bay burnham

CASE HILLS

LANDSCAPE DESIGN

University of Colorado Boulder, Masters of the Environment

Concept Idea

Climate change is drastically altering Colorado's climate. Modern landscape design should address climate change by seeking to incorporate species which ensure biodiversity, maintain topsoil, retain water, and create wildlife habitat. This can be done by planting a variety of species, indigenous and non-indigenous, and microclimates into the site. This landscape design is an experiment to better understand how to improve the quality of the site by revegetating it with species that can withstand the predicted climatic challenges of the future. The main problems this planting plan seeks to address at the CASE Hills are soil degradation, low biodiversity, erosion and runoff, and aesthetics.

Design Goals

- Reflect patterns of nature (wind seed dispersal, complementary textures and blooms/seasonality)
- Incorporate a wide variety of species with varied growing conditions, each suitable to the site's characteristics
- Choose species that rebuild soil quality
- Listen to the story of the site (brown grass, storm drains, swales, etc.) and design with those features in mind

Background

Geology

Using the USGS Google Earth Map resource, I was able to determine that the bedrock under the CASE Hills is Verdos Alluvium (Qv). A site's bedrock impacts the soil composition and determines what plant communities can survive within the area. Common traits associated with Verdos Alluvium (Qv) bedrock are listed in the image above.

Maps (USGS) used to determine the bedrock of the CASE Hills on the CU Boulder Campus.

Analysis

Soil Structure

This site most likely has a large quantity of urban soils, due to the history of intense development and disturbance in the area. However, the Verdos Alluvium (Qv) bedrock likely also impacts the makeup of the site's soils. Using information from the National Park Service (NPS), I was able to determine further soil composition characteristics of Verdos Alluvium (Qv) bedrock:

- This bedrock is from the pleistocene era
- Cobbly gravel, silty sand

I also used the Web Soil Survey to determine which types of soils are present at the CASE Hills.

- Nederland2 very cobbly sandy loam, 1 to 12 percent slopes

Photograph of Case Hills' organic layer and topsoil.

Information about existing plant species at the CASE Hills site was recorded for this project. This knowledge helps inform an overall understanding of the site's current ecological state. The next section has a record of the current plant species that exist within CASE Hills. Most of the species that were identified are not native and it was discovered that the site is not very biodiverse. A lack of native plants indicates an inhospitable and non-native environment.

Low species biodiversity is often an indicator of low soil biodiversity. Low soil biodiversity is characterized by a degraded microbiome and low organic matter. Organic matter is often accumulated by decaying species on topsoil. The more diversity that exists within an ecosystem, the more diverse the nutrients species recycle back into a site's soils.

Low soil biodiversity leads to low soil quality. Low soil quality is often associated with wind and water erosion, loss of topsoil, and increased runoff. This site is an exposed hill and there are not enough protective elements in place to prevent wind and water erosion. Low species biodiversity often results in a loss of beauty and aesthetic. This can take away from human enjoyment and meaningful interaction with a site.

Existing Plant Species

Non-indigenous

Blue Fescue
(Festuca glauca)
- Ornamental ground cover, non-native
- USDA zone: 4-8

Common snapdragon
(Antirrhinum majus)
- Native to China // non-invasive
- USDA zone: 5-10

Wild carrot
(Daucus carota)
- Naturalized in North America // some see it as invasive because it is very aggressive
- Biennial
- USDA zone: 4-8

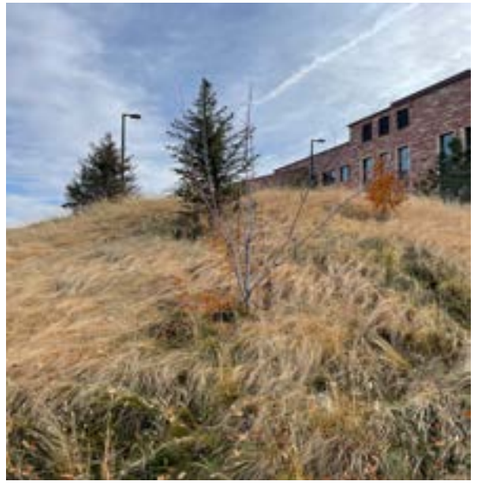
California poppy
(Eschscholzia californica)
- Native to the Pacific slope of North America from Western Oregon to Baja California // Naturalized in Colorado
- USDA zone: 6-10

Moth mullein
(Verbascum blattaria)
- Waste places in damp ground. Rather rare and not persisting, it is possibly an introduced species // prefers highly disturbed areas including pastures, vacant lots, roadsides, and abandoned fields
- Perennial
- can grow 2-4 ft // yellow-white flowers
- USDA zone: 5-9

Alfalfa
(Medicago sativa)
- Naturalized
- Good for revegetation projects, nitrogen-fixing, good for disturbed sites
- USDA zone: 4-8

Smooth brome
(Bromus inermis)
- Native to Europe // naturalized
- USDA zone: 3-7

Creeping thistle
(Cirsium arvense)
- Native to southeastern Europe and the eastern Mediterranean area, and was probably introduced to North America in the 1600s as a contaminant of crop seed and/or ship's ballast // Twenty large national parks across the country report it as a serious invasive plant affecting natural resources. It invades a variety of dry to moist open habitats including barrens, fields, glades, grasslands, pastures, stream banks, wet meadows, wet prairies, and open forests.
- USDA zone: 3-10



Photograph of existing plant species in Case Hill's landscape.

Photograph of existing plant species in Case Hill's landscape.

Indigenous

Curlycup gumweed
Grindelia squarrosa
- Native to western and central North America
- USDA zone: 3-8

Barnyard grass
Echinochloa
- Native to North America
- USDA zone: 5-9

Strategy

After reviewing the conditions at the CASE Hills site, I have concluded that the main factors that need to be addressed through this planting plan are soil quality, biodiversity, erosion and runoff, and aesthetics.

Soil quality can be improved by picking plants that create self-sustaining, mutually-beneficial communities. These plant communities will involve native and non-native species. Water retention design techniques will also be implemented in the landscape design plan. A Hugelkultur and rain gardens will be installed to retain water in the site. This will reduce or eliminate the university's need for supplemental irrigation.

Biodiversity will be increased in the site by incorporating diverse plant communities that not only sustain each other, but that also sustain wildlife. Appropriate wildlife that should be targeted for this site include bird species, pollinator species, and small rodents. The site habitat will be designed to work with both human and non-human systems.

Erosion will be reduced by incorporating protective plant barriers, like bushes. Additionally, designing a highly dense landscape plan will help protect topsoil and reduce runoff.

Aesthetics will be addressed in this planting plan by designing species to reflect patterns in nature. Wind-seed dispersal patterns will be used to help place plant species, colors and textures of plants will be contrasted and placed with intention, and seasonality will be considered in this design.

Plant Selection

Plant species will need to thrive in well-drained, low water (the site gets 15-20" a year in annual precipitation), cobbly sandy clay loam conditions2. The environment is classified as a Cobbly Foothill2. The USDA hardiness zone for CASE Hills is Zone 5a.

Mushroom Inoculation Logs:

- *Pleurotus ostreatus* (Oyster mushrooms) and *Schizophyllum commune* (Split gill mushrooms) are good to accelerate the biodegradation of plastic and other pollutants

Medium Hardy Ecosystem

1. *Calamovilfa longifolia*
2. *Andropogon hallii*
3. *Sorghastrum nutans*
4. *Atriplex canescens*
5. *Ericameria nauseosa*
6. *Echinacea purpurea*
7. *Allium giganteum*
8. *Callirhoe involucrata*
9. *Achillea millefolium*
10. *Helianthus pauciflorus*

Very Hardy Ecosystem

1. *Perovskia atriplicifolia*
2. *Achnatherum hymenoides*
3. *Grindelia squarrosa*
4. *Schizachyrium scoparium*
5. *Festuca glauca*
6. *Eschscholzia californica*

Plant Schedule

Herbaceous Perennials

Quantity	Abbrev	Latin	Common	Height	Spread	Sun	Water	Soil	Bloom	USDA Zone	Comments
25	EC	Eschscholzia californica	California poppy	6-18"	1'	full sun	low	sandy, well-drained	March-May	6-10	pollinator attractor, adaptable to freeze/ drought/ high temps/ variety of soil types
32	GS	Grindelia squarrosa	curlycup gumweed	6"-3'	1-2'	full sun	low	well-drained, sandy, loamy	July-October	3-7	disturbed soil, fields/ prairies
65	AM	Achillea millefolium	yarrow	2-3'	1-2'	full sun-part shade	low-medium	well-drained, sandy, loamy. clay	April-September	4-8	xeric, native bees
75	AG	Allium giganteum	giant allium	5-6'	1-2'	full sun	low-medium	well-drained, chalk, clay, loam, sand	May-June	4-9	pollinators
71	EP	Echinacea purpurea	purple coneflower	3-4'	1-2'	full sun-part sun	low-medium	well-drained, sandy loam	July-September	4-9	pollinators
89	HP	Helianthus pauciflorus	prairie sunflower	1-1.5'	1-2'	full sun	low	well-drained, clay, loam, sand	July-September	3-7	pollinators, phytoremediation
88	CI	Callirhoe involucrata	winecup	6-9"	3'	full sun	low-medium	well-drained sandy/loamy soils, tolerates infertile soils	June-July	4-9	ground cover, erosion preventative
78	ASE	Autumn Sedum	autumn stonecrop	1.5-2'	1.5-2'	full sun	low	sandy, loam, clay	August-November	2-9	salt tolerant, harsh soil conditions

Plant Schedule

Grasses

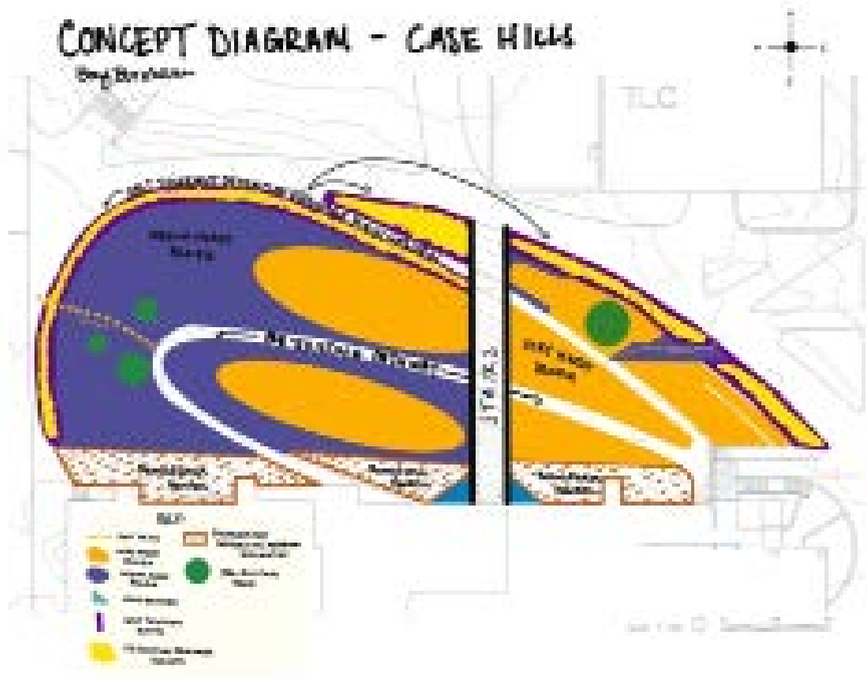
Quantity	Abbrev	Latin	Common	Height	Spread	Sun	Water	Soil	Bloom	USDA Zone	Comments
28	FG	Festuca glauca	blue fescue	6-7"	6-18"	full sun	low	well-drained, dry	August	4-8	tolerates dry and nutrient low soils, shear in late winter to extend life and promotes a neater appearance.
67	SN	Sorghastrum nutans	indiangrass	3-8'	3'	full sun-shade	medium	dry, moist	August-October	2-9	xeric, wildflower prairie; attracts butterflies (Pepper & Salt Skipper butterfly), wildlife (seeds), deer resistant, warm season
91	AH		indian rice grass	10"-2'	1-2'	full sun	low	well-drained, rocky, dry, sandy prairies	July-August	3-9	xeric, cold season
81	AHA	Andropogon hallii	sand bluestem	7'	15-20'	full sun	low-medium	sandy	June	3-8	warm season
41	CL	Calamovilfa longifolia	prairie sandreed	4-7'	26'	full sun-part sun	low-medium	mesic-dry, sandy	August-Septmeber	6	xeric, warm season
65	SS	Schizachyrium scoparium	little bluestem	1.5-4'	2-3'	full sun-part shade	low	well-drained, wide range of soil conditions	August-February	3-9	performs well in poor soils, warm-season

Plant Schedule

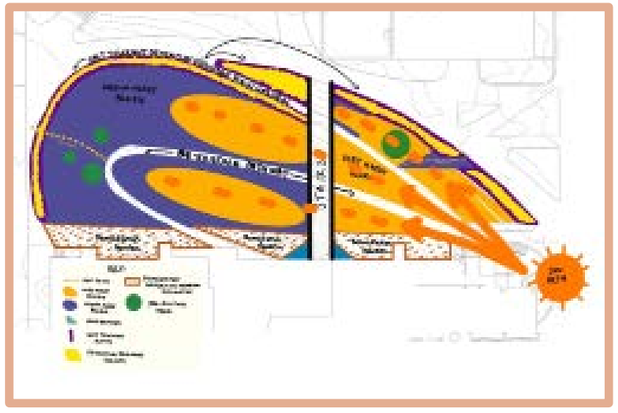
Shrub & Subshrubs

Quantity	Abbrev	Latin	Common	Height	Spread	Sun	Water	Soil	Bloom	USDA Zone	Comments
7	PA	Perovskia atriplicifolia	Russian sage	3-4'	3-4'	full sun	low	well-drained, chalk, loam, sand	June-November	5-9	xeric, salt tolerant, rabbit/deer tolerant, attracts pollinators
5	AC	Atriplex canescens	four-wing saltbush	3-8'	4-8'	full sun	low	well-drained, chalk, clay, loam, sand	April-October	5-9	will work in extremelt dry, salty conditions, recommended for its durability rather than beauty, important wildlife cover/food source
7	EN	Ericameria nauseosa	chamisa	4-7'	4-7'	full sun	low	well-drained, clay, loam, sand	August-October	3-9	xeric, dry soil tolerant, native bees

Concept Diagram



This concept diagram (above) shows the overarching approach of the landscape design idea at Case Hills. The sun path diagram (right) illustrates which area of the Case Hills landscape recieves the most sun year-round. The presence of sun on the landscape determines which habitat types (medium hardy prairie or very hardy prairie) go where in the landscape design.



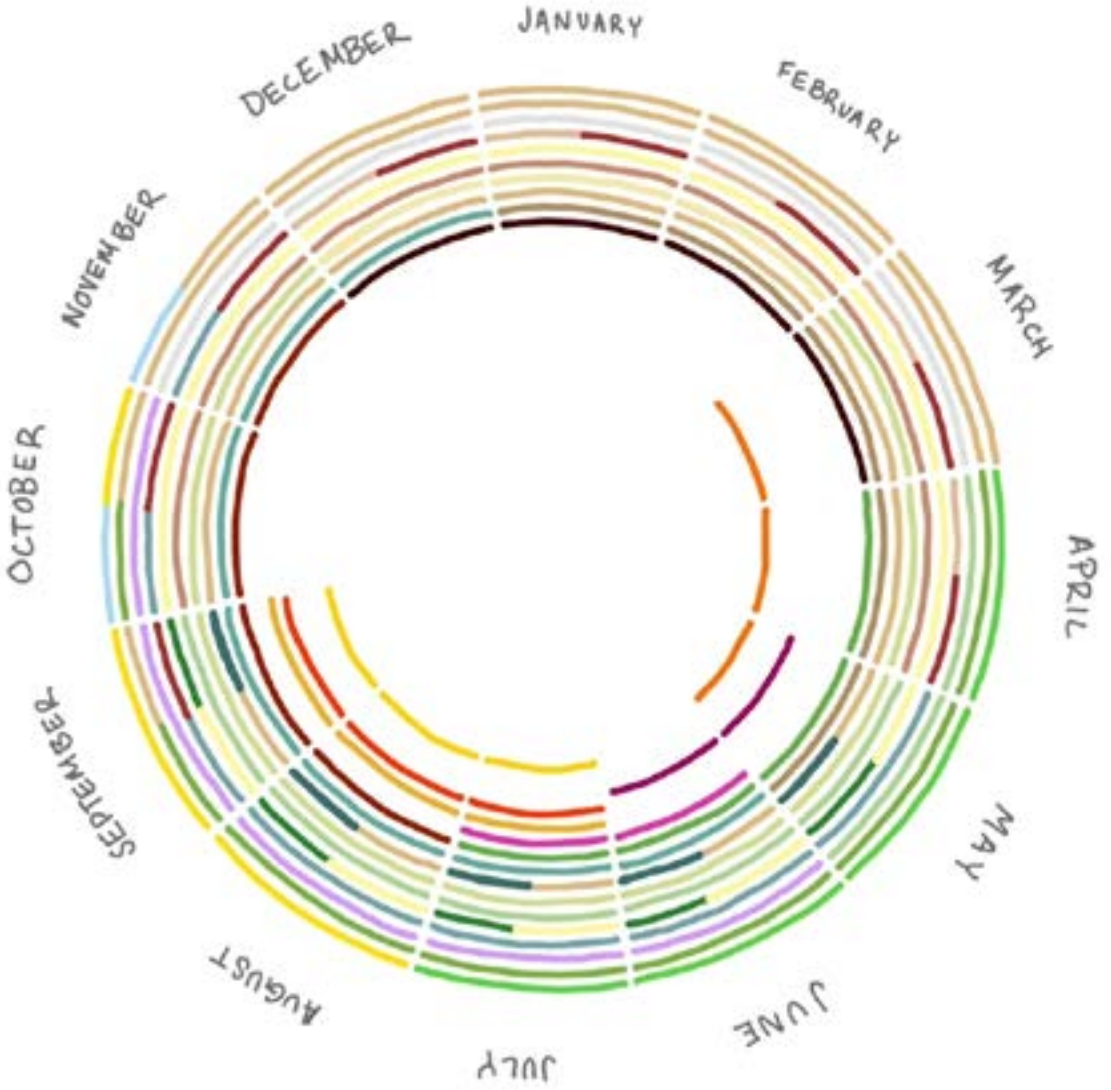
Case Hills Planting Plan

This planting plan, drawn to scale, provides a detailed visual guide on where each species (included in the planting schedule) are to be planted at Case Hills.

Case Hills Perspective Drawing

This perspective drawing depicts what the Case Hills landscape would look like, according to this project's plant schedule and planting plan. This landscape design is intended to regenerate the area's ecosystem services, filter out pollutants, introduce habitat to native wildlife species, and add beauty to CU Boulder's campus.

Landscape Color by Season



In this diagram, each of the lines represent plants included in this project's plant schedule. The lines show how the plants' colors will change throughout the year according to the month at Case Hills.