arm of the lake and at the northeastern corner of the park from the dog run area. Although not accessible due to a chain-link fence, a golf course is located to the north of West Pacific Road and Mountain Lake's northeastern border. The green for hole #11 and the tee for hole #12 are situated on the hill overlooking the lake.

Flora and Fauna

Three indigenous sandy plant communities surround Mountain Lake: Central Coast Arroyo Willow Forest, Central Freshwater Marsh, and Central Coast Dune Scrub (Figure 3) (Vasey 1996). While there is a substantial amount of riparian vegetation along the highway, the freshwater marsh community has been "significantly altered" due to years of human impacts and is "disturbed and typical of urban environments" (Codemo et al. 1995: 9). Small pockets of Central Coast Dune Scrub species exist along the southern lake edge, which borders the city park area.

A few of the more aggressive non-native plant species that threaten to out-compete the native riparian and wetland vegetation include blue gum eucalyptus (*Eucalyptus globulus*), German ivy (*Senecio mikanioides*), and Monterey cypress (*Cupressus macrocarpa*) (Codemo et al. 1995). A large eucalyptus stand is located on the northern bank, while the German ivy is thriving along the southeastern margins of the lake. The city park contains manicured lawn areas and numerous large mature Monterey cypress trees.

The most abundant and visible fauna are avian species, including waterfowl and migratory birds using the Pacific Flyway. The diversity of aquatic species is minimal due to the poor water quality, particularly after lake conditions, in July 1994, caused many of the lake's fish population to die and the NPS removed the remaining ones (Codemo et al. 1995). There have been no studies investigating the presence of larger mammals in the immediate area.

Mountain Lake's Native Terrestrial Plant Communities

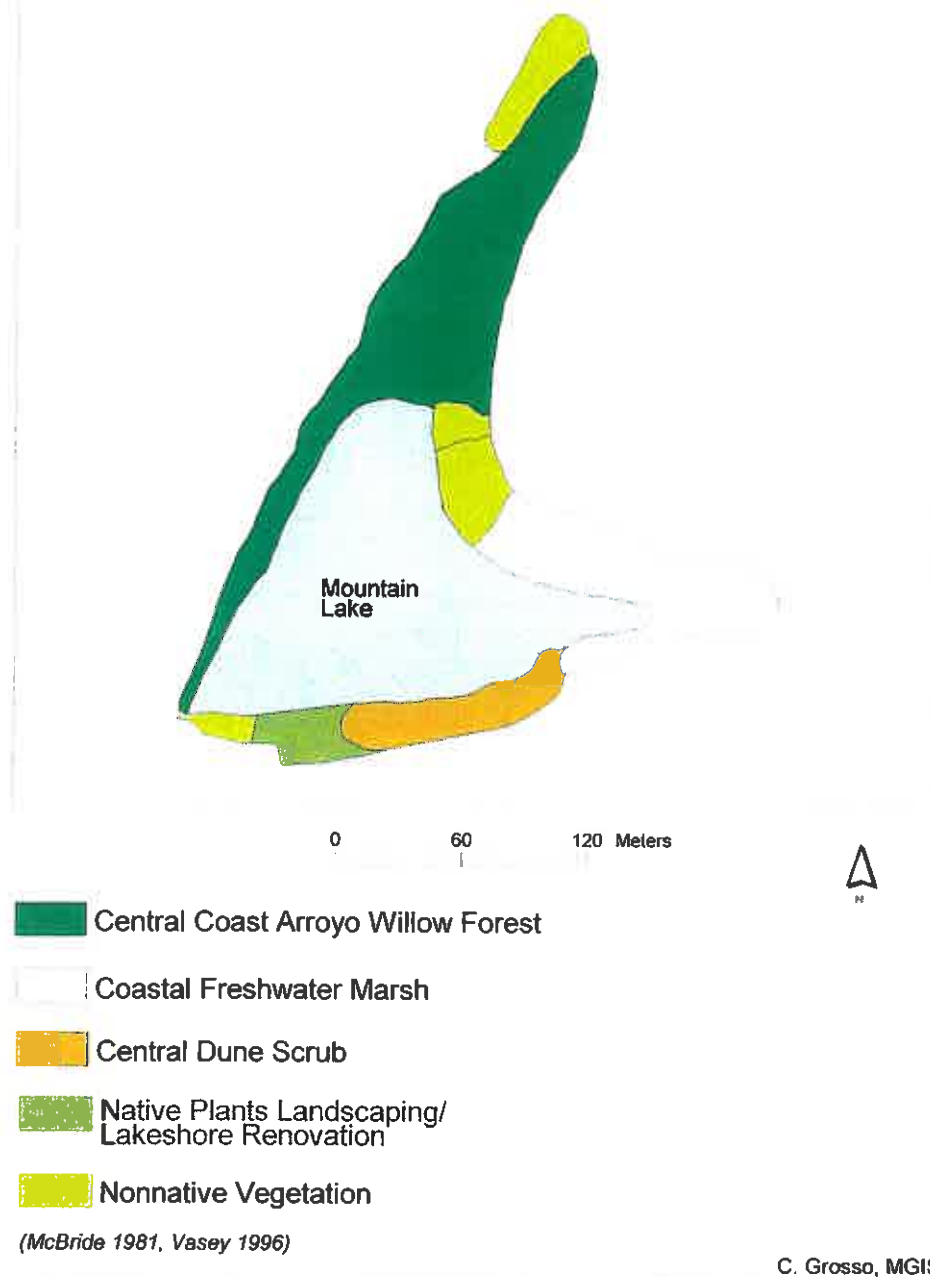


Figure 3 Three native plant communities surround Mountain Lake.

Recreational Facilities

Mountain Lake Park provides a variety of facilities and settings for both exercise-related and unorganized, or frequently referred to as passive, recreational activities for the visitor (Figure 4). Although the lake is the focal point of the area, no swimming, wading, or fishing is allowed due to the poor water quality. Facilities include tennis courts, playground, basketball court, dog run area, grass playing field with baseball backstop screen, and card shack. A paved jogging/walking trail meanders around the park's periphery and contains a Parcourse Fitness Circuit with seventeen exercise stations and instruction boards. Restrooms, community bulletin board, drinking fountains, picnic tables, garbage cans, and wooden boxes containing plastic bags for dog owners are optimally located.

Several settings are also available that encourage less organized and solitary experiences, for example the lakeshore and the numerous benches and logs scattered throughout the park. A few dirt trails exist that allow one to leave the main path and enjoy the park in a quieter atmosphere. While most of the facilities are located within the city park, there are dirt/woodchip trails linking the manicured setting of the city park to the more naturalistic landscape of the Presidio National Park. People heavily use West Pacific Road since it is the only connection to the Presidio from Mountain Lake Park, and the most controversial city park regulations do not apply there, such as leash laws for dogs and restricted areas for bicycles. While the area surrounding Mountain Lake is not extensive, it is able to provide different niches and accommodate the varied needs of its visitor community, which is diverse in both age and nationality.

Environmental Problems

Although there are several, the most significant environmental problem threatening Mountain Lake is its decreasing lake depth. During the 1930s road construction on Park Presidio Boulevard, debris from excavations was dumped into Mountain Lake; this substantially decreased the lake's depth from 20-30 feet to approximately 10 feet (Codomo et al. 1995). This threatens the Lake's biodiversity, since a shallower depth does not allow for an understory of cold water, which is needed to support species' diversity (Lambert 1996).

Mountain Lake is also altered by "cultural eutrophication", the rapidly accelerated nutrient enrichment of a water body due to human activities, such as run-off containing fertilizers. The resulting growth in biomass adds to the detritus on the lake's bottom and during the oxidation process, depletes the water of oxygen, contributing to the deterioration of its quality.

Mountain Lake Park's Recreational Areas

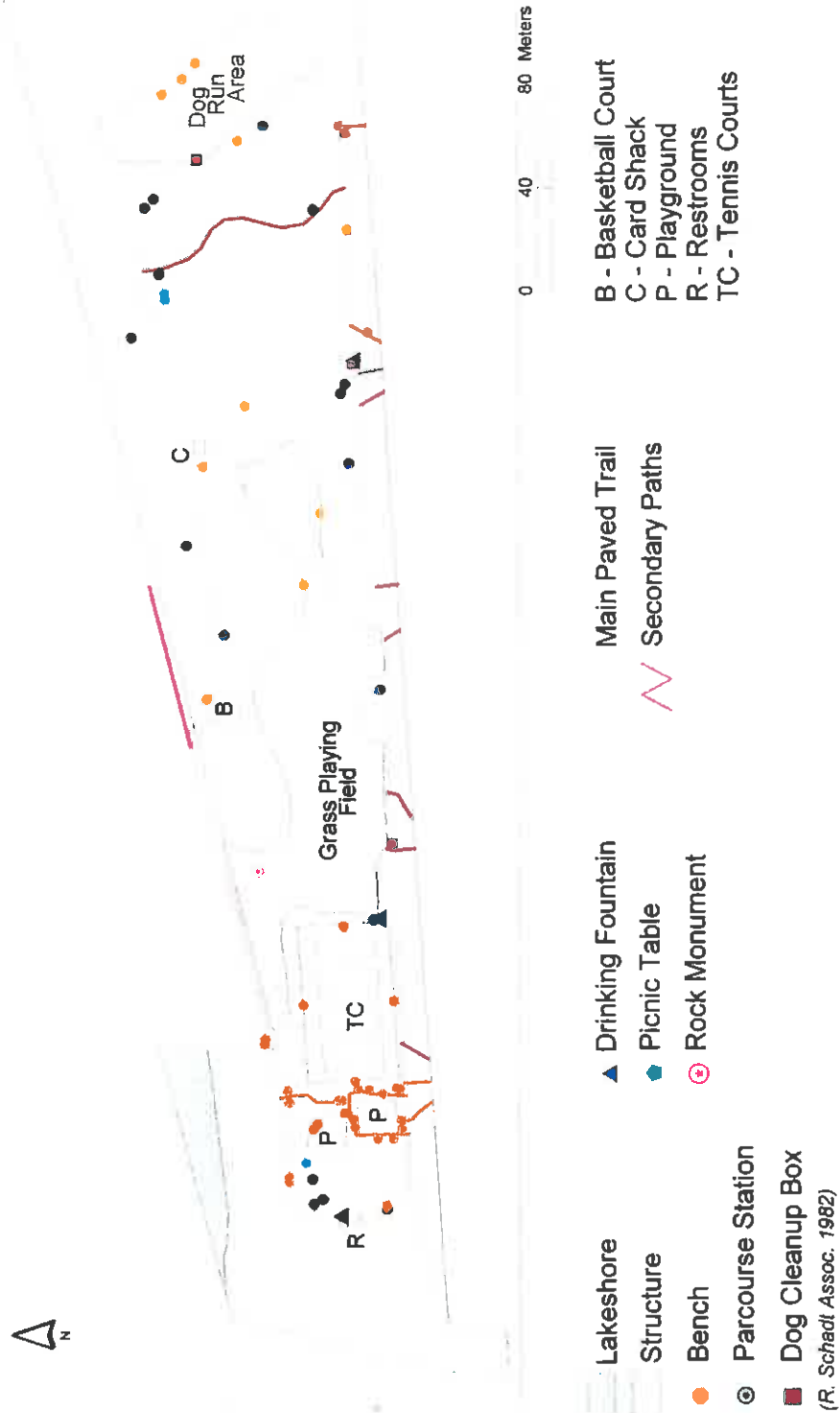


Figure 4 . Mountain Lake Park contains a variety of recreational areas and settings for park visitors.

A crash of an algal bloom was one possible explanation for the "fish kill" or numerous fish deaths that occurred in July 1994. The bloom occurred two weeks prior to the incident, and the decomposing algae may have decreased the oxygen in the lake to "levels incapable of supporting resident fish populations". Another theory identified the particular type of algae (*Aphanizomenon flos-aquae*) as "potentially toxic" since it had been associated with other fish kills (Codemo et al. 1995).

An additional concern is the lake's poor water quality due to "contaminants and nutrient runoff from the highway and nearby golf course" (NPS 1996b: 2). Denise Vore, the National Park Service [NPS] Hydrologist, summarized its condition as follows: "Current problems documented in Mountain Lake consist of high levels of ammonia (nitrogen), orthophosphates, total phosphates, and low levels of dissolved oxygen. These conditions are related to high nutrient loading and lake eutrophication. The source of some of these constituents (e.g. orthophosphates) can be traced to fertilizers rather than natural sources" (NPS 1996c, Memo 3/26/96). Although the lake's aquatic wildlife is partially responsible; the fecal coliform levels are significantly higher than acceptable standards.¹ Species diversity of the area is threatened due to the loss of native species' habitat from human impacts and the intrusion of non-native species. Native riparian and wetland vegetation has difficulty competing with the more aggressive non-native plants that crowd the lake margins, and non-native animals, such as the common bullfrog, have displaced the rare and endangered species, like the California red-legged frog and western pond turtle (NPS 1996b; Codemo et al. 1995). The larger mature trees planted at the beginning of the century are reaching the end of their life spans and probably cannot withstand the high winds of severe storms. During the winter storms in 1994, significant damage was caused to these aging trees and many were knocked down or lost branches (R. Dewey, pers. comm.) Although this poses more of a threat to homes bordering the park and public safety issues, the other problems discussed are a result of the accumulated effect of years of human disturbance to the area's natural environment.

Mountain Lake's Residential Community

Friends of Mountain Lake Park

The Friends of Mountain Lake Park [FMLP], a neighborhood association with a current membership of 263 households, was established in 1980 in response to neighbors' concerns about general park conditions and mature trees needing maintenance (FMLP 10/91: 1). They describe themselves as "an informal association of people who are concerned about their neighborhood park and readily demonstrate their consideration with labor, money and, when it is needed, their advocacy" (FMLP 5/94: 2). The group has been successful over the years in obtaining grant funding and attention from city and NPS officials, encouraging community involvement and support, and actively participating in

¹The San Francisco Zoo's autopsy of Daisy, one of the lake's resident swans who died in the spring of 1996, determined her death to be due to lead toxicity (Lambert 1996; Codemo et al. 1995).

the park's maintenance. Mountain Lake Park has received some media coverage lately due to its resident swan Myrtle and an abandoned alligator in 1997. This attention has also helped to increase awareness of the lake's deteriorating condition.

FMLP have maintained a strong dialogue with the San Francisco Recreation and Park Department [SFRPD] and a working relationship with the park's assigned gardeners. In November 1991, a prioritized "wish list" of park issues was compiled from neighbors' comments and given to the Director of Neighborhood Services for the Recreation and Park Department. Most of the neighborhood's needs were incorporated into park management by the end of 1992. FMLP has donated several pieces of equipment to the SFRPD for use at Mountain Lake, such as an Irri-Trol computerized watering control system, a mulching mower, a homelite generator for power trimming equipment, and a chain saw. Other expenditures have included bulbs, trees, and native plant seeds, equipment and workers to mulch the residue after cleanups, a preliminary plan designed by a landscape architect for the shoreline renovation project, and the lumber and signage for four "pooper-scooper" boxes stocked with plastic bags (FMLP 10/91; 2/93; 8/95).

A treasury is maintained from mostly garage sales and contributions, and the FMLP sponsor various activities to improve the park, such as park cleanups coordinated with park staff, neighborhood barbecues, plantings, and miscellaneous project workdays. Meetings are held as needed, and nine newsletters have been published since the first one in October 1991. Articles usually include park maintenance issues, the health and well being of the lake's prior resident swans, dates of upcoming events, historical accounts related to the lake, and letters from residents.

The Politics of Managing a Resource

Management Jurisdictions: The diversity of Mountain Lake's borders is also reflected in the different management jurisdictions of the lake and its ecosystem. The SFRPD maintains the city park area and one-fourth of the lake at the southwestern corner; the NPS is responsible for the majority of the lake and the northeastern border; and the western border adjacent to the highway is under the jurisdiction of Caltrans. Due to these separate management responsibilities of an ecosystem, "collaborative planning is essential" (NPS 1996a: 2).

Restoration Process: Although the active FMLP group have been dealing with park maintenance issues and trying to improve the park since 1980, recent official attention to the lake's health and water quality has been a result of the alarm caused by the 1994 fish kill and the "Greening of the Presidio", an environmental design charette held in October 1995.

At the charette, a community-based approach to the lake's restoration was proposed with the philosophy that "a community that actively participates in collaborative planning and stewardship will find common ground in seeking a sustainable

future for Mountain Lake". Three phases of restoration were identified - information gathering/community outreach; planning; and implementation, and a list of prioritized projects was outlined. Under the coordination of the NPS, several members of the charette team continued as the core of a steering committee to maintain the momentum and to conduct the first phase of information gathering and community outreach. Two major elements of this phase were to establish a Memorandum of Understanding [MOU] between the NPS and SFRPD to coordinate management, maintenance, and resources, and to organize a public forum to present information on the lake's ecological health and possible restoration options to the community (NPS 1996a).

Status of Restoration Efforts: Mountain Lake has been allocated \$500,000 for restoration planning and implementation as a result of the San Francisco Airport's current expansion and use of Bay wetlands. It is part of a \$7 million compensation agreement to restore and improve wetlands in San Francisco and Palo Alto (Adams 1997). However, this funding must be used shortly, and it has not been decided whether the GGNRA or the SFRPD will receive the mitigation funds (FMLP 4/97).

While the National Park Service's involvement has been delayed due to securing funding and the restoration of Crissy Field, the SFRPD's shoreline enhancement was completed in early 1998 (T. Thomas, pers. comm.). This project repaired the severely eroded southern lakeshore adjacent to the playground area. This is the lake's edge that receives the most foot traffic. While increasing accessibility, the renovation also provided more seating by adding benches and rocks on the beach area. In the summer of 1996, volunteers helped collect native plant seeds from the area, which were propagated at the Golden Gate Park nursery and used in the landscaping.

There is also the possibility of the U.S. Army contributing to the restoration's financing due to their impact on the area. As required by the Base Realignment and Closure [BRAC] Act, a Feasibility Study was conducted at the Presidio "to identify and evaluate remedial alternatives for potential chemical contamination possibly associated with Army activities" (Dames & Moore 1997: p.1-1). Mountain Lake was investigated as a Miscellaneous Site, since it is one of the few perennial surface-water features at the Presidio. However, these remedial efforts are not in coordination with the NPS and the funding for implementing institutional controls estimated at \$1,082,600 would probably be more effective if integrated with ongoing restoration efforts (Dames & Moore 1997).

Mountain Lake has a substantial history and ecology. The management and integration of these aspects into sound use is challenging and examined further in this research.

METHODOLOGY

In order to determine the compatibility between recreational use and native species' habitat at Mountain Lake, a combination of data collection methods were used. A questionnaire, park observations, and informal interviews were used to assess the

area's recreational use. A Geographic Information System (GIS) was developed with existing studies and fieldwork to assess habitat types and their compatibility with recreational use. While Mountain Lake is the focal point of the study area, Mountain Lake Park [SFRPD] and GGNRA Presidio of San Francisco [NPS] constitute the available land for recreational use and plant and wildlife habitat.

Recreational Use

To evaluate recreational use at Mountain Lake, questionnaires and direct observations were used to identify the users, types of activities, and the factors influencing recreational use.

Questionnaire: A questionnaire was administered to collect detailed information on the values, concerns, and personal background of park visitors. A three-page questionnaire consisting of 25 mostly closed-ended questions was distributed to a random sample of members of FMLP.

Questions focused on recreational use and human impact issues (Appendix 1). No questions regarding the ecological health of the environment or plant and wildlife species were included. Although the primary purpose was to determine users and their activities, questions regarding values, concerns, and future needs were included. Response options were based on preliminary work involving direct park observations, casual conversations with park visitors, and the public forum's preliminary events and proceedings.

The questionnaire was organized by six topics: characteristics of the park visitor, values, activities, use of park, concerns, and personal background. Questionnaires were mailed in September, 1997 to 125 residences randomly selected from the FMLP mailing list. A brief cover letter explained the purpose of the questionnaire, addressed the confidentiality of respondents, and requested participants for informal interviews. Although the mailing list originally included 255 names, 30 were removed from the selection process due to the following reasons: duplicate entry, contact name or address missing, address in different city or state, or individual associated with FMLP in only an official capacity (i.e. NPS or SFRPD personnel). From the remaining 225 names, approximately half or 125 names were randomly chosen.

Although the FMLP mailing list provides a selective sample of park users, its use was determined to be the most reliable and efficient method for conducting a self-administered questionnaire. Based on preliminary park observations, people appeared to be too engaged in their activities to be interrupted at the park. Since FMLP is a voluntary neighborhood organization and has free membership, its mailing list is assumed to provide a fairly representative sample of individuals who use the park and are interested in park issues.

Each questionnaire was assigned a record number, and responses were numerically coded and entered into a spreadsheet. All additional comments written on the questionnaire were compiled for easier review and reference during analysis.

Direct Observations: Direct observations were made to determine patterns in park use for different times and days by recording the number of people present and their activities. These observations also served to verify questionnaire responses and to identify users and activities not represented by the questionnaire data.

In order to become acquainted with the patterns of the park, numerous preliminary observations were made. Information gathered from these initial visits was used in developing a checklist of activities, which was continually updated according to new observations. The three-page checklist consists of fourteen sections; each representing a distinct area or facility at the park and containing a list of observed general activities for it. A summary of typical park activities is provided in Table 1. In addition, information on the context of setting, such as the day of week, time of visit, weather conditions, temperature, and any comments that might better explain park use at that given time, (for example, a holiday), were recorded. The same route was followed for each observation and took approximately 20 to 45 minutes to complete depending on the number of people at the park.

To determine the patterns of different user groups, three observations were made for every hour period from 6 a.m. - 6 p.m. These limits reflect the available daylight in San Francisco during the months of January - April, when the majority of the observations were conducted. Since there are no lights at the park, except one by the restrooms, no observations were made in the evening.

Informal Interviews: Several members of the Mountain Lake community were interviewed to verify and supplement survey data. Several former FMLP presidents, current FMLP officers, and survey respondents who expressed an interest in participating in an informal interview were contacted. A uniform set of questions addressing the topics of user groups, temporal changes in park use and landscape, values, concerns, future park improvements, and restoration alternatives, were discussed with each interviewee. Respondents were also given the opportunity to include additional comments. Notes were made during the interviews, and a standard form containing the set of questions was completed for each interviewee. Interview data were reviewed for potential contacts and issues that had not been previously considered.

Plant and Wildlife Habitat

Data on Mountain Lake's water quality, flora and fauna species, and habitat use were compiled from previous studies, interviews with specialists, and fieldwork. The plant communities and human impacts on the physical environment were mapped using Geographic Information Systems [GIS]. This information will be used in the assessment of Mountain Lake and its surrounding natural area.

Species' inventories, prior studies, and pertinent documents from organizational files were compiled. Members of the Steering Committee and other specialists who had

TYPICAL PARK ACTIVITIES

- Biking, rollerblading
- Birdwatching
- Children playing at the playground
- Children riding bikes or toys
- Dogwalking
- Exercising on parcourse equipment
- Feeding ducks
- Jogging
- Picnicking, parties
- Playing basketball
- Playing dominoes/cards in card shack
- Playing softball, football, frisbee
- Playing tennis
- Practicing Tai Chi
- Reading, writing
- School groups or club activities
- Sitting on benches or lawn areas
- Sunbathing, sleeping
- Talking with others
- Viewing lake, visiting lakeshore
- Walking alone or with others
- Walking children in stroller

MAIN RECREATIONAL AREAS AND FACILITIES

- Benches, logs, and picnic tables
- Dog run area
- Grass playing field
- Lakeshore
- West Pacific Road and paths
- Basketball court
- Card shack
- Playground
- Tennis courts
- Parcourse fitness stations

Table 1 Typical park activities and the main recreational areas and facilities at Mountain Lake Park are summarized from the observation checklist

recently conducted relevant research at Mountain Lake² were contacted for information. Interviews were informal and based on the individual's area of expertise and involvement in the restoration process at Mountain Lake. However, discussion regarding the environmental impacts of human activities on native species' habitat, historical information, current research, and management plans were integrated into interviews. Due to the joint jurisdiction of Mountain Lake, studies tend to focus on either the GGNRA Presidio of San Francisco or Mountain Lake Park.

A vegetation map was constructed from studies by Vasey (1996) and McBride (1981). In 1993-1994, Vasey (1996) developed an inventory for the entire Presidio of terrestrial vegetation, which is available in GIS format. The FMLP hired a forester to develop a Vegetation Management Plan for Mountain Lake Park in 1981. As part of that study, an inventory of the park's vegetation was inventoried. Since data were not in GIS format, the study's map was digitized and updated with fieldwork using GPS equipment. The SFRPD did not have any GIS data on Mountain Lake Park, and therefore, a Landscape Architect's layout map (Richard Schadt Assoc., Inc. 1982) was digitized to develop a recreational facilities' data layer, including structures, Parcourse fitness stations, and trails.

These data layers were used to create several maps for the area surrounding Mountain Lake: plant communities; recreational facilities and areas; and human impacts on the Mountain Lake ecosystem.

Compatibility Analysis

GIS can be a useful tool to integrate and assess the compatibility of social, physical and biological parameters of an area. For Mountain Lake, social data layers include recreational facilities, human impact areas, and intensity of recreational use, while physical data layers were created for elevation and vegetation communities. Since few studies have been conducted regarding specific species for the Mountain Lake area, no biological information regarding habitat suitability was available. However, once restoration efforts begin and studies are conducted for specific species' habitat requirements, our GIS database can be used to analyze restoration alternatives. Due to the unavailability of in-depth studies, analysis was limited to a general overview and the identifying of potential conflicts between recreational use and native species.

² Contacts included Terri Thomas, NPS (Charette Team Leader, Natural Habitats), Darren Fong, NPS (Aquatic Biologist), Daphne Hatch, NPS (Wildlife Biologist), Peter Holloran, CNPS, Dan Murphy, Golden Gate Audubon Society, Harry Fuller, Golden Gate Audubon Society, Dr. Alexander Horne, UCB (Limnologist), Mike Vasey, SFSU (Biologist), Marvin Yee, SFRPD (Project Manager), Leo Moffett, SFRPD (Area Supervisor), Mark Ewing, SFRPD (Gardener).

RESULTS AND DISCUSSION

Results are organized according to the main themes addressed in the questionnaire: general characteristics of visitor use, factors influencing recreational use, user groups and typical park activities, values and concerns of park visitors, and views on restoration, followed by native habitat considerations and a compatibility assessment.

Recreation

Questionnaire responses are summarized and any discrepancies or similarities determined from park observations and interviews with community members are noted.

The overall questionnaire response rate was 56% with a slightly higher percentage (54%) of female respondents. Demographic information indicates 71% of the respondents were 40 and older. The majority is partnered or married (60%), and many have a postgraduate degree (44%).

General Characteristics of Visitor Use: The majority of park visitors live either within one block (39%) or over four blocks (31%) and walk to the park (87%). Questionnaire respondents typically visit the park alone (59%), with friends (60%), or with a spouse/partner (53%), and many have been visiting Mountain Lake for over seven years (69%). Fifty-nine percent of the respondents own their residences. But both renters (23%) and owners (49%) indicated that they use a front or back yard in addition to visiting Mountain Lake Park. Forty-nine percent of respondents visit Mountain Lake on any day of the week. Respondents visit either everyday (21%) or two to three times per week (21%). However, 16% of respondents indicated only weekend use of the park, and another 16% do not use the park regularly. The most popular time to visit is during the period of 1 p.m. - 5 p.m. (63%), and a typical visit lasts approximately 30 minutes to one hour (53%).

Not apparent from the questionnaire data are the distinct patterns in park use. While 63% of the questionnaire respondents visit the park during the period of 1 p.m. to 5 p.m., park observations also indicate several other periods of high use (Figure 5a). There are two morning peaks and two less pronounced afternoon peaks. The times vary slightly for weekday and weekend observations. Several activities dominate park use during the weekday morning (Tai Chi, walking), mid-day (playground) and evening (playground, walking) peaks (Figure 5b). Similar activities also comprise the majority of park use during the weekend morning and evening. While overall park use is higher on Saturdays and Sundays (Figure 6), early morning use prior to 8 a.m. is greater on weekdays, which may reflect visitors using the park before going to work.

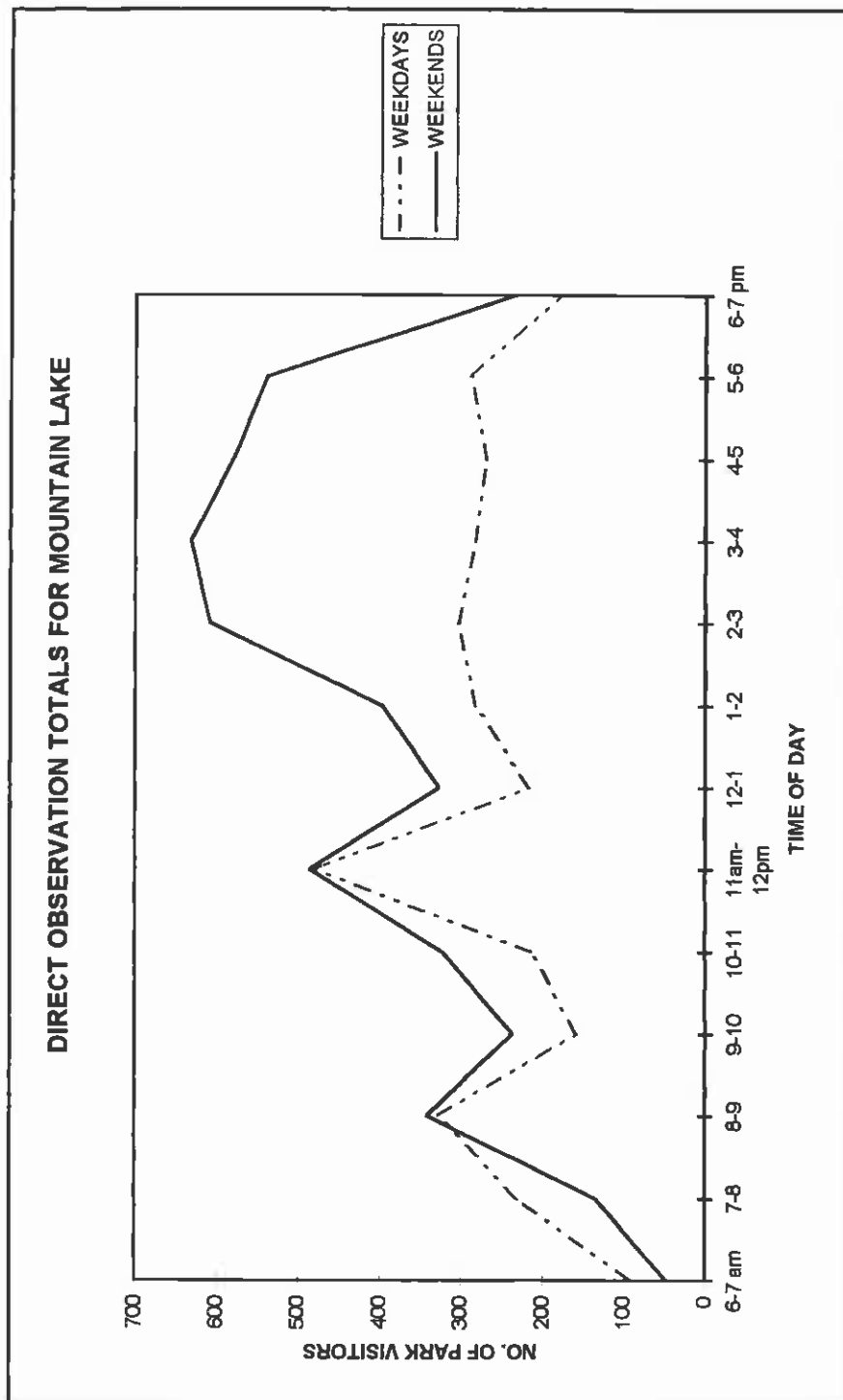


Figure 5a. For weekdays and weekends, the total number of park visitors for the specified time of day represents combined data for three observations recorded during the given hour period (N = 78).

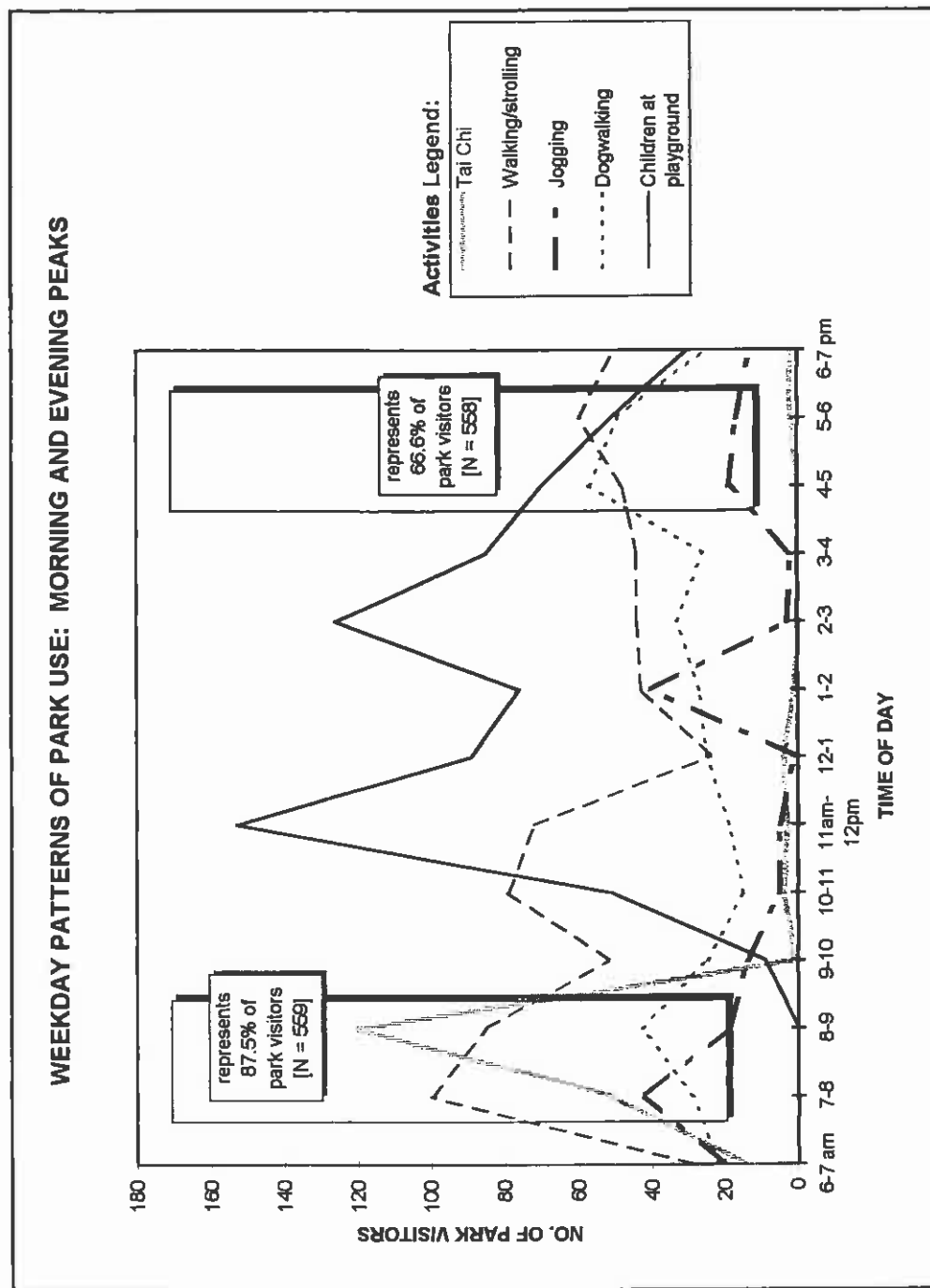


Figure 5b. Several activities represent the majority of park use during the morning and evening peaks. [The total number of park visitors for the specified time of day represents combined data for three observations recorded during the given hour period (N = 78)].

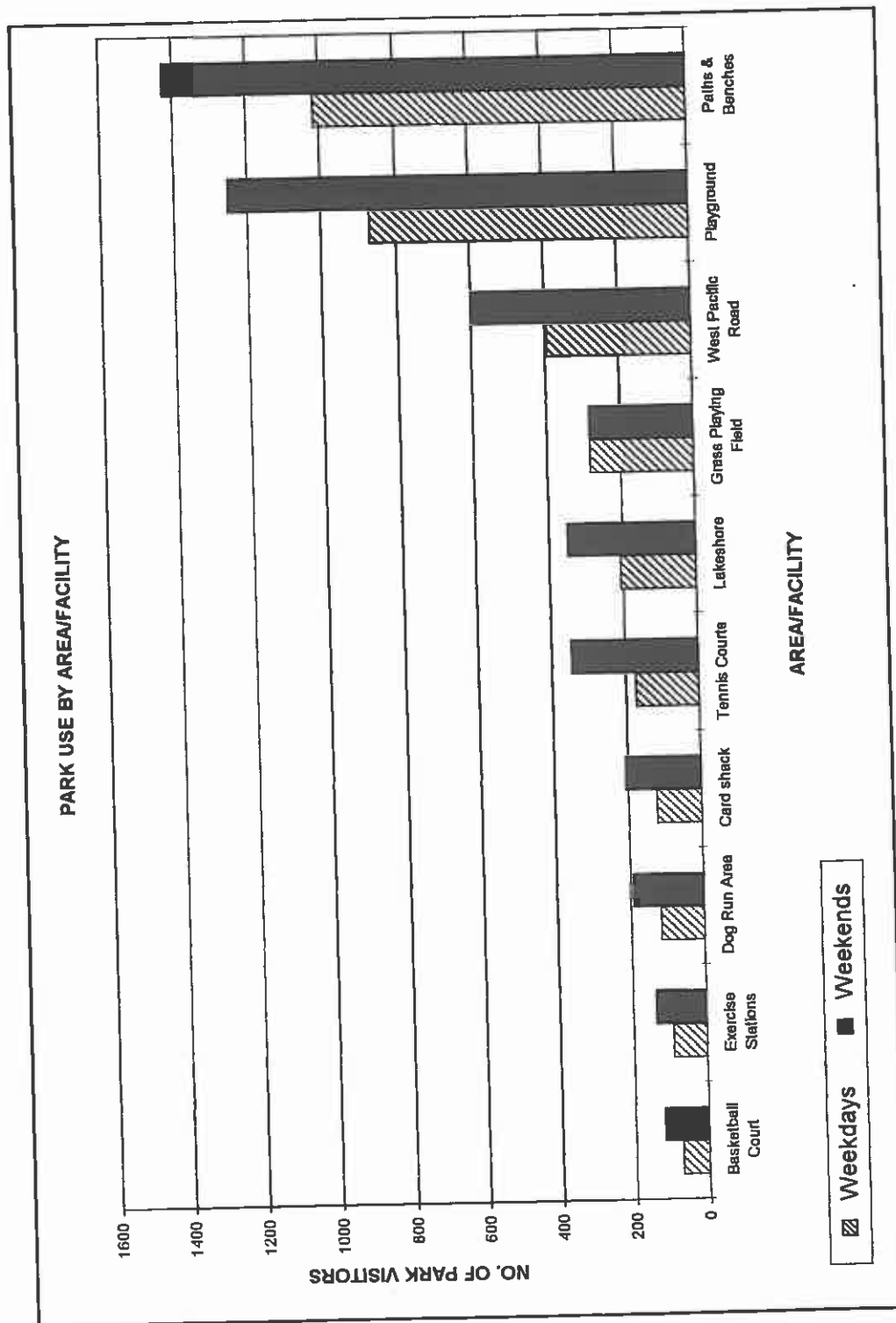


Figure 6. Area and facility use totals are based on 39 observations for both weekdays and weekends [N = 78].

The *General Management Plan Amendment Environmental Impact Statement* for the Presidio [GMPAEIS] (USDI/NPS 1994) uses the general terms of unspecified, defined, and private in which to examine visitor use. Unspecified use does not require a specific place or type of equipment, such as jogging and reading. Whereas, defined use areas are designed for a particular use, such as tennis and basketball courts. Mountain Lake Park provides both types of uses for its visitors. It contains areas for tennis, basketball, baseball, and children's play, while also incorporating open areas for numerous unspecified activities.

Factors Influencing Recreational Use: The weather (36%), work or social commitments (22%), the need to exercise (14%), and the period of the week (weekday vs. weekend) (14%) were identified as the most influential factors affecting an individual's decision to visit Mountain Lake. However, seven percent of respondents noted that there were no limiting factors for them.

Park observations showed that although the park is used throughout the day, activities such as Tai Chi, children playing, and card shack games are directly dependent on the time of day.

A factor mentioned by interviewees was that they do not visit the park unless they are with their children. They specifically go to the park to take their children to the playground and lakeshore.

User Groups and Typical Park Activities: The areas or facilities most frequently used at Mountain Lake are the paths and jogging trails (83%), the grass lawn areas (73%), and the benches (54%). Questionnaire respondents frequently walk (74%), visit the lakeshore (69%), view nature (69%), and relax (57%) during their visit to Mountain Lake Park, the latter two being difficult to assess from observations. Some of the typical activities observed at the park include visiting the lakeshore, playground use, playing cards, tennis or basketball, using the Parcourse equipment, playing sports on the grass playing field, exercising a dog, and walking along the park's paths or on West Pacific Road.

Park observations support the frequent use of paths and jogging trails described in the questionnaire data, but also reveal the playground as a significant area of use. Although children playing is the predominant activity, the playground is also used in the mornings for Tai Chi class. This dual use of facilities was also observed for the basketball court, tennis courts, and Parcourse fitness stations, which are all used in the mornings by individuals practicing Tai Chi. However, only nine percent of questionnaire respondents indicated they participated in the activity. Several other users may not be accurately represented by the questionnaire data: older Russian men and women take care of young children during the day; elderly Russian men congregate in the card shack in the afternoons to play dominoes, cards, and chess; children practice riding their bikes, tricycles, and at the playground and basketball court; many parents and grandparents walk children in strollers, especially during the day; professional dogwalkers use West

Pacific Road daily; and several even take advantage of the park's open environment to practice musical instruments.

Homeless park visitors were also frequently observed loitering in the card shack, picnic table area, by the restrooms, or sleeping on the grass playing field and benches. Shopping carts and other belongings, such as sleeping bags and clothes, were observed discarded by garbage cans. Since the park was not visited during the evening, other dubious or illicit activities were not recorded. However, it was frequently observed that those playing cards in the card shacks would go behind the shacks apparently to urinate. The odor surrounding the shacks verifies this observation.

Values and Concerns of Park Visitors: Questionnaire respondents highly value Mountain Lake's natural setting within the city (77%), its serenity and tranquillity (70%), the lake and shoreline (64%), the safety of the area (64%), its proximity to home (61%), and the park as a place to relax (56%). Most strongly agree that visiting Mountain Lake enhances their overall quality of life (67%), and that Mountain Lake enhances the image of the neighborhood (79%) and makes the city a more livable place (73%). These latter responses support benefits commonly associated with urban open spaces.

Questionnaire respondents are most concerned with the pollution of the lake water (79%), litter and garbage removal (71%), the maintenance of grounds (68%), safety and crime (64.3%), vandalism of park property (60.0%), the decreasing lake depth (57%), and dog litter clean-up (54%).

Views on Restoration: While 64% of the respondents strongly agree that restoration of Mountain Lake and its surrounding natural environment is needed, only 43% strongly agree that the proposed option to dredge the lake to its original depth is the best long-term solution.

Most of the additional comments included with the questionnaires focused on the general park setting and suggestions for improvements. However, several respondents (14.3%) also addressed restoration issues, such as restoring the lake depth, lack of information presented to community, preserving native flora, and less planting of ornamental flowers. One respondent clearly specified that restoration of the area should not interfere with human and pet use of the park.

Four factors (number of years visiting Mountain Lake, frequency of visits, number of blocks residence is from park, and the use of a yard) were also examined for their potential correlation to responses regarding environmental values and concerns, these variables were determined to be statistically independent.

Interviews conducted with individuals who were not affiliated with the Friends of Mountain Lake Park neighborhood organization tended to not be as informed about the area's environmental problems. One Richmond District resident, who has been visiting

the park for five years, mentioned she only recently learned of the lake's poor water quality when the local newspapers covered the abandoned alligator story in 1996.

Plant and Wildlife Habitat

Studies specifically assessing Mountain Lake's habitat are limited, and discussion is generally embedded in comprehensive studies for the entire Presidio of San Francisco. A general overview of the Presidio's open space lands (780 acres) and its species diversity was included in the General Management Plan Amendment Environmental Impact Statement [GMPAEIS] (USDI/NPS 1994). A more recent and extensive flora and fauna inventory for the Presidio was compiled in the Natural Resource Inventory and Vegetation Management Options [NRIVMO] (Jones & Stokes Assoc. 1997). This two part document focuses on the introduced Presidio forests, but incorporates information from the GMPAEIS (USDI/NPS 1994) and Vasey's (1996) research on native plant communities.

Plant Habitat: The GMPAEIS (USDI/NPS 1994) distinguishes between native and nonnative vegetation, and considers the Presidio a "cultural landscape". Native plant communities have been significantly altered by human impacts and introduced species. The Presidio forests represent the majority of this nonnative vegetation, a result of the Army's extensive afforestation program that began in the 1880s. Currently, the forest covers approximately 457 acres and contains almost 400,000 non-indigenous trees (Vasey 1996). Only an estimated 10% of the Presidio's land contains native vegetation. Mountain Lake's immediate borders are classified as being dominated by native plants (USDI/NPS 1994). Due to this scarcity of native vegetation, the importance of restoring and preserving Mountain Lake's native plant communities is magnified. Vasey (1996) suggests that "to serve as the type locality for 58 plant species is a rare distinction for any temperate locality in the world and is another reason to value the Presidio's remaining stands of indigenous vegetation".

Codemo et al. (1995) and Vasey (1996) use the Holland classification system to identify the native plant communities of Mountain Lake and the Presidio respectively. Codemo et al. (1995) focus their discussion on the riparian and wetland communities along the lake's margins and mapped individual indicator species. Blue gum eucalyptus (*Eucalyptus globulus*) is noted due to its significant presence on the lake's eastern margin. The Central Coast Arroyo Willow Riparian Forest is dominated by arroyo willow (*Salix lasiolepis*) and the Coastal Freshwater Marsh by tules (*Scirpus spp.*) and rushes (*Juncus spp.*). However, while Mountain Lake contains some characteristic aquatic emergent vegetation, it is not classified as "a true freshwater marsh community" because its environment has been significantly altered by nonnative plant species and human urban activities (Codemo et al. 1995). There are numerous benefits to wildlife associated with healthy riparian vegetation. It provides habitat, cover, food, and breeding areas; maintains water quality by reducing erosion, sedimentation, introduction of

nutrients, and phytoplankton blooms; and prevents increasing lake temperatures by providing shade (Codemo et al. 1995).

Vasey (1996) conducted a baseline survey of the Presidio's terrestrial vegetation and concentrated on mapping the plant communities with a species list for each defined vegetation area. Approximately 622 acres of natural lands, containing cultural forest, nonnative grasslands, and remnant indigenous vegetation, were examined.

Of the six areas that form the borders of Mountain Lake, there are three native plant communities: Central Coast Arroyo Willow Riparian Forest, Coastal Freshwater Marsh, and Central Dune Scrub³ (Figure 7). These are all located on sandy substrate and contain wetland species. The community with the highest indigenous ratio is the Central Coast Arroyo Willow Riparian Forest (Table 2), while the Coastal Freshwater Marsh at Mountain Lake is the only example of this specific natural community on the Presidio (Vasey 1996).

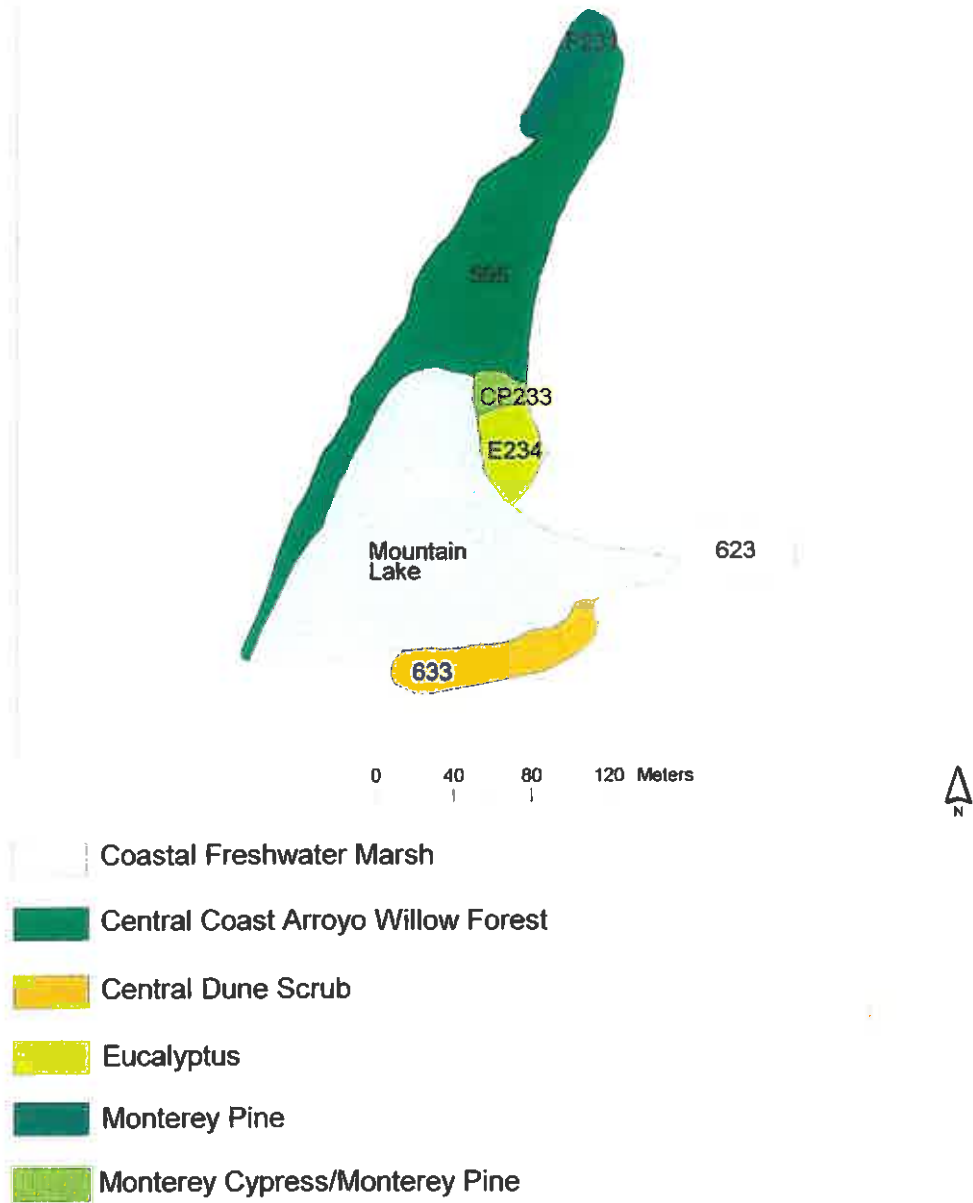
Vasey (1996) identified wetland vegetation as a significant source of indigenous species richness on the Presidio. While they are widely distributed, wetlands are highly restricted in area due to the numerous modifications to the Presidio's natural landscape. A remnant of San Francisco's historic vegetated landscape, "these wetland species, therefore, also possess special conservation value because of their biogeographic and habitat value" (Vasey 1996).

The other three areas bordering Mountain Lake are non-indigenous forest stands. The NRIVMO (Jones & Stokes Assoc. 1997) evaluated wildlife habitat, understory sensitivity, and stand vigor for each forest stands in the Presidio. Information on the three nonnative stands surrounding Mountain Lake is provided in Table 3. The Presidio forests provide habitat for migrating and wintering birds, as well as several local species. Although isolated, the Presidio is an important link in the coastal forests (Jones & Stokes Assoc. 1997).

As for the city park, the SFRPD currently does not have a vegetation management plan for Mountain Lake Park (Yee pers. comm.). Mountain Lake Park has been proposed as a candidate for inclusion in the SFRPD's Significant Natural Resource Areas Management Plan [SNRAMP] (1995). Under this plan, a standardized procedure for inventorying natural resources will be developed and areas will be assessed based on vegetation, wildlife, water, geology/soils, and public use. Although Mountain Lake Park is characterized by a nonindigenous landscape, its naturalistic setting is recognized as contributing to the region's biodiversity by supporting wildlife habitat (SFRPD 1995).

³ These three communities, as well as the no longer occurring Vernal Marsh, are ranked "highest inventory priority" by the CDFG's Natural Diversity Data Base [NDDDB] (CDFG 1990: 1). Additionally, due to their rarity, Holland (1986) also proposes their inclusion in the CNPS's *Inventory of Rare and Endangered Vascular Plants of California*.

Vegetation Polygons Surrounding Mountain Lake



(Vasey 1996)

C. Grosso, MGISC, SFSU

Figure 7 Three native plant communities and three introduced forest stands surround Mountain Lake. Polygon numbers are identified so that information on species may be examined in relevant studies (Vasey 1996, Jones & Stokes Assoc. 1997). There is no polygon for the lake's southwest margin because this is city property and was not included in Vasey's (1996) inventory.

TABLE 2: MOUNTAIN LAKE'S NATURAL TERRESTRIAL COMMUNITIES

<u>Polygon Number</u>	<u>Natural Community</u>	<u>Area (acres)</u>	<u>Indigenous Ratio</u>
595	Central Coast Arroyo Willow Riparian Forest	5.41	.67
623	Coastal Freshwater Marsh	1.37	.40
633	Central Dune Scrub	0.50	.41

Three native plant communities exist around Mountain Lake. The Indigenous Ratio is determined by the number of indigenous species observed compared to the total number of species for the polygon (Vasey 1996). For detailed species data for polygons refer to Vasey (1996).

Table 3: MOUNTAIN LAKE'S INTRODUCED FOREST STANDS

<u>Stand Number</u>	<u>Species</u>	<u>Wildlife Rating</u>	<u>Understory Sensitivity</u>	<u>Stand Vigor</u>	<u>Area (acres)</u>
P231	Monterey Pine	Medium	Nonnative plant species	Medium	0.3
CP233	Monterey Cypress and Monterey Pine	High	Nonnative plant species	Medium	0.1
E234	Eucalyptus	High	Mixed native and nonnative grasslands, forbs, herbs, trees, and shrubs	Medium	0.3

Although the majority of flora species are non-indigenous to Mountain Lake, they provide important wildlife habitat (Jones & Stokes Assoc. 1997)

Concerned by the park's aging trees and shrub cover, in 1980 FMLP obtained funding from the California Urban Forestry Program to inventory and assess the condition of the park's vegetation (McBride 1981). While a Consulting Forester was hired, members of the FMLP also assisted in data collection. Forty-five management areas were categorized on the basis of vegetative cover. Dominant vegetation types of tree, shrub, and grass were identified and mapped. Figure 8 includes McBride's (1981) data, updated with Geolocational data.

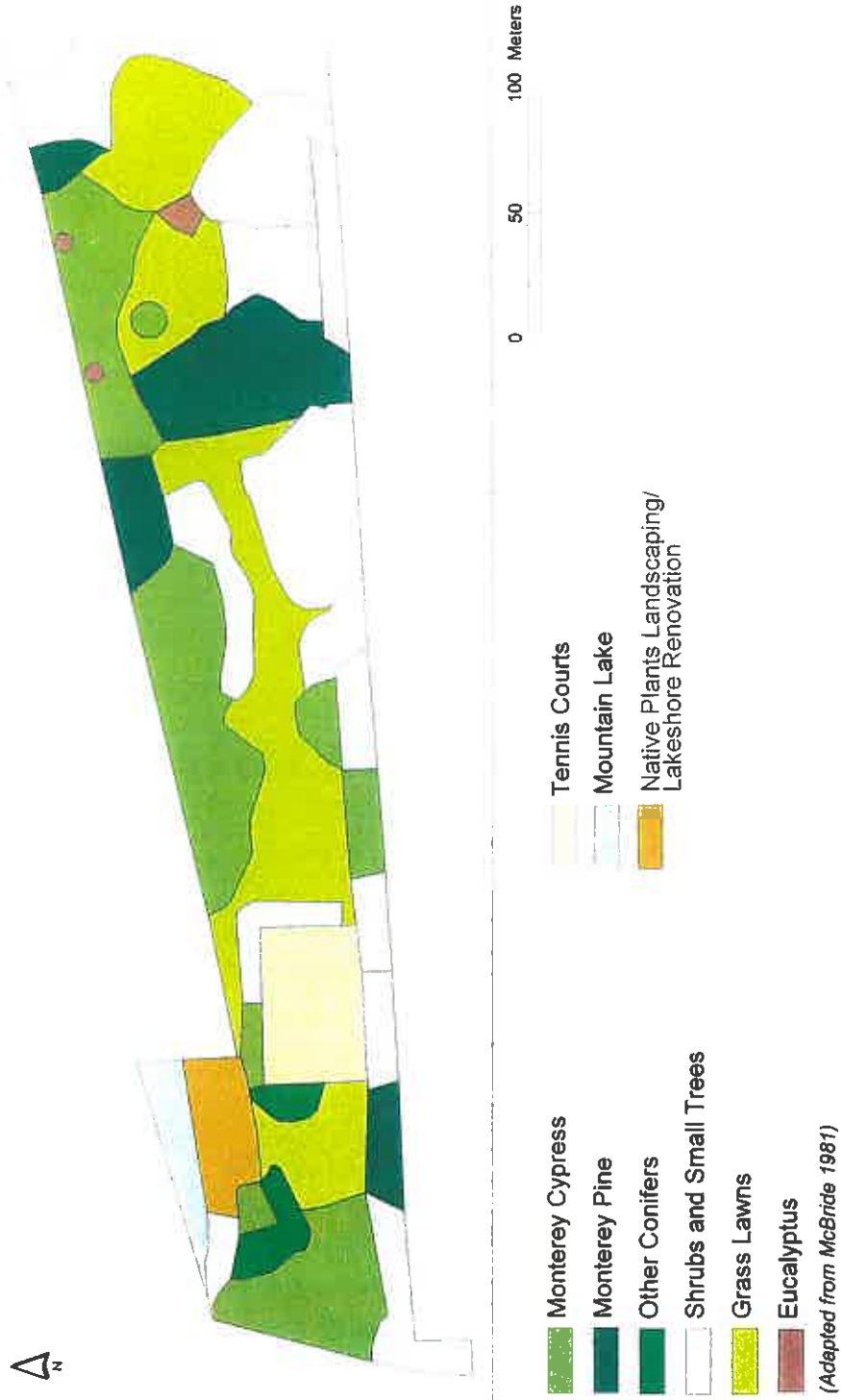
While Codemo et al. (1995) and Vasey (1996) distinguished between native and nonnative vegetation, McBride (1981) focused his discussion on desirable and undesirable plants in regards to the safety of park users. However, it was noted that two rare and endangered plants previously reported by the CNPS were not observed in Mountain Lake Park. Since the identification of grass species in the meadow areas was excluded from the inventory, the presence of California dichondra (*Dichondra donnelliana*) was not noted, but most likely still exists. The San Francisco allocarya (*Plagiobothrys diffuses*) is native to the Northern Coastal Scrub plant community, which once occupied most of the park (McBride 1981). However, only a small relict population currently exists on the southeast margin of Mountain Lake. Since this area is under the NPS' jurisdiction, it was not within the scope of the study (McBride 1981).

Tree hazards, lack of regeneration, root rotting fungus caused by Cape ivy (formerly German ivy) and Algerian ivy smothering vegetation, and control of noxious and poisonous plants were problems identified by the inventory (McBride 1981). Factors associated with vegetative health such as tree age, evidence of disease, soils, wind velocities, and animal damage were examined (McBride 1981). These factors were also associated with the safety and aesthetic enjoyment of park visitors.

Management recommendations focused on improving the condition of vegetation and initiating tree replacement. A priority ranking was assigned according to limiting further deterioration of vegetation, promoting tree regeneration, and protecting the safety of park users. Recommendations were also evaluated for their estimated costs and potential as a community project to incorporate volunteers, which included such activities as planting, general pruning and clearing of areas.

Wildlife Habitat: Few areas of the Presidio are undisturbed by human activities, and its plant communities support only "remnant wildlife habitat" within San Francisco's intensely developed environment (USDI/NPS 1994). Due to its isolated location at the tip of a peninsula, it is also "characterized by a low diversity of reptiles, amphibians, and mammals" and most vertebrate records are for birds (Jones & Stokes Assoc. 1997). While the overall monotypic composition of the nonnative forest does not promote diversity, it does offer important new habitat for terrestrial mammals and birds. Small

Vegetation Map of Mountain Lake Park



C. Grasso, MGISC, SFSU

Figure 8 This map provides a general overview of the vegetation at Mountain Lake Park. McBride's (1981) study was updated with GPS data.

mammals⁴ typical of urban environments have been observed at the Presidio, while the presence of larger mammals has not been documented (USDI/NPS 1994). The Presidio's bird habitat is unique in San Francisco's urban landscape and is used by over 160 bird species at various times of the year (USDI/NPS 1994). Since it is part of the Pacific Flyway migratory route, many species frequent the area during migration or to hunt (USDI/NPS 1994).

A discussion of aquatic species is limited; Mountain Lake was identified as habitat for the California red-legged frog (*Rana aurora draytonii*), federally listed as threatened, and southwestern pond turtle (*Clemmys marmorata pallida*), a federal candidate species. Both are also considered by the California Department of Fish and Game [CDFG] to be "Species of Special Concern" (USDI/NPS 1994, CDFG 1997a). These species have not been observed recently at Mountain Lake, and the southwestern pond turtle may even be extirpated (USDI/NPS 1994).

As of April 1997, the CDFG's Natural Diversity Data Base⁵ [NDDB] contained only one listing for Mountain Lake. There are two occurrences of the California red-legged frog (*Rana aurora draytonii*) within a 300-meter accuracy radius that encompasses all of Mountain Lake and its borders. While there are numerous plant occurrences for the Presidio, the only other animal listing is the Monarch butterfly (*Danaus plexippus*) near Rob Hill, which is located northwest of Mountain Lake (CDFG 1997b).

After the fish kill on July 28, 1994 at Mountain Lake, the dead fish were identified. The resident fish population was all nonnative species and included channel catfish (*Ictalurus punctatus*), carp (*Cyprinus carpio*), spotted bass (*Micropterus punctulatus*), hitch (*Lavinia exilicauda*), and fathead minnows (*Pimephales promelas*) (Codemo et al. 1995). There is also a record of 200 *Gambusia affinis*, tropical fish native to southern Florida and Mexico, being introduced into the lake around 1971 in an effort to control the mosquito population (Chaffee 1973).

Factors Influencing Native Species Habitat

Nonnative plant species, feral animals, water diversion projects, maintenance and construction, and recreational use have potential negative impacts on the Presidio's native plant communities and species diversity (USDI/NPS 1994). Reduction and degradation of native plant communities also affects native bird species whose survival is interdependent with certain plants (Adams 1994). Birds of prey require a combination of large trees for nesting and open grassy areas for foraging (Adams 1994). The city park's

⁴ Foxes, raccoons, opossums, squirrels, rabbits, skunks, shrews, mice, gophers, moles, bats, and feral cats (USDI/NPS 1994).

⁵ The CDFG's Natural Heritage Division is responsible for maintaining the NDDB. It is an inventory of the occurrences of rare, threatened, endangered, and sensitive animals, plants, and terrestrial and aquatic natural communities.

lawns and nearby golf course interspersed with mature Monterey pine and cypress provide this dual habitat at Mountain Lake. Amphibians and reptiles also require protective vegetative cover, since they depend on the external environment to regulate their body temperatures and are limited in their mobility (Adams 1994). One particularly disruptive activity to Mountain Lake's wildlife is the vehicle traffic on State Highway 1 (Park Presidio Boulevard). On a typical weekday, this highway carries more than 60,000 vehicles (USDI/NPS 1994).

While issues associated with the development of surrounding land have a significant impact, the availability of food, water, cover, and space is most limiting for wildlife in the urban environment (Adams 1994). Therefore, the potential and value of an urban area depends not only on its physical environment type, but also its plant communities, size and configuration, and adjacent land uses (Adams 1994). Also important to consider when devising an area's management plan are threatened and endangered species' habitat, vegetational areas important to wildlife, regionally limited or unique habitats, and habitats supporting numerous native animals or exceptional species diversity (Adams 1994).

COMPATIBILITY ANALYSIS

Analysis of the compatibility of recreational use and native species' habitat at Mountain Lake will be restricted to a general overview due to the lack of studies on species and habitat suitability for the area. Discussion of its habitat value is often addressed within larger comprehensive inventories for the entire Presidio of San Francisco. However, by comparing areas of high recreational use with locations of native plant communities and vegetation providing wildlife habitat, potential conflicts can be identified. Figure 9 identifies visitor use for the main recreational facilities and areas. While native plant communities are located along the lake's margins, recreational use of the area is concentrated in the city park. It is also important to examine management's commitment and community values regarding integrating these often divergent objectives.

Based on park observations, the playground is the area that receives the highest use by visitors. But paths throughout Mountain Lake Park and West Pacific Road also receive high overall visitor use. The lakeshore also attracts many visitors, since it is the only place to conveniently access the lake's edge and is in close proximity to the playground. The city park lakeshore is the most frequently used lake border. Two other openings in the vegetation allow accessibility to the water's edge, but are less frequently used for recreation. The eucalyptus stand on the northeast shore is used mostly for viewing the lake, since a band of tules border the shore. Secondly, the gullied area at the southeastern border is frequented predominantly by children and dogs due to its steepness and lack of seating.

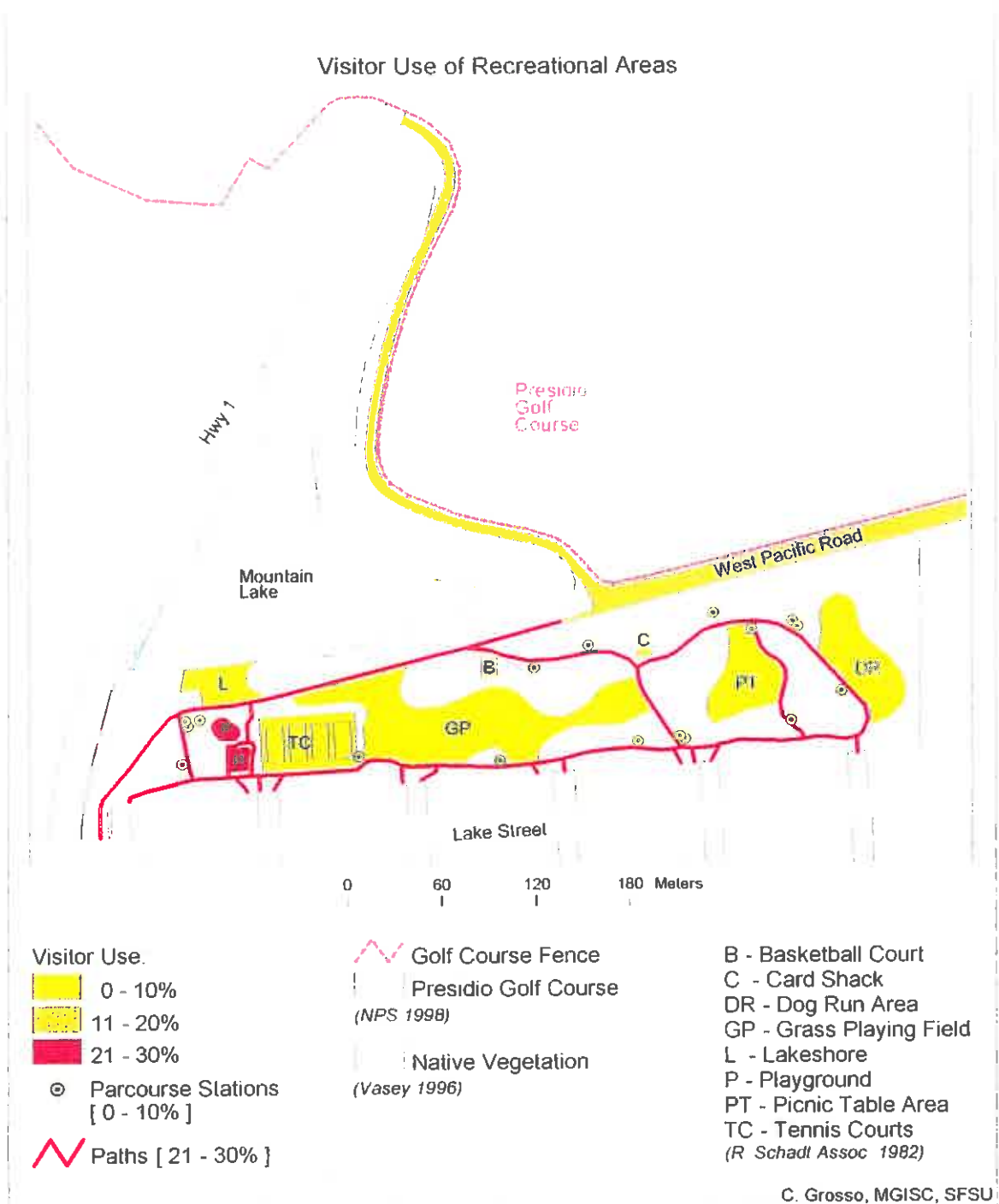


Figure 9 Visitor use of specific recreational areas as a percentage of total number of people observed. Although weekday and weekend use differed slightly, the percentages of total visitor use were within the same range.

Activities common at the city park's lakeshore are feeding ducks, sitting on benches, viewing the lake and its surrounding environment, and children playing at the lakeshore. As for the National Park's boundaries, recreation is primarily limited to trail use (West Pacific Road) due to the dense vegetation and golf course fence that border the trail on either side. Therefore, activities consist of walking, jogging, biking, and dog walking. This restriction is not true for the city park area, where children and dogs stray from paths to play in the shrubs, and individuals look for a more solitary setting. Activities observed that are particularly disruptive to bird species include throwing rocks at the birds, feeding the waterfowl, and off-leash dogs chasing birds.

The native plant communities are located primarily along the lake's margins. Some native species also exist scattered throughout Mountain Lake Park, however a thorough inventory of native vegetation has not been conducted for the area. The area's vegetation is also important to wildlife, especially bird species. The willows, eucalyptus trees, open water, open fields, and northern margin of the lake are identified as areas particularly important to wildlife habitat (Holloran and Murphy, pers. comm.). Since recreational use directly along the lake's borders is limited, the majority of impacts are from larger development projects, such as the highway, golf course, and landscaping with introduced species.

Compatibility of the two often divergent goals of recreation and wildlife habitat also depends greatly on the commitment of the governing agencies responsible for resource management and the community. It is essential that preservation and enhancement of wildlife habitat are incorporated in the area's planning documents for their consideration in future land use decisions (Johnston 1990b). Therefore, it is advantageous that the NPS and SFRPD have established a Memorandum of Understanding [MOU] to more effectively coordinate the management of their adjacent jurisdictions⁶. With the proposed development of its Significant Natural Resource Areas Management Plan [SNRAMP] (1995), the SFRPD has also demonstrated that it recognizes its parks as natural areas offering habitat, species diversity, and remnants of the native landscape, in addition to their recreational use. Mountain Lake Park is assigned a Rank C as a "naturalistic" park. However, if the adjacent lake borders were also considered, it may meet higher priority criteria, such as containing naturally occurring biotic remnants of the indigenous landscape, having special value as a riparian zone and wildlife habitat, and being vulnerable to degradation by exotic plant species (SFRPD 1995).

Compatibility assessment was also integrated into interviews with specialists. There was an overall optimism regarding recreational use and habitat potential at Mountain Lake because the lake's borders are ringed by native plant species, the numerous trees provide important bird habitat, and a contiguous natural area is formed by

⁶ The MOU was finalized in 1996 and was one of the major outcomes of the October 1995 charette.

the adjacent city and national parks. Recreational impacts from beach use and walking were considered to be minimal as compared to the development along the lake's edges (Horne and Thomas, pers. comm.). Although, it was also recognized that since it is a natural area, recreational use should be redefined to include the activities of stewardship, native habitat restoration, and environmental education. This could include gaining an understanding of how one's actions may disrupt the environment and recreational enjoyment of other park visitors (Holloran pers. comm.).

Although compatibility was not specifically addressed in the questionnaire, several values and concerns associated with the environment were incorporated. The majority of respondents (77.1%) assigned a "very important" rating to the park's natural setting within the city and 68.6% indicated viewing nature was an activity they participate in during their park visits. However, only 48.6% assigned the same value rank to providing habitat for animals. Concern regarding loss of native plants (34.3%) and loss of native wildlife (50%) was also moderate.

While parks have traditionally been recognized for their recreational opportunities, a new approach that integrates the objectives of recreational use and preservation of flora and fauna habitat has been offered. An emphasis on environmental education, community involvement, and stewardship are important mechanisms for promoting the long-term sustainability of urban open space areas. So how can some of these principles be incorporated into the management of Mountain Lake? While recreation, native species' habitat, and community involvement are already addressed by different organizations, the area's potential as an educational resource to promote stewardship is not.

Numerous educational opportunities are available at Mountain Lake, and most restoration recommendations advocate an educational component (Codemo et al. 1995, NPS/USDOE 1998). The charette team proposes a comprehensive habitat restoration plan that incorporates the community through "collaborative planning and environmental stewardship" (NPS/USDOE 1998: 46). Several educational opportunities are identified that focus on an interpretive center and aquatic laboratory where a curriculum can be developed for local schools, and university research can be conducted (NPS/USDOE 1998).

However, since there are numerous research opportunities regarding native habitat restoration, reintroduction of native species, treatment of runoff water, and spatial characteristics of natural areas, it would be beneficial to maintain a database of these studies. Currently there is no formal repository for all Presidio/Mountain Lake information, making access and an integrated compilation of available data difficult at best. This information should be readily accessible and useful for future research and management. Relevant data findings on plants, animals, and aquatic and terrestrial natural communities should also be submitted to the California Natural Diversity Data Base [NDDB].

Another interesting research opportunity is sustainable management of the adjacent golf course. While a golf course is considered urban green space, its habitat potential is limited due to its toxicity from chemical treatments and monotypic lawns. Since the golf course is located within the national park and, protecting open space and native habitat are identified NPS goals, it is an innovative situation to investigate and incorporate more sustainable techniques in golf course management. However, for community involvement and stewardship to truly be a component of the area's management, a more extensive outreach effort will have to take place to educate the diverse community of park visitors. Community outreach was conducted by the NPS prior to the public forum in 1996 through poster board sessions at the city park lakeshore, an informative brochure, and a habitat restoration day coordinated with FMLP. However, based on informal interviews⁷ with people not involved with FMLP, residents are not aware of the area's environmental problems. Although, this was tangentially addressed during the alligator media coverage, explanatory signage in English, Chinese, and Russian would be helpful. There is currently no signage explaining the area's habitat potential and sensitivity. However, signage should emphasize the connection between human activities, such as throwing rocks at birds, feeding waterfowl, or letting dogs chase birds, and their disruptive effect on the area's wildlife. This would foster an environmental understanding that does not usually occur by simply posting prohibitive signs. Park visitors could then educate themselves and also become involved in stewardship of the area without having to participate in FMLP.

CONCLUSION

Anthropocentric values of aesthetic and recreational enjoyment associated with urban open space are being expanded to include the important role of green space as urban habitat for both human and wildlife (Adams 1994, Lewis 1996). Since plants and humans have coevolved, humanity's adaptive and survival characteristics are dependent upon a coexistence with healthy flora communities (Lewis 1996). Although the urban environment has been significantly modified by human activities, its vegetation nonetheless has the potential to offer the basic wildlife requirements of food, water, cover, and space. Parks have this ability more than other urban open space because they often contain naturalistic settings and are of larger configurations (Adams 1994).

The ecosystem surrounding Mountain Lake offers the opportunity for a variety of recreational uses and has the potential to provide a viable habitat for native plants and animals. The adjoining city and national parks around Mountain Lake provide a variety of settings and facilities that allow solitary and social interactions, and exercise-related and unorganized activities. Visitors to the area are diverse in ethnicity and age, as well as in their reason to visit the park. There are also distinct patterns of use based on the time

⁷ Interviews were only conducted in English.

of day that allow the same facility to be used for several activities. While the continuous impact of humans for over two hundred years has dramatically transformed the landscape, especially the construction of State Highway 1, remnant native plant communities still exist along the lake's margins. Most often noted for the numerous avian species that frequent the area, Mountain Lake's native and nonnative vegetation provides important bird habitat as well as potential habitat for other endangered species.

While the area is already valued for its recreational opportunities, an environmental education program could connect community members with the natural environment of Mountain Lake. Since habitat restoration is still in its preliminary stage, environmental education could serve as the pivotal link between official governmental efforts and the neighborhood community, who would benefit from an ecologically healthy ecosystem at Mountain Lake. The community of Mountain Lake, primarily represented by FMLP, is an invaluable resource to restoration efforts. They have displayed on numerous occasions that they want to be active participants in the future of Mountain Lake, including a strong attendance at the public forum regarding lake restoration. An environmentally educated community can help maintain momentum during long-term restoration efforts through community involvement and stewardship, and therefore, should be a major cornerstone of future plans. While the priorities of governmental organizations, such as the NPS and SFRPD, change due to other obligations and available funding, Mountain Lake is a main priority for its neighborhood residents.

The Mountain Lake area and its management are fragmented under various national and city agencies. There is no regional or area plan for the entire lake and so management continues in a piecemeal fashion. The new Significant Natural Areas Plan by SFRPD has the possibility of incorporating the two governmental agencies in a combined plan, but does not appear to be moving in that direction. Until a truly combined wholistic effort is pursued the fate of this area treasure remains in danger.

Mountain Lake's historical, recreational, and ecological significance in San Francisco's urban landscape is recognized, and restoration of its landscape offers innovative opportunities. Mountain Lake is one of San Francisco's "endangered species" and makes the city a more livable place (Blackwell 1997). The area's native habitat potential presents a rare opportunity to integrate the principles of urban open space and to adopt a new approach in managing - one that emphasizes a community and governmental partnership for providing recreational use and wildlife habitat. Current restoration of the area hinges on remediation of the lake, the focal point of the ecosystem. The plan implemented will affect the long-term potential for native flora and fauna habitat. However, future efforts can be directed towards a greater integration of objectives by coordinating lake and native habitat restoration and community education. Mountain Lake also presents an encouraging opportunity to recognize the diverse roles of urban parks by expanding their traditional aesthetic and recreational roles to include a commitment to the ecological health of natural environments within the urban landscape.

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APPENDIX : COPY OF QUESTIONNAIRE

1. How do you get to the park? (Check all that apply)

- ☐ Walk ☐ Bicycle ☐ Jog ☐ By car
☐ By public transit ☐ Other: _____

2. Within how many blocks of Mountain Lake do you live?

- ☐ Within 1 block ☐ 1 to within 2 blocks ☐ 2 to within 3 blocks
☐ 3 to within 4 blocks ☐ Over 4 blocks

3. Do you rent or own your residence?

- ☐ Rent ☐ Own

4. Do you use a front or back yard at your residence?

- ☐ Yes ☐ No ☐ Don't have a yard

5. Who do you go to the park with? (Check all that apply)

- ☐ Alone ☐ With children ☐ With friend(s)
☐ With spouse or partner ☐ With family relative(s) ☐ With dog(s)

6. How many years have you been visiting Mountain Lake?

- ☐ Less than 1 year ☐ 1-3 years ☐ 3-7 years ☐ 7-12 years ☐ No opinion

7. On a scale of 1 to 4 where 1 is "least important" and 4 is "very important", please evaluate each item below in terms of its VALUE to you at Mountain Lake. Please use 0 to indicate "no opinion".

Rating 1 - 4	Rating 1 - 4
Lake and shoreline _____	Natural setting within the city _____
City park area and facilities _____	Escape from city life _____
Serenity and tranquility _____	Habitat for animals _____
Proximity of park to home _____	Place for children/families _____
Place to exercise _____	Place to walk dog _____
Sense of community _____	Place to relax _____
Safety of area _____	Other: _____

Please check the phrase that best describes your opinion on the following three statements:

8. Visiting Mountain Lake enhances your overall quality of life.

- ☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐ No opinion

9. Mountain Lake enhances the image of the neighborhood.

- ☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐ No opinion

10. Mountain Lake makes the city a more livable place.

- ☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐ No opinion

11. Which of the following do you use at Mountain Lake? (Check all that apply)

- | | | |
|---|--|---|
| ☐ Tennis courts | ☐ Playground | ☐ Basketball court |
| ☐ Picnic tables | ☐ Dog running field | ☐ Exercise stations |
| ☐ Playing field area | ☐ Benches | ☐ Paths and jogging trails |
| ☐ Grass lawn areas | ☐ Card shack | ☐ Other: _____ |

12. Which of the following activities do you participate in while visiting Mountain Lake?
(Check all that apply AND circle those activities that you do on a regular basis)

- | | | |
|--|--|---|
| ☐ Walk | ☐ Walk dog | ☐ Walk children in stroller |
| ☐ Jog | ☐ View nature | ☐ Take children to playground |
| ☐ Exercise | ☐ Relax | ☐ Birdwatch |
| ☐ Feed ducks | ☐ Play tennis | ☐ Play basketball |
| ☐ Play softball | ☐ Practice Tai Chi | ☐ Play cards, chess, or checkers |
| ☐ Sit on benches | ☐ Sit on grass areas | ☐ Socialize with friends/family |
| ☐ Visit the lakeshore | ☐ Visit Myrtle the swan | ☐ Participate in park clean-ups |
| ☐ Other: _____ | ☐ Other: _____ | |

13. What factors affect your decision to visit Mountain Lake? (For example, weather, season, day of week, work or social commitments, family and friends' schedules, personal health, or number of people at park).

14. How often do you visit Mountain Lake?

- | | | | |
|---|---|---|--------------------------------------|
| ☐ Everyday | ☐ 4-6 times per week | ☐ 2-3 times per week | ☐ Once a week |
| ☐ Once every 1 1/2 weeks | ☐ Once every 2 weeks | ☐ Don't visit the park regularly | |

15. Which days do you go to the park?

- | | |
|---|---|
| ☐ Weekends - Saturday and Sunday | ☐ Everyday |
| ☐ Weekdays - Monday through Friday | ☐ Don't visit the park regularly |

16. What time of day do you visit Mountain Lake? (Check all that apply)

- | | | |
|--|---|---|
| ☐ Between 6:00 a.m. - 8:00 a.m. | ☐ Between 8:01 a.m. - 11:00 a.m. | ☐ Between 11:01 a.m. - 1:00 p.m. |
| ☐ Between 1:01 p.m. - 5:00 p.m. | ☐ Between 5:01 p.m. - 9:00 p.m. | ☐ Between 9:01 p.m. - 5:59 a.m. |

17. Approximately how long is your typical visit to Mountain Lake?

- | | | |
|---|---|---|
| ☐ Less than 30 minutes | ☐ Between 30 minutes to 1 hour | ☐ 1 to 1 1/2 hours |
| ☐ 1 1/2 to 2 hours | ☐ 2 to 3 hours | ☐ Over 3 hours |

18. On a scale of 1 to 4 where 1 is "least important" and 4 is "very important", please evaluate each item below in terms of its **CONCERN** to you at Mountain Lake. Please use 0 to indicate "no opinion".

Rating 1 - 4		Rating 1 - 4	
Maintenance of grounds	_____	Litter and garbage removal	_____
Vandalism of park property	_____	Pollution of lake water	_____
Erosion of shoreline	_____	Decreasing lake depth	_____
Loss of native plants	_____	Loss of native wildlife	_____
People feeding ducks	_____	Dogs running loose	_____
Noise from highway	_____	Dog litter clean-up	_____
Safety and crime	_____	Being informed of environmental issues	_____
Other: _____	_____	Other: _____	_____

Please check the phrase that best describes your opinion on the following two statements:

19. Restoration of Mountain Lake and its surrounding natural environment is needed.
☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐ No opinion

20. The proposed option to dredge (removal of sediment from lake bottom) the lake to its original depth is the best long-term solution.
☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐ No opinion

Please tell me a little about yourself:

21. Sex: ☐ Male ☐ Female

22. Age: ☐ Younger than 25 ☐ 25-39 ☐ 40-55 ☐ Older than 55

23. Marital Status: ☐ Single ☐ Partnered or married ☐ Divorced or separated

24. In which category does your combined household income last year fit best?
☐ below \$30,000 ☐ \$70,001 - \$120,000 ☐ Over \$200,000
☐ \$30,001 - \$70,000 ☐ \$120,001 - \$200,000 ☐ Decline to state

25. Highest completed level of education:
☐ Some high school or less ☐ Some college ☐ Postgraduate
☐ High school graduate ☐ College graduate ☐ _____

Please use the space below and on the back of this page to include any additional comments you have, including projects you think are needed at Mountain Lake. If you have any questions, please contact Dr. Barbara A. Holzman at San Francisco State University, Dept. of Geography and Human Environmental Studies, 1600 Holloway Avenue, San Francisco, CA 94132. *Thank you again for your participation!*

APPENDIX COPY OF OBSERVATION CHECKLIST

DATE: _____	WEATHER:	blue skies prty cldy overcast
DAY: _____		sunny rainy breezy windy
TIME: _____		temp. (at Geary & 9th)

COMMENTS: _____

ACTIVITIES	TOTAL
LAKESHORE	
☐ Feeding ducks	☐
☐ Sitting on benches	☐
☐ Viewing lake/at shoreline	☐
WEST PACIFIC ROAD - EAST	
☐ Exercising - jogging	
☐ Exercising - walking quickly	
☐ Biking	
☐ Walking - alone	
☐ Walking - alone w/dog(s)	
☐ Walking - w/others	
☐ Walking - w/others & dog(s)	
☐ Walking - w/children in stroller	☐
☐ Professional dogwalker	☐ Practicing Tai Chi
WEST PACIFIC ROAD - NORTH	
☐ Exercising - jogging	☐ Walking - alone
☐ Exercising - walking quickly	☐ Walking - alone w/dog(s)
☐ Biking	☐ Walking - w/others
☐ At eucalyptus grove	☐ Walking - w/others & dog(s)
☐ Professional dogwalker	☐ Walking - w/children in stroller
☐	☐
BASKETBALL COURT	
☐ Playing basketball	☐ Sitting on bench or log
☐ Practicing Tai Chi	☐ Talking with others
☐	☐

CARD SHACK

☐ Elderly Russian men playing dominoes or cards

☐ Talking w/others

PICNIC TABLE/GRASS LAWN AREA

☐ Eating

☐ Sitting alone or w/children

☐ Children playing

☐ Talking w/others

☐

☐

DOG RUN AREA

☐ Playing with dog(s) in field

☐ Talking with others - standing

☐ Sitting alone on bench by field/path

☐ Talking with others - bench by field/path

☐ Standing by or walking to dog area

☐

GRASS PLAYING FIELD

☐ Dog activity

☐ Picnicking

☐ Playing with a ball

☐ Sitting on grass

☐ Playing - softball at screen

☐ Sitting on benches

☐ Children playing

☐ Talking with others

☐

☐

TENNIS COURTS

☐ Playing tennis

☐ Sitting on benches

☐ Practicing Tai Chi

☐

PLAYGROUND

☐ Children playing - slide area

☐ Children playing - jungle gym

☐ Grassy hill

☐ Sitting on benches (childcare related)

☐ Picnic table

☐ Practicing Tai Chi

☐ Sitting on benches/Talking w/others

☐

☐

FACILITIES THROUGHOUT PARK

EXERCISE STATIONS

- | | |
|--|---|
| ☐ Children playing on equipment | ☐ Practicing Tai Chi/Stretching |
| ☐ Exercising | ☐ Sitting on equipment alone or w/others |

BENCHES

LOGS

- | | |
|--|--|
| ☐ Reading | ☐ Reading |
| ☐ Writing | ☐ Writing |
| ☐ Sitting alone or w/children | ☐ Sitting alone or w/children |
| ☐ Sleeping/napping | ☐ Sleeping/napping |
| ☐ Talking with others | ☐ Talking with others |

GRASS LAWNS

- | | |
|--|--|
| ☐ Picnicking | ☐ Reading |
| ☐ Playing with children | ☐ Sleeping/napping |
| ☐ Practicing Tai Chi | ☐ Talking with others |
| ☐ | ☐ |

PATHS

- | | |
|---|---|
| ☐ Exercising - jogging | ☐ Exercising - walking quickly |
| ☐ Practicing Tai Chi | ☐ Biking |
| ☐ Walking - alone | |
| ☐ Walking - alone w/dog(s) | |
| ☐ Walking - w/others | |
| ☐ Walking - w/others & dog(s) | |
| ☐ Walking - w/children in stroller | |
| ☐ | ☐ |

TOTAL NO. OF PEOPLE AT PARK

APPENDIX INTERVIEW QUESTIONS FOR PARK VISITORS

Name of Respondent: _____ Date: _____

1. How often do you visit Mountain Lake? How many years?
2. Describe your typical visit to Mountain Lake.
3. What factors influence your decision to visit Mountain Lake?
4. Since you have been visiting Mountain Lake, have you noticed any changes in the physical landscape?

in the types of people visiting the park?

in the types of activities people participate in while at the park?
5. Who would you identify as the main groups of people who use Mountain Lake?
6. What do you value about Mountain Lake?
7. Do you have any concerns regarding Mountain Lake?

8. What improvements do you think are needed?
9. Are you familiar with restoration proposals for the lake? Do you think the lake and its surrounding area should be restored?
10. What do you think about the proposed option to dredge the lake, or would you suggest another alternative?
11. Do you think the majority of the community supports restoration?
12. Do you have any additional comments to add?