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Sustainable Landscaping at Sarah Lawrence College

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Chokeberry (Aronia Medik.)

SUSTAINABLE LANDSCAPING
AT SARAH LAWRENCE COLLEGE

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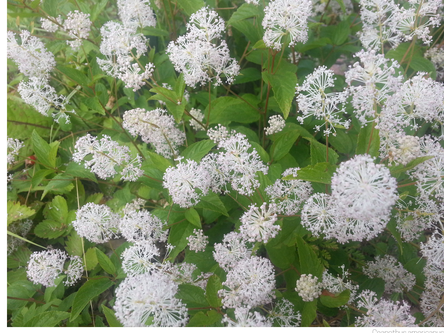


Ceanothus americanus

NATIVE PLANTINGS

Native species can be aesthetically pleasing and even visually similar to non-native species currently on campus, and are available in a wide range of light and water requirements as well as flowering period. Currently, the college has an excess of non-native species planted throughout the campus that could be replaced with native species.

Ecological Benefits

- Cultivating native species will provide habitats for insects and small mammals that are native to New York as opposed to invasive species.
- Non-native plants can alter soil processes and soil biota as soil microbial community structure and function, damaging native environments and promoting the growth of invasive species (Kourtev 2003).
- Some introduced plant species have the potential to escape cultivated areas and become pests in natural areas, leading to problems such as competition for resources, changes in nitrogen fixation rates, changes in hydrologic cycles, and increased sedimentation in natural areas (Reichard 2001).
- When planted in proper locations, native species can get the majority of their water supply from rainfall, saving freshwater
- Native plants do not require fertilizer, which damages aquatic ecosystems through runoff.

PLATE 132

Mountain Laurel, Kalmia latifolia

Practical Benefits

- Since the new native plantings will require little to no inputs once established, the college will save money on water bills, fertilizer costs, labor and maintenance costs.
- Establishing a campus full of native plantings will improve student life by allowing students to experience the beauty of native New York ecology

Initiatives on other campuses

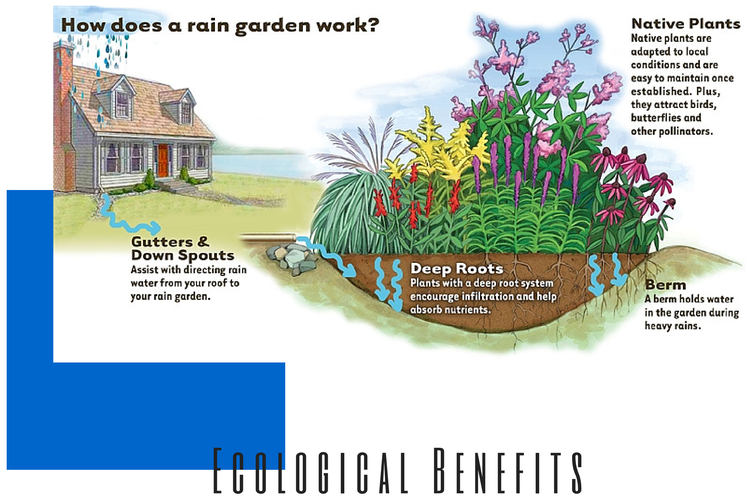
- University of New England created a native prairie garden and a blueberry garden comprised of entirely native plants, both of which were planted by students in an ecological restoration class
- Westchester Community College has a Native Plants Center that has “provid[ed] a regional identity, [and] sense of place” to its community

Implementation

- Sarah Lawrence College would benefit from a partnership with Westchester Community College's Native Plants Center to design new landscapes using native species throughout the campus.

RAIN GARDEN

A rain garden is a shallow depression that is planted with native plants that are able to tolerate both dry and wet conditions.
When placed near a source of runoff water, rain gardens allow water to seep into the soil at a slow rate instead of veering directly to a storm drain or natural body of water.



Ecological Benefits

- Planting native species will provide habitats for insects.
- Rain gardens filter stormwater runoff, which can otherwise carry pollutants such as fertilizer, pesticides, oil, yard wastes, sediments, and animal wastes into water sources.
- Helps prevent stream bank erosion by reducing peak storm flows
- Helps provide habitats for songbirds, butterflies, and other native wildlife

Practical Benefits

- Flood mitigation
- Campus beautification

Initiatives on other campuses

- The University of New England has an established rain garden situated at the source of stormwater runoff, slowing the flow of water and absorbing excess nutrients while filtering pollutants (University of New England). Their rain garden was funded by a grant from the EPA and involved the work of five faculty members and 49 students from conception to completion.

Implementation

The ideal location for a rain garden on the Sarah Lawrence College campus would be the small forested area in front of the Bates building. The topography of this location is sloped and continues toward the Alice Stone Lichman Science Center, which is prone to flooding. Placing a rain garden before the center may help diminish or prevent future accidents.

The cost of establishing an institutional rain garden can range between 10 to 40 dollars per square foot.

XERISCAPING

is creative and quality landscaping that conserves water and protects the environment.

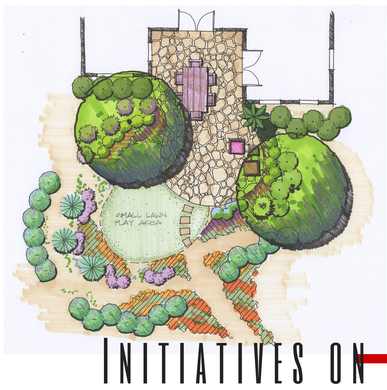
7 principles of Xeriscaping:
1. Water Conservation
2. Soil Improvement
3. Limited Turf Area
4. Appropriate Plants
5. Mulch
6. Irrigation
7. Maintain your landscape

Ecological Benefits

- By increasing the amount of organic material, such as compost, in the soil and also keeping it aerated will improve the quality of soil tremendously. Limiting turf area will reduce landscaping maintenance which will assist in conserving more water.
- Planting native species is another way to conserving water, since these plants are most suitable for this environment and placing them in zones based on their water needs will make the space work more efficiently.
- Mulch helps to prevent erosion, eliminate weeds, retain soil moisture and temperature. Irrigation systems are an important component to xeriscaping, because they conserve water by only providing water to the root of plants instead of all over the maintained area; this helps to reduce water loss from evaporation, and if delivered at a slow rate, helps promote root absorption.

Practical Benefits

- Xeriscaping is a landscaping alternative that will conserve resources, save money, beautify our campus and be a central source for community.



Initiatives on other campuses

- California State University, Fullerton has spent over $250,000 on drought-tolerant landscaping (Picazo 2014).
- University of Texas is saving 233,000 gallons of water annually by xeriscaping (The Daily Texan 2012)

Implementation

The large hill behind the "new dorms"is a prime location for xeriscaping on campus. With nothing more than grass there now, this community would benefit from a xeriscaped communal space for students on campus.

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Prof. Michelle Hersh
Global Change Biology
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Sustainable Landscaping at Sarah Lawrence College

I. Introduction

Sarah Lawrence College is an institution that inspires innovation within its students and teaches them how to understand and act upon the challenges that our ever-changing society raises. Currently, society is presented with some of the largest ecological crises that humans have ever faced, the consequences of which are widespread, affecting everyone on the planet. In order to address environmental devastation, all institutions must re-evaluate their current practices and implement significant changes. No college is better equipped for creating such change than Sarah Lawrence; founded on innovative educational techniques, we possess the knowledge and creativity that can be harnessed to create environmentally sustainable and economically viable policies on campus. One of the most simple and cost-effective ways to reduce the college's ecological footprint lies within our landscaping practices. The college currently uses an unnecessary amount of water and fossil fuels on maintaining plant species and grassy areas. In order to cut back on water and fossil fuel use, the college can implement basic changes including planting native species, establishing a rain garden, and incorporating Xeriscaping techniques. Not only will these changes provide ecosystem services and reduce the college's carbon footprint, they will also lower the cost of landscaping maintenance.

II. Native Species Plantings

Currently, the college has an excess of non-native species planted throughout the campus that could be replaced with native species to provide ecological and economic benefits by dramatically reducing the need for watering, fertilizer use, and

maintenance. The potential alternatives for non-native plants are abundant. Native species can be aesthetically pleasing and even visually similar to non-native species currently on campus, and are available in a wide range of light and water requirements as well as flowering period. Hydrangeas (*Hydrangea* L.), for instance, are a flowering shrub ubiquitous on campus that have an extensive underground root system, requiring water to penetrate deep into the soil, which is accomplished through hours of soaking. Two of the many potential native alternatives for flowering shrubs are New Jersey Tea (*Ceanothus americanus* L.), which improves soil quality by fixing nitrogen into the soil, and attracts butterflies, and Mountain Laurel (*Kalmia latifolia* L.), an evergreen that displays beautiful pink inflorescences. Both of these species are able to thrive with little water inputs and no fertilizer (Westchester Community College). Meanwhile, Chokeberry (*Aronia* Medik.) can replace the invasive Porcelain Berry (*Ampelopsis glandulosa* Wall. Momiy) found around campus, as it fruits beautiful dark berries and can thrive in multiple sunlight and watering conditions (Westchester Community College). There are also non flowering bushes planted around buildings that workers are required to spend hours watering with a hose; replacement potentials include Northern Bayberry (Myrica pensylvanica Mirbel) and Dwarf Sumac (Rhus copallinum
L.), which both require little water to thrive and change from deep greens in the summer to beautiful reds in the fall (Westchester Community College).

The benefits of planting native species across campus can be measured not only in terms of the direct benefits that the college will receive, but also in terms of ecological services that will benefit the environment. Cultivating native species will provide habitats for insects and small mammals that are native to New York, as opposed to species that are potentially invasive or harmful to the natural habitats in Yonkers (California Native Plant Society). Encouraging the successful establishment and growth of native populations makes for a more biologically sound, functioning local ecosystem and

minimizes the risks brought on by introducing non-native species. Non-native plants can alter soil processes and soil biota by changing potential nitrogen mineralization rates as well as soil microbial community structure and function; these changes can lead to long-term effects including changes in soil pH levels and nitrification rates, and consequently promote invasion of other exotic species and damage native species (Kourtev 2003). Some introduced plant species even have the potential to escape cultivated areas and become pests in natural areas, potentially leading to problems including but not limited to competition for resources, changes in nitrogen fixation rates, changes in hydrologic cycles, and increased sedimentation in natural areas (Reichard 2001). The economic costs of invasive plants in natural areas, agriculture, and gardens has been estimated at 35 billion dollars per year (Reichard 2001).

In terms of inputs, native species require significantly less water and fertilizer than the species currently planted on campus because they are acclimated to grow in this environment and therefore do not need additional supports in order to thrive (USDA). When planted in proper locations, native species can get the majority of their water supply from rainfall, which saves freshwater that would otherwise be provided by sprinklers and hoses. Although freshwater is a renewable resource, it is currently being used at a nonrenewable pace; a transition to native species will benefit the environment by alleviating the depletion of freshwater. Eliminating the need for fertilizer also provides environmental benefits. Fertilizer is used because it improves soil quality and provides nutrients to plants by increasing nitrogen and phosphorus levels; however, during rainfall nitrogen and phosphorus are washed away and carried into aquatic ecosystems through runoff (Murray 2004). Once in aquatic environments, nitrogen and phosphorus encourage the growth of algae, leading to excessive algal blooms, which deplete oxygen, sometimes to the point where no fish or sea life can survive (Biello 2008). Since native plants are already acclimated to grow in the soils found in New York, switching to

native plantings will indirectly help to improve the quality of aquatic ecosystems in the area by reducing the need for fertilizer. Finally, planting ground covers, which are plants that spread across the ground without growing tall, would eliminate the need for lawn watering and mowing in areas on campus where students do not use lawns or where lawns do not provide aesthetic purposes. This would save water as well as fossil fuels from gas powered equipment, therefore lowering the college's carbon footprint.

While the environmental benefits to ecosystems are reason enough to make the switch to native plantings, there are also economic and social gains to be had from changing. The money that the college will save from making the switch is perhaps the biggest incentive to make the switch. The costs would mainly entail purchasing new plantings and the labor of digging out old plantings and establishing new ones. Meanwhile, since the new native plantings will require little to no inputs once established, the college will save money on water bills, fertilizer costs, and labor and maintenance costs. The cost of purchasing fossil fuels for lawn maintenance equipment would also be lowered. Establishing a campus full of native plantings also has the opportunities to improve student life. Experiencing the beauty of New York's ecology will improve the ties that students have to the surrounding community and environment and allow students to fully experience living in New York.

Some schools across the United States have already begun to enact such a change. The University of New England, for example, has a native prairie garden as well as a blueberry garden on campus, both comprised of entirely native plants (University of New England). The native prairie garden was planted by students in an ecological restoration class; this kind of process helps to improve students' ties to their peers and the college community while reducing the cost of labor. The University of New England has described on their website the benefits they have received from planting native species:

> “Our perennial native wildflowers and grasses reduce the energy and resources needed to maintain landscaping. Well-adapted to Maine’s climate, these plants are deep-rooted, hardy and non-invasive, and they serve as host-plants required by native butterflies and other vital insect species. They demonstrate how human-modified landscapes can be beautiful while contributing to biodiversity and a healthier ecosystem.” (University of New England)

The experiences of other universities provide examples of how planting native wildlife can be beneficial. In addition, Westchester Community College, which has its own native plant center, has described native plants as “provid[ing] a regional identity, [and] sense of place” to its students, while providing practical and ecological benefits by “provid[ing] valuable sources of food and shelter for wildlife and help[ing to] protect water quality by filtering stormwater pollutants and reducing soil erosion” (Westchester Community College).

III. Rain Garden

Rain gardens are a an aesthetically pleasing solution to improving water quality for our community and protecting it against water pollution. A rain garden is a shallow depression that is planted with native plants that are able to tolerate both dry and wet conditions (NRCS 2005). The purpose of these gardens is when placed near a source of runoff water, for example a gutter after a storm, it allows the water to seep into the soil at a much slower rate than normal instead of veering directly to a storm drain or natural body of water. This process is immensely important, because runoff water can be a source or a catalyst for water pollution. It has been shown that, “Stormwater runoff from residential areas often contains excess lawn and garden fertilizers, pesticides and herbicides, oil, yard wastes, sediment and animal wastes which cause water pollution.”, and this water finds its way to our lakes and streams, which in turn has harmful effects

on the various species that need that water to survive (Mass Audubon). Polluted runoff affects not only aquatic life, but also makes the water unsuitable for leisure activities, such as fishing and swimming (University of Connecticut NEMO). Rain gardens are a way to reduce peak storm flows, which helps to prevent stream bank erosion (Mass Audubon). It also helps to reduce the risk of flooding, since any excess water will slowly seep and be absorbed into the soil.

When deciding to develop a rain garden, it is best to choose native plants and flowering perennials with light exposure, moisture retention and quality of soil in deep consideration. Plantings that don't require chemical fertilizers and pesticides are best when making a rain garden due to the high risk of such chemicals running off. When gardening one can also make sure to plant beautiful flowering species that will attract butterflies, songbirds, and other wildlife. This will provide food and a habitat for more native species that may be have lost theirs over time (EPA). Butterfly gardening is a popular, and easy way to achieve this,". It can be as simple as providing the appropriate variety of host plants for larval growth and adult feeding." That will encourage the annual return of butterfly populations (Krischik). There have been over 100 butterfly sighting in Westchester County. The beautiful Baltimore Checkerspot (*Euphydryas phaeton)* most common host plant is a flowering perennial, Turtlehead *(Chelone),* which is native to our area (Kim Eierman 2014). Milk weed (*Asclepias L.*) is another important plant to consider, because it is a host plant for the Monarch butterfly (*Danaus plexippus*), as well as other insects. The Monarch butterfly has been threatened greatly in past decades due to global warming (which affects the timing of migration), habitat loss, and pesticides used to kill the milkweed which is an important source of food for them. Monarchs aren't the only butterflies that are in trouble in the United States, and if we garden with them in mind, we can not only help restore their habitat, but improve our waters as well.

The rain garden will provide the ecological benefits discussed as well as practical uses that the college will directly benefit from. The flood mitigation services that rain gardens provide will save the college money and prevent the inconvenience of cleaning up a flooded building, a situation that the school recently had to deal with in the science center after snowmelt flooded the lobby. In addition, campus beautification is a large incentive for making a change; flowering plants, butterflies and songbirds brought on by the garden will improve student life and impress prospective students. A rain garden also offers the opportunity for hands-on learning in biology classes and community building activities for students.

Taking into account the environmental and practical benefits that a rain garden will provide, the college can't afford not to invest in the implementation of one. In general, institutional rain garden costs can range between 10 to 40 dollars per square foot; these costs occur in the planning phase, design phase, construction phase and closeout phase, and take into account the need for control structures, curbing, storm drains, underdrains, plants, and soil amendments (Low Impact Development Center, Inc. [LID] 2007). However, many of the costs that involve establishing and planting the rain garden can be done by student volunteers who are interested in environmental sustainability, gardening, or horticulture, which would lower the cost of implementation and improve student life by providing outdoor activities and increasing the bond between students. The college's cost savings will increase after the rain garden is established and the use of traditional structural stormwater conveyance systems is reduced. For example, a medical office building in Maryland reduced the amount needed of storm drain pipe from 800 feet to 230 feet by establishing a rain garden, saving the office 24,000 dollars (LID 2007). Similarly, a new residential development spent about 100,000 dollars using rain gardens on each lot instead of 400,000 for the traditional stormwater systems that were originally in use (LID 2007).

Other universities have already caught on to the benefits of rain gardens. The University of New England has an established rain garden situated at the source of stormwater runoff, slowing the flow of water and absorbing excess nutrients while filtering pollutants (University of New England). Their rain garden was funded by a grant from the EPA and involved the work of five faculty members and 49 students from conception to completion; students in environmental classes collected information about rain gardens; developed the garden design, installation and maintenance plans; grew the majority of the garden's plants from seeds, planted the garden, and prepared educational materials for the garden (University of New England). Not only does the garden provide an opportunity for hands on learning to the students, but it also provides a botanical haven with over 150 individual plants representing over 17 native species and includes a stone walking path, bridge, and seating for the students' enjoyment (University of New England). More locally, Westchester Community College has already established a rain garden on campus, making use of its practical components and providing aesthetic value to its campus (Westchester Community College). With neighboring colleges embracing this change, it is time for Sarah Lawrence to step up and follow in its peers' example.

IV. Xeriscaping

Xeriscaping is a creative way of landscaping that can help conserve water on campus. This area is meant to not only be a space where little landscaping is required but also a student space as well. Xeriscaping calls for planting drought tolerant plants, appropriate landscape design and horticultural techniques that minimize water use and is defined as "quality landscaping that conserves water and protects the environment" (EPA). There is a small landscape opposite of student housing on Mead Way that is underutilized and maintained for appearances. Students enjoy spending their free time

on top of the hill, but the rest of the area is rarely occupied. That is why it is a perfect space for a xeriscaped student area.

There are seven principles of Xeriscaping:

1. Water Conservation
2. Soil Improvement
3. Limited Turf Area
4. Appropriate Plants
5. Mulch
6. Irrigate
7. Maintain your landscape

And these principles are all necessary in creating the most efficient landscape (Earth Easy). How the area is designed is of utmost importance when it comes to conserving water. Certain plants should be zoned based on the amount of water they require in order to get the most efficient water use. By denoting anything that might limit water flow, such as, trees, fences, walkways, and structures, as well as note areas of shade and sun, we can get the most optimal space for water conservation and sun exposure, due to a well thought out design plan..

Xeriscaping is a way to not only promote soil that drains quickly but also store water at the same time (Earth Easy). By increasing the amount of organic material, such as compost, in the soil and also keeping it aerated will improve the quality of soil tremendously. Limiting turf area will reduce landscaping maintenance which will assist in conserving more water. Planting native species is another way to conserving water, since these plants are most suitable for this environment and implement them in zones based on their water needs will make the space work more efficiently. Mulch helps to prevent erosion, eliminate weeds, retain soil moisture and temperature. Irrigation

systems are an important component to xeriscaping, because they conserve water by only providing water to the root of plants instead of all over the maintained area; this helps to reduce water loss from evaporation, and if delivered at a slow rate, helps promote root absorption. If all seven principles are followed, we can reap the biological benefits and practical benefits that xeriscaping has to offer.

It is also important to note that by using native plants in this capacity will eliminate the need for chemicals from fertilizers or pesticides. The use of native plants, shrubs or trees, will also help establish more habitats for Westchester's local wildlife. Xeriscaping will also reduce pollution. Gas mowers consume fossil fuels, and with this type of landscaping, that can be minimized. Any turf, which should be small, can be maintained with a reel mower. Xeriscaping is very popular and has been shown to increase property value for homeowners (East Larimer County Water District). Xeriscaping is also popular amongst colleges and universities as well, as part of their own sustainability initiatives. In the midst of an extreme drought California State University, Fullerton has spent over $250,000 on drought-tolerant landscaping (Picazo 2014). In an article from the Daily Titan, their school newspaper reported that, "Kathy Ramos, associate resource specialist of Metropolitan Water District, said a water saving analysis showed that commercial sites who removed turf reduced their water usage on average by 23.9 percent.", showing how low maintenance landscaping can reduce water usage. By reducing water use, we in turn reduce spending, both on water, and lawn supplies, like lush greenery and rolls of sod for example. University of Texas is saving 233,000 gallons of water annually by xeriscaping (The Daily Texan 2012). Two of their rock gardens alone are saving the university 72,000 gallons of water annually. Because there is limited greenery, it would be easy to design a space that could be a meeting space for students on campus. This space could have benches, tables, and other seating areas that would encourage and invite students to congregate in. Xeriscaping is

a great landscaping alternative that will conserve resources, save money, beautify our campus and be a central source for community.

V. Conclusion

Landscaping practices, when done sustainably, are sure ways to reduce our ecological footprint. If more native species were planted on campus, in new rain gardens or added to a xeriscape landscape, more water would be conserved, we would use less fossil fuels, and curb the level of maintenance needed at Sarah Lawrence College. By making changes to the landscape, money can be saved, due to low maintenance solutions like native plantings, rain gardens, and xeriscaping. These solutions will also beautify our campus with flowering perennials, providing a once lost habitat for local wildlife, and be a source of food for other life forms as well. If one thoroughly thinks about and designs public spaces with the environment in mind and consider what's native to the region, one can reap the biological, ecological, and practical benefits of a more sustainable practice. By doing this, the community can help in reducing the consequences of its environmental degradation. Sustainable landscaping is an exemplary practice for reducing ecological footprints, beautifying public spaces, and being a catalyst for a greater sense of community.

Works cited:

Biello, D. 2008. Fertilizer runoff overwhelms streams and rivers--creating vast "dead zones". Scientific American, March 14.

Blanchard, Bobby. 2012. The Daily Texan. Landscaping technique helps UT save water. https://facilitiesservices.utexas.edu/about/documents/LandscapingtechniquehelpsUTsavewater_TheDailyTexan.pdf

Butterflies and Moths of North America. Euphydryas phaeton. http://www.butterfliesandmoths.org/species/Euphydryas-phaeton

Butterflies and Moths of North America. Butterflies of Westchester County, New York, USA. http://www.butterfliesandmoths.org/checklists?species_type=0&tid=2277

California Native Plant Society. 2016. Benefits of Gardening with Natives - California Native Plant Society. http://www.cnps.org/cnps/grownative/benefits.php

Earth Easy. 2012. Xeriscape http://eartheasy.com/grow_xeriscape.htm

East Larimer County Water District. What Is “Xeriscaping”?. http://www.elcowater.org/#!what-is-xeriscaping/cjog

Eierman, Kim. 2014. Be A Good Host to Butterflies This Year, White Plains. The Daily Voice- White Plains. http://whiteplains.dailyvoice.com/lifestyle/be-a-good-host-to-butterflies-this-year-white-plains/445755/

Environmental Protection Agency. 2016. Rain Gardens. https://www.epa.gov/soakuptherain/rain-gardens

Krischik, Vera. Butterfly Gardening. University of Minnesota. http://www.extension.umn.edu/garden/yard-garden/landscaping/butterfly-gardening/

Kourtev, P. S., J. G. Ehernfeld, and M. Haggblom. 2003. Experimental analysis of the effect of exotic and native plant species on the structure and function of soil microbial communities. Soil Biology and Biochemistry. 35.7:895-905.

Low Impact Development Center, Inc. 2007. LID Urban Design Tools - Biorentation. http://www.lid-stormwater.net/bio_costs.htm

Mass Audubon. Going Green with Storm Water- Rain Gardens. https://cfpub.epa.gov/npstbx/files/MassAudubonRGBrochure.pdf

Murray, R. H., B. F. Quin, and M. L. Nguyen. 2004. Phosphorus runoff from agricultural land and direct fertilizer effects. Journal of Environmental Quality. 33.6:1954-1972.

National Wildlife Federation. Monarch Butterfly. https://www.nwf.org/Wildlife/Wildlife-Library/Invertebrates/Monarch-Butterfly.aspx

Picazo, Katherine. 2014. Daily Titan. CSUF spends $250,000 to implement drought-tolerant landscaping http://www.dailytitan.com/2014/11/csuf-spends-250000-to-implement-drought-tolerant-landscaping/

Reichard, S. H. and P. White. 2001. Horticulture as a pathway of invasive plant introductions in the United States. BioScience. 51.2:103-113.

United States Department of Agriculture Forest Service. 2016. Native Gardening. http://www.fs.fed.us/wildflowers/Native_Plant_Materials/Native_Gardening/index.shtml

United States Environmental Protection Agency. 1993. Xeriscape Landscaping: Preventing Pollution and Using Resources Efficiently website

University of Connecticut NEMO. Rain Gardens 101. http://nemo.uconn.edu/raingardens/101.htm

University of Florida. 2006. Xeriscaping http://livinggreen.ifas.ufl.edu/landscaping/xeriscaping.html

University of New England. 2016. Native Prairie Garden | Sustainability. http://www.une.edu/sustainability/node/85641/native-prairie-garden

Westchester Community College. 2016. About - Westchester Community College. http://www.sunywcc.edu/about/npc/about-the-native-plant-center/