SAN FRANCISCO
GREEN ROOF TYPOLOGIES

Research + Education
Exposing the Public to the Potential of Green Roofs

CALIFORNIA ACADEMY OF SCIENCES

Photo: Kay Chang

CASE STUDY FACTS

CALIFORNIA ACADEMY OF SCIENCES

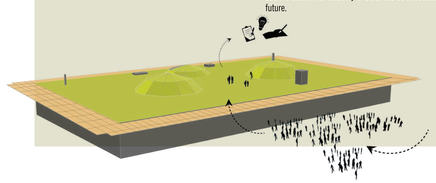
Year: 2007
Type: Intensive
Size: 197,000 sq. ft. (2.5 acres)
Access: Public access from museum to observation deck
Modular Greenroof System: Bio-Trays
Cost: ~$20 million
Designed by: Rana Creek

PROJECT BACKGROUND

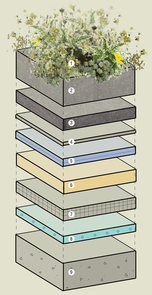
The California Academy of Sciences is a perfect opportunity to support, educate, and engage the public in local native plants because it is a popular museum in San Francisco and offers many opportunities to learn from and do research on its living roof.

The roof was primarily built for research and educational purposes. Some examples of the subjects of research projects include plant identification and studying which thrive on the roof, ground beetle diversity, bird habitat identification, cavity nesting native bees, ornothology, and carbon offsets. The roof structure itself also provides for unique research opportunity because different plants and their root systems have varying reactions to the slopes of the domes.

The museum is very open to new research projects that follow a scientific methodology and are open to valid peer review. The ability to do research on such a large scale is incredibly important for the success of green roofs in the future. Seeing the results of these studies will bring more answers for new green roof technology. San Francisco green roofs will be able to use the California Academy of Sciences as a test subject to improve the green roofs of the future.



ROOF SECTION



ROOF SECTION LAYERS
1. 80 DIFFERENT PLANT SPECIES
2. BIODEGRADABLE TRAYS
3. ADDITIONAL SOIL
4. POLYPROPYLENE FILTER SHEET
5. PLASTIC DRAINAGE LAYER
6. VINYL PROTECTION LAYER
7. POLYSTYRENE INSULATION
8. THERMAL PLASTIC WATERPROOFING
9. BUILDING CONCRETE

Urban Agriculture
Feeding Communities from a Rooftop

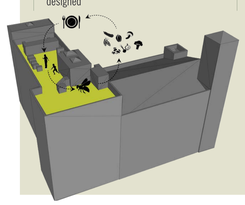
GRAZE THE ROOF

Photo: Graze the Roof

CASE STUDY FACTS

GRAZE THE ROOF

Year: 2008
Type: Lightweight
Size: 2,500 sq. ft.
Access: Public
Modular Greenroof System: Upcycled raised garden beds
Cost: Low Cost
Designed by: Volunteer/communiy designed



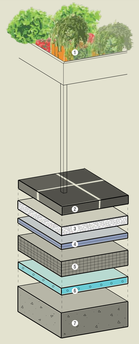
PROJECT BACKGROUND

This edible, community produced vegetable garden on the rooftop of Glide Memorial Church allows youth and volunteers to participate in and learn about urban agriculture. It features garden beds, a worm composting system, and an educational mural. On this rooftop the community can learn all about permaculture and how to plant seeds, harvest produce, cook healthy meals, compost, and extract honey. Workshops are also held to teach the community more about where their food comes from, cooking different recipes, and other aspects of urban farming.

The Graze the Roof site consists of native fruits, vegetables and 50,000 bees that live in the rooftop beehives. Each week, 10-15 pounds of salad from the roof goes to Glide Memorial Church kitchen, where 3,000 meals are prepared per day for people in the community.

Graze the Roof is an inspiring, community run urban agriculture project that will continue to grow with the help of volunteers and fundraising. It is a great opportunity to engage in a project that gets the public involved in farming in the city. Connecting people to their food is a unique experience, and rare when living in San Francisco, but Graze the Roof is a great example of how to successfully grow in the city.

ROOF SECTION



ROOF SECTION LAYERS
1. LIGHTWEIGHT GARDEN BEDS
2. ROOF DECK PAVERS
3. DRAINAGE ROCKS
4. ROOFING MEMBRANE/WATERPROOFING
5. RIGID FOAM/LIGHTWEIGHT CONCRETE INSULATION
6. DRAINAGE LAYER/WATERPROOFING VAPOR RETARDER
7. BUILDING CONCRETE

- Though green roofs and green walls have been called for in most plans developed by the Planning Department since 2007 there has not been a concrete implementable action plan or incentivizing policy created. The Planning Department is developing policies and incentives to advance alternative greening opportunities in the built environment including: green roofs, living walls, rooftop gardens, urban agriculture and temporary greening projects like parklets. In some instances green roofs and walls can be a lower cost option yet share most of the same benefits of street trees including: providing habitat and urban agriculture opportunities, promoting biodiversity, mitigating heat island and storm water, carbon sequestration, and aesthetic enhancement. Alternatives may be even more effective than street trees in providing certain desired benefits.

- Like street trees green roofs come in all shapes and sizes and various design and installation techniques yield varying levels of benefits. By categorizing green roofs and walls into typologies it can be easier to understand cost implications and to create policies to promote targeted benefits. Though these typologies are not mutually exclusive, the case studies on this poster showcase particular purposes. Variables that impact individual green roof and wall performance include: siting, irrigation, susbtrate type, soil depth, planting mix and other design criteria.

- In September 2013, SPUR convened a multi-stakeholder Green Roof Task Force was to address the question of how to support the development and implementation of green roofs in San Francisco. Next steps in these efforts will be policy amendments and creating a Better Roofs Guideline Document to enhance education and awareness about green roofs. Understanding the financial side of green roof policies will include determining funding sources and outlining an incentive program. This process will lead to a mandate on all city owned buildings to install green roofs for new and retrofit roofs. For more information please visit: http://www.spur.org/greenroofs

"I think it is something we can encourage and outright require. We have slowly ramped up [the environmental stringency] of our code. I would not think this would be unusual as the next step on a policy and regulatory framework."

"There is already a going discussion on how we can put regulatory incentives and policies in place to move it forward"
-Planning Director John Rahaim

Kay Cheng, LEED AP, Urban Designer
Anne Brask
SAN FRANCISCO
PLANNING DEPARTMENT

Stormwater Management
Capturing and Storing an Important Natural Resource

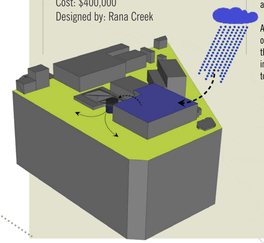
1 SOUTH VAN NESS

Photo: Anne Brask

CASE STUDY FACTS

1 SOUTH VAN NESS

Year: 2010
Type: Semi-intensive
Size: 9,500 sq. ft.
Access: By appointment
Greenroof System: Tray-based
Cost: $400,000
Designed by: Rana Creek



PROJECT BACKGROUND

The 1 South Van Ness green roof percolates storm water, reduces peak runoff, and reduces cooling loads. The roof's top story collects rainwater in a 6,500 gallon tank and pump system. Rainwater is then used for irrigating the roof, which provides a suitable habitat for butterflies, honeybees, and hummingbirds. The cistern sits on an existing megacolumn that was placed on the interior of the building for a seismic upgrade.

During construction the project team prioritized the reuse of roofing and insulation materials. River rock ballasts were reused around the edges of the living roof, provided by the Parks and Recreation Department, and pathways were made out of existing concrete roof pavers.

As Climate Change worsens, larger storms will occur more frequently. This makes the issue of stormwater management more prevalent in the city. Reducing stormwater runoff so that there is less water directed into storm drains is one way to help solve the issue of overflowing storm drains. One South Van Ness can then reuse the stormwater collected in the cistern to irrigate the native plants and reduce the need for potable water.

ROOF SECTION

ROOF SECTION LAYERS
1. NATIVE PLANT SPECIES
2. SOIL & ORGANIC MATTER
3. FILTER FABRIC
4. DRAINAGE ROCKS
5. FOAM INSULATION
6. DRAINAGE LAYER/WATERPROOFING
7. BUILDING CONCRETE

Habitat + Ecology
A Home for Native Plants and Animals in the City

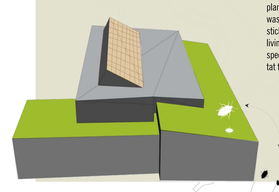
HERON'S HEAD ECOCENTER

Photo: Anne Brask

CASE STUDY FACTS

HERON'S HEAD ECO CENTER

Year: 2010
Type: Extensive
Size: 1,100 sq. ft.
Access: Not for public
Greenroof System: Modular trays
Cost: Low Cost
Designed by: Evocatalyst



PROJECT BACKGROUND

What used to be a toxic dumping ground is now an environmental education center and native species habitat. The center includes an off-grid solar array, on-site blackwater wastewater treatment system, a 15K gallons of rainwater storage, riparian wetlands, vegetative roof, and sustainable landscape.

Heron's Head Ecocenter became a habitat restoration project for plants and animals in this industrial, urban environment. Only Bay Area native plants are used in the landscaping and living roof at the EcoCenter. Native plants have evolved in a particular region over thousands to millions of years so they have adapted to the climate, geography, and organisms of the region. Therefore, they require less water and are used to local soils compared to non-native plants.

The parapet at Heron's Head is unique to many green roofs as it is layered with materials that plants and animals can call their home, such as logs, rocks, and shells. This material pallete was inspired by the surrounding beach and carried on to the rest of the roof. Larger rocks and sticks are important for native habitat as they provide shade and shelter for the ecosystems living on the roof. The roof also holds a small wetland that plays an important role in these species' lifecycles. Heron's Head is a great example of how a green roof can offset the habitat that development dispalces by restoring it on top of the building.

ROOF SECTION

ROOF SECTION LAYERS
1. NATIVE PLANT SPECIES
2. MULCH (SCORIA, COARSE SAND, ORGANIC MATTER)
3. SUBSURFACE DRIP SYSTEM
4. LAVA STONE PUMICE ROCK
5. CAPILARY MAT
6. MONOLITHIC URETHANE
7. BUILDING CONCRETE