

EDUCATIONAL FACILITIES

Kroon Hall, the ultra-green home of the Yale School of the Environment, expresses in physical form the School's best traditions, values, and aspirations. The building, which opened in January 2009, achieves its remarkable energy savings from a host of design elements and technical strategies molded to fit the weather and climate of its New England location. Situated in the area of the University known as Science Hill, Kroon Hall is named for the family of benefactor and Yale College alumnus Richard Kroon, B.A. 1964. With its high barrel-vaulted gable ends, simple lines, and curved rooftop, Kroon Hall is a modernist blend of cathedral nave and Connecticut barn.

Kroon Hall provides office space for fifty faculty and staff members and has three classrooms. The 175-seat Burke Auditorium is used for lectures and classes, and commands beautiful views of West Rock and the David S. Ingalls Rink across the street. The Knobloch Environment Center is meant for socializing, but students have also embraced it as a study space. The Ordway Learning Center on the ground floor also has ample space for quiet study. The \$43.5-million building was designed by Hopkins Architects of Great Britain in partnership with Connecticut-based Centerbrook Architects and Planners and holds the highest rating—platinum—in the green-building certification program, Leadership in Energy and Environmental Design (LEED). Kroon Hall provides 56,467 square feet and is designed to use 67 percent less energy than a typical building of its size. Its tall, thin shape and east-west orientation play a big role in heating and cooling. The lowest floor is set into a hillside, with only its south side exposed, providing thermal insulation, minimizing northern exposure, and increasing the amount of natural light that enters the building from adjacent courtyards. The south facade maximizes solar gain during the winter, and Douglas fir louvers covering glass facades on the east and west ends keep out unwanted heat and glare. The building's shape, combined with the glass facades, enables daylight to provide much of the interior's illumination. Light and occupancy sensors dim artificial lighting when it is not needed.

A 100-kilowatt rooftop array of photovoltaic panels is designed to provide 25 percent of the building's electricity. Four 1,500-foot-deep wells are designed to use the relatively constant 55° (F) temperature of underground water for heating and cooling, replacing the need for conventional boilers and air conditioning. Four solar panels embedded in the southern facade are designed to provide hot water. Exposed concrete walls and ceilings provide thermal stability by retaining heat in winter and cold in summer. Instead of air being forced through overhead ducts, an energy-saving displacement ventilation system moves warm and cool air through an air plenum and multiple diffusers in elevated floors. Low-velocity fans in the basement keep the air circulating throughout the building. In winter, the ventilation system also transfers the heat from exhaust to incoming fresh air; in summer, air handling units spray water on incoming fresh air, reducing its temperature by up to 18° through evaporation.

In mild weather, Kroon's occupants assist in the energy savings by opening windows in response to an electronic, color-coded prompt system. A pair of green and amber lights in each hallway indicate whether it's a "Green Day": i.e., when the green indicator light

is on, the ventilation and cooling/heating systems shut down, and the windows should be opened for natural ventilation.

A rainwater-harvesting system channels water from the roof and grounds to a garden in the south courtyard, where aquatic plants filter out sediment and contaminants. The gray water, held in underground storage tanks, is used for irrigation and pumped back into Kroon for flushing toilets. The system is designed to save 300,000 gallons of potable city water annually and to reduce the burden on city sewers by lessening the amount of storm runoff. Half of Kroon Hall's red oak paneling—15,000 board feet—came from the 7,840-acre Yale-Myers Forest in northern Connecticut, which is managed by the School. The building's pale yellow exterior, composed of sandstone from Ohio, echoes other Yale buildings. The north and south courtyards were constructed to create a community among disparate buildings on Science Hill. The south courtyard, landscaped by Olin Studio of Philadelphia, is a raised platform, with a green roof of soil one-foot deep and surrounded by twenty-five varieties of native plantings. Underneath the courtyard is a service node, centralizing all trash and recycling pickups as well as deliveries for the southwest corner of Science Hill and accessible by a single driveway off Sachem Street.

Sage Hall, a four-story building located at 205 Prospect Street and a gift of William H. Sage, B.A. 1865, in memory of his son, DeWitt Linn Sage, B.A. 1897, was completed in 1923. Administrative, development, alumni, and program offices of the School are housed in Sage Hall, along with four classrooms. Sage Hall is home to a computer cluster with twenty-four computers for student use. Sage also houses a 490-square-foot student lounge, appointed with a large table and comfortable couches, which students use for studying, special events, and weekly social events. Bowers Auditorium is designed to handle large lectures and seminars as well as small group projects. Bowers, which has a seating capacity of one hundred with tables and chairs, was built onto Sage Hall in 1931 with funds provided by the bequest of Edward A. Bowers, B.A. 1879. In 2011 the original Bowers floor was replaced using beautiful red oak flooring harvested from Yale-Myers Forest, and in 2016 energy-efficient LED lights were installed.

Facilities for research and instruction in silviculture, natural resource and forest economics, forest policy, and biometry are in Marsh Hall at 360 Prospect Street in the Marsh Botanical Garden. A classroom, meeting space, kitchen, and accessible bathroom are available on the first floor. This large, four-story mansion was originally the residence of Professor Othniel C. Marsh, B.A. 1860, a distinguished paleontologist and Western explorer of the nineteenth century. He bequeathed the building to the University in 1899, and for twenty-five years it housed the entire Forest School. Marsh Hall was designated a National Historic Landmark by the United States Department of the Interior in 1965.

The William B. Greeley Memorial Laboratory at 370 Prospect Street, named in honor of William Buckhout Greeley, M.F. 1904, houses a recently renovated social space in the main lobby; laboratories for research into the ecology and management of landscapes and ecosystems, urban sustainability, the biology of trees, and environmental chemistry; and doctoral program spaces. The building was designed by renowned architect Paul Rudolph and is a classic example of "Brutalist" architecture. Adjacent to the Greeley lab is a 3,800-square-foot greenhouse, which is used for hands-on learning

and research. Greeley Laboratory and its greenhouse were built in 1959 with funds from the forest industries, the John A. Hartford Foundation, and other benefactors.

The Class of 1954 Environmental Science Center at 21 Sachem Street is dedicated to the Class of 1954 in honor of the \$70 million the class donated in 2000 to support new science buildings and other major University priorities. It is an interdisciplinary facility built by the University with the aim of further fostering leadership in teaching of and research in science and engineering. The building was designed to encourage collaboration among faculty and students pursuing environmental studies. Four natural science faculty members from YSE have their laboratories in the Environmental Science Center, which also houses research laboratories for the Yale Science Departments of Ecology and Evolutionary Biology, Earth and Planetary Sciences, and Anthropology as well as the Yale Institute for Biospheric Studies.

The restored former residences at 301 Prospect Street and 380 Edwards Street house the offices of many of the School's programs, as well as doctoral student offices; each building has a classroom.

The mansion at 300 Prospect Street houses the School's Admissions, Financial Aid, Communications, and Research offices.

Osborn Memorial Laboratories at the corner of Prospect Street and Sachem Street houses one YSE faculty member's lab and office in addition to many other Yale laboratories.

YALE FORESTS AND THE QUIET CORNER INITIATIVE

North of New Haven, the Yale Forests Program manages 10,852 acres of forestland in Connecticut, New Hampshire, and Vermont that are part of the Forest School at the Yale School of the Environment. The seven discrete forests, donated to the School between 1913 and 1986, range in size from the seventy-five-acre Crowell Ravine in Vermont to the 7,840-acre Yale-Myers Forest in northeast Connecticut. The composition of the Yale Forests reflects a latitudinal gradient ranging from a central hardwood cover type in Connecticut to a northern hardwood cover type in New Hampshire and Vermont, with extensive mixed-wood stands of pine and hemlock in both regions. The area encompassed by the forests includes almost all of the topographical and soil conditions, site classifications, and cover types found in New England.

The Yale Forests Program provides educational, research, and professional opportunities to the Yale community and beyond through a sustainably managed and ecologically sound working forest. Faculty and students use the Yale Forests as a laboratory for teaching, management, demonstration, and research. Students working at the Yale Forests receive training that covers aspects of hydrology and soils, taxonomy, forest and community ecology, silviculture, forest operations, forest finance and policy, and sociology in order to prepare them for careers as foresters and natural resource managers. Every summer ten to twelve students are chosen for the apprentice forester program at the Yale Forests, which includes hands-on training in maintenance of infrastructure, property boundary research and delineation, geographic information systems (GIS), mapping and classification, sampling and inventory, managing forest operations, and the design and implementation of silvicultural prescriptions. Several students from the apprentice program are selected to work for the Yale Forests Program

the following academic year as assistant forest managers, where they receive additional training in forest administration and management.

Research performed at the Yale Forests is conducted under the supervision of faculty members of the School and by academic institutions across the region and encompasses a broad range of topics that include forest ecology, silviculture, aquatic and wildlife community ecology, hydrology, and economic, legal, and social studies. The forest is used for both doctoral and master's student research, the latter performed either as an independent project or in conjunction with student involvement with existing forest management. The forests also serve as a platform for collaborative research with other universities. Many breakthroughs in human understanding of ecological function began with research conducted at the Yale Forests.

The Yale Forests are used for both academic field trips and workshops held for professional or community organizations. Field trip and workshop topics are wide-ranging and include silviculture and forest dynamics, hydrology, wildlife habitat, carbon dynamics, and forest management.

Faculty and staff oversee management of the forests in partnership with three postgraduate fellows. Graduate professional students working as management fellows or coordinators carry out the bulk of the on-the-ground management. The forests are maintained as working forests, and outputs of management include commercial timber and non-timber forest products. The Yale-Myers Forest is the largest and most actively utilized parcel managed by the Yale Forests Program and is certified by the Forest Stewardship Council. Facilities at Yale-Myers Forest include 8,000 total square feet of living space within five buildings, including rustic bunkhouses that accommodate forty-eight, a classroom and library, kitchen and dining hall, communal living space, a research lab, and an open-air pavilion.

The Quiet Corner Initiative (QCI) engages with the communities and working landscape that surround Yale-Myers Forest. QCI works by developing programs that connect master's-level courses and University research to real environmental assessment and management challenges on private lands surrounding the forest. Current programs focus on forest and open space conservation and management; watersheds and rivers; renewable energy; and sustainable agriculture. The initiative seeks to advance three separate but related sets of goals: (1) to enrich the applied curriculum for professional students at the School of the Environment, providing reliable and consistent opportunities to bring learned skills to tangible problems that are in easy reach of the classroom and that contribute to a vibrant rural economy based on sustainable natural resource management; (2) to provide and cultivate a high-quality natural and social science research environment for students and faculty to investigate and analyze the drivers of environmental change and adaptive management at a landscape scale; and (3) to leverage the traditional strengths of Yale University in research, education, and leadership in working toward landscape-scale sustainability goals in our own backyard.

In addition to the forestland managed by the Yale Forests Program, close working relationships exist with non-Yale forests that faculty and students use for education and research. Yale has a long history of collaboration with the 6,800-acre Great Mountain Forest in northwestern Connecticut. The program manages the Yale Camp there, on about eight acres deeded to Yale in 1940 by Edward C. Childs, 1928 B.A., 1932 M.F., and

his family. The camp can accommodate fifty-four visitors overnight in the main lodge, four cabins, and a director's cottage. Sleeping tents in two large fields can accommodate visitors as well. The camp is mostly used by MODs, with sixty-five people visiting each week. It is powered by a new ground-based solar array. The kitchen in the main lodge is a communal kitchen licensed by the State of Connecticut.

Additionally, the 20,000-acre forestland owned and managed by the South Central Connecticut Regional Water Authority in New Haven County is one of the oldest managed forests in the western hemisphere and easily accessible from Yale's campus. Connecticut state forests and Yale's long history with the Connecticut Forest & Park Association serve as resources for student and faculty engagement as well.

LIBRARY COLLECTION

YSE students have access to the enormous holdings of the Yale University Library (YUL), which comprises fifteen million print and electronic volumes in more than a dozen different libraries and locations. The YUL is committed to acquiring whatever books and journals are needed to support Yale's teaching and research activities. The bulk of YSE materials are located online and in the Marx Science and Social Science Library, while smaller, more specialized collections, such as the Henry Solon Graves Papers and the Rachel Carson Papers, are housed in Manuscripts and Archives (in Sterling Memorial Library) and the Beinecke Rare Book and Manuscript Library. The librarian for environmental studies has an office in Marx Library (Rm. C44) and is available most weekday hours to provide assistance to students. Reference and information services are provided by experienced staff in the Marx Library. For electronic retrieval, the library has a network of databases accessible via its website, covering general environmental topics as well as the specific subject areas of forestry, soils, fish and wildlife, and water resources. Overall, Yale University Library subscribes to more than one thousand databases. Library resources outside of Yale are accessed through the Borrow Direct service as well as Interlibrary Loan. The YUL supports both EndNote and Zotero bibliographic data management tools, and the librarian for environmental studies provides instruction in both.

The YSE Library Research Guide is located at <https://guides.library.yale.edu/yse>. There are links to Orbis, Yale's main online catalog; direct links to several of the most frequently used bibliographic databases, such as BIOSIS, Web of Science, ProQuest Natural Science Collection, Environment Complete, and CAB Direct; and information ranging from instruction opportunities to online full-text journals. In-house bibliographic instruction begins during MODs and continues throughout the term. Notification of tours and group instruction sessions is posted via email; students may also contact the librarian directly (203.432.5912) to set up an individual session.

For additional information, please visit <https://web.library.yale.edu>.

COMPUTER RESOURCES

The mission of the YSE Information Technology Department (YSE-IT) is to support all aspects of computing for every member of the Yale School of the Environment community. We use and support multiple platforms, including Windows and Macintosh operating systems. Students are strongly encouraged, but not required, to bring their own computers. Admitted students may contact the YSE-IT Helpdesk by emailing helpdesk.yse@yale.edu for advice on the selection of appropriate hardware

and software. We strongly encourage the purchase of Apple Macbook Pro or Lenovo ThinkPad (T or X series) laptop computers. A robust campus network provides wireless access within all YSE buildings and throughout the Yale campus.

YSE-IT and trained student technicians from Yale's Student Technology Collaborative provide drop-in technical support for students to assist with any academic or research computer needs they may have while on campus. Weekend and after-hours student support is also available at Bass Library, within easy walking distance of the School. YSE-IT provides secure, centralized backup services for all YSE faculty, staff, and students, as well as a YSE-provisioned Dropbox account.

YSE-IT maintains a computer lab in Sage Hall, Rm. 39, with sixteen computer workstations that feature dual 24-inch displays, 3 GHz Intel i5 (quad-core) and 2.2 Xeon (10-core) processors, and at least 16 GB of RAM that were updated in the summer of 2018. The lab also features four 27-inch high-definition monitors for students who would like to utilize their own laptops.

The computer lab houses a multifunction copy/scan/fax/print device. Additional wireless student printing is available in each YSE building and throughout the Yale campus via the BluePrint (PaperCut) Printing System. Three-dimensional and wide-format printing is also available at the Yale Center for Engineering Innovation & Design (CEID) and the Yale School of Architecture.

YSE-IT maintains an inventory of equipment that students may borrow for short periods of time through an online equipment checkout system (<https://reservations.yale.edu/yse>). Equipment may be borrowed at no charge (late and replacement fees apply if equipment is returned late, lost, or damaged). Included are iPads, GPS units, digital cameras, walkie-talkies, compact audio recorders, and other equipment.

The Yale University Library is also very active in the integration of information resources in digital format. Students and faculty have online access to an extensive variety of journals and databases as well as innovative research resources such as the Digital Humanities Lab (<https://dhlab.yale.edu>).

The Marx Science and Social Science Library (<https://marx.library.yale.edu>) offers an array of digital media technologies and operates several important digital resources, including the Statistical Classroom ("StatLab"), featuring thirty machines with dual monitors, and a variety of software and databases, such as a Bloomberg Terminal. The Marx Library is also home to a full-time GIS librarian who assists students in obtaining and working with GIS datasets to support their work in any part of the globe, and to a data librarian who is available for questions or consultation about finding, using, and managing research data in the sciences and social sciences.

Faculty members have also developed many special computer applications for their projects, and some of these are available for student use in the Sage Hall computer lab.