Landscape and Watershed

> "Am I not right in feeling that it is especially the duty of an institution of learning which is possessed of such an example [of landscape beauty] to treasure it for future generations with the most sympathetic care for its scientific as well as for its aesthetic value?" (Michael Van Valkenburgh Associates, 2010, p. 44)

What Frederick Law Olmsted, Jr., wrote in 1902 is true today. In addition to its beauty, the College's wooded, glacial-till landscape at the edge of Lake Waban is a resource as precious as any financial asset we own—whether historic building or irreplaceable piece of art—and merits the most sustainable stewardship possible.

Unlike many other colleges and universities formed in the late nineteenth and early twentieth century, when campus design sought to showcase control over the environment, Wellesley made its landscape a primary, structuring feature of the campus. The College's mission of educating and empowering women by connecting them to their world was embodied in the landscape, which acts as a feminist critique of traditional campus-making. The Wellesley College campus was not designed to create efficiency and convenience, but to be a place where people move through the landscape, experience natural surroundings, and meander in a way that promotes physical and emotional health. The way from point A to point B is rarely a straight line here, which may have something to do with why Wellesley women are renowned for long vision, creative solutions, and navigating complex systems and organizations.

This historic campus landscape, with its remarkable biodiversity, is a living laboratory with tremendous potential: We must care for it to ensure that our environment continues to match our mission by creating a sustainable land use design that reflects and promotes our educational ideals. This would yield a wide range of potential benefits in aesthetics, community health, curriculum, and scholarship.

The College landscape today spreads across approximately 500 acres, 22 of which are managed by the Wellesley College Botanic Gardens, with the remainder—including the 90 acres of Nehoiden Golf Course—in the hands of the Grounds Department. The watershed we occupy is an integral part of this landscape. Wellesley is the only college or university in Massachusetts, and one of very few in the country, that manages and supplies all of its water needs from on-campus sources. Because we are part of the larger Charles River Watershed, our sustainable practices also have a broader influence on our neighbors and the region. We owe it to future generations to maintain the health, utility, and beauty of these systems.

How We're Doing

Wellesley College has a deep history in sustainable thinking about its landscape, starting with founders Henry and Pauline Durant, who gathered depleted agricultural parcels and re-naturalized the landscape by working with the land rather than shaping it. Appreciation of nature at the scale of natural systems was built into the landscape design from the very start. The Durants' vision gave women a place in the landscape from which they were well positioned to learn about the world and encouraged to experience it physically, through, for example, required morning walks designed to awaken bodies and minds—unusual at a time when prevailing notions held that women were fragile, indoor creatures. Olmsted was inspired by the College's glaciated landscape to lay it out in a way that facilitated biodiversity and green infrastructure: buildings arranged in three-sided, south-facing, micro-climatically sheltered quadrangles on wooded hilltops overlooking open valleys filled with meadows that infiltrated and directed the water to the lake. In the post-World War II period, however, with scarce resources, loss of institutional memory, and the rise of automobiles and power lawn mowers, Olmsted's approach was less faithfully followed, and the landscape suffered. The rerouting of College Road in the 1960s made campus more car-friendly, but fragmented the landscape and transferred the overland drainage into pipes, a major departure from the original reliance on natural infrastructure. The ecologically rich meadows were turned into a monoculture of lawn grass that required weekly motorized mowing and its attendant demand for fossil fuels; some meadows were turned into parking lots.

The 1998 Campus Master Plan (98CMP) by Michael Van Valkenburgh Associates sought to reconnect the valley system and revitalize ecological diversity on campus, strengthening infrastructure by embracing natural systems rather than attempting to control them. Alumnae Valley, for example, which drains 80 acres of campus watershed, was thoroughly rehabilitated in the first decade of the 2000s. It is now a working landscape: Toxic waste from a former coal-to-gas processing site is systematically removed; classified soils were utilized but insulated by 30 inches of clean soil above for planting and walkways; a wetland was restored and contaminants safely contained; the cattail marsh and a series of infiltration swales cleanse the water and provide habitat where there had been acres of impermeable surface parking. Since the gigantic Paintshop Pond remediation project was completed in 2004, all campus land west of a line between Hazard Quad and the Boat House—including the Campus Center, Alumnae Valley, and Davis Parking Garage—has been irrigated with water from Lake Waban, primarily to reduce potable water use but also to improve the health of the lake and its aquatic life. Other recent achievements in sustainability include:

- 5.7 acres of pavement and parking restored to landscape
- 60 acres of campus intensively renovated or restored
- Over 7,000 trees, 25,000 shrubs and tens of thousands of herbaceous perennials including wetlands plants planted in renovated areas
- 8 acres of wetlands restored at Paint Shop Pond and Alumnae Valley
- Reduction of potable water consumption by 38.6% since 1999
- Alumnae Valley received the highest honor of Design Excellence from the American Society of Landscape Architects.

This progress in restoring and renewing landscape sustainability resulted from substantial investment after 1998 and included numerous infrastructure upgrades throughout campus.

The Grounds Department has cultivated a skilled staff of 16 highly trained landscape professionals. Construction projects in recent years have presented challenges to landscaping efforts, but the Wellesley 2025 (W2025; also known as Campus Renewal) project team is more successfully collaborating with the landscape team. Each area on campus has a landscape management program, and integrated pest management (IPM) principles are rigorously followed campus-wide. Soil testing and pest management are linked to the specific place and time of their application. All organic debris (including stumps but excluding invasives) goes into compost and is eventually deployed on campus as mulch or loam, returning nutrients to the landscape. In keeping with the integrated design of the campus, barriers among divisions responsible for the landscape (e.g., Nehoiden groundskeeping team and playing fields groundskeeping team) have been broken down and these caretakers now work together more effectively.

The Botanic Gardens, too, are managed in an ecologically sound manner: Most plantings are well established and require very little water or fertilizer, and a comprehensive maintenance plan has been created. This is critical to Wellesley's potable water situation, because our wells are in the midst of the WCBG. The Edible Ecosystem grows on a slope above the campus wells, and this garden has been designed to improve the quality of the runoff into the wells. The new path there (basalt and schist stone-dust) was completed in spring 2014 with permission from Massachusetts Department of Environmental Protection (Mass. DEP); Botanic Gardens staff worked to make the path as accessible as possible while still being permeable for better water infiltration.

Stakeholders agree that maintenance and sustainability practices are much improved and heading in the right direction, though continued support from the community is needed.

Some trends, however, are less encouraging, and point to opportunities for education and fine-tuning our approaches. The economic downturn of 2008 slowed the professionalization of landscaping staff. Legal, logistical, and aesthetic resistance to allowing students and faculty to investigate the landscape for academic and research work (e.g., sampling in Lake Waban, measuring water quality, studying green roof construction) at times seems excessive. Community expectations in some areas are extremely (and resource-intensively) high, such as bare pavement on all walkways after snowstorms, grass mown to certain heights, or leaves removed from planting beds. The long-term work of following through on landscape maintenance, especially in the wake of construction and renovation projects, is at times postponed for budgetary reasons, giving the appearance of neglect.

Measuring the state of the landscape and watershed takes place on several fronts. Grounds crews test the soil on at least an annual basis. The water treatment vault just northwest of the Science Center is also used for regular measurement of water quality. The Mass. DEP requires compliance with the College's Water Management Act Permit for all water uses on campus; this includes both potable and

nonpotable water from ground and surface waters on campus. The College's Annual Statistical Report (ASR), is one of many reports submitted to Mass. DEP on an annual basis that describes water use on campus. Our Environmental Health and Safety (EHS) office maintains a database on use of pesticides, herbicides, fertilizers, etc., with data from Grounds personnel tracking amounts, dates, totals, and so on. A great deal of hazardous material testing is done on campus; the EHS Construction/Renovation checklist, for example, is followed before all construction projects are undertaken to record the condition of the site before work begins. The College is required by the Massachusetts Water Resources Authority (MWRA) to test wastewater that goes from campus into the sewer system. EHS continuously compares our practices to those of other colleges, and Wellesley is a member of several leading-edge environmental health and safety organizations (e.g., Campus Consortium for Environmental Excellence, or C2E2).

Main Issues/Primary Goals

1. Make the campus a fully regenerative landscape
2. Promote sustainable and educational human interaction with the landscape
3. Improve sustainability of water management

Recommended Strategies

Abbreviations of Responsible Parties:

WCBG=Wellesley College Botanic Gardens
FMPD=Facilities Management and Planning Department
OS=Office of Sustainability
EHS=Office of Environmental Health and Safety
G=Grounds Service
A=Academic community
PA=Public Affairs
CP=Campus Police

Issue	Strategy	Responsible Party	Status	Phase
LW1.1	Promote a systems approach to landscape management that boosts natural self-regeneration	WCBG G OS A PA	Ongoing	1

The College should aim to establish a "regenerative" landscape (to borrow a term from agriculture), managing soil, plant health, plant diversity, and dependent fauna with this goal in mind. The

regenerative approach seeks to make biological communities self-renewing, self-sustaining, even self-repairing. First, often overlapping, steps toward this include:

1. Remediation. Restore environmentally fragmented sites with a sustainable approach using green infrastructure, as in Alumnae Valley. Target areas for restoration that will beautify the campus and aid education, e.g., Severance-facing slope of Jewett Hill could become a site where flowering herbaceous plants and shrubs replace lawn. Reduce erosion on hillsides throughout campus (see 2, below).

2. Plants. Boost plantings on campus opportunistically. Plant trees close together (following the British model) in a naturalistic way to encourage a shaded understory and straight, vertical growth in selected areas. Plant long-lived, native species of herbaceous plants, shrubs, and trees. Tailor management of plant nutrients for each plant community.

3. Soil. Soil is a living system in its own right and is the foundation of the landscape. We should continue to emphasize soil management to achieve healthy structure, biological diversity, and mineral balance. Expand innovative soil management practices that approach landscape as a system. Restore organic matter and calcium in soil (e.g., by adding crushed limestone and composted plant litter). Monitor soil biology levels and use compost or compost teas to balance the bacterial and fungal communities as needed for plant health. Calcium and other beneficial minerals have been leached out by acid rain and organic matter is lost by removing all plant litter (leaves, twigs, grass cuttings, etc.) from the soil. Careful irrigation practices are crucial to healthy soil. Continue and expand such laudable current projects as the soil manufacturing effort on Service Drive. At Nehoiden Golf Course, add more natural areas and continue to use Audubon International's golf course certification program (Audubon International, n.d.). Increase and sustainably manage natural areas (e.g., Paint Shop Pond, Waban Brook, Fuller Brook).

4. Invasives. Address invasive species through gradual removal of invasive plants and trees, and employ integrated pest management to discourage, reduce, and remove invasive fauna. Encourage and support desirable types of plants and grasses that will compete for space, water, and sunlight against invasives.

Issue	**Strategy**	**Responsible Party**	**Status**	**Phase**
LW 1.2	etering, measurement, and environmental testing wher	FMPD OS EHS G	Some in place; more would be better	2

		WCBG		

"You can't manage what you don't measure" is a mantra of C2E2 (Campus Consortium for Environmental Excellence, n.d.). Metrics will ensure that we know what is needed and that we are on track. First steps include:

1. Inspect. Institute regular, systematic inspections of the landscape and watershed by qualified outside observers, perhaps every two years. Seek out ecological-systems-based consultants (e.g. Applied Ecological Services, Interfluven, Haley & Aldrich).

2. Monitor. Expand and regularize the existing Grounds Service soil testing regime campus-wide. Establish baseline soil measurements with top criteria as pH, calcium, phosphorus, organic matter, and soil biology. Monitor trends at a dozen specific sites representative of specific, varied habitats across campus landscape.

3. Expand. Investigate ways faculty and students may participate and broaden or deepen testing and sampling efforts. Use cutting-edge technology (including GIS and smartphone apps) when possible.

4. Communicate. Boost communication between FMPD and academic departments (e.g., staffers currently sampling the water supply and Geosciences, Chemistry, and Biology). Log data on water quality in a way that makes it usable for scientific study or publishable by scientists in academic departments. Make the data transparent and easily accessible to the campus community, such as on large video screens in public spaces on campus.

LW1.3	Revitalize and use the landscape master plan (98CMP)	FMPD G WCBG A		1

Although nearly 20 years old, the 1998 Campus Master Plan (98CMP) compiled by Michael Van Valkenburgh Associates is a rich resource. We should continue to review and update this plan to ensure its ongoing status as a guiding document. We recommend:

1. Assessment. Starting with an assessment of what's been done and how it has affected campus culture, landscape, and infrastructure, we urge a periodic revisiting of the plan.
2. Completion. Complete the remaining implementation projects of the plan that will make the campus even more sustainable. (Looming among these is to renovate or consolidate the remaining parking lots that are paved with impervious materials—likely a phase 3 project; see LW1.6 below.) Build on the important landscape goals set in the 98CMP by supplementing it with such

items as maintenance of the landscaping it had recommended. Include ongoing and evolving work as driven by goals old and new.

3. Revision. Systematically revisit the 98CMP to incorporate more recent discoveries and developments in eco-friendly practices and update goals accordingly. Create a short digest of 98CMP recommendations for dissemination to all responsible parties.

LW1.3	Continue to hire and develop expert staffs to steward the landscape	FMPD G WCBG OS	Partway there; budgets and hiring freezes have somewhat impeded progress	1

The enormous, biologically and aesthetically complex landscape of the College demands that we continue to build a scientifically sophisticated, qualified landscaping staff in Grounds and WCBG whose members take a holistic, systems-based approach that emphasizes sustainable practices. Grounds and WCBG already have a good working relationship, and they should continue to build on that foundation by meeting more regularly to exchange ideas and coordinate landscape management techniques. All of these landscape stewards should have the cleanest equipment to do the job. Replace as many internal-combustion-engine landscaping vehicles and tools as possible with manual or electric alternatives.

LW1.4	Continue to collaborate prudently with the best possible landscape experts/consultants	G FMPD WCBG A		

Involve landscape architects at the earliest stages of all building projects, including W2025, and constantly revisit our partnerships to ensure that we hire the firms best suited to our vision of a regenerative landscape. Michael Van Valkenburgh Associates and Andropogon Associates have been past and/or current partners. When hiring or working with any consultants, make sure to consider future use and maintenance in design plans, and seek the highest sustainability standards affordable.

1. Dissemination: Inform each project team (internal and external) of the College's overarching sustainability goals for the campus and the 98CMP principles and goals for the landscape.

2. Integration: Encourage integration of sustainable design principles at the beginning of the planning and design phase of projects to insure that the project's relationship with the landscape is a foundation of the design.

LW1.5	Embrace Lake Waban as part of the campus landscape	FMPD G PA EHS OS	Ongoing	1

Integrate Lake Waban, recognized by the Commonwealth as a "great pond," more fully into the campus landscape. Steps include:

1. Preservation. Preserve in perpetuity the berm along Lake Waban's northwestern shore that separates the lake from the Paintshop Brook marsh to prevent the marsh under the boardwalk from draining itself and disappearing.

2. Investigation. Incorporate study of the lake's water, soil, flora, and fauna in academic courses. Investigate the possibly detrimental effects of mute swans on vegetation in the lake's littoral zone.

3. Improvement. Take any necessary steps to discourage or remove invasive species. Restore the areas of the lake edge that are being de-forested by wooly adelgid infestations of the Eastern Hemlock stands (most notably at Tupelo Lane, Tupelo Point, and at the base of Tower Hill).

LW1.6	Continue to limit parking in central campus areas and improve parking facilities elsewhere.	FMPD OS G A PA CP		

Continue efforts to reduce the presence of automobiles in the center of campus and promote this as a walking campus. Gray Lot is an unsightly and environmentally injurious hardscape that sends pedestrian visitors from Wellesley Square the wrong message about the College's commitment to sustainability. Some of these action items are capital-intensive but should not be postponed indefinitely.

1. Limits. Eliminate non-handicap parking between the Science Center and WCBG; make the road to the Observatory into a pedestrian path open only to delivery vehicles.

2. Replacements. Replace Gray Lot with a multi-story structure that has a smaller footprint, open sides, green roof, and is designed (like the Davis Garage) to ensure the personal safety of its users. Alternatively, reconfigure the surface lot with a more sustainable design that collects

parking lot run-off into bioswales planted with plants and trees that will clean the water and provide shade to mediate heat island effects.

3. Improvements. Consider eliminating Founders Parking Lot, or changing its surface to be permeable. Use bio-swales or investigate a parking structure.

LW2.1	See the Global Flora project through to a successful conclusion	FMPD WCBG G OS EHS A	Ongoing	2

The new Global Flora greenhouse complex will beneficially blur the distinction between landscape and the indoor environment. With construction set for spring 2016, it will have the same sized footprint as the current greenhouses. Ensure that the finished project achieves its planned net-zero energy and water impact. If water table allows, dig another well to serve Global Flora.

LW2.2	Use the campus as a living laboratory	WCBG G A PA	Ongoing	1

As part of coursework in science departments or interdisciplinary studies, students could themselves undertake sampling projects (flora and fauna inventories; water or soil composition, etc.); findings of such projects could inform future sustainability plans.

1. Enlist faculty collaboration in the study of landscape.

2. Integrate investigations of new technology (e.g., micro-hydro generators) into the curriculum, possibly via the WeLab or Olin collaboration.

3. Develop courses that team humanities and science students to investigate the campus environment together; this could especially benefit underrepresented racial and socio-economic groups, who often have had fewer opportunities for outdoor experiences in childhood.

4. Involve faculty from Olin, Babson and MIT for wider perspectives on our vision for landscape sustainability; share resources if economies of scale are possible.

LW2.3	Make the landscape inviting and interesting to the campus community		1

These action items could be subtle, low-impact, and inexpensive. Examples include:

1. Place logs or boulders—materials already located on campus land—strategically so they can be used as outdoor seats (in keeping with Olmstedian design).

2. Place comfortable Adirondack chairs on common green spaces made from sustainable recyclable materials.

3. Place bird boxes, sundials, mounted weatherproof binoculars, or other unintrusive, naturally interesting items in the landscape to attract attention to the environment.

4. Preserve continuity of student interest in the landscape beyond graduation (e.g., revive/promote celebrations to encourage the Class Tree tradition; enlist students and alumnae to help with landscape activities on annual Community Service Day or at Reunion; continue Project Handprint).

LW2.4	Boost signage in WCBG, and for other campus specimens	WCBG G PA A		2

Increase signage interpreting landscape features (e.g., bog garden, green roof, Edible Ecosystem) and identifying species.

LW2.5	Create work-study jobs in the landscape that take advantage of students academic interests	WCBG A G OS PA		2

LW2.6	Continue to enlist the Hunnewell family as partners in stewarding the lake and surrounding properties	WCBG FMPD G PA A OS	Ongoing	1

LW2.7	Relocate student garden plots to promote their visibility	WCBG G FMPD		

		OS		

Garden plots, which will no longer be housed at the North 40 after 2015, should be moved to a carefully considered site close to the center of campus.

LW2.8	Increase our dissemination of environmental regulatory requirements (from EPA and Mass. DEP) to the campus community	EHS G WCBG OS PA	Ongoing	1

Increase awareness on campus of environmental regulatory requirements in order to promote best practices for environmental sustainability. Boost communication between groups affected by the regulations and those who serve as a conduit for those regulations; look ahead and anticipate future regulations.

LW2.9	Use creative means to communicate about the campus landscape	G WCBG A OS PA		2

Publicize the College's numerous achievements in environmental sustainability to date, and educate the community better about environmental impacts of their actions, such as what goes down campus drains and storm drains. Tactics to pursue:

1. Enlist clever, funny students to help campaign for the landscape.

2. Use the "Daily Shot" on the College homepage to educate the community (and wider world) about the campus landscape and watershed.

3. Use social media and viral videos to showcase the precious resource WC's landscape represents.

4. Use temporary signage cleverly and humorously to educate people about sustainability (e.g., "You need a rest. I do too" instead of "Keep off the grass" on lawns being reseeded).

5. Put eco-education messages on the flat-screen monitors in campus buildings.

6. Use outreach tools available at the website of Campus Consortium for Environmental Excellence (C2E2.org), of which Wellesley College is an active member.

7. Consider hiring innovative communications firms (e.g., Ideo, ESI Design) to help get the word out about sustainability at Wellesley.

LW2.10	Use tours to educate the community about the landscape	WCBG G A OS PA		1

Increase tours of the landscape, including virtual tours using GIS technology. Actions include:

1. Encourage student who is currently creating an iPod tour of the WC landscape.

2. Revive and extend the "Wellesley College Web of Species" website: http://academics.wellesley.edu/Biology/Web/index.html.

3. Incorporate the large Global Information System (GIS) database and map of plants and trees in WCBG being compiled by Mary Coyne (Prof. Emeritus of BISC).

4. Incorporate green infrastructure and campus sustainability features into tours by the Office of Admission for prospective students.

LW2.11	Exploit the Wang Campus Center as an outreach tool	OS A G WCBG PA		1

Make part of the Wang Campus Center a focus for environmental outreach. Make the Wang Center's roof garden into an edible garden.

LW3.1	Improve management of campus potable water supply	FMPD G EHS WCBG OS		1

Vigilantly continue to review all factors that might impact the campus water supply. Meanwhile:

1. Continue to reduce amount of water used on campus (required by Mass. DEP as part of Charles River watershed).

2. Undertake a comprehensive cost analysis (including labor, training, compliance reporting, chemicals, etc.) of our current practice of maintaining our own water supply and compare that with cost of switching entirely to Town of Wellesley water supply. Talk with the Town to ensure they would be able to handle the increased capacity.

LW3.2	Re-engineer the Silver Thread and Paramecium Pond water system	FMPD G WCBG EHS OS		

The use of treated well water to supply the Silver Thread and Paramecium Pond system is unsustainable. Increase use of non-potable water for irrigation throughout campus, and for Paramecium Pond develop a plan investigating these options:

1. Work to source water from Lake Waban in a way that eliminates the possibility of introducing lake-borne cyanobacteria into the Silver Thread system.

2. Drill a well on Water Tower Hill (if the water table allows) that would feed the Silver Thread; this would allow the stream and pond be largely gravity-fed rather receive pumped water.

LW3.3	Update snow and ice management approach	G FMPD WCBG A PA		2

Management of water in its frozen state is currently a significant problem for the health of the campus landscape. We urge these immediate measures:

1. Petition the Mass. state authorities responsible for clearing the section of Route 135 adjacent to campus to designate the area a low-salt zone.

2. Reduce salt use in the territory of the WCBG; temporary signage on the path as it goes by the bog garden can warn pedestrians of reduced salt in winter. Consider closing this path in the winter.

3. Devise and implement a campus-wide snow and ice management plan that minimizes both chloride use and impacts from Route 135 treatment. Continue to explore alternative melting agents (calcium, beet juice, brewery mash).

LW3.4	Update stormwater management	G EHS FMPD PA	Ongoing	1

The Commonwealth of Massachusetts, Town of Wellesley, and Wellesley College need to work in concert on stormwater management and should pull together a joint stormwater management plan. For our part, we should:

1. Create a precise, comprehensive inventory of exactly which stormwater drains empty into Lake Waban and how much volume they handle.

2. Ensure that stormwater "best management practices" are incorporated into new construction projects.

3. Consider employing soil moisture sensors to monitor water in the soil.

4. To fight erosion, develop a plan to manage stormwater that uses topography and plantings as much as possible.The 98CMP is a good starting place: "Design sites to capture, slow, and treat stormwater runoff by reducing impervious surfaces, harvesting rainwater, and directing the remaining runoff to soil- and vegetation-based treatment areas. Use vegetated bioretention facilities, such as rain gardens, constructed wetlands, green roofs, and bioswales, to capture and slowly infiltrate water into the soil or groundwater." (3)

5. Work with the MBTA (or other authority) to reduce use of pesticides and other potentially toxic substances in the railroad zone across Route 135 from campus.

LW3.4	Update irrigation systems	G FMPD PA		1

Expand the satellite irrigation systems—currently in use on the Athletic Fields—campus wide. Use software that encourages smart watering. Use flow sensors, water efficiency, metering, weather data, and evaporation transpiration.

Financial Implications

Though regenerative landscape management reduces maintenance costs and leads to a more sustainable landscape in the long term, the College should commit itself to real innovations in sustainability by being willing to sacrifice short-term financial payback, especially when a particular step fits our mission, institutional values, and core activities. It is not sustainable, for example, to continue to cut the Grounds budget; we must maintain healthy, realistic budgets for landscape caretakers.

As the Wellesley 2025 project proceeds, the administration must work with landscaping caretakers to ensure that funds for landscaping are not harmfully diverted by W2025. Moreover, the campus renewal plan for each building currently has no budget for landscape outside of a 5-foot perimeter. This must be revisited with a broader view of how landscape can function to support buildings, utilities, and circulation; money can be saved through increased efficiencies and avoidance of future repairs. Revisit the 98CMP, evaluate it, and use it as a tool for setting future landscape-related budgets.

Careful, functional landscaping and water management can have significant budgetary benefits. For example, the campus landscape currently produces the equivalent of $75,000 of mulch per year for its own use, and groundskeepers always save all soils for future use. Allowing the landscape to accommodate science students' field experiments will save money in the long run by obviating the need for off-campus field trips.

Climate Implications

The verdant, forested landscape of Wellesley College sequesters a great deal of carbon. WCBG grows and maintains significant carbon sinks, and both WCBG and Grounds compost and re-use landscape materials on campus, which prevents the emission of greenhouse gases created by trucking from and to campus. Future landscaping decisions should always be made with an eye toward boosting the campus's function as a carbon sink. An excellent guide to this approach is *Everything but the Carbon Sink: Managing Land Responsibly in a Time of Global Climate Change*, co-written by Professor of Biological Sciences Nicholas Rodenhouse with his Environmental Studies 300 students in spring 2008; see **Appendix**, below, for specific landscaping recommendations, tailored to campus biomes, excerpted from Chapter 6. Grounds Service's existing campus tree inventory, which tracks more than3,000 individual trees, can also help us estimate current and future carbon sequestration. The various landscape goals outlined above will allow Wellesley to reduce its carbon footprint and increase its capacity for carbon sequestration.

To confirm its commitment to addressing climate change, the College should immediately sign on to the American College and University Presidents' Climate Commitment (4). Membership would afford us access to a network of like-minded institutions as well as numerous tools for educating students, faculty, staff, and alumnae.

A changing climate (e.g., wetter winters and drier summers) will require WCBG and Grounds to plan ahead as much as possible for water-management implications. With climate change, we can expect to lose many mature, tall trees due to hurricanes, downbursts, ice storms, and invasive pests and pathogens (e.g., hemlock wooly adelgid, emerald ash borer, Asian longhorned beetle, etc.). Considerable effort has already been made, and we need to continue creating the next generation of trees to prevent the campus from being denuded by such events.

Potential Student Involvement

As is clear from our LW2 recommendations above, students have a crucial role to play in stewarding the campus landscape by studying it and promoting its well-being. Specific actions include:

- Incorporating landscape into coursework
- Using campus as a field laboratory
- Leading tours of the landscape
- Creating electronic landscape guides
- Taking part in outdoor activities
- Working in landscaping work-study jobs

Sources

Audubon International. (n.d.). About the Audubon Cooperative Sanctuary Program for Golf. Retrieved from http://www.audubonintemational.org/acspgolf

Campus Consortium for Environmental Excellence. (n.d.). Measuring Environmental Performance. Retrieved from http://www.c2e2.org/Documents/OriginalC2E2Documents/c2e2_CampusPoster_Full_PresCE84-link.pdf

Michael Van Valkenburgh Associates. (2010). The Observatory Hill Landscape Master Plan.

APPENDIX: *Everything but the Carbon Sink: Managing Land Responsibly in a Time of Global Climate Change*

by Lara Browning, Lindsey Habermann, Esther Kim, Claire Leamy, Roshni Sampath, Jenny Wang, Madeleine deBlois, Lesley Yen, and Nicholas Rodenhouse (ES 300, Spring 2008)

Specific recommendations in Chapter 6 ("Control Your Carbon: Recommendations for Landscape Management," pp. 61-73):

Woodland Recommendations (p. 62):
- Control invasive species
- Plant and/or select for long-lived tree species with a large leaf area
- Maintain multiple forest strata
- Allow forest debris to remain on forest floor
- Increase soil organic matter by leaving leaves and other decaying material on the forest floor
- Expand the area of forests where possible (Figure 1)

Grove Recommendations (p. 64):
- Plant large, long-lived tree species
- Create multiple strata
- Build soil organic matter, allowing small, woody debris to remain on the grove floor
- Remove trees only when necessary
- Increase the area of groves, such as planting trees around buildings and parking lots
- Allow some groves to become forests (Figure 2)

Meadow Recommendations (p. 66):
- Plant or encourage a wide array of species
- Manage for warm season grasses
- Mow only as frequently as needed to control invasive species
- Mow in mid-July for warm season grasses
- Leave mowing residues
- Never mow below 8 inches in height
- Spot mow if possible
- Do not drain wet meadows

Turfgrass Recommendations (p. 67):
- Minimize irrigation

- Time irrigation to minimize water loss due to evaporation
- Optimize fertilization
- Build soil organic matter
- Plant grasses that grow slowly and low to the ground
- Minimize soil disturbance
- Use energy-efficient mowers
- Reduce the frequency of mowing
- Avoid soil compaction by creating walkways in accordance with paths of desire or establishing green barriers

Wetland Recommendations (p. 71):
- Minimize both chemical and physical disturbance
- Do not drain them
- Prevent excess nutrients from entering wetlands
- Establish riparian buffers of forests, shrubs, or wet meadows

Lake Recommendations (p. 72):
- Establish riparian zones to mitigate shoreline erosion
- Control invasive species
- Promote integrated watershed management