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Strengthening Coastal Resilience Through Green Infrastructure

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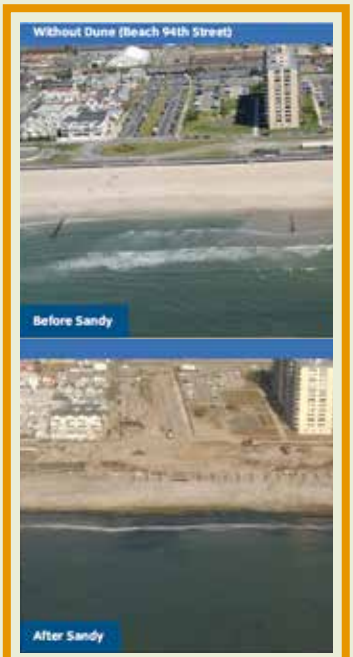
Dune Protection on Rockaway Penninsula



Credit: NOAA

Strengthening Coastal Resilience through Green Infrastructure

by Antonio F. Federici

Nine new rain gardens were completed in the Town of Southington this past summer, redirecting water from the street into the ground. In October, a class of 26 students completed Coastal Certification training through UConn's Master Gardener program in Haddam. A Coastal Riparian Planting Tool was recently released to provide Long Island Sound property owners with sustainable native planting guidance for coastal living. Across the border, the City of New York committed $3 million to the creation of a Science and Resilience Institute to promote "an understanding of resilience in urban ecosystems and their adjacent communities."

Around the country - and the world for that matter - communities are adopting new and innovative approaches to stormwater management by re-introducing natural (green) systems, into our surroundings. Forward thinking managers are also adopting similar coastal applications. Infrastructure consists of the physical framework that supports our society. Green infrastructure (GI) is the use of vegetation, often complemented by other bio-engineering products, to serve as functional parts of our human environment. A rain garden is a GI application. The plants, soil, and the shallow basins that define rain gardens are all functional components of this application. They capture rainfall runoff (from downspouts, parking lots, etc.), filter it as it passes through roots and soil, and ultimately replenish groundwater. Sometimes rain gardens are directly connected to storm sewer pipes by way of underdrains. This direct connection of downspout to rain garden and garden to storm sewer pipe is a direct example of GI.

We have, and will continue to have, the need for "gray" infrastructure - the pipes flowing from street to treatment plants, the rocks used to temporarily "stabilize" shorelines and bridge abutments, the breakwaters that temper the ocean's energy. The engineering community, however, is increasingly borrowing from the principles and strategies employed by biologists, ecologists and landscape architects.

Implementation of GI approaches is getting increased attention with the growing awareness of climate change. Such stormwater applications, especially over the last ten years, have primarily concentrated on improving water quality and reducing the volume of sewer outfall discharge into our creeks and rivers. More recently, the bio-engineering focus has captured the attention of coastal communities in direct response to the acceleration of sea level rise and the increased severity of storm events. Past issues of *Wrack Lines* and numerous other scientific publications have discussed how environmental changes are

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Living Shoreline (hybrid) installation in 2009. Cordgrass plugs (planted by volunteers) inside a rock sill with goose exclusion fence installed on the upland side to prevent predation during plant establishment. Yellow arrows point to designed inlets, which allow daily tidal flooding of this low marsh area.

The same location in October 2013. The site has matured and as with any well-executed bio-engineering project, it is unclear where the work starts or ends. The installation blends in naturally with the environment.

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linked to accelerated climate change that result from greenhouse gas emissions. Understanding how buffering elements of the natural world can be integrated into our human system will greatly increase our ability to adapt to the future.

Manmade dunes may be considered GI. These buffers received press attention in the aftermath of Superstorm Sandy, especially as they were found to have protected some shoreline communities in New Jersey and New York. In the spring issue of Land and Water magazine, Landscape Architect and Ecologist, William Young described how Bradley Beach, New Jersey proactively built dunes along the coast in the 1990s using snow fencing and discarded Christmas trees. Damage to this community was significantly reduced compared to neighboring towns that did not feature dune structures. Similarly, portions of New York's Rockaway peninsula benefited from dune buffers. The image on page 12, borrowed from the "plaNYC A Stronger More Resilient New York" (New York City Department of Environmental Protection, 2013) provides an excellent visual example of the difference a dune can make.

According to experts, dunes alone will not solve all of our problems. Changing policy regarding where and how we build is part of the bigger picture of moving forward successfully. Many coastal areas, for example, can be supported by shifting away from standard hard-armoring approaches to shoreline erosion. Hard-armoring one site can concentrate erosive forces at a neighboring site. The Living Shorelines Program developed by the Chesapeake Bay Foundation defines a practical range of tools specifically suited for areas of "low-to-moderate wave energy and minimal erosion" (Living Shorelines, www.cbf.org). The program guidelines provide quantified ranges of water depth, annual erosion rate, and fetch ("the distance traversed by waves without obstruction" as defined by Merriam-Webster) for categorical application from nonstructural, hybrid, and structural applications. Structural examples include more traditional strategies such as rock revetment or offshore breakwaters. Nonstructural approaches include grass plantings, often utilizing cordgrass/salt hay species (*Spartina* spp.) in combination with coir log edging/support. An example of a hybrid Living Shoreline installed with volunteer help (notably the author's mother-in-law) in Galesville, Maryland, is exhibited in the photos on previous page.

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It is important to keep in mind that our shorelines are dynamic systems. This was aptly described in Spring/Summer 2013 *Wrack Lines* article, "Shifting Sands, the Story of Griswold Point." Aside from the geologic aspects of sediment starvation from diminished river deposition (largely due to historical dam installations) and subsidence in some locations, our ocean water is moving inland. Marshes are degrading and also migrating landward, and they will continue to do so until they are impeded by geologic or manmade features (e.g., roadways).

The future of coastal living is going to be a lesson in adaptation. Each of us has the ability to play a role in reducing the severity of climate change by reducing our carbon footprint. At the Urban Resilience in an Era of Climate Change conference in Brooklyn, New York, Bruce Stein from the National Wildlife Federation explained that "climate-smart conservation" needs to act with intention, understand vulnerability, and account for risk. By way of scripting this article, this author hopes to participate in the conversation.

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To learn more about ways you can participate in change, please visit the following resource websites:

- Registration for the next Coastal Certification program www.ctmga.org/#/coastal-certificate/4572679798
- Coastal Riparian Planting Tool http://clear.uconn.edu/crlg/index.html
- Connecticut House Democrats' Shoreline Preservation Task Force www.housedems.ct.gov/Shore/index.asp
- Connecticut Fund for the Environment, Reduce Runoff website http://reducerunoff.org/index.htm
- "Living Shorelines" brochure www.cbf.org/Document.Doc?id=60
- "plaNYC, A Stronger More Resilient New York" www.nyc.gov/html/sirr/html/report/report.shtml