

San Francisco's Golden Gate Park is the largest human-made urban park in the country. ¹ Golden Gate Park is an area consisting of 1,017 acres. Rather than a space comprised of land and trees preserved in the city for residents' use and kept from development, Golden Gate Park is a human-made park which originally contained few native species and whose land was originally sand dunes rather than the green space it is today. It is an attraction for tourists and residents alike. This paper will examine some of its history and will explore whether its various elements represent a sustainable contribution to San Francisco's urban design. The California Academy of Natural Science's building and contribution within the park to the overall green design of the city will also be explored.

In the 1860's San Francisco was in the process of establishing itself as an urban center and attempting to make a conscious move from its existing reputation as a gold rush outpost. During this time period romanticism was a prevailing wave of thought and park spaces were modeled first upon European and then great parks in the eastern United States. An urban green space was thought to be necessary to counteract the ills of urban living and to promote morality and connection to the rural country-like nature of parks. ² Romanticism sought to inspire the participant emotionally by providing aesthetically pleasing environs.

The location chosen to become the site of the Golden Gate Park within San Francisco was not thought to be the most conducive site possible. Then known as the 'outside lands', the area was west of most of the already settled area of San Francisco and consisted of wind swept sand dunes. ³ Noted expert Frederick Law Olmsted, creator of New York City's Central Park, did not consider this outside land area at all when searching for the appropriate location for the park, as other sites existed which were sheltered from winds and retained greenery year round. ⁴ The outside lands area was sparsely populated by undesirables who had basically been cast out of the city proper for various poor behaviors. The ultimate decision to locate the park in the outside lands seemed to have had less to do with the ideal physical location for the park than with political advantages involving claiming the outside lands for San Francisco and moving to capture funds from these undesirables by paying for a title for their home for which they then needed to start to pay taxes. Because of the negative connotations of the outside lands area, at first it was not a popular choice among those who lived in the city but in time it would come to be accepted.

After choosing its location the city went about its work of claiming the sand dunes and planting various grasses to cut down on erosion by winds. The work was challenging as there were no real roads leading the area and it was difficult to find plants that would take hold in the soil to begin to stabilize the sand. By 1872 the park was completed and it has remained a central part of city life in San Francisco in the ensuing 100 plus years.

There are many benefits offered by the acres contained within the park space. The many acres of green lands are available to use for the public, representing a valuable opportunity to the many residents of San Francisco who do not have their own private yard. The opportunity for public physical fitness activities within the city limits including rollerblading, tennis, and bicycling in sanctioned areas of the park are a few examples of these benefits. The park also has the ability to inspire affinity toward the natural world for those city dwellers otherwise unable to access areas outside of the city. Because of the size and design of Golden Gate Park, there are places in the park where one can feel almost as if one is in the woods when they are really only in walking distance of various neighborhoods and restaurants. This is another aspect contributing to the overall green design of the park.

Another interesting destination in the park is the Buffalo paddock. The paddock opened in 1892, around the time that the great American Buffalo was on the verge of extinction, and has now been around for over 100 years. When first established, the park contained such animals as bison, bears and elk that were allowed to roam for a time before the nearby San Francisco Zoo was established. ⁵ The buffalo paddock remains, and the buffalo in the park today are related to the original buffalo from 1892.

The majority of the plants and trees in Golden Gate Park are not native to the area, but have been chosen because of their adaptability to the Mediterranean-like climate in San Francisco. Although the trees and plants may be exotic they give many of the same benefits as natives. Considering all of the acres in Golden Gate Park and the many trees contained within its acreage, the absorption of CO₂ is one benefit the park offers that would not have been as available if the land had remained in its original form as sand dunes. Stormwater runoff is also captured in the acres of park land that may otherwise have been developed in the last century and paved over with cemented roads. At times the park has also acted as a gathering place for residents. An example is after the great earthquake of 1906, many residents who were rendered homeless by earthquake damage gathered in the park to live in temporary housing in tents. The park has also had its place in cultural history as it served as an iconic gathering place in the 1960s.

Aside from the benefits the large park space of the Golden Gate Park offers to city residents, some of its impacts deserve discussion. At various times in its history the park has been challenged. For example, in the 1970s the park began to decline as many of the trees planted had reached a maturity of 100 years and died off; other species which were unable to remain healthy in the artificial conditions of the park also began to decline. ⁶ A reforestation plan was put into place. Because of the low organic compounds in the soil of reclaimed sand, the process was a labor intensive one which required hand watering for saplings. ⁷ It is uncertain as to the complete impact of the planting of grasses in reclamation of the sand dunes, or what impact the great number of exotic plant species in the park have had on biodiversity in the area. As one example, European Beach Grass was used to help to stabilize the dunes that later came to become the park lands of the Golden Gate Park. European Beach Grass lowers the diversity of native grasslands on the beach by the dense stands it forms, as well as reducing insect diversity and nesting ground for the threatened western snowy plover. ⁸

Today there is a strand of native coast live oaks in the eastern edge of the park which represents the entirety of the native tree population. Eucalypts were used in the establishment of the park land and make up 20% of the park's trees. They are so ubiquitous around San Francisco that it is somewhat controversial to suggest thinning out some of these trees. The Blue gum eucalyptus trees were unique in that they could successfully grow in the sandy soil of the park and could withstand the Pacific winds. Aside from not being native to the area, the trees drop big branches and shed long strips of bark, both of which are flammable. They also shade other tree species and consume much of the available groundwater, preventing as many other trees from growing. At the same time the trees do provide critical habitat for dozens of species, such as great horned owls, red-shouldered hawks, red-tailed hawks and Cooper's hawks. ⁹

The park includes a series of nine artificially made lakes, Stow Lake being the largest. While the nine lakes within Golden Gate Park add to the pleasant experience for park goers to view ducks or rent a paddle boat, these artificially made creations also require maintenance. At times the lakes have been found to be polluted and filled with sediment with eroding shorelines, and to leak large amounts of water into the underlying sand. ¹⁰ Both plant and animal invasive species are found within the lakes. In the history of the park, funds have not always been designated to take regular care of the lakes and to maintain the liners that separate them from the sand below.

Another inter-related aspect of the impact of an artificially created park is its impact on water consumption. Golden Gate Park's annual water usage is 2 million gallons. ¹¹ A pending proposal would allow the western part of San Francisco, where Golden Gate Park is located, to use recycled water. The Proposed Westside Recycled Water Project would have the ability to deliver approximately two million gallons per day of recycled water. Use of this recycled water for non-potable applications would expand the San Francisco Water Department's water supply portfolio, increase the supply system's reliability, decrease demand on surface water, and decrease discharges to the Pacific Ocean. ¹² In the 1950s a similar method was used in the use of effluent. During cold weather, with the introduction of artificial detergents but before modern biodegradable products, detergents would cause a discharge of foam to form on the creeks connecting the artificial lakes and could even be blown onto the roads. ¹³ The proposal to use recycled water is still being considered and possibly has been slowed to some degree because of the many budget challenges faced by California in the current economic downturn. For now the park's large water consumption continues to consist solely of drinkable water.

In constructing the park in 1872, the city obliged future generations to make decisions about maintaining the park's artificial infrastructure. Both deciding to maintain the park lands or not are both decisions that can vary depending upon the cultural values and priorities of different time periods.

Further along in the history of the park, public educational opportunities like museums were offered in addition to the outdoor garden-like spaces. Other amenities in the park include buildings left from the 1894 Midwinter International Exposition including the M.H. de Young Fine Arts Museum which was successful enough during the exposition to be established as a permanent museum. The Japanese Tea Garden, constructed to display the Japanese lifestyle, was also originally constructed for use in the exposition. The garden, covering five acres, features a teahouse, sculptures, ponds, bridges and many native Japanese plants and remains a very popular destination in today's Golden Gate Park. ¹⁴ Other examples include The Conservatory of Flowers and the California Academy of Sciences.

The California Academy of Sciences is worth discussing as it is a notable green building located within the largest green space in the city, the Golden Gate Park. The building recently received a platinum LEED rating designation, which renders it the largest and most-visited LEED Platinum building in the

world.¹⁵ The building was designed by architect Renzo Piano who had previously completed the Centre George Pompidou in Paris, making him experienced in designing revolutionary museum spaces.¹⁶ The building not only has a green roof but contains many other elements in its architectural design in order to make as little an impact as possible on its environment.

The building's green roof contains hills on the roof designed with the hills of San Francisco in mind, and the hills also work to channel the cool air from the Pacific down into the main part of the roof, thereby using natural means to cool the building. This is an important benefit to offer as one-sixth of all electricity consumed in the U.S. goes to cool buildings. Black tar-and-asphalt building rooftops typically used by many urban buildings lead to a phenomenon known as the "Urban Heat Island" effect, when rooftops and pavements trap heat and cause cities to be several degrees warmer than outlying areas. The Academy of Natural Science's green rooftop keeps the building's interior an average of 10 degrees cooler than a standard roof would. The plants which make up the green roof also transform CO₂ into oxygen and capture approximately 3.6 million gallons of rainwater annually that would otherwise overwhelm stormwater systems in heavy rain periods.¹⁷ In contrast to the plants found in Golden Gate Park, all of the plants found on the building's roof are native to the area. The plants will be able to withstand periods of little water, will be able to resist the salt spray from ocean air, and can tolerate wind along with reducing energy needs for heating and cooling.¹⁸ According to the Academy's website, they are planning a future project when the endangered San Bruno elfin butterfly and the Bay checkerspot butterfly will be introduced to this new habitat of native wildflowers.

The Academy's roof includes several other energy efficient features. Its circular skylights are fitted with heat sensors, and are programmable to open and close based on the time of day and weather, controlled by a building management system. This system actually took a year of monitoring through all four seasons to determine the best set up for the system.¹⁹ The planted area of the roof is surrounded by 60,000 photovoltaic cells to supply 5 to 10 percent of the Academy's energy needs and prevent more than 405,000 pounds of greenhouse gas emissions annually.²⁰ Another one of the interesting elements to the building's design involves the use of recycled denim employed as insulation in the museum. This product allows for the use of non toxic recycled materials which are formaldehyde-free and safe for workers to install as well as increasing the building's capacity to hold heat and absorbing sound better than spun fiberglass insulation.²¹

The Academy is one of ten green building projects of the San Francisco Department of the Environment, an initiative to develop models for workable, sustainable public architecture. The building is energy and water-efficient (consuming 30-35% less energy than required by code), and uses natural daylight and recycled building materials wherever possible. ²²

The building's green roof reportedly cost \$500 million to construct. ²³ Perhaps in part to offset this, the cost of admission to the museum is \$25.00 per person, seeming to be somewhat higher than other museum admission prices. This raises concerns about the accessibility of green spaces and abilities of many segments of society to be participants in these green-designed spaces, whether public spaces or private homes. Cost and accessibility seems a primary drawback at this point in green building design's evolution. It is worth noting, however, that many of the green improvements to energy usage will be realized over time. The up front cost to investing in this, as well as the less easily quantifiable benefits to the surrounding environment in the park, do have a real cost associated with them for which able residents of a city need to decide if they are willing to pay.

In closing, what I found unique about this project was the idea of the largest public use platinum LEED certified building designed with many green design elements, and its placement within the largest human-made urban park in the country. Although there are elements to the Golden Gate Park which might be done differently if designed with true low impact methods in mind, such as more native plantings which require less water usage and which can be longer lasting without as much maintenance required, the park represents a remarkable urban park space. The California Academy of Sciences building is an attractively designed and inviting building which kept the idea of the building's footprint in the forefront of the planning of its design. This building whose purpose is to interest visitors in learning about nature is unique in that its building uses natural elements as part of its design and leaves as little impact as possible on the park in which it is located.

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