

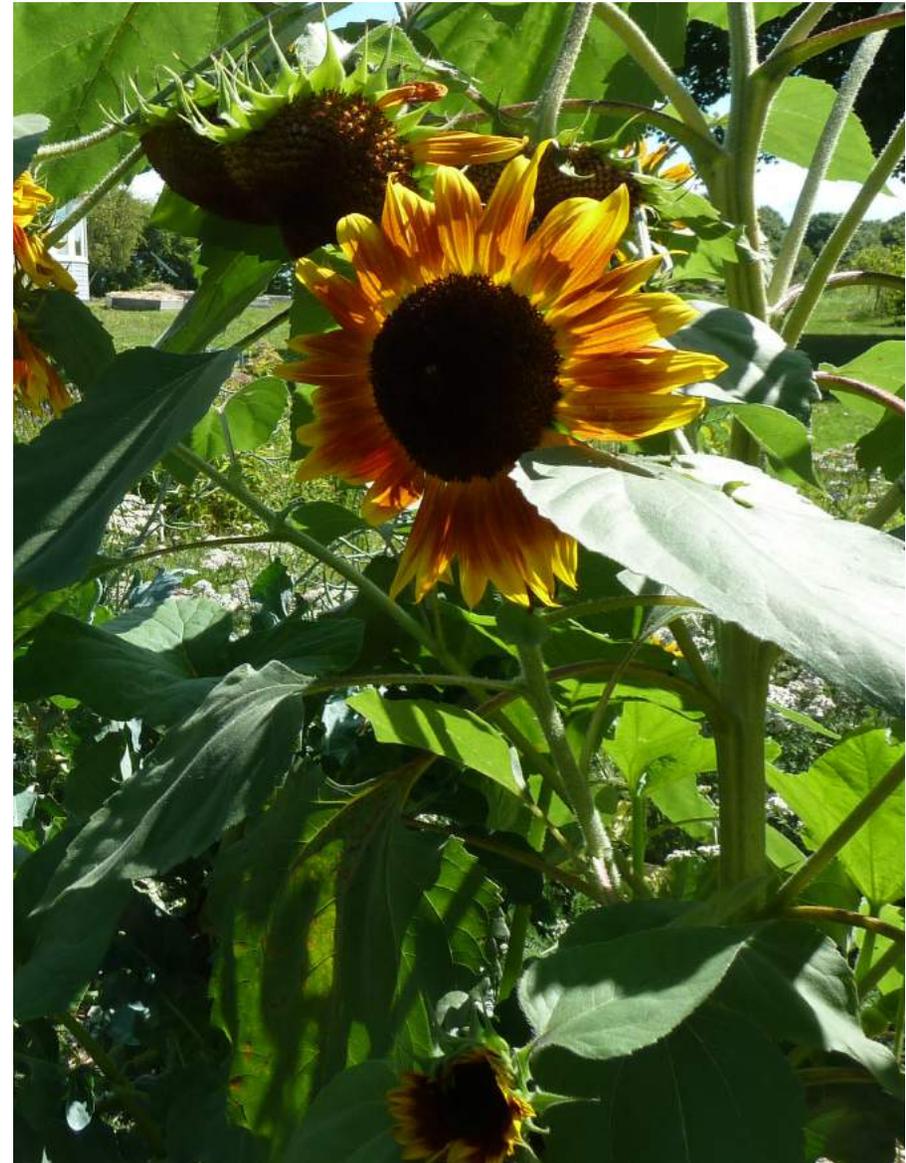
COLBY-SAWYER COLLEGE
LANDSCAPE
MANAGEMENT
PLAN



2016

TABLE OF CONTENTS

Introduction	03
Process & Analysis	
Goals & Strategic Themes	05
Principles of Colby-Sawyer's Landscape	07
Master Design	11
General Practices & Implementation	12
Water in the Landscape	13
Landscape Maintenance	16
Features	21
Invasive Species	24
Traffic/Roads	26
Focus Features	27
Third Spaces (Page Hall, Danforth/Lawson)	28
New Quad/ D Lot	36
Arts Building	40
Susan's Swamp	43
Kelsey Forest	46
Farm	49
Gateways	52
Secondary Designs	
Main Quad	55
Hogan Hill	57
The Lethbridge Lodge	59
Dining Hall Patio	62
Parking Expansion	66
Conclusion	68
Authors & Acknowledgments	73
Appendices	75
A - Phasing & Cost-Benefit Analysis	76
B - Planting Palette	95
C - 4 Principles of Sustainability	101
D - Precipitation	102
E - Invasive Species Management	103





INTRODUCTION

PROCESS & ANALYSIS

This Landscape Management Plan, created by the 2015-2016 Community-Based Research class, outlines the goals and steps for the strategic long-term management of the campus landscape for Colby-Sawyer College. In the Fall of 2015, our class researched the current condition of the landscape and the practices and principles related to its management. Our findings are outlined in the *Colby-Sawyer College: Landscape Management Research Fall 2015* document. The following semester, we developed design concepts and recommendations that are in alignment with the college's mission and strategic themes. Our plan complements the 2013 S.L.A.M. Master Plan, supplementing the proposed changes in buildings and athletic fields with alterations to the landscape. We have also developed a Forest Management Plan based on both our 2015 forest inventory and the S.L.A.M. future plans for the Kelsey Athletic Complex Expansions. In addition, we have utilized permaculture principles to help design a sustainable landscape to support the college's goal of reducing carbon emissions by 70% by 2020. This document is the first of its kind for Colby-Sawyer and contains phased planning, a cost-benefit analysis, and detailed design recommendations as part of the overall Landscape Management Plan.

A horizontal band of a stone wall texture, featuring irregular, rounded stones in shades of brown, tan, and grey, set against a white background.

GOALS & STRATEGIC THEMES

Goals Articulation

Based on our research that included interviews with stakeholders, quantitative analysis of the current landscape and survey results from faculty, students and staff, we developed the following goals articulation to guide our design process:

The Colby-Sawyer campus is a sustainable living laboratory and it provides engaging, interdisciplinary educational opportunities for students and visitors alike. The landscape promotes personal responsibility and efficient use of resources. It is aesthetically pleasing, economically viable, and ecologically sound. Spaces encourage the community to interact with the environment and with each other. The landscape is flexible and resilient—it fosters innovative ideas and adapts to external, temporal, and cultural changes.

Colby-Sawyer Mission Statement

Colby-Sawyer College is a private, independent college offering undergraduate and graduate educational programs based in the liberal arts and sciences that are designed to prepare students for their professions and lives of ongoing learning. Faculty, staff and students strive for excellence in the college's engaged teaching and learning community to foster students' academic, intellectual, and personal growth. The college prepares students to thrive in, and make a positive impact upon, a dynamic, diverse, and interdependent world. Colby-Sawyer College was founded as an academy in 1837 and has been engaged in higher education since 1928 (Colby-Sawyer College, 2016).

Colby-Sawyer College Philosophy Statement

Colby-Sawyer College provides a stimulating setting in which close faculty, staff, and student relationships facilitate student learning and growth. The college's educational programs are firmly grounded in the liberal arts and sciences, foster professional preparation, and emphasize connections across disciplines and across the programs of the college. The college is committed to sustaining a dynamic, challenging,

supportive, and respectful environment for all campus community members. As members of an academic community, we articulate these commonly held values to provide an educational and aspirational description of the culture of the college (Colby-Sawyer College, 2016).

Colby-Sawyer Strategic Themes

Engaged Learning

Students at Colby-Sawyer College are expected to gain knowledge through a liberal arts education that applies learning at the college, community, and global level. Interdisciplinary classes, community-based projects, and student-driven initiatives on campus are just a few examples of how the college institution facilitates higher learning engagement.

Living Sustainably

Colby-Sawyer is committed to integrating sustainability into its curriculum and to achieving carbon neutrality by 2050. The college has already decreased its carbon footprint by 50% and reduced its negative ecological, economic, and social impacts. They have accomplished this through renewable energy projects, waste reduction programs, a local food initiative, and more.

Linking to the World

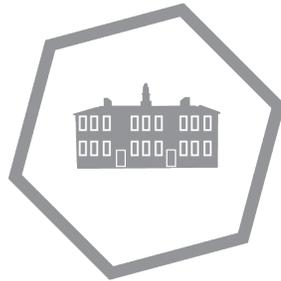
The college promotes and celebrates diversity in all of its various forms. It encourages everyone on campus to involve themselves in projects that have a positive impact on our greater local and global community. Students work to develop a broad understanding of their potential to leverage change in regional initiatives as well as in cultures around the world.

Dynamic Devotion to Excellence

The college urges students, employees, and the surrounding community to apply their knowledge to finding responsive, innovative solutions to real-world problems, while upholding standards of excellence for both individuals and the college.

PRINCIPLES OF COLBY-SAWYER LANDSCAPE

SENSE OF PLACE



Based on the strategic themes and goals of the college outlined above, we identified three core philosophies to guide our design process:

An important motif behind our Landscape Management Plan is developing a strong sense of place on the Colby-Sawyer campus. “Sense of place” is a broad term that, in this context, refers to the character of the landscape and its ability to enrapture students, faculty, and visitors alike. We want the college landscape to reflect the human experience that takes place on campus. Dave Sauerwein, Dean of Students, was interviewed as a stakeholder for our project in the previous semester. In regards to sense of place, Sauerwein stated:

“I hope people, when they see our landscape, become attached to it. I hope they learn how to connect to a place--a skillset that they could develop by being a student here. By learning these skills on how to connect with place...by knowing how to connect to find work, it would help students to be prepared for life beyond college. I think landscape plays an important part in this.”

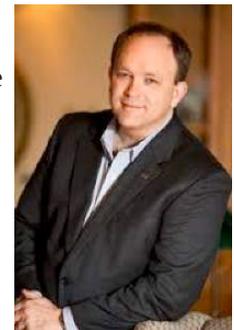
Dave Sauerwein also commented on how movement around campus influences sense of place, stating that:

“Getting around and having sense of the place is important. I think our connection to where we sit matters. So often we have orientations around the country and my research has confirmed this: by learning how to develop a sense of place, students can learn a life skill that could be important in a more mobile society.”

Located in a rural New Hampshire town, the school can be described as a “traditional New England college.” The brick buildings, manicured lawns, and rolling hills support this description. We plan to maintain the integrity of the New England style, and remind people exactly where they are geographically every time they take a walk on campus.

One of our main goals is to make Colby-Sawyer College a place that people will remember for the rest of their lives. We aim to make our college unique from other traditional New England institutions.

Colby-Sawyer embraces the concept of learning and thinking outside of the classroom. Ideally, we would like to create many different types of areas throughout campus where students, staff, and faculty can engage with the landscape in a variety of ways. This includes different locations designed for studying, socializing, dining, and recreational activities. We would like to create a friendly and welcoming environment that entices visitors to attend Colby-Sawyer and take part in the diverse range of opportunities.



Dave Sauerwein, Dean of Students

EDUCATION



Colby-Sawyer values the interconnectedness between the college lifestyle and academics by identifying engaged learning as one of its strategic themes. Therefore, the recommendations and concepts we present in this Landscape Management Plan are based on enhancing educational opportunities. We would like to design a landscape that inspires students, faculty, and staff to find engaging activities in the outdoor environment. Our plan focuses on strengthening the academic setting so that it expands beyond the classroom, supporting the college's tagline, "Thinking Outside the Class." Ultimately, this provides the students with opportunities that cannot be found in a classroom setting, allowing Colby-Sawyer to administer a unique academic experience with the surrounding environment.

The landscape plays an important role in the learning process by encouraging members of the college community to interact and engage with one another through various design elements. This interaction is accomplished through educational signs, student-driven landscape design and maintenance, and the creation of relevant courses. Case studies in this educational process have already been introduced at Colby-Sawyer, including outdoor classroom sites and two functional permaculture gardens. It is our goal to promote the values characterized by these sites throughout campus.

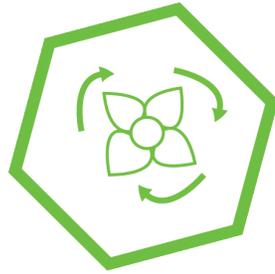


Sue's Sugar House in front of the Susan Colgate Cleveland Library/Learning Center



Outdoor Classroom behind Sunshack with Mount Kearsarge in the background

SUSTAINABILITY



Sustainability is defined as the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs (United Nations Economic Commission for Europe, n.d.). In developing a sustainable campus, we aim to bring our levels of consumption, “into alignment with the regeneration rates of renewable resources and the tolerance levels of our ecosystems” (GreenROUTES, 2010). In this plan, we apply this definition according to four main principles of whole system sustainability: personal well-being, social justice, ecological balance and economic stability (see Appendix C).



Solar Panels on the roof of the Curtis L. Ivey Science Center

Our landscape management plan is intended to “develop healthy, active habits of mind and body in our community; build financial strength for the present and future; become more diverse and more inclusive of people from different backgrounds, cultures, experiences, sexual orientations, and views; and create an environmentally sustainable campus community” (Colby-Sawyer College, n.d.).

Living sustainably, one of the college’s strategic themes, acts as a guiding principle for both education and development. In the past, the college has embodied this theme through a variety of initiatives—including the local food initiative in the dining hall, the sustainable classroom project, and the implementation of a school-wide solar array to offset electricity usage. These initiatives employ a “systems approach” toward sustainability that attempts to integrate sustainable healthy lifestyle choices with the institution of the college. Sustainable initiatives such as these have been known to support financial and resource efficiency, movement towards a self-sufficient future, and improving environmental quality.

Our plan envisions a college where all elements of the landscape are efficiently and effectively managed, while continuing to meet the needs and desires of the community. Our plan examines the development of the campus from as many aspects as possible, encouraging support and interaction between various groups and resources, and using resources that already exist on campus in order to apply whole system sustainability.

Our General Principles of Sustainability:

1. Maintain physical design efficiency to make movement, communication, maintenance and navigation easy and effective
2. Use local and campus resources wherever possible
3. Recycle “waste” back into the landscape rather than losing it to the external environment
4. Implement methods to capture and store energy for future use
5. Stack functions within design elements in order to more efficiently meet multiple needs
6. Constantly maintain sustainable thinking to provide effective consistency
7. Maintain economic stability of the landscape through efficient practices
8. Maintain ability to adapt to future changes



Solar Panels on the roof of the Lethbridge Lodge

Solar Panels at Colby-Sawyer

- 517-panel solar array
- 150,000 kWh generated annually (equal to 9.4 residential homes)
- Carbon emissions reduction of roughly 100 MTCO₂e (Carbon dioxide equivalent)



GENERAL PRACTICES & IMPLEMENTATION

PERMACULTURE PRINCIPLES AND PRACTICES



Permaculture Garden behind the Susan Colgate Cleveland Library

Permaculture is a system of design “for sustainable living and land use,” first coined by David Holmgren and Bill Mollison in the 1970s (Holmgren, 2012). It is defined by a series of guiding principles and techniques applicable to a variety of landscape types. Permaculture designs are sustainable and productive, serving the many functions required of a landscape.

Colby-Sawyer has been in support of permaculture as a design philosophy for several years and is one of only thirty-three schools in the US to offer a certification in Permaculture Design (Zimmer, n.d.). To date, the program boasts seventy-three certificates—forty-three to community members and thirty to Colby-Sawyer students. In addition, the campus currently supports two functional permaculture gardens—one located behind the Susan Colgate Cleveland Library and the other outside of the Ware Student Center.

Permaculture sites are maintained by students and faculty with support through the college’s internship program, thus embodying Colby-Sawyer’s strategic theme of Engaged Learning. Program curricula utilize these spaces as living laboratories by incorporating them into courses in such subjects as biodiversity, agricultural principles, and sustainable design. The edible yields provided by these gardens help to support the dining hall, are free for public consumption, and provide unique settings to wander through. Permaculture sites are also designed to be adaptable and manageable for future iterations of the campus, with hopes that our designs will create a unique and usable space for years to come. With the interest in increasing the space and functionality of campus, we identified additional sites as permaculture gardens in the the overall design outlined in this report.

WATER IN THE LANDSCAPE

Seasonal Considerations

Colby-Sawyer receives about 47 inches of rain annually. The graph located in Appendix D displays the average annual precipitation in the state of New Hampshire on a monthly basis (NOAA, 2014). Winter and stormwater management are important management considerations that are both heavily influenced by seasonal variations in precipitation. As such, it is important to remain mindful of seasonal fluctuations and how they influence the landscape.



Sand and Salt Impacted Walkways in front of the Reichold Science Center

Winter Management

Snow removal accounts for 57% of labor costs and requires a significant amount of gasoline. Maintaining the pathways and roads on campus requires a significant amount of labor, especially during the winter months. Each year, \$37,065 is spent on 434,342 pounds of sand and salt to keep the roadways and pathways safe. Our research indicated that these activities negatively impact lawn and water quality of the landscape, resulting in erosion along the edges of lawns, and contributing to Susan Swamp's excessively high conductivity of 695 $\mu\text{S}/\text{cm}$ (normal range in New Hampshire is below 100 $\mu\text{S}/\text{cm}$.) With this in mind, we developed several suggestions for mitigating this environmental impact while also maintaining an effective level of upkeep:

- Keep sidewalks and pathways wide and generally straight
- Limit use of salt where possible
- Remove excess sand and salt when it is no longer needed on pathways to help reduce their harmful effects as runoff
- Choose surfaces that are resilient to weather and winter maintenance in order to avoid future repair costs, such as additional paving

We understand that winter maintenance is necessary and cannot be reduced in many cases. However, these suggestions are meant to be applied in future planning and construction to facilitate this maintenance wherever possible.

Stormwater Management

Currently, the college does not implement any type of stormwater management plan. Roughly 21% of Colby-Sawyer's campus consists of impervious surfaces, meaning that we are at a high risk for polluting our local watersheds. According to a study published in The Journal of the American Planning Association, environmental degradation first occurs at 10% impervious surface, and is virtually impossible to reverse at 30% (Arnold,1996). In a one inch rain event, approximately 761,618 gallons of water run off the impervious surfaces on campus. Our overall objective in relation to this is to limit the amount of stormwater leaving the property and ensure that the water that does leave is free of pollutants. We developed a list of simple suggestions based on the practices of other colleges nationwide. While these suggestions are not a complete stormwater management plan, they are a good start to making Colby-Sawyer College a healthy and sustainable ecosystem:

- Create bioswales in sloped areas with heavy runoff
- Choose plants fit for both wet and dry climates, that absorb water, and filter pollutants
- Install water catchment systems on flat surfaces throughout campus
- Repave old impervious surfaces to prevent pooling and runoff
- Develop a water management plan that can facilitate future construction on campus

By implementing these concepts, it is possible to limit the amount of pollution Colby-Sawyer releases into the local watershed. Cleaning, preserving, and recycling the water on campus now would prevent potential environmental concerns in the future.



Water Catchment Basin above the Tennis Courts



Improper Drainage outside of the Hogan Sports Center

Irrigation

Irrigation refers to any human induced watering of the landscape to enhance the growing potential of the vegetation in the area. Athletic fields, flowerbeds, and maintained lawns at Colby-Sawyer College are irrigated. Our goal is to increase efficiency of water usage on campus to reduce costs and environmental impact. The following suggestions aim to improve irrigation methods:

- Install flow meters on irrigation lines to measure consumption
- Use collected rainwater for irrigation
- Upgrade old pumps and infrastructure

The design shown to the right of a catchment system for the library near the Anne Baynes Hall Permaculture Garden would capture water from 1,900 square feet of roof. During a one inch rain event, this would amount to 1,184 gallons of water capture for use at a later date.



*Digital rendering of a potential water catchment system outside of the Susan Colgate Cleveland Library/Learning center
Rendering by Nicholas Dibble*

LANDSCAPE MAINTENANCE

Lawns

Lawns cover a total of 43.69 acres at Colby-Sawyer, or roughly 65% of our college landscape. Maintenance for these lawns costs \$1,112 per acre and emits approximately 257 pounds of CO₂ per acre. Although lawns are high in maintenance and provide limited function, they are an aesthetic and flexible part of the landscape. We aim to maintain these positive aspects of existing lawns while also including elements that decrease the negative aspects. Lawns should consist of a variety of herbaceous groundcovers, such as white clover. Incorporating multiple species increases soil health and biodiversity, builds resiliency, and provides an educational resource while maintaining aesthetic appeal. In areas where lawns meet walkways and roadways, a buffer area of salt tolerant species should be maintained in order to mitigate the effects of road salt (reference Appendix B - Planting Palette).

These changes are intended to maintain a consistent aesthetic, primarily along high-traffic areas that are visible from the main roads. Our goal is to decrease maintenance and lessen the cost of labor, gas, fertilizer, and equipment.



View from behind the Ivey Science Center

Meadowlands or Low Mow Areas

Meadowlands are areas of reduced mowing with tall-growing grasses, flowers, and herbaceous plants. They are known to increase biodiversity, provide wildlife habitat, and reduce maintenance costs and externalities. Meadowlands add an aesthetic diversity and could also serve as an educational resource by providing information about the native flora and fauna that thrive in these habitats. We recommend that meadowlands be applied in the following ways:

- Convert existing lawns that are low-use and not highly valued for aesthetic quality
- Utilize a hardy mix of grasses and wildflowers (reference Appendix B - Planting Palette)
- Use low-maintenance practices to reduce costs while promoting biodiversity and soil health



The designated area at Hampshire College where a future Meadowland will soon exist

Meadowlands may be a point of tension with stakeholders who value more traditional aesthetics and functionality on campus. However, by employing appropriate design and management in these spaces, meadowlands can act as a positive influence on the campus and community. Some specific areas that we recommend for meadowland conversion are as follows:

- The backyards of Gray House, Yellow House, and London House
- Behind Abbey Hall
- Steep slope next to Hogan
- Open plot of land on Main Street next to the President's house
- In between Page Hall and Baird Health Center
- In between Commuter Parking Lot and Main Street
- Meadow below the new Arts Building



An example of a wildflower garden plot in an urban setting

Meadowlands

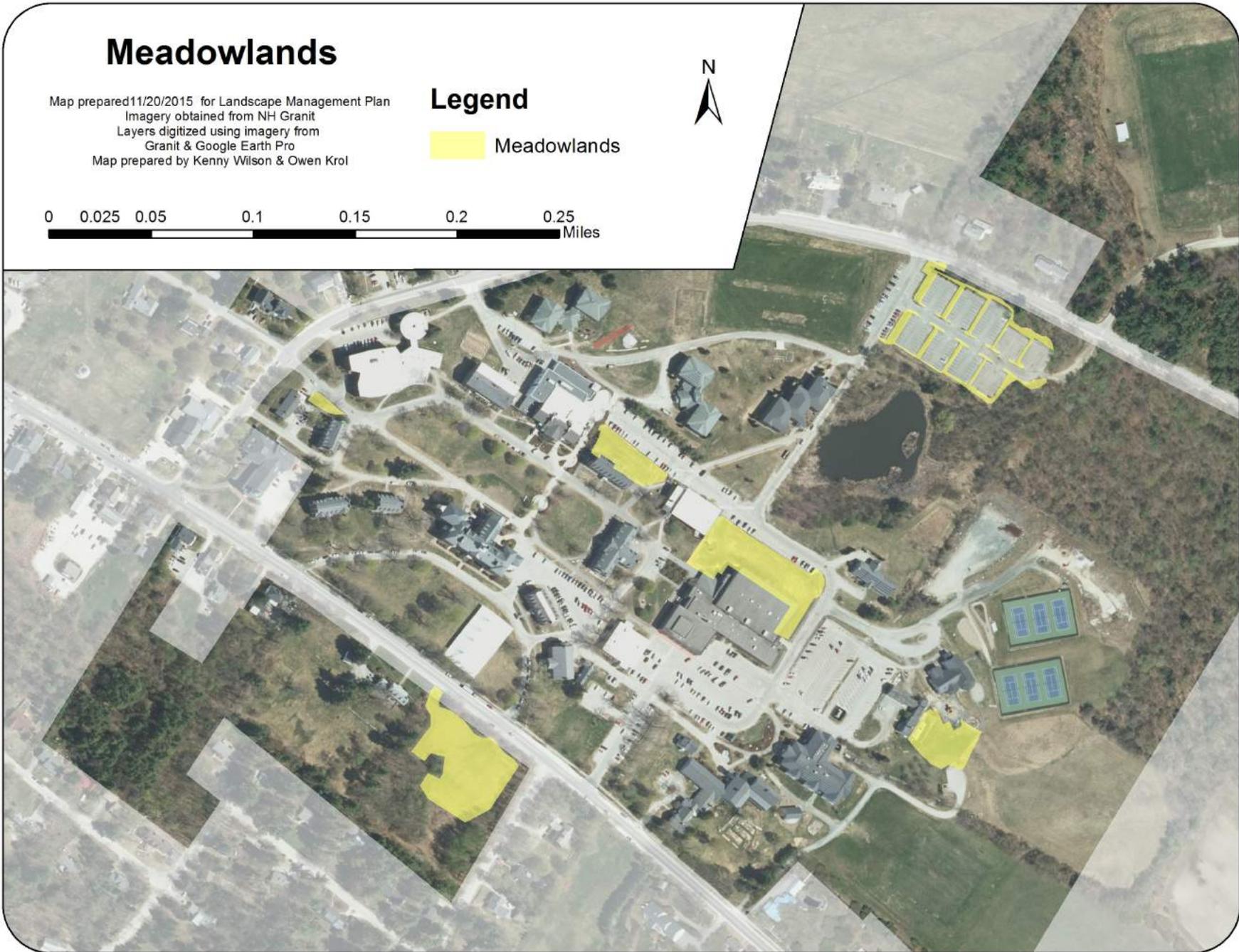
Map prepared 11/20/2015 for Landscape Management Plan
Imagery obtained from NH Granit
Layers digitized using imagery from
Granit & Google Earth Pro
Map prepared by Kenny Wilson & Owen Krol

Legend

 Meadowlands



0 0.025 0.05 0.1 0.15 0.2 0.25 Miles



Flowerbeds

Flowerbeds are used throughout campus to improve aesthetic quality and maintain sense of place. However, flowerbeds can be costly. Each year, the college spends an average of \$4,000 on 125 cubic yards of mulch and approximately \$27,134 in labor to maintain traditional flowerbeds. In addition, plantings of annual flowers are supported by the college throughout the year. To decrease costs and increase sustainability, we suggest the following alterations to the development and maintenance of flowerbeds:

- Develop a consistent design and planting palette for flowerbeds
- Design flowerbed spaces to serve multiple functions (e.g. produce yield, attract pollinators, and create biodiversity) within a single bed
- Include edible species that also have showy flowers or foliage
- Process leaf litter and wood chips for mulch in flowerbeds
- Replace annual beds with perennial gardens that flower throughout the year
- Consider using more blue and white flowering plants to align with school colors

Our overall goal for flowerbeds is to balance aesthetics with permaculture principles in order to create systems on campus that are resilient, beneficial, and aesthetically pleasing. Specific areas on campus that are ideal for flowerbeds are as follows:

- Large lawn behind the President’s House
- Grass areas around Baird Health and Wellness Center
- Pierce Park
- Side of Mercer Hall adjacent to the Quad
- Patio behind the Lethbridge Lodge
- Grass triangle in front of Danforth Hall
- Alongside B-Lot and C-Lot
- In front of Burpee Hall



Students observing existing flowerbeds on a campus tour

Mulch Usage Areas



Colby-Sawyer
College



Map prepared for Landscape Management Plan
Imagery Obtained from NH Granit
Map prepared by Travis Yandow

Legend

 Flowerbeds



FEATURES

Colby-Sawyer College uses a variety of outdoor features throughout campus that serve practical functions as well as provide aesthetic value while reinforcing a general sense of place. Of these, lighting is among the most prevalent and diverse, featuring several different types of bulbs—high pressure sodium, fluorescent, and downward-facing LED. We suggest the following to improve lighting on campus:

- Make all lighting consistent
- Prioritize downward-facing LEDs in the interest of improving efficiency and decreasing light pollution

Another significant campus feature is seating. Types of seating include granite benches (both with and without backrest), stone benches, wooden chairs and benches, picnic tables, metal chairs, and round tables. We suggest the following seating improvements:

- Make seating throughout campus consistent
- Determine the surface of seating based on community input



High Pressure Sodium lights around quad

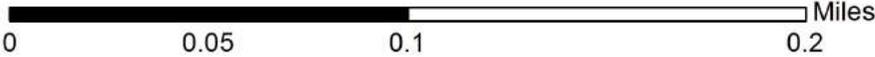


Downward-facing LED light



Fluorescent lamp around Chargers Loop

Existing Seating



Map prepared for 2016 Landscape Management Plan .
Imagery obtained from NH Granit.

Map prepared by Owen Krol

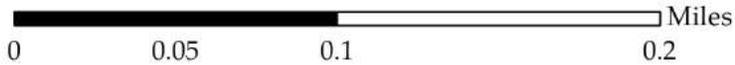
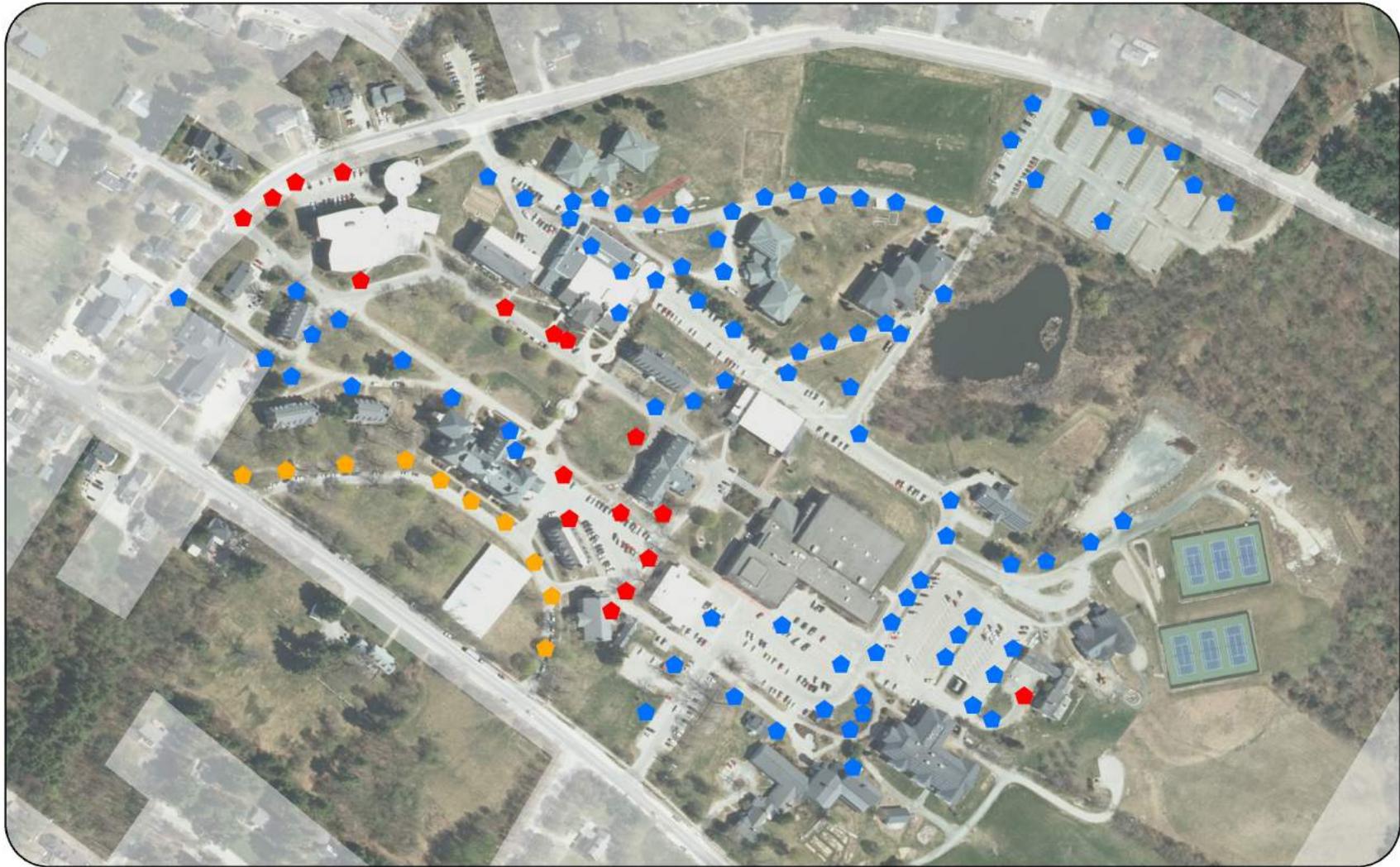
Seating Type

- ▲ Granite Bench
- ▲ Picnic Table
- ▲ Round Table
- ▲ Wooden Bench
- ▲ Wooden Chair



Seating map as of November 8, 2015

Existing Lighting



Map prepared for 2016 Landscape Management Plan.
Imagery obtained from NH Granit.

Map prepared by Owen Krol

Lighting Type

- Blue polygon: Downward-Facing LED
- Yellow polygon: Fluorescent
- Red polygon: High Pressure Sodium



INVASIVE SPECIES

Invasive species are a substantial component of the flora present on campus. An invasive species is an organism outside of its native region, as a result of intentional or unintentional human activities. Invasive species can cause ecological and economic harm to a new area by outcompeting native species through traits such as reproduction, early and rapid development, adaptability, tolerance of a broad range of environmental conditions, and a lack of natural population controls (Cygan, 2014).

The invasive species found on campus are:

- Multiflora rose
- Purple loosestrife
- Norway maple
- Japanese barberry
- Oriental bittersweet
- Burning bush
- Japanese knotweed
- Autumn olive

The invasive species map below shows the areas on campus that contain dense growth of invasive species. Many of the species found individually around campus were originally planted as ornamentals, but have since spread unintentionally. Examples of this include the large norway maples planted throughout campus (especially on the Quad), and the burning bushes that are found near Sawyer, Austin, Page, and other buildings.

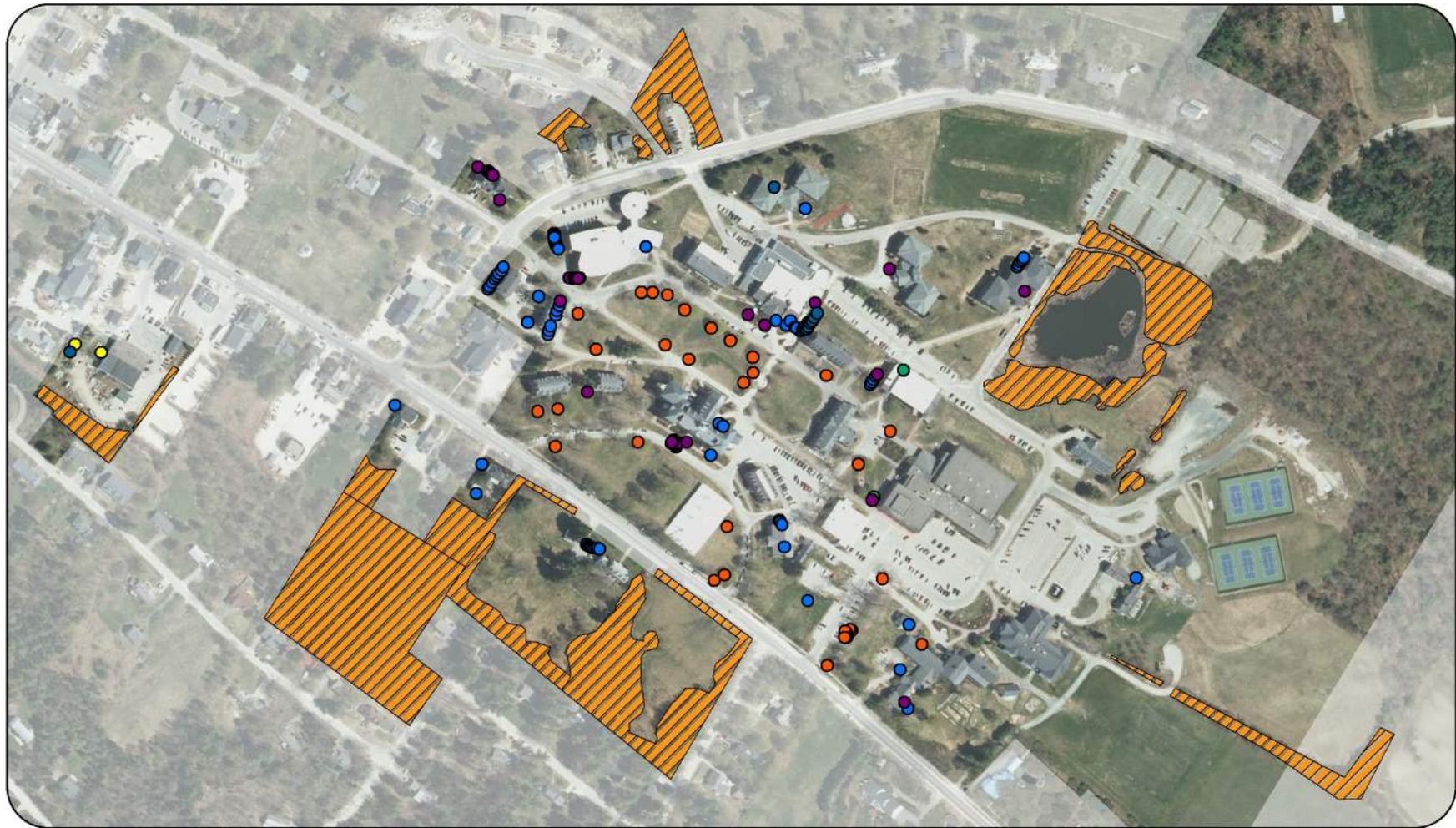
Removal of these invasive species would improve the ecological integrity of campus and its surroundings. The removal and analysis of these species could merge with the curriculum as part of an ongoing class, independent study, or capstone project. Furthermore, eliminating these species would create opportunities for more beneficial native species to be planted in their place. See Appendix E for potential methods for the removal of these species.

Benefits of removing invasive species include:

- Increase the ecological resilience of campus
- Uphold Colby-Sawyer's strategic themes of Engaged Learning and Living Sustainably
- Improve sense of place on campus by using native species to create consistent and attractive landscaping in place of invasives

Once these species are removed, it is important to find suitable replacements that are adequate for the microclimate and also have the desired aesthetic. (Refer to Appendix B Plant Palette)

Colby-Sawyer Invasive Species Map



0 0.125 0.25 Miles

Map prepared for Landscape Management for 11/2015
 Imagery obtained from NH Granit.
 Species data obtained through field collection.
 Map prepared by Kenny Wilson

Legend

- Oriental Bittersweet
- Multiflora Rose
- Japanese Barberry
- Burning Bush
- Autumn Olive
- Norway Maple
- ▨ High Concentration Areas



TRAFFIC AND ROADS

Walking and driving surfaces throughout campus are comprised of a variety of materials. These surfaces include concrete, pavement, pavers, stone and concrete mix, as well as two different dirt/gravel surfaces. Oftentimes, these surfaces transition very abruptly and create mismatched intersections. Many of these pathways experience seasonal weathering such as cracks and frost heaves. Since the majority of these surfaces are impervious, water accumulates in these uneven areas. Our design aims to create pathway consistency and reduce the impacts of impervious surfaces through the following implementations:

- Convert high-use pathways to a permeable or semi-permeable pavement
- Convert low-use pathways to permeable materials such as gravel and wood chips
- Differentiate surface types between pedestrian and vehicular pathways in a way that is consistent. This will indicate which pathways are primary, secondary, or low-use.

We suggest the following ranking system:

- All primary pedestrian pathways should be indicated by a light red colored asphalt, intended to appear as brick
- Secondary pathways should have the same surface, but will be smaller in size
- Low-use pathways should consist of impervious material such as wood chips or gravel
- All vehicular pathways will consist of black pavement to be easily differentiated from pedestrian pathways

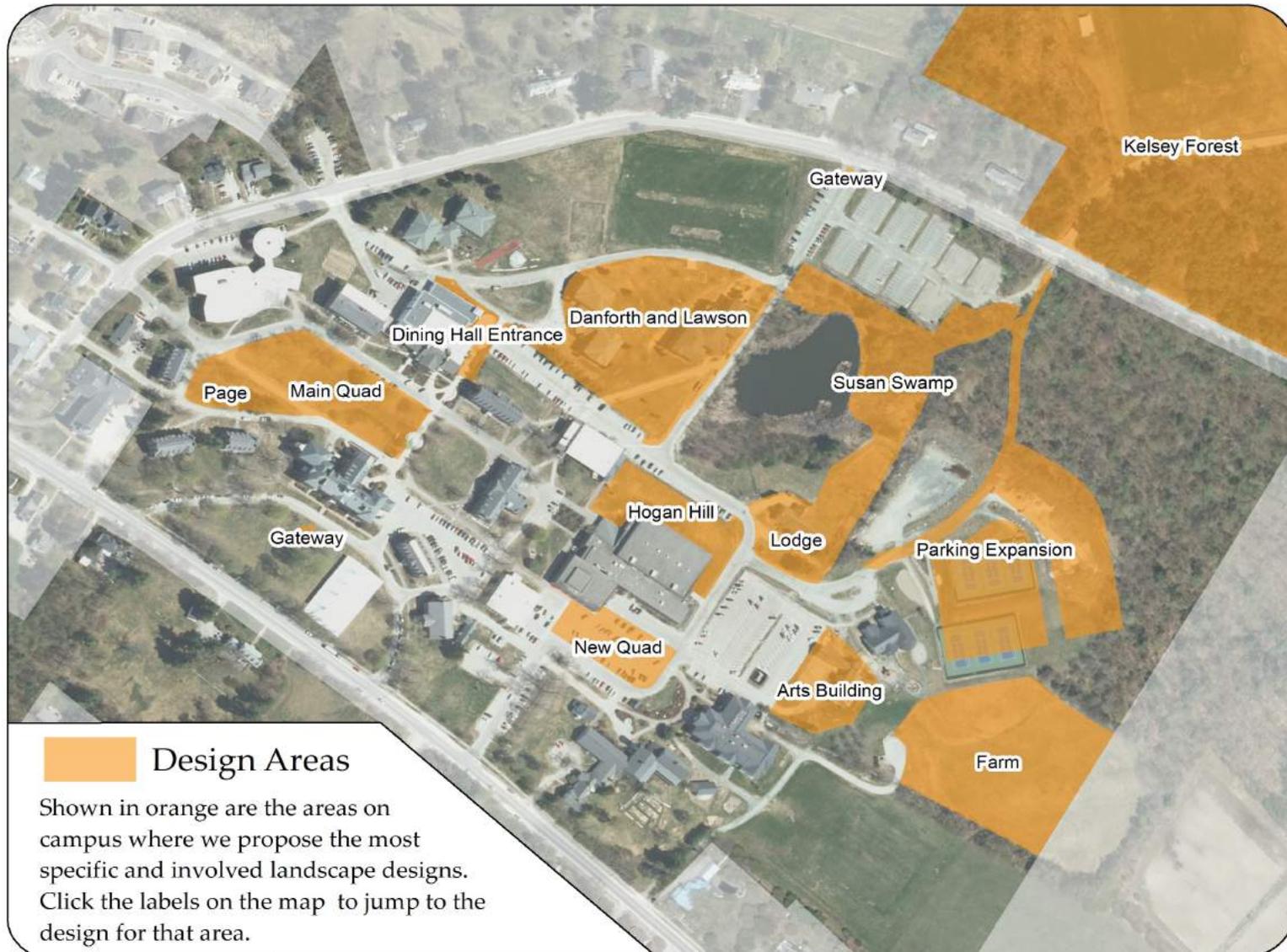


Poorly maintained and inconsistent existing pathway to Susan Colgate Cleveland Library/Learning center



Bottom left is an image of the gravel surface covering P lot, the larger image is the permeable pavement on the driveway to Colby farm

FOCUS FEATURES



THIRD SPACES

In the late 80's, Ray Oldenburg coined the term "third space." It is defined as a social surrounding that is separated from the home and work environment. In reference to Colby-Sawyer, third spaces are areas on campus that are different from the usual social environments of residence halls and academic buildings. These spaces provide a unique opportunity for the community to interact within the landscape both as individuals and part of a community. Existing third spaces include the dining hall patio, the quad, and the permaculture garden outside the Ware Student Center.

In our new design, we aim to create third spaces with elements that are engaging, diverse, productive, and multi-functional. The majority of these areas should be converted to a low-maintained grass and clover polyculture. Additional elements include permaculture gardens, perennial flower beds, art, and activity related structures. In order to maintain consistency amongst third spaces, the majority of pathways should be wood chips or fine gravel. This will create a distinctive environment from traditional pedestrian pathways. However, in areas where main pedestrian pathways intersect third spaces, the traditional red asphalt should remain. Each third space is intended to create a unique setting unparalleled by any other location on campus. Such spaces are ideally located in open areas nearby residence halls. We designed the lawn space in front of Page as well as between Lawson and Danforth to model potential third spaces in our landscape.

Page Hall

Currently, the area to the southeast of Page Hall consists of a grass monoculture, two invasive norway maples, two honey locusts, two pines, and one dying elm tree. This space is typically wet due to the large amount of snow deposited here during removal periods and its comparatively lower elevation than the rest of the quad. Since this space receives low use, we developed a design to increase its accessibility.

The invasive norway maples and diseased elm tree should be removed while the other trees could remain. A mulch trail would lead from one end to the other, traveling through a trellised seating area around a small water feature and birdbath in the center. Small rocks could line the pathway to define the edges and ease maintenance. Medium height perennial flowers and edible plants, such as highbush blueberries, should be planted along the path as well as hardy kiwi to cover the trellis. Increasing the volume of plant life and moving snow placement further west of Page will reduce puddling in this area.

Running along the edge of this triangular space would be a path composed of fine gravel to replace the existing asphalt one. Species such as highbush blueberries could line the fine gravel path to act as an interactive buffer between this low-maintained space and the adjacent high-maintained quad lawn.

How it meets our goals:

Sustainable

- Eliminates the grass monoculture and invasive species in the area
- Increases biodiversity
- Filters out pollutants from the campus watershed
- Reduces pooling of water
- Reduces total impervious surfaces
- Increases resiliency and reduces maintenance
- Produces an edible yield

Sense of Place

- Increases open seating area for relaxation and socializing
- Provides a space for studying, eating, socializing, and recreating
- Diversifies the setting on the main quad while maintaining and distinguishing features
- Reflects qualities of other third spaces

Educational and Engaging

- Increases knowledge about species and ecosystem services through informational signage
- Encourages exploration and curiosity
- Acts as a living laboratory for classes and individuals



View from the front of Page Hall





3-D rendering of the potential Page Hall design after implementation

Rendered by Evan Dalton

Hugelkultur

A no-dig, raised bed gardening style using a base of decomposing branches, logs and other vegetative material.

Lawson/Danforth

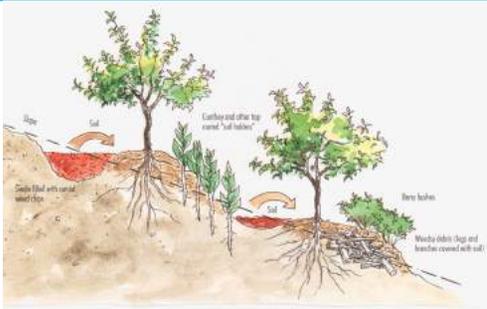
The area between Lawson Hall and Danforth Hall currently consists of a mix of red maple, sugar maple, red oak, arborvitae, eastern white pine, and pin oak trees amongst an expanse of manicured lawn. There is a pronounced slope that extends eastward from the southwest part of the plot to a drainage area to the east of Lawson Hall. This is a typically wet space, as it resides on lower campus and is surrounded by impervious surfaces. This space receives low use compared to other areas on campus. This space should be designed with elements that encourage an increased use of this area. These features include wooden benches, tables, and paths composed of fine gravel in order to increase access from adjacent residence halls and roads. Pathways can also be enhanced through elements such as a gazebo and trellis. The entrance of the pathway beside F-Lot is in need of a set of stairs in order to

accommodate the steep slope. The problem of waterlogging in the southern area can be addressed through hugelkultur beds and bioswales. Edible garden beds can be planted adjacent to the bioswales in order to take advantage of the accumulated water.

We recommend lining the boundary beside Mercer field with wildflower islands and sugar maple trees for aesthetic enhancement. The area behind Lawson can be converted into edible garden beds with low-growing bushes and shrubs. These garden beds could be maintained by students, such as applied farming students. An outdoor fitness area with a wood chip substrate may be set up in the southern section for exercise and sporting activities. Athletic surfaces such as volleyball or basketball courts could also be installed here. The triangular patch in front of Danforth Hall can be designed as a small catchment pond for water that collects in the middle portion due to the sloped landscape. This will reduce the level of water accumulating between the two residence halls. This triangular patch area can also be populated with wildflower islands and seating fixtures around the pond.

Bioswale

Vegetated ditch systems designed on contour to aid in runoff management.



View from the pathway connecting Danforth Hall to F-Lot

How it meets our goals:

Sustainable

- Sources local wood for pathways, stairs, and structures
- Eliminates the grass monoculture and invasives in the area
- Increases biodiversity
- Increases resiliency and reduces maintenance
- Filters out pollutants from the campus watershed
- Reduce pooling of water
- Produces an edible yield
- Provides opportunity for exercise and supports personal well-being

Sense of Place

- Increases open seating area for relaxation and socializing
- Provides a space for studying, eating, and recreating
- Improves visual aesthetics with wildflowers
- Connects the communities of Danforth Hall and Lawson Hall
- Reflects qualities of other third spaces

Education

- Increases knowledge about species and ecosystem services through informational signage
- Encourages exploration and curiosity
- Acts as a living laboratory for classes and individuals



Potential trellis designs found in the permaculture garden behind the Susan Colgate Cleveland Library/Learning center

Danforth/Lawson Design



Permaculture Garden



Hugelkulture Raised bed



(Port Angeles Community)



Sand Volleyball Court
(Shippensburg University)



Bioswale on Contour
(Bonnett, L.)



Wild Flower Garden

New Quad/ D-Lot

D-Lot is the central parking area behind Hogan, Reichold, and adjacent to the Sugar House. The 53,700 square foot parking lot is reserved for community members, faculty, and commuter students. Cutting through this parking lot is a pathway leading from the western side of campus to Ivey, Colby Farm, and the Sunshack. According to a campus-wide survey taken in the Fall semester of 2015, D-Lot is considered to be an unattractive “problem area” on our campus. However, a campus-wide foot traffic survey indicated, this space is one of the most heavily trafficked zones on campus due to the academic buildings. Since the new Fine and Performing Arts building will also be on the eastern part of campus, this area will experience a further increase in traffic.

We propose redesigning this area to act as an additional academic quad, removing the main parking area and only maintaining parking for Hogan members and Athletic Training faculty. The central parking area would be transformed into a grassy quad with four pathways intersecting in the middle. Vehicle traffic flow would be directed along the path of the existing roadway that extends between Ivey and Hogan. This roadway will maintain traffic flow between campus and Main Street while connecting upper and lower campus.

A stone buffer would surround the entire border of the quad in order to slow down water movement and match the design of the garden area in front of Ivey. We also recommend planting a buffer of salt tolerant species to protect adjacent areas from the plowing and salt associated

with winter maintenance. Small edible bushes such as blueberries should be planted on the north and south ends of the quad. A gazebo would be installed in the center of the quad where the footpaths meet. Small edible garden areas and seating could be placed along the pathways. Downward-facing LED lights should be installed around this quad for evening access.

How it meets our goals:

Sustainability

- Attracts pollinators as an ecosystem service
- Provides an edible yield
- Increases biodiversity
- Reduces winter plowing and maintenance
- Slows and infiltrates water movement using stone buffer surrounding the quad area
- Uses downward-facing LED lights to provide efficient lighting
- Salt tolerant species reduces effects of winter maintenance and protects the local watershed

Sense of Place

- Encourages student interaction and engagement
- Provides shelter with the Gazebo; useful during inclement weather
- Acts as a third space for students and community
- Creates an aesthetically pleasing and peaceful space
- Reflects the design of the main quad to provide consistency
- Provides recreation opportunities in a heavily trafficked area
- Separates foot and vehicular traffic, keeping vehicles to the outskirts

Education

- Creates potential educational spaces for students to learn about edible and native plants
- Increases knowledge about the purposes of features through informational signage
- Provides educational spaces for studying close to academic buildings and the library
- Encourages exploration and curiosity
- Acts as a living laboratory for classes and the community



View of D-Lot walking towards Ivey Science Center



Pedestrian walkway from Ivey Science Center

New Quad Design

**Reichold
Science
Center**

**Hogan
Sports
Center**

- Stamped Pavement
- Gazebo
- Meadowland
- Hardy Grass
- Bioswale
- Tree (Apple & Maple)
- Blueberry Bushes
- Light Posts



Created by: Nawaraj Shahi





*3-D rendering of the potential New Quad design after implementation
Rendered by Nawaraj Shahi*

Arts Building

The new Fine and Performing Arts Center will occupy the space between the Ivey Science Center and Windy Hill School. To accommodate the needs of the new arts center as well as the existing buildings, we developed a landscape design that incorporates aspects of the art department, science department, and the preschool.



View from behind the proposed Fine and Performing Arts center

The arts building is designed to integrate art inside and out, with a sculpture garden and an art yard included. The building and landscape are designed to function together as one entity. The art yard will be a productive space for students to create artwork, while the sculpture garden will be an outdoor display of artwork from a variety of artists.

The path that currently leads to this area, discussed in the above D-Lot design, crosses over vehicular roads and the parking lot multiple times. This path does not accommodate lines of desire or aesthetic preferences. To meet fire safety regulations, the building must have accessibility for fire trucks on two and half sides of the building. To collect water runoff from the building, there is a proposed water catchment pond. We factored each of these components into our design.

Our recommendation for the area is to implement this design in phases that minimize the parking lot's interaction with pedestrian traffic. In the final phase, we would like parking in this area to be limited to handicap accessibility and a few faculty/staff spaces, clearing space for the art yard or sculpture garden to expand. The majority of parking will be moved to the proposed new parking lot, seen in the parking expansion section. This will improve building accessibility by reducing competition between pedestrian and vehicular traffic and will accommodate lines of desire. This plan is fluid so that we may creatively use and respond to changes within the landscape and the Colby-Sawyer community.

How it meets our goals:

Sustainability

- Provides an edible yield
- Reduces runoff and pollutants in campus watershed
- Increases biodiversity while limiting the amount of impervious surfaces
- Separates pedestrian and vehicular traffic
- Creatively uses and responds to change with phasing outline

Sense of Place

- Increases open seating area for relaxation and socializing
- Enhances the culture of campus by incorporating art into the landscape
- Incorporates themes from the interior of the building into the landscape
- Offers a gathering place for the community and event attendees

Educational

- Multiple educational workspaces for students
- Opportunity to learn about art in an outdoor environment
- Art students will have the chance to design individual spaces in the landscape

Building Elevations



Susan's Swamp

Susan's Swamp is one of the college's most beneficial ecosystems. The swamp filters out pollution from the campus' runoff; which includes the heavy salting of impervious surfaces and fertilizer that is spread over campus lawns. However, this area is largely underutilized by students and the community. The water body supports a diversity of birdlife (redwing blackbirds, Canada geese, common yellowthroat, warblers and others). It also supports a diversity of aquatic plants not found elsewhere on campus.

Our new design for Susan's Swamp makes this area more accessible for students and community members to enjoy. Currently, there is a small unmaintained path with bushes and trees that are overgrown, making it an undesirable destination. To make this area more desirable and easier to navigate, our design includes a boardwalk around the entirety of Susan's Swamp. The boardwalk would look similar to the one currently at the Philbrick-Cricenti bog.

At our community outreach event, that we conducted as part of our research, a staff member brought up the lack of seating around this area. We included this feedback into our design by adding benches and tables around the swamp. We used lines of desire, indicated by worn down foot trails through the landscape, to determine where we would place new paths leading to the boardwalk. We included an access path that extends from the back of the lodge to connect these two community spaces. We also propose to add a path that avoids

K-Lot and provides access to Kelsey field without the conflict between pedestrian and vehicle traffic that currently occurs in K-Lot. Areas around the water body where the soil is firm could have woodchip paths rather than boardwalk. By adding these paths, individuals can walk through a beautiful space and enjoy the features that the forest offers.

The water quality tests that we performed showed that the conductivity of Susan's Swamp is very high, with an average level of 650 $\mu\text{S}/\text{cm}$; while any readings over 100 $\mu\text{S}/\text{cm}$ are cause for concern in New Hampshire water bodies. The tests also showed the alkalinity of the water to be 309.2 mg/L; New Hampshire's average being approximately 20 mg/L. Plants tolerant of these abnormal wetlands characteristics need to be incorporated in the redesign of this area (reference Appendix B - Planting Palette).



Examples of boardwalks used in wetland areas

How it meets our goals:

Sustainability

- Sources local wood for pathways, stairs, and structures
- Improves the water quality of Susan's Swamp
- Reduce pollution and water runoff in campus watershed
- Ensures the existence and health of a natural filtration system
- Produces an edible yield that can be served at the pub or dining hall
- Increases biodiversity and provides habitats for surrounding wildlife
- Raises awareness for the protection of wetlands
- Separates pedestrian and vehicular traffic.

Sense of Place

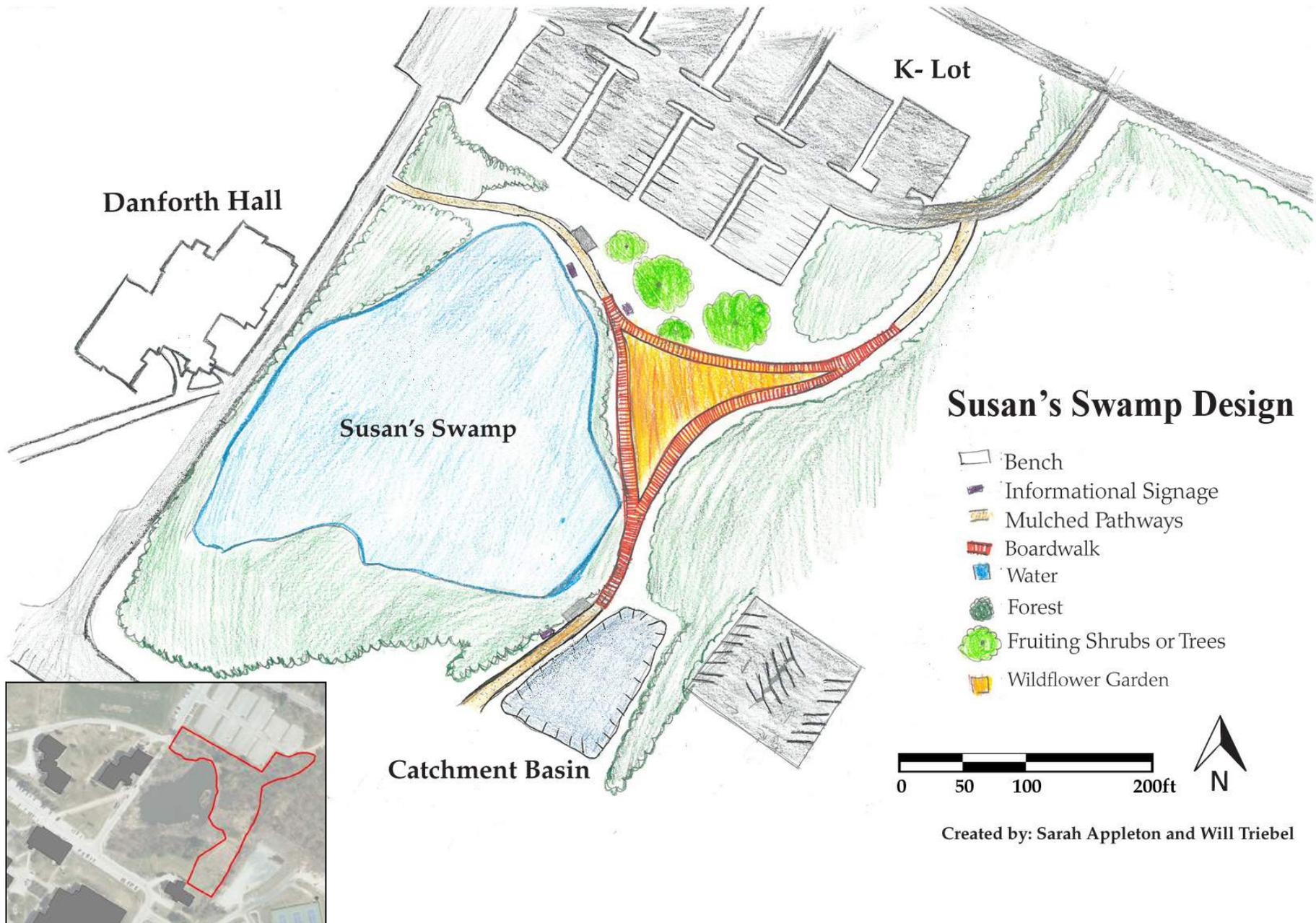
- Increases open seating area for relaxation and socializing
- Creates a campus third space
- Provides area for wildlife observation
- Acts as a destination for the local community
- Connects the lodge and Kelsey Fields in an aesthetically pleasing way

Education

- Provides potential educational opportunities in construction of swamp infrastructure
- Educates through informational signage around the boardwalk
- Creates an outdoor lab space to study water quality, macroinvertebrates, bathymetry, etc.
- Provides area for informational nature hikes
- Provides a secluded place to study



View of Susan's Swamp and Danforth Hall from the pathway going around the Swamp



Susan's Swamp Design

-  Bench
-  Informational Signage
-  Mulched Pathways
-  Boardwalk
-  Water
-  Forest
-  Fruiting Shrubs or Trees
-  Wildflower Garden



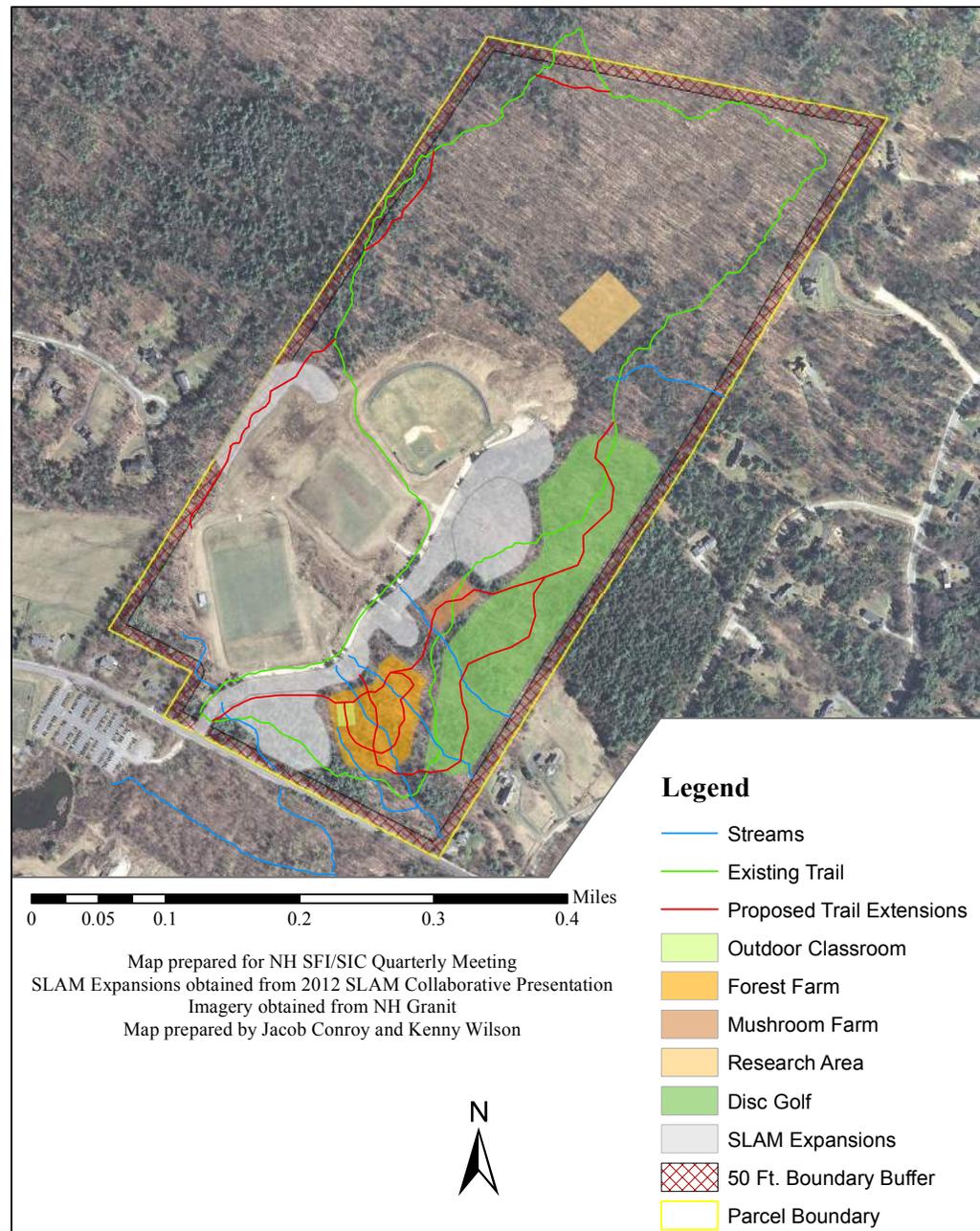
Created by: Sarah Appleton and Will Triebel

Kelsey Forest Educational Expansions

Kelsey Forest

The college owns 85.61 acres of forest, which includes a 1.6 mile trail that is open to the public. The forest, which is home to several flora and fauna species, is fairly underutilized by the college. The presence of Kelsey Forest provides a diverse landscape and environment, especially compared to the landscaped areas on campus. It is also an important economic and educational asset to the college. However, due to underutilization, its value and significance has been undermined. In addition to the suggestions outlined here, a separate Forest Management Plan was prepared as part of this project, which more specifically outlines the current ecological and economic of the forest.

Establishing seating areas in a few locations along the trail will create places for social gathering in the woods. An innovative idea would be the creation of a forest mushroom farm, which could be located just west of the new disc golf course and adjacent to the parking facilities along the access road. One log or tree can support five to ten years of mushroom growth. In addition, a forest farm could be added between the tennis courts, just west of the disc golf course and adjacent to the parking lot. This area is easily accessible for both college and community members. We suggest creating an outdoor classroom within the food forest. To provide easy navigation of the forest, we propose to change





the existing trail to tie all of the design features together. The trail would begin at the parking lot at the south end of the disc golf course and extend in a path through each feature.

The first and foremost solution to better utilize

Kelsey Forest is to effectively advertise about this important resource. Enrolling the Kelsey Forest in the American Tree Farm System is the first step in managing this forest. Through the timber generated through sustainable forest management, the forest can generate income. If utilized correctly, this forest could be used as a branding option to attract more students to the college.

How it meets our goals:

Sustainability

- Provides carbon storage (See Forest Management Plan)
- Provides local timber yields through sustainable silvicultural practices
- Provides an edible yield for use in the dining hall and for sale in the community
- Advocates personal well-being and outdoor exercise using trails

The American Tree Farm System standards are:

- Commitment to the Practice of Sustainable Forestry
- Compliance with laws
- Reforestation and afforestation
- Air, water and soil protection
- Fish, wildlife, biodiversity and forest health
- Forest aesthetics
- Protection of special sites
- Timber harvest and other management activities guidance

Sense of place

- Concentrates athletic surfaces in one area
- Gives students a place to explore, congregate, and hold recreational activities
- Increases seating throughout the trail and allows more space for relaxing and socializing
- Acts as a destination for the local community

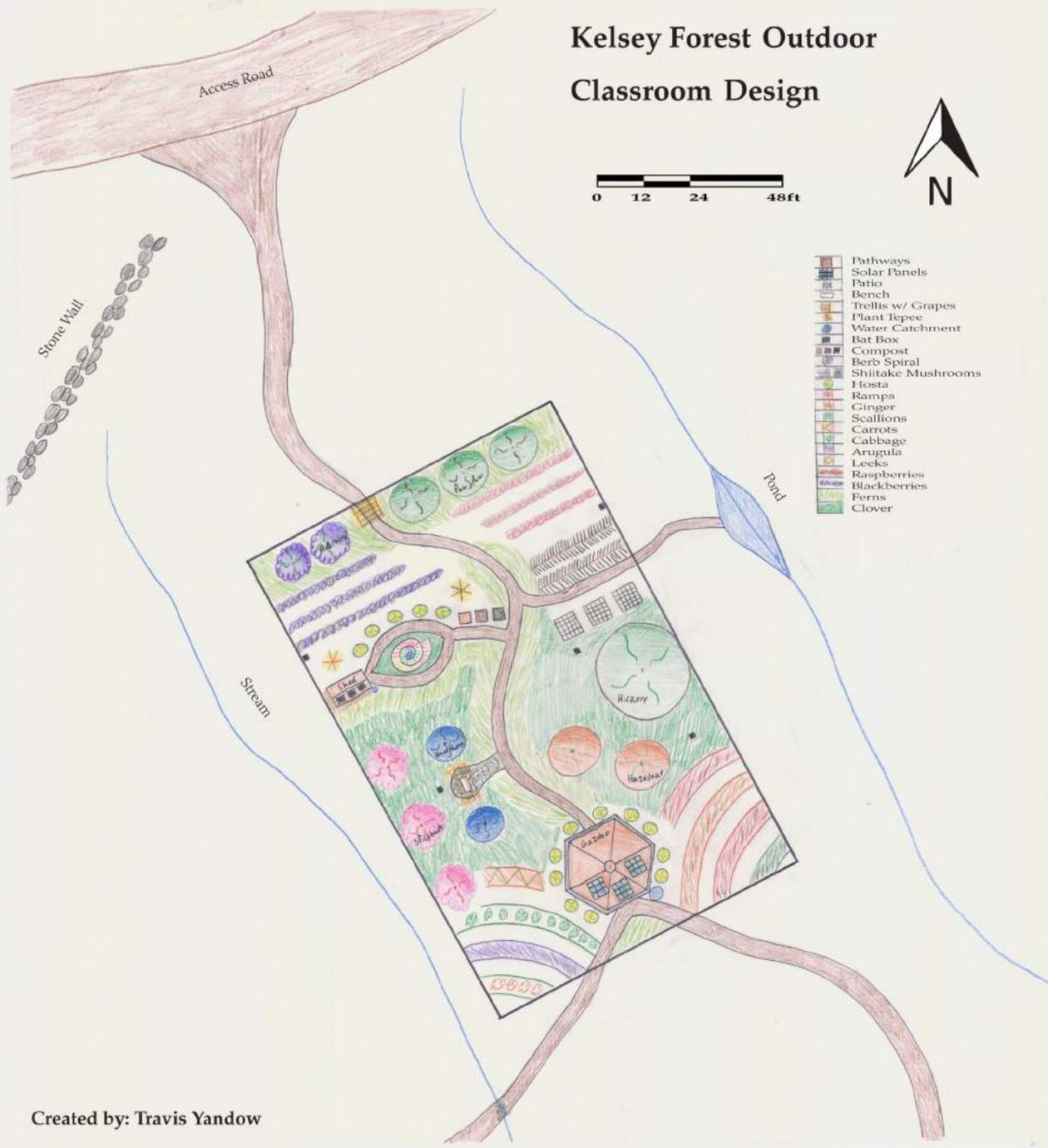
Education

- Incorporates courses in the construction and maintenance of forest infrastructure
- Acts as a living laboratory through research and the outdoor classroom
- Tangibly models sustainable forestry for the campus and surrounding community

Kelsey Forest Outdoor Classroom Design



- Pathways
- Solar Panels
- Patio
- Bench
- Trellis w/ Grapes
- Plant Teepee
- Water Catchment
- Bat Box
- Compost
- Herb Spiral
- Shiitake Mushrooms
- Hosta
- Ramps
- Ginger
- Scallions
- Carrots
- Cabbage
- Arugula
- Leeks
- Raspberries
- Blackberries
- Ferns
- Clover



Created by: Travis Yandow

Farm

The 3.1 acre meadow behind the existing Colby Farm is an underutilized meadowland surrounded by trees, with a slight slope on the eastern side of the field. Hidden by a treeline, it allows for above ground infrastructure to exist without negatively impacting the viewsheds of surrounding neighbors. This open area is provided with sun almost all day long. In addition to these characteristics, this area has one of the best viewsheds on campus—looking straight at the beautiful summit of Mount Kearsarge.

We suggest utilizing this area for a campus farm, which can generate food for use in the dining hall and can be sold to local community members. The larger elements would consist of a shed, a barn, an apiary, and two greenhouses. The shed and barn could provide a working space or a home for small farm animals. A majority of the 3.1 acres would consist of a large diversity of crops grown on contour, with the meadowland and a fruit orchard in the east corner. An access road would weave through the farm, connecting all the farm elements and the pathways leading from Windy Hill. Having a campus farm will improve the many different elements of the college. It would increase the competitive, educational, and cultural aspects of Colby-Sawyer.



Professor Laura Alexander at Green Mountain College's Farm in Vermont



Vegetable farm at Green Mountain College in Vermont



Farm access road at Hampshire College

How it meets our goals:

Sustainability

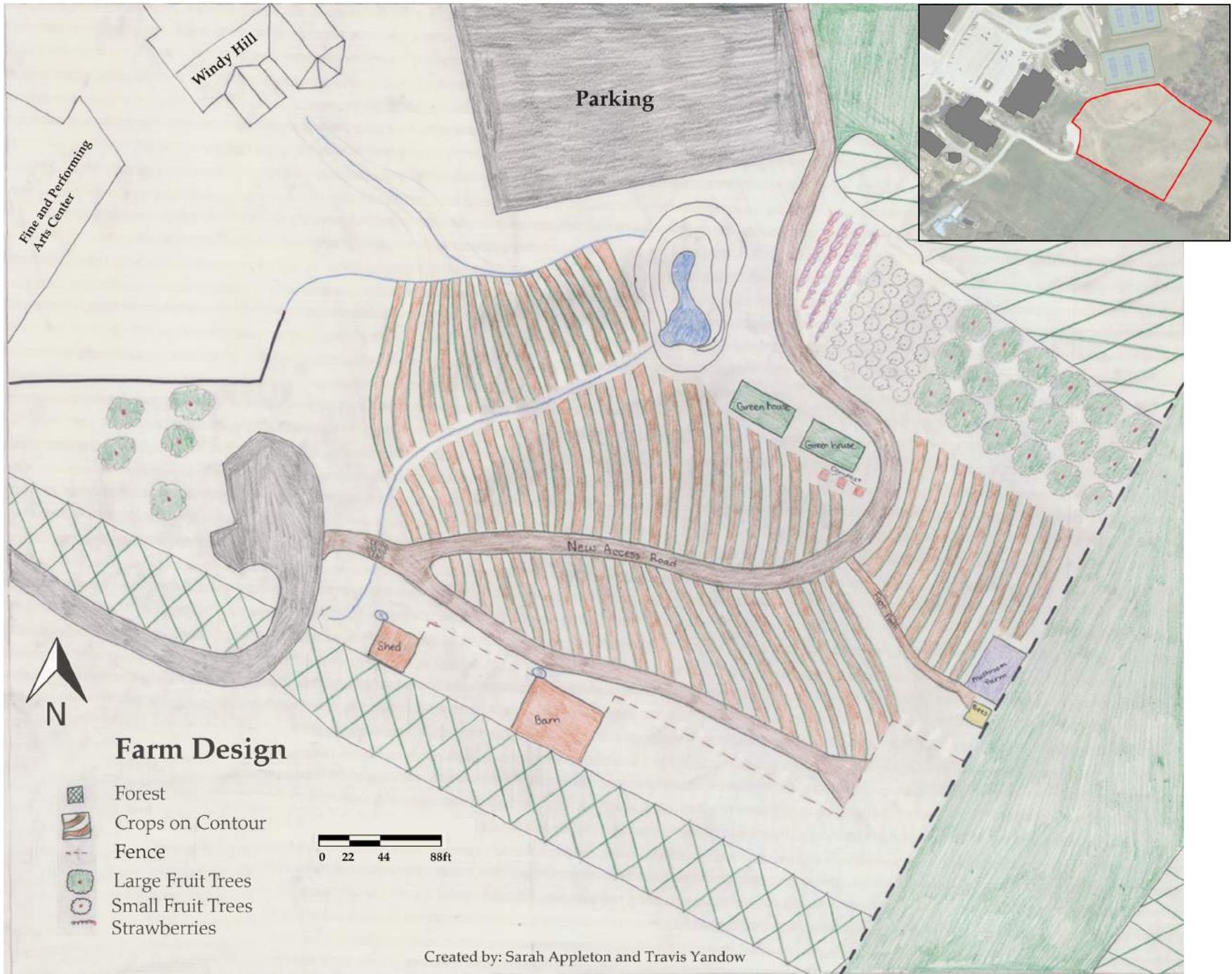
- Flexible and resilient to ecological, climatic, and economic changes
- Designed to expand or shrink based on involvement and overall success
- Provides an edible yield for use in dining facilities
- Surplus provides a CSA (Community Supported Agriculture) crop shares

Sense of Place

- Acts as a secluded third space
- Provides a significant viewshed, highlighting Kearsarge
- Increases seating area and tables for relaxation and socializing
- Creates a unique landscape element that enhances the college's brand
- Connects the college to the cultural history of agriculture in New London

Education

- Generates internship opportunities for students
- Educates through informational signage of permaculture principles and crops
- Gives Windy Hill students access to the farm for early exposure
- Provides an agricultural lens for multiple disciplines and topics (e.g. nutrition, public health, social justice, history, artistic expression, soil chemistry, carbon capture)



Gateways

The gateways into campus are currently confusing and lack consistency. Chargers Loop, the one-way entrance from Main Street, is the main gateway to campus. It is currently marked with a white post suspending a small white sign reading, “Colby-Sawyer College.” In addition, there are five secondary gateways—one from Main Street and four from Seamans Road. All of these gateways are marked only with standard green street signs. Directing vehicular traffic to the proper gateways will help to control the flow of traffic throughout campus, keeping vehicles away from pedestrian pathways. With the recent installation of gates to restrict vehicular traffic from the main quad, the college has begun implementing its goal of rerouting vehicles to the edges of campus.

A new design for this area could include a raised walkway on the Chargers Loop, beginning at the front door of Colgate Hall and leading towards a raised seating area with three flag poles. These flag poles will hold the American flag, State of New Hampshire flag, and a custom college flag. A new college sign consisting of Sugar House inspired cobblestones would be placed at the front of this seating area. The letters on this sign would protrude from the rocks and be lit from the ground during the evening so it can be seen from Main Street at all times.

The secondary gateways should all be marked with a similar design to the new campus sign, but at a smaller scale. A rock pillar reading, “C-S 1837” could mark the gateways and be a beacon for visitors, allowing

them to know that they have entered the campus. The pillar will be tall enough so that during the winter months the lettering is not blocked by snow accumulation or snow banks. The letters will protrude in the same style as the Chargers Loop sign and will also be lit up during the evening.



Main gateway



Secondary gateway

How it meets our goals:

Sustainability

- Uses locally sourced stones
- Creates a long-term solution to traffic flow patterns on campus
- Separates vehicular and pedestrian traffic for safety and ease of use
- Requires minimal maintenance after installation

Sense of Place

- Creates consistency
- Expands on the existing stone designs present throughout campus
- Clearly brands and identifies campus
- Improves aesthetic appeal
- Displays Colby-Sawyer's connection to the global community using flags
- Builds ties with the community and advertises campus resources for greater use

Education

- Incorporates student involvement in the design of the campus flag and signs
- Educates through informational signage about locations on campus



Secondary Gateway Sign



3-D rendering of the potential K-Lot entrance design after implementation

Rendered by Nicholas Dibble



*3-D rendering of the potential gateway design after implementation
Rendered by Nicholas Dibble*

SECONDARY DESIGNS

Main Quad

The quad is the center of residential life on upper campus. Our research showed that the quad has the most foot traffic of any area on campus, drawing people from the surrounding buildings as well as those from lower campus. Currently, the large maintained lawns on either side of Pierce Park act as the primary destination for people who are looking to engage in the landscape.

With the new gates installed to block vehicular traffic, the roadways can be converted into red-paved pedestrian pathways. In order to accommodate lines of desire, two bisecting pathways could cross the west lawn in order to connect traffic from one side of the lawn to the other. These pathways will be lined with benches and lights to encourage interaction and make the quad a social destination. To provide further seating, wooden benches designed to wrap around the trunks of trees could be installed throughout the quad. This style of seating adds opportunities for social congregation without reducing the area available for lawn games, such as frisbee or soccer.

With this design, several of the existing foot paths along the buildings surrounding the quad become superfluous. These excess pathways along buildings will be converted into a “green loop” that serves as walkable gardens and third spaces. The majority of the loop, extending from Colby Hall and continuing along the front of the Sawyer Center to Burpee Hall, could consist of edible permaculture gardens. These gardens could be designed by students and community members who

are enrolled in the Permaculture Certification course. The remaining portion of the loop, extending from Burpee Hall clockwise to Colby Hall and adjacent to Colgate Hall, could consist of perennial flowerbeds (reference Appendix B - Planting Palette). Since Colgate is the center for tours, marketing campaigns, and visitors, the perennial flowerbeds were chosen in order to maintain a traditional college aesthetic.



Potential wooden benches around trees

Responses from our surveys sent out to students, faculty, and staff, reported that permaculture gardens and lawns were the most visually appealing landscape features. The addition of the green loop will provide a setting for different activities than those taking place on the lawns, while maintaining a visually pleasing landscape. This loop would act as a scenic walk, transforming previously unused lawns into a path for discovery, exercise, mindfulness, and relaxation. The main component of the green loop is the gardens. These gardens, placed on both sides of the pathway throughout the entirety of the loop, would each hold their own special character and include interactive features.

How it meets our goals:

Sustainability

- Increases biodiversity, resilience, and ecosystem functions
- Provides an edible yield
- Eliminates unnecessary walkways to reduce maintenance
- Reduces impervious surfaces and increases vegetation for water infiltration
- Sources local wood for paths and benches
- Utilizes space efficiently through tree-wrapped seating and reduced paths
- Incorporates public survey suggestions, allowing for community input



Sense of Place

- Increases seating and unique third spaces for landscape interaction
- Ties diverse environments together through consistent features
- Encourages a variety of activities to meet various community desires
- Meets lines of desire to facilitate convenient movement

Education

- Incorporates courses in the design and maintenance of gardens
- Informational signage educates about garden species and designs
- Acts as a living laboratory for courses and research
- Encourages exploration and curiosity

Hogan Hill

Due to the steep slope and lack of diverse vegetation on the hill behind the Hogan Sports Center, water runs down the hill and into a storm drain, carrying surface runoff into Susan's Swamp. The slope of this hill makes mowing and other seasonal maintenance difficult and time-consuming. In addition to being a source of runoff and a challenge to maintain, the Hogan Hill offers limited aesthetic value, consisting of only manicured grass and a few trees placed alongside Hogan.

It is our plan to transform the hill behind Hogan into a low maintenance water catchment system that prompts those passing by to explore. We suggest creating bioswales in line with the contour of the hill and planting deep rooted grasses and flowering perennials to maintain seasonal allure and diversity. Some examples are joe-pye weed and switchgrass. We also suggest planting woody shrubs such as highbush/lowbush blueberry, staghorn sumac, and winterberry holly throughout the bioswales to maintain structure and visual appeal. Refrain from planting any canopy cover trees as they are particularly susceptible to ice, wind, and snow damage in this location. We would also suggest creating a seating area with picnic tables and Adirondack chairs at the top of the hill to utilize the view of Mt. Kearsarge and Susan's Swamp. The seating area should be surrounded with a small stonewall to create a barrier between the seating and the slope of the hill. If possible, refurbished or reclaimed wood should be used to build a stairway that comes up the corner of the hill and platforms over the



Manicured Lawn on Hogan Hill

bioswales, leading directly to the seating area. Also, it could benefit pedestrian traffic to create a path along the edge of the Hogan building that connects Hogan to the Lodge.



Example of a bioswales that could be used on Hogan Hill

How it meets our goals:

Sustainability

- Creates an ecosystem service to reduce and purify campus runoff
- Provides an edible yield
- Adapts to seasonal and climate changes with planting choices
- Reduces maintenance
- Adds another channel that connects west campus to the new arts building

Sense of Place

- Creates a place for relaxation and socializing
- Increase the aesthetic value of the area
- Offers a view of the mountainous region

Education

- Educates through informational signage about the purpose of landscape practices
- Encourages gym members to stay and learn about other campus opportunities



Viewshed from the Lethbridge Lodge

The Lethbridge Lodge

The Lethbridge Lodge is a space that is underutilized by students and faculty. While the inside of the building is seen as one of the better locations on a campus tour, the area surrounding the building is not an aesthetically pleasing space. Behind The Lodge is a steep slope that descends into a drainage basin for Susan's Swamp. In the space on top of this hill is a 60 x 20 ft. flat area, which provides an incredible viewshed of the surrounding mountains and the swamp. To the east of the building there is a hedge of overgrown invasive shrubs. The lawn in front of the building receives a large amount of winter damage; from sand, salt, and vehicular traffic. The lawn is heavily shaded by four eastern white pine trees, creating more underutilized space.

One of the main goals for the new design of this site is to utilize the viewshed from behind the lodge. By constructing a patio that connects to the proposed boardwalks around Susan's Swamp as well as a short path that leads inside the pub; traffic from all over campus would be channeled to this viewshed. This area could also grow vegetables for use as ingredients in The Lodge's menu items, or hops to be used in the beer brewing class.

How it meets our goals:

Sustainability

- Provides an edible yield
- Increases biodiversity and resiliency
- Reduces intense maintenance practices
- Utilizes local timber for the construction of the boardwalk

Sense of Place

- Creates a place for relaxation and socializing
- Utilizes the mountain viewshed, which is as an icon of Colby-Sawyer College
- Demonstrates the locally sourced food brand through edible vegetation

Education

- Facilitates interactions between students and the edible landscape to better understand where food comes from
- Integrates courses such as permaculture into the landscape design
- Integrates courses such as the brewing course into the landscape



An example of a walled in patio with planters on the railings

Dining Hall Patio

The area outside the Dining Hall is one of the most frequented areas on campus and provides a large concrete patio which is not fully utilized. Other than a few landscape features such as the stone benches, trees, and shrubs, the space is mostly bare concrete. In order to incorporate lines of desire, we would add a pedestrian pathway alongside the building to connect the Dining Hall entrance to Rooke Hall. Other pathways should also be created near the existing stone benches to allow for better foot traffic flow. Beside the path, we recommend planting a tea garden that includes species such as mint, chamomile, hyssop, sage, lavender, and thyme. Next to the concrete semi-circle, planting woody shrubs and perennials will help retain the runoff from the concrete. Salt tolerant species including red osier dogwood, switchgrass, joe pye weed, bearberry, hostas, fountain grass, and sea thrift would work well here. To the left of the stairway could be a perennial garden full of native flowers and to the right of the stairs, we would replace all the invasive burning bushes with edible shrubs, such as blueberry, elderberry, hazelnut, and raspberry.

We recommend adding and improving seating areas around the Dining Hall. We suggest creating a concrete semicircle with multiple steps serving as seating. In front of the new stepped concrete seating, there could be a gas fire pit outlined with stone. In addition, cafe style tables and chairs would be installed in this area to allow for outdoor dining. Adjacent to the parking lot, there could be a corner seating zone sectioned off as a designated smokers area. This way, the smoking that

is typical to this area would not disturb non-smokers at the entrance to the Dining Hall. On top of the stairwell would be a weatherproof sign that contains flyers for campus events, sports statistics, and academic opportunities. This sign could be constructed using wood sourced from our forest and could also inform students about the design. A unique mural could be added on the wall to the right of the main entrance. This mural could start small and grow with segments added on an annual basis to depict the cultural diversity of the college over time.



Patio space outside Dining hall



Potential Fireplace and Stepped Concrete Seating Area outside Dining Hall at Washington University, St Louis, MO

How it meets our goals:

Sustainability

- Provides an edible yield
- Moves smoking away from the entrance of the building
- Replaces annuals with perennial species
- Replaces invasive species with native species
- Grows species in the tea garden that provide health benefits

Sense of Place

- Creates a place for relaxation and socializing
- Adds character to the currently underutilized space
- Provides a space for future recreational and campus activities to be held
- Grows food right on the dining hall patio to enhance the local food image
- Broadcasts campus events and encourages community interactions with an activity board
- Includes a painting of the college's mascot
- Expresses ideals of the college landscape through the goals articulation sign

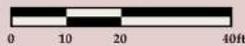
Education

- Educates through informational signage about the design and function of the area
- Incorporates students in the design of the mural
- Allows for educational events through event-style seating

Dining Hall Concept Design



Ware Student Center



Created by: Lea Taylor

- Shade Tolerant
- Salt Tolerant
- Tea Garden
- Seating
- Stone Wall
- Mulched Path
- Perennial Garden
- Witch Hazel
- Raspberry
- Blueberry
- Hazelnut
- Elderberry
- Informational Sign



*3-D rendering of the potential Dining Hall design after implementation
Rendered by Nawaraj Shahi*

Parking Expansion

Parking is vital to the functionality of a college landscape. Currently, parking areas are located in central areas that receive high foot traffic. Many students who took part in our survey suggested that they did not like walking across large areas of impervious surfaces, including parking lots. By relocating these parking lots, more green space could be created in these central areas for recreational use. This expansion could be the size of K-Lot, approximately 212 spots. These relocated lots would account for the spaces from D-Lot (127 spaces), while adding additional spaces to compensate for other campus additions in the future like the arts building. Our primary suggestion for the location of this expansion is the site outlined by the S.L.A.M. presentation, as shown by the map on the following page. Relocating parking to the outskirts of campus allows for a consistent, uninterrupted sense of place that unifies the campus as a whole.

Possible Parking Expansion Areas:

- Tennis Court Area (S.L.A.M.)
- P-Lot (S.L.A.M.)

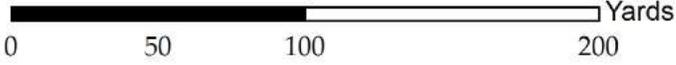
Benefits to Expansion:

- More parking spaces
- Removes parking lots from central campus
- Compensates for a vehicle influx associated with the new arts building

Parking Expansion



Map created for 2016 Landscape Management Plan
Imagery obtained from NH Granit
Expansion Data obtained from SLAM presentation
Map Prepared by Owen Krol



 Proposed Expansion





CONCLUSION

Colby-Sawyer College is an institution that cares deeply about involving and engaging students, employees, and community members. The college is conscientious about how its landscape reflects the values, goals, mission, and aesthetics of the institution. These ideals provide a good foundation around which we designed this landscape management plan.

This process began in the Fall of 2015 with intensive research and resulted in this comprehensive document. It was our original goal to create a management plan that was "aesthetically pleasing, functional, sustainable, educational, and cost effective." We strongly believe that the product here encompasses just that and will benefit Colby-Sawyer in multiple ways for years to come. Not only will this plan benefit the institution itself, but it will also provide a diverse and unique place for students, faculty, and staff to thrive.

By implementing the landscape practices and designs outlined above, Colby-Sawyer's landscape would better reflect its mission and goals. These changes will improve Colby-Sawyer's sense of place, provide educational opportunities for engaged learning, and uphold the college's objectives for sustainability. This document is designed to aid the continual development of Colby-Sawyer so that it upholds an evolving devotion to excellence, remains competitive, and responds to future needs.

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ACKNOWLEDGEMENTS

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APPENDICES

PHASING FOR DESIGN ELEMENTS

We evaluated our design suggestions in terms of existing costs, new costs, and benefits, as well as the phases in which they could be implemented. This section is divided into two parts: General Elements and Focus Areas. The General Elements section includes phasing and cost-benefit information for recommendations related to overall management practices. The Focus Area section provides more specific design details and includes cost estimates for the implementation of these elements within suggested timeframes.

Phases are divided into three tiers. The description of the respective phases and method by which General Elements and Focus Areas were assigned to them are listed as follows:

Phase 1

Entails the changes that can be implemented fairly easily and within the timespan of a year. Such changes are relatively inexpensive and do not require external technical assistance. They have great potential to illustrate engaged learning by providing hands-on educational opportunities through classes or research projects.



Ann-Banes Hall '67 permaculture garden 2010-2014

Phase 2

Entails changes that require a timeframe of 2-4 years to implement and would require external technical assistance. This longer timeframe is due to higher costs and the necessity for available financing and approval by the college administration.

Phase 3

Entails long-term projects that would require significant capital. Due to this, they are unlikely to be implemented quickly. They will require additional research due to potential changes that might have already happened after the project starts. They also propose significant changes to a particular area. These changes may take roughly 5 years or more.



Phasing Summary for Focus Area Elements

Focus Area Elements	Phase 1	Phase 2	Phase 3
Lawson/Danforth	X		
Benches	X		
Trellis	X		
Meadowlands	X		
Bioswales	X		
Edible Garden Beds	X		
Hugel Beds	X		
Gazebo		X	
Light Fixtures		X	
Pavements			X
Pond			X
Susan's Swamp		X	
Benches	X		
Informational Signage	X		
Wildflower Beds	X		
Boardwalk		X	
Woodchip Path		X	
Kelsey Forest			X
Informational Signage	X		
Outdoor Classroom			X
Disc Golf Course			X
New Quad			X
Gazebo			X
Wooden Benches			X
Bioswale			X
Red-Asphalt Pathway			X
Garden Beds			X
Light Fixtures			X

Focus Area Elements	Phase 1	Phase 2	Phase 3
Page	X		
Wooden Benches	X		
Trellis	X		
Edible Garden Beds	X		
Meadowlands	X		
Wood Chip Path		X	
Entrances & Gateways	X		
Concrete Slab	X		
Flag Poles	X		
Main Sign (Fieldstone Veneer)	X		
Entrance Pillars (Fieldstone Veneer)	X		
Dining Hall		X	
Flower Beds	X		
Picnic Tables and Benches	X		
Wood Chip Path		X	
Concrete Seating Fixtures		X	
Painted Concrete Artwork		X	
Gas Fire Pit			X
Arts Building		X	
Trellis	X		
Benches	X		
Wildflower Beds	X		
Wooden Fence		X	
Gravel Path		X	

We assigned the focus areas and their respective elements to the three tiers of phases mentioned above. This is summarized in the table above.

	Cost-Benefit Analysis Summary				
	Current Costs		Estimated Costs of Proposed Designs		
	Maintenance Costs	Carbon Emissions (lbs CO2e)	Installation Costs	Maintenance Costs	Carbon Emissions (lbs CO2e)
Lawson/Danforth	\$2,951	797	\$92,605	\$2,858	239
New Quad	\$20,479	3,462	\$151,355	\$1,868	1,963
Dining Hall	\$6,092	294	\$5,506	\$1,760	294
Page	\$2,102	414	\$2,150	\$957	36
Arts Building	N/A	N/A	\$13,772	\$617	114
Kelsey Forest	\$28,673	4,171	\$1,800	\$28,859	5,170
Entrances & Gateways	\$8,511	1,753	\$24,800	\$8,476	1,740
Susan's Swamp	N/A	N/A	\$3,657	\$284	N/A
Total	\$68,808	10,892	\$295,644	\$45,680	9,557

The table above summarizes the existing and new financial and environmental costs attributed to the focus areas.

The reasoning for designs' inclusion in the different phases as well as particulars regarding their cost and location are discussed in detail in the following section. The financial costs are based on our research in the document *Colby-Sawyer College: Landscape Management Research Fall 2016* and the carbon emission costs are derived from the Clean Air Cool Planet calculator. (UNH, 2014)

PHASE 1

General Elements:

Bioswales

Bioswales require minor to major earthworks using either hand labor or heavy machinery depending on their scale. This would require additional site evaluation to locate appropriate contours and development of alterations to these contours. It falls under this phase since we already have access to the machinery that is required for extensive digging, as well as the ability to survey sites for contours. Bioswales have been recommended in Hogan Hill, between Danforth/Lawson, beside D-Lot, etc. (See Stormwater Management for more details)



Example of a bioswale at Lewis and Clark

Lawns

The proposal for inclusion of native herbaceous groundcover in addition to the turf grass is a relatively inexpensive and easy task. The project would only include the buying of seeds for the necessary herbaceous groundcover. For example, sowing white clover seeds costs roughly \$65-\$97 per acre. These biodiverse lawns can be instituted in areas such as Main Quad, New Quad, between Danforth/Lawson, Page Hall, etc. (See Lawns)





An example of wildflowers in a meadowland

Meadowlands

Meadowlands consist of a variety of native grasses and wildflowers. After the initial setup of sowing seeds and preparing the soil, it requires little to no maintenance. The grasses can be partly mowed once a year to maintain a tidy appearance, thus presenting fairly significant cost benefits in terms of reduced maintenance requirements. The mowed grass can then be used as mulch or green manure in other garden beds. Such landscapes have been successfully implemented in institutions such as Hampshire College, University of California Berkeley, etc (The Vermont Wild-

flower Farm, 2016).

Based on our research in *Colby-Sawyer College: Landscape Management Research Fall 2016*, converting current lawns into low-maintenance meadowlands can save up to \$716 per acre due to reduced maintenance needs. Meadowlands are appropriate for less visible areas on campus such as backyards of Grey, Yellow and London House, behind Abbey Hall, slope beside Hogan, below the new Fine and Performing Arts Center. (See Meadowlands)

Flowerbeds

Flowerbeds are designs that include a variety of perennial and annual ground covers, edible shrubs, and grasses (reference Appendix B - Planting Palette). Seedlings of native plants can be obtained from the state nursery or other local nurseries at a minimal cost. Leaf mulch sourced from trees on campus can be used instead of bark mulch, and the dehydrated organic matter from the dining hall may be utilized as a soil amendment. If an ecologically-conscious design is implemented, maintenance will be greatly reduced, potentially reducing labor costs. Flowerbed design could be undertaken as a student initiative and could engage multiple classes and departments. This pertains to existing flowerbeds which are situated around the buildings on campus. (See Flowerbeds)

Edible Garden Beds

Edible Gardens can be established with minimal effort through sheet mulching and cover-cropping methods. If the beds are made using a sheet mulching process, the materials necessary for this can be easily sourced from campus—cardboard from the dining hall, leaf mulch from trees on campus, and fresh lawn clippings. The leaf mulch will act as a carbon source and the lawn clippings as a nitrogen source. These can be covered with store-bought compost and enhanced with dehydrated organic matter from the dining hall. Lastly, nitrogen-fixing cover crops such as white clover and peas can be planted to enhance soil and provide a source of green manure. Edible Garden beds are located in the New Quad and between Danforth/Lawson.

Trellis

The proposed trellis is a simple structure that does not require many materials. A simple trellis design costs approximately \$40 per foot. The structure consists of vertical beams with a lattice of horizontal beams on the top. They can be used as support structures for plants like grapes, which provide shade after they have grown around the trellis. It can be constructed at a minor cost, perhaps even sourcing local wood from Kelsey Forest or trees selected for removal on campus. Trellises have been suggested for inclusion in Third Spaces such as Danforth/Lawson and Page Hall designs.

Hugelkultur Beds

Hugel beds are raised beds filled with rotting wood, plant matter, and soil. Twigs and scrap wood can act as a base for the beds, and soil excavated elsewhere can be put on top. The plant matter can be sourced from lawn clippings and leaves. Further soil enhancement can be provided by the dehydrated food products of the Ecovim composter located in dining hall. Plants can again be sourced from the state nursery at a minimal cost (refer to Appendix B - Planting Palette). Hugel beds are low-maintenance, yet highly productive due to the active decomposition process occurring inside the bed. They also provide significant water run-off control since the rotting wood acts as a sponge. Due to this, they are useful in the design between Lawson Hall and F-lot.

Benches

The proposed wooden benches are inexpensive features. A simple wooden design costs approximately \$150, and they can immediately enhance the aesthetics and functionality of a space. Their low cost as well as ease of installation makes them suitable for Phase 1. The benches bring immediate benefits as they can be utilized right away. There is also the possibility of using wood from Kelsey Forest to construct them as part of an Applied Permaculture course, further reducing costs. Benches have been recommended in many places across campus, including areas such as the Main Quad, New Quad, Danforth/Lawson, and Page Hall.

Focus Areas:

Third Spaces: Page Hall

The Page Hall area design aims to provide a space for the community to reflect, recreate, and learn from each other and the environment. It is also easy to implement, as it does not require significant alteration of the landscape. A majority of the area to be converted is currently lawn, which can be easily changed. Also, this design has the greatest potential to be utilized by students due to its central location and close proximity to residence halls.

Current Costs			
Element	Estimated Area (Acres)	Maintenance Costs	Carbon Emissions (lbs CO ₂ e)
Lawn	0.44	\$315	113
Pedestrian Pathway	0.126	\$1,787	301
Total	--	\$2,102	414

References

Trellis: <http://www.improvenet.com/r/costs-and-prices/arbor-trellis-pergola-cost-estimator>

Wood chip path: http://www.homevyse.com/services/cost_to_install_mulch.html

Flower Bed: <http://www.greenmountaincompost.com/all-about-compost/coverage/#comp-calc>

Estimated Costs of Proposed Changes				
Element	Estimated Area (Acres)	Installation Costs	Maintenance Costs	Carbon Emissions (lbs CO ₂ e)
Plants (highbush blueberry, butternut, sugar maple trees, etc.)	N/A	Labor for installation. Dependent on number, size, and type of plants installed	General maintenance and trimmings.	Potential Carbon Capture
Benches (x2)	N/A	\$300	N/A	N/A
Woodchip Path	0.1	\$1,022	\$400	Potential Carbon Capture
Wildflower Seed (based on patch size)	0.34	\$28	N/A	N/A
Trellis	24 ft. of Trellis Fencing	\$800	Labor for repairs when needed (staining, painting, etc.)	N/A
Flower/Garden Beds	0.015	N/A	\$557	36
Total	--	\$2,150	\$957	36

Danforth/Lawson Halls

The Danforth/Lawson area design is fairly easy to implement, and its design elements come with significant benefits. There is a demonstrated need for setting up Third Spaces on campus, thus it is a good fit for Phase 1. As mentioned above, Hugel beds, bioswales, benches, trellises, lawns, and flower bed features are all viable to implement in the first phase. However, some other features such as light fixtures, gazebo, pond, and gravel paths will be implemented in Phase 3. So, the Phase 1 features must be implemented right away so that the landscape's functions are enhanced.

Current Costs		
Element	Estimated Area (Acres)	Maintenance Costs
Lawn	2.2	\$1,575
Pedestrian Pathways	0.097	\$1,376
Flowerbeds	0.07	\$2,601
Total	--	\$2,951

References

Gravel Path: http://www.homewyse.com/services/cost_to_install_landscape_gravel.html

Pond installation: <http://www.landscapingnetwork.com/ponds/cost.html>

Red Asphalt: http://www.homewyse.com/services/cost_to_install_asphaltic_concrete_driveway.html

Lightings: http://www.homewyse.com/services/cost_to_install_outdoor_lighting.html

Gazebo: http://www.homewyse.com/services/cost_to_install_wood_gazebo.html

Estimated Costs of Proposed Changes					
Elements	Estimated Area (Acres)	Installation Cost	Maintenance Cost	Carbon Emissions (lbs CO ₂ e)	Comments
Plants (highbush blueberry, bloodroot, american holly, etc.)	N/A	Labor for installation. Dependent on number, size, and type of plants installed	General maintenance and trimmings.	Potential Carbon Capture	
Gazebo	N/A	\$20,000	N/A	N/A	Very Limited Maintenance Cost
Pond	0.05	\$44,940	N/A	N/A	Very Limited Maintenance Cost
Trellis	200 ft.	\$8,000	N/A	N/A	Very Limited Maintenance Cost
Woodchip Path	0.36	\$5,518	\$1,440	Potential Carbon Capture	One cubic yard of mulch will cover a 324 sq ft area with 1" of mulch. Estimated \$38 per yard in NH.
Benches (x5)	N/A	\$750	N/A	N/A	\$150 per wooden bench
Red Asphalt Pavement	0.1	\$12,720	\$1,418	239	
Light Fixtures	N/A	\$650	N/A	N/A	Total installation cost includes the cost for installing 7 downward facing LEDs
Wildflower Beds	0.02	\$28	N/A	N/A	Wildflower beds require limited maintenance compared to flower beds
Total	--	\$92,605	\$2,858	239	

Gateways

The design elements suggested for gateways are fairly easy to implement. It is important to include the enhancement of gateways as a priority due to their important function of generating first impressions for those visiting campus. (United States Flag Store, 2016.)

Current Costs			
Element	Estimated Area (Acres)	Maintenance Costs	Carbon Emissions (lbs CO ₂ e)
Roadways & Parking	0.485	\$6,857	1,160
Lawns	2.31	\$1,654	594
Total	--	\$8,511	1,753

References

Flag pole: http://www.united-states-flag.com/commercial-grade-sectional-20ft-flagpole-satin-finish.html?utm_source=googlepepla&utm_medium=adwords&id=89798911242&gclid=CjwKEAju55K4BRC53L6x9pyDz14SAD_21V1zB7QSi6IMT7IKnCnSgjGZJSpaQu7Z1OJkkpCx:CUZIBoC6azw_wcB
 Fieldstone: http://landscapersdepot.com/wp-content/uploads/2015/04/2015_Catalog_web_site_ersion.pdf

Estimated Costs of Proposed Changes				
Element	Estimated Area (Acres)	Installation Costs	Maintenance Costs	Carbon Emissions (lbs CO ₂ e)
Roadways & Parking	0.485	N/A	\$6,857	1,160
Lawns	2.26	N/A	\$1,618	581
Concrete	0.05	\$21,780	N/A	N/A
Flag Poles (x2)	N/A	\$500	N/A	N/A
Main Sign (New England Fieldstone Veneer)	N/A	Starts at \$11.25 per Sq Ft. (4'x3'x12' = \$1620)	N/A	N/A
Entrance Pillars (New England Fieldstone Veneer) (x8)	N/A	Starts at \$11.25 per Sq Ft. (5'x4'x4' = \$900)	N/A	N/A
Total	--	\$24,800	\$8,476	1,740

PHASE 2

General Elements:

Light Fixtures

We have proposed to replace current high pressure sodium and fluorescent lights with more energy efficient downward facing LED lights. Since a majority of lighting on campus is already downward facing LED lights on campus, this change is not a high priority. However, when finances are available, replacement should be a straightforward process as the same suppliers and contractors from the initial installation can be used again for the final replacement. This would result in a decrease in light pollution as well since the majority of high pressure sodium light fixtures are round in shape, which radiates light upward as well.

Boardwalk

The proposed boardwalk around Susan's Swamp can potentially be constructed of reclaimed wood from the removal of Colby Farm, or from Kelsey Forest. It would be fairly simple to install them around the swamp following appropriate clearing on the proposed route.

Gazebo

Gazebos must be structurally sound and may require significant labor and time in the construction process. Since we are proposing gazebos that can act as a shelter, it may require additional time to plan and pour a proper concrete foundation. This will require additional technical assistance as well.



Example of a downward facing LED on campus



Example of a boardwalk

Focus Areas:

Dining Hall

The Dining Hall east entrance is a high use area due to its central location to residence halls. The changes proposed must be gradually implemented so as to not disrupt its current functionality. However, the changes are fairly inexpensive and can be implemented following identification of appropriate contractors. These changes could also occur at a time of low-student occupancy on campus.

Current Costs			
Element	Estimated Area (Acres)	Maintenance Cost	Carbon Emissions (lbs CO ₂ e)
Patio & Walkways	0.123	\$1,744	294
Flowerbeds	0.117	\$4,347	N/A
Total	--	\$6,092	294

References

Picnic Tables: http://www.uline.com/Product/Detail/H-2127G/Outdoor-Furniture/46-Round-Picnic-Tables-Green?pri code=WY699&gadtype=pla&id=H-2127GQ&gclid=CjwKEAju55K4BRC53L6x9pyDzl4SjAD_21V1wOHarrFPQFa yV51e1tMsl8FMv8_9WVh2c3MrDdX_whoC6TLw_wcB&gclsrc=av.ds

Fire Pit: <http://www.landscapingnetwork.com/fire-pits/cost.html>

Estimated Costs of Proposed Changes				
Element	Estimated Area (Acres)	Installation Costs	Maintenance Costs	Carbon Emissions (lbs CO ₂ e)
Patio & Walkways	0.123	N/A	\$1,744	294
Flowerbeds	0.105	N/A	\$3,901	N/A
Plants (witch hazel, raspberry, blueberry, hazelnut, elderberry)	N/A	Labor costs, possibly supplemented by student volunteers through potential curricular incorporation	Dependent on number, size, and local prices of plants installed.	Potential Carbon Capture
Wood Chip Path	0.004	\$41	\$16	Potential Carbon Capture
Gas Fire Pit	N/A	\$500	N/A	17 lbs CO ₂ e per hour of use
46" Round Picnic Tables (x2)	N/A	\$1,480	N/A	N/A
Concrete Semi-Circle Seating	0.006	\$2,614	N/A	N/A
Corner Seating Bench	N/A	\$871	N/A	N/A
Painted Concrete of Colby-Sawyer's Charger Horse	N/A	Student Painting Opportunity	N/A	N/A
Total	--	\$5,506	\$1,760	294

Susan's Swamp

Susan's Swamp is currently underutilized. Through inclusion of elements such as a boardwalk, benches, informational signage, edible/aesthetically pleasing plants, and paths for easy access, the function of this space can be greatly enhanced. Since the area is overgrown and has a very wet substrate, it might take a longer time to implement changes, thus we have assigned it to Phase 2.

There are no current costs associated with this section.

Estimated Costs of Proposed Changes					
Element	Estimated Area (Acres)	Installation Costs	Maintenance Costs	Carbon Emissions (lbs CO ₂ e)	Comments
Boardwalk	300 Ft.	\$2,100	N/A	N/A	Lumber: 5/4"x6"x12'(x50) and 6"x6"x8' (x74)
Bench (x3)	N/A	\$450	N/A	N/A	\$150 per wooden bench. Could potentially use timber from forest.
Info Signs Posts (x2)	N/A	\$16	N/A	N/A	4"x4"x8' Posts
Wood Chip Paths	0.071	\$760	\$284	Potential Carbon Capture	One cubic yard of mulch will cover a 324 sq ft area with 1" of mulch. Estimated \$38 per yard in NH.
Plants (elderberry, cranberry, highbush blueberry)	N/A	\$150	N/A	Potential Carbon Capture	
Wildflower Beds	0.15	\$181	N/A	N/A	Wildflower beds require limited maintenance compared to flower beds. Coverage Rate: 1 lb covers 1,000 - 2,000 sq ft depending on density of coverage desired.
Total	--	\$3,657	\$284	N/A	

References

Wildflower beds: <http://www.vermontwildflowerfarm.com/northeast-mix.html>

Plants: <http://www.foundwellfarm.com/trees.htm>

Boardwalk: <http://www.homedepot.com/b/Lumber-Composites-Appearance-Boards/N-5yc1vZbqmc>

Wood chip paths: <http://landscapersdepot.com/wp-content/uploads/2016/03/Mulch-Soil.pdf>

Farm

The Farm design area is a significant alteration of the current landscape. It may have possible disruption in terms of noise and aesthetics to the surrounding area, and those disruptions will need to be carefully considered and monitored. There are also a significant amount of materials required in the initial setup. For our farm costs, we referred to a standard calculation of starting a farm from scratch (Fortier, 2014). The potential costs of different farm elements are tabulated below:

There are no current costs associated with this section.

Start-up Costs for Farm	
Element	Cost
Greenhouse	\$11,000
Two-wheel tractor and accessories	\$8,500
Hoophouses (x2)	\$7,000
Cold room	\$4,000
Irrigation system	\$3,000
Furnace	\$1,150
Flame weeder	\$600
Indoor seeding equipment	\$600
Hoes and wheel hoe	\$600
Broadfork	\$200
Seeders	\$300
Rakes, shovels, spades, wheelbarrow, etc.	\$200
Harvest cart	\$350
Floating row cover, anti-insect netting, and hoops	\$600
Sprayer	\$100
Harvest baskets, scales, other equipment	\$300
Electric fencing	\$500
Total	\$39,000

There is significant potential for generating revenue through selling produce from the farm. For this purpose, it may be useful to partner with the college's dining service provider Sodexo. Through this partnership, production from the campus premises itself can be utilized for making meals at the Dining Hall. This will have increased benefits of reducing our reliance on food sourced from external food retailers which are high in embedded energy due to distance and processing costs. This will in turn reduce carbon emission and financial costs. The table on the right shows the potential revenue of an organic farm.

The farm can also be used as an educational tool by incorporating Applied Sustainable Farming courses directly into its operations. This will result in labor cost reductions and provide the students with increased learning opportunities. Furthermore, the farm could provide the college with a new stream of revenue. If the college creates a summer course relating to the management of farms, the farm would be maintained while participants would be paying the institution for their participation in the class. Similar programs are offered at both Green Mountain and Hampshire Colleges. Students from other disciplines such as business, graphic design, etc. can be involved in the operations as well. In addition to this, the replacement of currently underutilized meadow with the farm will result in increased carbon capture through the crops that are grown.

Typical Annual Sales at Les Jardins Farm					
Vegetable	Total Sales	Price	Garden Space	Number of days in the garden	Profitability
Greenhouse tomato	\$35,200	\$2.75/lb	3%	180	high
Mesclun mix	\$15,750	\$6.00/lb	18%	45	high
Lettuce	\$9,000	\$2.00/unit	9%	50	high
Greenhouse cucumber	\$8,280	\$2.00/unit	2%	90	high
Garlic	\$6,600	\$1.50/unit	4%	90	high
Carrots (bunch)	\$6,515	\$2.50/unit	7%	85	medium
Onion	\$6,075	\$1.50/lb	4%	110	medium
Pepper	\$4,400	\$4.00/lb	4%	120	medium
Broccoli	\$3,900	\$2.50/unit	7%	65	low
Snow/snap beans	\$3,840	\$6.00/lb	4%	85	medium
Summer squash	\$3,690	\$1.50/lb	3%	70	medium
Green onion	\$3,360	\$2.00/unit	2%	50	high
Beans	\$3,280	\$3.75/lb	4%	70	low
Spinach	\$3,000	\$6.00/lb	3%	50	medium
Beets (bunch)	\$2,900	\$2.50/unit	4%	70	medium
Turnip	\$2,100	\$2.50/unit	2%	50	medium
Radish	\$2,000	\$1.50/unit	3%	45	medium
Cherry tomato	\$1,930	\$5.00/lb	1%	120	high
Ground cherry	\$1,650	\$6.00/lb	1%	120	medium
Swiss chard	\$1,600	\$2.00/unit	1%	90	medium
Kale	\$1,600	\$2.00/unit	1%	90	medium
Cauliflower	\$1,600	\$3.00/unit	2%	80	low
Basil	\$1,400	\$20.00/lb	1%	120	medium
Eggplant	\$1,350	\$3.00/lb	2%	120	low
Melon	\$1,225	\$4.00/lb	3%	85	low
Leek	\$1,200	\$4.00/unit	2%	150	low
Kohirabi	\$940	\$1.25/unit	1%	55	medium
Wild leek	\$840	\$3.00/unit	1%	135	medium
Arugula (bunch)	\$800	\$2.00/unit	1%	45	medium
Total	\$136,025				

(Fortier, 2014)

PHASE 3

General Elements

Pavement (Pervious, Red Asphalt, Gravel)

Changes to current roadways and walkways will likely require additional time and further analysis for determining specific costs, sourcing materials, and identifying contractors. Pavement may also require alterations of features such as existing lawns or pathways which will further lengthen the implementation process. The proposed areas would also need additional analysis to ensure that any underground infrastructure will not be disrupted. Our cost calculations for pavement included estimated costs from various contractors that were found online. The per unit costs were multiplied with the area or length of proposed pathways. (Refer to tables on the following page)



An example of red asphalt



P -lot, an example of a gravel lot already used on campus

Focus Areas

New Quad/D-Lot

This focus area requires extensive work as it involves removal of the existing parking lot and installation of a lawn. Since the existing parking lot provides an indispensable function, it is necessary to wait for the construction of the new proposed parking. This design requires significant change to the existing landscape, which takes a longer period of time. The current costs associated with the existing landscape and future costs related to the proposed design elements are shown in the table below.

As can be seen in the table, the biggest cost component is the removal of asphalt and installation of lawn. This would also result in carbon emissions due to the use of fossil fuel powered machinery in the removal process. It should also be acknowledged that this does not represent a reduction in overall parking capacity on campus, as other lots will be constructed to replace this one. Therefore, there would still be a need for snow maintenance in these new lots.

Current Costs			
Element	Estimated Area (Acres)	Maintenance Costs	Carbon Emissions (lbs CO ₂ e)
Pedestrian Pathways	0.138	\$1,957	330
Roadway & Parking	1.31	\$18,522	3,132
Total	--	\$20,479	3,462

Although this design is costly, there are benefits to installing a quad area in this location. It would create an aesthetically pleasing and functional academic area. The pathway to Ivey Science Center starting from Hogan Sports Center will be enhanced and the problem of vehicular-pedestrian conflict will be reduced by removing majority of the cars to the periphery of campus.

Estimated Costs of Proposed Changes					
Element	Estimated Area (Acres)	Installation Costs	Maintenance Costs	Carbon Emission (lbs CO ₂ e)	Comments
Red Asphalt Pedestrian Pathway	0.082	\$10,430	\$1,163	196	Installation cost includes demolition of existing parking and installation of pathway
Gazebo	N/A	\$20,000	N/A	N/A	Very Limited Maintenance Cost
Wooden Benches (x8)	N/A	\$1,200	N/A	N/A	Installation Cost is for 8 wooden benches
Bio-Swale	0.053	\$37,375	N/A	N/A	Various classes and research projects for maintenance
Lawn	0.57	\$82,000	\$408	146	Installation cost includes demolition of existing parking and installation of turf grass
Garden Beds	0.008	\$350	\$297	2	\$50 per cubic yard of compost required
Light Fixtures	N/A	\$910	N/A	N/A	Total Installation cost is for 10 downward facing LEDs
Total	--	\$151,355	\$1,868	1,963	

References

Bioswale: http://epa.ohio.gov/Portals/41/storm_workshop/lid/CRWP_LID_Cost%20Study.pdf
 Parking removal: <http://www.hometowndemolitioncontractors.com/demolition-cost/concrete-and-asphalt-removal/concrete-parking-lot-removal>
 SOD installation: http://www.homewyse.com/services/cost_to_install_sod.html
 Flower Bed: <http://www.greenmountaincompost.com/all-about-compost/coverage/#comp-calc>

Arts Building

Since the Arts building is yet to be constructed, it is difficult to implement designs for its surrounding landscape right away. The sculpture garden, art yard, and wildflower meadows would need to be installed following the completion of the Arts building to ensure that they are in an optimal location in terms of the aspect of the building. There is significant opportunity for engaging students in this design by including their artwork in the sculpture garden and art yard.

There are no current costs associated with this section.

Estimated Costs of Proposed Changes					
Element	Estimated Area (Acres)	Installation Costs	Maintenance Costs	Carbon Emissions (lbs CO ₂ e)	Comments
Gravel Path	0.04	\$5,808	\$567	96	
Trellis	32 ft	\$1,067	N/A	N/A	\$200 per 6 ft of trellis fencing
Wooden Fence	43 ft	Reclaimed wood from Colby Farm. Labor needed.	N/A	N/A	
Plants (white birch, blue wild indigo, spotted crane's bill, etc.)	N/A	Labor for installation. Dependent on number, size, and type of plants installed.	General maintenance and trimmings.	N/A	
Wooden Benches (x15)	N/A	\$2,250	N/A		\$150 per bench
Lawn (Turf Grass, Clover, & Thyme Mix)	0.07	\$13	\$50	18	3 pound bag of seed.
Wildflower	0.23	\$278	N/A	N/A	
Cement and Stone Sculpture Blocks	0.01	\$4,356	N/A	N/A	
Total	--	\$13,772	\$617	114	

References

Lawn: <http://www.homedepot.com/p/MasterGreen-3-lb-Sun-and-Shade-North-Grass-Seed-with-Micro-Clover-HDSSN003/204144472>

Kelsey Forest

Kelsey Forest is one of the most underutilized areas on campus as indicated by survey results. However, the designs suggested for the forest are fairly long-term concepts. Some of the recommendations, like proper maintenance of the forest trails and increased informational signage, are easy to implement. But the major designs, like the disc golf course and research area, require more planning and analysis, and also have a larger cost associated with them. Nonetheless, the proposed designs will help provide a social gathering space for students, faculty, and the surrounding community, and will also help them to interact with the college landscape.

Current Costs			
Element	Estimated Area (Acres)	Maintenance Costs	Carbon Emissions (lbs CO ₂ e)
Kelsey Athletic Fields	6.65	\$6,743	1,709
Roadway	1.2	\$16,967	2,869
Lawn	2.303	\$1,649	592
Sally Shaw Veitch Track & Field	2.2	\$3,500	N/A
Total	--	\$28,859	5,170

Estimated Costs of Proposed Changes					
Element	Estimated Area (Acres)	Installation Costs	Maintenance Costs	Carbon Emissions (lbs CO ₂ e)	Comments
Kelsey Athletic Fields	6.65	N/A	\$6,743	1,709	
Roadway	1.2	N/A	\$16,967	2,869	
Lawn	2.303	N/A	\$1,649	592	
Sally Shaw Veitch Track & Field	2.2	N/A	\$3,500	N/A	
Disc Golf Course	N/A	\$1,800	Occasion trail trimming can be done by student volunteers or classes	N/A	9 holes (\$200 each basket).
Outdoor Classroom	0.46	About \$400 from timber sale	Bi-annual trimmings and touch ups.	N/A	Benches and tables made from cut trees and stumps.
Total	--	\$1,800	\$28,859	5,170	

References

Timber Cuts: See Forest Management Plan

Mushroom Farm: Refer to UIVM's Best Management Practices for Log-Based Shiitake Cultivation in the Northeastern United States

Turf: http://www.denvilllenj.org/docs/Misc/Artificial_Turf_LifeCycle_Costs.pdf

Disc Golf Equipment: <https://discsunlimited.net/disc-golf-basket/lighting-db3-permanent-disc-golf-basket>

Lastly, it must be noted that the cost figures above are estimates and should be treated as such during the implementation process. The material costs are sourced from vendors that were found online, and costs may be different due to the need for additional resource considerations after site inspection. Furthermore, the college may already have partnerships with various vendors from whom the materials could be sourced at a cheaper cost.

Nonetheless, the phasing details and cost-benefit analysis give a rough idea about the scale of the proposed focus areas and the general element changes. We believe that these figures will be useful as approximations during the implementation process and that the phasing details will ensure that projects that are relatively feasible and provide immediate benefits are prioritized.

Colby-Sawyer Planting Palette

Common Name	Scientific Name	NH Native	Height	Shape	Shade Tolerance	Salt Tolerant	Moisture	Comments	
Deciduous Species									
Large Trees (Over 45 ft)	Sugar Maple	<i>Acer sacharum</i>	Yes	50-75'	Oval	Full Sun		Medium	Yellow foliage
	Red Maple	<i>Acer rubrum</i>	Yes	60-75'	Round	Full Sun to Partial Shade		Medium/Wet	Brilliant red foliage
	Silver Maple	<i>Acer sachharinum</i>	Yes	60-80'	Round/Irregular	Full Sun to Partial Shade		Medium	Interesting shape w/ Low branches
	White Ash	<i>Fraxinus americana</i>	Yes	70-100'	Oval	Full Sun		Medium	Vulnerable to Emerald Ash-Borer
	Northern Red Oak	<i>Quercus rubra</i>	Yes	70-80'	Round/Oval	Full Sun	Yes	Dry	
	White Oak	<i>Quercus alba</i>	Yes	60-80'	Round	Full Sun	Yes	Medium	
	Black Oak	<i>Quercus valutina</i>	Yes	50-80'	Round/Oval	Full Sun		Dry	
	Scarlet Oak	<i>Quercus coccinea</i>	Yes	60-80'	Oval	Full Sun		Dry	Low hanging branches
	Shagbark Hickory	<i>Carya ovata</i>	US	70-90'	Round/Oval	Full Sun		Medium	Shaggy bark, nut-bearing
	White (Paper) Birch	<i>Betula papyrifera</i>	Yes	50-70'	Irregular	Full sun		Medium/Wet	White trunks
	River Birch	<i>Betula nigra</i>	Yes	50-70'	Pyramid	Full sun	Yes	Medium/Wet	Red paper bark, some smaller cultivars
	Black Locust	<i>Robinia pseudoacacia</i>	US	50-80'	Round/Irregular	Full sun	Yes	Medium/Dry	Produces bean pods, nitrogen fixer
Tulip Poplar	<i>Lireodendron tulipifera</i>	US	70-90'	Oval	Full Sun		Medium	Grows tall with long trunk	

	Common Name	Scientific Name	NH Native	Height	Shape	Shade Tolerance	Salt Tolerant	Moisture	Comments
Large Trees (Over 45 ft)	Black Gum/Tupelo	<i>Nyssa sylvetica</i>	Yes	40-60'	Oval	Full Sun to Partial Shade	Yes	Medium/Wet	Crimson foliage, berries
	Eastern Larch	<i>Larix laricina</i>	Yes	40-80'	Pyramid	Full Sun	Yes	Medium/Wet	Deciduous conifer
	Northern Catalpa	<i>Catalpa speciosa</i>	US	50-60'	Irregular/Oval	Full Sun		Medium	Orchid-like June flowers, produces long pods
	American Basswood	<i>Tilia americana</i>	Yes	50-70'	Oval	Full Sun		Medium	
	Horse Chestnut	<i>Aesculus hippocastanum</i>	Yes	50-75'	Oval	Full Sun to Partial Shade		Medium	Nut producing, shouldn't be planted unsheltered from wind
	American Sycamore	<i>Platanus occidentalis</i>	US	30-60'	Oval/Irregular	Full Sun		Medium/Wet	Light-colored bark
Medium Trees (25-45 ft)	Crimson Frost Japanese Birch	<i>Betula platyphylla</i>		35' max	Narrow Pyramid	Full Sun		Medium/Wet	White bark with purple leaves
	Honey Locust	<i>Gleditsia triancathos</i>	US	35-45'	Round	Full Sun	Yes	Medium	Produces bean pods, nitrogen fixer, produces thin shade
	Black Willow	<i>Salix nigra</i>	Yes	25-45'	Round/Droopy	Full Sun		Wet	
	Sassafrass	<i>Sassafrass albidum</i>	US	30-40'	Pyramid	Full Sun		Medium	Fragrant, mitten-shaped leaves
	American Hornbeam	<i>Carpinus caroliniana</i>	Yes	20-30'	Round	Full Sun to Partial Shade		Medium/Wet	Smooth, Sinewy bark. Nice shape.
	American Mountain Ash	<i>Sorbus americana</i>	Yes	20-30'	Vase/Round	Full Sun to Partial Shade		Medium/Wet	White flowers, brilliant red berries, cold tolerant
	Eastern Redbud	<i>Cercis canadensis</i>	Yes	20-30'	Vase/Round	Full Sun to Partial Shade		Medium	Nice shape, bright pink spring flowers
Small Trees (<25 ft)	Apple	<i>Pyrus malus</i>		10-25'	Round/Irregular	Full Sun		Medium	Edible, many varieties
	Asian Pear	<i>Pyrus pyrifolia</i>		25' max	Round/Irregular	Full Sun		Medium	Edible

	Common Name	Scientific Name	NH Native	Height	Shape	Shade Tolerance	Salt Tolerant	Moisture	Comments
Small Trees (<25 ft)	American Plum	<i>Prunus americana</i>	Yes	15-25'	Round	Full Sun to Partial Shade		Medium / Dry	Edible
	Nannyberry	<i>Viburnum lentago</i>	Yes	15-25'	Pyramid / Irregular	Full Sun to Partial Shade		Medium	Lacey white flowers in spring, dark berries in fall
	Hawthorn	<i>Crataegus spp.</i>		20-30'	Round	Full Sun		Medium	White spring flowers, bright red fruits, attractive fall foliage
	Flowering Dogwood	<i>Cornus florida</i>	US	25' max	Pyramid	Full Sun to Partial Shade		Medium	Beautiful spring flowers
	Japanese Maple	<i>Acer palmatum</i>		15-25'	Round	Full Sun to Partial Shade		Medium	Purple leaves
	Speckled Alder	<i>Alnus incana</i>	Yes	15-20'	Irregular	Full Sun to Partial Shade	Yes	Wet	Dark bark, nitrogen fixer
	Pussy Willow	<i>Salix discolor</i>	Yes	15-20'	Vase	Full Sun		Medium / Wet	Velvety twigs
	Serviceberry	<i>Amelanchier arborea</i>	Yes	15-25'	Round / Oval	Full Sun to Partial Shade		Medium / Wet	Bright foliage, edible, showy berries
	Star Magnolia	<i>Magnolia stellata</i>		15-20'	Oval / Pyramid	Full Sun to Partial Shade	Yes	Medium	Fragrant spring flowers, striking gray bark
	Cornelian Cherry	<i>Cornus mas</i>		15-25'	Round	Full Sun to Partial Shade		Medium	Showy, edible red fruit, small yellow spring flowers, bright foliage
Shrubs (<15 ft)	Common Witchhazel	<i>Hanamelis virginiana</i>	Yes	13-15'	Vase	Full Sun to Partial Shade	Yes	Medium	Fragrant October flowers
	Beach Plum	<i>Prunus maritima</i>	Yes	10-12'	Vase / round	Full Sun	Yes	Medium / Dry	Edible, orange / red foliage. Salt tolerant
	Red-Osier Dogwood	<i>Cornus sericea</i>	Yes	4-9'	Round	Full Sun to Partial Shade		Medium / Wet	Bright red stems
	Winterberry Holly	<i>Ilex verticillata</i>	Yes	5-12'	Vase	Full Sun to Partial Shade	Yes	Medium / Wet	Red berries in winter
	American Hazelnut	<i>Corylus americana</i>	Yes	6-12'	Round / Vase	Full Sun to Partial Shade		Medium	Yields edible nuts

	Common Name	Scientific Name	NH Native	Height	Shape	Shade Tolerance	Salt Tolerant	Moisture	Comments
Evergreen Species									
Large Trees (Over 45 ft)	Red Pine	<i>Pinus resinosa</i>	Yes	60-80'	Oval	Full Sun		Dry	Long trunk. Can be coppiced and kept small.
	Eastern Hemlock	<i>Tsuga canadensis</i>	Yes	40-70'	Irregular	Partial to Full Shade		Medium/Wet	Dark green color, unique shape
	Blue Spruce	<i>Picea pungens</i>	US	40-60'	Oval	Full Sun	Yes	Medium	Blueish color, height depends on cultivar; can also be shrub
	Scotch Pine	<i>Pinus sylvestris</i>		50-70'	Round	Full Sun	Yes	Medium	Very hardy, dwarf variety is shrub-size
	Red Spruce	<i>Picea rubens</i>	Yes	50-80'	Pyramid/Irregular	Full Sun to Partial Shade		Medium	
	Norway Spruce	<i>Picea abies</i>		60-90'	Pyramid	Full Sun		Medium	Bowed branches that point up at tip
	Balsam Fir	<i>Abies balsamea</i>	Yes	45-75'	Pyramid	Full Sun to Partial Shade		Medium	Variety of cultivars, many smaller, can be coppiced
	Jack Pine	<i>Pinus baltiana</i>	US	55-65'	Irregular	Full Sun	Yes	Medium/Dry	Does well in sandy soil
	Korean Pine	<i>Pinus koraiensis</i>		100' max	Oval	Full Sun		Medium/Dry	Produces edible pine nuts
Medium Trees (25-45 ft)	Eastern Red Cedar	<i>Juniperus virginiana</i>	Yes	30-45'	Oval		Yes	Medium/Dry	Very drought resistant
	Eastern Arborvitae	<i>Thuja occidentalis</i>	Yes	20-40'	Pyramid/Oval	Full Sun to Partial Shade		Medium	
Small Trees (<25 ft)	Mugo Pine	<i>Pinus mugo</i>		15-20'	Round	Full Sun	Yes	Medium	Shrub like form
Shrubs (<15 ft)	Rosebay Rhododendron	<i>Rhododendron maximum</i>	Yes	4-15'	Round	Partial Shade		Medium/Wet	Different varieties have different color flowers, some are deciduous
	Blue Star Juniper	<i>Juniperus squamata</i>		3'	Low spreading	Full Sun		Medium/Dry	Blue color, good for foundation planting

	Common Name	Scientific Name	NH Native	Height	Shape	Shade Tolerance	Salt Tolerant	Moisture	Comments
Shrubs (<15 ft)	Mountain Andromeda	<i>Pieris floribunda</i>	Yes	4-6'	Round	Partial Shade		Medium/Dry	White spring flowers
	Dense Spreading Yew	<i>Taxus x media 'Densiflora'</i>		3-5'	Spreading	Full Sun to Partial Shade		Medium/Dry	Common foundation planting, low maintenance
	American Holly	<i>Ilex opaca</i>	US	10-15'	Round/Pyramid	Full Sun to Partial Shade		Medium	Spiny leaves and bright red berries
Evergreen Ground Covers	Partridgeberry	<i>Mitchella repens</i>	Yes	> 1'	Low Spreading	Full Shade		Medium	Leafy evergreen with red berries
	Wintergreen	<i>Gaultheria procumbens</i>	Yes	> 1'	Low Spreading	Partial to Full Shade		Medium	Minty leaves
	Christmas Fern	<i>Polystichum acrostichoides</i>	Yes	> 1'	Roseate	Partial Shade		Medium	Dark green fronds
	Bearberry	<i>Arctostaphylos uva-ursi</i>	Yes	> 1'	Low Spreading	Full Sun to Partial Shade	Yes	Medium/Dry	White spring flowers
	Vinca	<i>Vinca minor</i>		> 1'	Low Spreading	Full Sun to Partial Shade		Medium/Dry	Purple spring/summer flowers
	Lingonberry	<i>Vaccinium vitis-idaea</i>		> 1'	Low Spreading	Full Sun to Partial Shade		Medium/Dry	Edible red berries, small white spring flowers, acid loving
Flowers & Perennials									
Flowers & Perennials	Columbine	<i>Aquilegia canadensis</i>	Yes	3'	Upright	Partial to Full Shade		Medium/Dry	Irregular, bell-shaped flowers
	Joe-Pye Weed	<i>Eupatorium maculatum</i>	Yes	4' max	Upright	Full Sun		Medium/Wet	Purple fall flowers, attracts pollinators
	Blue Flag Iris	<i>Iris versicolor</i>	Yes	2-3'	Upright	Full Sun to Partial Shade		Medium/Wet	Orchid-like flowers in Summer
	New England Aster	<i>Symphyotrichum novae-angliae</i>	Yes	3-6'	Upright	Partial Shade		Medium	Purple fall flowers
	Blue Wild Indigo	<i>Baptisia australis</i>	Yes	3-4'	Upright	Full Sun to Partial Shade		Medium/Dry	Purple Spring/Summer flowers, nitrogen fixer

	Common Name	Scientific Name	NH Native	Height	Shape	Shade Tolerance	Salt Tolerant	Moisture	Comments
Flowers & Perennials	Bee Balm	<i>Monarda didyma</i>	Yes	2-4'	Spreading	Full Sun to Partial Shade		Medium/Wet	Fragrant flowers and leaves
	Labrador Violet	<i>Viola labradorica</i>	Yes	> 1'	Low Spreading	Full Sun to Partial Shade		Medium/Wet	Can also be groundcover, simple purple late spring flowers
	Bloodroot	<i>Sanguinaria canadensis</i>	Yes	> 1'	Spreading	Partial to Full Shade		Medium	White Spring flowers
	Hosta	<i>Hosta spp.</i>		3' max	Clump	Partial to Full Shade	Yes	Medium	Often browsed by wildlife
	Daylilies	<i>Hemerocallis spp.</i>		3' max	Clump	Full Sun to Partial Shade		Medium	Many varieties
	Sea Thrift	<i>Armeria maritima</i>	Yes	> 1'	Clump	Full Sun	Yes	Dry	Pink spring flowers
	Fountain Grass	<i>Pennisetum alopecuroides</i>		3' max	Clump	Full Sun to Partial Shade	Yes	Medium	
	Solomon's Seal	<i>Polygonatum commutatum</i>	Yes	6' max	Long Stalk	Partial to Full Shade		Medium/Wet	Spreads through rhizomes, edible spring shoots
	Black-eyed Susan	<i>Rudbeckia hirta</i>	Yes	3' max	Long Stem	Full Sun		Medium	Yellow summer flowers
	Canada Mayflower	<i>Maianthemum canadense</i>	Yes	> 1'	Low Growing	Full Sun to Partial Shade		Medium	White spring flowers
	False Hellebore	<i>Veratrum viride</i>	Yes	4' max	Tall Stalk	Full Sun to Partial Shade		Medium/Wet	White Summer Flowers, dark green leaves
	Jack-in-the-Pulpit	<i>Arisaema triphyllum</i>	Yes	2' max	Tall Stalk	Partial to Full Shade		Medium/Wet	Interesting cup-shaped flower, purple color
	Butterfly Weed	<i>Asclepias tuberosa</i>	Yes	3' max	Clump	Full Sun		Medium/Dry	Orange summer flowers, very drought tolerant, attracts pollinators
Ostrich Fern	<i>Matteuccia struthiopteris</i>	Yes	2-4'	Clump	Partial to Full Shade		Medium/Wet	Edible fiddleheads, feather-like fronds	

4 PRINCIPLES OF SUSTAINABILITY

Personal Well-being

Personal well-being includes all of the aspects that directly influence an individual's well-being, such as physical, mental, emotional, and spiritual well-being. The combined effects of these components determine the overall satisfaction and happiness of an individual. Personal well-being is acquired through a balanced lifestyle composed of a variety of activities, stress management, and living according to a set of personal values. Personal well-being can be promoted through the landscape by providing a balance between academic, social, and solitary environments.

Social Justice

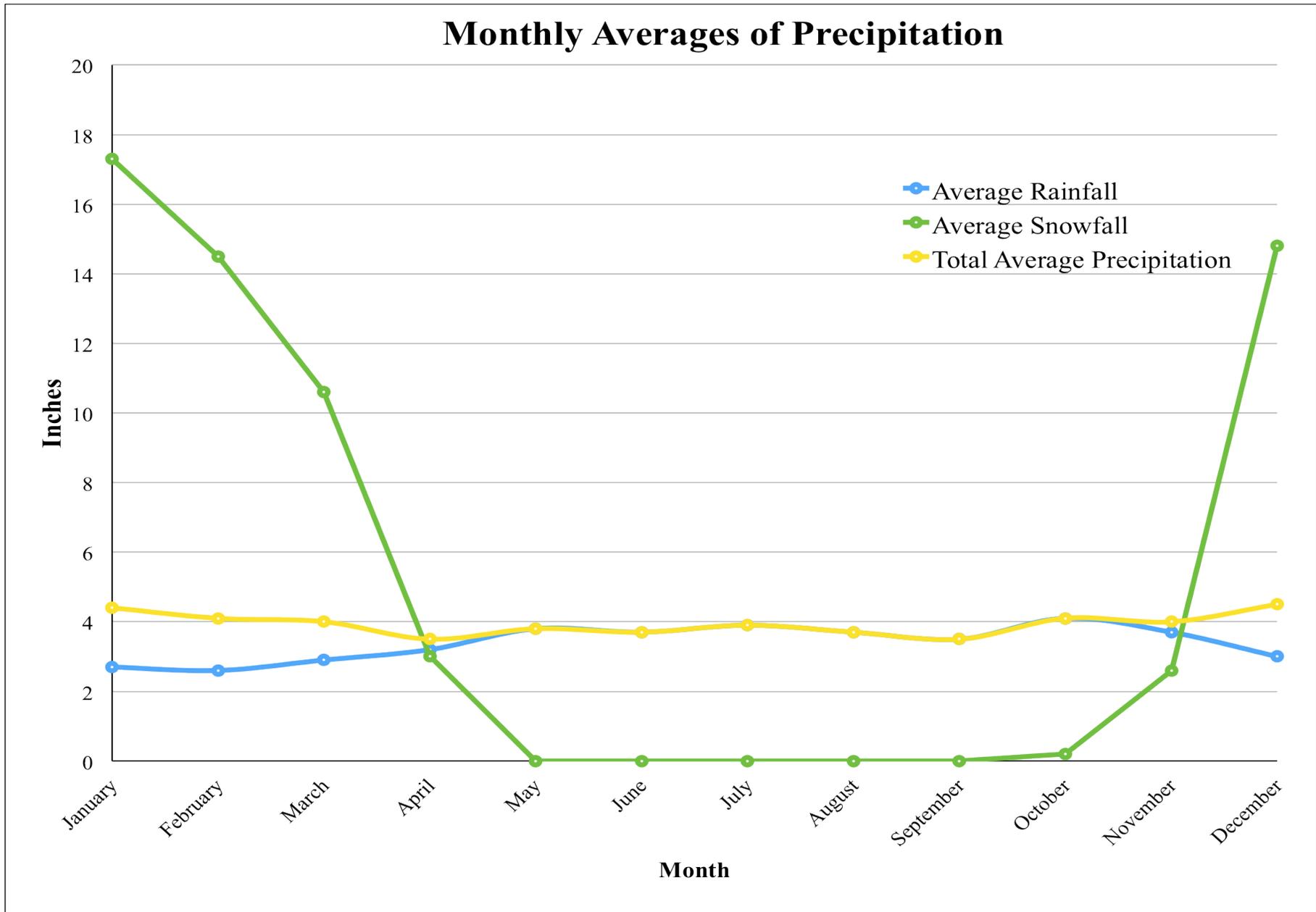
Social justice requires individuals, communities, and businesses to uphold the rights of not only themselves, but everyone on the planet. Social justice takes place at an international level and includes all inhabitants of the earth including people and wildlife. To uphold social justice, individuals must understand how their actions affect those around them, and act according to the interests of everyone who the actions affect. In an academic setting, social justice helps to keep learning environments safe and positive. By designing landscape features that serve the diverse desires of the college community, Colby-Sawyer can provide equal opportunities for all members of its diverse community.

Ecological Balance

Ecological balance takes place when a community of organisms create stability among one another, and are able to adjust to gradual natural changes as a resilient community. Ecological balance provides an environment with a balanced species composition, mutualistic relationships, and controlled resource consumption. Balanced ecosystems work as a closed-loop system in which all outputs are cycled back into the system as an input. In an academic setting, ecological balance can be promoted by integrating diverse species into the landscape and practicing permaculture principles.

Economic Stability

Economic stability is when an economy displays only minor fluctuations in output with little inflation. Economic stability can take place at the personal, organizational, national, or international level. Economic stability encompasses all components of an economy and is assessed according to the triple bottom line. The triple bottom line assesses gross profit according to what is gained for the people, the planet, and the monetary economy. When profits are positive for all three of these sectors, the required conditions for long-term stability are met. In an academic setting, economic stability can be maintained by sourcing locally, outlining project budgets, and planning landscape implementations according to a phasing schedule.



INVASIVE SPECIES MANAGEMENT

Possible methods for the removal of invasive species include:

Suffocation

- Application of 2-3 layers thick of UV-stabilized plastic sheeting over the infestation and secure the plastic with stakes or weights
- Extent of the plastic should be 5 feet past the infestation
- Leave the plastic for a minimum of 2 years
- Follow up with cover crop such as annual rye to prevent new invasions

Cutting or Mowing

- Frequency: 3-4 times a year for up to 5 years
 - Disposal, Dehydrate, and Compost
- Place herbaceous material into black plastic bags and expose to sun for a month in order to kill seeds
- Incorporate disposed invasive species into a separate compost pile
- Periodically observe pile for new sprouts

Pulling and Digging

- Remove plants roots system as much as possible to prevent regrowth
- Use tools such as weed wrench, root jack, or root talon (Mattrick, 2001)