LID Plant Guidance

Semiarid Steppe Climate

Low Impact Development (LID) aims to reduce the impact of human development on a site's hydrologic system. Strategies used include infiltration and evapotranspiration which work to slow runoff in order to prevent flooding and use native vegetation to reduce urban pollutants. In wet regions, LID is used to limit how much water goes into large, conventional end-of-pipe stormwater infrastructure, while in dry regions, LID can store water aiding in overall water savings.

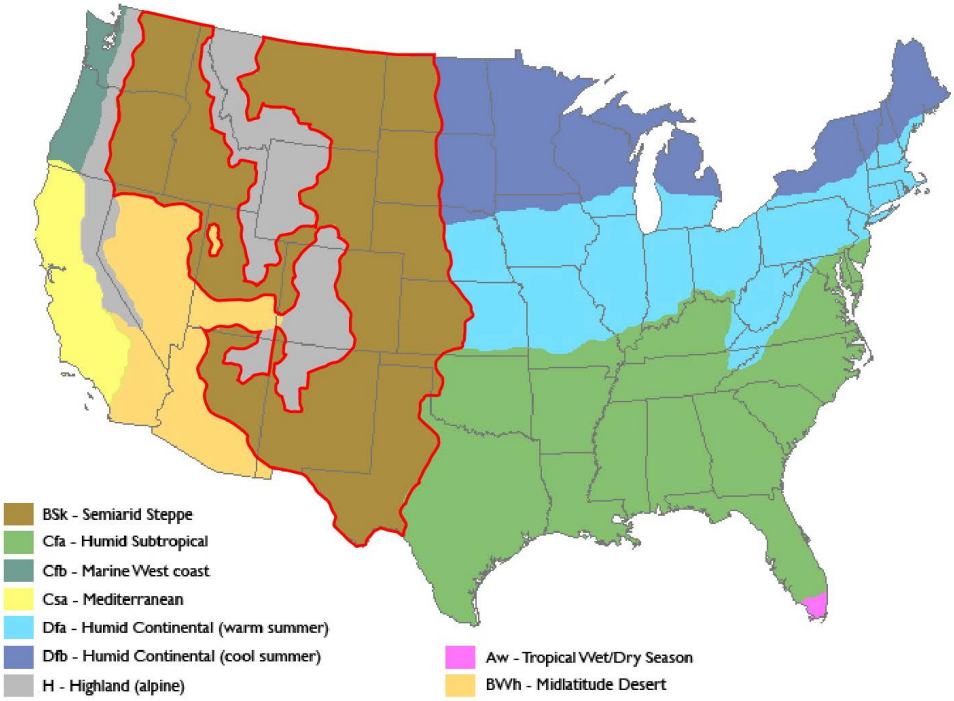
LID designs can natural resource area conservation, incorporate reduction of the development envelope, and minimization of impervious surfaces. LID Best Management Practices (BMP) are landscape and infrastructure controls for stormwater management. The selection of drought tolerant, native plantings is critical to enhance BMP functions and efficiencies. Because LID BMPs are designed to accommodate rain events, the vegetation used in LID systems needs to be adapted to both dry periods and flooding. To perform effectively, LID BMPs must be planned and maintained properly to provide pollutant removal and protection of predevelopment hydrological functions. This factsheet can be used by engineers, landscape architects, planners, landscapers, and developers in selecting appropriate vegetation in the development and implementation of LID BMPs for individual climatic regions.

Key Concepts

- Cost-effective
- Easy to maintain
- Aesthetic
- Maintain runoff near site
- Pollution removal
- Species management
- Noise and dust abatement
- Reduce heat islands

Semiarid Steppe Climate

The Köppen Climate system divides the United States into nine zones. The Semiarid Steppe zone encompasses much of the inland western United States. It is characterized by low levels of precipitation throughout the year. The western mountain ranges act as a barrier between oceanic humidity and winter precipitation for most of the region while northern areas experience winter snow accumulation. Temperature can fluctuate greatly from day to night and seasonally due to low humidity and moisture levels. Consequently, vegetation must be adapted to both temperature variations and drought conditions. Grasses are the primary vegetation for this climate, with taller grasses near forest cover and shorter near desert. Using locally adapted native plants for the region's soils and climate will result in higher success rates, and less overall maintenance inputs than non-native ornamentals.



Army Low Impact Development Technical User Guide. Washington, DC: U.S. Army Corps of Engineers, 4 January 2013.

US EPA. "Managing Wet Weather with Green Infrastructure." 2008.

LID BMPs

According to the Army Low Impact Development Technical User Guide (2013), there are seven primary types of structural LID BMPs. Of those seven types, there are three that require extensive planting designs to function properly: bioretention, vegetated swales, and vegetated filter strips. Selecting the right vegetation for the BMP ensures overall plant success as well as maximizing the benefits gained from the LID system.

Bioretention

- ✓ *Holds stormwater to prevent flooding*
- ✓ *Allows water to infiltrate soil/ underdrain*
- ✓ *Filters out pollutants and sediments*

Courtesy of Salt Lake County, Utah

Bioretention collects and holds stormwater runoff in flat-bottomed, shallow depressions or basins. The basins are vegetated and designed to filter pollutants as stormwater infiltrates into the soil or underlying drain.

Bioretention cells are designed for water infiltration, filtration, or a combination of both making use of the physical properties of water, soils, and vegetation to reduce or remove pollution from stormwater runoff (U.S. Army Corps of Engineers 2013, 2-26).

Installed within a planned system of multiple smaller LID installations, bioretention in semiarid environments can be shallow, and in certain areas will not be required to have an underdrain. In these cases, drought resilient plantings have been shown to withstand prolonged inundation, but the site should be naturally well- drained, ideally within 8 hours but no longer than within 24 hours of a typical storm event (USEPA, 2013). Organic mulch can be used to absorb oils and sediments from urban areas and provide additional treatment and retention. Use of stones and gravel should be minimized, as they will not mitigate heat island effects of urban areas nor provide adequate retention and pollutant removal benefits. Northern areas should design retention around snowmelt events.

Vegetated Swales

- ✓ *Allows water to infiltrate soil/ underdrain*
- ✓ *Filters out pollutants and sediments*
- ✓ *Slows runoff*

Courtesy of USEPA

Vegetated swales are broad, shallow channels that direct stormwater surface runoff to a waterbody or stormwater system. Swales are densely planted with grasses, shrubs, and trees to slow and filter stormwater while enabling transpiration and infiltration. There are three types of vegetated swales: grass, wet, and bio-swales (USACE 2013, 2-30).

Vegetative cover in the Semiarid Steppe Climate can function as heat island reduction within hot urban areas during summer heat. In areas with snowmelt, the swale can be a tool for pollutant removal and flood management during spring. However, care should be taken to ensure stormwater runoff is slowed and erosion potential is minimized. Native grasses are optimal for swale infrastructure.

Vegetated Filter Strips

- ✓ *Filters out pollutants and sediments*
- ✓ *Slows runoff*

Courtesy of Denver Colorado

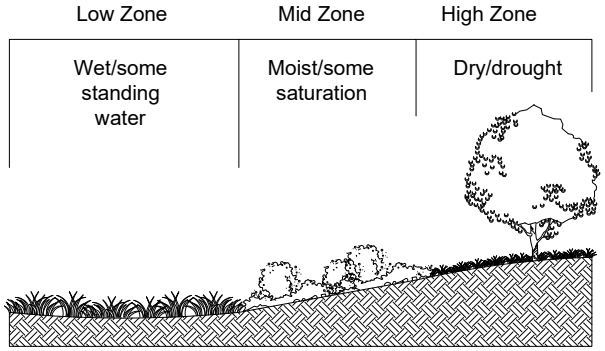
Vegetated filter strips are heavily planted, narrow depressions that collect sheetflow runoff from adjacent impervious areas. Vegetated filter strips can connect to other LID BMPs, vegetated areas, or receiving waterbodies as well as treat runoff from isolated impervious areas such as roofs and parking lots (USACE 2013, 2-33).

VFS must be able to handle short periods of high water flow and volume. Layering of plant canopies can be beneficial in achieving maximum water detention.

Vegetated filter strips are not meant to hold water for long, so they will require plants that can endure long dry periods, especially in the summer, as well as in general periods of drought.

LID Planting Considerations

Working with local authorities is key to developing a compliant LID retention site, as local planting height and setback limitations may not be compatible with LID BMPs (USEPA, 2013). LID BMPs are strategically designed to slow and infiltrate runoff. Therefore, plants selected for use must be able to accommodate periodic flooding as well as prolonged dry conditions. Selecting low maintenance, native vegetation ensures that a LID BMP will work within the Semiarid Steppe climate and be more efficient and use less resources. Shrubs, grasses, perennials, and groundcovers should be used strategically to stabilize slopes, slow and absorb runoff, and filter pollutant loads. Understanding how LID BMP vegetation functions is important to the overall success of the stormwater system. The depressions of LID BMPs can be divided into three general moisture zones: low, middle, and high. The lowest section collects and holds water for the longest amount of time. Vegetation in the lowest zone must be able to accommodate periodic inundation as well as the dry conditions between infrequent precipitation events. Mid zone plantings should provide slope stabilization and be able to withstand potentially high runoff volumes. Plants selected for the highest zone of a Semiarid Steppe BMP require little tolerance to extreme wet conditions, but must still be able to survive with limited water.



References / More Information

US Department of Agriculture. *Plants Database*. http://www.plants.usda.gov

Utah State University Extension. *Range Plants of Utah.* http://extension.usu.edu/rangeplants/

University of Arizona Pima County Cooperative Extension. *Arid Plant List.* http://ag.arizona.edu/pima/gardening/aridplants/aridplant_botindex.html

The International Sustainability Council. *The Dry Climate.* http://www.thesustainabilitycouncil.org/the-koppen-climate-classification-system/the-dry-climate/

Special Considerations for the Semiarid Steppe Zone

Because of the arid conditions of this region, selected plants must be drought-tolerant. In addition to collecting, directing, and filtering stormwater, LID vegetation in this climate zone should be used to stabilize soils and prevent erosion, especially in areas with high volumes of runoff during snowmelt and extreme precipitation events. Using native and locally-adapted plants ensures that species will be able to handle the low humidity and large temperature shifts. Grasses should be interspersed with larger vegetation (shrubs, trees) in order to layer canopies. Layering increases the amount of vegetative coverage because certain plant species grow slowly in this climate. In well-drained soils, irrigation may assist plants during the initial establishment period. Selecting specific plant species will be dependent on location, city codes, and local resources. Below are suggested vegetation species applicable to the Semiarid Steppe zone. Proposed LID designs include but are not limited to suggested plant species shown below. Coordination with local plant nurseries and natural resource services is essential to successful LID planning and functioning. Proposed LID plantings and planting locations shall be in accordance with applicable AT/FP (Anti-terrorism/Force Protection) guidelines and UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings.

LID Plant Suggestions	Form	Height	Width	High Zone	Mid Zone	Low Zone	Sun	Part Sun	Shade	Hardiness	Notes / Maintenance
Prairie Junegrass *Koeleria macrantha*	Grass	1-2'	1-2'	X			X			3-9	Does well in sandy or rocky soils
Indian Ricegrass *Achnatherum hymenoides*	Grass	1-2'	1-2'	X			X			3-9	Drought tolerant, can be mowed to be 8" tall
Desert Needlegrass *Stipa speciosa*	Grass	1-3'	1'	X			X			5-8	Drought tolerant once established, tolerates most soil types
Silver Beard Grass *Andropogon saccharoides*	Grass	2-4'	2'	X	X					5-8	Grows up to 7,500 ft, tolerates all soil types, low water use
Blue Grama Grass *Bouteloua gracilis*	Grass	1-2'	1'	X	X					2-8	Grows in elevations up to 9,500 ft, tolerates light shade, low water use
Little Bluestem *Schizachyrium scoparium*	Grass	1-4'	1-2'	X	X					3-9	Grows in elevations up to 7,500 ft, tolerant of most soils
Alkali Sacaton *Sporobolus airoides*	Grass	2-5'	1-3'	X	X					3-10	Grows in elevations up to 7,500 feet, robust grass, low water use, tolerates most soils
Slender Wheatgrass *Elymus trachycaulus*	Grass	1-3'	1'		X		X	X		2-9	Does well in loamy and clay soils
LID Plant Suggestions	**Form**	**Height**	**Width**	**High Zone**	**Mid Zone**	**Low Zone**	**Sun**	**Part Sun**	**Shade**	**Hardiness**	**Notes / Maintenance**
Desert Marigold *Baileya multiradiata*	Forb	1'	1'	X			X	X		7-10	Drought tolerant, tolerates rocky soils
Utah Penstemon *Penstemon utahensis*	Forb	1-2'	1-2'	X			X			3-8	Drought tolerant
Fringed Sage *Artemisia frigida*	Forb	1-3'	1-3'	X			X			3-10	Drought tolerant
Big Sagebrush *Artemisia tridentata*	Forb	4-9'	3-4'	X			X			4-10	Drought tolerant
Butterfly Weed *Asclepias tuberosa*	Forb	1-3'	1'	X	X		X			3-9	Drought tolerant, tolerates rocky soils
Silver Sage *Artemisia cana*	Forb	2-5'	2-3'	X	X		X			4-10	Drought tolerant
Arrowleaf Balsamroot *Balsamorhiza sagittata*	Forb	1-3'	1'		X		X			4-8	Does well in gravelly or sandy soils

LID Plant Suggestions	Form	Height	Width	High Zone	Mid Zone	Low Zone	Sun	Part Sun	Shade	Hardiness	Notes / Maintenance
Winterfat *Ceratoides lanata*	Shrub	3'	3'	X			X			3-6	Drought tolerant, does not tolerate standing water
Rubber Rabbitbush *Chrysothamnus nauseosus*	Shrub	5-6'	5-6'	X			X			4-8	Very drought tolerant
Bitterbrush *Purshia tridentata*	Shrub	4-8'	3-4'	X			X			3-9	Does well in gravelly, sandy soils
Apache Plume *Fallugia paradoxa*	Shrub	4'	4'	X	X		X			4-9	Drought tolerant
Black Currant *Ribes aureum*	Shrub	4-6'	4-6'	X	X					3-8	Drought tolerant
Fernbush *Chamaebatiaria millefolium*	Shrub	5-6'	6-8'	X	X		X			4-9	Drought tolerant
Twinberry honeysuckle *Lonicera involucrata*	Shrub	6'	10'	X	X		X	X		6-8	Drought tolerant once established
Utah Serviceberry *Amelanchier utahensis*	Shrub	6-10'	6-10'	X	X		X			5-8	Prefers well-drained soils, tolerates most soil types
Snowbrush *Ceanothus velutinus*	Shrub	3-5'	3-8'		X		X	X		4-8	Tolerates rocky soils
Red Twigged Dogwood *Cornus sericea*	Shrub	6-9'	8-12'		X	X	X	X		3-8	Can be cut back to the ground if needed
LID Plant Suggestions	**Form**	**Height**	**Width**	**High Zone**	**Mid Zone**	**Low Zone**	**Sun**	**Part Sun**	**Shade**	**Hardiness**	**Notes / Maintenance**
Desert Willow *Chilopsis linearis*	Tree	20-25'	15-20'	X			X			5-9	Drought tolerant
Chokecherry *Prunus virginiana*	Tree	20-30'	15-20'	X	X		X	X		2-7	Drought tolerant
Blue Elderberry *Sambucus caerulea*	Tree	25'	10'		X	X	X			4-8	Prefer well-drained soils
Water Birch *Betula occidentalis*	Tree	20-30'	10-20'		X	X	X	X		4-6	Prune in late summer or early fall
Narrowleaf Cottonwood *Populus angustifolia*	Tree	50-65'	35-50'		X	X				1-11	Plant at least 100' from septic systems or other infrastructure
Quaking Aspen *Populus tremuloides*	Tree	40-100'	30'			X	X			2-6	Grows well in most soils, prefers moist conditions