site LINES

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Letter from the Editor

More than half of Earth's surface lies beneath the ocean. This underwater topography is as geologically and biologically varied as its visible landmasses. With the planetary crust composed of shifting tectonic plates, both surface and subsurface are constantly mobile, causing significant continental and oceanic transformations over slow eons of geologic time. The more observable events in this operation of the earth's internal dynamics, notably volcanic eruptions and earthquakes, alter global topography in sudden and often disastrous ways. Sea elevations can also rise and lower because of human action – or political inaction – which is one reason why the land-encroaching waters caused by our excessively tardy response to global warming are of such concern today.

This issue of *Site/Lines* does not, however, focus on either geological phenomena or our current environmental crisis. Tectonics and the loss of rich troves of biota and the large-scale dislocation of human communities cannot be ignored, but our primary aim here is to introduce our readers to a handful of islands whose historical, cultural, and natural landscapes constitute fascinating present-day chapters in Earth's ongoing story of land, water, and life.

Alcatraz – the name immediately brings to mind gangsters behind bars. But as Russell Beatty tells us, the island was more than a place of incarceration for the likes of Al Capone and "Machine Gun" Kelly. Improbably, throughout its eventful history as a U.S. Army outpost, military prison, federal penitentiary, and historic site for tourists, this rocky, inhospitable landscape became an island of gardens. Against a backdrop of grim, stony walls, they were planted and cultivated by the families of army officers and later by wardens and inmates. Beatty details the Garden Conservancy's current efforts to restore and maintain these gardens in partnership with the National Park Service and the Golden Gate National Parks Conservancy.

Who would take dense, space-deprived Singapore as a role model of green urbanism? Timothy Beatley explains how farsighted centralized planning has turned this city cum nation into a most agreeable urban environment for its five million citizens.

Paula Deitz brings her traveler's perspective to Tresco Abbey Garden on one of the Isles of Scilly, not far from the coast of Cornwall. The creation of a single family over five generations, this unusual garden has the advantage of a Mediterranean climate due to Tresco's position within the Atlantic Drift, the northern tail of the Gulf Stream. Deitz marvels at how warm temperatures, an extended growing season, the extraordinary plantsmanship of the original creator and his heirs, and the knowledge and devotion of the present horticultural curator made her visit to this garden a memorable experience.

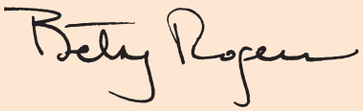
Another island traveler, Katherine Harmon, gives a vivid account of her recent voyage to the Galapagos, where we learn some of the lessons about the indigenous species that made these islands a laboratory for Charles Darwin's revelatory studies of biodiversity, which led to his theory of evolution.

William Kornblum, a professor of sociology and environmental psychology and an avid sailor, takes our readers with him into the waters of New York City's East River to explore the islands of the Hell Gate. He introduces us to North Brother and South Brother islands, which are steeped in legend and rich in sad and sinister history. The pair now host remarkable nonhuman populations.

Suzanne Morse Moomaw, an urban and environmental planner, discusses Cuba's rich yet vexed identity as one of the great sugar producers of the world. For hundreds of years the sugar industry ruled this island, but the international politics surrounding Cuban dependence on this primary crop, which was formerly capitalized by outside corporations, made its own internal economy vulnerable. It is unclear whether the country can (or should) experience a renaissance in the production of sugar as a source of energy-producing ethanol or continue its present course of local food production. Moomaw argues both sides of this complicated question with considerable insight, while also discussing the government's relaxation of the ban on foreign visitors in the interest of building a tourist economy.

Since *Site/Lines* is entirely donor-supported and therefore not a subscription journal per se, to continue to publish essays like these we depend on the generosity our readers. We will be very grateful therefore if you will take time to make a contribution in the enclosed envelope.

Happy fall and good green wishes,



Elizabeth Barlow Rogers
President

On the Cover:
View of Hell Gate from the Manhattan shore of the East River. This scene of the entrance to New York City from Long Island Sound was drawn from the site of Gracie Mansion, engraved by Merigot, and published in 1807 by James Cundee, Albion Press, London. The sailing vessels are tacking over the then fearsome Hell Gate rapids. Spanned today by the Triborough and Amtrak Bridges, this densely urban and still-complicated section of the East River ends at the lonely North and South Brother Islands, now dedicated nature preserves and bird sanctuaries. Digital photographic reproduction courtesy of the New York Public Library.

Up from the Deep: Island Landscapes

Brothers of the Hell Gate

From the deck of a small sailboat, views of the city emerge in slow motion from unusual angles and uncommon perspectives. We take for granted that most of New York is connected by bridges and tunnels, but there are still some true islands – like Prall's and Shooter's Islands, in the Kill Van Kull, and Hoffman and Swinburne Islands, off the shore of Staten Island in the Narrows – that can only be seen up close from the water; they are landed on at one's peril. The most gloomy and foreboding among these lesser islands are the dark siblings – North and South Brother islands.

The pair are part of a series of islands and rock outcroppings at the eastern end of the Hell Gate passage in the tidal strait we call the East River. They were produced by geological uplift and folding over millions of years that left faults in the deep rock layers under the city. Glaciation then carved basins and straits, creating the complicated intersection of the Harlem and East rivers and forming what are now Wards, Randall's, and Roosevelt islands; Mill Rock; and the Brothers.

In earliest Dutch colonial times, the Hell Gate had a dual identity, which is enshrined in the controversial origins of its name. In Dutch the term *hellegat* can mean hellish entrance or bright passage, and for much of the city's history before the Civil War the channel was both fearsome to navigators and a paradise for the fishermen and hunters who lived along its marshy shores and peaceful coves. From an outstanding 1807 engraving of the area, we can get a visual sense of how this stretch of water, which today may seem forbidding, could have had this dual identity. (See cover page.)

The artist drew the scene from the Manhattan shore, near the site of present-day Gracie Mansion, looking out over the East River. On the far right is the passage into Rikers Island Channel and the North Brother Islands. On the far left are the Harlem River and, beyond it, Spuyten Duyvil Creek, which connects the Harlem to the Hudson River.

Today Mill Rock, the small island near the mouth of the Harlem (shown here with two lonely trees), is the only remnant of the fearsome Hell Gate obstacles. But the engraving offers a fine view of the dangerous Flood Rock rapids, which, during the age of sail, had mariners and passengers alike clutching ship's lines and railings with white knuckles. Without engines, sailing vessels were dependent on wind and tide. Approximately every six hours the current shifts: during an ebbing tide the flow is westward; a flooding tide turns the current eastward. Sailing ships had to time their approach through the treacherous Hell Gate rapids so that the swift tides would favor rather than hinder their passage.

Sailors can appreciate the difficulty of the ships' maneuvers shown in the engraving. A port tack across the prevailing southwesterly wind sped vessels over the passage, and no doubt they were helped by a favorable tide as well. Yet despite all possible precautions, the Hell Gate was an extremely dangerous bit of river. If winds shifted or suddenly died, a ship could be caught in swift currents or whirlpools that might smash it against the exposed rocks. The Hell Gate's reputation as the graveyard of ships was well earned and contributed mightily to the area's fearsome reputation – even before its islands became places of disease, exile, and imprisonment.

Since the engraving views the Hell Gate from its western entrance, North Brother and South Brother islands, which are to be found at the eastern end of the passage, are not visible. Originally claimed by the Dutch West India company in 1614, both islands are at present uninhabited – little more than overgrown rock outcroppings between the shores of the Bronx and the much larger (and even more ominous) Rikers Island, site of the city's prison. South Brother Island is only seven acres in size; its larger companion, about five hundred feet to the north across a narrow channel in the East River, is just over seventeen acres. For most of its history South Brother was held privately. Until 1907 it was owned by the beer magnate Jacob Ruppert and his descendants. Ruppert also owned the New York Yankees and had a summer residence on the island; Babe Ruth and other visiting Yankees were said to have enjoyed hitting baseballs into the river. North Brother Island, in contrast, has a history of illness and exile, as did the better-known islands in the Hell Gate, especially Roosevelt (formally Blackwell's, and then Welfare Island), which housed a prison, lunatic asylum, workhouse, and smallpox hospital, and Wards, whose forbidding mental hospital still dominates views of the East River from Manhattan north of Ninety-sixth Street.

Early in the twentieth century, North Brother Island became infamous as the forced residence of Mary Mallon, better known as Typhoid Mary, the first-known healthy carrier of the typhoid bacillus. After willfully infecting others, Mallon was kept in isolation at Riverside Hospital on North Brother Island until her death in 1938. Today the old quarantine hospital, which last served during the 1960s as a residential drug-treatment center, is a hulking ruin that attracts birders and explorers in search of "hidden New York." Even the passing sailor unfamiliar with North Brother's sad history feels chilled at the sight of the crumbling remains, now barely visible through encroaching trees and vines, as the cormorants and screeching gulls careen through its gaping windows.

North Brother Island's association with death and disaster was reinforced by a sensational tragedy that occurred shortly after the turn of the twentieth century. On a bright summer Sunday in 1904, the island became the fatal shore for the fiery wreck of the General Slocum, a popular excursion ship. The Slocum was carrying 1,358 residents of Kleindeutschland (Little Germany), the tightly knit immigrant community that surrounded Tompkins Square on the Lower East Side. The majority of the passengers were women and children.

The *New York Times* reported that the General Slocum, which had been recently overhauled, had departed with much fanfare that morning: "As she cast off and stood out into the stream her flags were flying, the band was playing a lively air, and her three decks were crowded to their capacity with a happy throng that looked for a pleasant day's outing at Locust Point, on the Sound." Just as the ship was passing Sunken Meadow, adjacent to Randall's Island in the Hell Gate (almost directly under the present-day span of the Triborough Bridge), cries of "Fire!" broke out below. "It was only a matter of seconds until the entire forward part of the boat was a mass of flames," the journalists of the *Times* reported. Passengers began rushing madly over the three decks to avoid the heat.

Unable to quell the raging fire or prevent passengers from jumping into the swift currents of the East River, the Slocum's captain finally grounded his ship on North Brother Island.

Horrified patients, locked in their isolation wards, watched from closed windows while nurses and other hospital personnel fought to rescue those leaping from the burning decks. Bodies washed up on island and elsewhere along the riverbank for days. The event claimed the lives of 1,005 picnickers. Kleindeutchland never recovered. The German settlement moved uptown to the part of the East Side known as Yorkville and northwest to Astoria in Queens – neighborhoods that overlooked the site of the disaster from opposite sides of the East River. Before the fall of the World Trade Towers in 2001, the tragic fire aboard the Slocum was by far the city's most deadly disaster. North Brother Island's association with the event surely contributes even today to the sense of gloom emanating from its shores.

The Brother islands and the Hell Gate section of the East River deserve special attention not only because of their fearsome reputations but also because they call attention to vast changes over the past century that have transformed the way we think about and use the islands of the Hell Gate passage. After 1917, with the opening of the Hell Gate railroad bridge, New Yorkers typically glimpsed the Brothers and the Hell Gate not from the water but from the air, high above the rushing currents. This distancing of the river and its islands from our everyday experience became even more complete in 1936 with the opening of the Triborough Bridge, one of Robert Moses's most far-reaching highway projects in the early era of automobility. Commissioner Moses also had Randall's Island connected to Wards Island with construction fill. From the great bridge that linked Queens, Manhattan, and the Bronx, the enlarged Randall's Island suddenly became accessible by car to a mass public. These engineering feats stimulated vast population growth and a construction boom in housing along all sides of the water. The built environment and the hard-surface thinking it seemed to require came to dominate the landscape to the detriment of the city's waterways. Before long, their shores were lined with miles of riprap and concrete. By the mid-twentieth century there were few places along the East River where one could actually reach the water.

Only Mill Rock, at the mouth of the Harlem River, and the Brothers, on the eastern edge of the Hell Gate passage, remained true islands. Today Mill Rock is a unique city park accessible only from the water, a destination for kayaks and small boats. The Brother islands are more isolated and forgotten. Too small and distant from the bridge to merit an off ramp, their quotidian accessibility would have required costly ferry service. After Riverside Hospital closed, North Brother remained in city hands, a part of the Bronx. South Brother, always under private ownership, was purchased in 2007 by the city for $2 million from Hampton Scows, a Long Island sand and gravel company that had originally paid the city ten dollars in 1975 for its title. The repurchase was made possible by a combination of federal and local funds and through the good offices of the Trust for Public Land.

Uninhabited for decades, the Brothers have recently become a subject of discussion among South Bronx community activists and local advocates, and are now acquiring a different sort of reputation – as an important nesting site for shore birds.

Waterborne birders come to the Brothers to observe egrets, night herons, cormorants, and many other avian species. The New York Chapter of the Audubon society conducts regular census work on the islands. According to a report it submitted to the national organization, surveys conducted in 2004 found large populations of breeding great egrets (an estimated 60 nests), snowy egrets (an estimated 65 nests), and black-crowned night-herons (365 nests). There were also cattle egrets (two nests) and glossy ibis (four nests), as well as the more common double-crested cormorants (350 nests), herring gulls (more than 140 nests), and great black-backed gulls (over 90 nests). Under the auspices of the New York City Department of Parks & Recreation, the Bronx Zoo, and the Audubon Society, plans are being developed for habitat restoration on both islands to enhance opportunities for avian and other species to continue making the Brothers their home.

In June of 2012 I sailed between the Brother Islands in my old Crosby catboat, as I often do on my way out to the Long Island Sound. I have never set foot on either of them, but as on past occasions – whether circling the islands or anchored just offshore for better views of their winged inhabitants – I told my crewmates gloomy tales of North Brother's history. Now, however, the stories end on a more upbeat note. Although nothing is ever final in an estuarine environment, especially when the sea level is rising, the city has designated North and South Brother islands nature sanctuaries, and they are likely to remain urban wilderness areas for a long time. Shorebirds and upland species will return there to nest. The ruins will crumble. And all of it will be best seen not from far above, but from the river itself. – William Kornblum

Tresco Abbey Garden

Isolated as they are across the waters, islands offer challenges to visitors and residents alike. Weather is one factor that greatly influences the ease of arrival and departure. I discovered this for myself on a windy, wet morning last April as I headed out to sea by plane to the Isles of Scilly, thirty miles southwest of the British coast of Cornwall. I could see the rocky shores of St. Mary's Island as the plane descended to the narrow runway only to make a sharp lift into the air again. "Too much crosswind to land," the pilot announced. After a half-hour of cruising – with clear views of the islands, framed by white sandy beaches – a second attempt was likewise aborted, taking us back to Land's End and a smaller, more maneuverable plane hours later.

Following a successful landing on St. Mary's, there was the matter of being transported by van to the docks, where we boarded an Isles of Scilly Steamship Company boat. Plying treacherously high waves in a driving rain, this boat delivered us to Tresco, one of the five inhabited islands among the forty or so in the archipelago. Within minutes of my arrival, Mike Nelhams, the curator of Tresco Abbey Garden, arrived at quayside in his green Japanese Diahatsu (no other vehicles are permitted except for golf carts and tractors), and thus began my adventure into a botanical wonderland – a vast, subtropical hillside garden maintained since 1834 by five generations of one family. The fact that this garden also provides the cultural and economic underpinnings of a seemingly idyllic island life only adds to its charm.

As we drove to the garden, Nelhams described how the island's environment made the garden unique. Though Tresco is far out in the Atlantic Ocean, the warming airflow from the Gulf Stream produces temperatures from forty-six to seventy degrees Fahrenheit, creating a two-mile-long, 735-acre, paradisaical island he calls "the Riviera without the heat." And then Nelhams delivered an astounding fact. "While the plants have been collected from many countries to flourish in this sheltered environment," he explained, "those selected from one country may not grow in another, so that Tresco is the only garden in the world where all of these particular plants can be seen growing together."

Despite the dramatic weather and the hour, we went straight into the garden where, under towering palm trees (almost three dozen different species) and thirty-five-foot-high evergreen oak hedges clipped into wave patterns, I first saw the profusion of plantings. Along its formal pathways and terraces, stiff-leaved agaves, architectural in their severity, are coupled with fluffy-blossomed shrubberies and luxuriant ground covers. Off the Long Walk that bisects the garden, circuitous

pathways lead to two upper terraces where clifflike support walls have been transformed into self-seeded tapestries of succulents and floral cascades. After climbing up the garden's central staircase, Neptune's Steps, with its long, Villa d'Este-style vista under palms rather than cypresses, we turned right toward the Gothic-arched ruins of the abbey that gave the garden its name. There, high above the hillside, stands the comfortable cluster of blocky granite buildings and towers that forms the manor house, now called the Abbey.

"Exotic" may be too tame a word for the singular, spiky, bottle-brush blossoms I encountered, with their brilliantly contrasting colors – "extraterrestrial" is more like it. Neither rain forest nor simple botanic garden, this collection of trees and plants ingeniously juxtaposed across fifteen acres is – as I came to learn – the Noah's ark of plants from far-flung Mediterranean climatic zones.

Having discovered this brave new world, I spent my evening poring over my books – among them Nelhams's book *Tresco Abbey Garden*, which sensitively delineates its origins and evolution over many years. I learned that there were early Roman settlements on the islands and that the writer Sulpicius Severus (c. 400 CE) refers to the *Sylina insula* off the British coast. But the origin of the name of the Isles of Scilly remains a mystery. In the tenth century, St. Nicholas Priory was founded on Tresco as a dependency of the Benedictine monastery at Tavistock in Devon, and the monks stayed well into the sixteenth century. In 1834, when a young, well-to-do Oxonian named Augustus Smith acquired the ninety-nine-year leasehold on the islands from the Duchy of Cornwall, he selected the site above the priory ruins for his home. Although Tresco is protected by the surrounding islands, the terrain, buffeted by salt gales from the Atlantic Ocean, was inhospitable to anything but bracken and heath. But by building more walls, Smith created a protected site for an extravagant garden where, early on, he designed a pebble garden in the configuration of the Union Jack, with bedding plants in red, white, and blue. In brief, he laid down the bones of the garden as it exists today, with extensive south-facing terraces and intermittent walkways sheltered on the northern and western hillsides by a belt of fast-growing Monterey pines and cypresses from California. The formality of its design, in combination with its unusual leaf textures, brilliant colors, and the wild array of dense plantings at various heights, gives the garden its visual splendor.

While the Royal Botanic Gardens at Kew supplied some early plants, Smith realized that the Mediterranean climate of warm winters and low rainfall meant that plants from South Africa, Australia, and New Zealand would survive year-round. In addition, many seafaring men from Scilly, who had profited from Smith's new programs for compulsory education on the islands, brought back plants and cuttings from their voyages. (Current plantings come from Bermuda, Brazil, Burma, Canary Islands, Cape Province, Chile, China, the Himalayas, Japan, Madeira, Mexico, northeast Asia, Peru, Sardinia, the southwest United States, Tasmania, Uganda, Uruguay, and a variety of Mediterranean coastal countries.)

At the same time, Smith created another major attraction within the garden: a collection of figureheads, gathered from the frequent shipwrecks around the islands, to which he gave the name Valhalla. Indeed, these proud wooden figures of aristocratic women, fashionably dressed men, and even a monk would have possessed – as they still do – a kind of godlike spirit, symbolizing the hopes and ambitions leading the ship forward. Beautifully restored to the finest detail, they are in a sense also a memorial to those lost at sea.

Smith died without heirs in 1872, but fortunately a nephew, Thomas Algernon Dorrien-Smith, fresh out of the Hussars, took up the botanical mantle as lord proprietor. Beyond the personal upkeep of the Abbey Garden, the family has always served as responsible overseers of the islands' welfare, especially during Dorrien-Smith's watch, when inhabitants suffered from the decline of shipbuilding and potato farming. Since I had noted the vast meadows of narcissus and garlic blossoms on St. Mary's, I was not surprised to learn that Dorrien-Smith had greatly expanded the islands' cut-flower industry, which brought with it renewed prosperity and improved shipping facilities. Because their growing season was a month ahead of the mainland, some locals had already begun exporting flowers to Covent Garden in London, but Dorrien-Smith traveled to Holland and Belgium to research the latest horticultural techniques and devoted his own land and new glasshouses to growing narcissus. He eventually cultivated 150 varieties,

Ruined abbey arch covered in plants in this superb sub-tropical garden.

inspiring farmers to follow suit. The launches that shipped the crates to the mainland also delivered the local fishermen's catch.

When Dorrien-Smith died in 1918, his son Arthur Dorrien-Smith was already an experienced horticulturist. Arthur had collected specimens for Tresco in Australia in 1903, when he was serving on the governor general's staff there, and he attached himself to a botanic expedition to Chatham Island, near New Zealand, in 1907. He also sent plants home from the Veldt during World War I. After returning to England around Cape Horn with a boatload of rare plants in holding cases, he divided his finds among Tresco and the Edinburgh and Kew botanic gardens. In 1922, Arthur decided to relinquish control of the four other inhabited islands to the Duchy of Cornwall, retaining Tresco as the family's private domain and focussing on its garden. He and his wife, Eleanor, an equally enthusiastic plants person, spent their honeymoon collecting in the Australian bush, which resulted in a scientific paper for the Royal Horticultural Society by Arthur, and many additions to the garden. By 1935, it was calculated that nearly thirty-five hundred species and varieties had been cultivated in Tresco Abbey Garden.

As the successor in 1955, Thomas Mervyn Dorrien-Smith (Arthur's last remaining son, since the other three had been killed in World War II) learned to become an enthusiastic plantsman. But with the garden's increased popularity, he was keen to develop tourism alongside agriculture to support Tresco. His mother accompanied him to Australia, where he collected 220 more specimens, and also to New Zealand; later, with his wife, Peggy, he traveled to South Africa. With high-profile visits from members of the royal family, the garden's first exhibit at the Chelsea Flower Show in the early sixties, and a new helicopter service and cottages to rent, Tresco became a destination garden – without, however, ever losing its close family associations.

Mike Nelhams first arrived at the garden on a student scholarship in 1976, following his training at the Royal Horticultural Society's Wisley Garden. During this initial sojourn he met his wife, Isobel, who was born on Tresco. They have lived there ever since Nelhams returned in 1984 as head gardener; he is now curator. His book is not only a history but a pictorial dictionary of the exotic plants that thrive on Tresco, and it includes a list of the more than 240 plants that are in flower on New Year's Day. Knowing the garden's past history – and the owners' generational devotion to developing its singular collection of rare species – is important to grasp fully the extent of the natural disasters that befell it during the current tenancy of Robert A. Dorrien-Smith, who took over from his father in the seventies.

An example of the the varied Mediterranean-climate plantings with contrasting shapes and foliage that define Tresco Abbey's architectural structure and vegetative variety exuberance.

Although the garden had been damaged by gales in the past, those had been nothing compared to the freak snowstorm that arrived in January 1987, covering the garden for the first time and leaving freezing temperatures in its wake for weeks to come. When the snows finally melted, the garden's custodians were faced with the total destruction of thousands of tender plants and sheltering trees, many collapsing into soggy heaps after their caretakers' vain attempts at regeneration or tree surgery. In October of that year, Nelhams set out with another gardener on an ambitious plant expedition of their own to the mainland to replenish the garden's offerings and restore it to its previous glory. As they made the rounds of botanic gardens and private collections, one likes to think that many of the plants, cuttings, and seeds they amassed had descended from the gifts made by previous Dorrien-Smiths after their own expeditions on foreign shores – an unintentional investment in an unforeseen future. Surplus plants from Kew's temperate collection were a major contribution to the garden's revival.

Just as all seemed well again, three years later on another January morning the winds picked up and gigantic waves smashed against the island. By late morning, with wind speeds reaching 127 miles per hour, Tresco inhabitants found themselves in the midst of a ferocious hurricane, with human safety the first priority. But soon the sound of huge trees falling and branches breaking filled the air as the garden's hillside shelterbelt, pivotal to the survival of this protected environment, crashed to the ground. Whole forests simply disappeared, including old trees from the original plantings. In recognition of Tresco's importance as a singular British botanic garden, English Heritage came to the rescue with financial assistance for tree removal so that replanting and restoration could begin all over again. In the end, sixty thousand trees were planted to renew the shelterbelt, with those from California's Monterey Peninsula the leading choice, and windbreak fences were placed throughout the garden to protect newly established tender plants. Botanic garden contributions came generously from the mainland, but in addition family members traveled extensively to collect new seeds for the garden.

On the picture-perfect day I set out with Nelhams on my second morning on Tresco, the experience of the garden and its lush beauty was enriched by my understanding of the tremendous effort, intelligence, and perseverance required to have re-created it – a process through which Nelhams remained in command with a jovial outlook. What may appear as a hodgepodge of plants and trees is monitored assiduously, indeed daily, and the planning process incorporates both new placements and naturally seeded areas with their surprises. As we walked along the upper terrace, there were landscaped hillocks overlooking the calm blue sea, and along the western

edge the Aloe Walk opened onto vast fruit and vegetable gardens, with a central walk bordered by clipped bay trees and lavender. And in the several greenhouses, some of which housed fruit trees in earlier times, rows upon rows of seedlings are watered daily – after which, as Nelhams demonstrated, the earth must be compacted in each small pot.

The extreme damage created the opportunity for designing a terraced Mediterranean Garden within the garden. The new space is built around a central fountain: an enormous bronze agave. A gazebo called the Shell House is at the apex of the garden, decorated inside with shell and broken-tile mosaics in floral motifs; these have been executed by Lucy Dorrien-Smith, the wife of the current proprietor, whose artistry can be seen throughout the island. The Mediterranean Garden, with its clipped olives and *Aeonium*, *Protea*, and *Aloe* flanked by two Canary Island palms, recalls the great Hanbury Botanical Garden at La Mortola on the Italian Riviera. In fact, during winter's slow periods, Nelhams and his gardeners travel to La Mortola each year to expand their experience by working in the garden there and visiting others in the area.

Tresco Abbey, Neptune's Steps through palm trees looking down the garden towards the sea.

On my last morning on Tresco, I went to visit the garden a final time. I set out from the inn in the village early and walked along the shore to a back road that passes through farmland and cattle pastures, offering a view across the countryside to the old St. Nicholas Church. I turned into the lane through the towering, forested shelterbelt behind the garden, passed by the Abbey gate, and continued down the hill along the heliport field across from the garden's main entrance. Passing through it, I ambled along the Long Walk and climbed up to the abbey ruins with the flower-encrusted Gothic arch and through a pergola to an upper terrace with a grottolike enclosure by a pond, all the while being rewarded periodically with glimpses of the sea.

Book in hand, I proceeded at a leisurely place, identifying plants along the way and marveling at the forms of many of the blossoms, especially the *Banksia* and *Protea*. The day was fair and balmy, in contrast to that of my first visit, and by now I had grown familiar with the pathways and secret corners that made me feel at home in this treasure trove of a garden.

When I took my leave through an avenue of flame trees, I gave a wave to Mike Nelhams, who was about to give a tour to visitors on a walking trip. I followed a narrow lane across the bracken-and-heath-covered dunes to a lone dock that Mike had shown me from his Diahatsu; by foot, however, the distance seemed frighteningly endless. Under a blazing sun and blue skies, I trudged on, hopeful of finding my way. Finally, at a rise in the path, I saw the decline down to the water and a slender dock, just as the launch ordered to fetch me came into view, gliding through the water. On this day, at this hour, the tide was at its lowest point of the year, and elsewhere people were walking from island to island. As the boat pulled away to make the run to St. Mary's, Tresco receded, losing the features that had become so dear to me in a few days but would be there again when I returned.

Back in New York, I unpacked the purple *Aeonium* cutting Nelhams had given me and potted it with good drainage, placing it on my living-room window sill where double glazing has produced a Mediterranean climate of its own. Each day, after watering, I compact the earth just as Mike Nelhams instructed me in the greenhouses. After several inches of growth have appeared, I will cut off the rosette of dark, fleshy leaves with the hope that, as he promised, two more rosettes will grow in its stead, as a memory of Tresco. – Paula Deitz

Mutable Islands: The Evolving Galapagos

The Galapagos are in many ways the ultimate islands. Situated some six hundred miles out to sea in the Pacific, these fourteen-plus rocky outcroppings are prized for their remoteness, isolation, and nearly pristine natural beauty. There are also distinct worlds within these islands, each ecosystem hosting species and subspecies of flora and fauna that exist nowhere else on the planet. But just as they were upon Darwin's visit – and as they were for the millions of years before – these islands are changing. The volcanic activity that formed them continues to shape the newer islands today. And beyond the plodding geological scale, in the last four centuries human beings have subjected the Galapagos archipelago to a rush of invasive animals and plants as it has become increasingly connected with the ever-encroaching world.

A Galapagos tortoise grazes on Santa Cruz Island.

It was during his relatively brief time here – just five weeks of a five-year journey – that Charles Darwin began to gather evidence for his comprehensive theory of evolution by natural selection. On a trip in the summer of 2012, 177 years after Darwin, I, too, witnessed firsthand the stunning differences of coloration between the brown Galapagos land iguana and the yellow Santa Fe land iguana; attempted to discern the various sizes and disposition of the dozens of finches; and tried to follow naturalists' explanations of the subtleties of distinguishing each island's cactuses.

On Santa Cruz Island, I trekked through the tall grass, finding the giant Galapagos tortoises slowly grazing their way through the afternoon – just as some of these long-lived creatures had been doing since Theodore Roosevelt was president

of the United States. These humble giants, or *galapago*, are the namesakes for the whole archipelago; the appellation was chosen by the sixteenth-century Spanish explorers who encountered the docile, lumbering, four hundred-pound terrapins. In subsequent centuries the tortoises were pillaged by sailors, carried down to boats by the hundreds as a source of long-lasting food on ocean journeys. Exactly how many island-specific subspecies exist – or persist – is still up for debate.

Each island holds its own world. On Espanola, in the soft sunset, the scrubby forests resounded with the dull clacks of albatross bills as countless couples performed their pairing rituals. On the side of the trail, blue-footed boobies whistled and honked their stylized mating dance while others sat nearby on eggs, apparently unbothered by our nearby footfalls, whispers, or camera shutters. On wind-swept Genovesa, above Prince Philip's Steps, a sleepy, short-eared Galapagos owl emerged from its ground nest after a day's rest.

Initially Darwin was not all that impressed by the islands when he visited them in 1835, during his voyage on the *H.M.S. Beagle*. On September 15, after making his first landing in the archipelago on San Cristobal (where many tourists now arrive or depart by plane), Darwin proclaimed in his travel narrative *The Voyage of the Beagle*: "Nothing could be less inviting than the first appearance." Indeed, as our plane touched down, aside from the small open-air airport, it looked to be a landscape mostly of dry grass and scrubby vegetation.

Darwin had spent the last three and a half years exploring various Atlantic Ocean islands and the fascinating frontiers of South America. A humble, equatorial island "covered by stunted, sun-burnt brushwood, which shows little signs of life" must have literally paled in comparison to the stunning and exotic tropics he had encountered in Brazil. Nevertheless, he soldiered on, collecting specimens from a few of the islands during his relatively short time in the archipelago, while the crew of the ship sailed ahead, completing their cartographical mission to remap the islands. Darwin gathered plants, seeds, birds, and insects, diligently noting each one, if not where he had collected it. But it was not until a chance conversation on Floreana Island with fellow Brit Nicholas Lawson, the vice governor, that Darwin learned that locals could distinguish tortoises from different islands by subtle differences in their shell shape.

At the time, the observation came as rather a shock to Darwin, who noted, "I never dreamed that islands, about fifty or sixty miles apart, and most of them in sight of each other, formed of precisely the same rocks, placed under quite similar climate, rising to a nearly equal height, would have been differently tenanted." Indeed he had been carelessly mixing his collected finch specimens together, not suspecting that the island from which they came would much matter. But this seemingly random aside set the wheels in motion, ultimately leading him – from what looked to be such a barren place – to the rich and enduring theory of natural selection.

Darwin wrestled with his theory, especially given its theological implications. After twenty-three years back in England, studying his and others' collections and performing experiments, he only published his *Origin of Species* when he learned that another naturalist, Alfred Russell Wallace, had come to the same conclusions on the shores of another set of islands – the Malay archipelago – halfway around the world.

In his writings, Darwin called the Galapagos "a little world within itself." These miniature worlds were "physically similar, organically distinct, yet intimately related to each other," he wrote. This intimate relationship brought about the incremental changes that he ultimately documented in flora and finches and that others had observed in the tortoises. And it was these fine-grained differences – rather than the presence of vast, glaring variations – that led him to the conclusion that, "both in space and time, we seem to be brought somewhat near to that great fact – that mystery of mysteries – the first appearance of new beings on this earth."

The insight about the tortoises might have dawned on Darwin eventually. But it is interesting that it came first from someone

Darwin Bay, Genovesa Island.

who had already been observing life on the Galapagos for some time. The archipelago had long been a stopover for pirates and whalers alike. And by the time Darwin arrived, hundreds of people were already living there – most as part of an Ecuadorian political penal colony (what paradise for punishment!). Today, due in part to previously lax government settlement rules, the human population has exploded to more than twenty-five thousand. To my great surprise, some of the islands host whole towns and farms, complete with cattle and buses and chintzy, touristy T-shirt shops. With these pockets of civilization (many catering to visitors such as ourselves) have come imported goods and foods and new species.

A Galapagos land iguana basks in the sun.

As Darwin realized – from his own experience with doves so tame that one could walk over and kill them with a whack from a stick – the many acquired traits of local species also made them vulnerable to change. "We may infer," he wrote, "what havoc the introduction of any new beast of prey must cause." Some of the earliest human visitors and residents brought the most harmful animals: rats from ships; goats and pigs from farms; cats from household settlements. Darwin himself even remarked on the plentitude of wild goats and pigs roaming the woods of Floreana Island. These early invaders wrought havoc on the finely tuned ecosystems on many of the Galapagos islands. Goats and pigs stripped the vegetation that giant tortoises needed to survive. Rats ate the eggs of tortoises and birds. And feral cats pounced upon unafraid iguanas, decimating many of the populations.

Alarmed to see the Galapagos go the way of the world's other island ecosystems, in the late twentieth-century conservationists began a patchwork-style assault on the invaders, which has escalated in recent years to full-fledged war. Helicopters have been dropping poison-filled cubes over many of the islands to kill off invasive rat populations, an attempt estimated to cost about $1 million. The wild goats have been even more difficult and costly to kill. Previous failed attempts led park managers to take drastic and elaborate measures. A group of goats were tagged and sterilized. Released back into the wild, these animals, nicknamed "Judas goats," would seek out the company of other goats, thereby betraying the location of population clusters. Helicopters were then dispatched and the nontagged goats gunned down, leaving the lonely Judas goats to find other companions, which would meet similar fates. After an estimated $6.1 million and about four and a half years, some eighty thousand goats were eradicated from Santiago Island's craggy landscape.

While conservationists were wiping out nonnative interlopers, they also launched large-scale captive breeding programs for endemic species, such as some tortoises and land iguanas, that seemed to be at risk of being pushed off into extinction. These programs are, like the eradication ones, rather rigorous. Conservationists have gone to great lengths to preserve the distinctive subspecies' lineages (so much so that they have sterilized many hybrid tortoises rather than offer these new breeds a chance to recolonize niches left vacant by extinct varieties on depopulated islands such as Pinta and Floreana).

The epicenter of these programs is the Charles Darwin Research Station on Santa Cruz Island, run by the Charles Darwin Foundation. This ramshackle collection of buildings in various states of disrepair and construction contains breeding and experimental operations for animal and plant species. Baby tortoises with numbers painted on their shells scramble around their barbed-wired-topped enclosures. The centerpiece to the organization's effort has long been the last-known Pinta tortoise, Lonesome George, who famously failed to produce any offspring in his thirty years in captivity, despite many patient female companions.

Just a couple of days into our trip, news reached our ship that Lonesome George had died unexpectedly the day before. And so, with a last breath heard by no human, not even his longtime caretaker Fausto Llerena, this Galapagos giant tortoise subspecies was officially gone.

Every man might be an island, as the saying goes, but no island is an island. Only today with such rapid movements of goods and species have we realized this with such clarity. But it is perhaps instructive to look back over evolutionary history and see that no island has ever been an island. Wherever there is life, there has been a connection made to another place, whether that's a seed dropped by a bird or a tortoise carried on a raft by an ocean current.

Surely there is no easy solution to managing these disparate fragile places. Even the fresh fruits and vegetables for our

An intrepid Mollugo volunteer emerges in the lava fields of Santiago Island.

ship's meals had to be washed and vacuum-packed before being flown out from the mainland to prevent invasive species from hitching a ride (a measure, like so much else in the Galapagos, that seems so extreme as to be hardly sustainable). Since 2007, the Galapagos has been protected as a UNESCO World Heritage Site. Ecuador has also placed greater restrictions on residents moving to the Galapagos from other prefectures. And the National Park, which administers most of the islands' land, gives out a limited number of permits for tourist boats and strictly controls their itineraries and the areas where guests can visit. Nevertheless, the visitors keep coming. And locals also require modern comforts – imported foods and goods – too. So to truly conserve or reinvent a historical version of the Galapagos, are people – residents and visitors – to be expunged along with the introduced animals? Many families have now been living on the islands for generations. Are they to be slowly forced out to restore the place to its prehuman history? Where do we draw the line?

But even as invasive blackberries (not even the kinds that are good to eat, one of our guides explained) are squeezing out indigenous plants, and accidentally imported mosquitoes are spreading rapidly across the landscape, threatening to bring avian malaria to endemic birds, the islands themselves are being recreated and destroyed by the earth itself. The islands sit on the eastern edge of the Nazca Plate, which is moving eastward over a volcanic hot spot. This opening has birthed the islands, slowly, over millions of years, creating a timeline of islands, and continues to shape the newest ones, Isabela and Fernandina. And we do not have the full story to study. The Nazca Plate is slowly being forced back down into the Earth's mantle by the adjacent South American Plate. Genetic studies of some of the islands' animals have shown them to be much older than others, much more deeply divergent from their closest relatives on the mainland, suggesting that their ancestors may have been living on Galapagos islands that no longer exist. Those erased islands must remain part of the Galapagos of the mind.

Our journey was plotted along geological lines, beginning with some of the oldest islands. Our first stop, San Cristobal, a well-worn, scrub-covered mass, is at least 2.5 million years old. Toward the end of our trip, we hiked on Santiago Island, which is estimated to have first emerged some 750,000 years ago. On its eastern side, in a place called Sullivan Bay, a few brownish, cinder-cone volcanoes "peaked" up in the distance, but the foreground was all black, lunarlike lava. Its contours in 2012, in fact, would have been unfamiliar to Darwin, Captain FitzRoy, and the surveying crew aboard the *Beagle*. Just sixty-two years after their expedition left these waters, a large volcanic eruption pushed out fresh lava. Pouring slowly out to sea, it incinerated anything in its path.

Today, this 115-year-old event remains freshly told in rocks formed from pahoehoe lava, resembling twisted ropes in some places and frozen waves in others. Bubbles frozen in the act of bursting seem to be gurgling up imaginary gasses from some unseen heat source.

In this dramatic landscape, which dwarfs and overwhelms even the surrounding sea, one has the feeling of being on another planet. It would not seem out of place to spot three moons hanging in the afternoon sky. But instead there was the familiar sun and a faint rainbow. And down below, if you looked closely enough, a few small, volunteer *Mollugo* plants were already creeping out of the rocks, colonizing the island's newest frontier. – Katherine Harmon

Gardens on Alcatraz?

If once you have slept on an island
You'll never be quite the same.
In your dreams the tide and the seagulls
Will softly be calling your name.
Your everyday life will be happily changed
For deep in your heart will remain,
The fresh salt air and the sound of the surf,
To recall – to return once again.
Anonymous

The romance of islands is undeniable. Throughout history islands have been places of great mystery and allure, often attached to dreams of paradise – Bali Hai, Maui, Tahiti, Majorca – places to escape the demands of everyday life.

Then there is Alcatraz. The name itself conjures up an inescapable fortress full of the nation's most notorious criminals – Al Capone, Machine Gun Kelly, and others – a terrifying specter perpetuated by both fact and myth, a hard, isolated, cold place of unrelenting grayness and harsh treatment, surrounded by barbed wire and ever-watchful guards in gun towers. It was not a place "To recall – to return once again." On the other hand, this popular view of "The Rock" draws 1.3 million visitors a year, 5,000 a day, seeking to satisfy their macabre curiosity about a time that represents a very small piece of its history as a Federal penitentiary (1934 to 1963).

The island got its name from a Spanish sailor entering San Francisco Bay in 1775, who called it *Isla de los Alcatraces* because of its numerous birds; *alcatraces* translates as "pelicans" or "cormorants." The name may also have been applied to nearby Yerba Buena Island (the island of "good herbs"), but the name stuck to this island, evolving into "Alcatraz," a label that now has very different connotations. In 1972 Alcatraz became the centerpiece of the sprawling Golden Gate National Recreation Area, and it was opened to the public the following year. Owned and operated by the National Park Service, this lonely and abandoned fortress has become one of its most popular parks. At the same time, a longer and less dramatic island tradition has recently revealed itself – that of gardening on The Rock.

The horticultural history of Alcatraz is a compelling account of men and plants brought together on an island hostile to both. Like their keepers, the plants brought there over the past hundred and forty years became prisoners too, banished from the well-tended gardens of the mainland to what had been a windswept hump opposite the Golden Gate.

As those "inside" residents discovered, only those plants that could adapt survived. Today, we see those surviving plants as a living history of an island in constant change of over a hundred years of occupation. They tell the other story of this forbidding prison – the human and humane story of individual and group efforts to bring a bit of beauty to the otherwise grim island; of changing fashions in plant selection through the years; of survival and adaptation in an unyielding environment; of rich, new ecosystems created where none existed before; and of the therapeutic solace found in caring for plants in a place where little compassion was in evidence.

In 1853 this gently sloping island was first transformed into a military fort by grading it into high cliffs to support a three-story barracks, known as the Citadel, and its gun emplacements. The only vegetation – mostly grasses and forbs – was destroyed. By 1890, every foot of soil had been cut away or buried. Soil was imported from nearby Angel Island to build defensive mounds and create planting beds near the officers' houses. Initial planting to control erosion was followed by the planting of gardens for Officers' Row on the leeward side of the island. As early as the Civil War, Alcatraz was also used as a military prison. Inmates – who were called "trustees" – became the first gardeners, creating compact displays of colorful annuals and perennials.

A c. 1870 photograph by Eadweard Muybridge shows an elaborate garden on the east side of the Citadel. Deep holes had been cut into the rock, filled with soil, and planted with roses, sweet peas, and lilies. The beds were irrigated by canvas hoses from underground cisterns. Typically Victorian in its layout – chock-full of flowers, its fences dripping with roses – this garden clearly demonstrates the desire to bring civility and beauty to an otherwise barren spot. The Army developed a vocational garden-training program in which men were studying to become gardeners.

Despite these efforts, public disapproval of the island's stark appearance from San Francisco inspired more extensive beautification work. In the fall of 1923 and spring of 1924 the California Spring Blossom and Wild Flower Association mounted an aggressive campaign to beautify the island, along with Yerba Buena and Angel Island. Army prisoners were enlisted to plant three hundred trees and shrubs, install lawns, and plant wild flowers. Donated by members of the Association, these plantings included native pines, sequoias, and cypresses, as well as one hundred pounds of nasturtium and Shirley poppy seeds.

Many of these plants died, due to the shortage of water, pervasive wind, and lack of adequate maintenance. But with the help of moisture from summer fog and their inherent adaptability, some did survive. Army photographs show imported eucalyptus and Monterey cypress (*Cupressus macrocarpa*), pink ice plant covering the slopes, and century plants (*Agave americana*) along the south side of the island, lining what became known by the curious name of "Lovers' Lane." One cannot conceive of a less romantic plant than the spiky agave, but this was Alcatraz!

In 1933 Alcatraz was transferred to the Bureau of Prisons and an era of planting and tending the gardens and beautifying the island came to an end. Still, when the Federal employees arrived in early 1934, they were greeted with an unexpected display of flowers spilling down the rock slopes and terraces. A "Persian Carpet" of pink-flowered ice plant draping the south slopes, a beautiful rose garden, a greenhouse, and smaller gardens scattered throughout the island helped allay their fears of a bleak life on the Rock.

Fortunately, a man came along who would honor the Army's horticultural legacy. Freddie Reichel, Secretary to Warden Johnson from 1934 to 1941, was so impressed with the island's gardens that he committed his free time to their care and to expanding the plantings. In correspondence many years later, Reichel gave a detailed account of the gardens and his efforts over seven years to improve them: "I knew . . . that it would be impossible to maintain all that glory . . . but I resolved then and there to try to find some time in my . . . long days for the relaxation afforded by the raising of plants for others to tend and the development of areas by myself."

He took over the greenhouse, the rose garden, "the slope behind my quarters and the small, flat garden near the Post Exchange." Though he admitted to having little horticultural knowledge, Reichel became an expert self-taught gardener through his love of plants and his dedication to improving Alcatraz. From his isolated outpost, Reichel sought out both knowledge and plants from a group of experts that reads like a *Who's Who* of horticulture in California – Kate Sessions of San Diego, Hugh Evans of Los Angeles, and Edward O. Orpet of Santa Barbara. Locally he made friends with members of the California Horticultural Society. By attending their meetings in San Francisco and enlisting their help, he was able to learn enough to combat the difficult growing conditions on Alcatraz. Remembering the spectacular succulent gardens created by Kate Sessions at Balboa Park in San Diego, he corresponded with her for advice. Her generosity in providing cuttings of various species of agave and ice plant enabled Reichel to beau-

In the early 1920s, the military was pressured by San Francisco to beautify the island. The south side of the island was planted with agave, eucalyptus trees, and pink ice plant. Photography by Elizabeth Barlow Rogers.

tify the previously unplanted, wind-blasted west side.

He quickly learned to adapt his plantings to the difficult growing conditions: wind, drought, and poor soil in terraced beds that were frequently bathed in fog. He turned first to California native plants – which, he later wrote, were "more famous in England than here. It is so good to have plants which literally smile back at you." His plants of the native, white-flowered bush poppy (*Carpenteria californica*) and the brilliant, yellow-flowered flannel bush (*Fremontodendron californicum*) are no longer there, but the logic of choosing native plants demonstrated good horticultural sense.

Evidently he learned about other, similar regions of the world whose plants might survive the wind, fog, and drought. He sought tough plants that would thrive on neglect – "even downright abuse." One of his most popular introductions was

An unknown penitentiary inmate gardener standing in bed of red roses in Officers' Row garden (undated photo by Lt. Joseph H. Simpson, courtesy of Joan S. Moore, Simpson's daughter).

the showy, blue-flowered Pride of Madeira (*Echium fastuosum*). A single plant acquired from the Los Angeles nurseryman Hugh Evans has naturalized, and its seedlings still grace the island in early spring.

He planted many succulents in addition to the ice plants and century plants – species of *Aeonium, Aloe,* and *Sedum.* Bulbs, many of which come from the Mediterranean region and South Africa, were well adapted to the wet winters and dry summers. He not only planted such bulbs as gladiolus, narcissus, and watsonia, but also experimented with hybridizing new varieties.

In time, Reichel cajoled his superiors into assigning "trustees" to assist him. He willingly and patiently shared his passion for plants with the inmate gardeners. In an era when prison officials gave no thought to horticulture as a form of therapy to rehabilitate the incarcerated, Freddie Reichel must have been a positive influence on the inmates who helped him. He wrote of one man's amazement "to find that plants 'were like that' when I explained to him the mysteries of hybridization."

Upon Reichel's departure, in 1941, inmate Elliott Michener (AZ-578) arrived. He was assigned the weekend duty of retrieving softballs that went over the wall of the prison Recreation Yard onto the slope below and helping to maintain ice plant on the ragged, barren slope. By December, he had become a full-time gardener, working seven days a week on the area east of the fence that divided the slope. There he began a six-year endeavor to create his garden. Years later, Michener described his experience:

> My gardening work began with planting the strip of hill beside the steps with mesembryanthemum, so that all of the hillside would be the same – pink, laced with (yellow) oxalis. The terrace – six to ten feet wide on either side of a curbed, graveled road – had been gardened, apparently, for many years, but under difficulties. Nowhere was the soil more than four or five inches deep. Under that was solid yellow hardpan....
>
> I undertook what turned out to be a two-year task – breaking up the hardpan to a depth of 2 1/2 feet, screening it, fertilizing it with thousands upon thousands of five-gallon pails of garbage lugged up from the incinerator and disposal area. . . . As the garbage rotted and the beds subsided, I planted them with Iceland poppies, stock, and snapdragon, all supplied by my friend Dick Franseen. Later, I got permission from Warden Johnson to send out for seeds and plants and was able to raise picture-beds of delphinium, chrysanthemum, dahlias, and iris. . . . All the water for the hillside and the terrace came from the general supply, brought in by barge. There was never any attempt to conserve on it.

Dick was Richard C. Franseen, AZ-387, whom Michener described as "a happy-go-lucky farm boy who had a good knowledge of how to grow plants," and who had a small garden and greenhouse on the other side of the island that Michener never saw. Franseen taught Michener a great deal about gardening – which would become for Michener a lifelong passion. He also gave him seed catalogs to study and provided him with seeds and plants he had propagated in his greenhouse. The two men became lifelong friends.

Michener was also befriended by a tough but compassionate guard, Captain Weinhold, who helped him secure various resources for his garden – old windows that had been removed from the cell house and stored in the model shop were used to build a flimsy but serviceable greenhouse on the foundation of an earlier one. Weinhold also obtained plants and seeds for him on his trips to San Francisco. One day, after seeing the blisters on Michener's hands, he gave him a pair of gloves.

Michener's labor resulted in the conversion of a barren terrace into a garden of exquisite beauty bursting with flowers – Shasta daisies, Iceland poppies, red-hot pokers, and many others. It was hard, tedious work, but he relished the task as an escape from the stress of prison life. Each day he looked forward to returning to his garden, the physical labor helping him to endure his sentence on Alcatraz.

As Michener's garden flourished, he shared his flowers by providing large bouquets for the Warden's house. Warden Swope's wife showed her appreciation by giving him seeds and plants, eventually offering him the position of houseboy, cook, and gardener at the warden's house until his release from Alcatraz in 1950. During this period – his last two years on the island – Michener spent all his free time gardening when he wasn't doing things for the Warden and his wife. "She raised tuberous begonias in a little greenhouse I built," he later recalled, "and supplied whatever plants I wanted."

The legacy of gardens, beautification, and other planting efforts – from the early army days of the late nineteenth century through the Federal penitentiary period – was the accumulation of untiring efforts of dedicated individuals and groups whose passion for plants left extraordinary and lasting beauty on the Rock. Aesthetically, the plantings lack a designer's approach to composition, color, texture, form, and space. But in winter and spring, as though gracing an ancient ruin, their great beauty emerged in a kaleidoscope of color in this stern, forbidding place. When we realize the extraordinary effort that was required to create that beauty, our aesthetic appreciation becomes visceral. We then can appreciate the true meaning of the gardens: the human drama they represent and the dynamic process that changed the lives of the gardeners who invested their energies and spirits.

For Elliott Michener, like Freddie Reichel, the garden became not only a release but an obsession, and he found a new part of himself in his labor there: "If we are all our own jailers, and prisoners of our traits, then I am grateful for my introduction to the spade and trowel, the seed and spray can," he wrote. "They have given me a lasting interest in creativity.

At eighty-nine, I'm still at it." One can only imagine that many others had their spirits lifted and their lives changed in the same way – from the military gardeners and their families to the unknown men tutored by such gardeners as Reichel and Michener.

After closure of the Federal Penitentiary in 1963, the gardens and all the plantings were left fallow without any maintenance or irrigation. Surprisingly many plants did endure, despite the wind, fog, and lack of summer rain – Monterey cypress, roses, pelargoniums, Pride of Madeira, succulents, and many others. After almost thirty years of neglect, in 1992, landscape architect Ron Lutsko and his associate Robin Menigoz conducted a detailed inventory of these survivors, discovering and cataloguing nearly 150 different plants in over 100 genera amid a jungle of thorny blackberry and other "naturalized" weedy plants.

Today, a cadre of new gardeners is reviving the gardens of Alcatraz through the joint efforts of The Garden Conservancy, the National Parks Association, and the National Park Service staff on the island. After years of planning, research, and the development of a systematic approach, gardens are being resurrected to simulate the appearance and effects that the long history of gardeners endowed on Alcatraz. Instead of being compelled to live on the island, these dedicated gardeners volunteer to come to the island each week to perform such arduous tasks as removing thorny blackberry, hacking back overgrowth, and improving the soil with compost, in the tradition of the inmate gardeners. They began by uncovering and utilizing the many plants that had survived as the basis for reviving the past. Once the clearing out was accomplished, the volunteers turned to the more creative work of propagating, placing, and maintaining the new plantings. Near the old water tower they have built a new greenhouse – a replica of the original where Dick Franseen worked – and replanted the beds on the foundations of Officers' Row. They also continue to resurrect the inmate gardens, such as Michener's, using photographs to guide the spirit – if not the exact plant-choice – of their retelling of this forgotten strand of Alcatraz's story.

The gardens soften the harshness of the prison. Succulents are ideal plants for surviving the windy dry conditions of the Prisoner Gardens on the west side of the island.

Under the skillful direction of Shelagh Fritz, hired by The Garden Conservancy in 2006, volunteers (as many as 40 regulars) have cleared an imposing tangle of overgrown blackberry, ivy, and invasive shrubs and planted a series of five garden areas following treatment plans developed in association with the Garden Conservancy and the National Parks Association. Today, visitors are greeted with spectacular displays of flowers as they make their way from the ferry dock to the cellblock and beyond. Interpretive signs at each garden illustrate the original gardens with text and historic photographs. Docent-led tours provide a rich experience that ties together the human stories from the various periods of gardening on the island – from the Army to the Federal penitentiary – as a softer counterpoint to the harsh prison environment related on tours of the cellblock. Volunteer docents are trained under National Park Service standards and lead an average of 30 visitors to tour the gardens. A self-guided tour brochure is also available.

This garden is where Elliott Michener gardened on the west side of the island for eight years as an inmate. The photo shows its restoration in full bloom by the Garden Conservancy volunteers. Photo by Russell A. Beatty, 2012.

The dedicated garden volunteers range in age from teenagers to retirees and bring a variety of skills – masonry, carpentry, and gardening – with some speaking French, Spanish, or German. Of the 40 regulars, 20 come to work every week, with five twice a week. In addition, groups from businesses (56 in 2011) come to work in a team-building exercise to give back to the community. The passion and joy these amiable, hardworking volunteers find in their labors reflect the words of Elliott Michener when he said, "the work became a release, an obsession. This thing I would do well." And in the words of the anonymous poet, their lives, like the lives of the inmate gardeners, have been happily changed:

For deep in your heart will remain,
The fresh salt air and the sound of the surf,
To recall – to return once again.

– Russell A. Beatty

Singapore: How to Grow a High-Rise City in a Garden

Although the city-state of Singapore is home to some five million people, it occupies a relatively small space – an island of only about seven hundred square kilometers, located off the southern tip of the Malay Peninsula. Designing and planning for such a dense living environment is essential; the vast majority of the population lives in high-rise buildings. More remarkable are the exemplary efforts that have produced a city surprisingly green and full of nature. Singapore is rapidly becoming a model of vertical green living, relevant to many other Asian cities as well other parts of the world. As Poon Hong Yuen, the CEO of the National Parks Board, or NParks, told me on a recent visit, this is a matter of necessity for the land-scarce city.

Singapore is a difficult country to generalize about – a nation that has achieved in a short period a first-world level of economic and social development; a people highly diverse in religions, cultures, and languages living harmoniously together. The social and health statistics are impressive: Singapore now has the fourth-highest life expectancy in the world and the fourth-lowest infant mortality rate, far outranking the United States. The U.S. State Department calls its government a "parliamentary republic," but since Singapore achieved independence from the British in 1959 it has been largely controlled by one party, the People's Action Party, or PAP, with its first prime minister, Lee Kuan Yew, continuing to serve in that role for more than three decades. Although Singapore does not feel like an authoritarian country, the PAP exerts a significant degree of control over daily life.

From Singapore's beginnings as an independent nation, its natural beauty was given a central role. Greening the city was one of Lee Kuan Yew's passions. Efforts at fusing density and nature, so impressive to this writer, are not new here; they began in the 1960s when the city's motto was "Singapore – Garden City." Recently the motto has been changed to "Singapore – City in a Garden," and the shift suggests something quite significant – that the city is not simply a place of gardens, it is a garden, in which all current and future building is nestled. Although the tropical environment, in which everything seems to grow and grow well, is part of the plan's success, there is also much conscious intention here. It begins with the impressive protection of much of the interior of the island in nature reserves, and the extensive system of parks tied together by the 180-kilometer Park Connectors Network. These connectors are in some cases conventional trails and bike paths, but often they dramatically weave through and even above the city's extensive greenery.

One of the most impressive stretches can be seen in a series of parks called the Southern Ridges, where much of the connector is in the form of an elevated walk through the forest canopy, providing striking vistas and perspectives on both the natural and the built setting only a few hundred meters from extensive high-rise development. The connectors provide ecological connectivity but they also tie major housing areas and population centers to the parks. The goal is to eventually expand the network to three hundred kilometers. This system offers Singaporeans a remarkable opportunity to walk, stroll, and hike the city, with dramatic pedestrian bridges, such as the Henderson Waves, that save walkers from having to cross busy roadways.

And the city is doing many things to foster a culture that connects with and cares about nature. Its Community in Bloom program supports gardens throughout the city, some producing food, others flowers and butterflies. The number of these gardens continues to rise, and is now at 480. Planting trees and expanding the city's multilayered tree canopy is another key strategy. There has been a special effort to create nearly closed canopies along major roadways, and these provide important shade to residents. Rain trees, with their beautiful sweeping branches dripping with epiphytes, are plentiful, and they themselves serve as small, complex ecosystems. And

Singapore's extensive network of Park Connectors provides unusual access to parks and greenspaces. Much of this connector system happens aboveground, as in the canopy walk here along a series of parks called the Southern Ridges.

Singapore is emerging as an international model for how to grow densely as a city but also to provide access to nature and greenery.

everywhere in this city, it seems, leftover space is planted with trees and greenery: under highway and transit overpasses, along median strips, or even on the small, sometimes oddly shaped parcels that surround buildings.

A Future of Vertical Gardens

Singaporean innovations are especially impressive in the area of vertical greening; the country recognizes that most future growth will by necessity happen in high-rise buildings. NParks has a Skyrise Greening Section that provides generous subsidies for the installation of green walls, green rooftops, sky parks, terraces, and other vertical green features. Skyrise Greening will cover up to half the cost of installation, and in some parts of the city a mandatory green-spaces replacement standard applies. There are many other ways in which vertical greening is encouraged – through support for research and development, for instance. There is an annual Skyrise Greening awards competition, and at the NPark-sponsored green walls at HortPark, eight different vertical wall systems are being monitored and tested. In addition, NPark has created a Centre for Urban Greening and Ecology (CUGE) that trains landscape workers and promotes greening in the city. CUGE produces beautiful publications, such as its magazine *CityGreen*, which profiles urban greening theory and practice in cities around the world.

The private sector has contributed many innovative and creative vertical green designs. These include, for instance, the thirty-six-story residential tower Newtown Suites, which has a long green wall and external garden terraces that jut out every fifth floor. We spent some time visiting and filming at 158 Cecil Street, the location of a dramatic, seven-story green wall made from a system of irrigated pots. It is the highlight of a verdant indoor (and partially outdoor) space. Other examples include the Singapore School of Arts building, which has extensive facade trellising, and the new Solaris science center, which is dramatically wrapped in a series of linear forests every few floors.

Another good example can be seen in the new Solaris office building, designed by green-skyscraper guru Ken Yeang of the design firm T. R. Hamzah & Yeang. Fifteen stories at its tallest, it combines a number of ecological design features, including the extensive use of daylight as a substitute for artificial interior lighting. This means that there is relatively little consumption of energy for an office building of its size. But most visually dramatic is the way the building is wrapped by a continuous ribbon of green. Referred to in the architect's write-up as an "ecological armature" and a "continuous spiral landscaped ramp," it provides walking space and also cools the building, thus further reducing energy consumption. In total the ramp is some 1.5 kilometers in length. With an estimated 95% of the landscaping above ground level, all the green features taken together exceed the square footage of the building's footprint. According to the design literature, "The continuity of the landscaping is a key component of the project's ecological design concept, as it allows for fluid movement of organisms and plant species between all vegetated areas within the building, enhancing biodiversity and contributing to the overall health of these ecosystems."

Creative vertical greening is clearly valued by consumers and policy makers alike, and the urban housing market has also caught on to the importance of green elements in these higher-density projects. A casual perusing of the weekend edition of the *Straits Times*, the major local paper, provides strong evidence of the increasing importance of green features in the purchase or rental of properties in the city. One full-page advertisement in a recent edition screams, "Welcome home to Eco-Blissfulness" and boasts a new project's green credentials, which include vertical farming, rainwater harvesting, and a five-minute walk to the city's metro system. Other advertisements speak of access to nature and the outdoors – "nature revealed" – in one case, by balconies overlooking a dense tree canopy. Another ad reads, "creation sits at your doorstep." In Singapore, the housing market seems in harmony with, and is helping to reinforce, a model of dense green urbanism.

Hospital in a Garden, Hospital as an Ark

There are truly impressive examples of how greening the city can translate into more healthful, healing environments, beginning with some of the most obvious places: hospitals. Here Singapore innovates as well. I visited with Mr. Liat Teng Lit, who runs perhaps the greenest, most biophilic hospital in the world – certainly the best example I have ever encountered. For Mr. Liat, the story began with an older hospital, the Alexandra, where nature's power to heal and transform was dramatically illustrated. The transformation began when some of Liat's staff expressed an interest in planting flowers and greenery and Liat allocated a few hundred dollars to finance the project: the impact was profound. Eventually he instituted Monday planting day and set the goal of planting sufficient host plants to accommodate some hundred species of native butterflies – an unusual performance measure for a hospital. In two to three years' time, 102 species called the hospital home. Then Liat was called in to take charge of a new hospital where biophilic ambitions have been even greater.

Liat believes that every building should be seen as an opportunity to restore and repair nature, a philosophy strongly

Singapore's tree canopy provides extensive shade, as well as ecological connections for birds and wildlife.

reflected in the design of the Khoo Teck Puat Hospital (KTPH), which opened its doors in 2010. Liat serves as its CEO and in many ways is responsible for the hospital's extraordinary emphasis on nature.

"Why don't we set a national goal," Liat argues: "Just as the rest of the world is chopping down all the rain forest, we declare ourselves as the Noah's ark of tropical rain forests. That means we consciously, with every single project, bring back a few species of tropical rain forest." He dreams audaciously of coinhabiting the hospital with a family of river otters; although that has not happened, the new institution consciously harbors and provides habitat for an amazing diversity of species. There are many butterflies and birds to be seen in and around the hospital and prominent wall placards keep track of the running total of species sighted. Moreover, there are ninety-two native fish species inhabiting the hospital's pond system.

There is food production as well. Liat and the hospital offered to make the roof available to a local community gardening group that had lost some space to new development. Liat had some apprehensions, but the farming operation has grown and now occupies much of the rooftop. It turned out that patients with windows looking out on the farm enjoy seeing it, so it could be considered a healing landscape.

Liat says the healing concept of the greenery that permeates the environment is central to the hospital's design: "Our definition is when you come in here your blood pressure and your heart rate go down, not up." There are window planter boxes, terraced gardens on several levels, and an interior green courtyard with a waterfall. Most of the rooms in the hospital, including all those in the intensive care unit, have a view of this green milieu.

People who don't have to go to hospitals don't tend to seek them out, but this one was designed from the beginning to be connected with the surrounding neighborhood, which has gone through its own greening process. KTPH is perceived as a community space; students come to its green havens to study, and Mr. Ng of NPark notes that on "weekends and evenings this place is bustling with people."

A visit to the Hougang Primary School revealed another remarkable example of the extent to which nature can inhabit an institutional space and the salutary effect it can have on the building's inhabitants. The school's green features include multiple gardens integrated into its courtyards, a vegetable garden, a fernery, an orchid garden, and one of the most beautiful green walls I have ever seen, designed and constructed by the students here and supported by the Skyrise Greenery program. This is a school I wish every child could attend.

City on the Water

One of the most impressive innovations has been to reimagine the city's storm-water collection system as an opportunity to restore nature. The new municipal ABC (Active, Beautiful, Clean) water program is a joint effort of NParks and the city's Public Utility Board. The premier pilot project was to convert a straight-as-an-arrow concrete drainage ditch in Bishan Park to a beautiful, meandering natural stream. German designer Herbert Dreiseitl was commissioned to undertake the transformation and the result is breathtaking – 3.2 kilometers of nature, a ribbon of life surrounded by forty-story residential towers. On a recent visit to the park after the construction fences were taken down, I found that the biodiversity was remarkable. Birds, including kingfishers, were everywhere; there was a population of endangered dragonflies; and even some monitor lizards were spotted. Before this Bishan Park already received some three million recreational visits a year, but now nature will be the main attraction.

Singapore's immense amount of native vegetation extends to coastal and marine areas. Conservation efforts in those domains have been growing in importance. This is a different

way perhaps of thinking about the "garden" in which the city lies. Much was lost – mainly mangroves and coral reefs – to the extensive land reclamation and shoreline development that occurred in the previous half century, especially in the 1960s. Now, however, there are many signs that Singapore views its coastal and marine environments differently. A key turning point was the public opposition that emerged in 2001 to the proposed land reclamation project at Chek Jawa. This area of wetlands and intertidal flats on Palau Ubin, one of the larger islands surrounding Singapore, boasts a remarkable abundance of marine life, from longhorn cowfish and orange sea stars to antibacterial sponges and carpet anemones. A new visitor center and a kilometer-long boardwalk celebrate these habitats; now Chek Jawa has become a beloved area to visit. Also very popular are intertidal walks, conducted during low tides by NParks guides. These excursions allow Singaporeans a firsthand view of exotic marine life.

Ria Tan, who runs the website Wild Singapore and has organized citizen support for marine conservation, believes that finding ways to connect this vertical city to its abundant aquatic life is critical. "I really believe that people need to see it, taste it, feel it; then when the time comes they will stick up for it," she says. There is more to do here and NParks is currently about halfway through a comprehensive marine biodiversity survey to better understand what exists and what is at risk.

Has the city been successful in creating a green culture at the same time that it has accommodated dramatic population growth in recent years? The evidence suggests that it has. Landsat imagery comparing green areas in 1986 and 2007 show that while development has increased substantially, green areas went from 36% of the island to 47%; in spite of an increase in nearly two million residents during that period. It is not a perfect story, certainly: there is continued loss of nature and green space at ground level – too much, some believe – and some of the newest and densest development areas, such as the ecodistrict of Punggol, are not especially green. Still, there is much to laud in this Asian model. And the city is exercising leadership in other ways. NPark has spearheaded the development of a Cities Biodiversity Index (CBI, known as the Singapore Index) and has worked hard to make biodiversity conservation important to other local agencies and government offices. Increasingly, Singapore's pioneering brand of green urbanism will be relevant in other cities in Asia and beyond, and its vertical innovations will show that green and dense can be coupled to protect the natural environment and improve living conditions for all. Singapore continues to demonstrate Lee Kuan Yew's belief that greening the island, creating a city in a garden, would lay the foundation for economic prosperity and a high quality of life – treasures that Singaporeans enjoy today.
– Timothy Beatley

The Henderson Waves pedestrian bridge, shown here, provides an important connection along the Southern Ridges parks, and allows hikers to rise high above the car traffic below.

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Sugar Cane on the Horizon: Cuba's Artifact or Legacy

A few miles outside Trinidad, Cuba, on the southern side of the island, the remnants of more than seventy sugar mills and plantation homes dot the landscape. Valle de los Ingenios, known as the Valley of the Sugar Mills, consists of three interconnected valleys of prime agricultural land. Together they create a lush vista of palm trees, variegated green fields, and small ponds, framed by the El Escambray Mountains. One of the most photographed landscapes in Cuba, the view of it alone is worth the trip from Havana, but it is the rich architectural, industrial, and cultural history of the Valley of the Sugar Mills that is the magnet for thousands of tourists each year.

The most famous building in the valley, the seven-story Iznaga Bell Tower, still dominates the view. Part of the Manaca Iznaga Plantation, this 147-foot tower was used to watch over the huge cane fields and toiling workforce. Its bell alerted overseers to slave escapes or fires and signaled the start of morning prayers to the Virgin Mary. Today the famous bell is silent, but the tower still stands as a sinister reminder of sugar's once-invincible place in Cuba's landscape, economy, and culture, and its more recent dramatic decline. While sugar is no longer the monoculture of the valley – or even of the country – the potential of those fertile fields presents an interesting dilemma for the island and its people.

There is an old Spanish saying: *Sin azucar, no hay pais* ("No sugar, no Cuba") – and from the conqueror's perspective, that was true for hundreds of years. The Spanish began growing sugarcane in Cuba shortly after Christopher Columbus landed there. Before long they were exploiting their new colony for all its possible exports: minerals, sugar, tobacco, and coffee. Once the indigenous peoples had died out due to disease and poor treatment, African slaves were imported to work the plantations in their place.

By the early nineteenth century, the small island was the world's leading producer of sugar. A perfect climate, fertile soil, and a subjugated workforce created ideal conditions for maximizing profits over the next hundred years, and the island's colonial system supported foreign ownership. William H. Stewart, the leading sugar importer to New York in the late nineteenth century, contracted for twenty million pounds of sugar, on which his profit was five cents per pound. His earnings on that deal alone were one million dollars. However, the financial rewards of sugar were smaller in Cuba itself. Although there were a handful of large landowners like Don

Domingo de Aldama, who was considered the richest of the local plantation owners in the nineteenth century, a significant portion of the industry was still anchored by small farms.

Spain's dominance of the country's sugar business ended with the Spanish-American War in 1898, during which much of the country's infrastructure and roughly 80 percent of its 1,100 mills and refineries were destroyed. After Spain's defeat, the United States agreed to transfer sovereignty to the new Cuban government only after the latter accepted harsh conditions giving the U.S. almost complete control of the island's political and economic systems. The war's devastation led to widespread debt among Cuban planters large and small, who had little choice but to sell their land to the people with the money – primarily Americans. The Cuban-American Sugar Company, established by R. B. Hawley in 1899, built a sugar mill called Chaparra on a staggering seventy thousand acres of land. By 1904 United Fruit had purchased almost four hundred thousand acres, a generous portion of that for only two dollars per acre. Only seven years after the war ended, Americans owned fifty million dollars' worth of Cuban land.

During the first half of the twentieth century, the United States retained a firm hold on the island's sugar industry, remaining the largest consumer of, and investor in, Cuban sugar. While there were still a substantial number of Cuban mills, big U.S.-owned plantations and the capital that supported them were the backbone of the industry, ensuring Cuba's dependency on the United States for the next fifty years.

When Fidel Castro came to power in 1959, he called for a diversification of the economy, agricultural reform, and less reliance on the tourist industry. Indeed, he expressed considerable distaste for the capitalistic influence that tourism represented, so much so that a few years later he outlawed private industry and foreign travel to Cuba altogether.

Castro was wary of the sugar monoculture, but that proved a harder dependency to break. There were 161 sugar mills in operation at the time Castro took over, with 30 percent of them owned by foreigners. While government officials wanted to reduce sugar's hold on the island, the short-term solution of nationalization was too appealing to resist. Che Guevara asked successful Cuban planter Julio Lobo, who was the richest man in Cuba before the Revolution and controlled 10 percent of the sugar crop, to run the newly nationalized sugar industry. When Lobo refused, all his assets were seized. He left the country the following night, never to return.

The revolutionary government also had a particular interest in the lucrative rum industry made famous by the Bacardi family, but while executing its takeover it made a logistical error that changed Cuba's future in rum forever. The troops dispatched to confiscate the distillation formula went to the Art Deco Bacardi building in Old Havana rather than the Santiago laboratory that held the yeast. By the time the mistake was realized and the troops arrived in Santiago, the yeast had been dispatched to its new home, Puerto Rico.

The consequences of this failure on the part of the Cuban government were compounded when President Kennedy signed the trade embargo against Cuba in 1962 and the country lost its largest trading partner. Almost immediately, however, the Soviet Union stepped in to provide the sweetheart deal Castro needed, allowing Cuba to trade sugar for oil at above-world-market prices and guaranteeing itself complete access to one of the world's largest sugar producers and a presence near the United States' southern border. Cuba now had a three-billion-dollar annual subsidy, access to much-needed petroleum products, and employment for almost half a million Cubans connected to a ramped-up sugar industry. For almost fifteen years, from 1976 to 1990, sugar was Cuba's major export and accounted for a fifth of the country's capital investments. For the first time in the history of the sugar industry on the island, national interest trumped foreign profits.

Unfortunately, though, Cuba had traded one dependency for another: the fate of its dominant export was still governed by a large and powerful foreign country.

In 1989, when the Soviet Union fell, the consequences for Cuba were immediate and severe: the island was left with huge sugar-growing and production capacity and no big customer. Cuba also had almost no fossil fuel to run its refineries, or even to power the machines that were needed in the fields. Officials scrambled to find food for the people and employment for hundreds of thousands of workers whose mills were underproducing or had shut down completely. Money was also needed to modernize and repair existing factories for the industry to be competitive. These internal difficulties were compounded by the increasing use of artificial sweeteners and corn syrup, which had dampened world demand for sugar and, correspondingly, its prices. While there was an attempt by the government to keep the industry alive, Cuba had to find a new agricultural model.

By 1991, in what could only be called a drastic repositioning of the economy, Fidel Castro shifted his country away from its traditional monocrop orientation and focused instead on feeding his citizens. The following year, 1992–93, sugar production dropped almost 40 percent and sustainable food production began in earnest. Because of the country's fuel costs, much farming was done without heavy machinery, planting and harvesting powered instead by human labor and animals.

Many of the large, nationalized farms were carved up into agricultural cooperatives, some of which eschewed pesticides and benefited from the government's investments in agricultural research on organic processes, crop rotation, and land conservation. Cuba's remaining sugar mills started using the waste from the crushing process to produce energy in order to keep running.

The Convent of San Francisco in Trinidad, Cuba.

At first, the new strategy seemed to be working, and more basic foodstuffs were produced in 1996–97 than ever before. It became clear, however, that supply could not keep pace with demand, and more and more food had to be imported. Clearly sugar was not the only answer, but neither could Cuba survive without the much-needed revenue that exports provided. Therefore, amid the country's idealistic and belated attempts to become self-sufficient, the seeds of a formerly abjured tourist industry were quietly sown.

As far as heritage and environmental tourism were concerned, Cuba's assets are considerable. Founded in 1514, Trinidad is considered to be an exceptionally good example of a well-preserved colonial city with architecture dating from the eighteenth, nineteenth, and twentieth centuries. Its original urban layout, which extends over fifty-five largely intact blocks, includes short streets, plazas, and distinctive public buildings. The domestic architecture of the small city is historically significant, its one-story homes finished with wide verandas, awnings, pastel facades, and balconies. Moreover, UNESCO declared the Valle de los Ingenios a living museum. Because of its beauty and the historic plantation culture it represents, in 1988 the entire valley and its city were declared a World Heritage Site. At the same time, scrambling to revamp its economy, Cuba was forced to revisit its policies concerning tourism. In 1994 a Ministry of Tourism was created and the government began investing in hotels, restoration efforts, beach resorts, and cultural artifacts – like the Valley of the Sugar Mills – to draw in desperately needed hard currency. By the late 1990s, the country's agricultural landscape had truly diversified; at the same time, tourism had surpassed sugar as Cuba's leading source of revenue.

Landscape of Valle de los Ingenios.

In 2002 increasing financial pressures and the costs of imported food caused the government to close almost half of the existing sugar mills on the island. The land that had once been planted with cane was converted to different uses. While some emphasis remained on sugar products and derivatives, particularly ethanol (produced from sugarcane rather than corn), food crops received precedence. The scenery that tourists see on day trips around the valley therefore does not include the once-active refineries. Leafy green plants and tubular vines have replaced ramrod-straight thickets of thousands of acres of cane.

Ironically, however, Cuba's increased interest in sustainability and diversification may lead it in a roundabout way back to sugar. The country's recent strides in replenishing and enriching the soil have made the fields more productive than ever before, and new technologies suggest that a sugar mill could generate ten times the electricity needed for its own operation and sell the surplus. It has also been argued that the time is ripe to revisit the conversion capacity of the sugar mills into ethanol factories. Some researchers predict that if land could produce as much sugarcane as in the late nineteen-eighties and its mills could be retrofitted with conversion technology, Cuba could become a world leader in ethanol exports.

The allure of this vision is undeniable. For the first time since the arrival of Columbus, sugar would no longer be a local crop grown almost entirely for export. Instead, its production would provide an important local source of energy. With forty-four mils still in operation, perhaps Cuba has yet the ability to capitalize on the world's need for sustainable energy production – and this time the Cubans could keep the industry's profits within their own country. Certainly the opportunity to decrease dependence on fossil fuels through the conversion of sugar waste and to increase export potential with ethanol is appealing. A national economic, land-use, and agricultural model could include an efficient sugar industry, food production, and new energy sources – a promising scenario for a truly sustainable future.

But there are arguments on both sides. Today large portions of the fertile 40,000 acres in the Valley of the Sugar Mills form a patchwork of small farms and eleven agricultural cooperatives that belong to the National Association of Farmers. Rather than ship their crops to world markets, the cooperatives supply most of the food for the region. With help from Oxfam International over the last decade, their yields have either doubled or tripled, wages have increased, and women now have more employment opportunities than they had before the creation of this place-based economy. Many Cubans are therefore understandably wary of repurposing agricultural land. As it is, the island's inability to feed itself independently forces some families to pay as much as 75 percent of their income for food.

The conundrum is this: reviving the sugar industry would require huge sums of capital investment before revenues could be returned. Although these revenues might provide funds for much-needed roads, housing, bridges, and technological infrastructure, for the present the capital outlay for sugar production would delay investment in such critical needs. In addition, some islanders worry that while the shift to agriculture was born of necessity, a return to mechanized, state-controlled farming could harm recent environmental gains through heavy fertilizer and pesticide use, putting too much demand on the already-strained water supply and impairing air quality. Others fear Cuba may no longer have a workforce with the skills and knowledge necessary to run the mills and manage new industry. Moreover, such a strategy would require innovative financial partnerships, different priorities on land use, and, perhaps most important, national decisions on whether Cuba should adopt a leadership role in pioneering clean energy.

In sum, a compelling argument can be made that a return to sugar cultivation would allow Cuba to meet some of the world's demand for energy, decrease dependence on fossil fuels, and produce export revenue to upgrade the island's physical infrastructure. It is an appealing and hopeful vision. For now, the country will boost its economy through tourism and keep its focus on food production, and this may or may not be the better course of action overall. In the future, however, who knows? Only time will tell if today's Cubans will be willing to give up their farmland and bet on a future whose economy is sustained by sugar once more.

– Suzanne Morse Moomaw

Place Keeper

"History is a pontoon bridge. Every man walks and works at its building end, and has come as far as he has over the pontoons laid by others he may never have heard of. Events have a way of making other events inevitable; the actions of men are consecutive and indivisible."
Wallace Earle Stegner, Wolf Willow

Shelagh Fritz, Project Manager / Horticulturist for the Gardens of Alcatraz

The legacy of gardeners and their gardens on Alcatraz spans nearly 150 years. With each generation, a new batch of gardeners arrived and left their mark, planting among the remnants of the earlier gardens they'd discovered upon their arrival. Initially military prisoners gardened on the island, leaving behind a bounty of flowering beauty that amazed and surprised prison staff and inmates when the site became a federal penitentiary. Some of the civilian prisoners and those who supervised them were inspired to continue their work. This "pontoon bridge" of gardeners – men who rarely knew those who preceded them – continues to lengthen as a new crew of cultivators, this time volunteers and Garden Conservancy staff, adds yet another pontoon to the gardening tradition of Alcatraz.

Unlike the prison gardens, which were plots created independently by individual inmates, today's restored gardens are the fruits of a collaborative effort organized and led by one person: Shelagh Fritz, project manager and horticulturist for the Garden Conservancy. The gardens resurrected from the past are not managed in isolation but instead carefully planned to complement and enhance one another, based upon a strategy developed by the conservancy in association with the Park Service and the Golden Gate National Parks Conservancy.

Holding the only full-time position funded by the Garden Conservancy, Fritz directs a corps of forty regular volunteers who work Wednesdays and Fridays and also guides the efforts of up to 140 others who come to the island at least once a year. These dedicated men and women, who as a group average some 670 volunteer hours a month, travel to the island from San Francisco and other Bay Area cities. They arrive at the ferry dock in time to meet the 8:45 AM staff boat for a day of grubbing out overgrowth, weeding, planting, watering, propagating, and building structures – all in an effort to create and maintain gardens that replicate the spirit of those left by the inmates. Docents, who give tours as well as work in the gardens, come every Wednesday, Friday, and Saturday.

Managing the volunteers is only one part of Fritz's responsibility. She also plans the restoration work, scheduling which garden requires attention next; orders about 50 percent of the plants from wholesale nurseries; and propagates the rest in the rebuilt greenhouse. She also schedules and sometimes leads docent tours; coordinates projects with the National Park Service staff; works with consultants hired by the Conservancy; and records the evolving landscape with photographs and a written log. And all the while she is recreating Alcatraz's earlier gardens from the images in historical photographs.

Shelagh Fritz, chief horticulturist and project manager for the Garden Conservancy, overseeing the restored Officers' Row garden.

Fritz arrived at Alcatraz in 2006 from England, where she had been a gardener at Syon Park, the private estate of the Duke of Northumberland. The property, now open to the public, was originally designed by Capability Brown in the mid-eighteenth century. Her work there, akin to the endeavor on Alcatraz, was to re-create a garden similar in character to Brown's design, rather than imposing a completely new and different style. When she subsequently moved to San Francisco, Fritz interviewed for a job on the island. She was awarded a position under project manager Carola Ashford, who was beginning to restore the gardens with volunteer assistance. Fritz had never worked with volunteers, but she quickly adapted. After Ashford died unexpectedly in 2009, Fritz became the project manager.

Alcatraz could not be more different than the estate in England – a windblown rock instead of a verdant green park. But, as Fritz says, "I heard somewhere that all your life experiences are like a thread; when you start out, you don't know where you are going, but following it backwards, you can easily see how each experience led to the next." Fritz graduated from the University of Guelph, Ontario, in 1999, with a degree in horticultural science and business. She first worked managing a small crew caring for the gardens of the Glen Abbey Golf Club, which was home to the Canadian Open that year. This gave her practical experience in gardening, supervising workers, ordering plants, and designing a display.

Her next opportunity was at the Manulife Insurance Company in Toronto, where she was responsible for the manicured lawns and flower gardens. She became the garden manager and supervised a small crew between 2000 and 2003. At the young age of twenty-three, she had a crash course in human resources. "The gardening part was easy," she recalled. "Managing a staff was something I wasn't prepared for."

Fritz then became an intern at Longwood Gardens in Philadelphia in their International Program (September 2003–August 2004). Working at Longwood gave her not only excellent horticultural experience but also practice in meeting a high standard of quality. The position at Syon Park followed, lasting from 2004 to 2006.

This is the thread that led Fritz to her role as project manager for the gardens at Alcatraz. There, to the delight and amazement of visitors to the island, she is bringing to life gardens that once lay in ruins. One only has to see the happy camaraderie among the volunteers as they arrive on the island for a day of hard labor to know that their dedication is largely due to the fun of working with Fritz. Their enthusiasm grows along with the knowledge that they are part of the long con-

tinuum of gardeners who have brought great beauty to one of the world's most hostile places.

One of the biggest challenges for Fritz is to keep the gardens in bloom year-round – not an easy task in this Mediterranean climate on an island buffeted by wind; it is dry in summer and meagerly supplied with water. What water there is comes from two sources. One is a supply system filled by the ferry each day, used for the restrooms and for irrigating some of the gardens on the island's east side. The other source is a system for harvesting water off the Cellhouse roof on the west side of the island, involving four tanks with a total capacity of twelve thousand gallons. Maintaining the gardens that have already been restored is labor-intensive; ongoing tasks include weeding, deadheading, and pruning as well as watering all the plantings by hand. Initially the multitude of seagulls that nest in and around the gardens posed a problem for the intruding volunteers. But Fritz says that they have come to terms of coexistence – "the gulls have gotten used to us and we have gotten used to them." A few of the regulars even have names. She works closely with a National Park Service wildlife biologist to ensure that the bird population is protected. The nesting area for the black-crowned night heron is kept off limits during the nesting season, but it doesn't conflict with the gardens.

The history of the gardens and their gardeners is told in a variety of ways: the docent-led tours, a brochure for self-guided tours, and interpretive signs along the route to the gardens. Luring visitors from the Cellhouse – the main attraction – remains a challenge, especially if they have not been informed of the gardens as they arrive at the ferry dock. Still, Fritz's tours average fifty visitors.

The gardens are not just about horticulture; they reveal in a strikingly comprehensive way the social history of Alcatraz from the military period to that of the federal penitentiary and beyond. Understanding their history gives visitors a holistic perspective of life on the Rock. The gardens created by inmates and staff were a refuge from conditions inside the Cellhouse – truly a pontoon bridge stretching 150 years in length, built by those who found creativity and solace in gardening. Fritz and her dedicated volunteers continue to extend that bridge even as they inspire others to join them and discover the satisfaction to be found in doing so.

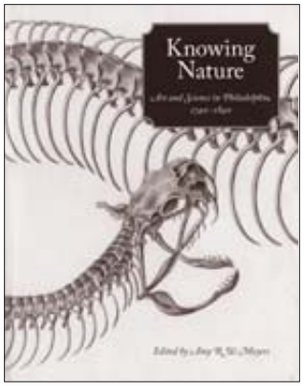
– Russell A. Beatty

Book Review

Knowing Nature: Art and Science in Philadelphia, 1740-1840

By Amy R. W. Meyers with the assistance of Lisa L. Ford

New Haven: Yale University Press, 2012.



The juxtaposition of the words "science" and "Philadelphia" conjures images of Benjamin Franklin and his kite. Franklin however, keeps a low profile in *Knowing Nature: Art and Science in Philadelphia, 1740-1840*, the sumptuously illustrated and weighty catalogue edited by Amy R. W. Meyers with the assistance of Lisa L. Ford. This is due no doubt to the book's strong emphasis on natural history (both as a science and a subject of artistic representation), rather than scientific fields with which Franklin was more closely identified. Since botany was the queen of the sciences in the eighteenth century, with zoology a close second, and both lend themselves spectacularly to artistic representation, the omission is understandable. One of the few things Franklin was not was an artist.

Historians and sociologists have wrestled with the question of what gave Philadelphia its preeminence as the capital of Enlightenment science in eighteenth-century America. The authors of the present book have emphasized its openness and relatively egalitarian society as well as its cosmopolitan ties to the "dynamic intellectual circles of Europe." Meyers claims Laura Rigal's *The American Manufactory: Art, Labor, and the World of Things in the Early Republic* (1998) as the particular inspiration for many of the essays in *Knowing Nature*. Although Rigal deals primarily with the latter part of the period covered in the catalogue, she argues that a "performance of things" characterized the culture of Philadelphia from the eighteenth century into the early nineteenth and helps explain the city's remarkable intertwining of the pursuit of science and the making of things; the interplay of scientist, artist, and artisan.

While Charles Wilson Peale – painter, inventor, and founder of America's first science and art museum – exemplifies this combination, he was by no means unique. Elaborating on Rigal's insights, *Knowing Nature* offers a "picture of how the visual and material interpretation of the natural world functioned not only in colonial and early republican science but across the culture of the period more generally." This meant not only the founding of menageries and botanical gardens, the crafting of cabinets of curiosity, and the creation of images of the natural world, but also the extension of the terms "art" and "science" to encompass the design and production of decorative arts, challenging the hierarchies in both. Indeed, a central theme of the book, Meyers argues, is the "many ways in which the process of coming to know nature was essentially reversed – in which artistic and artisanal culture informed scientific interpretations of the natural world."

The subtitle of the book might appropriately have included "Commerce." Lacking the financial backing of institutions such as the Royal Botanical Gardens at Kew or wealthy sponsors such as Sir Joseph Banks or the Duke of Devonshire, key figures such as John Bartram and his son William were dependent on the sale of seeds and plants to English and continental buyers to finance their collecting expeditions and the illustration of their finds. William Bartram, a failure at business, was saved only by the timely intervention of Dr. John Fothergill, proprietor of one of the largest private gardens in England. Fothergill sponsored William's expeditions with the understanding that he would have first claim on the most beautiful, useful, and singular plants Bartram collected. One of the particular strengths of several of the essays is to show these close connections of commerce and science – not only as they related to field research but also to the publication of results. It was all very well for the American Philosophical Society or local newspapers to publish

papers, but without illustrations those concerning the discovery of new flora and fauna were frustratingly inadequate. Copperplate engraving and hand coloring were expensive, beyond the means of many Philadelphia publishers; several illustrated natural histories were financial disasters. Nevertheless James Green asserts that by the early nineteenth century "Philadelphia was both the principal center for the study of natural history and the nation's leading printing and publishing city." His essay and that of Robert McCracken Peck offer an interesting look at experiments in colorization intended to reduce the price of color printing and make works of natural history more affordable. These goals were achieved only in 1840 – at the end of the period surveyed – with the refinement of color lithography.

Inevitably the Bartrams, John and William, loom large in any overview of Philadelphia's achievements in natural history, and several essays deal with them, most notably Joel T. Fry's "America's 'Ancient Garden': The Bartram Botanic Garden 1728-1850," which traces the vicissitudes of America's most important garden through four generations. It was founded in 1728 with John Bartram's purchase of a 102-acre farm on the banks of the Schuylkill in what was then a rural township outside of Philadelphia. In time it became the foremost nursery in the Colonies for the propagation of native plants and trees, and John Bartram one of the first successful botanical entrepreneurs. He had an avid clientele in England, thanks especially to his London intermediary, Peter Collinson.

John Bartram was above all an empirical interpreter of the natural world. He and mapmaker Lewis Evans had joined Conrad Weiser on a diplomatic mission to the Six Nations in 1743. Along the way they observed not only vegetation but also geological formations and fossils, questioning dominant theories of their formation, most notably those of Thomas Burnet, an influential believer in the transformative effects of the Noachian deluge.

Bartram's son William (1739-1823), in contrast, reflects the shift to the more emotional response to nature characteristic of the later eighteenth century with its emphasis on the "aesthetic of the 'natural Sublime.'" As Margaret Pritchard puts it, he "viewed nature as a series of unified relationships." Thus he often provided contexts for his drawings, in contrast with the dominant European model of botanical illustration, in which ideal forms are represented largely divorced from their surroundings. The juxtaposition of botanical drawings by Mark Catesby and William Bartram, for example, is striking for the absence of context in the first and the romantically exaggerated context in the latter.

William's brother, John, Jr., though less well known, was also a plant collector and cultivated the garden. After a period of reversals during the Revolution, the garden's prospects improved in the third generation. John, Jr.'s daughter Ann inherited the family passion for plants and was a talented illustrator in her own right. With her marriage to Robert Carr, a Philadelphia printer, in 1809, the family fortunes revived. An experienced businessman, Carr took over the management of the garden and expanded its network of clients at home and abroad. But with the depression of 1837; the early death in 1839 of Robert's son John, a well trained and promising botanist; and the declining European interest in North American flora, the business failed and the garden was sold at auction. Nevertheless, it had an afterlife as a private park, tended by a Kew-trained gardener.

Even though the Bartrams' garden was ultimately lost, imports of American pines, magnolias, and a variety of shrubs changed the face of many English estates during the middle decades of the eighteenth century, thanks to the efforts of family patriarch John. As Peter Collinson declared, "England must be turned up side down & America transplanted Heither"[sic]. But was this flood of American flora matched by an equal desire for American fauna? This is the question explored by Mark Laird. He looks at three attempts to translate a "New World vision of natural history into Edenic or scientific gardening": the Second Duke of Richmond's "American grove" at Goodwood; Princess Augusta's exotic plantings and menagerie at Kew; and, more briefly, Gilbert White's establishment at Selborne.

It took time to acclimate woody species from the colonial wilderness to Georgian pleasure grounds but eventually the imports adapted; acclimating exotic animals and birds was a sadder affair. White describes the languishing deaths of two moose (presumably not imported from Philadelphia) at Goodwood. Other animals fared no better. In time birds and beasts – and, before long, plants – from Hudson Bay, the Indies, Africa, and Asia overshadowed those from the United States in English pleasure gardens. There was even a resurgence of interest in native songbirds.

The Bartrams' garden on the Schuylkill River was by no means the only one to serve as a lodestone for foreign travelers to Philadelphia eager to see American flora *in situ*. Europeans were also frequent visitors to Franklin's garden (when he was in town between or after his long absences), Peale's estate at Belfield, and William Hamilton's Woodlands, which was reputed to be the most beautiful landscape garden in the post-Revolutionary period.

In a particularly appealing essay, Lisa L. Ford personalizes the encounters between Europeans and Americans and highlights their shared interest in arts and sciences that could be of practical benefit to society. André Michaux's numerous collecting forays in North America were detailed in his "Botanical Journal in North America, 1787-1796," which was given to the American Philosophical Society by his son, François-André Michaux, in 1824.

Michaux *fils* played an even more important role in the history of American botany, above all in the field of silvaculture. He had accompanied his father on several of his expeditions before being commissioned by Napoleon's finance minister to make a thorough study of the forests of North America with an eye to what trees might be most useful commercially and most adaptable to cultivation in France. While American colonists were most aware of trees as things that must be chopped down before fields could be planted, Europeans were acutely conscious of their disappearing forests. To complete his magnum opus, *Histoire des arbres forestiers de l'Amérique septentrionale*, the younger Michaux relied not only on his travels with his

father but also on five journeys of his own into forests along the eastern seaboard.

His aim was not purely scientific; just as important were his researches into the uses of American woods: in ship-building, tanning, medicine, fencing, and as fuel. In addition, he corresponded with just about everyone who was anyone in American botany and developed close friendships with many of Philadelphia's leading savants. Not surprisingly, he spent much of the summer of 1808 with the Bartrams.

Michaux's three-volume *Histoire* was published in France from 1810 to 1813 with the author's watercolors translated into beautiful, color-printed engravings by leading French artists such as Pierre-Joseph Redouté. As Ford comments, the illustrations "grant as much importance to art as they do to science." It was a challenge to find an American publisher for the English translation, which was already available in an expanded edition in Paris 1817-1819 under the title *The Sylva Americana; or, A Description of the Forest Trees Indigenous to the United States*. The *Histoire/Sylva* was finally picked up by booksellers in Philadelphia and other major American cities. Ironically, its success was so great that it went through a number of later editions and versions, a testament to the value of its "useful knowledge" on both sides of the Atlantic.

Knowing Nature is ambitious in its aims. It covers a century in which, Meyers asserts, Philadelphia "shifted in status from the largest and most affluent colonial city of the British Empire" – a claim Calcutta would surely have contested – "to the capital of the new Republic, and, finally, to one of several competing centers of political, social, and cultural influence." The essays included are intended to "demonstrate how the study of the material and artistic culture of science can illuminate much broader societal attitudes and trends."

Do they in fact share this unifying theme and does the book as a whole live up to its billing? Inevitably the answer is not clear-cut. The essays are extremely useful contributions in their own right, but some are broader in their sweep than others; some are more convincing in their linkage of science and art; and some maintain the focus on Philadelphia, while for others it is more tenuous.

If the final essay, Alexander Nemerov's "A World Too Much: Democracy and Natural History in Godman and Audubon," was meant to serve as a conclusion to the book as a whole, it seems an odd choice. Nemerov poses the question, "What happened to natural history in America with the advent of Jacksonian democracy in the late 1820s and early 1830s? How was the representation of nature transformed under the pressures of the new age?" He offers answers based on a close examination of two works: John D. Godman's *Rambles of a Naturalist* and John James Audubon's *Northern Mockingbird*. His analyses of the two are something of a tour de force but in the end too fragile to support a broader interpretation of the period – aside from the fact that Godman died young of tuberculosis, while Audubon spent little time in Philadelphia and was never part of its intellectual or artistic community.

But these are minor quibbles. *Knowing Nature* not only extends our knowledge of the intimate associations of art and science in America but also our awareness of the global networks that fed them and were nourished by them in turn.

– Eugenia W. Herbert

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