GUIDE TO
GREEN
EMBASSIES
ECO-DIPLOMACY IN OPERATION
Natural wetland systems have often been described as the ‘earth’s kidneys’ because they filter pollutants from water that flows through on its way to receiving lakes, streams, and oceans. Because these systems can improve water quality, engineers and scientists construct systems that replicate the functions of natural wetlands.
Sustainable site features at the U.S. Embassy Karachi include permeable gravel for rainwater absorption, constructed wetlands for on-site biofiltration, native plant species to reduce irrigation requirements, and efficient exterior lighting that minimizes light pollution and conserves energy.
SITE

Federal Performance Goals

**Irrigation:**
- Reduce irrigation water intensity by 20% for existing and by 50% for new buildings from 2010 baseline by 2020 per Executive Order (EO) 13514

**Integrated Pest Management:**
- Implement Integrated Pest Management (IPM), as managed by OBO’s SHEM, required by 15 FAM 957.2, and described in OBO’s IPM Program Document

**Stormwater:**
- Manage stormwater runoff to pre-developed conditions per the Energy Independence and Security Act (EISA)

Chapter Overview

By 2050, it is expected that 70% of the world’s population may be living in urban communities.¹ This increasing global urbanization may continue to have environmental and social impacts beyond the city limits, but the extent of those impacts is difficult to predict. Cities and towns create external demands for food, water, power, transportation, and waste disposal.² Burdens placed on local and global ecosystems by urban demands can include elevated air temperatures; air, soil, and water pollution; increased incidence of disease and chronic health conditions; loss of animal and plant species; and higher levels of atmospheric carbon.

Embassy and consulate sites present opportunities to ensure that host country citizens can have a positive first impression of the United States. Post grounds that respect the natural ecosystems, enhance biodiversity, and incorporate technological innovations can demonstrate leadership in wise use of resources, providing tangible examples of eco-diplomacy. This is especially important in developing countries that may be struggling to balance natural resource management with economic growth.

Posts that maintain a healthy, functional, and preserved ecosystem help protect water resources, control erosion, regulate pests and disease, provide
nutrient storage and recycling, assist in pollution breakdown and absorption, contribute to climate stability, increase habitats, decrease building energy use, and increase resilience to natural disasters.

Integration of native and adapted species, low-impact development, and stormwater management into the landscape design of diplomatic sites offers a highly visible opportunity for the mission to demonstrate American best practices in sustainability.

Figure 1: Air temperature variation by land use type

Evidence of heat island effect is another compelling reason to preserve the natural landscape of diplomatic sites. The concentration of heat-absorbing surfaces within urban areas, such as asphalt paving or darkly colored roof areas, produces higher temperatures than surrounding suburban and rural areas (Figure 1). Resultant increases in local temperatures have negative environmental and health impacts.

Site Profile

Post sites may be composed of many elements, including buildings, landscaping, stormwater management infrastructure, parking, roadways, patios, and sidewalks. Site configuration varies dramatically from post to post, as illustrated by the comparison of U.S. Embassy Berlin and U.S. Embassy Nairobi in Figure 2. Variations in proportions of site elements, total land area, permeability of surfaces, and types of materials result in significantly different maintenance and operational needs. Therefore, the existing site composition is a significant driver of an appropriate site management solution.
For example, compact sites with high proportions of built and impervious surface coverage, including U.S. Embassy Berlin, may be best served by structural solutions, such as green roofs or pervious pavement. Posts with expansive landscaping, similar to U.S. Embassy Nairobi, are prime candidates for low-impact development strategies that use ecological processes, such as bioswales and constructed wetlands, to minimize impact on the surrounding area and reduce resource demand.

The post facilities team should conduct audits to understand existing site composition, conditions, and maintenance practices. After assessing sites, the most effective sequence for pursuing site performance improvement is as follows:
1. **Reduce loads:** Non-native plantings, lawn areas, and extensive areas of hardscape can unnecessarily increase site water loads, thereby requiring increased stormwater management. Establish xeriscaping strategies and reduce hardscape areas to decrease both irrigation demands (see Water: Irrigation) and runoff.

2. **Choose lower-impact alternatives:** IPM, green exterior maintenance and cleaning, and sustainable landscaping practices include low-impact techniques that require less water, fuel, and time to implement than conventional, unsustainable practices. Identify strategies to reduce site runoff through stormwater detention techniques. Additionally, low-impact site strategies can improve air and water quality of surrounding areas.

3. **Consider on-site treatment:** Posts can reduce the burden on their host country’s municipal water treatment and conveyance systems through rainwater collection from roofs, retention in cisterns or tanks, green roofs, treatment for reuse, and discharge into groundwater tables. These techniques can minimize or even eliminate the need to connect to municipal water or rely on well water systems. These strategies can also reduce negative impacts from stormwater runoff.

**Strategy Selection Factors**

In order to determine the most appropriate site strategies, Post Green Teams should identify the contexts of the regional habitats in which their embassy compounds are located, and then consider which of the following characteristics are applicable:

- **Urban location:** Posts in high density areas are likely to have significantly higher ratios of hardscape to landscape, a situation that tends to generate greater quantities of stormwater runoff and contributes to the heat island effect that impacts the host country and ultimately the greater region.

- **Lack of infrastructure:** Posts should routinely implement low-impact development strategies to retain, infiltrate, and treat stormwater on-site. These strategies are particularly important for posts located in developing regions that lack infrastructure to mitigate stormwater.

- **Significant annual rainfall:** Posts located in areas with moderate or heavy annual rainfall should work to integrate pervious surfaces and natural stormwater detention techniques to manage site runoff and reduce erosion. These locations should also consider harvesting rainwater for reuse (see Water: Rainwater Harvesting).

- **Arid climate:** In dry climates, posts should undertake landscaping
strategies that include drought-tolerant native and adapted plant species to conserve water and support the local ecological environment. Consider opportunities for reducing hardscape, and increase shading to reduce heat islands.

- **Extensive landscaped areas**: Posts that manage an extensive landscaped area, including posts where the site area is more than twice as large as the building footprint, should explore IPM solutions, examine landscaping practices, and undertake low-impact exterior maintenance. Consider constructed wetlands for tertiary on-site wastewater treatment (WWT) and infiltration opportunities. Also, consider reducing lawn areas to a minimum to reduce irrigation demands.

### Priority Selection Criteria

<table>
<thead>
<tr>
<th>Priority Selection Criteria</th>
<th>Urban location</th>
<th>Lack of infrastructure</th>
<th>Significant annual rainfall</th>
<th>Arid climate</th>
<th>Extensive landscaped areas</th>
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<td>Audit</td>
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Case Study: Wildlife Habitats

Geneva, Switzerland

The U.S. Mission to the United Nations in Geneva was the first U.S. Department of State (the Department) facility to be certified as a wildlife habitat by the National Wildlife Federation®. The Mission’s garden staff and Green Team implemented several changes in the existing gardens in order to meet National Wildlife Federation’s requirements for sustainable horticulture and habitat development. Changes included minimizing the use of water and fertilizer and maximizing native plants, particularly those friendly to bees, butterflies, and other pollinators. In addition, staff used mulch, compost, and chemical-free fertilizer. To promote and protect wildlife habitat, the Mission provided for wildlife seeds, fruits, berries, and other food sources; roosting locations; water sources such as birdbaths and ponds; thickets, rock piles, and other cover; and places for wildlife to raise young, including mature trees and host plants for butterflies. The Green Team even organized a workshop for the Mission’s children, who made birdhouses that staff placed in the trees on the Mission’s five-acre grounds.

Mission Geneva customized the Wildlife Habitat Certification to address their specific site. Ecologists or local wildlife specialists provided guidance and expertise to ensure that various species’ needs were met. For more information about the program, visit: http://www.nwf.org/How-to-Help/Garden-for-Wildlife.aspx.

The U.S. Mission to the United Nations in Geneva is a Certified Wildlife Habitat™

Image Source: State Magazine, May 2010
# Strategies

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<th>Strategy</th>
<th>Benefit</th>
<th>Time</th>
<th>Investment</th>
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<td>Audit</td>
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Xeriscaping practices at U.S. Consulate General Ciudad Juarez

Image Source: U.S. Consulate General Ciudad Juarez
Audit

**Benefit**
Identifies no- and low-cost strategies to improve operational efficiency and reduce environmental impact on the site

**Time**
One week to survey the site and compile an audit report

**Investment**
No financial investment required

**Team Members**
FM | Post Green Team

Site management affects the sustainability of exterior areas, indoor environments, and the environment of the surrounding region. Unlike water and energy audits, site audits cover a broad range of current practices and environmental conditions related to stormwater, landscaping, and maintenance.

**Landscaped grounds of U.S. Embassy Monrovia**

*Image Source: Thierry Rosenheck, OBO*
Post Green Teams should review the strategy selection factors for post’s location to determine the particularly relevant elements of a site audit and focus efforts on assessments related to the most applicable strategies. For example, posts located in dense urban environments are less likely to receive benefit from a review of plants and irrigation practices, whereas posts with significant rainfall would benefit from a review of stormwater management systems. For each relevant strategy, use the audit to evaluate impacts on site operations and to identify potential impact reduction measures.

Some elements of a site audit are best performed at night. An after-dark audit allows identification of light pollution sources as well as nocturnal wildlife that could become pest problems.

**Practical Application**

1. **Contact** the teams or people responsible for post site operations and engage them in the site audit.

2. **Identify** and focus efforts on the site audit elements that are most relevant to post.

3. **Evaluate** site landscaping (see Site: Landscaping) and hardscaping.
   - Quantify landscaped spaces by area and percentage of total site.
   - Identify the types of plants installed and note whether each species is native, drought-tolerant, habitat-providing, or a food crop.
   - Document maintenance and irrigation practices, irrigation system conditions, equipment used, and products applied, such as mowers, mulches, fertilizers, and pest control treatments (see Water: Irrigation).

4. **Evaluate** heat island and stormwater runoff impacts (see Site: Runoff, Erosion, and Sediment Control and Heat Island Mitigation).
   - Quantify hardscaped spaces by area and percentage.
   - Identify the color and type of each hardscaped area, maintenance practices, and products used for cleaning and snow removal.
   - Identify stormwater management systems or structures in use on-site, as well as their maintenance requirements.
   - Note whether storms typically result in significant runoff from the site and, if so, locations where runoff causes erosion or flooding.

5. **Assess** the type and application of products used for building exterior and landscape maintenance, including pest management (see Site: Exterior Maintenance and Integrated Pest Management).
- Collect maintenance records for exterior building and landscape maintenance, including pest management treatments.
- Identify products used, such as paints, sealants, cleaners, pesticides, de-icing agents, fertilizers, and fungicides.
- Assemble relevant material safety data sheets (MSDS) for each product used.

6. Review applicable strategies and identify measures to increase efficiency and sustainability of site management, based on the audit results. Categorize opportunities as no- or low-cost, short-term, or mid- or longer-term initiatives.
   - Consider no- or low-cost improvements such as product substitutions, repair of malfunctioning parts, schedule changes, or lamp replacement.
   - Propose a schedule for mid- or longer-term strategies, such as replacing light fixtures, expanding permeable site surface area, or improving irrigation systems.

7. Document existing and proposed site management measures in a report.

Landscape design at U.S. Embassy Phnom Penh enhances natural areas with indigenous plants
Exterior Maintenance

**Benefit**

★★★★☆ Increases worker safety, improves environmental quality of post sites and surrounding areas, and improves indoor air quality (IAQ)

**Time**

 ожидает One to three months to review audit results and develop purchasing and maintenance plans

**Investment**

$ $ $ $ Purchase of alternative products during regular reordering

**Team Members**

FM | GSO, Post Green Team

Materials and equipment used for cleaning and maintaining building exterior and site surfaces can impact air and water quality of surrounding areas. Some alkaline and acidic cleaners can be neutralized and safely discharged into storm sewers. However, most solvent-based cleaners, such as pine-oil products, cannot be neutralized, are categorized as pollutants, and must be disposed of by a licensed transport, storage, and disposal facility.⁵

Rainfall can wash potentially harmful cleaning compounds off cleaned surfaces and onto the ground and off-site into local waterways. Volatile organic compounds (VOCs) in exterior cleaning and maintenance products can compromise local air quality and can potentially be drawn into buildings through openings and air intakes. Runoff containing phosphorus, nitrogen, and other chemicals found in fertilizers and cleaning products contributes to the growth of the algal blooms that create hypoxic (low oxygen) or ‘dead’ zones in estuaries and coastal areas, where marine life cannot survive.⁶

Of an estimated 400 such dead zones located around the world, the Gulf of Mexico hypoxic zone is one of the largest, at approximately 17,000 square kilometers (km²) (6,600 square miles (mi²)), which is roughly the size of Massachusetts.⁶

Select cleaning products that have the least environmental impact for building and site cleaning activities, such as Green Seal certified products.

**Consider using the following:**

- Water-based products rather than solvents for cleaning, paints, sealants, and adhesives
- Exterior paints, sealants, and adhesives that meet Green Seal® standard
for Paints and Coatings GS-11 (see Indoor Environment: Contaminant Reduction)

Undertake site maintenance practices that are environmentally safe:

- Use simple methods, such as a brush or low-pressure water wash. Water of slightly higher pressure or with a non-ionic detergent additive also may be effective.
- Minimize use of resource-intensive or polluting maintenance equipment, such as pressure washers and gas-powered mowers. Use only as necessary to maintain safe and operable surface conditions.
- Use hand tools rather than power tools where feasible, such as rakes rather than leaf-blowers or push rather than gas-powered mowers.
- When replacing equipment, consider electric, low-decibel, energy-efficient, and water-efficient models.
- Avoid environmentally-damaging products, such as salt or calcium chloride, where snow or ice removal is required. Select environmentally preferable de-icing chemicals, such as magnesium chloride, potassium acetate, and potassium chloride. Use a small amount of de-icer to prevent icing, rather than a large amount to treat existing ice.

Practical Application

1. Review results of the site audit related to cleaning and maintenance products and practices.
2. Include exterior maintenance products in post’s green cleaning procurement and use policies. Choose environmentally-sensitive cleaning products. Replace solvent-based cleaners with environmentally-safe alternatives (see Indoor Environment: Green Cleaning).
4. Create a plan to replace maintenance equipment with lower-impact alternatives as items reach the end of their useful life.
5. Develop a plan to communicate new cleaning and maintenance procedures to the appropriate post staff (see Site: Staff Engagement).
**Integrated Pest Management**

<table>
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<th><strong>Benefit</strong></th>
<th>Controls pests, protects the health and safety of employees, maintains facilities, and protects the environment</th>
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<tr>
<td><strong>Time</strong></td>
<td>One to two months to create an IPM plan, one year for plan establishment, and ongoing review and assessment after establishment</td>
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<tr>
<td><strong>Investment</strong></td>
<td>New IPM measures such as bird mesh and pest-proof waste bins</td>
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<td><strong>Team Members</strong></td>
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Effective pest control protects people from pest-borne disease, and shields buildings and other property from damage. Pesticide, herbicide, insecticide, and fungicide application leads to pests developing resistance to those products; negatively impacts other beneficial species; pollutes soils, air, and water bodies; and causes human health issues.

Pest problems aren’t just inconvenient. Cockroach allergens—proteins in cockroach feces, saliva, and decomposing body parts—can cause allergies and asthma attacks.

The goal of IPM is to reduce risk to both human health and the environment. The Department’s IPM program emphasizes controlling factors that could invite pests, preferably using non-chemical methods to reduce pest populations. If pesticides are required, they must be authorized by the Department through the OBO’s SHEM. Methods include reducing the prevalence of pests through prevention, self-help measures that post personnel can implement independently without engaging the SHEM IPM team, and application of EPA-registered and SHEM-authorized pesticides, if necessary. A typical IPM plan includes identification of problem pest species, pest-prevention measures, monitoring and reporting systems, occupant self-help programs, communication protocols, action thresholds for pest populations, pest control methods and priorities, documentation methods, and inspection schedules.

**Include the following best practices in post’s IPM program:**

- Verify that pests are the cause of the problem rather than a symptom.
- Use pesticides as a last resort. Prevention is the first course of action.
• Obtain SHEM approval when pesticides are needed and use the least toxic pesticide in the smallest possible quantity, targeting concentrated areas of pests.

• Use pruning and pest-resistant plantings, and locate new vegetation away from the building to reduce bridges that allow pests to access the building.

• Keep lawns short to avoid hiding places for snakes and rodents.

• Use netting or mesh to discourage roosting birds.

• Secure building waste in insect- and rodent-proof containers.

• Eliminate stagnant water to reduce mosquitoes, and consider stocking ponds with larvae-eating fish.

• Use heat treatment rather than chemical fumigation of enclosed areas.

• Provide information to all post personnel on self-help pest control methods as indicated in the IPM Program Document (see Resources: The IPM Program Document).

Practical Application

1. **Consider** any pest management recommendations included in the site audit report.

2. **Review** SHEM’s IPM Program Document, available on the OBO intranet, for specific requirements and methodologies (see Resources: The IPM Program Document).

3. **Identify** the IPM team members.

4. **Document** conditions that historically have attracted problematic pests and employ prevention techniques.

5. **Work** with post’s IPM team to develop a plan, or update post’s plans to meet the requirements of the IPM Program Document. Include proposed schedules and self-help measures.

6. **Implement** the plan.
Landscaping

**Benefit**

Reducers stormwater runoff volume and water use for irrigation, improves stormwater runoff quality, promotes biodiversity and pollination, and reduces atmospheric carbon

**Time**

One to three months to implement low-impact maintenance procedures and six to 18 months to change or add landscaped area

**Investment**

Vegetation selection and planting and installation of automated irrigation systems (if necessary) for new or modified landscaping

**Team Members**

FM | OBO, Gardeners

Sustainable landscaping incorporates native or adapted plants, grasses, and trees. The practice requires less irrigation and maintenance, offsets carbon dioxide (CO₂), promotes biodiversity by providing wildlife habitat, provides erosion control, controls stormwater runoff, and reduces heat island effect. Xeriscaping is a specific landscaping method that uses slow-growing, drought-tolerant plants that thrive with minimal fertilization.

To the extent possible, group plants with similar irrigation needs (see Water: Irrigation). Irrigation systems should be carefully selected and zoned to further minimize water consumption.

Post grounds may be able to support regional endangered species by converting portions of the facility’s landscaped areas to pollinator-friendly habitats that include native, flowering plants; nesting areas; and shelter for bees, butterflies, bats, hummingbirds, and other pollinators (see Resources: Pollinator Friendly Practices).

**Pollinator insects and animals are needed for the production of at least 30% of human food crops, including almost all fruits and vegetables.**

Low-impact maintenance can further reduce irrigation and chemical fertilizer demand, decreasing stormwater runoff volumes that can pollute or degrade the quality of local aquifers and waterways.

**Include low-impact maintenance strategies, such as the following:**

- Mulch landscape beds and potted plants to reduce evaporation and keep
the soil cool, where appropriate.

- Designate an on-site composting area for landscape trimmings.
- Amend soils with trimmings, compost, and manure as required by the soil for the types of plants used, in place of chemical fertilizers.
- Use low-impact equipment for landscape maintenance.
- Dispose of yard waste on-site and leave grass clippings on lawns.
- Add large-canopy shade trees to reduce evaporation and increase privacy. Take care not to encroach on perimeter ‘clear zone’ or breach non-climb perimeter or building conditions.
- Allow native grasses to go dormant in the winter, and reduce watering to minimum levels during the summer.

**Practical Application**

1. **Review** the site audit report for opportunities to improve landscaping and landscape maintenance procedures.

2. **Work** with FM to plan and implement low-impact maintenance practices. Incorporate low-impact maintenance procedures and upgraded site elements into the site maintenance plan.

3. **Consult** with OBO and local landscape architects for appropriate landscape species, irrigation system improvements, and xeriscaping practices.

4. **Implement** water-efficient irrigation (see Water: **Irrigation**). Consider non-potable water sources for irrigation (see Water: **Rainwater Harvesting** and **On-site Wastewater Treatment**).

5. **Reduce** site areas requiring irrigation by replacing high-maintenance plants with native or drought-tolerant species, and consider xeriscaping.

6. **Specify** and install vegetation and trees that do not require irrigation, that provide shade, and that are pollinator-friendly (see Site: **Runoff, Erosion, and Sediment Control** and **Heat Island Mitigation**).
Case Study: Native Planting

Cape Town, South Africa

**Benefit**
Preserves endangered species habitat, decreases potable water consumption, and reduces greenhouse gas (GHG) emissions

**Team Members**
OBO | Design Consultants, FM, Gardeners

The U.S. Consulate General in Cape Town, South Africa, made particularly good use of native plants to reduce irrigation demands, beautify their site, and preserve local endangered species, including the leopard frog, which makes its home in the Westlake River.9

Landscape architects specified using only indigenous plants, which are attractive and perform well under local conditions. The plants selected help prevent soil erosion, even on steeply graded slopes. Erosion control was a major challenge, as the Westlake River runs through the Consulate site.

The results of the Consulate’s landscape efforts included decreased potable water consumption for irrigation, increased biodiversity, and reduced GHG emissions and the overall carbon footprint of the United States Government. The Department is demonstrating eco-diplomacy through landscape design that promotes native habitat.

Native plants foster endangered wildlife species at U.S. Consulate General Cape Town

Image Source: State Magazine, April 2012
Runoff, Erosion, and Sediment Control

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Minimizes quantity and rate of stormwater runoff, which reduces site erosion and potential contamination of water bodies</th>
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<tr>
<td>Time</td>
<td>One to three months to implement no- and low-cost tactics, six to 12 months to establish new plantings, and one to two years for longer-term site upgrades</td>
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<tr>
<td>Investment</td>
<td>Vegetation selection and planting and installation of permeable surfaces</td>
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Stormwater runoff can cause soil erosion and sedimentation of local waterways. Erosion results in loss of topsoil, which regulates water flow and is essential for plant life. Topsoil loss may lead to increased need for fertilizers and pesticides to maintain plant material. In turn, the use of increased fertilizers and pesticides pollutes rivers, lakes, and oceans. Site sediment also pollutes and degrades aquifers and local waterways by adding high concentrations of total suspended solids and toxins.

Runoff prevention strategies are particularly important to implement at posts that experience large storm events or high volumes of annual precipitation. Existing erosion control measures should be protected and reinforced to prevent breaches and damage during new construction or major renovations to buildings, landscapes, or hardscapes. Strategies may include temporary installations of hay bales around inlets, silt fences at the boundary of disturbed soils, and gravel at construction vehicle entrances and exits.

Runoff from erosion has impacts far from the site of origin. The sediment produced can clog fish gills and suffocate aquatic habitats.10

Consider the following landscape plan components to reduce the quantity and speed of runoff and minimize associated erosion:

- Use compost and mulch in planted areas to protect exposed soils.
- Add small-scale bioretention areas, such as planter boxes or tree wells.
Longer-term initiatives for on-site stormwater retention and detention include:

- Rainwater harvesting for larger-scale irrigation or potable water use (see Water: Rainwater Harvesting)
- Site regrading to eliminate steep slopes and retain water on-site
- Natural bioswales to treat runoff passively instead of concrete curbs, gutters, and culverts, which concentrate and exacerbate site runoff
- Biofiltration to treat runoff passively
- Replacement of hardscape with permeable surfaces, such as gravel or pervious pavement, to increase infiltration and recharge groundwater
- Installation of vegetated roofs and rain gardens to control runoff

**Figure 3: Bioswales, or ‘rain gardens,’ passively treat stormwater runoff**

Practical Application

1. **Review** the site audit report to identify any major concerns and recommendations for improvements. Implement recommended no- and low-cost tactics.

2. **Use** groundcover such as mulch, compost, or vegetation to protect exposed soil between other landscape plants and to stabilize loose soil, especially on slopes (see Site: Landscaping).

3. **Install** splash blocks where rainwater from buildings drains to the site at ground level, use rainwater barrels for catchment and diversion to landscaped areas, or implement small-scale bioretention (see Water: Irrigation).

4. **Work** with OBO civil engineers and landscape architects to prioritize and implement longer-term site upgrades.

5. **Incorporate** upgraded site elements into the site maintenance plan, and monitor site runoff to measure success of implemented initiatives.
Heat Island Mitigation

**Benefit**

Decreases load on heating, ventilating, and air conditioning (HVAC) systems, thereby reducing associated utility charges; provides shade for comfort; promotes human health; promotes biodiversity; and helps control stormwater runoff.

**Time**

One to two years for plant establishment; major retrofits or structural additions should be part of a larger capital project.

**Investment**

Installation of plantings or architectural shade structures, and replacement of existing roof or paved areas.

**Team Members**

FM | FMO, OBO

Heat island effect is the phenomenon whereby metropolitan areas are significantly warmer than their rural surroundings due to the amount of paved area and buildings that have replaced vegetated and permeable surfaces. Dry and unshaded urban surfaces absorb solar gain and re-radiate heat into the atmosphere, elevating air temperatures. For example, low-reflectance building rooftops and pavement can reach temperatures of 66–88 degrees Celsius (°C) (150–190 degrees Fahrenheit (°F)), warming the local area (see Figure 1). As urban densities, areas, and populations increase, this issue may become of greater concern.

Heat islands can contribute to the following:

- Risks to human health, including heat-related illness and mortality, as well as species loss
- Reduced indoor and outdoor comfort
- Increased cooling energy use and higher utility bills
- Higher peak electricity demand and raised electricity production costs
- Higher intake air temperatures for building conditioning systems
- Increased air pollution from increased energy to cool building interiors
- Accelerated deterioration of roofing materials, increased roof maintenance costs, and higher levels of roofing waste sent to landfills.

OBO’s design criteria for new projects require shading and high-albedo (reflective or ‘cool’) materials on site surfaces and roofs. Various heat island...
mitigation strategies can also be implemented around existing buildings and are particularly beneficial in locations with extended cooling seasons.

**Consider the following strategies:**

- Installing native, drought-tolerant species, with shade provided within five years (see Site: Landscaping)
- Working with OBO landscape architects to identify appropriate locations for planting additional trees, taking care not to breach anti-climb walls and building conditions and without encroaching into the perimeter ‘clear zone’ (see Site: Landscaping)
- Where energy costs and solar insolation values are high, installing solar energy generating systems, such as photovoltaics (PV) or solar thermal, at shade structures and canopies (see Energy: Photovoltaics)
- Resurfacing with high albedo materials (see Resources: Energy Star®)
- Installing green roofs (see Resources: Cool Roofs and Emissivity and Vegetated Roof Study)
- Replacing asphalt or other dark surfaces with permeable, open-grid pavers or light-colored materials

**Practical Application**

1. **Review** site plans to identify opportunities for planting shade trees or plants around paved areas.
2. **Consult** with OBO or a local landscape architect or nursery to select and plant the appropriate species for shading.
3. **Evaluate** whether shade structures or canopies are appropriate for the site.
4. **Work** with OBO to select high solar reflectance roofing materials.
5. **Evaluate** the feasibility of permeable, open-grid pavers or light-colored materials as a replacement for asphalt or other dark surfaces.
6. **Develop** a plan to undertake regular maintenance, at least every three years, of all high-reflectance surfaces to ensure that they are clean. Maintain vegetated roofs for planting and structural conditions.
Staff Engagement

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Instills land conservation as a fundamental value and motivates building occupants to adopt behaviors and habits that conserve soil and protect water resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>One to two months to develop education materials and install signage; and regularly scheduled short training sessions</td>
</tr>
<tr>
<td>Investment</td>
<td>Preparation and printing of training materials and signage</td>
</tr>
<tr>
<td>Team Members</td>
<td>Post Green Team</td>
</tr>
</tbody>
</table>

Sustainable site management practices encompass a range of topics, from rainwater retention and landscaping to pest management. Many of the strategies are structural in nature and require implementation by FM staff; however, there are a variety of behavioral activities that can easily be undertaken by general post occupants.

The People’s Garden Initiative encourages the U.S. Department of Agriculture to develop community gardens around the world, teaches sustainable gardening practices and nutrition, and shares produce with neighbors and food banks.14

Encourage post personnel to:

- Prohibit pouring or dumping harmful chemicals into building plumbing or facility storm drains.
- Use hand tools, such as rakes and shovels, rather than power equipment, such as leaf-blowers and snow-blowers, whenever possible and practical.
- Help maintain the site and avoid pest infestations by closing garbage lids, picking up garbage, and not feeding wildlife.
- Report problems on-site, such as oil spills in parking lots, standing water, or poorly-timed exterior lights, as soon as noticed.
- Organize post community planting projects on mission grounds.
- Hold an education session on rain gardens.
- Initiate or participate in a community clean-up day.
- Coordinate with the local international school to start a vegetable garden.
Members of the Lisbon Eco-Friendly Action Forum (LEAF) begin a community garden on-site

Image Source: U.S. Embassy Lisbon

**Practical Application**

1. **Review** general tips on how to implement an occupant engagement program (see Using This Guide: Influencing Occupant Behavior).

2. **Educate** occupants on personal contributions.
   - Coordinate local garden tours.
   - Provide information about beneficial and harmful insects.
   - Host gardening classes with a focus on native plants and urban farming.

3. **Create** social involvement opportunities.
   - Create a community garden and have social harvest days.
   - Initiate a ‘Green Site Champion’ annual award that receives public recognition.
   - Collaborate with PAO to organize social events such as on-site or community cleanups and tree plantings.
   - Organize events around the following partial list of relevant annual United Nations observances:
     - March 21: International Day of Forests
     - March 22: World Water Day
     - April 22: Earth Day
• Last Friday in April: Arbor Day
• May 9-10: World Migratory Bird Day
• May 22: International Day for Biological Diversity
• June 5: World Environment Day
• June 8: World Oceans Day
• June 17: World Day to Combat Desertification and Drought
• October 22: World Energy Day

4. **Implement** structural components.

• Install signage near storm drains, perhaps with the likeness of a beloved local species that is endangered by poor water quality.

• Install educational signage on-site that highlights attractive features such as butterfly-friendly landscaping.

• Distribute information providing self-help guidance for common pest management problems and IPM solutions.

• Ensure that post staff has clear instructions on protocol and contact information to report site related issues.

• Create opportunities for small teams to contribute or compete with one another, perhaps by offering a prize for the best new solution to a post site sustainability challenge.

**Wandsworth Mayor Cooper and U.S. Deputy COM Stephenson plant a tree at the American Gardens in Wandsworth, England**

*Image Source: U.S. Embassy London*
Resources

Visit http://www.state.gov/obo/green/greenguiderefs/index.html#site

Endnotes


3 Human Health Impacts and Adaptation. EPA. http://www.epa.gov/climatechange/impacts-adaptation/health.html


6 Hypoxia 101. EPA. http://water.epa.gov/type/watersheds/named/msbasin/hypoxia101.cfm

7 Integrated Pest Management in Schools. EPA. http://www.epa.gov/pesticides/ipm


10 Stormwater Runoff Control. EPA. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=4

11 Heat Island Effect: Basic Information. EPA. http://www.epa.gov/heatisland/about/index.htm

12 Heat Island Effect. EPA. http://www.epa.gov/hiri

13 Heat Island Effect: Cool Roofs. EPA. http://www.epa.gov/hiri/mitigation/coolroofs.htm