FIGURE 1

Campus Subwatersheds

LEGEND

Subwatershed A

Subwatershed B

Subwatershed C

Subwatershed D

Subwatershed E

Wetland

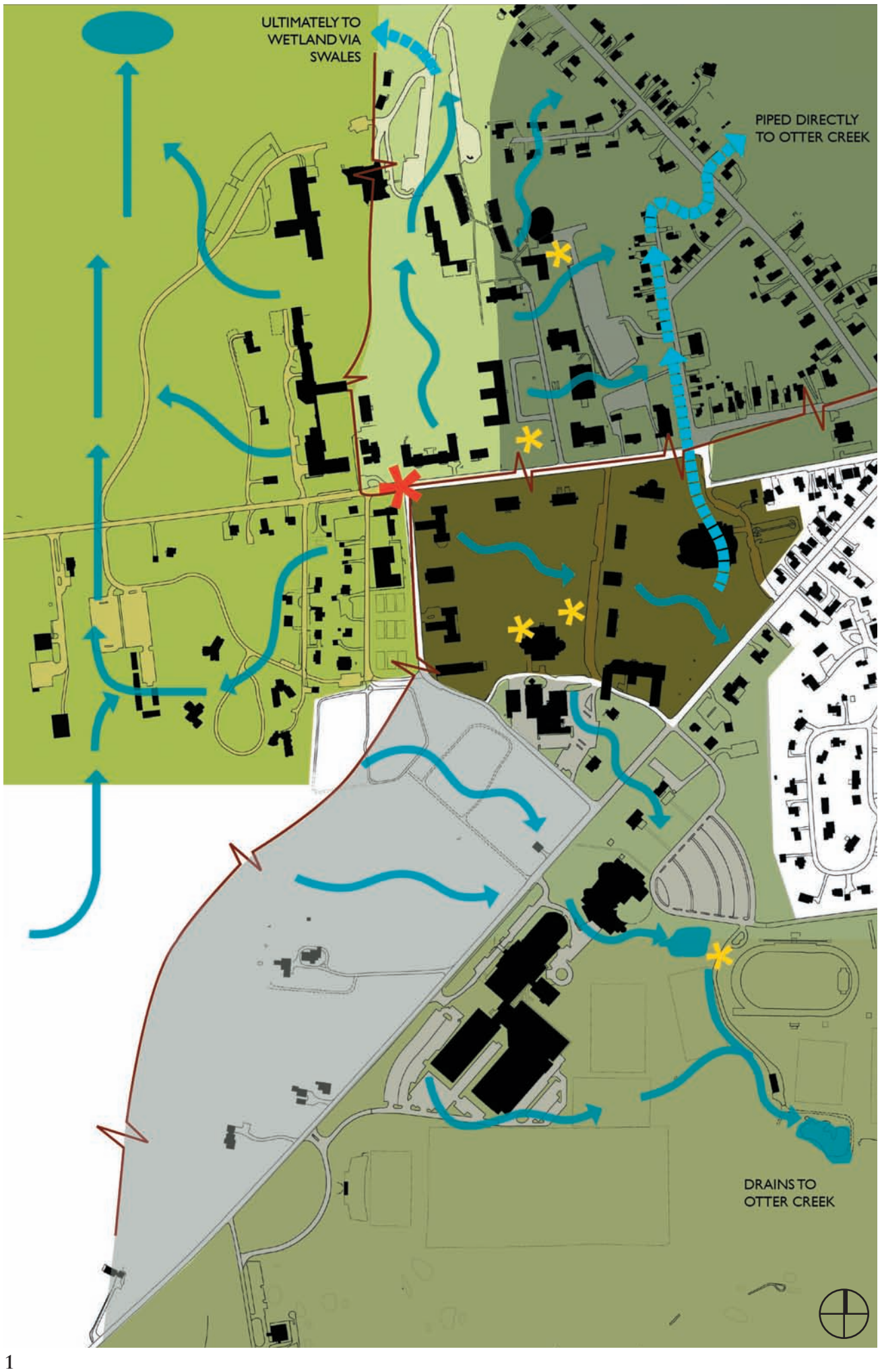
Ridge Line

Piped Below Ground

Unchannelized Surface Flow

High Point

Low Point



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north of McCullough Hall and on the west side of Battell Field result. McCullough and the bermlike condition at the southern end of Old Chapel Road block the Main Quad's natural surface drainage pattern; in spite of numerous storm drains, the area is still prone to puddles. Le Chateau Quad drains south toward College Street. The low spot just north of College Street often temporarily detains stormwater or meltwater. On the other hand, soils on the campus's ridges, particularly at Mead Chapel and Pearsons Hall, are shallow and tend to dry out, affecting the resident plant species composition and rates of plant growth.

Water Quality

Middlebury is located beside Vermont's longest river, Otter Creek. The falls at Middlebury mark an abrupt change both in fluvial and watershed characteristics of Otter Creek. After Middlebury, the river passes through agricultural lands and its catchment area and streambed both widen. Almost all of Middlebury's academic campus is drained by a sewer network directly into Otter Creek. In a few places—at the Atwater Residence Halls and Dining Hall, by the Library, and in the athletics area—raingardens and bioswales (low areas with carefully selected plants) detain and filter stormwater before it enters the sewer system. In the rest of the academic campus, stormwater has no opportunity to drop its sediment and nutrients, or to reduce its velocity and temperature before entering Otter Creek.

In other parts of campus, grass swales and wetlands filter sediments and nutrients and attenuate temperature and velocity. The athletics area east of South Main Street (Route 30) is drained almost entirely by a network of grassy swales. Stormwater from this portion of the campus is further filtered by a retention pond and habitat buffer strips before entering Otter Creek. West of campus there are extensive agricultural fields. These fields have been ditched and tiled to speed drainage. They are buffered from campus by a very narrow wetland and a ditched and straightened stream draining northward. South of College Street (Route 125), this stream corridor is maintained as meadow. Portions of it north of College Street are cultivated: it is regularly disturbed and planted for hay.

FIGURE 2

Middlebury College and Otter Creek, with Lake Champlain in the far distance

2

FIGURE 1
Trees of the Clayplain Forest

Red Oak
Quercus rubra

White Oak
Quercus alba

White Ash
Fraxinus Americana

American Elm
Ulmus Americana

American Beech
Fagus grandifolia

Red Maple
Acer rubrum

Shagbark Hickory
Carya ovata

Swamp White Oak
Quercus bicolor

Musclewood
Carpinus caroliniana

White Pine
Pinus strobus

Basswood
Tilia Americana

Sugar Maple
Acer saccharum

Eastern Hemlock
Tsuga canadensis

Bur Oak
Quercus macrocarpa

1

Broad Beech Fern
Thelypteris hexagonoptera

Large Enchanter's Nightshade
Circaea lutetiana

Winterberry Holly
Ilex verticillata

Woodland Sedge
Carex pennsylvanica

Carolina Rose
Rosa carolina

Maple-leaf Viburnum
Viburnum acerifolium

Gray Dogwood
Cornus racemosa

Witch Hazel
Hamamelis virginiana

2

Plant Communities

According to the Nature Conservancy's ecoregion classification system, Middlebury resides in the St. Lawrence-Champlain Valley Ecoregion. This ecoregion is characterized by warm summers and cold, snowy winters. The forests of the region are transitional between Central Hardwood Forests and Northern Hardwood Forests.

Just a few miles upstream of Middlebury, Otter Creek passes through New England's largest and most biologically diverse wetland complex, Otter Creek Swamps. The northernmost end of the Otter Creek Swamp Complex is adjacent to campus; it extends upstream for 20 miles to Short Swamp at the feet of the northernmost hills of the Taconic Range. Cornwall Swamp, part of the Otter Creek Swamp Complex, is a National Natural Landmark, recognized by the Department of the Interior for its amazing natural habitat values. The Otter Creek Swamps are extremely important for the exemplary natural communities and the many rare and uncommon species that reside there. They are an important lowland habitat bridge for animals that have large ranges, such as bobcat, bear, and moose. Otter Creek Swamps (portions of which are protected by Middlebury College, The Nature Conservancy, and the state of Vermont) is also one of the most important stopover areas for migratory waterfowl in the region.

The primary "landscape of reference" (the landscape type that would occur without human disturbance) of the Middlebury campus is the Clayplain Forest. This type of forest dominated the clay and silt soils of the Champlain Valley prior to European settlement. As the campus lies on a limy ridge, it would also naturally feature Transition Hardwood Limestone Forest and Dry Oak-Hickory-Hophornbeam Forest. Today, the Clayplain Forest community is extremely rare. It is considered threatened by the Vermont Fish and Wildlife Department. The portions that do remain are fragmented into islands of 100 acres or less. This is significant because, for many species, the size of contiguous areas of habitat is absolutely critical; movement between areas of forest isolated from one another by expanses of agricultural land can be difficult or impossible. Isolated areas of otherwise adequate habitat are of small benefit to these species.

The Clayplain Forest consists of a diverse mixture of species. The characteristic canopy species are red maple, sugar maple, hemlock, white ash, white pine, swamp white oak, bur oak, red oak, white oak, shagbark hickory, American beech, and American elm. Primary shrubs and herbaceous plants are maple-leaf viburnum, Carolina rose, large enchanter's-nightshade, winterberry holly, and woodland sedge. This assemblage of species and the unique soils and warm valley climate create a biologically diverse environment with innumerable ecological relationships.

While the Clayplain Forest is the regionally dominant landscape of reference, there is no single palette of plants appropriate for the variety of soil and microclimatic conditions on the Middlebury campus. On the campus's dry, rocky ridges, different landscapes of reference are pertinent: Transition Hardwoods Limestone Forest and Dry Oak-Hickory-Hophornbeam Forest. These communities share many of the same species as the Clayplain Forest, including several species of oaks and hickories, but they also feature a number of shrubs and herbs not found in the Clayplain Forest.

The existing campus vegetation consists of a mix of native and non-native species. Because of land use history and regular maintenance disturbances, the campus's soils do not currently host all the species of the landscape of reference. Some species present on campus are considered to be invasive. These include Norway maple, common buckthorn, purple loosestrife, phragmites, Japanese and common barberry, and several honeysuckle species.

FIGURE 1

Existing Landscape Plan of Campus

FIGURE 2

Existing Landscape Plan of Core Campus

LEGEND

Forest—Canopy and Groundcover

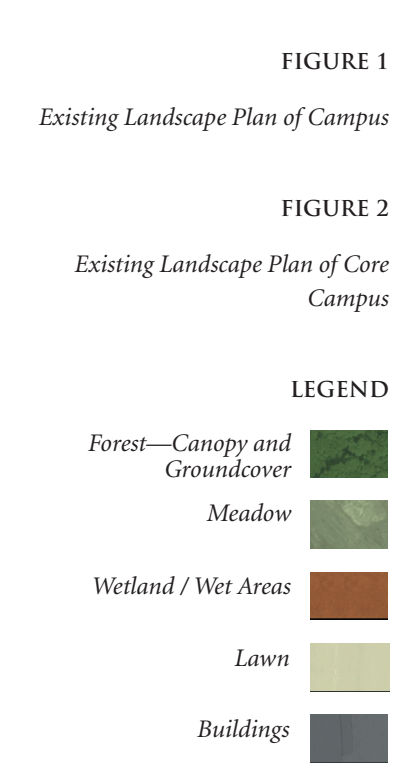
Meadow

Wetland / Wet Areas

Lawn

Buildings

Impervious Surface



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Existing Campus Landscape

The existing landscape plan shows, in broad terms, the patterns of campus vegetation as conditioned by planting, hydrology, and landscape maintenance regimes. This plan conveys the irresolute form of many of the campus spaces, documents the large areas dedicated to lawn, and reveals the degree of habitat fragmentation.

While the campus has a few really grand old trees, including good examples of native American elm, white oak, red oak, bur oak, Norway spruce, and sugar maple, a comparison to old photographs reveals that in the last fifty or so years, many of the larger trees of the campus have died off—notably, most of the elms. Not only is their beauty missed, but also the definition and shade they once gave to campus streets, paths, and spaces. Replacements have not kept pace with these losses. In some cases, plantings interfere with or fail to support the spatial coherence of the spaces they occupy. Furthermore, many of the remaining large mature trees are nearing the end of their lives.

Of the 161 acres in the core academic campus, 123 acres are lawn, buildings, walks, and parking. Lawn—both open lawn and lawn with shade trees—predominates, at 76.5 acres. Lawn is in many ways an appropriate groundcover for the campus. It is a relatively durable surface, suitable for a wide variety of uses. It is related to the greenery of the area, but more refined and controlled. It symbolizes the way the natural landscape is adapted for human use: as though a huge green carpet has been laid on the land to lay claim to it, make it suitable for outdoor activities, and to gather together the buildings of the campus. However, Middlebury's lawns require nearly continuous mowing from spring to fall, and leaf blowers and vacuumers are used in the fall; these activities contribute to Middlebury's carbon footprint.

The predominance of open lawn and of parkland—lawn with shade trees—limits the suitability of campus as habitat for a variety of plant and animal species. Large expanses of lawn are akin to desert for many bird and insect species. The rich environment of ecological niches provided by the variety of plant types and sizes at the transitions between fields and woods are missing from most of campus. Trees and forested areas exist mostly as isolated patches, which limits the campus's contribution to the regional habitat of species that require larger territories.

The College's landscape is in need of significant renovation. The natural beauty of the setting tends to mask, or deflect attention from, the gradual degradation of the campus's landscape. In many cases the soil needs rejuvenation for better use and drainage; many shrubs are overgrown; trees are often inappropriate types, or are in inappropriate locations; invasive species have infiltrated; and manicured lawn has become too dominant and extensive.

Maintenance

The landscape of the Middlebury campus is constantly shaped and controlled by human intervention. Maintenance regimes shape outdoor space and modify its character; they invite or exclude species by altering habitat. The effort of maintenance is, in effect, the expenditure of energy to alter the landscape from its natural state to a desired condition. At Middlebury, the expansiveness of the campus taxes the limits of maintenance. As the College strives to reduce its energy-related impact on local and global natural systems, it will need to make deliberate and judicious decisions regarding how its landscape is maintained.

About half of the campus is currently lawn. This is the single most resource-intensive landscape cover type on campus. It requires twenty mowing cycles per year, which take more than 9,000 work hours and consume approximately 6,000 gallons of fuel, contributing to Middlebury's carbon footprint.

Irrigation and the use of fertilizer, herbicides, and pesticides are almost entirely limited to the athletics fields and the golf course. Dragone Track and Youngman Field are typically irrigated from a well in the athletics area. This is occasionally supplemented by water drawn from Otter Creek. In years with insufficient rainfall, other playing fields receive some irrigation. No pesticides are used in this area, herbicides are used only in spot locations at the edges of playing fields, and fertilization is very minimal. Because of its specialized purpose, the golf course requires a higher level of maintenance than other landscaped areas on campus. The golf course is irrigated using water drawn from Otter Creek and stored in a pond on the course. The golf course staff has practiced "Integrated Pest Management" for the last 30 years to minimize the use of fertilizer, pesticides, and herbicides and to maximize their effectiveness. The golf course would benefit from renovation to improve drainage; this would reduce the need for chemical applications.

FIGURE 1

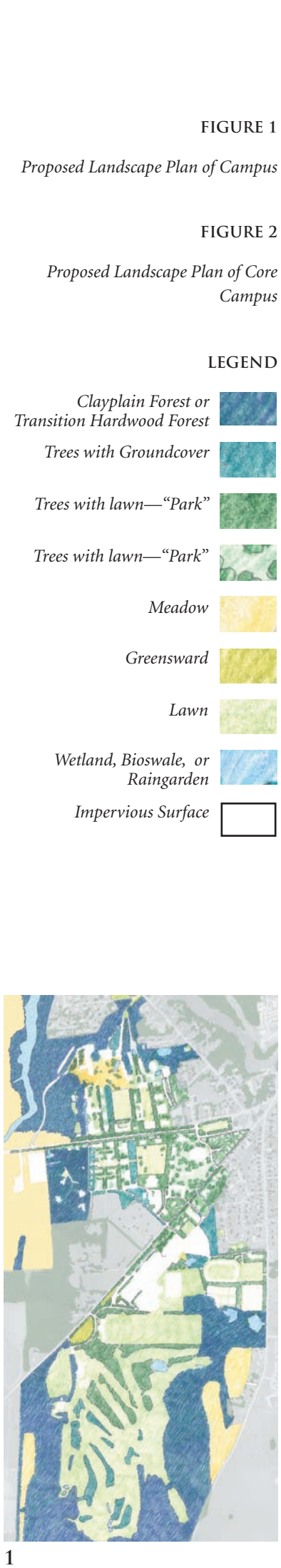
Proposed Landscape Plan of Campus

FIGURE 2

Proposed Landscape Plan of Core Campus

LEGEND

- *Clayplain Forest or Transition Hardwood Forest*
- *Trees with Groundcover*
- *Trees with lawn—"Park"*
- *Trees with lawn—"Park"*
- *Meadow*
- *Greensward*
- *Lawn*
- *Wetland, Bioswale, or Raingarden*
- *Impervious Surface*



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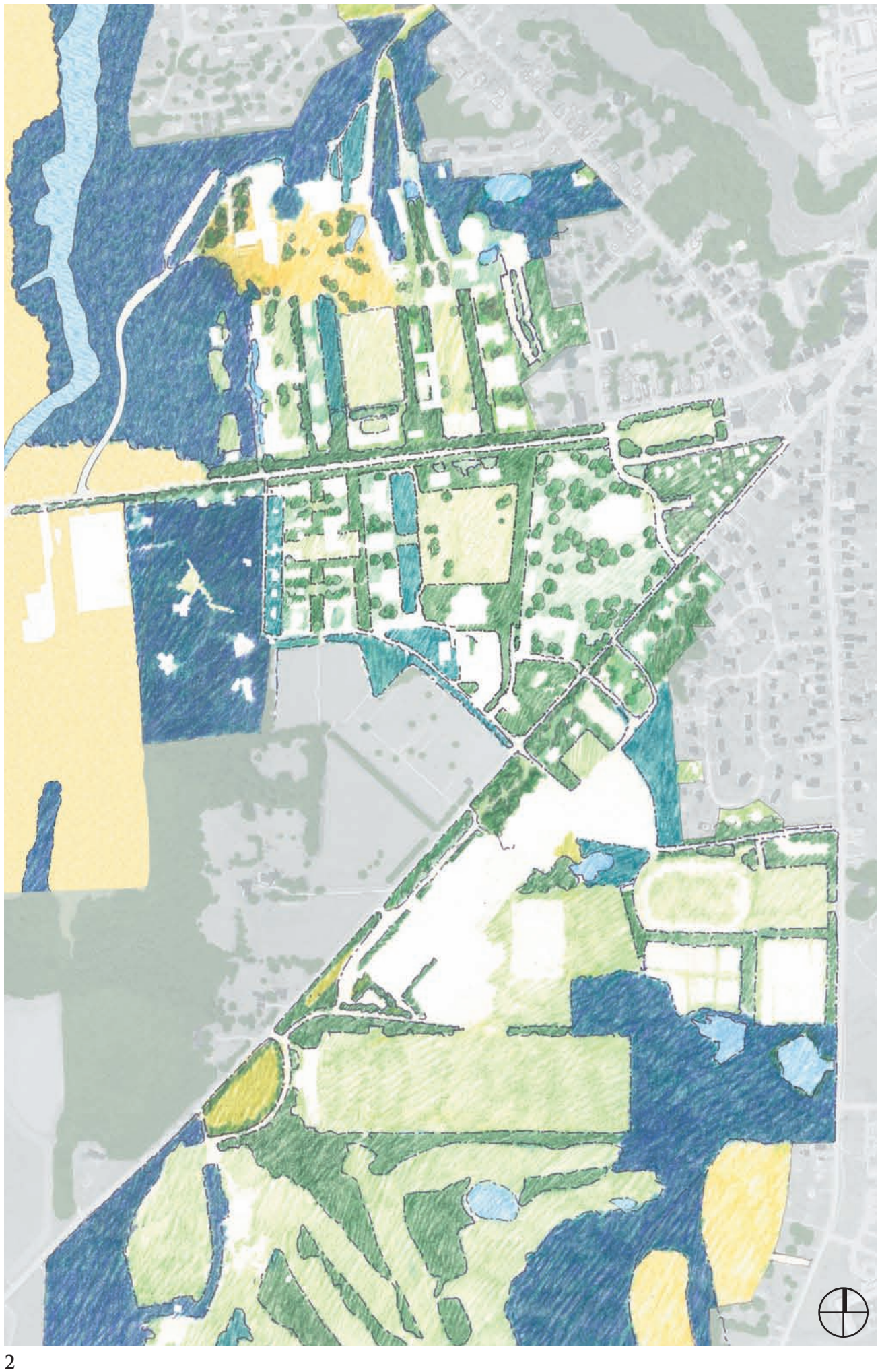

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LANDSCAPE PLAN AND PRINCIPLES

The Proposed Landscape Plan strengthens the civic structure of the campus by adding trees and other vegetation so as to frame and interconnect spaces. (The proposed campus spaces are discussed in more detail in Chapter 4: The Campus Plan.) It reduces the amount of lawn, substitutes plant communities that require less intensive maintenance regimes, and connects the campus to its surroundings.

The plan increases the amount and diversity of plant and animal habitat by adding meadow, greensward, and other alternate groundcovers to the campus, and by increasing the area occupied by woods. It preserves existing wetlands, recommends that additional wet areas be protected, and recommends that raingardens and bioswales be added to improve water quality and reduce runoff. The plan increases the connectivity of habitat for both forest and transitional species by adding corridors of trees and associated understory to link together isolated wooded areas.

The following principles guided the development of the landscape plan:

1. ***Increase the "Connectivity" of Middlebury's landscape. This applies to habitats, species selection, hydrology, and campus spaces***

2. ***Minimize the negative impact that the campus has on the environment—both regionally and globally***

3. ***Make the campus landscape a more suitable environment for the recreational and ceremonial uses to which it is put***

4. ***Enhance the campus landscape's ability to educate and inform***

Soils and Drainage

Soils and drainage should be improved so as to make the campus's primary open spaces more suitable for the heavy use they experience. Compost, already available on campus, should be inserted into the hydric soils of the primary quadrangles and the dry soils of the ridges through seasonal soil aeration. In addition, those soils should be mixed with sand where better drainage and more resilience from heavy use is desired. Adding compost and sand to the soil mix will:

- Reinvigorate the organic fraction of the soils to the benefit of plants
- Reduce or eliminate the need for synthetic fertilizers
- Enhance and sustain the soil biota
- Enable faster percolation of rainwater into the soil
- Enhance the ability of the soil to store rainwater, and so reduce the susceptibility of lawns and other plantings to drought

Subsurface drain tile should also be added in high-traffic, heavily used spaces such as the Main Quad, Battell Field, and the athletics fields. At the Main Quad and Battell Field, soil augmentation could be linked to raingardens by way of sub-surface drain tile. Battell Field should be regraded to improve drainage. Seasonal turf and soil restoration may be needed to compensate for the stresses these spaces experience.

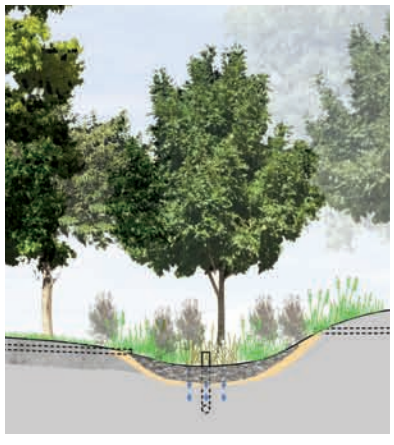
Water Quality

Middlebury should reduce its impact on Otter Creek and on Lake Champlain by installing additional bioswales and raingardens in appropriate locations to reduce the volume of stormwater runoff and to improve water quality. Raingardens temporarily impound water and allow it to soak into the ground and be transpired by plants. They are planted with wetland vegetation such as sedges, rushes, ferns, and shrubs. Bioswales convey water, but use plants, rocks, and soils to attenuate its velocity and thereby reduce its suspended solids. Raingardens and bioswales can capture both surface and sub-surface drainage. They will

- Provide focal points within larger spaces
- Diversify plant life
- Slow stormwater flow and reduce the water volume discharged to Otter Creek
- Reduce nutrient and sediment loading to Otter Creek and to Lake Champlain

FIGURE 3

Cross Section of a Raingarden



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	Lawn	*Greensward*	*Upland or Wet Meadows*	*Canopy & Groundcover or Early Successional Woodland*	*Clayplain Forest with Understory Community*	
Vegetation Area						***Total***
Existing	*269.6 acres*	*0 acres*	*57.5 acres*	*163.0 acres*	*0 acres*	490.1 acres
Proposed	*213.4 acres*	*4.3 acres*	*49.3 acres*	*21.0 acres*	*190.6 acres*	478.6 acres
Increase or Decrease	***–56.2 acres***	***4.3 acres***	***–8.2 acres***	***–142.0 acres***	***190.6 acres***	***–11.5 acres****
Fuel Use/year						
per acre	*23.05 gallons*	*2.81 gallons*	*1.41 gallons*	*0.30 gallons*	*0.30 gallons*	***Total***
Existing	*6,213.83 gallons*	*0 gallons*	*80.86 gallons*	*48.90 gallons*	*0 gallons*	6,344 gallons
Master Plan Proposal	*4,918.51 gallons*	*12.09 gallons*	*69.33 gallons*	*6.30 gallons*	*57.18 gallons*	5,063 gallons
Increase or Decrease	***–1,295.32 gallons***	***12.09 gallons***	***–11.53 gallons***	***–42.60 gallons***	***57.18 gallons***	***–1,281 gallons***
CO_2 Emissions/year						
per acre	*0.2445 MTCDE*	*0.0298 MTCDE*	*0.0149 MTCDE*	*0.0040 MTCDE*	*0.0040 MTCDE*	***Total***
Existing	*65.92 MTCDE*	*0 MTCDE*	*0.86 MTCDE*	*0.65 MTCDE*	*0 MTCDE*	67.43 MTCDE
Master Plan Proposal	*52.18 MTCDE*	*0.13 MTCDE*	*0.74 MTCDE*	*0.08 MTCDE*	*0.76 MTCDE*	53.89 MTCDE
Increase or Decrease	***–13.74 MTCDE***	***0.13 MTCDE***	***–0.12 MTCDE***	***–0.56 MTCDE***	***0.76 MTCDE***	***–13.54 MTCDE***
CO_2 Sequestration/year						
per acre	*0 MTCDE*	*0 MTCDE*	*0 MTCDE*	*1.5 MTCDE*	*1.5 MTCDE*	***Total***
Existing	*0 MTCDE*	*0 MTCDE*	*0 MTCDE*	*244.5 MTCDE*	*0 MTCDE*	244.5 MTCDE
Master Plan Proposal	*0 MTCDE*	*0 MTCDE*	*0 MTCDE*	*31.5 MTCDE*	*285.9 MTCDE*	317.4 MTCDE
Increase or Decrease	***0 MTCDE***	***0 MTCDE***	***0 MTCDE***	***–213.0 MTCDE***	***285.9 MTCDE***	***72.9 MTCDE***
Net Effect on CO_2 Emissions	***-13.74 MTCDE***	***0.13 MTCDE***	***-0.12 MTCDE***	***212.44 MTCDE****	***-285.14 MTCDE***	***-86.44 MTCDE***
Operations & Maintenance/year						
per acre	$ 219	$ 53	$ 26	$ 14	$ 14	***Total***
Existing	$ 59,042	$ 0	$1,495	$ 2,282	$ 0	$ 62,819
Master Plan Proposal	$ 46,735	$ 228	$ 1,282	$ 294	$ 2,668	$ 51,207
Increase or Decrease	***–$ 12,307***	***$ 228***	***–$ 213***	***–$ 1,988***	***$ 2,668***	***–$11,612***

1

Plant Communities

The diversity of plant species on campus should be increased. Where possible, native plants from the Clayplain Forest, the Transition Hardwood Limestone Forest, and the Oak-Hickory-Hophornbeam Forest palettes should be utilized. These should be supplemented with additional species as appropriate for specific soil conditions and environmental stresses. Invasive introduced species should be avoided. To ensure variety and disease resistance, no more than 30% of trees on the campus should be from one family, no more than 20% should be from one genus, and no more than 10% should be from one species.

The Middlebury campus could host a larger number of bird and insect species than it currently does, species that perform important roles in plant propagation. It currently lacks the appropriate habitats. In portions of campus, meadow, greensward, and forest with understory should replace existing lawns. *Greenswards* are mixtures of grasses, perennials, and annuals that are allowed to grow to a height of about 12 inches. *Meadow* has a more diverse species mixture of grasses and other herbaceous plants and is allowed to grow taller before mowing (which is done three times per year). *Forest with understory* consists of canopy trees and a variety of shade-loving perennials and ferns. Groundcovers appropriate for shady slopes vary depending on the specific conditions, but include low evergreen shrubs, a wide variety of ferns, and many shade-loving, easy-to-maintain perennials. These alternative planting regimes will add variety and seasonal interest, reduce maintenance, and improve habitat.

Existing forest patches should be restored and enhanced with plants from the Clayplain Forest, the Transition Hardwood Limestone Forest, and the Oak-Hickory-Hophornbeam Forest palettes. Invasive species should be selectively removed and native species encouraged. By favoring the Clayplain Forest, the forest seed bank will be replenished, and a more robust and resilient plant community created.

FIGURE 1

Comparison of existing and proposed Landscape Planting Regimes, showing fuel use, cost, and net effect on CO_2 emissions. See the plans on pages 100 and 102

** The Master Plan proposes an increase in forested area, transforming much of the existing Canopy & Groundcover into Clayplain Forest. CO_2 previously sequestered by Canopy & Groundcover is now sequestered by Clayplain Forest*

*** Total acreage is reduced due to an increase in impervious surface associated with new construction*

FIGURE 2

Representation of alternative ground covers on the west slopes of Battell Field. A mixture of ferns, trees, junipers, and perennials would create a lush garden-like effect

2

FIGURE 1

Existing Habitat Connectivity: Forest patches are separated by farmland and campus lawns, significantly reducing their value as habitiat for numerous plant and animal species

FIGURE 2

Proposed Habitat Connectivity: New forested areas link existing forest patches along Otter Creek and on Middlebury College's ridges

LEGEND

Existing Forest Patch

Existing Forest Interior (with 150′ forest buffer)

Proposed Forest Patch

Proposed Forest Corridor

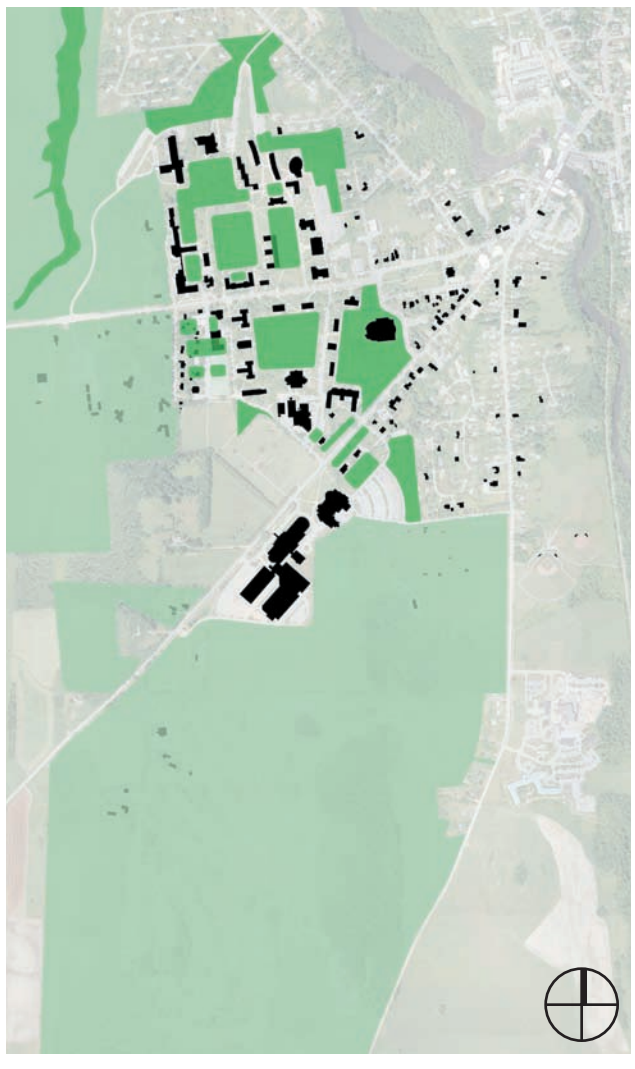
Wetlands

1

2

Habitat Connectivity

Habitat fragmentation is one of the primary causes of the ongoing Holocene Mass Extinction. Otherwise suitable habitat is rendered useless to particular species when it is divided into small areas, and when these areas are too distant from one another. Because of the interdependency of species within an ecosystem, when one species is lost, others can no longer survive. Middlebury should not only preserve habitat, but also create biologically healthy and diverse habitat corridors between otherwise isolated areas by enhancing and interconnecting the woodland patches bordering Otter Creek and those running along Middlebury's ridgelines. These habitat corridors will consist of woods and the associated transitional environment at the edges of open spaces. A diverse plant palette in these areas, one emphasizing native species, will strengthen and enrich insect and avian communities. This will help buffer Otter Creek from agricultural and other disturbed lands and contribute to the linked habitat systems along Otter Creek and the Otter Creek Swamps.



3

Green Reserve

Middlebury College should establish a Green Reserve to protect critical open spaces on campus. The spaces will vary in character and function, ranging from highly maintained and heavily used quadrangles in the center of campus to natural wooded areas and agricultural land in the periphery. The Reserve will serve numerous purposes: it will reinforce the civic structure of the campus by designating certain areas as open spaces that should be preserved free of buildings indefinitely; it will protect particularly important or sensitive areas of habitat from development or interference, and improve their interconnectedness; it will conserve the College's extensive, but finite, land resources; and it will buffer surrounding residential areas from the College.

The primary spaces of the campus's civic structure form the core of the Green Reserve. In addition, the Green Reserve incorporates wooded areas and fields that provide valuable ecological services, recreational areas, and preserve the sense that the campus is nestled into the Vermont countryside. The Green Reserve is a fundamental part of the College's program of preservation and restoration of the natural environment. The College's open space system should be a living laboratory that illustrates the continuity of and conjunctions between its landscapes and ecosystems. The establishment and protection of native plant habitats and processes should be an essential part of the higher learning experience, as well as part of the College's societal responsibility. By channeling the growth of facilities, the Green Reserve prevents sprawl. It supports the sense of community by maintaining the campus as a coherent and usable environment. The Green Reserve protects adjoining residential areas from noise and interference, and shields their views.

The Green Reserve is differentiated into two zones (see Figure 3). Zone 1 consists of the parks and quadrangles of the central campus. Zone 2 consists of the woods, meadows, and athletics fields that surround the central campus. Zone 1 should be considered as analogous to Central Park in New York City—no buildings may be built there. Zone 2 consists of areas that are rural in character, or consist of athletics open space. Detached buildings may be built in this zone, but they must be related in form and character to the use to which the land is put. Any large buildings in this zone should be subject to Master Plan Committee review (discussed in more detail in Chapter 10: Implementation).

FIGURE 3
Middlebury College Green Reserve

LEGEND

Zone 1

Zone 2

Areas within Zone 2 that require additional protection should be established on the basis of a land value survey (see Landscape and Open Space recommendation 9, page 52).

While this Master Plan is focused on the central campus and the surrounding areas indicated on the Green Reserve plan, the farmland to the west of campus, and the land Middlebury owns between South Street and Otter Creek, should also be treated as Zone 2.

Use, Comfort, and Delight

Landscape design should be utilized to make indoor and outdoor spaces more pleasant, usable, and beautiful. Many of the campus's open spaces would benefit from additional trees at their edges to increase their sense of enclosure and protect them from wind. Deciduous trees should be used to shade buildings from hot summer sun and allow winter sunshine to warm facades and building interiors. Evergreens should be used judiciously to shelter entries from predominant winds without shading or compromising sight lines. Small-scale spaces, suitable for outdoor classrooms and study, and transitional spaces at building entrances should be enhanced by planting, site furniture, and site design.

Maintenance

The Master Plan recommends that the amount of lawn on campus be reduced by about fifty-six acres and replaced by various types of groundcover that require less work and expense to maintain. This will not only make the campus a richer environment, but will reduce its contribution to global warming by reducing the greenhouse gas emissions associated with maintenance. Alternative planting regimes can be grouped into four broad categories: greensward, meadow, trees with shade-loving groundcover, and forest with understory.

Greensward is the least labor-intensive cover and requires very little in capital expense to establish. The grasses grow their own seed heads and self-seed every year. With the exception of a five-foot width of mown grass on both sides of paths, mowing cycles can be reduced from twenty cycles to six cycles per year, reducing the consumption of fuel and labor by 70%.

Meadow is more capital-intensive than greensward. While lawn can be "let go" to create a greensward, it must usually be removed entirely before a proper meadow can be established. Meadow requires a more diverse species mixture of grasses and other herbaceous plants than a base of lawn will provide. Under certain conditions, meadow can be established from seed, but if the existing soil is not treated to prevent the reemergence of old lawn and weed species, installation from much more expensive, tightly packed plugs is more effective. In the long term, meadow is less expensive to maintain than greensward, requiring only half the number of cutting cycles annually. As with greensward, a five-foot width of grass on both sides of paths should be mowed.

Meadow and groundcover options have considerable capital cost implications. While meadow can be established for a few dollars per square foot, the installation of herbaceous groundcovers using container-grown plants may cost twice as much. The expense and effort required by alternative groundcovers will be highest during their first two to five years and will decline thereafter.

Sixteen acres of lawn are currently "parkland"—areas of lawn shaded by canopy trees; some of it is on level ground, some is on slopes. This is a particularly resource-intensive landscape cover type because mowing around trees is time consuming, especially on slopes, and because it is difficult to establish and maintain lawn in shady conditions. Some of the existing sixteen acres of shaded lawn can be replaced with groundcover that:

- Varies more in appearance from season to season
- Offers a more dramatic backdrop to open spaces
- Requires less maintenance once established
- Broadens species diversity
- Guides pedestrian traffic along paths, and thus reduces soil erosion and compaction

In addition, the amount of forest with understory on campus should be increased. The establishment of Clayplain forest should be encouraged by the removal of competing species. (See Figure 1 on page 104.)

The landscape plan should be realized in phases. As soon as possible, the plantings shown on the proposed landscape plan should be begun, particularly the projects indicated in the Campus Plan chapter of this Master Plan. As time goes by and existing plantings at odds with the proposed plan grow old and die, their loss should be used as an

opportunity to clarify open spaces by replacing them with trees located according to the Campus Plan.

Some existing vegetation should be removed to improve views. The east face of Mead Chapel ridge is heavily overgrown in places. Simply removing low-hanging limbs and selectively removing evergreen trees would help clarify the space by allowing the facades of the buildings along the ridge line to help define the Main Quad and to open views from the ridge. Similarly, trees on Pearsons Ridge should be selectively limbed up to preserve views.

Middlebury has an ongoing program to minimize its use of herbicides, pesticides, and fertilizer. Improvement of soils by the addition of compost will aid this effort.

Site Furnishings

Site furnishings, such as benches, light and banner poles, bollards, curbs, drains, and signage should be part of a larger "eco-purchasing" plan. Their materials, construction, methods, and maintenance should be reviewed with regard to sustainability. For example, wooden benches should be made of sustainably and locally harvested timber, lighting should be "Dark Sky" compliant, and where appropriate, plants should be locally grown and have local genetic provenance.

The Educational Landscape

The campus landscape is an educational resource. The campus should be thought of as a member of the faculty, enabled to teach, to contribute to research, and to inspire. By doing so, the landscape will convey lessons in ecology, economy, art, and culture. Where appropriate, engaging issues such as stormwater runoff, soil augmentation, and microclimate enhancement in didactic ways will help the landscape convey more to its users, and will make the campus more responsive to its climate and physiography.

Examples of ways the landscape can do this include:

- Utilizing a diversity of plant types, and incorporating a variety of habitat types
- Adding informative labels and descriptions
- Representing and explaining student and faculty projects
- Making a variety of ecological processes visibly present on campus

Recommendations

1. ***Improve soils in heavily used areas of campus by adding sand and compost***
2. ***Improve drainage in heavily used areas by regrading and adding sub-surface drain tiles***
3. ***Add raingardens and bioswales to reduce the amount of and improve the quality of stormwater runoff***
4. ***Preferentially utilize native plant species and plants with native provenances***
5. ***Do not use invasive non-native plants***
6. ***Where appropriate, remove invasive non-native plants***
7. ***Establish a Green Reserve to protect sensitive areas***
8. ***Develop management plans to protect water quality and preserve natural and semi-natural habitats***
9. ***Use campus landscape design to support the campus's civic structure***
10. ***Enhance small scale spaces for outdoor teaching, study, and informal gathering***
11. ***Selectively remove and trim vegetation to preserve views***
12. ***As the campus grows and vegetation is maintained and improved, preserve views from campus out to the surrounding landscape***
13. ***Improve the microclimates of buildings and outdoor spaces by appropriate planting***
14. ***Reduce the amount of lawn to reduce campus landscape maintenance's contribution to Middlebury's greenhouse gas footprint***
15. ***Replace lawn with greensward, meadow, groundcover, and forest, to augment the quantity and diversity of plant and animal habitat***
16. ***Protect existing trees and other plantings from damage during construction projects***
17. ***Plant additional trees and create new forested areas and edge transitional zones to increase the connectivity of plant and animal habitat***
18. ***Gradually transform existing forested areas into Clayplain Forest by encouraging appropriate species and selectively removing inappropriate species***
19. ***Continue to reduce the use of herbicides, pesticides, and inorganic fertilizers, with a goal to eliminate their use***
20. ***Replace synthetic pesticides with biological ones***
21. ***Consider sustainability when selecting site materials and furnishings***
22. ***Augment the ways the landscape educates and informs its users***