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The effects of Global Climate Change on the Landscape: The role of Landscape Architecture in adaptation strategies

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1. Introduction

The impacts of climate change have been observed throughout the nation and worldwide. Climate change is altering the water cycle, affecting where, when, and how much water is available. Extreme weather events such as drought and heavy precipitation, which are expected to increase as climate changes, can significantly impact water resources including surface water quality and groundwater storage. Increases in air temperature are causing a rise in sea level, reducing snow cover, and melting glaciers. These changes will affect water supply, water quality, human health, and many aspects of the natural environment.

Climate information from the National Oceanic and Atmospheric Administration (NOAA) identifies projected changes throughout the southeast including key regional areas on water resources, energy, transportation, agriculture, and ecosystems. Providing access to relevant climate information is essential to understanding how weather patterns and climate trends influence the landscape, and to developing appropriate planning and design solutions by employing response and adaptation strategies.

The field of Landscape Architecture can play a key role in applying adaptation strategies to mitigate the impacts of climate change. Landscape Architecture is a multi-disciplinary field of science and design using "hard" (built) and "soft" (planted) materials, while integrating ecological sustainability. Landscape Architects are involved in a wide variety of projects such as the creation of public parks, greenway, and parkways; site planning for residential developments, campuses and corporate office parks; design for stormwater and civil infrastructure; design of residential estates and gardens; management of large wilderness areas; and restoration of degraded landscapes.

Specifically Landscape Architects are well equipped to create adaptation strategies to mitigate the impacts of climate change in areas pertaining to stormwater management, sustainable landscape design, plant

selection, natural resources, land development, ecological restoration, and urban forestry. Climate change will have an impact on these core areas in which Landscape Architects can make significant contributions to help craft design, planning, and management solutions that can sequester carbon and help communities and regions adapt to climate change.

2. Stormwater

The expected impacts of climate change on the water cycle that can be addressed through planning and design include stormwater collection, infiltration and volume control. One of the anticipated changes as identified by NOAA is an increase in drought in some parts of the United States. Stormwater collection for re-use in buildings and for irrigation to reduce the demand on local water supplies can be designed into new projects and also be retrofitted for existing projects. While drought is a concern, the anticipated increase in heavy rain events can overwhelm existing stormwater infrastructure. According to the 2009 report by the U.S. Global Change Research Program, the number of days with heavy rain events has increased by 18 percent between 1958 and 2007. This can lead to flooding and impacts to the natural environment in terms of erosion and sedimentation of streams and rivers. It can also cause impacts to the built environment leading to property damage and loss.

By using Integrated Stormwater Management techniques that combine traditional stormwater methods with stormwater best management practices (BMPs), designs can be created to provide flood control, infiltration, and treatment. Stormwater BMPs such as constructed wetlands, bio retention areas, bio swales, and vegetative buffers are some of the applications that can also be used with underground storage to provide multiple benefits. By utilizing such methods and designing and installing systems to mimic pre-development hydrology with post-development hydrology, the amount and intensity of stormwater discharge can be better controlled.

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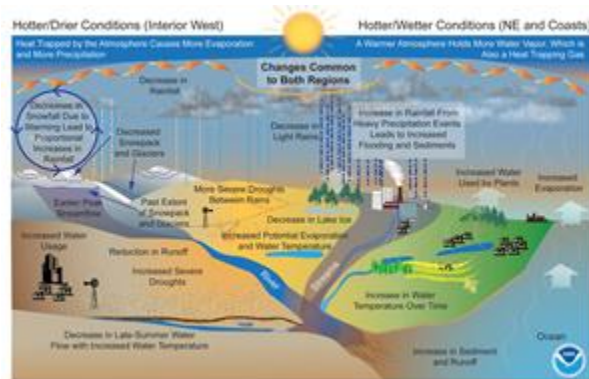


Figure 1: Changes to the Water Cycle depiction from Global Climate Change Impacts in the United States, 2009.

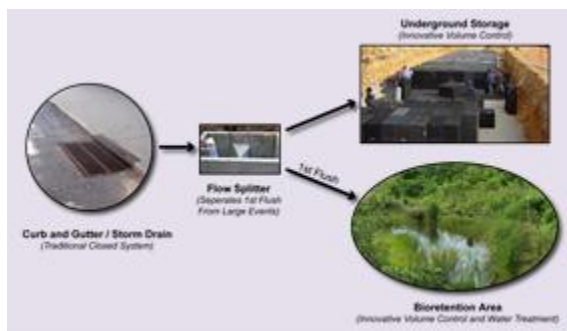


Figure 2: Integrated Approach using underground storage and bio retention.

3. Sustainable Landscape Design

Landscape Architects often work on projects that address issues of environmental sustainability. A major aspect of this is the use of plants in the design of the landscape. Plants can be used to create aesthetic spaces but also play a functional role in the landscape. Proper plant selection can be a determining factor in the long term success of a project. Landscape Architects are making design decisions today that will last 20 years, 50 years, or longer. Nationwide patterns and changes in climate and the U.S. Department of Agriculture (USDA) plant hardiness zones will have an impact on those decisions. Knowing the adaptability of plants and which plants are on the edge of their hardiness zone will become even more important over the next 30 years.

In addition to adapting to the changes in the plant hardiness zones, plant selection will also need to consider the use of drought tolerant and native plants to address changes in the water cycle. Proper plant selection is relevant to design but also relevant is the

use of plants and groupings of plants to help with the energy efficient of buildings. Based on the geographic location in which a landscape architect is

Projected Zone Changes in Next 30 Years In Color of New Planting Zone

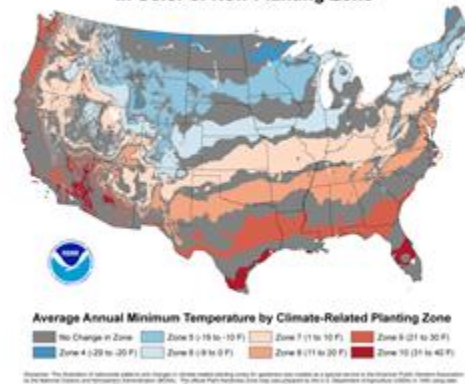


Figure 3: This illustration of nationwide patterns and changes in climate-related planting zones for gardeners was created as a special service to the America Public Gardens Association by the National Oceanic and Atmospheric Administration (NOAA).

working, plants can be located to deflect winter winds, provide shade during the summer, and funnel cooling summer breezes towards a building to help reduce energy needs.

Many additional principles of sustainable landscape design can also be applied such as green infrastructure, active or passive solar, stormwater, and creation or preservation of greenspace/open space, and food production (community gardens). Landscape Architects will be challenged to create integrated and connected natural systems that address multiple issues (stormwater runoff, habitat, species migration, urban heat island, alternative transportation, etc). These principles are not exhaustive but in combination can have multiple benefits to reducing carbon, sequestering carbon, and adapting to landscape scale changes in the environment.

4. Land Planning

Landscape Architects are actively involved in the planning and design for new development. The residential development patterns that can help mitigate and serve as adaptation to climate change include; conservation based development, low-impact development, and mixed-use development.

Conservation based development also known as Conservation Subdivision Design can provide for the conservation of natural areas and vegetation while providing limited residential development. While providing for carbon sequestration and other environmental benefits, this development pattern is

best suited for suburban and rural areas in which high density development cannot be supported by existing infrastructure. When infrastructure is available, Conservation Subdivision Design can be combined with a cluster development approach in which homes are not spread out over an entire property but instead focused on one part of a property.

Low Impact Development (LID) is a development pattern in which the primary focus is on resource reduction. This type of development aims to minimize impervious surfaces and implements stormwater BMPs to address water quality and quantity. It also can include smaller footprint buildings and homes. LID development is an appropriate development pattern for rural, suburban, and urban sites and is particularly suitable for infill development.

Mixed-Use Development, based on the tenants of Smart Growth is a pattern of development that mixes multiple uses together such as residential dwelling with retail and business. A variety of residential options are often included such as townhomes, condominiums, and single family. Mixed use development reduces sprawl as this development type is well suited for high density. It reduces dependency on automobiles as basic goods and services are provided within the development. It provides alternative transportation options such as mass transit, bicycle paths, trails, and greenways with a major emphasis on “walkability”.



Figure 4: Rivercane- a mixed-use development designed by Equinox Environmental with high density, alternative transportation, green infrastructure, and open space.

5. Ecological Restoration

Climate change will impact natural resources and Landscape Architects can apply the tools needed to help ecosystems adapt. Carbon sequestration could be accomplished through restoring degraded

landscapes that are devoid of natural vegetation. Restoring habitat and connectivity will also be beneficial for species migration as a result of climate change. Additional activities to sequester carbon include preservation of forestland and open space, conserving rural land, conserving parkland, creating urban forestry programs, and managing open land to maximize carbon sequestration and in urban areas address the urban heat island effect.

With data provided by the scientific community, the design professions such as Landscape Architecture can help develop adaptation strategies by developing appropriate planning and design solutions for the landscape.

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