Landscape Architecture Is a STEM Discipline

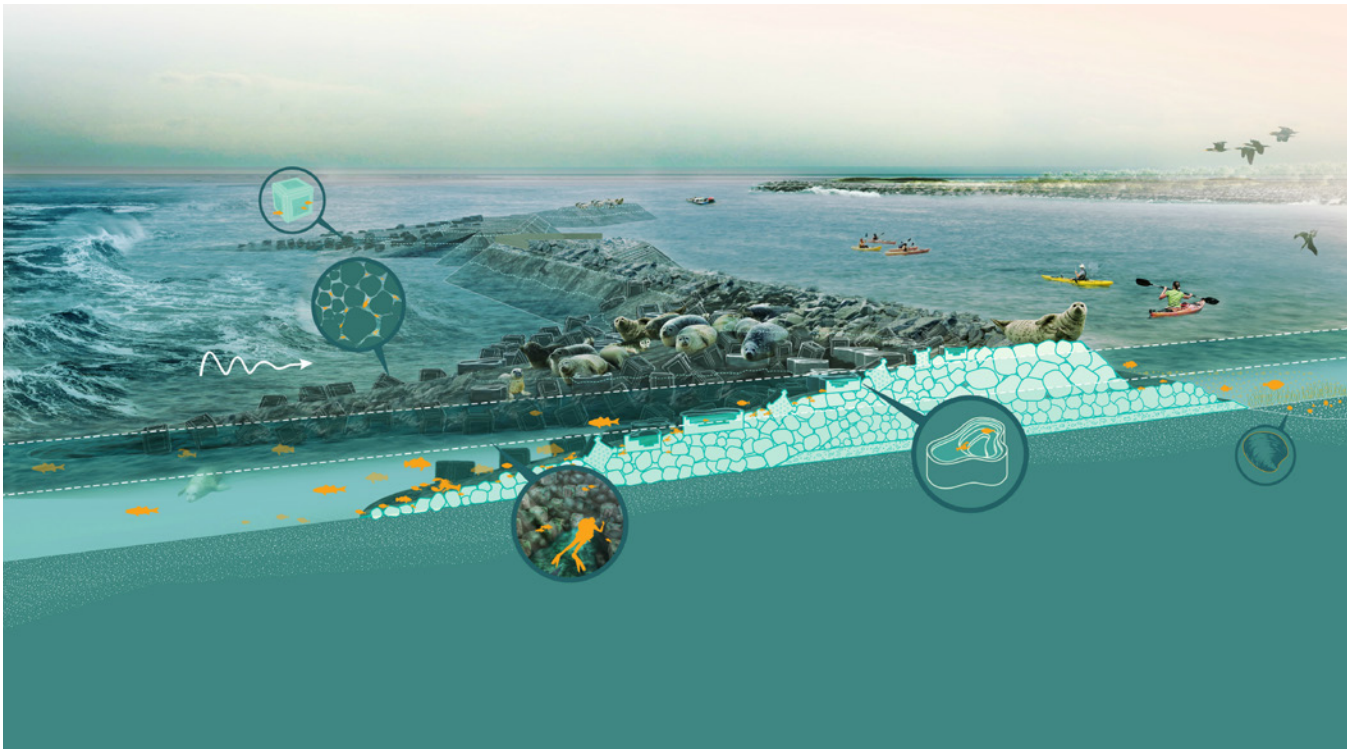
Landscape architecture educators and landscape architects conducted primary field research on seed germination rates for the sediment landscape of Hart-Miller Island in the Chesapeake Bay, Maryland. Field research included a transect study and measurements of water levels, soil pH, vegetative cover, and plant diversity in quadrats. The findings show significant variance between published germination rates under controlled conditions and experimentally derived seedling emergence in site soil.

Credit: ASLA 2020 Professional Research Honor Award. Seeding Specificity: Materials and Methods for Novel Ecosystems. Baltimore, Maryland. Mahan Rykiel Associates. Client: Maryland Department of Transportation and Maryland Port Administration

American Society of Landscape Architects

Table of Contents

Executive Summary



Landscape architects apply their in depth knowledge of natural sciences, hydrodynamic modeling, and coastal systems engineering to plan and design reef barriers that protect against wave damage and erosion and create new wildlife habitat.

Credit: Living Breakwater, Staten Island, NY.
SCAPE Landscape Architecture

Landscape architecture is inherently a science, technology, engineering, and mathematics (STEM) discipline. Landscape architects are educated in and routinely apply the physical and natural sciences, technology, engineering, and mathematics in the planning and design of sites where millions of people live, work, and play.

Increased recognition in recent years of the natural and built landscapes' impact on human health and well-being has underscored the need for landscape architecture professionals to be educated and trained in the sciences. The profession has responded by intensifying efforts to center landscape architecture education and licensure around STEM disciplines. In addition, the increasing number of federal and state government bodies defining landscape architecture as a STEM profession demonstrates the growing awareness that the sciences play a primary role in preparing landscape architects to address some of our most challenging problems.

While the evidence is clear that landscape architecture is a STEM discipline and profession, some organizations and government entities do not officially recognize this. The American Society of Landscape Architects (ASLA) and its

15,000 members are working to ensure that landscape architecture is rightfully recognized and designated as a STEM discipline and profession by a myriad of governmental bodies and STEM-focused organizations.

This white paper reviews the evidence that demonstrates that landscape architecture sits firmly within the category of STEM disciplines. It reviews the current state of landscape architecture education and licensure with respect to STEM disciplines and compares landscape architecture education to the educational content of other fields that are widely considered to be STEM. It explores the high degree to which landscape architecture education programs engage in research and innovation using STEM concepts to craft real-world solutions to complex problems. This paper also reviews the numerous governmental agencies at the federal and state level that already define landscape architecture as a STEM discipline.

Although there currently is no uniform definition of a "STEM discipline," the interagency Standard Occupational Classification (SOC) Policy Committee recommended in 2012 that landscape architecture be included in the scope of STEM occupations under an Architecture Occupations subgroup, a move approved by the Office of Management and Budget in 2017. Further, several states formally define landscape architecture as a STEM discipline.

Landscape architecture also is defined by a number of federal programs and agencies in ways that highlight the central role that STEM disciplines play in its educational curricula, including the Classification of Instructional Programs (CIP), which defines landscape architecture (CIP code 04.0601) as a program that "[i]ncludes instruction in geology and hydrology; soils, groundcovers, and horticultural elements."

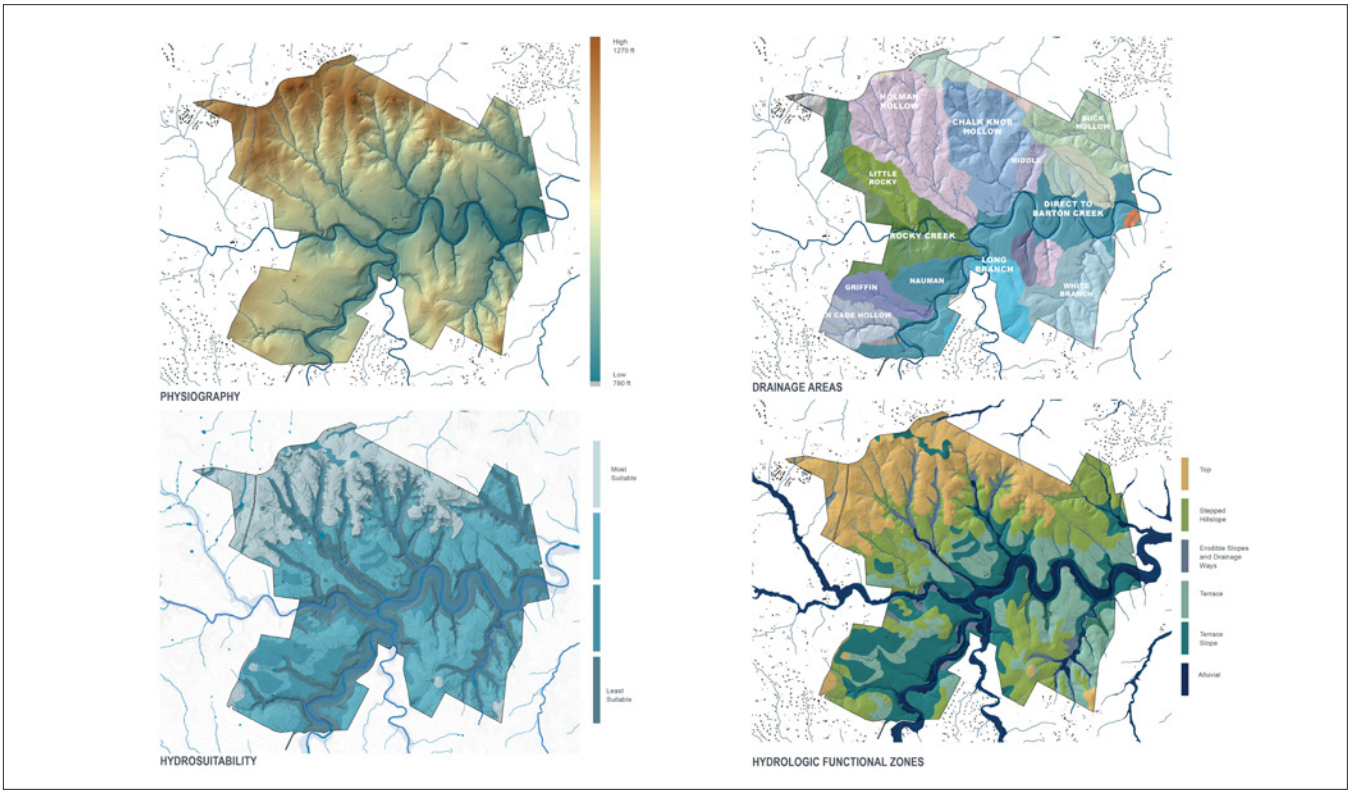
Landscape architects are educated, trained, and tested on a set of knowledge, skills, and abilities that are undoubtedly within STEM disciplines. The Landscape Architectural Accreditation Board (LAAB), which sets accreditation standards for degree programs in landscape architecture, requires accredited programs to "establish learning outcomes that" include competency in numerous STEM disciplines. In addition, one of the Core Values that LAAB requires academic programs to embed into their curricula, policies, community, processes and activities is "Application of the Sciences to the Design of Natural and Built Landscapes." The strong presence of STEM in landscape architecture education has been affirmed by landscape architecture programs at nearly every U.S. institution of higher education that offers degrees in the field.

The technical complexity of landscape architecture and its impact on public health, safety, and welfare have led all 50 states and the District of Columbia to require practitioners to be licensed. Landscape architects must pass a national registration exam, the Landscape Architecture Registration Exam (LARE), before they can be licensed by the state boards of registration. Two of the LARE's four sections—Inventory and Analysis (Sec. 2) and Grading, Drainage, and Construction Documentation (Sec. 4) —focus almost exclusively on scientific, engineering, technological, and mathematical knowledge.

Landscape architecture programs frequently and consistently engage in research and innovation—including the development of new technologies—in the pursuit of solutions to problems that confront the natural and manmade environments. Surveys by ASLA and others have found a sizable number of examples of programs using scientific methods to discover forward-thinking design solutions to climate change, food insecurity, water quality and other pressing concerns. Landscape architecture programs also have engaged in the development of patentable technologies and innovation.

U.S. landscape architecture degree programs include as much or more STEM content as degree programs for related disciplines commonly considered to be STEM. A 2019 analysis of two such programs—environmental studies (CIP code 3.0103) and sustainability studies (CIP code 30.3301)—in comparison with a landscape architecture program reveals that the landscape architecture program has higher overall STEM content than those on the DHS-approved list.

Introduction: Landscape Architecture and STEM



Landscape architects map hydro-geologically-sensitive landscape factors in GIS, including floodplains, slopes, risers, geological formation boundaries, and soils, in order to create sustainable water management zones as part of a new masterplan.

Credit: 2018 ASLA Professional Analysis and Planning Honor Award. From Pixels to Stewardship: Advancing Conservation Through Digital Innovation. Andropogon Associates.

Landscape architecture is a discipline that requires education in and the application of science, technology, engineering, and mathematics (STEM) as part of its academic foundation and its professional practice.

As a field rooted in the natural, physical, and human sciences, landscape architecture education prepares future practitioners to use science, technology, engineering, and mathematics to develop innovative solutions to design challenges in the built and natural environments. Because each landscape architecture project is unique, developing site-specific solutions that rely on the natural, physical, and human sciences is fundamental to the education, training, and practice of landscape architecture.

Landscape architects continue to spearhead the innovative application of the physical and human sciences toward solving problems of nature-human interactions. The profession applies technology in cutting-edge materials and processes to improve the efficiency, functionality, and health of our natural and built environments. Landscape architects engage in engineering-based design processes to protect the health, safety, and welfare of the public, and to

create lasting value in the built environment. Finally, landscape architecture's practical application of mathematics is inherent in the day-to-day practice of the profession, occurring as part of the calculations in everything from construction cost estimates to the complex biochemical reactions of pollutant removal.

In addition to leading planning and design projects, landscape architects are also critical members of interdisciplinary teams that have been assembled to address specific design or research challenges. This is due to landscape architects' grasp of the scientific implications of the function and value of natural systems, along with their ability—honed through education and training—to create innovative design solutions.

1. Definitions of STEM

1.1 Lack of a Uniform STEM Definition

There currently does not exist a single, uniform definition on what constitutes a "STEM discipline." As the Congressional Research Service (CRS) notes:

> Whether it is visas for foreign workers, scholarships for STEM majors, or funding for scientific research, the question of what is meant by the term STEM is central to the federal policy conversation. Some federal agencies, such as the National Science Foundation (NSF), generally use a broader definition of STEM that includes psychology and the social sciences (e.g., political science, economics) as well as the physical and life sciences and engineering (e.g., physics, chemistry, biology, mathematics). Others, including the Department of Homeland Security (DHS) and the U.S. Immigration and Customs Enforcement (ICE), use a narrower definition that generally excludes most (but not all) social sciences and focuses on mathematics, chemistry, physics, computer and information sciences, and engineering. . . . However, some analysts argue that field-specific definitions are too static and that definitions of STEM should focus on "an assemblage of practices and processes that transcend disciplinary lines and from which knowledge and learning of a particular kind emerges." The lack of a common definition for STEM has contributed to confusion, and even contradictory findings, in federal agency, academic, and nonprofit research on the condition of the U.S. STEM workforce and labor supply.[1]

1.2 Standard Occupational Classification

Managed by the Bureau of Labor Statistics (BLS), the Standard Occupational Classification (SOC) system is a federal statistical standard used by a number of federal agencies[2] to classify workers into occupational categories "for the purpose of collecting, calculating, or disseminating data."[3]

The interagency SOC Policy Committee addressed the lack of clarity around a definition of STEM in 2012, noting that "[t]he acronym 'STEM' is widely used in discussions across government, academia, and business, given increased emphasis on innovation and its implications for the economy and labor market. The discussion and analyses quickly get confounded since there is no commonly agreed upon definition of STEM."[4]

[1] Science, Technology, Engineering, and Mathematics (STEM) Education: An Overview

[2] Other federal agencies and programs that use the SOC include the Department of Commerce (Census Bureau), Department of Defense, Department of Education, Department of Labor (Employment and Training Administration), Equal Employment Opportunity Commission, and the National Science Foundation (https://www.bls.gov/soc/socimp.htm).

[3] https://www.bls.gov/soc/home.htm

[4] Microsoft Word - Attachment A_ STEM.docx (bls.gov)

As a result of the confusion, the U.S. Office of Management and Budget (OMB) asked the SOC Policy Committee (SOCPC) in 2011 to make recommendations for defining STEM occupations "in order to enhance comparability of data across statistical agencies and organizations studying the STEM workforce for policymaking purposes, including educational and workforce planners."[5]

In 2012, SOCPC disseminated recommendations for defining STEM occupations. According to CRS, "The SOC Policy Committee recommended that STEM occupations fall into two domains: (1) Science, Engineering, Mathematics, and Information Technology, and (2) Science- and Engineering-Related."[6]

In addition, within the domains the Committee identified five types of STEM occupations:

- Research, Development, Design, or Practitioner Occupations
- Technologist and Technician Occupations
- Postsecondary Teaching Occupations
- Managerial Occupations
- Sales Occupations

Within the Science and Engineering-Related Domain, the Committee recommended two subgroups, Architecture Occupations and Health Occupations. Under Architecture Occupations, the Committee identified landscape architecture (SOC 17-1012) as a STEM occupation as a "Research, Development, Design, or Practitioner Occupation."[7]

The 2012 recommendations were included in the 2018 SOC update, published by the Office of Management and Budget (OMB) on November 28, 2017.[8] (See Appendix A)

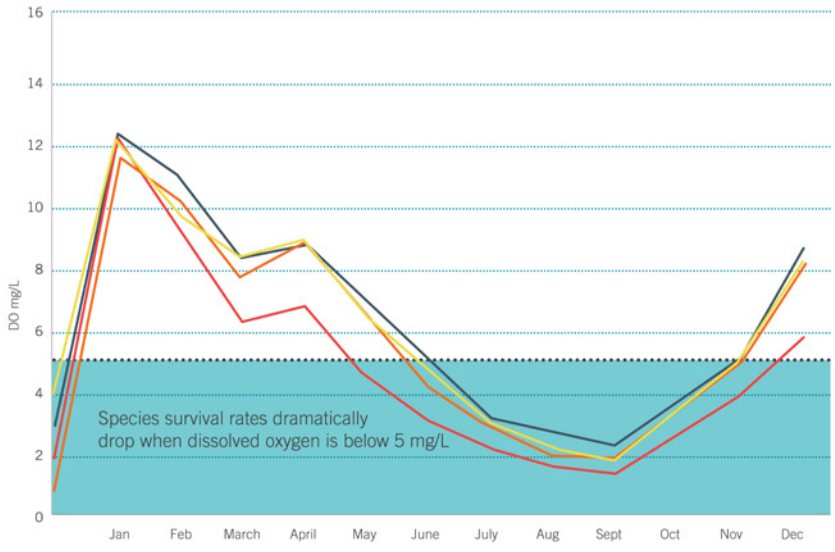
[5] Ibid.

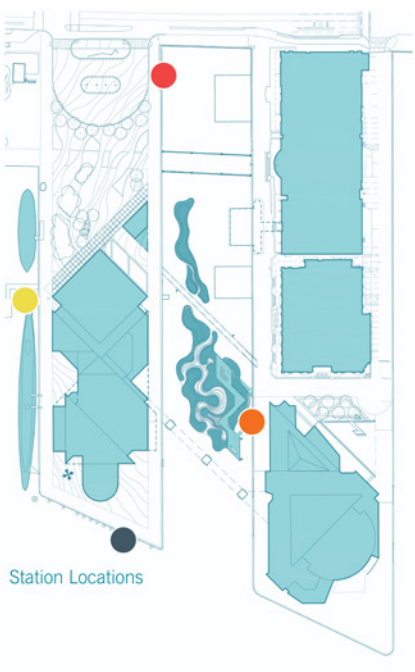
[6] Science, Technology, Engineering, and Mathematics (STEM) Education: An Overview

[7] Attachment_ STEM.xls (bls.gov)

[8] Attachment_C_2018 (bls.gov)

2. Landscape Architecture Definitions and Scope





Landscape architecture encompasses the analysis, planning, design, management, and stewardship of the natural and built environment.

Landscape architects led a team conducting field research on dissolved oxygen levels in Baltimore's inner harbor with the National Aquarium and found that the harbor's excessive nutrients from stormwater runoff can fuel an explosion of algae populations. The resulting algae bloom removes available oxygen from the water column, which in turn causes a fish kill.

Credit: ASLA 2018 Professional Research Honor Award. Urban Aquatic Health: Integrating New Technologies and Resiliency into Floating Wetlands. Baltimore, Maryland. Ayers Saint Gross. Client: National Aquarium

2.1 American Society of Landscape Architects Definition of Landscape Architecture

Landscape architects plan and design the spaces outside buildings and structures, as well as spaces on rooftops and over structures, including community master plans, multimodal transportation networks, transit-oriented development, park and outdoor recreation spaces, water and stormwater management infrastructure, streetscapes, and more. Furthermore, as the impacts of climate change intensify, landscape architects are leading efforts to conserve water, protect food sources, prevent surface water and groundwater pollution, mitigate storm surge flooding and sea-level rise, protect against and manage wildfires, and more.

The American Society of Landscape Architects (ASLA) defines landscape architecture as "any service where landscape architectural education, training, experience, and the application of mathematical, physical, social, and natural science principles are applied."[9]

2.2 Federal Government Definitions of Landscape Architecture

Several federal agencies and programs define landscape architecture in ways that highlight the connections of the discipline to the sciences.

Classification of Instructional Programs (CIP)

The Classification of Instructional Programs (CIP) "provides a taxonomic scheme that supports the accurate tracking and reporting of fields of study and program completions activity. CIP was originally developed by the U.S. Department of Education's National Center for Education Statistics (NCES) in 1980, with revisions occurring in 1985, 1990, 2000, 2010 and 2020."[10]

The 2020 update of the CIP defines landscape architecture (CIP code 04.0601) as:

> "A program that prepares individuals for the independent professional practice of landscape architecture and research in various aspects of the field. Includes instruction in geology and hydrology; soils, groundcovers, and horticultural elements; project and site planning; landscape design, history, and theory; environmental design; applicable law and regulations; and professional responsibilities and standards."[11]

Department of Defense

The U.S. Department of Defense's (DoD) Unified Facilities Criteria (UFC) provides planning, design, construction, sustainment, restoration, and modernization criteria for military departments, for defense agencies, and for DoD Field Activities. UFC are used on all DoD projects and work for other customers where appropriate.[12]

The UFC defines landscape architecture as a field that:

> "combines ecology, hydrology, engineering, planning, and functional design to create successful DoD facilities that achieve the following goals:

[9] https://www.asla.org/uploadedFiles/CMS/Advocate/Public_Policies/ Public/Licensure_Definition_of_Prac-tice.pdf

[10] CIP user site (ed.gov)

[11] CIP user site (ed.gov)

[12] UNIFIED FACILITIES CRITERIA (UFC) DoD MINIMUM ANTI-TERROR- ISM STANDARDS FOR BUILDINGS -UNT Digital Library

- Protect the health, safety, and welfare of all users.
- Elevate Installation functionality and appearance to enhance the quality of life.
- Establish a sense of place and unique identity.
- Preserve cultural and historic landscapes.
- Provide spaces considering 'human factors.'
- Achieve environmentally sustainable development and operations.
- Protect natural communities of plants and wildlife.
- Meet DoD requirements for outdoor water use and management.
- Utilize operation and maintenance plans to ensure successful long-term viability of landscapes."[13]

[13] UFC 3-201-02 Landscape Architecture, with Change 1 (wbdg.org).

[14] § 54.1-400. Definitions (virginia.gov)

2.3 State Government Definitions of Landscape Architecture

While each state has its own definition of landscape architecture, most are similar in nature to that of the Commonwealth of Virginia:

> "Landscape architect" means a person who, by reason of his special knowledge of natural, physical, and mathematical sciences, and the principles and methodology of landscape architecture and landscape architectural design acquired by professional education, practical experience, or both, is qualified to engage in the practice of landscape architecture and whose competence has been attested by the Board through licensure as a landscape architect."[14]

As noted above, landscape architecture is defined in federal guidelines and state licensure legislation as a profession whose practitioners require extensive education in—and routinely practice—the physical and natural sciences in the pursuit of innovative design solutions to shape the natural and built environments.

3. Landscape Architecture Education and Licensure

In order to practice the profession, landscape architects are educated, trained, and tested on a set of knowledge, skills, and abilities that sit firmly within STEM disciplines, including:

- site design
- land planning
- grading
- drainage
- stormwater management
- horticulture
- environmental sciences
- site suitability
- erosion control
- hydrology
- irrigation
- vehicular and pedestrian circulation
- roadway alignment design
- manipulation of contours and spot elevations

Landscape architects are also educators who teach undergraduate and graduate students with the latest technologies, such as this dynamic modeling and geo-morphological table that helps students understand how vegetation and creek structures affect flood control.

Credit: 2019 ASLA Professional Analysis and Planning Honor Award. Public Sediment for Alameda. SCAPE Landscape Architecture.

- calculations of slopes, grades, and volumes of material
- design of surface and subsurface storm drainage, including hydraulic characteristics and storm drain connections
- site planning for buildings and other structures; and
- the research of innovative design solutions.

[15] LAAB, "Accreditation Standards For Professional Programs in Landscape Architecture," Updated September 2021

3.1 Landscape Architecture Education Requirements and STEM

Landscape architects are educated, trained, and tested on numerous STEM disciplines that comprise the core of the landscape architecture education.

In the United States, the Landscape Architectural Accreditation Board (LAAB) specifies standards for the accreditation for programs offering professional degrees in landscape architecture, including bachelor or master of landscape architecture (BLA or MLA). (See Appendix B)

The Landscape Architectural Accreditation Board (LAAB) is recognized by the Council for Higher Education Accreditation as the accrediting agency for first-professional baccalaureate and master's degree programs in landscape architecture in the United States. Currently, LAAB accredits at least one program at 73 institutions in the United States. There are 53 accredited MLA programs and 47 accredited undergraduate programs. In addition to the accredited programs, one MLA program has achieved candidacy status. A program that has candidacy status has made a commitment to apply for initial accreditation within twelve months of its first graduating class.

LAAB requires academic programs in landscape architecture to "embed [six] Core Values into its curriculum, policies, community, processes, and activities, and identify and engage in contemporary issues in alignment with these Core Values." One of those Core Values is "Application of the Sciences to the Design of Natural and Built Landscapes":

> "As practitioners of a discipline firmly rooted in the natural, physical, and social sciences, landscape architects utilize science, technology, engineering, and mathematics to develop innovative, site-specific design solutions that protect human health and safety and the environment."[15]

Furthermore, the LAAB requires that accredited landscape architecture professional degree programs "shall establish learning outcomes that shall include competency in," among other criteria, the knowledge of:

- "the application of the natural, physical, and social sciences in the development of site-specific design solutions";

- "Plants, Ecosystems, and Climate Science, i.e., the abiotic and biotic aspects of ecosystems associated with natural and constructed landscapes; application of ecology, botany and horticulture principles to the design of the landscape; knowledge of soil science and geology and their impact on the landscape; impacts associated with landscape engineering, development, post construction management and maintenance; and the interrelationships between ecosystems and climate."; and

- "the use of behavioral sciences to assess the impacts of design within diverse social, human, economic and environmental systems."

- Additionally, the LAAB standards require that accredited landscape architecture professional degree programs "shall establish learning outcomes that shall include competency in," among other criteria, skills and competencies in:

- the "assessment, i.e., analysis of the physical, biotic, climatic, and cultural context of a project";

- the "application of the natural, physical, and social sciences in the development of innovative and site-specific design solutions;"

- the "integration of materials, engineering, specifications, and construction techniques in a design proposal;"

- "applying quantifiable principles and practice of engineering including of grading, drainage, water quality and management, and other landform processes to design landscapes that are accessible, safe, and ecologically sustainable;" and

- "Numeracy/Quantification, i.e., the mathematical calculations to inform and substantiate design and construction performance."[16]

[16] Ibid.

3.1a Typical Landscape Architecture Curricula

Although each landscape architecture program is somewhat different, every LAAB-accredited program must meet the requirements above.

As such, landscape architecture students are required to take courses in numerous STEM disciplines. A 2021 survey of U.S. landscape architecture schools conducted by ASLA found that bachelor's and master's degree programs in landscape architecture contain numerous courses with significant STEM content:

Average Number of Required Courses with STEM Content in U.S. Landscape Architecture BLA/MLA Programs[17]

	BLA	MLA
Botany/Horticulture	4.2	2.6
Construction Materials/Methods	4.2	2.8
Ecology	4.7	3.8
Engineering	2.8	2.5
Geology	2.7	0.8
Hydrology	3.0	1.6
Mathematics	2.3	1.1
Stormwater Management/Drainage	3.3	1.9
Sustainability Studies	5.7	4.4
Vehicular/Pedestrian Circulation/ Roadway Alignment/Design	3.3	2.1

(See Appendix E for detailed information from schools that responded to the ASLA survey.)

3.1b Consensus Among Educational Institutions

The centrality of STEM disciplines in landscape architecture education is further demonstrated by the strong consensus of the landscape architecture academic community that landscape architecture is a STEM field.

There are currently 100 accredited landscape architecture undergraduate and graduate degree programs at 73 institutions of higher learning across the United States. In August 2021, programs at 72 out of the 73 institutions of higher education that offer landscape architecture degrees signed a statement expressing their "continued commitment to the formation of rigorous academic programs grounded in the sciences and responsive to the needs of the planet and all its inhabitants."[18]

[17] ASLA, Survey of Landscape Architecture BLA/MLA Programs, 2021

[18] https://www.asla.org/uploadedFiles/ASLAProgramSignonStatement-20210907.pdf

As the statement notes:

> "Through the rigorous study of the sciences, technology, engineering, and mathematics, our students develop the ability to make design decisions that are grounded in scientific principles. Our programs recognize that only through following the science will we be able to address the most harmful impacts of climate change. That is why we require students to take classes in ecology, geology, biodiversity, horticulture, engineering and site design, water management, sustainability studies, climatology, and other scientific disciplines as an integral part of their education."[19] (See Appendix C)

[19] Ibid.

3.2 Landscape Architects' Professional Licensure Requirements and STEM

Landscape architects are charged to ensure the health, safety, and welfare of the users of all their works. The technical complexity of landscape architecture and its impact on public health, safety, and welfare have led all 50 states and the District of Columbia to require practitioners to be licensed. In addition to meeting education and experience requirements, candidates for landscape architecture licensure must pass a national registration exam—the Landscape Architecture Registration Exam (LARE)—before they can be licensed by the state boards of registration.

The Landscape Architect Registration Examination (LARE) is a four-part, fully computerized examination designed to determine whether applicants for landscape architectural licensure possess sufficient knowledge, skills, and abilities to provide landscape architectural services without endangering the health, safety, and welfare of the public. The LARE is prepared and scored by the Council of Landscape Architecture Registration Boards (CLARB) in accordance with all current standards for fairness and quality of licensure exams. All sections of the LARE are administered by CLARB, and all candidates register for the exam on the CLARB website. While the requirements to sit for the exam vary by jurisdiction, the exam, its administration dates and procedures, and its standards for passing the exam are the same in every jurisdiction.

The content of the LARE is based on the results of a scientific "job analysis" survey conducted every five to seven years. The most recent survey was administered in early 2016 and included the participation of more than 5548 practicing landscape architects from the United States and Canada. The survey results were analyzed by a group of subject matter experts, composed of licensed landscape architects from diverse areas of practice and locations across the

continent. Survey respondents were asked to rate all job tasks on three separate scales: how frequently the tasks were performed, how important the tasks were to successful performance of the job, and whether successful performance of each task was required at initial licensure.[20]

Section 1 — Project and Construction Management
Section 2 — Inventory and Analysis
Section 3 — Design
Section 4 — Grading, Drainage, and Construction Documentation[21]

In particular, Sections 2 and 4 of the LARE focus on scientific, engineering, technological, and mathematical knowledge:[22]

Section 2: Inventory and Analysis
Tests a candidate's knowledge of inventory, data gathering and analysis techniques, and the conceptual decision-making process that occurs before site planning. Topics include site suitability, functional relationships, land use planning, principles of design, and stormwater management. An analysis of existing conditions may include site use, circulation, utility, microclimate, floodplain conditions, soil, slope, solar, surface hydrology, and other factors.

Knowledge, Skills, and Abilities (KSA) tested in Section 2 include:

- Perform Circulation Analysis
- Interpret Utility Analysis
- Perform Micro and Macro Climate Analysis
- Perform Hydrological Analysis
- Perform Vegetation Analysis
- Interpret Ecological Analysis
- Perform Topographical Analysis
- Interpret Soil and Geotechnical/Geological Analysis
- Interpret Environmental Studies
- Interpret Economic Analysis

Section 4: Grading, Drainage, and Construction Documentation
Tests KSAs required to manipulate the surface of the land and constructed features to meet design objectives and to direct surface and subsurface water. The grading portions of the section require examinees to manipulate contours and spot elevations, calculate slopes, grades, and volumes of material, facilitate the removal of stormwater, and change the elevations of the existing landscape to accommodate buildings, structures, and vehicular and pedestrian circulation systems. The drainage portions of the section test the ability to design surface

[20] Take the Exam FAQs (clarb.org)

[21] Landscape Architect Registration Examination (clarb.org)

[22] See Appendix D for full listing of LARE content.

and subsurface storm drainage systems, including hydraulic characteristics and storm drain connections, to effectively and safely manage stormwater.

KSAs tested in Section 4 include:

- Prepare Soil Boring Location Plan
- Develop Stormwater Pollution Prevention Plan
- Develop Site Protection Plan
- Develop Mitigation Plan
- Develop Grading and Drainage Plan
- Develop Planting Practices, Plans, Notes and Schedules
- Develop Materials Plan
- Prepare Site Infrastructure Plan
- Develop Irrigation Plan
- Prepare Lighting Plan
- Prepare Stormwater Management Plan

4. Landscape Architecture Education's Use of STEM-Related Research, Innovation And Technology

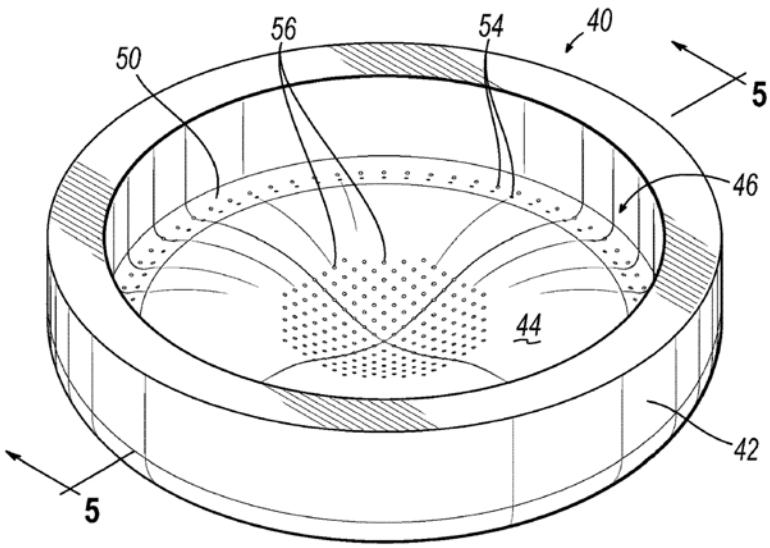


FIG. 3

In 2021, landscape architecture educators received a patent for their permeable floating concrete vessel devised for creating floating aquatic habitats. The vessel includes an interior space to hold growth material, plants, and channels to enable plant roots to spread throughout the water.

Credit: Boswell, J., Koelsch, M. Burris, L. (2021) Permeable Concrete Vessel for Creating Floating Aquatic Habitats (U.S. Patent No. 11,034,415 B2). Ohio State Innovation Foundation, Columbus, Ohio. Foundation. U.S. Patent and Trademark Office.

As a discipline rooted in the application of the natural and physical sciences to address real-world challenges, landscape architecture programs in the United States frequently and consistently engage in STEM-based research and innovation—including the development of new technologies—in the pursuit of solutions to a wide range of problems that confront the natural and manmade environments.

Surveys of landscape architecture programs by ASLA and others have found a sizable number of examples where faculty and students collaborate on research and innovation projects using scientific methods—and in many cases, with the involvement and financial support of federal and state government agencies—that unlock new ways to harness technology and the natural and physical sciences toward forward-thinking design solutions to climate change, food insecurity, water quality and other pressing concerns.

In addition, landscape architecture programs have engaged in the development of patentable technologies and innovation; in fact, the patent classification system used by the federal government and the continuing education

requirements of numerous states reflect the fact that there is significant patentable technology and innovation in the landscape architecture field.

4.1 Research

ASLA research has shown that the vast majority of landscape architecture programs engage in cutting-edge research, using science, engineering, mathematics, and technology to explore important issues related to physical and manmade landscapes. Such research is performed by both faculty and students, and in many cases is funded through grants from the federal government, state governments, or private institutions.

The research covers a wide range of topics, including stormwater control, coastal protection, forestry, food insecurity and agriculture, and land use and renewable energy, among others. Schools conduct this research using a variety of scientific methods and technological tools, including:

- Augmented reality and AI
- Hydraulic modeling
- Robotic fabrication
- GIS technology
- Parametric studies

Numerous schools have received grant funding from, or are working in partnership with, federal agencies, including the National Science Foundation and the Departments of Agriculture, Defense, Health and Human Services, and Transportation.

Below are examples of some of these research endeavors.

1. **Stormwater Control and Coastal Restoration, Auburn University School of Architecture, Planning & Landscape Architecture**
   Landscape architecture faculty in the School of Architecture, Planning & Landscape Architecture at Auburn University are part of Auburn's Green Infrastructure Team, which uses the school's Green Infrastructure Lab to research quantifying low impact development stormwater control measures to mitigate thermal gain and heat island effect. Thermal gain to in shore waters causes Harmful Algal Blooms (HABs) that reduce the availability of water oxygen to aquatic species. The faculty work with the Mississippi Alabama Sea Grant Consortium (MASGC) and the Alabama

Department of Environmental Management (ADEM) to quantify thermal gain of stormwater flowing over impervious surfaces.

[23] https://www.nsf.gov/award-search/showAward?AWD_ID=1830642

In addition, Auburn faculty also have a collaborative project funded in part by the U.S. Army Corps of Engineers to help improve the design, function, and efficacy of coastal infrastructure nationally through innovative design concepts for water-related infrastructure like levees, jetties, and dams. The USACE's Engineering With Nature® (EWN®) initiative uses combined natural and engineering processes to provide economic, social, and environmental benefits to the public. Faculty will apply landscape architecture approaches to USACE infrastructure projects to help ensure they are beneficial to local communities not only in terms of their primary engineered functions, but also in terms of ecology, recreation, and aesthetics.

2. Autonomous Vehicles and Urban Design, Illinois Institute of Technology Landscape Architecture + Urbanism

Faculty in the Illinois Institute of Technology Landscape Architecture + Urbanism program serve as co-primary investigators for The Driverless City Project, which investigates the urban design implications of autonomous vehicles. The research has been funded by the National Science Foundation, Illinois-Indiana Sea Grant, and the Nayar Prize. According to the NSF grant award, "This project will investigate the critical link between the urban landscape and navigation safety of mobile co-robots, from self-driving cars to delivery drones, or any mobile co-robot that operates on city streets and sidewalks. It will address fundamental questions of safety and trust in operating ubiquitous robots in dense urban environments by determining what changes to the urban infrastructure can simultaneously ensure safety, usability, and environmental sustainability. It will bring to light opportunities enabled by ubiquitous co-robots, and more to the point it will show how to leverage that technology to make changes in the transportation infrastructure that lead to positive changes for society."

In awarding the grant, the NSF noted that "This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria."[23]

3. Diversified Farming Systems, Purdue University Horticulture and Landscape Architecture

Faculty in the Purdue University Horticulture and Landscape Architecture program are collaborating in the Diverse Corn Belt Project (#DCB), a five-year, multi-disciplinary research project exploring opportunities to

enhance rural resilience through landscape diversity in the Midwest. Recognizing that "more choices for crop rotation can help build soil microbial communities, improve carbon sequestration, interrupt the buildup of pests and pathogens in the soil, and broaden possible income streams,"[24] the project's goal is to develop landscape planning scenarios with more than 30 research partners to investigate the real-world impacts of diversified farming systems and understand the agronomic, economic, social, infrastructure, and policy changes that could make them viable. A $10 million grant from the U.S. Department of Agriculture's National Institute of Food and Agriculture funded this work.

[24] https://diversecornbelt.org/

The table below includes additional STEM-based research projects being conducted by landscape architecture programs.

Boston Architectural College School of Landscape Architecture, Boston, MA The school conducts **parametric studies** to measure urban heat island effects and wind patterns that could mitigate temperatures in urban settings. During the pandemic, faculty and students utilized parametric studies to analyze spatial corridors and landform shapes to augment air flows, with the goal of preventing airborne transmission in the public realm.
Harvard University Department of Landscape Architecture, Cambridge, MA Faculty founded the Ecosystem Restoration Lab to study the long-term recovery of ecosystems degraded by human development. The Lab's research aims to estimate how long it takes for ecosystems to recover their less resilient attributes, such as the interactions among soil organisms and plants. Better understanding of these processes will enable the development of new tools that will not only increase the currently limited performance of ecosystem restoration, but also increase ecological understanding of landscape architecture.
Harvard University Department of Landscape Architecture, Cambridge, MA Graduate School of Design Dean's Annual Junior Faculty Research Grants have been awarded to the following STEM-related projects: "Sensing the Landscape: Computational Re-Making of the

Environment;" "The 'Making' of Gangnam Alternative Nature in Mitigating the Impact of Climate Change;" and "Understanding the recovery of New England's forest ecosystems after agricultural decline to inform ecosystem restoration and landscape architecture." The GSD's Harvard Center for Green Buildings and Cities has awarded research grants to landscape architecture faculty for STEM-related projects, including "Reshaping Urban Environments through Infrastructure Design Protocols;" "The Oasis Effect: Agricultural Practices in Arid Environments;" and "Energies of the Night: Nocturnal Public Space and Energy Policy in the Arabian Peninsula."

Kent State University College of Architecture and Environmental Design, Kent, OH

As part of its applied research course "Empirical Research in Environmental Design," faculty incorporate **GIS mapping** as an analysis tool that also supports the concurrent studio course. Students address issues within the studio brief and develop a research method for a study site within the studio project area. Recent courses have focused on urban forestry in the city of Cleveland and have looked at primary source data collection methods for geospatial analysis.

Mississippi State University Department of Landscape Architecture, Mississippi State, MS

Faculty study methods of conserving prairie ecosystems, which play an important role in creating more sustainable communities, boosting Mississippi's economy and ecosystems. As part of the study, faculty tested seven different plant species native to blackland prairies to determine whether inoculating the plants' root systems with beneficial fungi will help them grow in a prairie environment. In another project, faculty studied the role prairie plants play in slowing the overland flow of stormwater in developed areas, which could maximize its filtration into the soil to recharge groundwater.

Pennsylvania State University Department of Landscape Architecture, State College, PA

The school's Stormwater Living Lab has secured funding for green stormwater infrastructure-related research, including an **ecosystem services assessment** for green stormwater infrastructure in Lancaster, PA.

Pennsylvania State University Department of Landscape Architecture, State College, PA

Faculty lead ecological restoration research projects, implementing and monitoring ecological restoration techniques to determine their effectiveness in different contexts and for different species.

Pennsylvania State University Department of Landscape Architecture, State College, PA

Through an Institute for Energy and the Environment grant, landscape architecture graduate students are working with students and faculty in the health sciences, veterinary sciences, environmental sciences and landscape architecture to research and map parameters affecting perinatal health in Pennsylvania. This innovative interdisciplinary collaboration embeds landscape architects within the conversation on prevention of complex real world human health and animal health conditions.

University of Arizona School of Landscape Architecture and Planning, Tucson, AZ

Faculty conduct research on renewable energy infrastructure and its impacts on land use, including on the impact of **utility-scale solar photovoltaic (PV) systems** on farmland and rural landscapes, which will provide guidance to future integrated development with renewable energy using PV.

University of Arizona School of Landscape Architecture and Planning, Tucson, AZ

The school created a Campus Living Lab, a **green stormwater infrastructure (GSI) "living lab"** on campus designed to expand student experiential learning, enhance research capacity and create partnerships across disciplinary boundaries to fill critical gaps in GSI design and ecological performance.

University of Arizona School of Landscape Architecture and Planning, Tucson, AZ

Faculty have developed a demonstration project using **agrivoltaics**, a method of growing crops under solar panels to increase the efficiency of both. The project includes the construction of a rooftop garden and solar panels atop a university building as a way to demonstrate sustainability in the desert while also providing unique research and learning opportunities for the University community.

University of Florida Department of Landscape Architecture, Gainesville, FL

Faculty are currently working in partnership with the **U.S. Forest Service** on a project focused on springshed management and design in National Forests.

University of Idaho College of Art and Architecture, Moscow, ID

The school has a **National Science Foundation (NSF)** research grant to explore the nexus between food, energy, and water systems to evaluate future scenarios for the protection and management of natural resources, and statewide NSF Established Program to Stimulate Competitive Research (EPSCoR) program aimed at discovering fundamental knowledge of genetic mechanisms that can predict how organisms adapt to changing environments and thus inform evidence-based management of natural resources.

University of Kentucky Department of Landscape Architecture, Lexington, KY

Faculty members are working with collaborators in forestry to develop approaches to urban forest canopy improvement in four cities, which are acting as test cases for methods development. This project involves **remote sensing, field measurement and mapping**, urban canopy evaluation, and plans for canopy improvement, particularly relative to climate change.

University of Nevada-Las Vegas Landscape Architecture Program, Las Vegas, NV

The landscape architecture program is the only academic unit at the school, which is classified as an R1-Doctoral University[25] that teaches, researches, and disseminates metrics on site engineering; stormwater management; data collection regarding urban heat island effect; applied urban heat island mitigation strategies; applied environmental sustainability strategies; applied environmental sustainability strategies, i.e. carbon sequestration provided by trees; and augmented reality to teach all of the criteria listed above. Program faculty use advanced **computational modeling and fabrication methods** to evaluate and visualize desert ecosystem services for strategic development and communication of social and environmental design.

[25] The Carnegie Classification of Institutions of Higher Education classifies as R1 Universities those institutions that conferred at least 20 research/scholarship doctorates in 2019-20 and reported at least $5 million in total research expenditures in FY20. R1: Doctoral Universities are those with "Very high research activity;" R2 Doctoral Universities are those with "High research activity." https://carnegieclassifications.acenet.edu/classification_descriptions/basic.php

University of Pennsylvania Department of Landscape Architecture, Philadelphia, PA

The Environmental Modeling Lab (EMLab) is an applied research unit of the Weitzman School of Design's McHarg Center, specializing in the analysis, simulation, and visualization of environmental systems. The EMLab works with both academic and private-sector partners to expand the role of sensing, simulation, and modeling within contemporary landscape architecture practice. This work takes the form of grant and competition collaborations, consultancy and landscape monitoring contracts, applied research projects, as well as speculative projects and teaching. For example, the EMLab provides remote sensing and field collection support for their ongoing collaboration with the **U.S. Army Corps of Engineers** in Maurice River, NJ.

University of Southern California School of Architecture, Los Angeles, CA

Faculty conduct research into a number of areas, including hydraulic modeling, robotic fabrication, and augmented reality related to the future of the Los Angeles River in partnership with the **U.S. Army Corps of Engineers**; and serve as a research partner in the Public Exchange Urban Trees Initiative to study spatial assessment of urban canopy, development of shade modeling, and scenario development for urban cooling and air pollution filtration by local and native tree species.

University of Texas at Arlington Landscape Architecture Program, Arlington, TX

Faculty assessed the impact of extreme weather events under changing climate conditions on transit desert communities. Conducted for the **U.S. Department of Transportation's University Transportation Center**, the study conducted a vulnerability assessment combining storm surge and extreme rainfall projections with the Transit Deserts method that assesses geographic vulnerability, with respect to access to employment and other services that impact quality of life, and transit equity and access.

University of Texas at Austin Graduate Program in Landscape Architecture, Austin, TX

Faculty have performed research into carbon accounting and sequestration through agro-ecological restoration, funded by the Loren Roots Initiative; the project reviewed general strategies

for capturing carbon on the Louisiana Gulf Coast. Faculty also conducted research into "Achievable Future Conditions as a Framework for Guiding Forest Conservation and Management," which studied how ecological responses can be evaluated at landscape or regional scales using risk-based approaches to incorporate uncertainty into forest management efforts with subsequent goals for management based on Achievable Future Conditions (AFC).

University of Washington Department of Landscape Architecture, Seattle, WA

Led by landscape architecture faculty, the Green Futures Lab at UW supports interdisciplinary research and design that advances the understanding of, visions for, and design of an ecologically sustainable public realm. The Lab is actively collaborating with King County and the City of Seattle to explore and assess the use of floating wetlands to improve local water quality and provide habitat.

Utah State University Landscape Architecture and Environmental Planning, Logan, UT

Faculty are conducting perception research with the **Department of Defense**, community integration research with the **Department of Health and Human Services' Administration for Community Living**, transportation research with t**he Department of Transportation**, and climate change research with the **Department of Agriculture**, among others.

4.2 Technology and Innovation

At its core, landscape architecture involves applying STEM disciplines to solve site-specific design problems; therefore it is no surprise that landscape architecture education programs place a large emphasis on utilizing technology and scientific principles to develop innovative solutions to challenges that communities face, including solutions that have broader uses beyond specific sites.

ASLA research has found that faculty and students at many landscape architecture programs have taken leadership roles in the formation of innovative materials, techniques, and strategies to help solve problems related to the natural and built environments. They have done so within multidisciplinary collaborations, and with the assistance, partnership, and financial support of

state and federal governments. Many schools have developed new techniques, technologies, and approaches that have been used in the real world.

Such innovations range from using robot-assisted agriculture to address food insecurity, to helping communities develop strategies to protect ecosystems and wildlife, using computer simulation to forecast the impact of climate change on agriculture and the landscape, and the invention of modular "living wall" systems and other built elements to make buildings and spaces more environmentally sustainable. Landscape architecture schools have collaborated with multiple federal agencies on these and other projects, including the National Science Foundation and the Departments of Agriculture, Defense, Energy, Homeland Security and Interior.

Below are examples of some of these innovation and technology projects.

1. **Robot-Assisted Urban Agriculture, City College of New York Spitzer School of Architecture**

   Landscape architecture faculty at the City College of New York's Spitzer School of Architecture have established the Urban Ecology and Agriculture Laboratory (UEAL), which designs, tests, and evaluates innovative models of robot-assisted urban agriculture to alleviate food insecurity in US cities. The team collaborates with scholars in environmental design, artificial intelligence, robotics, and urban ecology.

   Exploring innovative solutions that integrate sensing networks, machine learning, and robot-assisted systems to create new types of urban agricultural practice, the research has substantial potential impacts on increasing urban food security, biodiversity, and the ability to adapt to climate change. The project will also build collaborations with community partners and high schools, motivating the next generation of scientists and urban farmers through STEM curriculum development and community outreach.

2. **Wildlife Corridor Planning and Conservation, University of Florida Department of Landscape Architecture**

   Faculty in the University of Florida's Department of Landscape Architecture have been directly involved for nearly three decades in developing the science foundation for wildlife corridor and landscape level conservation planning in Florida, with practical applications at regional, state, and international levels. This work includes development of the Florida Ecological Greenways Network (FEGN), which is based on and contributes to the best available science on landscape-level corridor design. Faculty are also developing science related to climate-wise landscape design strategies

as part of the Department's Climate-Wise Landscape Initiative, working with faculty in the Institute for Food and Agricultural Sciences. Faculty have applied this information through local government partnerships focused on the use of green infrastructure to increase resilience to future hazards within disadvantaged and historic communities as part of the Department's Urban Green Infrastructure Initiative and the Florida Resilient Cities Program, which includes development of new approaches for assessing vulnerability and resilience in coastal areas.

Faculty also have worked in partnership with the U.S. Fish and Wildlife Service and Air Force Civil Engineer Center (AFCEC) to create a model for regional conservation partnerships throughout the U.S. focused on protection of conservation priorities adjacent to U.S. Air Force installations. The goal of the Florida Strategic Plan for Sustaining Military Readiness through Conservation Partnerships is to identify a regional natural resources management approach to help minimize encroachment threats to Air Force missions, while identifying partner-leveraged conservation opportunities throughout the state of Florida.

3. Hurricane-Impact Prediction Modeling, Pennsylvania State University Department of Landscape Architecture

Faculty in the Pennsylvania State University Department of Landscape Architecture are actively developing systems that integrate ocean and wind models with qualitative spatial data to improve hurricane impact prediction in systems, such as the U.S. Department of Homeland Security-funded CHAMP (Coastal Hazard Analysis Modeling Program. A pilot project in partnership with Rhode Island Emergency Management Agency (RIEMA) is now being expanded regionally to be part of the National Oceanic and Atmospheric Administration's (NOAA) Environmental Response Management Application (ERMA). The research by landscape architecture faculty facilitates real-time analysis available to end users in advance of hurricane landfall forecasts. This work is funded by the Department of Homeland Security Center of Excellence in Coastal Resilience.

4. AI and Machine Learning for Simulation of Site Designs, Purdue University Horticulture and Landscape Architecture

Purdue University Horticulture and Landscape Architecture faculty are developing an artificial intelligence and machine learning-driven automated site inventory tool using video game engines to simulate people and objects in as-yet unbuilt proposed designs for testing and visualization. This involves using programming, data-curation principles, and logic-driven math. These tools will be able to automate site inventory for

more complete post-occupation evaluations and site-performance case studies. It also teaches students how to develop immersive presentation and design testing experiences. This project is funded by the National Science Foundation in collaboration with Argonne National Laboratory.

The table below includes additional STEM-based innovation and technology projects being conducted by landscape architecture programs.

Harvard University Department of Landscape Architecture, Cambridge, MA The department has invested in equipment and resources that employ new technologies—such as **geomorphology** and tables to study biophysical systems—and other lab equipment.
Louisiana State University Robert Reich School of Landscape Architecture , Baton Rouge, LA Faculty conduct joint research on **robotic planting techniques, drone planting techniques, and using light detection and ranging (LIDAR)** to document existing landscapes.
Michigan State University School of Planning, Design and Construction, East Lansing, MI Faculty have secured **U.S. Department of Housing and Urban Development** grant funding for "Development of Comprehensive Climate Vulnerability Resilience Capacity Indexes for Enhancing Urban Recovery in Midwestern Communities," and a state grant from the Michigan Department of Natural Resources for developing vision plans to create sustainable and resilient open space across Michigan.
Mississippi State University Department of Landscape Architecture, Mississippi State, MS The school has developed a project to utilize beach landscaping to protect the coastline, which began in 1995 and serves as a model for mitigating storm damage and reducing cleanup costs along the Mississippi Gulf Coast. Faculty developed an experimental beach with limited mechanical maintenance and lots of native plants, which had a dramatic effect on beach erosion in the area. Based on this success, they were commissioned to design a similar landscape along 26 miles of manmade coastal beach in Harrison County, MS.

Pennsylvania State University Department of Landscape Architecture, State College, PA

Faculty have developed a **dynamic mapping procedure** using filters of land-use, physiography, state and local policies, and socio-cultural data to show "hot spots" where renewable energy infrastructure is possible. The process is replicable throughout the United States.

Pennsylvania State University Department of Landscape Architecture, State College, PA

A landscape architecture student has developed an **open-source Python library**[26] for green infrastructure planning. The library integrates Rhodium, a Python library for Many-Objective Robust Decision Making, and SWMM (Storm Water Management Model) to form a dynamic rainfall-runoff simulation model used for the design and analysis of urban drainage systems. The student applied the Rhodium-SWMM model in Pittsburgh, PA, to identify critical areas of green stormwater infrastructure investment that will be resilient to future climate change.

Purdue University Horticulture and Landscape Architecture, Lafayette, IN

The Purdue Center for Community and Environmental Design, housed in the Department of Horticulture and Landscape Architecture, is engaged in a multi-year partnership with the **National Park Service Midwest Rivers, Trails, and Conservation Assistance program (NPS-RTCA)** team, supporting collaborative landscape planning and community design projects for students and community partners

Purdue University Horticulture and Landscape Architecture, Lafayette, IN

Faculty are developing Climate BufferNet, an educational, visual simulation designed to engage higher education students in the Midwestern United States with ideas for improving rural landscape planning outcomes. The simulation uses ecological, economic, and social data inputs to support student understanding of biodiversity conservation and climate change adaptation within agricultural landscapes.

[26] The Carnegie Classification of Institutions of Higher Education classifies as R1 Universities those institutions that conferred at least 20 research/scholarship doctorates in 2019-20 and reported at least $5 million in total research expenditures in FY20. R1: Doctoral Universities are those with "Very high research activity;" R2 Doctoral Universities are those with "High research activity." https://carnegieclassifications.acenet.edu/classification_descriptions/basic.php

University of Arizona School of Landscape Architecture and Planning, Tucson, AZ

Faculty helped develop the DASH-SAFE dashboard during the pandemic, which uses **predictive modeling** of movement of people through campus to help users visualize areas on campus that are safer or riskier from a COVID standpoint and provides navigation routes based on people's movement throughout the day. The dashboard also provides building managers with real-time information to help them quickly address problems that might increase viral spread.

University of Florida Department of Landscape Architecture, Gainesville, FL

Faculty are part of the Florida 2070 project, conducted in partnership with a state non-profit organization (1000 Friends of Florida) and the Florida Department of Agriculture and Consumer Services, using **GIS-based scenario modeling** and dissemination of future land use and development scenarios for the state.

University of Florida Department of Landscape Architecture, Gainesville, FL

The school has been directly involved in applying **machine learning modeling techniques** to identify and prioritize areas important for biodiversity and ecosystem service in Florida, South America, and southeast Asia

University of Kentucky Department of Landscape Architecture, Lexington, KY

School research is testing planting systems for urban trees that will result in information on best practices for tree survival and growth in challenging urban and suburban environments. In another project, faculty are working with researchers at UK HealthCare and faculty in horticulture, entomology, and civil engineering to develop and evaluate a Nature Rx approach to planting on the medical campus. This project is resulting in new, more biologically diverse plantings that bring patients, visitors, students, and staff into closer contact with nature. Psychological and physiological responses to the plantings will be measured post-establishment.

University of Minnesota Department of Landscape Architecture, Minneapolis, MN

Faculty conduct research on land-based interventions for climate change infrastructure to support vegetation and animal habitats, improve local water management and increase human engagement with the environment. Working with a multidisciplinary team with members in ecology, evolution and behavior, architecture, STEM education, and philosophy at the University, the research is seeking to develop a **new conceptual framework for function in biology** that articulates with bio-inspired design approaches from architecture and engineering. A key output of this analysis will be theoretical resources for engineers and designers to understand multifunctionality and collaborate with biologists in discerning associated explanatory principles of function in living systems.

University of Wisconsin-Madison Planning & Landscape Architecture, Madison, WI

Faculty formed the Kaufman Lab for the Study and Design of Food Systems and Marketplaces in 2014; the lab serves as a home to foster the work of many undergraduate, graduate, and post-doctoral students in various projects relating to the development of local and regional food systems around the world, including Metrics + Indicators for Impact (MIFI), an online toolkit that helps farmers markets be able to create a holistic picture of their work by creating and analyzing data. MIFI was piloted in seven different states and is now offered across the country to individual farmers markets and organizations of them. MIFI was originally funded by a **U.S. Department of Agriculture's Agriculture and Food Research Initiative (AFRI)** grant with the Farmers Market Coalition. MIFI also is used as a subcontractor on many grants, most notably the Farmers Market Promotion Program (FMPP) and the Local Food Promotion Program (LFPP) grants through the USDA.

University of Wisconsin-Madison Planning & Landscape Architecture, Madison, WI

Faculty and students in the Landscape Conservation Lab work to combine conservation science with **geospatial analyses, scenario modeling** and citizen engagement approaches to inform innovative conservation strategies and design. In particular, they have been leaders in developing spatial narrative approaches and geodesign tools. Focal areas of interest have included international crane conservation in Wisconsin and Asia, Great Lakes forest landscape

scenarios, and bioregional landscapes and ecosystem services (e.g., pollinator foraging, wild rice harvesting, maple sugaring).

4.3 Patents and Landscape Architecture

By applying STEM concepts to design problems facing the natural and man-made environments, landscape architecture programs have demonstrated that patentable technology and innovation exists in the landscape architecture field.

Patents and landscape architecture have been interconnected since the very start of the U.S. patent system in the late 18th Century. The number of patents issued for innovations that impact the landscape during the nation's early years—including technologies to control flooding, clear land for new development and provide lighting for cities—shows that the "US government was cognizant of the role of patents in the transformation of the built environment."[27] Even before landscape architecture was formally recognized as a licensed profession in the 20th Century,[28] professionals educated and trained in the natural and physical sciences have secured design and utility patents for inventions that improve the built landscape. Today, the intersection between landscape, science, and technology is reflected in landscape architecture academia's STEM-based education requirements, and in the profession's emphasis on developing patentable innovations.

Such efforts have led in recent years to at least three patents (plus a provisional patent) being granted to landscape architecture school faculty and students. It also is reflected in the fact that a number of states recognize obtaining a patent as a way to fulfill continuing education requirements for maintaining a landscape architecture professional license, and that the patent classification system used by both the United States and the European Union devotes a section to patentable innovations spurred by the application of STEM principles to landscape architecture.

Patents Received by Landscape Architecture School Faculty and Students

1. **Floating Aquatic Habitats, Ohio State University**
   An Ohio State University Landscape Architecture program faculty member and student invented and received a patent in 2021 for a Permeable Concrete Vessel for Creating Floating Aquatic Habitats (U.S. Patent #11,034,415).[29]

[27] https://arpajournal.net/patents-agency-and-environment/

[28] California was the first state to adopt registration of the title "Landscape Architect," in 1953. (https://www.asla.org/contentdetail.aspx?id=48272)

[29] https://knowlton.osu.edu/sites/default/files/2021-06/US_Patent_11034415_B2.PDF

The invention addresses the problem of algal blooms that regularly occur in lakes and reservoirs in the Midwest; in 2014 one such algal bloom shut down the water supply to 400,000 people in the Toledo area. The blooms are due to high levels of nitrogen and phosphorus in the water.

The invention consists of a buoyant concrete vessel that allows for nutrient exchange between the plant and the water, allowing the plant's biomass to help absorb the algae, and decreases light penetration, which lowers water temperatures and creates a less favorable environment for bloom outbreaks.[30]

[30] https://knowlton.osu.edu/news/2021/04/landscape-faculty-student-design-collaboration-leads-possible-patent

[31] https://patentimages.storage.googleapis.com/d2/92/4d/44547f6c88c7c2/WO2017155927A1.pdf

2. Movable Meadow for Stormwater Runoff Control, Kent State University

A landscape architecture faculty member and other faculty at Kent State University invented and received a patent in 2017 for a movable meadow and method of implementation. (WIPO/PCT Patent #WO2017155927A1)

According to the patent, the invention is a "method and apparatus for controlling stormwater runoff." It is used to protect property from stormwater damage via a movable meadow allowing for the temporary deployment of site-specific plants in modular containers to receive and retain stormwater and stormwater runoff to prevent damage that would otherwise occur to the site.[31]

The invention addresses the challenge that owners of vacant or soon-to-be redeveloped properties face in protecting their land from damage from stormwater runoff, which normally requires expensive and permanent stormwater infrastructure like subgrade drain pipes, rain gardens, or green roofs.

3. Structural Soil, Rutgers University & Cornell University

Landscape architecture faculty from Rutgers University's Department of Landscape Architecture and Cornell University's Landscape Architecture Program, invented, and received a parent in 1998 for CU-Structural Soil™ (U.S. Patent # 5,849,069), a two-part system consisting of a rigid stone "lattice" (to meet engineering requirements for a load-bearing soil) and a quantity of soil (to meet tree requirements for root growth).

The patented product addresses the challenges involved in planting and sustaining trees in urban environments. Studies have shown that trees planted in small squares surrounded by pavement, as found in many urban areas, live for an average of 7 years, while the same species planted in more hospitable settings can live up to 200 years. This is due in large part to a

lack of uncompacted soil, with adequate drainage, aeration, and reasonable fertility.[32]

According to the CU-Structural Soil™ patent, "the invention teaches a stone/soil urban tree mix that can safely support pavements yet also provide ample rooting area—a current limitation—for street trees that are planted close to the pavement. By expanding the rooting zone, the mix allows increased tree growth, decreased tree mortality, and decreased sidewalk failure."[33]

4. Living Wall System, Texas A&M University (provisional patent)

A landscape architecture faculty member at the Texas A&M Landscape Architecture and Urban Planning program, along with students and another faculty member, have received a provisional patent from the U.S. Patent and Trademark Office for a living green wall with separate planting containing module (Ref. # 5027TAMU19 (provisional)).[34]

A multi-year, cross-disciplinary process led to the development of the galvanized steel living wall system, which will reduce heat gain in buildings and create the potential for a circular economy that transforms industrial waste into green infrastructure while enlivening a blank wall. The team used automotive sheet metal scraps to form inverted pyramids that form a flexible façade garden; individually demountable units allow discrete control and modulation of watering, soil maintenance, and plant health.

Extensive study of plant performance across eighteen species, paint performance as related to heat gain, and comparisons to existing wall systems resulted in a diverse micro-scaled ecosystem that reduces heat load and welcomes pollinators to a new focal point.

Patents and State Continuing Education Requirements

Continuing education is required for landscape architecture license renewal in 37 states.[35] According to an ASLA analysis, at least four states allow continuing education credit for obtaining a patent.

[32] https://thefield.asla.org/2014/01/30/structural-soil-part-1/

[33] https://patents.google.com/patent/US5849069A/en

[34] https://theeagle.com/news/first-of-its-kind-living-wall-at-texas-a-m/article_dd02c94e-90be-11e9-8e4a-7bdc79580ace.html

[35] https://www.asla.org/continuingedrequirements.aspx

States Giving Continuing Education Credit For Landscape Architecture License Renewal For Patents

STATE	REQUIREMENT
Minnesota	Continuing education activities that satisfy the professional development requirement include, but are not limited to, the following: . . . patents, for a credit of ten PDH during the biennium in which the patent was granted. (https://mn.gov/aelslagid/continuinged.html#requirements)
New Hampshire	Lsa 403.04 Continuing Education Hour Credits Continuing education hours shall be credited as follows: . . . (j) Credit awarded for one patent shall equal 10 continuing education hours; . . . . (http://www.gencourt.state.nh.us/rules/state_agencies/lsa100-500.html)
New York	Educational activities must be offered by an approved New York State sponsor (provider) and in an acceptable subject area. A maximum of 18 of the 36 hours of continuing education may be in educational activities for landscape architects. Acceptable educational activities include: . .. Obtaining a patent related to the practice of landscape architecture. You will receive nine continuing education hours for each patent granted on an invention during the registration period. (http://www.op.nysed.gov/prof/larch/larchce.htm#rqts)
Ohio	A landscape architect may earn the required contact hours by any of the following methods, except that credit shall be awarded only once in a renewal period for the same program with the same content: . . . (6) Receiving a patent award. Credit: one hour per patent award. (https://codes.ohio.gov/ohio-administrative-code/rule-4703:1-1-06)

Landscape Architecture Technologies and Innovations in Patent Classification Systems

The Cooperative Patent Classification (CPC) is a joint partnership between the U.S. Patent and Trademark Office (USPTO) and the European Patent Office (EPO), under which the two agencies have agreed to harmonize their existing classification systems and migrate towards a common classification scheme.[36] In 2013, the USPTO moved from using the United States Patent Classification (USPC) system to the Cooperative Patent Classification (CPC) system. CPC has since been adopted by many countries throughout the world.[37]

The CPC includes nine classifications of patentable technologies, each with corresponding subsections. Section Y02 includes "Technologies or Applications for Mitigation or Adaptation Against Climate Change," which "covers selected technologies, which control, reduce or prevent anthropogenic emissions of greenhouse gases in the framework of the Kyoto Protocol and the Paris Agreement, and also technologies which allow adapting to the adverse effects of climate change."

Y02A, a subsection of Y02, focuses on "Technologies for Adaptation to Climate Change," which is defined as "technologies that allow adapting to the adverse effects of climate change in human, industrial (including agriculture and livestock), and economic activities."[38]

Within Y02A are more detailed categories of technologies to support climate change adaptation. An ASLA analysis of the technologies in Y02A shows that at least 22 of them relate directly to topics covered in the landscape architecture curricula or have been the subject of research and innovation projects by landscape architecture students and faculty, including:

[36] https://www.cooperativepatent-classification.org/about

[37] https://www.uspto.gov/patents/search/classification-standards-and-development#:~:text=On%20January%201%2C%202013%2C%20the,many%20countries%20throughout%20the%20world.

[38] https://www.cooperativepatent-classification.org/sites/default/files/cpc/scheme/Y/scheme-Y.pdf

Y02a: Technologies For Adaptation To Climate Change[39]

This subclass covers technologies for adaptation to climate change, i.e. technologies that allow adapting to the adverse effects of climate change in human, industrial (including agriculture and livestock), and economic activities.

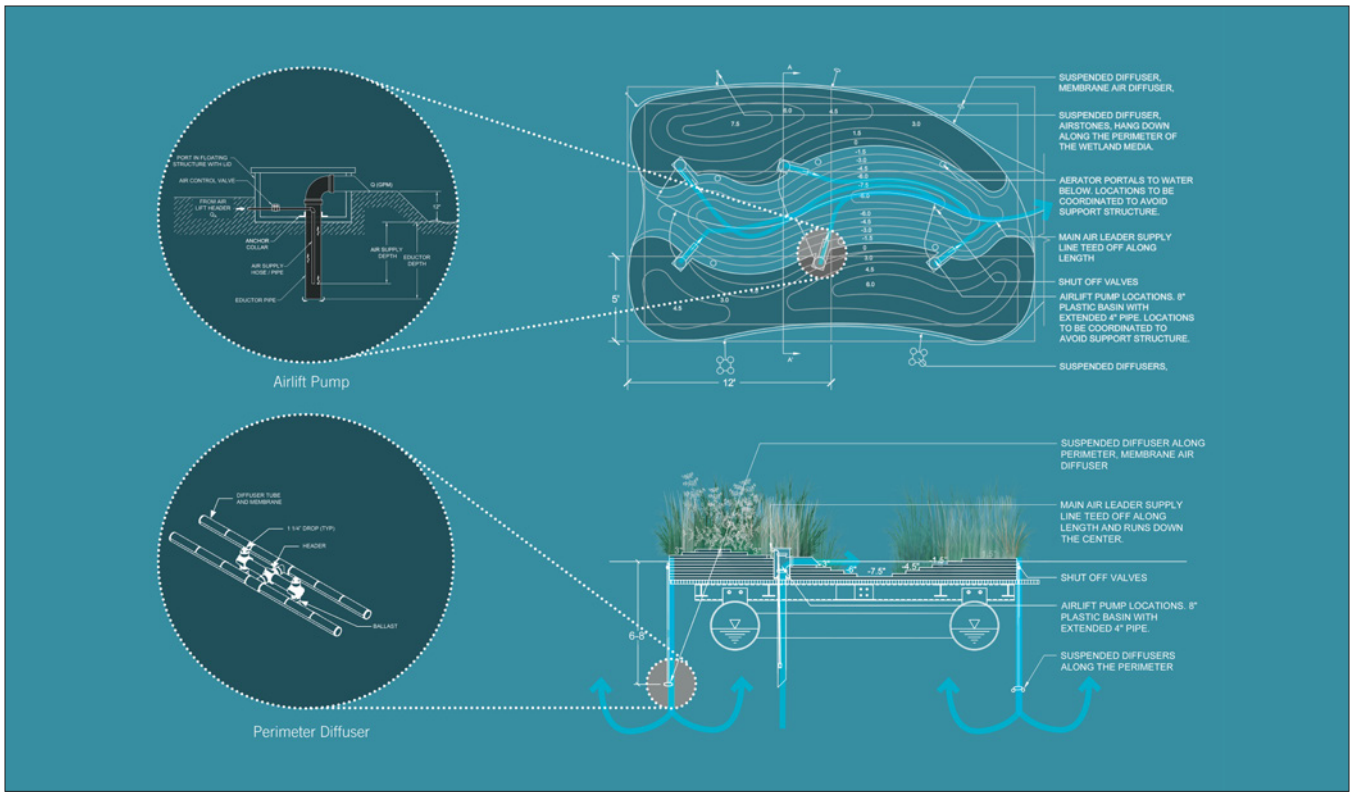
[39] https://www.cooperativepatentclassification.org/sites/default/files/cpc/scheme/Y/scheme-Y02A.pdf

Y02A 10/00		**at coastal zones; at river basins**
Y02A 10/23	*	Dune restoration or creation; Cliff stabilization
Y02A 20/00		**Water conservation; Efficient water supply; Efficient water use**
Y02A 20/108	*	Rainwater harvesting
Y02A 20/142	* * *	Solar thermal; Photovoltaics
Y02A 20/146	*	Using grey water
Y02A 20/148	* *	Using household water from wash basins or showers
Y02A 20/152	*	Water filtration
Y02A 20/20	*	Controlling water pollution; Wastewater treatment
Y02A 20/40	*	Protecting water resources
Y02A 20/402	* *	River restoration
Y02A 20/404	* *	Saltwater intrusion barriers
Y02A 30/00		**Adapting or protecting infrastructure or their operation**
Y02A 30/244	* *	Using natural or recycled building materials, e.g. straw, wool, clay or used tires
Y02A 30/254	* *	Roof garden systems; Roof coverings with high solar reflectance
Y02A 30/30	*	In transportation, e.g. on roads, waterways or railways
Y02A 30/60	*	Planning or developing urban green infrastructure

Y02A 40/00		**Adaptation technologies in agriculture, forestry, livestock or agroalimentary production**
Y02A 40/132	* * *	Plants tolerant to drought
Y02A 40/135	* * *	Plants tolerant to salinity
Y02A 40/138	* * *	Plants tolerant to heat
Y02A 40/22	* *	Improving land use; Improving water use or availability; Controlling erosion
Y02A 40/58	* * *	Using renewable energies
Y02A 40/60	*	Ecological corridors or buffer zones

Y02A 90/00		**Technologies having an indirect contribution to adaptation to climate change**
Y02A 90/10	*	Information and communication technologies [ICT] supporting adaptation to climate change, e.g. for weather forecasting or climate simulation
Y02A 90/30	*	Assessment of water resources

5. Comparing Landscape Architecture to Currently Recognized STEM Disciplines



The Department of Homeland Security (DHS) is currently reviewing a recommendation from ASLA to include landscape architecture on the STEM Designated Degree Program list. Numerous allied disciplines already are found on the DHS-approved list, including environmental studies, environmental science, plant science, urban forestry, natural resources conservation, engineering, and others.

In fact, landscape architecture degree programs across the country include as much or more STEM content as degree programs for many of these currently recognized disciplines.

A 2019 analysis of two such programs—environmental studies (CIP code 3.0103) and sustainability studies (CIP code 30.3301)—in comparison with a highly ranked landscape architecture program reveals that the landscape architecture program has higher overall STEM content than those on the DHS-approved list.

Landscape architects devised a set of prototype floating wetlands in Baltimore's inner harbor, which include a combination of airlifts and perimeter aeration diffusers that create responsive infrastructure to counteract low dissolved oxygen events before a fish kill. Through intensive field research and prototyping, landscape architects found that a mixing of water invites colonization of new biofilms and creates a refuge for species in the event of a low dissolved oxygen event.

Credit: ASLA 2018 Professional Research Honor Award. Urban Aquatic Health: Integrating New Technologies and Resiliency into Floating Wetlands. Baltimore, Maryland. Ayers Saint Gross. Client: National Aquarium

The study compared the Master of Landscape Architecture (MLA) Program at Harvard University with the Master of Environmental Studies (MES) Program at the University of Pennsylvania and the Master of Sustainability (MAS) Program at Arizona State University, finding higher overall STEM content in the required course material of the landscape architecture program. (See Table 1)

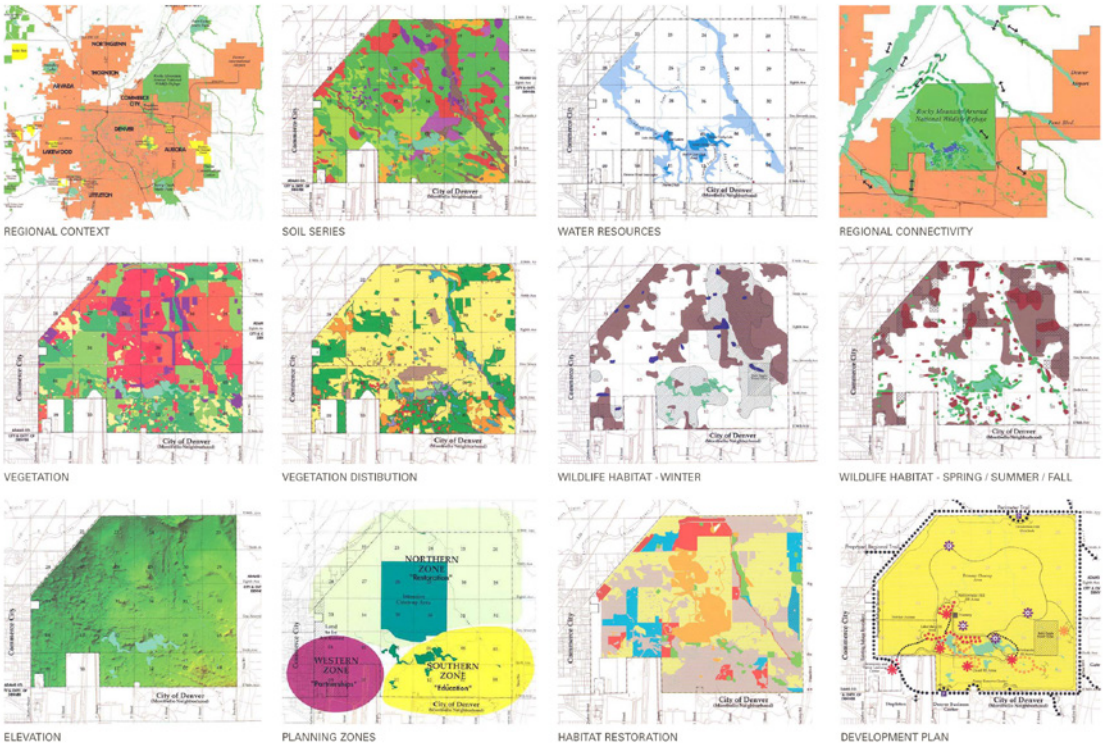
A review of the curriculum structure for each program, including a class-by-class analysis of STEM content, was used to designate each class—whether a required course or an optional course/elective—as being either "STEM-focused," including "some STEM content," or including "little to no STEM content." This analysis clearly demonstrates the breadth of STEM content for the landscape architecture program in comparison to other STEM-designated programs.

[40] Barth, Brian. Landscape Architecture STEM Graduate Curriculum Comparison [unpublished research]. 2019.

STEM Graduate Curriculum Comparison[40]

	MLA - Harvard	MES - UPenn	MAS-ASU
Required STEM-focused courses	13%	8%	-
Required courses with some STEM content	47%	17%	16%
Optional courses that may include STEM content	33%	75%	49%
Required or optional courses with little to no STEM content	7%	-	35%

6. Current Governmental Landscape Architecture STEM Designations



6.1 Federal Designations of Landscape Architecture as STEM

As noted earlier, the Bureau of Labor Statistics Standard Occupational Classification (SOC) System has recognized—and OMB has approved—landscape architecture as a science and engineering related domain since 2012.

Specifically, landscape architecture is listed under 17-0000 Architecture and Engineering Occupations. This system is used by the federal government to classify workers into occupational categories. Detailed occupations in the SOC with similar job duties, and in some cases, skills, education, and/or training, are grouped together. Under this system, landscape architecture is grouped with civil engineers, architectural and civil drafters, environmental engineers, and surveyors, all of which are included on the DHS STEM Designated Degree Program List.

For the Rocky Mountain Arsenal National Wildlife Refuge Comprehensive Management Plan in Commerce City, Colorado, landscape architects conducted intensive research and led biological assessments in order to transform a 17,000-acre Superfund site into one of the U.S.'s largest urban wildlife refuges. The plan created a template for future restoration, research, and wildlife and habitat management work.

Credit: ASLA 2018 Professional Landmark Award. From Weapons to Wildlife: The Rocky Mountain Arsenal National Wildlife Refuge Comprehensive Management Plan. Commerce City, CO. Design Workshop - Denver. Client: U.S. Fish and Wildlife Service, U.S. Army, United States Government, and Shell Oil Company

6.2 State Designations of Landscape Architecture as STEM

While not all states have developed their own lists of STEM disciplines, there are at least three states that formally define landscape architecture as a STEM discipline. The Departments of Labor in both New York[41] and Connecticut[42] recognize landscape architecture as a STEM profession. Additionally, the state of Florida recognizes landscape architecture as a STEM degree program through the Board of Governors' State University System's list of "Programs of Strategic Emphasis." The fundamental purpose of the "Programs of Strategic Emphasis" is to promote the alignment of the State University System's degree program offerings with the state's economic and workforce needs.[43]

[41] stem-occupations-in-new-york-state.pdf (ny.gov)

[42] Connecticut Careers in Science, Technology, Engineering, and Mathematics - STEM (state.ct.us)

[43] Current-PSE-list-approved-by-the-BOG-at-its-September-2020-meeting-PDF.pdf (flbog.edu)

Conclusion

Increased emphasis in recent years on the impacts of natural and built landscapes on the planet's climate and human health and well-being has underscored the need for landscape architecture professionals educated and trained in the natural, physical, and human sciences to solve increasingly complex planning and design problems. Efforts to conserve water, prevent water pollution, mitigate flooding, protect and preserve ecosystems, and protect the health and safety of the public are central to the practice of landscape architecture, and all require extensive education and training in the sciences, technology, engineering, and mathematics.

The landscape architecture profession has responded to this need by intensifying efforts to center landscape architecture education around STEM disciplines, from hydrology and botany to engineering and sustainability studies. Likewise, the landscape architecture licensure examination required by all 50 states and the District of Columbia demands extensive knowledge of STEM subjects from those who take it. In fact, as ASLA's review of landscape architecture and similar post-secondary programs indicates, landscape architecture education contains as much if not more STEM content than several disciplines that are currently defined as STEM.

Landscape architecture programs across the nation have taken on leadership roles in conducting research and developing innovative new technologies and processes using the STEM disciplines to address some of society's greatest challenges. These programs have demonstrated that patentable technology and innovation exists in the landscape architecture field.

In addition, the increasing number of federal and state government bodies defining landscape architecture as a STEM profession demonstrates the primary role that the sciences play in preparing landscape architects to innovatively address some of the nation's most complex and challenging problems.

The principles of STEM constitute the foundation of the academic criteria and professional practice of landscape architecture. Through advocacy, communication, and research, ASLA will continue to raise the visibility of the profession's innate STEM qualities and practice areas with federal, state, and local stakeholders, the STEM community, and the general public.

Appendices

Appendix A

Bureau of Labor Statistics SOC (Standard Occupational Classification) Policy Committee, June 2019, https://www.bls.gov/soc/Attachment_C_STEM_2018.pdf

Appendix B

LAAB Accreditation Standards For Professional Programs in Landscape Architecture, September 2021, https://www.asla.org/uploadedFiles/LAAB_ACCREDITATION_STANDARDS_SEPTEMBER2021.pdf

Appendix C

A Statement by the Landscape Architecture University Program Chairs on the Role of Landscape Architecture in Addressing Climate Change, September 2021, https://www.asla.org/uploadedFiles/ASLAProgramSignon-Statement-20210907.pdf

Appendix D

LARE Orientation: Understanding the Landscape Architect Registration Examination, Council of Landscape Architectural Registration Boards (CLARB), October 2020, https://www.clarb.org/docs/default-source/take-the-exam/ lareorientationguide.pdf?sfvrsn=4

Appendix E

ASLA Survey of Landscape Architecture Schools, May 2021. Charts assembled by Agora Consulting, June 2021

Appendix A

Bureau of Labor Statistics SOC (Standard Occupational Classification) Policy Committee

Key	Sub-domain	
	1	Life and Physical Science, Engineering, Mathematics, and Information Technology Occupations
	2	Social Science Occupations
	3	Architecture Occupations
	4	Health Occupations
		Split across 2 sub-domains or type of occupation

	Types of occupations	
	A	Research, Development, Design, or Practitioner Occupations
	B	Technologist and Technician Occupations
	C	Postsecondary Teaching Occupations
	D	Managerial Occupations
	E	Sales Occupations

Sub-domain and Type of Occupation	2018 SOC code	2018 SOC code
	11-1011	Chief Executives
	11-1021	General and Operations Managers
	11-1031	Legislators
	11-2011	Advertising and Promotions Managers
	11-2021	Marketing Managers
	11-2022	Sales Managers
	11-2032	Public Relations Managers
	11-2033	Fundraising Managers
	11-3012	Administrative Services Managers
	11-3013	Facilities Managers
1.D	11-3021	Computer and Information Systems Managers
	11-3031	Financial Managers
	11-3051	Industrial Production Managers
	11-3061	Purchasing Managers
	11-3071	Transportation, Storage, and Distribution Managers
	11-3111	Compensation and Benefits Managers
	11-3121	Human Resources Managers
	11-3131	Training and Development Managers
	11-9013	Farmers, Ranchers, and Other Agricultural Managers
	11-9021	Construction Managers
	11-9031	Education and Childcare Administrators, Preschool and Daycare
	11-9032	Education Administrators, Kindergarten through Secondary
	11-9033	Education Administrators, Postsecondary
	11-9039	Education Administrators, All Other
1.D and 3.D	11-9041	Architectural and Engineering Managers
	11-9051	Food Service Managers
	11-9071	Gambling Managers
	11-9072	Entertainment and Recreation Managers, Except Gambling
	11-9081	Lodging Managers
4.D	11-9111	Medical and Health Services Managers
1.D	11-9121	Natural Sciences Managers
	11-9131	Postmasters and Mail Superintendents
	11-9141	Property, Real Estate, and Community Association Managers
	11-9151	Social and Community Service Managers
	11-9161	Emergency Management Directors
	11-9171	Funeral Home Managers
	11-9179	Personal Service Managers, All Other
	11-9199	Managers, All Other

	13-1011	Agents and Business Managers of Artists, Performers, and Athletes
	13-1021	Buyers and Purchasing Agents, Farm Products
	13-1022	Wholesale and Retail Buyers, Except Farm Products
	13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products
	13-1031	Claims Adjusters, Examiners, and Investigators
	13-1032	Insurance Appraisers, Auto Damage
	13-1041	Compliance Officers
	13-1051	Cost Estimators
	13-1071	Human Resources Specialists
	13-1074	Farm Labor Contractors
	13-1075	Labor Relations Specialists
	13-1081	Logisticians
	13-1082	Project Management Specialists
	13-1111	Management Analysts
	13-1121	Meeting, Convention, and Event Planners
	13-1131	Fundraisers
	13-1141	Compensation, Benefits, and Job Analysis Specialists
	13-1151	Training and Development Specialists
	13-1161	Market Research Analysts and Marketing Specialists
	13-1199	Business Operations Specialists, All Other
	13-2011	Accountants and Auditors
	13-2022	Appraisers of Personal and Business Property
	13-2023	Appraisers and Assessors of Real Estate
	13-2031	Budget Analysts
	13-2041	Credit Analysts
	13-2051	Financial and Investment Analysts
	13-2052	Personal Financial Advisors
	13-2053	Insurance Underwriters
	13-2054	Financial Risk Specialists
	13-2061	Financial Examiners
	13-2071	Credit Counselors
	13-2072	Loan Officers
	13-2081	Tax Examiners and Collectors, and Revenue Agents
	13-2082	Tax Preparers
	13-2099	Financial Specialists, All Other
1.A	15-1211	Computer Systems Analysts
1.A	15-1212	Information Security Analysts
1.A	15-1221	Computer and Information Research Scientists
1.B	15-1231	Computer Network Support Specialists
1.B	15-1232	Computer User Support Specialists
1.A	15-1241	Computer Network Architects
1.A	15-1242	Database Administrators
1.A	15-1243	Database Architects
1.A	15-1244	Network and Computer Systems Administrators
1.A	15-1251	Computer Programmers
1.A	15-1252	Software Developers
1.A	15-1253	Software Quality Assurance Analysts and Testers
1.A	15-1254	Web Developers
1.A	15-1255	Web and Digital Interface Designers
1.A and 1.B	15-1299	Computer Occupations, All Other
1.A	15-2011	Actuaries
1.A	15-2021	Mathematicians
1.A	15-2031	Operations Research Analysts
1.A	15-2041	Statisticians
1.A	15-2051	Data Scientists
1.A and 1.B	15-2099	Mathematical Science Occupations, All Other

3.A	17-1011	Architects, Except Landscape and Naval
3.A	17-1012	Landscape Architects
1.B	17-1021	Cartographers and Photogrammetrists
1.B	17-1022	Surveyors
1.A	17-2011	Aerospace Engineers
1.A	17-2021	Agricultural Engineers
1.A	17-2031	Bioengineers and Biomedical Engineers
1.A	17-2041	Chemical Engineers
1.A	17-2051	Civil Engineers
1.A	17-2061	Computer Hardware Engineers
1.A	17-2071	Electrical Engineers
1.A	17-2072	Electronics Engineers, Except Computer
1.A	17-2081	Environmental Engineers
1.A	17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors
1.A	17-2112	Industrial Engineers
1.A	17-2121	Marine Engineers and Naval Architects
1.A	17-2131	Materials Engineers
1.A	17-2141	Mechanical Engineers
1.A	17-2151	Mining and Geological Engineers, Including Mining Safety Engineers
1.A	17-2161	Nuclear Engineers
1.A	17-2171	Petroleum Engineers
1.A	17-2199	Engineers, All Other
1.B and 3.B	17-3011	Architectural and Civil Drafters
1.B	17-3012	Electrical and Electronics Drafters
1.B	17-3013	Mechanical Drafters
1.B and 3.B	17-3019	Drafters, All Other
1.B	17-3021	Aerospace Engineering and Operations Technologists and Technicians
1.B	17-3022	Civil Engineering Technologists and Technicians
1.B	17-3023	Electrical and Electronic Engineering Technologists and Technicians
1.B	17-3024	Electro-Mechanical and Mechatronics Technologists and Technicians
1.B	17-3025	Environmental Engineering Technologists and Technicians
1.B	17-3026	Industrial Engineering Technologists and Technicians
1.B	17-3027	Mechanical Engineering Technologists and Technicians
1.B	17-3028	Calibration Technologists and Technicians
1.B	17-3029	Engineering Technologists and Technicians, Except Drafters, All Other
1.B	17-3031	Surveying and Mapping Technicians
1.A	19-1011	Animal Scientists
1.A	19-1012	Food Scientists and Technologists
1.A	19-1013	Soil and Plant Scientists
1.A	19-1021	Biochemists and Biophysicists
1.A	19-1022	Microbiologists
1.A	19-1023	Zoologists and Wildlife Biologists
1.A	19-1029	Biological Scientists, All Other
1.A	19-1031	Conservation Scientists
1.A	19-1032	Foresters
1.A	19-1041	Epidemiologists
1.A	19-1042	Medical Scientists, Except Epidemiologists
1.A	19-1099	Life Scientists, All Other
1.A	19-2011	Astronomers
1.A	19-2012	Physicists
1.A	19-2021	Atmospheric and Space Scientists
1.A	19-2031	Chemists
1.A	19-2032	Materials Scientists
1.A	19-2041	Environmental Scientists and Specialists, Including Health
1.A	19-2042	Geoscientists, Except Hydrologists and Geographers
1.A	19-2043	Hydrologists

1.A	19-2099	Physical Scientists, All Other
2.A	19-3011	Economists
2.A	19-3022	Survey Researchers
2.A	19-3032	Industrial-Organizational Psychologists
2.A	19-3033	Clinical and Counseling Psychologists
2.A	19-3034	School Psychologists
2.A	19-3039	Psychologists, All Other
2.A	19-3041	Sociologists
2.A	19-3051	Urban and Regional Planners
2.A	19-3091	Anthropologists and Archeologists
2.A	19-3092	Geographers
	19-3093	Historians
2.A	19-3094	Political Scientists
2.A	19-3099	Social Scientists and Related Workers, All Other
1.B	19-4012	Agricultural Technicians
1.B	19-4013	Food Science Technicians
1.B	19-4021	Biological Technicians
1.B	19-4031	Chemical Technicians
1.B	19-4042	Environmental Science and Protection Technicians, Including Health
1.B	19-4043	Geological Technicians, Except Hydrologic Technicians
1.B	19-4044	Hydrologic Technicians
1.B	19-4051	Nuclear Technicians
2.B	19-4061	Social Science Research Assistants
1.B	19-4071	Forest and Conservation Technicians
1.B	19-4092	Forensic Science Technicians
1.B and 2.B	19-4099	Life, Physical, and Social Science Technicians, All Other
	19-5011	Occupational Health and Safety Specialists
	19-5012	Occupational Health and Safety Technicians
	21-1011	Substance Abuse and Behavioral Disorder Counselors
	21-1012	Educational, Guidance, and Career Counselors and Advisors
	21-1013	Marriage and Family Therapists
	21-1014	Mental Health Counselors
	21-1015	Rehabilitation Counselors
	21-1019	Counselors, All Other
	21-1021	Child, Family, and School Social Workers
	21-1022	Healthcare Social Workers
	21-1023	Mental Health and Substance Abuse Social Workers
	21-1029	Social Workers, All Other
	21-1091	Health Education Specialists
	21-1092	Probation Officers and Correctional Treatment Specialists
	21-1093	Social and Human Service Assistants
	21-1094	Community Health Workers
	21-1099	Community and Social Service Specialists, All Other
	21-2011	Clergy
	21-2021	Directors, Religious Activities and Education
	21-2099	Religious Workers, All Other
	23-1011	Lawyers
	23-1012	Judicial Law Clerks
	23-1021	Administrative Law Judges, Adjudicators, and Hearing Officers
	23-1022	Arbitrators, Mediators, and Conciliators
	23-1023	Judges, Magistrate Judges, and Magistrates
	23-2011	Paralegals and Legal Assistants
	23-2093	Title Examiners, Abstractors, and Searchers
	23-2099	Legal Support Workers, All Other
	25-1011	Business Teachers, Postsecondary
1.C	25-1021	Computer Science Teachers, Postsecondary

1.C	25-1022	Mathematical Science Teachers, Postsecondary
3.C	25-1031	Architecture Teachers, Postsecondary
1.C	25-1032	Engineering Teachers, Postsecondary
1.C	25-1041	Agricultural Sciences Teachers, Postsecondary
1.C	25-1042	Biological Science Teachers, Postsecondary
1.C	25-1043	Forestry and Conservation Science Teachers, Postsecondary
1.C	25-1051	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary
1.C	25-1052	Chemistry Teachers, Postsecondary
1.C	25-1053	Environmental Science Teachers, Postsecondary
1.C	25-1054	Physics Teachers, Postsecondary
2.C	25-1061	Anthropology and Archeology Teachers, Postsecondary
2.C	25-1062	Area, Ethnic, and Cultural Studies Teachers, Postsecondary
2.C	25-1063	Economics Teachers, Postsecondary
2.C	25-1064	Geography Teachers, Postsecondary
2.C	25-1065	Political Science Teachers, Postsecondary
2.C	25-1066	Psychology Teachers, Postsecondary
2.C	25-1067	Sociology Teachers, Postsecondary
2.C	25-1069	Social Sciences Teachers, Postsecondary, All Other
4.C	25-1071	Health Specialties Teachers, Postsecondary
4.C	25-1072	Nursing Instructors and Teachers, Postsecondary
	25-1081	Education Teachers, Postsecondary
	25-1082	Library Science Teachers, Postsecondary
	25-1111	Criminal Justice and Law Enforcement Teachers, Postsecondary
	25-1112	Law Teachers, Postsecondary
	25-1113	Social Work Teachers, Postsecondary
	25-1121	Art, Drama, and Music Teachers, Postsecondary
	25-1122	Communications Teachers, Postsecondary
	25-1123	English Language and Literature Teachers, Postsecondary
	25-1124	Foreign Language and Literature Teachers, Postsecondary
	25-1125	History Teachers, Postsecondary
	25-1126	Philosophy and Religion Teachers, Postsecondary
	25-1192	Family and Consumer Sciences Teachers, Postsecondary
	25-1193	Recreation and Fitness Studies Teachers, Postsecondary
	25-1194	Career/Technical Education Teachers, Postsecondary
	25-1199	Postsecondary Teachers, All Other
	25-2011	Preschool Teachers, Except Special Education
	25-2012	Kindergarten Teachers, Except Special Education
	25-2021	Elementary School Teachers, Except Special Education
	25-2022	Middle School Teachers, Except Special and Career/Technical Education
	25-2023	Career/Technical Education Teachers, Middle School
	25-2031	Secondary School Teachers, Except Special and Career/Technical Education
	25-2032	Career/Technical Education Teachers, Secondary School
	25-2051	Special Education Teachers, Preschool
	25-2055	Special Education Teachers, Kindergarten
	25-2056	Special Education Teachers, Elementary School
	25-2057	Special Education Teachers, Middle School
	25-2058	Special Education Teachers, Secondary School
	25-2059	Special Education Teachers, All Other
	25-3011	Adult Basic Education, Adult Secondary Education, and English as a Second Language Instructors
	25-3021	Self-Enrichment Teachers
	25-3031	Substitute Teachers, Short-Term
	25-3041	Tutors
	25-3099	Teachers and Instructors, All Other
	25-4011	Archivists
	25-4012	Curators
	25-4013	Museum Technicians and Conservators

	25-4022	Librarians and Media Collections Specialists
	25-4031	Library Technicians
	25-9021	Farm and Home Management Educators
	25-9031	Instructional Coordinators
	25-9042	Teaching Assistants, Preschool, Elementary, Middle, and Secondary School, Except Special Education
	25-9043	Teaching Assistants, Special Education
	25-9044	Teaching Assistants, Postsecondary
	25-9049	Teaching Assistants, All Other
	25-9099	Educational Instruction and Library Workers, All Other
	27-1011	Art Directors
	27-1012	Craft Artists
	27-1013	Fine Artists, Including Painters, Sculptors, and Illustrators
	27-1014	Special Effects Artists and Animators
	27-1019	Artists and Related Workers, All Other
	27-1021	Commercial and Industrial Designers
	27-1022	Fashion Designers
	27-1023	Floral Designers
	27-1024	Graphic Designers
	27-1025	Interior Designers
	27-1026	Merchandise Displayers and Window Trimmers
	27-1027	Set and Exhibit Designers
	27-1029	Designers, All Other
	27-2011	Actors
	27-2012	Producers and Directors
	27-2021	Athletes and Sports Competitors
	27-2022	Coaches and Scouts
	27-2023	Umpires, Referees, and Other Sports Officials
	27-2031	Dancers
	27-2032	Choreographers
	27-2041	Music Directors and Composers
	27-2042	Musicians and Singers
	27-2091	Disc Jockeys, Except Radio
	27-2099	Entertainers and Performers, Sports and Related Workers, All Other
	27-3011	Broadcast Announcers and Radio Disc Jockeys
	27-3023	News Analysts, Reporters, and Journalists
	27-3031	Public Relations Specialists
	27-3041	Editors
	27-3042	Technical Writers
	27-3043	Writers and Authors
	27-3091	Interpreters and Translators
	27-3092	Court Reporters and Simultaneous Captioners
	27-3099	Media and Communication Workers, All Other
	27-4011	Audio and Video Technicians
	27-4012	Broadcast Technicians
	27-4014	Sound Engineering Technicians
	27-4015	Lighting Technicians
	27-4021	Photographers
	27-4031	Camera Operators, Television, Video, and Film
	27-4032	Film and Video Editors
	27-4099	Media and Communication Equipment Workers, All Other
4.A	29-1011	Chiropractors
4.A	29-1021	Dentists, General
4.A	29-1022	Oral and Maxillofacial Surgeons
4.A	29-1023	Orthodontists
4.A	29-1024	Prosthodontists
4.A	29-1029	Dentists, All Other Specialists

4.A	29-1031	Dietitians and Nutritionists
4.A	29-1041	Optometrists
4.A	29-1051	Pharmacists
4.A	29-1071	Physician Assistants
4.A	29-1081	Podiatrists
4.A	29-1122	Occupational Therapists
4.A	29-1123	Physical Therapists
4.A	29-1124	Radiation Therapists
4.A	29-1125	Recreational Therapists
4.A	29-1126	Respiratory Therapists
4.A	29-1127	Speech-Language Pathologists
4.A	29-1128	Exercise Physiologists
4.A	29-1129	Therapists, All Other
4.A	29-1131	Veterinarians
4.A	29-1141	Registered Nurses
4.A	29-1151	Nurse Anesthetists
4.A	29-1161	Nurse Midwives
4.A	29-1171	Nurse Practitioners
4.A	29-1181	Audiologists
4.A	29-1211	Anesthesiologists
4.A	29-1212	Cardiologists
4.A	29-1213	Dermatologists
4.A	29-1214	Emergency Medicine Physicians
4.A	29-1215	Family Medicine Physicians
4.A	29-1216	General Internal Medicine Physicians
4.A	29-1217	Neurologists
4.A	29-1218	Obstetricians and Gynecologists
4.A	29-1221	Pediatricians, General
4.A	29-1222	Physicians, Pathologists
4.A	29-1223	Psychiatrists
4.A	29-1224	Radiologists
4.A	29-1229	Physicians, All Other
4.A	29-1241	Ophthalmologists, Except Pediatric
4.A	29-1242	Orthopedic Surgeons, Except Pediatric
4.A	29-1243	Pediatric Surgeons
4.A	29-1249	Surgeons, All Other
4.A	29-1291	Acupuncturists
4.A	29-1292	Dental Hygienists
4.A	29-1299	Healthcare Diagnosing or Treating Practitioners, All Other
4.B	29-2011	Medical and Clinical Laboratory Technologists
4.B	29-2012	Medical and Clinical Laboratory Technicians
4.B	29-2031	Cardiovascular Technologists and Technicians
4.B	29-2032	Diagnostic Medical Sonographers
4.B	29-2033	Nuclear Medicine Technologists
4.B	29-2034	Radiologic Technologists and Technicians
4.B	29-2035	Magnetic Resonance Imaging Technologists
4.B	29-2036	Medical Dosimetrists
4.B	29-2042	Emergency Medical Technicians
4.B	29-2043	Paramedics
4.B	29-2051	Dietetic Technicians
4.B	29-2052	Pharmacy Technicians
4.B	29-2053	Psychiatric Technicians
4.B	29-2055	Surgical Technologists
4.B	29-2056	Veterinary Technologists and Technicians
4.B	29-2057	Ophthalmic Medical Technicians
4.B	29-2061	Licensed Practical and Licensed Vocational Nurses

4.B	29-2072	Medical Records Specialists
4.B	29-2081	Opticians, Dispensing
4.B	29-2091	Orthotists and Prosthetists
4.B	29-2092	Hearing Aid Specialists
4.B	29-2099	Health Technologists and Technicians, All Other
4.A and 4.B	29-9021	Health Information Technologists and Medical Registrars
4.A	29-9091	Athletic Trainers
4.A	29-9092	Genetic Counselors
4.A	29-9093	Surgical Assistants
4.A and 4.B	29-9099	Healthcare Practitioners and Technical Workers, All Other
	31-1121	Home Health Aides
	31-1122	Personal Care Aides
	31-1131	Nursing Assistants
	31-1132	Orderlies
	31-1133	Psychiatric Aides
	31-2011	Occupational Therapy Assistants
	31-2012	Occupational Therapy Aides
	31-2021	Physical Therapist Assistants
	31-2022	Physical Therapist Aides
	31-9011	Massage Therapists
	31-9091	Dental Assistants
	31-9092	Medical Assistants
	31-9093	Medical Equipment Preparers
	31-9094	Medical Transcriptionists
	31-9095	Pharmacy Aides
	31-9096	Veterinary Assistants and Laboratory Animal Caretakers
	31-9097	Phlebotomists
	31-9099	Healthcare Support Workers, All Other
	33-1011	First-Line Supervisors of Correctional Officers
	33-1012	First-Line Supervisors of Police and Detectives
	33-1021	First-Line Supervisors of Firefighting and Prevention Workers
	33-1091	First-Line Supervisors of Security Workers
	33-1099	First-Line Supervisors of Protective Service Workers, All Other
	33-2011	Firefighters
	33-2021	Fire Inspectors and Investigators
	33-2022	Forest Fire Inspectors and Prevention Specialists
	33-3011	Bailiffs
	33-3012	Correctional Officers and Jailers
	33-3021	Detectives and Criminal Investigators
	33-3031	Fish and Game Wardens
	33-3041	Parking Enforcement Workers
	33-3051	Police and Sheriff's Patrol Officers
	33-3052	Transit and Railroad Police
	33-9011	Animal Control Workers
	33-9021	Private Detectives and Investigators
	33-9031	Gambling Surveillance Officers and Gambling Investigators
	33-9032	Security Guards
	33-9091	Crossing Guards and Flaggers
	33-9092	Lifeguards, Ski Patrol, and Other Recreational Protective Service Workers
	33-9093	Transportation Security Screeners
	33-9094	School Bus Monitors
	33-9099	Protective Service Workers, All Other
	35-1011	Chefs and Head Cooks
	35-1012	First-Line Supervisors of Food Preparation and Serving Workers
	35-2011	Cooks, Fast Food
	35-2012	Cooks, Institution and Cafeteria

35-2013	Cooks, Private Household
35-2014	Cooks, Restaurant
35-2015	Cooks, Short Order
35-2019	Cooks, All Other
35-2021	Food Preparation Workers
35-3011	Bartenders
35-3023	Fast Food and Counter Workers
35-3031	Waiters and Waitresses
35-3041	Food Servers, Nonrestaurant
35-9011	Dining Room and Cafeteria Attendants and Bartender Helpers
35-9021	Dishwashers
35-9031	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop
35-9099	Food Preparation and Serving Related Workers, All Other
37-1011	First-Line Supervisors of Housekeeping and Janitorial Workers
37-1012	First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers
37-2011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners
37-2012	Maids and Housekeeping Cleaners
37-2019	Building Cleaning Workers, All Other
37-2021	Pest Control Workers
37-3011	Landscaping and Groundskeeping Workers
37-3012	Pesticide Handlers, Sprayers, and Applicators, Vegetation
37-3013	Tree Trimmers and Pruners
37-3019	Grounds Maintenance Workers, All Other
39-1013	First-Line Supervisors of Gambling Services Workers
39-1014	First-Line Supervisors of Entertainment and Recreation Workers, Except Gambling Services
39-1022	First-Line Supervisors of Personal Service Workers
39-2011	Animal Trainers
39-2021	Animal Caretakers
39-3011	Gambling Dealers
39-3012	Gambling and Sports Book Writers and Runners
39-3019	Gambling Service Workers, All Other
39-3021	Motion Picture Projectionists
39-3031	Ushers, Lobby Attendants, and Ticket Takers
39-3091	Amusement and Recreation Attendants
39-3092	Costume Attendants
39-3093	Locker Room, Coatroom, and Dressing Room Attendants
39-3099	Entertainment Attendants and Related Workers, All Other
39-4011	Embalmers
39-4012	Crematory Operators
39-4021	Funeral Attendants
39-4031	Morticians, Undertakers, and Funeral Arrangers
39-5011	Barbers
39-5012	Hairdressers, Hairstylists, and Cosmetologists
39-5091	Makeup Artists, Theatrical and Performance
39-5092	Manicurists and Pedicurists
39-5093	Shampooers
39-5094	Skincare Specialists
39-6011	Baggage Porters and Bellhops
39-6012	Concierges
39-7011	Tour Guides and Escorts
39-7012	Travel Guides
39-9011	Childcare Workers
39-9031	Exercise Trainers and Group Fitness Instructors
39-9032	Recreation Workers
39-9041	Residential Advisors
39-9099	Personal Care and Service Workers, All Other

	41-1011	First-Line Supervisors of Retail Sales Workers
	41-1012	First-Line Supervisors of Non-Retail Sales Workers
	41-2011	Cashiers
	41-2012	Gambling Change Persons and Booth Cashiers
	41-2021	Counter and Rental Clerks
	41-2022	Parts Salespersons
	41-2031	Retail Salespersons
	41-3011	Advertising Sales Agents
	41-3021	Insurance Sales Agents
	41-3031	Securities, Commodities, and Financial Services Sales Agents
	41-3041	Travel Agents
	41-3091	Sales Representatives of Services, Except Advertising, Insurance, Financial Services, and Travel
1.E	41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
	41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products
	41-9011	Demonstrators and Product Promoters
	41-9012	Models
	41-9021	Real Estate Brokers
	41-9022	Real Estate Sales Agents
1.E	41-9031	Sales Engineers
	41-9041	Telemarketers
	41-9091	Door-to-Door Sales Workers, News and Street Vendors, and Related Workers
	41-9099	Sales and Related Workers, All Other
	43-1011	First-Line Supervisors of Office and Administrative Support Workers
	43-2011	Switchboard Operators, Including Answering Service
	43-2021	Telephone Operators
	43-2099	Communications Equipment Operators, All Other
	43-3011	Bill and Account Collectors
	43-3021	Billing and Posting Clerks
	43-3031	Bookkeeping, Accounting, and Auditing Clerks
	43-3041	Gambling Cage Workers
	43-3051	Payroll and Timekeeping Clerks
	43-3061	Procurement Clerks
	43-3071	Tellers
	43-3099	Financial Clerks, All Other
	43-4011	Brokerage Clerks
	43-4021	Correspondence Clerks
	43-4031	Court, Municipal, and License Clerks
	43-4041	Credit Authorizers, Checkers, and Clerks
	43-4051	Customer Service Representatives
	43-4061	Eligibility Interviewers, Government Programs
	43-4071	File Clerks
	43-4081	Hotel, Motel, and Resort Desk Clerks
	43-4111	Interviewers, Except Eligibility and Loan
	43-4121	Library Assistants, Clerical
	43-4131	Loan Interviewers and Clerks
	43-4141	New Accounts Clerks
	43-4151	Order Clerks
	43-4161	Human Resources Assistants, Except Payroll and Timekeeping
	43-4171	Receptionists and Information Clerks
	43-4181	Reservation and Transportation Ticket Agents and Travel Clerks
	43-4199	Information and Record Clerks, All Other
	43-5011	Cargo and Freight Agents
	43-5021	Couriers and Messengers
	43-5031	Public Safety Telecommunicators
	43-5032	Dispatchers, Except Police, Fire, and Ambulance
	43-5041	Meter Readers, Utilities

43-5051	Postal Service Clerks
43-5052	Postal Service Mail Carriers
43-5053	Postal Service Mail Sorters, Processors, and Processing Machine Operators
43-5061	Production, Planning, and Expediting Clerks
43-5071	Shipping, Receiving, and Inventory Clerks
43-5111	Weighers, Measurers, Checkers, and Samplers, Recordkeeping
43-6011	Executive Secretaries and Executive Administrative Assistants
43-6012	Legal Secretaries and Administrative Assistants
43-6013	Medical Secretaries and Administrative Assistants
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive
43-9021	Data Entry Keyers
43-9022	Word Processors and Typists
43-9031	Desktop Publishers
43-9041	Insurance Claims and Policy Processing Clerks
43-9051	Mail Clerks and Mail Machine Operators, Except Postal Service
43-9061	Office Clerks, General
43-9071	Office Machine Operators, Except Computer
43-9081	Proofreaders and Copy Markers
43-9111	Statistical Assistants
43-9199	Office and Administrative Support Workers, All Other
45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers
45-2011	Agricultural Inspectors
45-2021	Animal Breeders
45-2041	Graders and Sorters, Agricultural Products
45-2091	Agricultural Equipment Operators
45-2092	Farmworkers and Laborers, Crop, Nursery, and Greenhouse
45-2093	Farmworkers, Farm, Ranch, and Aquacultural Animals
45-2099	Agricultural Workers, All Other
45-3031	Fishing and Hunting Workers
45-4011	Forest and Conservation Workers
45-4021	Fallers
45-4022	Logging Equipment Operators
45-4023	Log Graders and Scalers
45-4029	Logging Workers, All Other
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers
47-2011	Boilermakers
47-2021	Brickmasons and Blockmasons
47-2022	Stonemasons
47-2031	Carpenters
47-2041	Carpet Installers
47-2042	Floor Layers, Except Carpet, Wood, and Hard Tiles
47-2043	Floor Sanders and Finishers
47-2044	Tile and Stone Setters
47-2051	Cement Masons and Concrete Finishers
47-2053	Terrazzo Workers and Finishers
47-2061	Construction Laborers
47-2071	Paving, Surfacing, and Tamping Equipment Operators
47-2072	Pile Driver Operators
47-2073	Operating Engineers and Other Construction Equipment Operators
47-2081	Drywall and Ceiling Tile Installers
47-2082	Tapers
47-2111	Electricians
47-2121	Glaziers
47-2131	Insulation Workers, Floor, Ceiling, and Wall
47-2132	Insulation Workers, Mechanical
47-2141	Painters, Construction and Maintenance

47-2142	Paperhangers
47-2151	Pipelayers
47-2152	Plumbers, Pipefitters, and Steamfitters
47-2161	Plasterers and Stucco Masons
47-2171	Reinforcing Iron and Rebar Workers
47-2181	Roofers
47-2211	Sheet Metal Workers
47-2221	Structural Iron and Steel Workers
47-2231	Solar Photovoltaic Installers
47-3011	Helpers--Brickmasons, Blockmasons, Stonemasons, and Tile and Marble Setters
47-3012	Helpers--Carpenters
47-3013	Helpers--Electricians
47-3014	Helpers--Painters, Paperhangers, Plasterers, and Stucco Masons
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters
47-3016	Helpers--Roofers
47-3019	Helpers, Construction Trades, All Other
47-4011	Construction and Building Inspectors
47-4021	Elevator and Escalator Installers and Repairers
47-4031	Fence Erectors
47-4041	Hazardous Materials Removal Workers
47-4051	Highway Maintenance Workers
47-4061	Rail-Track Laying and Maintenance Equipment Operators
47-4071	Septic Tank Servicers and Sewer Pipe Cleaners
47-4091	Segmental Pavers
47-4099	Construction and Related Workers, All Other
47-5011	Derrick Operators, Oil and Gas
47-5012	Rotary Drill Operators, Oil and Gas
47-5013	Service Unit Operators, Oil and Gas
47-5022	Excavating and Loading Machine and Dragline Operators, Surface Mining
47-5023	Earth Drillers, Except Oil and Gas
47-5032	Explosives Workers, Ordnance Handling Experts, and Blasters
47-5041	Continuous Mining Machine Operators
47-5043	Roof Bolters, Mining
47-5044	Loading and Moving Machine Operators, Underground Mining
47-5049	Underground Mining Machine Operators, All Other
47-5051	Rock Splitters, Quarry
47-5071	Roustabouts, Oil and Gas
47-5081	Helpers--Extraction Workers
47-5099	Extraction Workers, All Other
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers
49-2011	Computer, Automated Teller, and Office Machine Repairers
49-2021	Radio, Cellular, and Tower Equipment Installers and Repairers
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers
49-2091	Avionics Technicians
49-2092	Electric Motor, Power Tool, and Related Repairers
49-2093	Electrical and Electronics Installers and Repairers, Transportation Equipment
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay
49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles
49-2097	Audiovisual Equipment Installers and Repairers
49-2098	Security and Fire Alarm Systems Installers
49-3011	Aircraft Mechanics and Service Technicians
49-3021	Automotive Body and Related Repairers
49-3022	Automotive Glass Installers and Repairers
49-3023	Automotive Service Technicians and Mechanics
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists

49-3041	Farm Equipment Mechanics and Service Technicians
49-3042	Mobile Heavy Equipment Mechanics, Except Engines
49-3043	Rail Car Repairers
49-3051	Motorboat Mechanics and Service Technicians
49-3052	Motorcycle Mechanics
49-3053	Outdoor Power Equipment and Other Small Engine Mechanics
49-3091	Bicycle Repairers
49-3092	Recreational Vehicle Service Technicians
49-3093	Tire Repairers and Changers
49-9011	Mechanical Door Repairers
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers
49-9031	Home Appliance Repairers
49-9041	Industrial Machinery Mechanics
49-9043	Maintenance Workers, Machinery
49-9044	Millwrights
49-9045	Refractory Materials Repairers, Except Brickmasons
49-9051	Electrical Power-Line Installers and Repairers
49-9052	Telecommunications Line Installers and Repairers
49-9061	Camera and Photographic Equipment Repairers
49-9062	Medical Equipment Repairers
49-9063	Musical Instrument Repairers and Tuners
49-9064	Watch and Clock Repairers
49-9069	Precision Instrument and Equipment Repairers, All Other
49-9071	Maintenance and Repair Workers, General
49-9081	Wind Turbine Service Technicians
49-9091	Coin, Vending, and Amusement Machine Servicers and Repairers
49-9092	Commercial Divers
49-9094	Locksmiths and Safe Repairers
49-9095	Manufactured Building and Mobile Home Installers
49-9096	Riggers
49-9097	Signal and Track Switch Repairers
49-9098	Helpers--Installation, Maintenance, and Repair Workers
49-9099	Installation, Maintenance, and Repair Workers, All Other
51-1011	First-Line Supervisors of Production and Operating Workers
51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers
51-2021	Coil Winders, Tapers, and Finishers
51-2022	Electrical and Electronic Equipment Assemblers
51-2023	Electromechanical Equipment Assemblers
51-2031	Engine and Other Machine Assemblers
51-2041	Structural Metal Fabricators and Fitters
51-2051	Fiberglass Laminators and Fabricators
51-2061	Timing Device Assemblers and Adjusters
51-2092	Team Assemblers
51-2099	Assemblers and Fabricators, All Other
51-3011	Bakers
51-3021	Butchers and Meat Cutters
51-3022	Meat, Poultry, and Fish Cutters and Trimmers
51-3023	Slaughterers and Meat Packers
51-3091	Food and Tobacco Roasting, Baking, and Drying Machine Operators and Tenders
51-3092	Food Batchmakers
51-3093	Food Cooking Machine Operators and Tenders
51-3099	Food Processing Workers, All Other
51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic
51-4022	Forging Machine Setters, Operators, and Tenders, Metal and Plastic
51-4023	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic

51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic
51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic
51-4041	Machinists
51-4051	Metal-Refining Furnace Operators and Tenders
51-4052	Pourers and Casters, Metal
51-4061	Model Makers, Metal and Plastic
51-4062	Patternmakers, Metal and Plastic
51-4071	Foundry Mold and Coremakers
51-4072	Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic
51-4111	Tool and Die Makers
51-4121	Welders, Cutters, Solderers, and Brazers
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders
51-4191	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic
51-4192	Layout Workers, Metal and Plastic
51-4193	Plating Machine Setters, Operators, and Tenders, Metal and Plastic
51-4194	Tool Grinders, Filers, and Sharpeners
51-4199	Metal Workers and Plastic Workers, All Other
51-5111	Prepress Technicians and Workers
51-5112	Printing Press Operators
51-5113	Print Binding and Finishing Workers
51-6011	Laundry and Dry-Cleaning Workers
51-6021	Pressers, Textile, Garment, and Related Materials
51-6031	Sewing Machine Operators
51-6041	Shoe and Leather Workers and Repairers
51-6042	Shoe Machine Operators and Tenders
51-6051	Sewers, Hand
51-6052	Tailors, Dressmakers, and Custom Sewers
51-6061	Textile Bleaching and Dyeing Machine Operators and Tenders
51-6062	Textile Cutting Machine Setters, Operators, and Tenders
51-6063	Textile Knitting and Weaving Machine Setters, Operators, and Tenders
51-6064	Textile Winding, Twisting, and Drawing Out Machine Setters, Operators, and Tenders
51-6091	Extruding and Forming Machine Setters, Operators, and Tenders, Synthetic and Glass Fibers
51-6092	Fabric and Apparel Patternmakers
51-6093	Upholsterers
51-6099	Textile, Apparel, and Furnishings Workers, All Other
51-7011	Cabinetmakers and Bench Carpenters
51-7021	Furniture Finishers
51-7031	Model Makers, Wood
51-7032	Patternmakers, Wood
51-7041	Sawing Machine Setters, Operators, and Tenders, Wood
51-7042	Woodworking Machine Setters, Operators, and Tenders, Except Sawing
51-7099	Woodworkers, All Other
51-8011	Nuclear Power Reactor Operators
51-8012	Power Distributors and Dispatchers
51-8013	Power Plant Operators
51-8021	Stationary Engineers and Boiler Operators
51-8031	Water and Wastewater Treatment Plant and System Operators
51-8091	Chemical Plant and System Operators
51-8092	Gas Plant Operators
51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers
51-8099	Plant and System Operators, All Other
51-9011	Chemical Equipment Operators and Tenders

51-9012	Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders
51-9021	Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders
51-9022	Grinding and Polishing Workers, Hand
51-9023	Mixing and Blending Machine Setters, Operators, and Tenders
51-9031	Cutters and Trimmers, Hand
51-9032	Cutting and Slicing Machine Setters, Operators, and Tenders
51-9041	Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders
51-9051	Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers
51-9071	Jewelers and Precious Stone and Metal Workers
51-9081	Dental Laboratory Technicians
51-9082	Medical Appliance Technicians
51-9083	Ophthalmic Laboratory Technicians
51-9111	Packaging and Filling Machine Operators and Tenders
51-9123	Painting, Coating, and Decorating Workers
51-9124	Coating, Painting, and Spraying Machine Setters, Operators, and Tenders
51-9141	Semiconductor Processing Technicians
51-9151	Photographic Process Workers and Processing Machine Operators
51-9161	Computer Numerically Controlled Tool Operators
51-9162	Computer Numerically Controlled Tool Programmers
51-9191	Adhesive Bonding Machine Operators and Tenders
51-9192	Cleaning, Washing, and Metal Pickling Equipment Operators and Tenders
51-9193	Cooling and Freezing Equipment Operators and Tenders
51-9194	Etchers and Engravers
51-9195	Molders, Shapers, and Casters, Except Metal and Plastic
51-9196	Paper Goods Machine Setters, Operators, and Tenders
51-9197	Tire Builders
51-9198	Helpers--Production Workers
51-9199	Production Workers, All Other
53-1041	Aircraft Cargo Handling Supervisors
53-1042	First-Line Supervisors of Helpers, Laborers, and Material Movers, Hand
53-1043	First-Line Supervisors of Material-Moving Machine and Vehicle Operators
53-1044	First-Line Supervisors of Passenger Attendants
53-1049	First-Line Supervisors of Transportation Workers, All Other
53-2011	Airline Pilots, Copilots, and Flight Engineers
53-2012	Commercial Pilots
53-2021	Air Traffic Controllers
53-2022	Airfield Operations Specialists
53-2031	Flight Attendants
53-3011	Ambulance Drivers and Attendants, Except Emergency Medical Technicians
53-3031	Driver/Sales Workers
53-3032	Heavy and Tractor-Trailer Truck Drivers
53-3033	Light Truck Drivers
53-3051	Bus Drivers, School
53-3052	Bus Drivers, Transit and Intercity
53-3053	Shuttle Drivers and Chauffeurs
53-3054	Taxi Drivers
53-3099	Motor Vehicle Operators, All Other
53-4011	Locomotive Engineers
53-4013	Rail Yard Engineers, Dinkey Operators, and Hostlers
53-4022	Railroad Brake, Signal, and Switch Operators and Locomotive Firers
53-4031	Railroad Conductors and Yardmasters
53-4041	Subway and Streetcar Operators
53-4099	Rail Transportation Workers, All Other
53-5011	Sailors and Marine Oilers
53-5021	Captains, Mates, and Pilots of Water Vessels

53-5022	Motorboat Operators
53-5031	Ship Engineers
53-6011	Bridge and Lock Tenders
53-6021	Parking Attendants
53-6031	Automotive and Watercraft Service Attendants
53-6032	Aircraft Service Attendants
53-6041	Traffic Technicians
53-6051	Transportation Inspectors
53-6061	Passenger Attendants
53-6099	Transportation Workers, All Other
53-7011	Conveyor Operators and Tenders
53-7021	Crane and Tower Operators
53-7031	Dredge Operators
53-7041	Hoist and Winch Operators
53-7051	Industrial Truck and Tractor Operators
53-7061	Cleaners of Vehicles and Equipment
53-7062	Laborers and Freight, Stock, and Material Movers, Hand
53-7063	Machine Feeders and Offbearers
53-7064	Packers and Packagers, Hand
53-7065	Stockers and Order Fillers
53-7071	Gas Compressor and Gas Pumping Station Operators
53-7072	Pump Operators, Except Wellhead Pumpers
53-7073	Wellhead Pumpers
53-7081	Refuse and Recyclable Material Collectors
53-7121	Tank Car, Truck, and Ship Loaders
53-7199	Material Moving Workers, All Other
55-1011	Air Crew Officers
55-1012	Aircraft Launch and Recovery Officers
55-1013	Armored Assault Vehicle Officers
55-1014	Artillery and Missile Officers
55-1015	Command and Control Center Officers
55-1016	Infantry Officers
55-1017	Special Forces Officers
55-1019	Military Officer Special and Tactical Operations Leaders, All Other
55-2011	First-Line Supervisors of Air Crew Members
55-2012	First-Line Supervisors of Weapons Specialists/Crew Members
55-2013	First-Line Supervisors of All Other Tactical Operations Specialists
55-3011	Air Crew Members
55-3012	Aircraft Launch and Recovery Specialists
55-3013	Armored Assault Vehicle Crew Members
55-3014	Artillery and Missile Crew Members
55-3015	Command and Control Center Specialists
55-3016	Infantry
55-3018	Special Forces
55-3019	Military Enlisted Tactical Operations and Air/Weapons Specialists and Crew Members, All Other

Appendix B

LAAB Accreditation Standards For Professional Programs in Landscape Architecture

Introduction

The mission of the Landscape Architectural Accreditation Board (LAAB) is to evaluate, advocate for, and advance the quality of education in professional programs leading to a degree in landscape architecture. To do that, the Board creates and applies Accreditation ***Standards*** and Accreditation ***Procedures*** which LAAB develops with input from the communities of interest. The Standards are qualitative statements of the essential conditions which a professional program in landscape architecture must meet to achieve accreditation. The Procedures identify the mission, goals, and values of LAAB, define the accreditation process, and establish the basis for decision-making within and action undertaken by the LAAB. LAAB regularly reviews and assesses the Standards and Procedures—at a minimum of once every five years— through a process articulated in the Accreditation Procedures.

This document contains the Accreditation Standards.

Core Values

The profession of landscape architecture serves two primary principles in the planning, design, and stewardship of natural and built environments: 1) to protect the health, safety, and well-being of people and communities, including future generations; and 2) to safeguard the health and resilience of natural systems, ecosystems, and non-human inhabitants.

LAAB believes the following Core Values are essential to the education of future landscape architects. Accordingly, the professional program shall embed these Core Values into its curriculum, policies, community, processes, and activities, and identify and engage in contemporary issues in alignment with these Core Values.

1. **Environmental Health, Sustainability, Resilience, and Stewardship**: Landscape architects preserve, plan, design, and steward healthy environmental systems that promote the health and resilience of the environment, people, and cultures. Well-functioning ecological and biological systems are assets essential to the well-being, sustainability, and resiliency of current and future generations.

2. **Diversity, Equity, and Inclusion**: Landscape architects, through their professional undertakings and products, strive to create and maintain an inclusive and welcoming climate which embraces differences, offers respect in words and actions, displays cultural sensitivity and competence, and values all people and their perspectives as essential for the health and well-being of diverse individuals and communities.

3. **Human and Community Health and Safety**: Landscape architectural practice impacts individual and community health, safety, and well-being. Landscape architects commit to methodologies that study and understand the public protections, policies, and environmental justice outcomes that improve individual and community health.

4. **Professional Ethics and Responsibility**: Landscape architects serve the environment, the public, and their clients; address inherent conflicts in those services with honesty, integrity, fairness, equality, dignity, and with a recognition of diverse and individual rights; and advocate for the principles of the profession.

5. **Leadership and Innovation**: To practice effectively in changing contexts, landscape architects seek continuous advancement of their own and the discipline's values, knowledge, and skills; create new ideas and knowledge; effect positive change in the environment; and lead, inspire, facilitate, and empower innovation.

6. **Application of the Sciences to the Design of Natural and Built Landscapes**: As practitioners of a discipline firmly rooted in the natural, physical, and social sciences, landscape architects utilize science, technology, engineering, and mathematics to develop innovative, site-specific design solutions that protect both human and environmental health and safety.

Definitions, Interpretation, and Application

The information which follows is included to clarify the meaning and intent of words and terminology used throughout these Standards.

Accreditation: Accreditation is a voluntary process of peer review designed to evaluate programs against not only the accreditation standards that follow but also the program's own stated objectives.

Accreditation Procedures: Accreditation Procedures define the accreditation process and establish the basis for decision-making and action undertaken by the Board.

Administrative Probationary Accreditation: Administrative Probationary Accreditation status is assigned when an institution or professional program does not meet its administrative obligations. LAAB assigns this status if the institution or professional program fails to comply with one or more of the following requirements:

- paying annual fees within 90 days of the invoice date,
- paying a late fee by the due date,
- submitting reports or other required information within 45 days of the due date, or
- agreeing to a reasonable on-site evaluation visit date at or near the time established by LAAB staff.

Administrative Probationary Accreditation is an accreditation category not subject to appeal. The professional program is recognized and listed as accredited with this designation until the requirement(s) that was not met has been fully satisfied. Failure to completely remedy the situation by the date specified in the probationary letter may result in revocation of accreditation.

***Assessment*:** Assessment is the process by which a professional program or institution's level of compliance with and achievement of the accreditation-relevant criteria is evaluated.

Candidacy: Candidacy status is an accreditation classification granted to a professional program that is in the planning or early stages of development, or in an intermediate stage of program implementation.

Compliance: Compliance with a standard is achieved when LAAB concludes—after review of relevant indicators or other evidence—that the standard is "Met" or "Met with Recommendation," as defined below. To achieve LAAB accreditation, a professional program must demonstrate through the Self- Evaluation Report, site visit, and technical accuracy review of the Visiting Team's Report that it complies with all standards.

Considerations for Improvement: Considerations for Improvement are informal counsel offered to a professional program as a part of the Visiting Team's Report but not included in the final action letter from LAAB to the professional program. These may be areas where the professional program can build on a strength or address an area of concern that does not directly affect accreditation at the time of the LAAB review.

Core Values: The five (5) foundational values identified by LAAB and further described by these Accreditation Standards that inform the education of future landscape architects.

Criteria: Each LAAB standard has one or more criteria statements that define the requirements needed to satisfy the standard. Failure to satisfy a criterion does not automatically lead to the assessment of a standard as not met. To be accredited, a professional program must demonstrate progress toward meeting the criteria. In this document, criteria are identified by letters (for example: **A. Program Mission**).

Cultural competence*:* Cultural competence refers to the understanding, willingness, and honesty in working with diverse individuals and communities in ways that are responsive to and reflective of historical and cultural settings. These competencies include self-awareness, open-minded inquiry and assessment, and the ability to recognize and adapt to cultural diversity. Programs should strive to work with individuals and communities that reflect cultures that are different from the program's dominant culture. Recognizing and adapting to cultural differences—and being conscious of these differences—is integral to the art and science of landscape architecture.

Diversity: Diversity includes all the ways in which people differ. While diversity is often used in reference to race, ethnicity, and gender, we embrace a broader definition of diversity that also includes abilities, age, education, gender identity, language, marital status, national origin, physical appearance, religion, sexual orientation, and socioeconomic status. Our definition also includes diversity of ideas, perspectives, and values. We also recognize that individuals affiliate with multiple identities.

Equity: Equity is the fair treatment, access, opportunity, and advancement for all people. Equity demands that we identify and understand the root causes of unjust outcomes, eliminate systemic barriers to justice, and strive to create a more equal society.

Faculty Full-Time Equivalence (FTE): The FTE is a figure representing the aggregated time committed by full- and part-time faculty members to teaching in a department or professional program, including both faculty who have their duties or teaching assignments split between an undergraduate and a graduate program, and also faculty who have their assignments split between disciplines. For purposes of calculation, a faculty member with a part-time appointment of 50 percent would be assigned a 0.5 FTE. A full-time faculty member with duties in only one department would be assigned an FTE of 1.0 for that department.

Final Action Letter: A final action letter is an official communication from LAAB to a professional program reporting its accreditation status and any recommendations affecting accreditation.

Inclusion: Inclusion is the act of creating environments in which any individual or group can be and feel welcomed, respected, supported, and valued to fully participate. An inclusive and welcoming climate embraces differences and offers respect in words and actions for all people. Increasingly, recognition of unconscious or implicit bias helps organizations to be deliberate about addressing issues of inclusivity. Importantly, while inclusive groups are diverse by definition, not all diverse groups are necessarily inclusive.

Initial Accreditation: The first period of accreditation for a professional program leading to a degree in landscape architecture is its initial accreditation; LAAB initial accreditation applies to degrees awarded within two years prior to initial accreditation by LAAB.

Interim Report: An interim report is an annual update documenting progress toward meeting Recommendations Affecting Accreditation, and is additional reporting required for any program that is given one or more Recommendations Affecting Accreditation.

Long-Range Plan: A long-range plan is the output of a process that examines the mission, goals, objectives, and aspirations of a professional program over a minimum of three years. A strategic plan may be a long- range plan provided it meets the terms of this definition.

Professional Program: A professional program in landscape architecture encompasses the body of knowledge common to the profession and promotes acquisition of the knowledge and skills necessary to enter professional practice. A professional program has an academic offering based on a mission that articulates its purpose and goals, and a professional program also comprises the coursework and other learning experiences leading to a degree. A professional program has an administration, faculty, staff, facilities, and services that supports its mission, provides learning experiences, and complies with these Standards. At the bachelor's level, a professional program is typically conducted in a context enriched by the liberal arts and natural and social sciences. At the master's level, a professional program also provides instruction in and application of research and scholarly methods.

Program Administrator: A program administrator is responsible for the operation of the professional program in compliance with the Standards.

Recommendations Affecting Accreditation: Recommendations Affecting Accreditation (Recommendations) are issues of serious concern that directly affect the quality of a professional program. Recommendations are issued when a visiting team assesses a standard as "Standard Met with Recommendation" or "Standard Not Met." Recommendations are derived from the identified areas of weakness in meeting a standard as described in the rationale sections of a visiting team's report. The professional program is required to submit an Interim Report for each Recommendation issued during an initial accreditation or accreditation renewal. Recommendations identify issues; they do not prescribe solutions.

Self-Evaluation Report (SER): A SER is a document prepared by a professional program that describes its expectations, operations, and resources; assesses its progress toward meeting its mission, goals, and objectives; and measures its performance against the criteria for accreditation.

Shall: In official LAAB standards and criteria, "shall" indicates mandatory actions for a professional program or institution.

Standards: Standards are qualitative statements of the essential conditions an accredited professional program must meet to achieve accreditation.

Standard Met: A "Standard Met" designation indicates that overall program performance in the relevant area meets LAAB minimum standards. LAAB may judge a standard as met even though one or more indicators within the standard are not minimally met.

Standard Met with Recommendation: A "Standard Met with Recommendation" designation indicates that deficiencies exist in an area directly bearing on accreditation. The problem or problems have observable effects on the overall quality of the professional program.

Standard Not Met: A "Standard Not Met" designation means that a cited deficiency is so severe that the overall quality of a professional program is compromised, and the professional program's ability to deliver adequate landscape architecture education is impaired.

Track: A track is an organized curricular or course-of-study path through a professional program leading to a degree.

Minimum Requirements for Achieving and Maintaining Accredited Status

1. An accredited professional program's title and degree must incorporate the term "landscape architecture."

2. A professional program offering an accredited undergraduate professional degree must meet the following degree length requirements.

    a. An undergraduate professional program leading to a Bachelor of Landscape Architecture (BLA) or a Bachelor of Science of Landscape Architecture (BSLA) degree must be a single-degree program that has a minimum number of total credit hours equivalent to its institution's definition of four academic years of full-time undergraduate enrollment.

    b. A professional program may allow for advanced placement up to one academic year, provided it has a clearly articulated policy and criteria for advanced placement and how the professional program determines whether an applicant meets the criteria. The advanced placement may be counted towards the minimum requirements referenced in 2.a above.

    c. Any professional program that offers a degree with Bachelor of Landscape Architecture or BLA, or a Bachelor of Science of Landscape Architecture or BSLA in the degree title must meet the requirements of the LAAB accreditation standards. This includes a professional program that offers a BLA degree with an advanced placement track or pathway. An institution that offers a program or track leading to a degree with the words "Bachelor of Landscape Architecture" or "BLA", or "Bachelor of Science in Landscape Architecture" or "BSLA" in the title that does not comply with these Standards is not eligible to offer any accredited BLA or BSLA degree.

3. A professional program offering an accredited graduate professional degree must meet the following degree length requirements:

    a. The graduate professional program, leading to a Master of Landscape Architecture (MLA) must be a single-degree program that has a minimum number of total credit hours equivalent to its institution's definition of three academic years of full-time graduate enrollment.

    b. A professional program may allow for advanced placement of up to one academic year of study, provided it has a clearly articulated policy and criteria for advanced placement and demonstrates how the professional program determines whether an applicant meets the criteria. The advanced placement may be counted towards the minimum requirements referenced in 3.a. above.

    c. Any professional program that offers a degree with Master of Landscape Architecture or MLA in the degree title must meet the requirements of the LAAB accreditation standards. This includes a professional program that offers an MLA degree with an advanced-placement track or pathway. An institution that offers a program or track leading to a degree with the words "Master of Landscape Architecture" or "MLA" in the title that does not comply with these Standards is not eligible to offer any accredited MLA degree.

4. An institution may offer a program leading to a degree with the title "Master of Science in Landscape Architecture" or "Master of Arts in Landscape Architecture" that is not an accredited degree in Landscape Architecture without jeopardizing the institution's accredited degree in Landscape Architecture. In offering such a degree, an institution must disclose that the degree is not accredited in its public statements and to the Council of Landscape Architectural Registration Boards (CLARB).

5. A professional program may be offered in whole or in part through an online platform. A professional program that offers all or part of its curriculum through an online platform must demonstrate that it meets all the requirements of these Standards.

6. Faculty instruction full-time equivalence (FTE) requirements are as follows:

    a. An academic unit that offers a single professional-degree program at the Candidacy or Initial Accreditation status has at least three FTE instructional faculty who hold professional degrees in landscape architecture, at least one of whom is full-time.

    b. An academic unit that offers a professional-degree program at both the bachelor's and master's levels at the Candidacy or Initial Accreditation status has at least six FTE instructional faculty, at least five of whom hold professional degrees in landscape architecture, at least two of whom are full- time in the department.

    c. An academic unit that offers a single professional-degree program at the continuing full accreditation status has an FTE of at least five instructional faculty, at least four of these faculty members hold a professional degree in landscape architecture, at least three of whom are full-time in the department.

    d. An academic unit that offers professional-degree programs at both the bachelor's and master's levels with continuing full accreditation status has an FTE of at least seven instructional faculty, at least five of whom hold professional degrees in landscape architecture and are full-time in the department.

Program Status	Number of Full-time Equivalent Instructional Faculty*	Number of Faculty members with an accredited Professional Degree in Landscape Architecture (could be part-time or adjunct)	Number of Full-time Faculty members with an accredited Professional Degree in Landscape Architecture
Programs seeking Initial Accreditation			
Single Program	3	3	1
Existing Program adding a new Program	6	5	4
Programs seeking re-accreditation			
Single Program	5	4	3
Bachelor's and Master's Program	7	6	5

* In determining FTEs and the pro-rata contribution some faculty may make to teaching in a professional program, we acknowledge that variations do exist among institutions regarding how standard teaching loads are determined. Please provide in the SER any commentary that you believe appropriate to demonstrate how your professional program achieves the required faculty numbers within your institution's particular administrative and staffing model.

7. The parent institution must be accredited by an institutional accrediting agency recognized by the U.S. Department of Education.

8. There must be a designated program administrator responsible for the leadership and management functions for the professional program under review. The program administrator shall have significant influence in the budget and personnel management decisions of the professional program.

9. The professional program must provide a comprehensive disclosure about the professional program's status and performance as set forth in Standard 1.E within a single-click link from the professional program's website.

10. The professional program must:
    - continuously comply with accreditation standards,
    - pay the annual sustaining fee and other fees as required, and
    - regularly file complete annual and other requested reports, as required by the Accreditation Procedures.

11. The program administrator shall inform LAAB if any of these factors fail to apply during an accreditation period. The program administrator is responsible for reporting any substantive changes to the professional program when they occur. (Substantive changes are those that may affect the accreditation status of the professional program, addressed in the LAAB Accreditation Procedures.)

STANDARDS

Standard 1: Program Mission and Goals

The professional program shall have a clearly defined mission supported by goals appropriate to the profession of landscape architecture and the Core Values of these Standards, and that promotes diversity, equity, and inclusion. The program shall demonstrate progress toward the attainment of its mission and goals.

A. Program Mission.

The professional program shall have a mission statement which expresses the underlying purposes and values of the professional program; defines for the faculty, students, prospective students, and the institution its values and fundamental purpose; and summarizes why the professional program exists.

Assessment 1: The professional program has a clearly stated mission reflecting its purpose and values, which relates to the institution's mission and addresses the Core Values.

B. Educational Goals.

The professional program shall have clearly defined and formally stated academic goals that reflect the mission and demonstrate that attainment of the goals will advance the professional program's mission.

Assessment 1: The professional program has clearly defined, achievable educational goals.

Assessment 2: The professional program has an effective procedure which it uses regularly to assess and determine progress in meeting its goals.

Assessment 3: The professional program provides benchmarks for assessing and advancing the professional program in meeting the stated goals.

C. Commitment to Diversity, Equity, and Inclusion.

The professional program shall demonstrate—through concrete steps—systematic, coherent, and long- term efforts to incorporate diversity, equity, and inclusion through its program. The program shall provide a learning environment that prepares students with a broad range of cultural competencies to navigate a diverse professional world.

Assessment 1: The professional program defines its under-represented populations, explains why these groups are of particular interest and importance to the professional program, and describes the process used to define the under-represented population(s). The professional program should take into consideration populations under-represented within the profession.

Assessment 2: The professional program describes its specific goals for increasing the representation and retention of under-represented population(s) among students, faculty, and staff; the actions and strategies it has identified to advance those goals; and its method for measuring success.

Assessment 3: The professional program shall demonstrate its commitment to advance diversity and cultural competency through a variety of practices including the development and/or implementation of policies that advance and support a welcoming climate of equity and inclusion that is free of harassment, aggressions, and discrimination.

D. Long-Range Planning Process.

The professional program shall engage in an effective long-range planning and program assessment process.

Assessment 1: At the time of an accreditation review, a professional program has a long-range plan in effect.

Assessment 2: The long-range plan describes how the professional program's mission, goals, and objectives will be met, and the professional program documents the review and evaluation process.

Assessment 3: A professional program reviews and revises its long-range plan (along with its mission, goals, and objectives) periodically and determines if the plan presents realistic and attainable methods for advancing the professional program's academic mission.

E. Program Disclosure.

A professional program shall accurately disclose the following information about each landscape architecture degree in its literature, in its promotional media, and on its website:

a. the professional program's mission, objectives, and goals,
b. accreditation status,
c. estimated cost of attendance, including fellowship, assistantship, and scholarship opportunities and other financial support options to reduce the cost of attending,
d. student retention and graduation rates,
e. number of degrees granted per year,
f. percentage of students with timely graduation,
g. list of required and optional materials and equipment and provides an estimated cost as well as available shared resources or alternative access,
h. supplemental and experiential learning opportunities associated costs and potentially available subsidies,
i. post-graduation employment,
j. number of licensed faculty, and
k. in accordance with the Higher Education Act, disclose whether or not the program meets the educational requirements for licensure eligibility in each U.S. state.

Assessment 1: The professional program information is accurate, understandable, and accessible to the public.

Assessment 2: The professional program disclosure information can be found with a single-click link from the professional program's website.

Standard 2: Program Autonomy, Governance, and Administration

The professional program shall have the authority and resources to achieve its mission and goals, and shall be recognized as a discrete professional program with the resources, institutional support, and authority to enable achievement of the stated program mission and goals.

A. Program Administration.

The landscape architecture program shall be administered as an identifiable, discrete program within its institution.

Assessment 1: The professional program is seen as a discrete and identifiable program within the institution.

Assessment 2: The program administrator holds a faculty appointment in landscape architecture.

Assessment 3: The program administrator exercises effective leadership of and management functions for the professional program. (Where the program administrator is not the primary administrator for the academic unit, as in a landscape architecture program within a multidisciplinary department or school, the landscape architecture leader has the authority to significantly influence the management of resources, including budget, faculty review, tenure and promotion outcomes, and the direction of the professional program.)

B. Institutional Support.

The institution shall provide sufficient resources to enable the professional program to achieve its mission and goals, and it shall support individual faculty members' development and advancement.

Assessment 1: Funding is available to assist faculty and other instructional personnel with continued professional development, including support in developing funded grants and attendance at conferences. Funding is sufficient to maintain computers and appropriate software, other types of equipment, and technical support.

Assessment 2: Funding is adequate for student support, such as scholarships and work-study jobs.

Assessment 3: Adequate support personnel are available to accomplish the professional program's mission and goals.

C. Faculty Participation.

The faculty shall participate in program governance and administration.

Assessment 1: The faculty makes recommendations on the allocation of resources and has the responsibility to develop, implement, evaluate, and modify the professional program's curriculum, and to contribute to operating practices.

Assessment 2: The faculty participates, in accordance with institutional guidelines, in developing criteria and procedures for annual evaluation, promotion, and tenure of faculty members.

Assessment 3: The faculty participates, in accordance with institutional guidelines, in developing and applying criteria and procedures for the appointment and assessment of professional program and academic unit leadership.

Assessment 4: The professional program or institution adequately communicates with and provides mentoring services to faculty regarding policies, expectations, and procedures for annual evaluations, tenure, and promotion to all ranks.

D. Faculty Number.

The faculty shall be of a sufficient size to accomplish the professional program's goals and objectives, to teach the curriculum, to support students through advising and other functions, to engage in research, creative activity, and scholarship, and to be actively involved in professional endeavors such as presenting at conferences. The faculty FTE shall be assessed by the institutional culture for faculty development across the closely related academic units (such as other departments and programs within a college). The workload (number, type, and sizes of courses assigned) and responsibilities (such as a split of time for teaching, research, and service activities) for a typical tenured or long-term faculty member within the college shall be considered the template for assessing the FTE resources assigned to the landscape architecture program. Where landscape architecture faculty members have their responsibilities split between programs (such as bachelor's and master's or between landscape architecture and another discipline), the FTE assessment must be prorated.

Assessment 1: Student/faculty ratios in studios are typically not greater than 15:1.

Assessment 2: There are sufficient faculty FTE to carry out the mission, goals and objectives of the professional program (such as duties in teaching, research, service, program administration, academic advising, and creative professional development).

Standard 3: Professional Curriculum

The professional degree curriculum includes the Core Values of these Standards, the knowledge, skills, and competencies of landscape architecture, and the learning goals stated by the professional program. The curriculum encompasses coursework and co- curricular opportunities intended to develop students' knowledge and skills in landscape architecture.

A. Curricular Expression of the Mission, Goals, and Core Values.

The professional program shall integrate its mission, goals, and the Core Values into the curriculum.

Assessment 1: The professional program demonstrates how the curriculum reflects its mission and goals and the Core Values.

B. Learning Outcomes.

A professional program shall establish learning outcomes that shall include competency in the following:

1. Knowledge

a. **Design Process, Principles and Theory**, i.e. the range of creative, cultural, and historical approaches to developing material, spatial, and temporal landscape compositions, site-specific design solutions, and other creative responses that are grounded in the natural, physical, and social sciences and address aesthetic, environmental, and social issues and goals.

b. **Histories and Theories of the Art and Science of Landscape Architecture**, i.e. built and natural environment, and urban, community, and ecological planning and design; framed by diverse social, cultural, economic, political, and scientific forces in North America and globally.

c. **Plants, Ecosystems, and Climate Science**, i.e., the abiotic and biotic aspects of ecosystems associated with natural and constructed landscapes; application of ecology, botany, and horticulture principles to the design of the landscape; knowledge of soil science and geology and their impact on the landscape; impacts associated with landscape engineering, development, post- construction management, and maintenance; and the interrelationships between ecosystems and climate.

d. **Resilience**, i.e., the social, human, economic, and environmental principles of sustainability and resilience; landscape performance categories, metrics, and methodologies; and the use of behavioral sciences to assess the impacts of design within diverse social, human, economic, and environmental systems.

e. **Legal Context of the Profession**, i.e., the legal responsibilities and the role of landscape architects to preserve and safeguard human health, safety, and the public welfare through their professional practice; maintaining the intrinsic values of environmental, historic, cultural, and community resources in compliance with legal and regulatory frameworks; and the regulatory professional practice and licensure requirements.

f. **Professional Practice**, i.e., the current and emerging practice opportunities that utilize landscape architectural skills and knowledge in a variety of private, public, academic, and non- governmental settings; project management and delivery; the ethical and professional obligations to clients, communities, the public, and the landscape and environment; and life-long learning, advocacy, career development, and the role of professional and community organizations.

2. Skills and Competencies

a. **Assessment**, i.e., analysis of the physical, biotic, climatic, and cultural context of a project; comprehensive synthesis of objective and subjective analysis; evaluation of the suitability of a program to multiple sites and prioritization of a site based on program; evaluation of spatial and other relevant data; and communication of the criteria and methodologies used in evaluation.

b. **Design and Construction**, i.e., generation of multiple design concepts for a project; evaluation and critique of alternatives and synthesis of ideas into a comprehensive, implementable result; application of the natural, physical, and social sciences in the development of innovative and site- specific design solutions; design decision-making that incorporates physical, cultural, climatic, and regulatory context, the diverse needs of users, considering all abilities and modes of perception, equitable access, ecological health, and temporal change, materials and constructability.

c. **Communication**, i.e., the use of verbal, nonverbal, visual, and written communication to clearly and concretely express ideas; solicit ideas from, listen to, and seek to understand and communicate effectively with diverse audiences; and thoughtfully provide, receive, and respond to feedback and critiques; all while demonstrating empathy and respect.

d. **Construction, Materials and Methods**, i.e., the integration of materials, engineering, specifications, and construction techniques in a design proposal; selection of materials for character, quality, cost, constructability, sustainability, and cultural relevance; preparation of design development, construction documents, details, and understanding of construction administration and oversight.

e. **Landform/Landscape Engineering and Green Infrastructure**, i.e., applying quantifiable principles and practice of engineering including grading, drainage, water quality and management, and other landform processes to design landscapes that are accessible, safe, and ecologically sustainable.

f. **Numeracy/Quantification**, i.e., the mathematical calculations to inform and substantiate design and construction performance.

g. **Landscape Performance**, i.e., the ability to define and measure the impact of a design on its environmental, social, and economic goals based on measurable outcomes; identification of types of data to measure project impact(s); and use of performance metrics to measure performative impacts of a project.

h. **Collaboration**, i.e., leadership and collaboration on multidisciplinary teams; and the incorporation of knowledge from other disciplines, professions, and perspectives for example sustainable development, environmental policies, ethics, ecology, city and regional planning, economics, natural resources, sociology, and anthropology.

i. **Research (graduate level)**, i.e., articulation of a clear research theory; selection and application of appropriate research methods; placement of work within an existing body of knowledge and articulation of the significance of the work to the field; the practice of research ethics and responsible conduct; and work autonomously and effectively to complete independent project; and the contribution of new knowledge to the profession to address current and future challenges.

Assessment 1: The curriculum integrates the professional knowledge, skills, and competencies in a clearly defined sequence.

Assessment 2: The curriculum identifies and engages in contemporary issues in alignment with the Core Values.

Assessment 3: Student work and other accomplishments demonstrate that students are achieving these professional skills and competencies.

Assessment 4: Curriculum enables students to pursue academic interests consistent with institutional requirements, enter into the profession, and be prepared to pursue licensure.

Assessment 5: (for graduate level only) Student work and other accomplishments demonstrate student mastery of research skills.

C. General Studies.

1. In addition to the professional curriculum, a professional degree program at the bachelor's level shall provide an educational context enriched by other disciplines, including but not limited to liberal and fine arts, natural, physical, and social sciences, as well as opportunities for students to develop other areas of interest. This may be covered within the institution's general education requirements.

2. A professional degree at the master's level that does not require all students to have an undergraduate degree before receiving the MLA shall meet requirement 1.

Assessment: Students take courses in the humanities, arts, technologies, mathematics, natural sciences, social sciences, and/or other disciplines.

D. Delivery of and Augmentation to Curricular Experience.

Students shall participate in service learning and interdisciplinary curricular experiences outside of the professional program. The professional program shall provide opportunities for co-curricular activities such as institutional and professional activities, internships, off-campus studies, research assistantships, or practicum experiences.

Assessment 1: Students participate in service-learning projects and interdisciplinary curricular experiences outside of the professional program.

Assessment 2: The professional program identifies the objectives of and documents students' participation in both service-learning projects and interdisciplinary curricular experiences outside of the professional program.

Assessment 3: The professional program provides opportunities for students to augment their formal educational experience—through events such as LABash, ASLA Conference on Landscape Architecture, state and local ASLA chapter events, LAF Symposium and research and activities, and the activities of other professional societies or special-interest groups—and also documents students' participation in these opportunities.

Assessment 4: The professional program provides students with opportunities to share these experiences with their fellow students.

E. Areas of Interest (Bachelor's Level).

The professional program shall provide opportunities for students to pursue or develop focal interests within the discipline of landscape architecture.

Assessment 1: The professional program provides opportunities for students to pursue independent projects, focused electives, optional studios, certificates, and/or minors beyond the core curriculum.

F. Research and Innovation (Master's Level).

The professional program shall provide opportunity for graduate students to develop independent research and/or innovative projects to address current and future challenges by advancing the knowledge within the discipline.

Assessment 1: The professional program requires that theses or terminal projects exhibit creative and independent thinking and contain a significant research and/or innovation component.

G. Syllabi.

Appropriate syllabi shall be maintained and distributed for courses.

Assessment 1: Syllabi include course learning objectives, course content, and the criteria and the methods used to evaluate student performance.

Assessment 2: Syllabi identify the various levels of accomplishment students need to achieve to successfully complete the course and advance in the curriculum.

Assessment 3: Syllabi include a list of required and optional materials and equipment and provides an estimated cost as well as available shared resources or alternative access.

Assessment 4: Syllabi are complete, consistent, and readily accessible to all students throughout the period of course offering and delivery.

H. Curriculum Evaluation and Development.

The professional program shall define continuous, systematic, and well-documented curriculum evaluation procedures which include appropriate evaluation methods and metrics that allow the professional program to determine its effectiveness in advancing its learning objectives. The chosen evaluation methods and metrics shall track the professional program's progress in advancing its mission and goals, alignment with the Core Values, and promoting student competency.

Assessment 1: The evaluation procedures identify the professional program's evaluation methods and metrics, curriculum development, and the parties responsible for review.

Assessment 2: The evaluation examines, documents, and tracks the professional program's progress in advancing its mission and goals (including instruction, scholarship, and service), alignment with the Core Values, and promoting student competency.

Assessment 3: Evidence that the evaluation procedures are being implemented is provided. (Evidence may include reports or data summaries prepared for review, minutes of meetings at which results were discussed, action items that were identified, etc.)

Assessment 4: The professional program regularly assesses and documents its strengths and weaknesses related to this standard and identifies opportunities for improvement in accordance with the evaluation procedures.

Assessment 5: The professional program assesses and documents the effectiveness of curricular development and refinement in addressing issues identified through the evaluation process.

Assessment 6: Students participate in evaluation of the professional program, courses, and curriculum.

I. Academic Integrity.

The institution establishes and the professional program implements and demonstrates clear, specific policies related to student integrity and academic honesty in all course delivery methods.

Assessment 1: The professional program affirms that the student who takes an examination or submits project work is the same person who enrolled in the professional program and that the examination or project results will reflect the student's own knowledge and competence.

Standard 4: Student Outcomes and Experiences

The professional program shall prepare students—through educational programs, advising, mentoring, and other academic and professional opportunities—to pursue careers in landscape architecture upon graduation. The professional program shall foster the Core Values of these Standards and the knowledge, skills, and competencies embodied in the art and science of landscape architecture.

A. Student Outcomes.

The professional program shall qualify students to pursue careers in landscape architecture.

Assessment 1: Student work demonstrates the competencies required for entry-level positions in the profession of landscape architecture.

Assessment 2: Students demonstrate their achievement of the professional program's learning outcomes as defined by the professional program's curriculum and stated in Standard 3.

B. Student Advising.

The professional program shall provide students with effective advising and mentoring that recognizes and supports their individual circumstances and continues throughout their educational careers.

Assessment 1: Students receive effective advising regarding academic development.

Assessment 2: Students receive effective advising regarding career and personal development, the benefits of and pathways to licensure, general licensure requirements, and the need for continuing education.

Assessment 3: Students are made aware of professional opportunities, advanced educational opportunities, licensure requirements, and continuing education requirements associated with professional practice.

Assessment 4: Students have the opportunity to provide feedback on their academic experiences and their preparation for the landscape architecture profession.

C. Student Experiences.

In addition to curricular engagement, the professional program shall provide students with both an educational experience that considers the diverse needs and obligations of students, and also provides opportunities to learn about and grow within the profession of landscape architecture. The professional program shall provide students with an understanding of the role of the community in the profession and the profession in the community, the changing culture and environment of the profession, and competency regarding diversity, equity, and inclusion.

Assessment 1: The professional program provides students with opportunities to participate in service- learning activities which incorporate community-based collaboration and engagement, and which build cultural competence during their educational career.

Assessment 2: The educational structure of the professional program considers the varied needs and obligations of students, recognizes and affirms the importance of study/work-life balance, and seeks to overcome barriers to student success.

Assessment 3: Students have an opportunity to engage with various aspects of the landscape architecture profession and the skills required in practice.

Assessment 4: Students have an opportunity to provide input regarding the Program's efforts to foster an inclusive community and environment.

Standard 5: Faculty

The professional program shall advance its program mission and objectives by means of promoting the qualifications, academic position, professional activities, and individual professional development of its faculty and instructional personnel. A professional program shall have qualified, experienced, and diverse faculty and other instructional personnel to instill the Core Values of these Standards and the knowledge, skills, and competencies that students will need to pursue a career in landscape architecture. It shall also have equitable faculty workloads and faculty and staff compensation within the program, and overall support for career development that contributes to the success of the professional program.

A. Credentials.

The qualifications of the faculty, instructional personnel, and teaching assistants shall be appropriate to their roles.

Assessment 1: The faculty has a balance of professional practice and academic experience appropriate to the professional program's mission.

Assessment 2: Faculty assignments are appropriate to the course content, delivery methodology, and professional program's mission.

Assessment 3: Adjunct and/or part-time faculty (if present) are integrated into the professional program's administration and curriculum evaluation/development in a coordinated and organized manner.

Assessment 4: Faculty qualifications are appropriate to responsibilities of the professional program as defined by the institution.

B. Faculty Development.

The faculty members shall be continuously engaged in activities leading to their professional growth and advancement, the advancement of the profession, the mission, goals, Core Values, and effectiveness of the professional program, and curriculum and course delivery methodology.

Assessment 1: Faculty activities such as scholarly inquiry, research, professional practice, and service to the profession, university, and community are documented, peer-reviewed, and disseminated through appropriate media such as journals, professional magazines, community, and university publications.

Assessment 2: Teaching and administrative assignments allow sufficient opportunity for faculty to pursue advancement and professional development. Expectations for faculty workload and distribution of responsibilities (of teaching, research, service, and professional engagement) are similar to expectations in related academic units.

Assessment 3: Faculty seek and make effective use of available funding for conference attendance, equipment, technical support, and other professional needs.

Assessment 4: Faculty participate in university and professional service, student advising, and other activities that enhance the effectiveness of the professional program.

Assessment 5: Faculty members participate in a range of ongoing professional development opportunities, such as: career development; emerging issues in the profession; diversity, equity, inclusion, and cultural competency.

Assessment 6: The professional program provides resources to its faculty similar to the resources provided to other programs and departments in the institution.

Assessment 7: The professional program systematically evaluates the development, teaching effectiveness, and cultural competence of faculty and instructional personnel through a peer and program review process and uses the results for individual and program improvement.

Assessment 8: Programs regularly audit and update internal policies and procedures related to diversity, equity, and inclusion.

C. Faculty Retention.

The faculty shall hold academic status appropriate to the institution, have workloads, and receive compensation, mentoring, and support that promote productivity and retention.

Assessment 1: Faculty salaries and support are evaluated and are appropriate to promote faculty retention and productivity.

Assessment 2: The rate of faculty turnover does not undermine the mission and goals of the professional program.

Standard 6: Outreach to the Institution, Communities, Alumni, and Practitioners

The professional program shall maintain effective relationships with the institution, the public, its alumni, and practitioners in order to enhance the professional program and educate its constituencies regarding the profession of landscape architecture.

A. Interaction with the Institution and Public.

The professional program shall represent and advocate for the profession by interacting with the institution, the local community, practitioners, and the public at large.

Assessment 1: Community engagement and service-learning activities undertaken by students and faculty are documented and publicly disseminated on a regular basis.

Assessment 2: The professional program interacts with the institution to build awareness of the program; interact with both local, diverse, and historically underserved communities, and with the general public at large to advance knowledge and understanding of landscape architecture; all in a way that builds students' cultural competence during their educational career.

B. Interaction with Alumni and Practitioners.

The professional program shall engage alumni and practitioners as a resource to create partnerships that build the depth and capacity of the professional program.

Assessment 1: The professional program maintains or has access to a current registry of alumni that includes information pertaining to current employment, professional activity, postgraduate study, and significant professional accomplishments.

Assessment 2: The professional program engages its alumni and other practitioners in activities that include efforts to expand students' educational opportunities, mentoring, career advising and potential employment, curriculum review and development, service on a formal advisory board, fundraising, and continuing education.

Assessment 3: The professional program engages with alumni and practitioners in a way that reflects, supports, and promotes diversity, equity, and inclusion, assists in the recruitment of students with diverse backgrounds, and provides students with experiences that expand their cultural competence for interacting with diverse communities.

Assessment 4: The professional program engages with alumni and practitioners to provide opportunities for community engagement and service-learning for students, scholarly development for faculty, and professional guidance and financial support for the professional program.

Assessment 5: The professional program acknowledges and celebrates the significant professional accomplishments of its alumni and benefactors within the institution and the public at large.

Standard 7: Facilities, Equipment, and Technology

The professional program shall provide faculty, students, and staff access to facilities, equipment, libraries, and other resources necessary for achieving the professional program's mission and goals.

A. Facilities.

A professional program shall provide facilities and tools in designated, code-compliant space that enable achievement of the professional program's mission and goals and are adequately maintained to serve the professional and educational requirements of the faculty, students, and staff.

Assessment 1: Faculty, staff, and administration are provided with appropriate office, presentation, and meeting space.

Assessment 2: Students are assigned studio workspaces and have access to collaborative workspace adequate to meet the professional program's needs and designed to meet the diverse needs of students.

Assessment 3: Facilities are adequately maintained and in compliance with the Americans with Disabilities Act (ADA), the Life Safety Code, and applicable building codes. (Acceptable documentation includes reasonable-accommodation reports from the university ADA-compliance office and/or facilities or risk-management office.)

B. Information Systems and Technical Equipment.

The professional program shall provide to students, faculty, and other instructional and administrative personnel the software, information systems, and technical equipment needed to achieve its mission and goals.

Assessment 1: The information systems and technical equipment are sufficient, accessible, equitable, and available to serve the diverse needs of faculty and students.

Assessment 2: The frequency of hardware and software maintenance, updating, and replacement is sufficient.

Assessment 3: The professional program has a strategy for funding, maintaining, and advancing technology that supports learning.

C. Library Resources.

The professional program shall provide access to a digital and/or physical library and/or specialized resources sufficient to support its mission and goals.

Assessment 1: Collections are adequate to support the professional program and include access to a broad cross-section of publications, periodicals, research, and other materials that reflect the diverse social, cultural, economic, political, and scientific forces that shape the art and science of landscape architecture.

Assessment 2: Courses integrate library and other resources.

Assessment 3: Library hours of operation and access to library resources are convenient, accessible, and adequate to serve the diverse needs of faculty and students.

Appendix C

A Statement by the Landscape Architecture University Program Chairs on the Role of Landscape Architecture in Addressing Climate Change

A STATEMENT BY THE LANDSCAPE ARCHITECTURE UNIVERSITY PROGRAM CHAIRS ON THE ROLE OF LANDSCAPE ARCHITECTURE IN ADDRESSING CLIMATE CHANGE

Climate change is one of the defining challenges of our time. We see its impacts through- out the built and natural environments, and it touches the lives of everyone. Extreme weather events, drought and famine, the degradation of our natural resources, and the loss of biodiversity are undeniable proof that failure to act will have grave consequences for our society.

Landscape architecture plays a vital role in responding and adapting to a changing climate. As the Landscape Architectural Accreditation Board states in its revised 2021 accreditation standards, environmental health, sustainability, resilience, and stewardship are core values in the education of landscape architects. By linking time-tested design principles with cutting-edge scientific knowledge, the practice of landscape architecture ensures that we pass a more sustainable environment onto future generations.

Our programs recognize and embrace our duty to prepare future landscape architects to help meet the ecological and environmental challenges our communities, nation, and planet face. By challenging our students to apply scientific knowledge towards practical design solutions, we prepare them to identify design approaches of our built environment that replenish natural resources, protect vulnerable populations, and mitigate the most-harmful consequences of our changing climate.

Through the rigorous study of the sciences, technology, engineering and mathematics, our students develop the ability to make design decisions that are grounded in scientific principles. Our programs recognize that only through following the science will we be able to address the most harmful impacts of climate change. That is why we require students to take classes in ecology, geology, biodiversity, horticulture, engineering and site design, water management, sustainability studies, climatology, and other scientific disciplines as an integral part of their education.

Humanity's scientific understanding of the causes and consequences of climate change has evolved over the years. But our obligation to prepare future generations of design leaders to address this challenge remains constant.

To that end, we pledge our continued commitment to the formation of rigorous academic programs grounded in the sciences and responsive to the needs of our planet and all its inhabitants.

Arizona State University, Landscape Architecture Program, Chingwen Cheng, ASLA
Arizona State University, Landscape Architecture Program, Joseph M. Ewan ASLA
Auburn University, Landscape Architecture, David Hill, ASLA
Ball State University, Landscape Architecture, Martha Hunt, ASLA
Boston Architectural College, School of Landscape Architecture, Maria Bellalta, ASLA
California Polytechnic State University, Landscape Architecture, Beverly Bass, ASLA
California State Polytechnic University Pomona, Department of Landscape Architecture, Andrew O. Wilcox, ASLA
City College of New York, Graduate Landscape Architecture Program, Spitzer School of Architecture, Catherine Seavitt Nordenson, ASLA
Clemson University, Master of Landscape Architecture, Matthew N. Powers, ASLA
Colorado State University, Department of Horticulture & Landscape Architecture, Bradley C. Goetz
Colorado State University, Department of Horticulture & Landscape Architecture, Jessica G. Davis
Cornell University, Landscape Architecture, C. Timothy Baird, ASLA
Delaware Valley University, Department of Landscape Architecture & Environmental Sciences, Michael J. Fleischacker, ASLA, RLA, LEED AP
Florida International University, Landscape Architecture + Environmental and Urban Design, Roberto J. Rovira, ASLA
Harvard University, Master in Landscape Architecture, Anita Berrizbeitia, ASLA
Illinois Institute of Technology, Master of Landscape Architecture, Ron Henderson FASLA
Iowa State University, Department of Landscape Architecture, Carl Rogers, ASLA
Kansas State University, Department of Landscape Architecture and Regional & Community Planning, Stephanie Rolley, FASLA
Kent State University, Master's Program in Landscape Architecture, Cathy Marshall, ASLA
Louisiana State University, Robert Reich School of Landscape Architecture, Mark E. Boyer, FASLA
Michigan State University, Landscape Architecture Program, Jun-Hyun Kim, Ph.D., ASLA
Mississippi State University, Department of Landscape Architecture, Sadik C. Artunc, FASLA
Morgan State University, Graduate Program in Landscape Architecture, Laurel McSherry, ASLA
North Carolina State University, Department of Landscape Architecture and Environmental Planning, Meg Calkins, FASLA
North Dakota State University, Department of Landscape Architecture, Dominic Fischer, ASLA
Oklahoma State University, Landscape Architecture Program, Michael Holmes, ASLA
Pennsylvania State University, Department of Landscape Architecture, Roxi Thoren, ASLA
Polytechnic University of Puerto Rico, Landscape Architecture Graduate Program, Olga Angueira, ASLA
Purdue University, Landscape Architecture Program, Sean Rotar, ASLA
Rhode Island School of Design, Masters of Landscape Architecture, Johanna Barthmaier-Payne, ASLA
Rutgers University, Department of Landscape Architecture, Richard Alomar, ASLA
South Dakota State University, Landscape Architecture Program, Pat Crawford
State University of New York College of Environmental Science and Forestry, Department of Landscape Architecture, S. Scott Shannon, ASLA
Texas A&M University, Bachelor of Landscape Architecture, Galen D. Newman, Ph.D., ASLA
Texas Tech University, Department of Landscape Architecture, Eric A. Bernard, ASLA
The Ohio State University, The Knowlton School, Landscape Architecture, Kristi Cheramie
The University of Arizona, School of Landscape Architecture and Planning, Lauri Macmillan Johnson, ASLA
The University of Oklahoma, Master of Landscape Architecture, Leehu Loon, ASLA

Thomas Jefferson University, Landscape Architecture, Kim Douglas, ASLA
Universidad Ana G. Méndez, International School of Design and Architecture, Elizabeth Castrodad
University of Arkansas, Department of Landscape Architecture, Ken McCown, ASLA
University of California, Berkeley, Master of Landscape Architecture, Louise A. Mozingo
University of California, Davis, Landscape Architecture + Environmental Design, N. Claire
Napawan University of Cincinnati, Master of Landscape Architecture, Virginia L. Russell, FASLA
University of Colorado Denver, Master of Landscape Architecture, Louise Bordelon, Ph.D.
University of Connecticut, Landscape Architecture, Richard McAvoy
University of Delaware, Bachelor of Landscape Architecture, Jules Bruck, Ph.D., ASLA
University of Florida, Department of Landscape Architecture, Daniel P. Manley, ASLA
University of Georgia, College of Environment and Design, Ashley Steffens, ASLA
University of Georgia, College of Environment and Design, Ronald B. Sawhill, ASLA
University of Idaho, Landscape Architecture, Elizabeth Scott, ASLA
University of Illinois at Urbana-Champaign, Department of Landscape Architecture, David L. Hays
University of Kentucky, Bachelor of Science in Landscape Architecture, Ned Crankshaw, FASLA
University of Maryland, Landscape Architecture, Dennis R. Nola, ASLA
University of Massachusetts, Amherst, Landscape Architecture, Ethan Carr
University of Michigan, Master of Landscape Architecture, Stanton I. Jones, ASLA
University of Minnesota, Landscape Architecture, Joseph Favour, ASLA
University of Nebraska-Lincoln, Landscape Architecture, Mark A. Hoistad
University of Nevada Las Vegas, Landscape Architecture, Daniel H. Ortega, ASLA
University of New Mexico, Department of Landscape Architecture, Katya Crawford, Affiliate ASLA
University of Oregon, Department of Landscape Architecture, Renee A. Irvin
University of Pennsylvania, Weitzman School of Design, Frederick R. Steiner, FASLA
University of Pennsylvania, Weitzman School of Design, Richard Weller, ASLA
University of Rhode Island, Landscape Architecture, Richard Sheridan, ASLA
University of Southern California, Graduate Program in Landscape Architecture + Urbanism,
Alison Hirsch, Ph.D., ASLA
University of Tennessee, School of Landscape Architecture, Gale Fulton, ASLA
University of Texas at Arlington, Landscape Architecture Program, Diane Jones Allen, D. Eng.,
ASLA University of Texas at Austin, Graduate Program in Landscape Architecture,
Hope H Hasbrouck, ASLA
University of Virginia, Master of Landscape Architecture, Bradley Cantrell, ASLA
University of Washington, Seattle, Department of Landscape Architecture,
Kenneth Yocom, Ph.D., ASLA
University of Wisconsin-Madison, Department of Planning and Landscape Architecture,
Samuel Dennis Jr, Ph.D. ASLA
Utah State University, Landscape Architecture and Environmental Planning,
Keith Christensen, Ph.D., ASLA
Virginia Polytechnic Institute and State University, Landscape Architecture Program,
Terry Clements, FASLA
Washington State University, Landscape Architecture, Jolie Kaytes, ASLA
Washington University in St. Louis, Master of Landscape Architecture,
Derek Hoeferlin, Affiliate ASLA
West Virginia University, Landscape Architecture Program, Elisabeth Orr, ASLA

Appendix D

LARE Orientation: Understanding the Landscape Architect Registration Examination, Council of Landscape Architectural Registration Boards (CLARB)

Section 1 - Project and Construction Management

85 scored items & 15 pretest items consisting of multiple-choice and multiple-response questions; 3 hours seat time, 2 ½ hours for exam

Pre-Project Management: 10%	Project Management: 30%	Bidding: 20%	Construction: 30%	Maintenance: 10%
• Select Project Team • Develop Contract • Negotiate Contract • Prepare RFPs or RFQs • Determine Project Scope, Schedule, and Budget	• Manage Project Team • Manage Project Scope, Schedule, and Budget • Determine Common Goals and Objectives • Establish Quality Control Procedures and Conduct Quality Control Review • Facilitate Meetings Coordinate Work of/with Other Disciplines Document Design Decisions and Project Communication • Execute Records Retention Policy • Facilitate Client Review and Coordination • Obtain Permits • Prepare Cost Estimates • Prepare Project Deliverables	• Develop Bidding Criteria • Prepare and Issue Addenda • Facilitate Meetings • Evaluate Bids and Make Recommendations • Identify Delivery Methods • Evaluate Contractor Qualifications • Assist with Construction Contract Execution and Administration	• Respond to RFIs • Coordinate with Contractors • Facilitate Pre-Construction Meeting • Document Pre-Construction Existing Conditions • Review Submittals • Prepare Change Orders • Conduct and Document Construction-related Actions • Prepare Drawing Revisions or Clarification Sketches • Review and Certify Applications for Payment • Attend Substantial Completion (practical completion) Walkthrough and Prepare Punch List (deficiency list) • Attend Final Completion Walkthrough • Prepare As-Built (record) Drawings • Conduct Warranty Review • Conduct Project Close-out • Collect and Analyze Performance Metrics	• Estimate Maintenance and Management Costs • Prepare Maintenance and Operation Manual • Review Maintenance Services • Prepare Management Plan

Section 2 – Inventory and Analysis

70 scored items & 10 pretest items consisting of multiple-choice and multiple-response, 2 ½ hours seat time, 2 hours for the exam

Site Inventory: 35%	Physical Analysis: 40%	Contextual Analysis: 25%
• Determine Applicable Codes, Regulations, and Permitting Requirements • Collect Contextual Data • Gather Stakeholder Input • Identify Policy Objectives • Conduct Project Related Research • Conduct Onsite Investigation and Fieldwork • Document Site Inventory • Determine Performance Metrics	• Determine Appropriate Types of Analyses • Perform Circulation Analysis • Interpret Utility Analysis • Perform Visual Resource Analysis • Perform Micro and Macro Climate Analysis • Perform Hydrological Analysis • Perform Vegetation Analysis • Interpret Ecological Analysis • Perform Topographical Analysis • Interpret Soil and Geotechnical/Geological Analysis • Interpret Environmental Studies	• Analyze Codes, Regulations, and Permitting Requirements for Design Impact • Interpret Cultural, Historical, and Archeological Analysis • Interpret Social Analysis • Interpret Economic Analysis • Analyze Contextual Data • Analyze Stakeholder Feedback

Section 3 – Design

85 scored items & 15 pretest items consisting of advanced item types, multiple-choice and multiple-response questions; 4 hours seat time, 3 ½ hours for the exam

Stakeholder Process: 9%	Master Planning: 45%	Site Design: 46%
• Design and Execute Public Participation Process • Prioritize Stakeholder Goals • Initiate Communication Strategy • Synthesize Stakeholder Feedback • Communicate Concept(s)/Schematic(s)	• Perform Site Analysis and Determine Opportunities and Constraints • Develop Vision or Framework Plan • Develop and Conduct Urban Plan • Develop Land Use Plan • Develop Strategic Implementation Plan • Develop Site Master Plan • Develop Historic/Cultural Restoration and Preservation Plan • Develop Parks, Open Space, and Trails Master Plan • Develop Design Guidelines • Develop a Feasibility Study • Develop View Corridor Plan • Develop Redevelopment Plan • Develop Environmental Resources Plan • Develop Multi-modal Transportation Plan	• Synthesize and Apply the Site Analysis • Develop and Refine the Program • Create the Basis for the Design • Create Conceptual Design Alternatives and Scenarios • Evaluate Design Alternatives • Refine and Synthesize Concept Alternative • Develop Schematic Design • Prepare Preliminary Quantities and Cost Estimate • Prepare Presentation Drawings and Communication Tools • Compile Materials Sample Board • Identify and Develop Performance Metrics

Section 4 – Grading, Drainage and Construction Documentation

105 scored items & 15 pretest items consisting of advanced item types, multiple-choice and multiple-response questions; 4 ½ hours seat time, 4 hours for the exam

Site Preparation Plans: 20%	General Plans and Details: 40%	Specialty Plans: 25%	Specifications: 15%
• Develop Demolition Plan • Develop Existing Conditions Plan • Prepare Soil Boring Location Plan • Develop Stormwater Pollution Prevention Plan • Develop Site Protection Plan • Develop Mitigation Plan	• Develop Layout Plan • Develop General Notes • Develop Grading and Drainage Plan • Develop Planting Practices, Plans, Notes and Schedules • Develop Materials Plan • Develop Details • Prepare Sections, Elevations, and Profiles • Incorporate Code Requirements • Prepare Summary of Quantities • Prepare Site Infrastructure Plan	• Develop Phasing Plan • Develop Irrigation Plan • Prepare Lighting Plan • Develop Site Furnishings Plan • Develop Signage and Wayfinding Plan • Develop Traffic Control Plan • Develop Emergency Access Plan • Prepare Stormwater Management Plan	• Develop Technical Specifications • Prepare Bid Form/Schedule • Develop Project Manual/Front End Specifications

Appendix E

ASLA Survey of Landscape Architecture Schools, May 2021.
Charts assembled by Agora Consulting

AVERAGE NUMBER OF REQUIRED COURSES WITH STEM CONTENT

BLA Programs

	Botany/ Horticulture	*Construction Methods and Methods*	*Ecology*	*Engineering*	*Geology*	*Hydrology*	*Mathematics*	*Storm Water Management/Drainage*	*Sustainability Studies*	*Vehicular and Pedestrian Circulation/ Roadway Alignment & Design*
TAMU BLA	5	8	8	2	3	6	2	6	15	5
MSU BLA	4	4	4	4	2	3	2	2	8	1
UTAH BLA	2	3	1	0	1	0	1	1	0	1
UW-Mad	2	1	2	0	0	0	1	1	1	0
ColoSU	8	7	9	10	9	8	6	9	8	8
PennStB	4	2	4	1	1	1	2	1	2	5
AVG	**4.2**	**4.2**	**4.7**	**2.8**	**2.7**	**3.0**	**2.3**	**3.3**	**5.7**	**3.3**

MLA Programs

	Botany/ Horticulture	*Construction Methods and Methods*	*Ecology*	*Engineering*	*Geology*	*Hydrology*	*Mathematics*	*Storm Water Management/Drainage*	*Sustainability Studies*	*Vehicular and Pedestrian Circulation/ Roadway Alignment & Design*
TAMU MLA	3	4	8	8	2	4	2	5	10	6
MSU MLA	2	2	2	2	0	3	1	3	16	1
UTAH MLA	0	1	1	0	0	0	0	1	0	1
PENN	2	1	3	1	1	1	0	1	0	0
RISD MLA	2	5	3	2	0	1	0	1	2	0
PennState	4	2	4	1	0	1	0	1	0	5
UNM	7	6	5	5	3	3	6	3	7	3
UT Austin	1	1	4	1	0	0	0	0	0	1
AVG	**2.6**	**2.8**	**3.8**	**2.5**	**0.8**	**1.6**	**1.1**	**1.9**	**4.4**	**2.1**

University/Program Reviewed: **Colorado State University BSLA**

Required/optional courses that cover any of the following topics:	Course name(s)	Degree level(s)	Required or Optional?	Number of courses in topic required through all years of program
Botany/Horticulture	BZ120 - Principles of Plant Biology SOCR240 - Introductory Soil Science BZ223 or HORT221 - Plant Identification or Landscape Plants Studio/Lab: LAND240 - Fundamentals of Landscape Design Process Studio/Lab: LAND364 - Design and Nature Studio/Lab: LAND366 - Landscape Design Expression Studio/Lab: LAND 454 - Landscape Field Studies Studio/Lab: LAND447 - Comprehensive Landscape Design	BLA	Required	8
Construction Materials and methods	LAND360 - Basic Landscape Design and Construction LAND363 - Advanced Landscape Site Engineering LAND365 - Landscape Contract Drawing and Specifications LAND368 - Landscape Irrigation and Water Conservation Studio/Lab: LAND230 - Drawing the Landscape Studio/Lab: LAND240 - Fundamentals of Landscape Design Process Studio/Lab: LAND 364 - Design and Nature	BLA	Required	7
Ecology	LAND241 - Environmental Analysis LAND220 - Fundamentals of Ecology LAND444 - Ecology of Landscapes Studio/Lab: LAND110 - Introduction to Landscape Architecture Studio/Lab: LAND240 - Fundamentals of Landscape Design Process Studio/Lab: LAND 364 - Design and Nature Studio/Lab: LAND366 - Landscape Design Expression Studio/Lab: LAND 454 - Landscape Field Studies Studio/Lab: LAND447 - Comprehensive Landscape Design	BLA	Required	9
Engineering	LAND360 - Basic Landscape Design and Construction LAND363 - Advanced Landscape Site Engineering LAND365 - Landscape Contract Drawing and Specifications LAND368 - Landscape Irrigation and Water Conservation LAND510 - Virtual Design Methods Studio/Lab: LAND230 - Drawing the Landscape Studio/Lab: LAND240 - Fundamentals of Landscape Design Process Studio/Lab: LAND 364 - Design and Nature Studio/Lab: LAND446 - Urban Design Studio/Lab: LAND447 - Comprehensive Landscape Design	BLA	Required	10
Geology	GEOL120 or 122 - Exploring Earth / The Blue Planet GEOL121 - Introductory Geology Laboratory NR319 or NR323 - Geospatial Applications OR Remote Sensity of Natural Resources LAND520 - Geographical Information Systems Studio/Lab: LAND240 - Fundamentals of Landscape Design Process Studio/Lab: LAND364 - Design and Nature Studio/Lab: LAND366 - Landscape Design Expression Studio/Lab: LAND 454 - Landscape Field Studies Studio/Lab: LAND447 - Comprehensive Landscape Design	BLA	Required	9

Hydrology	LAND360 - Basic Landscape Design and Construction LAND363 - Advanced Landscape Site Engineering LAND368 - Landscape Irrigation and Water Conservation Studio/Lab: LAND240 - Fundamentals of Landscape Design Process Studio/Lab: LAND364 - Design and Nature Studio/Lab: LAND366 - Landscape Design Expression Studio/Lab: LAND 454 - Landscape Field Studies Studio/Lab: LAND447 - Comprehensive Landscape Design	BLA	Required	8
Mathematics	MATH126 - Analytical Trigonometry LAND360 - Basic Landscape Design and Construction LAND363 - Advanced Landscape Site Engineering ECON202 or AREC202 Principles of Microeconomics – or – Ag. and Resource Economics Studio/Lab: LAND230 - Drawing the Landscape Studio/Lab: LAND447 - Comprehensive Landscape Design	BLA	Required	6
Stormwater management/drainage	LAND360 - Basic Landscape Design and Construction LAND363 - Advanced Landscape Site Engineering LAND368 - Landscape Irrigation and Water Conservation Studio/Lab: LAND110 - Introduction to Landscape Architecture Studio/Lab: LAND240 - Fundamentals of Landscape Design Process Studio/Lab: LAND364 - Design and Nature Studio/Lab: LAND366 - Landscape Design Expression Studio/Lab: LAND 454 - Landscape Field Studies Studio/Lab: LAND447 - Comprehensive Landscape Design	BLA	Required	9
Sustainability Studies	LAND360 - Basic Landscape Design and Construction LAND368 - Landscape Irrigation and Water Conservation Studio/Lab: LAND110 - Introduction to Landscape Architecture Studio/Lab: LAND240 - Fundamentals of Landscape Design Process Studio/Lab: LAND364 - Design and Nature Studio/Lab: LAND366 - Landscape Design Expression Studio/Lab: LAND 454 - Landscape Field Studies Studio/Lab: LAND447 - Comprehensive Landscape Design	BLA	Required	8
Vehicular and pedestrian circulation/roadway alignment design	LAND360 - Basic Landscape Design and Construction LAND363 - Advanced Landscape Site Engineering Studio/Lab: LAND110 - Introduction to Landscape Architecture Studio/Lab: LAND240 - Fundamentals of Landscape Design Process Studio/Lab: LAND364 - Design and Nature Studio/Lab: LAND366 - Landscape Design Expression Studio/Lab: LAND446 - Urban Design Studio/Lab: LAND447 - Comprehensive Landscape Design	BLA	Required	8

University/Program Reviewed: **Mississippi State BLA**

Required/optional courses that cover any of the following topics:	Course name(s)	Degree level(s)	Required or Optional?	Number of courses in topic required through all years of program
Botany/Horticulture	LA 1333 Landscape Systems and Plant Communities	BLA	Required	4
	LA 3653 Planting Design Fundamentals in Landscape Architecture	BLA	Required	
	LA 4514 Ecological Planting Design	BLA	Required	
	LA 4753 Sustainable Landscape Management	BLA	Optional	
	LA 4853 Sustainable Communities	BLA	Required	
Construction Materials and methods	LA 2544 Landscape Architecture Construction I	BLA	Required	4
	LA 2644 Landscape Architecture Construction II	BLA	Required	
	LA 2644 Landscape Architecture Construction III	BLA	Required	
	LA 4344 Landscape Architecture Construction IV	BLA	Optional	
	LA 4124 Landscape Architecture Construction V - Construction Documents	BLA	Optional	
	LA 4443 Exterior Design-Build Studio	BLA	Required	
Ecology	LA 1333 Landscape Systems and Plant Communities	BLA	Required	4
	LA 3653 Planting Design Fundamentals in Landscape Architecture	BLA	Required	
	LA 4514 Ecological Planting Design	BLA	Required	
	LA 4753 Sustainable Landscape Management	BLA	Optional	
	LA 4853 Sustainable Communities	BLA	Required	
Engineering	LA 2544 Landscape Architecture Construction I	BLA	Required	4
	LA 2644 Landscape Architecture Construction II	BLA	Required	
	LA 2644 Landscape Architecture Construction III	BLA	Required	
	LA 4344 Landscape Architecture Construction IV	BLA	Optional	
	LA 4124 Landscape Architecture Construction V - Construction Documents	BLA	Optional	
	LA 4443 Exterior Design-Build Studio	BLA	Required	
	LA 4523 Applications for GIS in Landscape Architects	BLA	Optional	
Geology	GG 1111 Earth Science I Lab	BLA	Required	2
	GG 1113 Survey of Earth Sciences I	BLA	Required	
	GG 1121 Earth Science II Lab	BLA	Optional	
	GG 1123 Survey of Earth Sciences II	BLA	Optional	
Hydrology	LA 4753 Sustainable Landscape Management	BLA	Optional	3
	LA 2644 Landscape Architecture Construction II	BLA	Required	
	LA 2644 Landscape Architecture Construction III	BLA	Required	
	LA 4344 Landscape Architecture Construction IV	BLA	Optional	
	LA 4124 Landscape Architecture Construction V - Construction Documents	BLA	Optional	
	LA 4443 Exterior Design-Build Studio	BLA	Required	
Mathematics	MA 1313 College Algebra	BLA	Required	2
	MA 1323 Trigonometry	BLA	Required	
	MA 1613 Calculus I	BLA	Optional	
	MA 2113 Introduction to Statistics	BLA	Optional	
Stormwater management/drainage	LA 4753 Sustainable Landscape Management	BLA	Optional	2
	LA 2644 Landscape Architecture Construction II	BLA	Required	
	LA 2644 Landscape Architecture Construction III	BLA	Required	
Sustainability Studies	LA 4753 Sustainable Landscape Management	BLA	Optional	8
	LA 4853 Sustainable Communities	BLA	Required	
	LA 2554 Landscape Architecture Design Studio I	BLA	Required	
	LA 2654 Landscape Architecture Design Studio II	BLA	Required	
	LA 3454 Landscape Architecture Design Studio III - Small Town/Rural	BLA	Required	
	LA 3623 Urban Planning Theory	BLA	Required	
	LA 3454 Landscape Architecture Design Studio IV - Urban Design	BLA	Required	
	LA 4523 Applications for GIS in Landscape Architects	BLA	Optional	
	LA 3454 Landscape Architecture Design Studio V - Regional	BLA	Required	
	LA 3454 Landscape Architecture Capstone Studio	BLA	Required	
Vehicular and pedestrian circulation/roadway alignment design	LA 2644 Landscape Architecture Construction II	BLA	Required	1

University/Program Reviewed: **Mississippi State MLA**

Required/optional courses that cover any of the following topics:	Course name(s)	Degree level(s)	Required or Optional?	Number of courses in topic required through all years of program
Botany/Horticulture	LA 1333 Landscape Systems and Plant Communities	MLA	Required	2
	LA 3653 Planting Design Fundamentals in Landscape Architecture	MLA	Required	
	LA 6463 Community Food Systems	MLA	Optional	
	LA 6514 Ecological Planting Design	MLA	Optional	
	LA 6753 Sustainable Landscape Management	MLA	Optional	
	LA 6853 Sustainable Communities	MLA	Optional	
Construction Materials and methods	LA 2544 Landscape Architecture Construction I - Materials	MLA	Required	2
	LA 2644 Landscape Architecture Construction II - Grading	MLA	Required	
	LA 2644 Landscape Architecture Construction III - Hydrology	MLA	Optional	
	LA 4344 Landscape Architecture Construction IV	MLA	Optional	
	LA 4124 Landscape Architecture Construction V - Construction Documents	MLA	Optional	
	LA 4443 Exterior Design-Build Studio	MLA	Optional	
Ecology	LA 1333 Landscape Systems and Plant Communities	MLA	Required	2
	LA 3653 Planting Design Fundamentals in Landscape Architecture	MLA	Required	
	LA 6463 Community Food Systems	MLA	Optional	
	LA 6514 Ecological Planting Design	MLA	Optional	
	LA 6753 Sustainable Landscape Management	MLA	Optional	
	LA 6853 Sustainable Communities	MLA	Optional	
Engineering	LA 2544 Landscape Architecture Construction I - Materials	MLA	Required	2
	LA 2644 Landscape Architecture Construction II - Grading	MLA	Required	
	LA 2644 Landscape Architecture Construction III - Hydrology	MLA	Optional	
	LA 4344 Landscape Architecture Construction IV	MLA	Optional	
	LA 4124 Landscape Architecture Construction V - Construction Documents	MLA	Optional	
	LA 4443 Exterior Design-Build Studio	MLA	Optional	
Geology				0
Hydrology	LA 6753 Sustainable Landscape Management	MLA	Optional	3
	LA 2644 Landscape Architecture Construction II - Grading	MLA	Required	
	LA 2644 Landscape Architecture Construction III - Hydrology	MLA	Optional	
	LA 4344 Landscape Architecture Construction IV	MLA	Optional	
	LA 4124 Landscape Architecture Construction V - Construction Documents	MLA	Optional	
	LA 4443 Exterior Design-Build Studio	MLA	Optional	
	LA 8513 Landscape Architecture Graduate Studio I	MLA	Required	
	LA 8522 Landscape Architecture Graduate Studio II	MLA	Required	
Mathematics	SO 8274 Graduate Social Statistics I	MLA	Optional	1
	ST 8114 Statistical Methods	MLA	Optional	
	LA 6463 Community Food Systems	MLA	Optional	
	LA 1223 Computers in Landscape Architecture	MLA	Required	
	LA 4523 Applications for GIS in Landscape Architects	MLA	Optional	
Stormwater management/drainage	LA 6753 Sustainable Landscape Management	MLA	Optional	3
	LA 2644 Landscape Architecture Construction II - Grading	MLA	Required	
	LA 2644 Landscape Architecture Construction III - Hydrology	MLA	Optional	
	LA 8513 Landscape Architecture Graduate Studio I	MLA	Required	
	LA 8522 Landscape Architecture Graduate Studio II	MLA	Required	
Sustainability Studies	LA 2554 Landscape Architecture Design Studio I	MLA	Required	16
	LA 2654 Landscape Architecture Design Studio II	MLA	Required	
	LA 4523 Applications for GIS in Landscape Architects	MLA	Required	
	LA 8512 Landscape Architecture Graduate Studio I	MLA	Required	
	LA 8513 Landscape Architecture Graduate Studio I	MLA	Required	
	LA 8522 Landscape Architecture Graduate Studio II	MLA	Required	
	LA 8523 Landscape Architecture Graduate Studio II	MLA	Required	
	LA 8532 Landscape Architecture Graduate Studio III	MLA	Required	
	LA 8533 Landscape Architecture Graduate Studio III	MLA	Required	
	LA 8545 Landscape Architecture Graduate Studio IV - Case Study	MLA	Required	
	LA 8613 Research Methods in Landscape Architecture	MLA	Required	
	LA 8711 Seminar in Watershed Planning and Management	MLA	Required	
	LA 8721 Seminar in Landscape Management	MLA	Required	

	LA 8731 Seminar in Community Based Planning	MLA	Required	
	LA 8741 Proposal Writing Seminar	MLA	Required	
	LA 8751 Seminar in Contemporary Issues	MLA	Required	
	LA 6753 Sustainable Landscape Management	MLA	Optional	
	LA 6853 Sustainable Communities	MLA	Optional	
Vehicular and pedestrian circulation/roadway alignment design	LA 2644 Landscape Architecture Construction II - Grading	MLA	Required	1

University/Program Reviewed: **Penn State**

Required/optional courses that cover any of the following topics:	Course name(s)	Degree level(s)	Required or Optional?	Number of courses in topic required through all years of program (BLA)	Number of courses in topic required through all years of program (MLA)
Botany/Horticulture	(See ecology courses)			4	4
Construction Materials and methods	LArch 236 Materials; LArch 335 Planting Methods	BLA, MLA	Required	2	2
Ecology	LArch 145 - Ecol & Plants I; LArch 245 Ecol & Plants II; LArch 246 Ridge & Valley Field Trip; LArch 216 Natural & Cultural Systems studio	BLA, MLA	Required	4	4
Engineering	LArch 245 Grading	BLA, MLA	Required	1	1
Geology	Soils 101	BLA	Required	1	
Hydrology	(see stormwater course)			1	1
Mathematics	2 gen eds (variable courses)	BLA	Required	2	
Stormwater management/drainage	LArch 336 Stormwater	BLA, MLA	Required	1	1
Sustainability Studies	2 required natural sciences gen eds (beyond soils)	BLA	Required	2	
Vehicular and pedestrian circulation/roadway alignment design	LArch 215 Design III: Site Design; LArch 315 Design V: Expanded Use, Scale, and Context; LArch 414 (3 required upper level studios with varied topics)	BLA, MLA	Required	5	5

University/Program Reviewed: **Rhode Island School of Design, Department of Landscape Architecture, MLA**

Required/optional courses that cover any of the following topics:	Course name(s)	Degree level(s)	Required or Optional?	Number of courses in topic required through all years of program
Botany/Horticulture	LDAR 2252 Plants Botany + Ecology	ML	Required	2
	LDAR-2253 Plants Form + Space	MLA	Required	
Construction Materials and methods	LDAR 2251 Material Logic Wood Metal + Stone	MLA	Required	5
	LDAR-2266 Material Tests Prototyping + Digi Fab	MLA	Required	
	LDAR 2254 Material Assemblies Detailing + Construction	MLA	Required	
	LDAR 231G Topics In Representation	MLA	Required	
	LDAR 232G Topics in Representation 2	MLA	Required	
Ecology	LDAR 2256 Design Foundations + Field Ecology	MLA	Required	3
	LDAR 2203 Site Ecology + Design	MLA	Required	
	LDAR 2201 Design Principles	MLA	Required	
Engineering	LDAR W207 Constructed Ground Terrain + Earthwork	MLA	Required	2
	LDAR 2204 Constructed Landscapes	MLA	Required	
Sustainability Studies	LDAR 226G Landscape Research Theory + Design	MLA	Required	2
	LDAR WW217 Research Methods	MLA	Required	
Hydrology / Stormwater management/drainage	LDAR 2257 Hydrological Systems	MLA	Required	1

University/Program Reviewed: **Texas A&M BLA**

Required/optional courses that cover any of the following topics:	Course name(s)	Degree level(s)	Required or Optional?	Number of courses in topic required through all years of program
Botany/Horticulture	HORT 306 Trees & Shrubs for Susainable Built Environments	BLA	Required	5
	HORT 308 Plants for Sustainable Landscapes	BLA	Required	
	LAND 211 Landscape Design I	BLA	Required	
	LAND 212 Landscape Design II	BLA	Required	
	LAND 231 Landscape Construction I	BLA	Required	
Construction Materials and methods	LAND 301 Landscape Architecture Theory	BLA	Required	8
	LAND 484 Summer Internship	BLA	Required	
	LAND 494 Internship	BLA	Required	
	LAND 312 Landscape Design IV	BLA	Required	
	LAND 412 Landscape Design VI	BLA	Required	
	LAND 210 Microclimatic Urban Design: Cool Solutions for Hot Cities	BLA	Optional	
	LAND 231 Landscape Construction I	BLA	Required	
	LAND 232 Landscape Construction II	BLA	Required	
	LAND 331 Landscape Construction III	BLA	Required	
Ecology	RENR 205 Fundamentals of Ecology	BLA	Required	8
	RENR 215 Fundamentals of Ecology --Lab 1	BLA	Required	
	LAND 240 History of Landscape Architecture	BLA	Required	
	LAND 241 History and Development of Landscape Architecture in North America	BLA	Required	
	LAND 311 Landscape Design III	BLA	Required	
	LAND 312 Landscape Design IV	BLA	Required	
	LAND 210 Microclimatic Urban Design: Cool Solutions for Hot Cities	BLA	Optional	
	LAND 231 Landscape Construction I	BLA	Required	
	LAND 232 Landscape Construction II	BLA	Required	
	URPN 325 Introduction to GIS in Urban and Regional Planning]	BLA	Optional	
Engineering	LAND 232 Landscape Construction II	BLA	Required	2
	LAND 331 Landscape Construction III	BLA	Required	
Geology	LAND 211 Landscape Design I	BLA	Required	3
	LAND 212 Landscape Design II	BLA	Required	
	LAND 312 Landscape Design IV	BLA	Required	
Hydrology	LAND 311 Landscape Design III	BLA	Required	6
	LAND 312 Landscape Design IV	BLA	Required	
	LAND 412 Landscape Design VI	BLA	Required	
	LAND 210 Microclimatic Urban Design: Cool Solutions for Hot Cities	BLA	Optional	
	LAND 231 Landscape Construction I	BLA	Required	
	LAND 232 Landscape Construction II	BLA	Required	
	LAND 331 Landscape Construction III	BLA	Required	
Mathematics	MATH 140 Math for Business & Social Science	BLA	Required	2
	MATH 142 Business Calculus	BLA	Required	
Stormwater management/drainage	LAND 311 Landscape Design III	BLA	Required	6
	LAND 312 Landscape Design IV	BLA	Required	
	LAND 412 Landscape Design VI	BLA	Required	
	LAND 210 Microclimatic Urban Design: Cool Solutions for Hot Cities	BLA	Optional	
	LAND 231 Landscape Construction I	BLA	Required	
	LAND 232 Landscape Construction II	BLA	Required	
	LAND 331 Landscape Construction III	BLA	Required	
Sustainability Studies	LAND 101 Introduction to Landscape Architectural Practice	BLA	Required	15
	LAND 240 History of Landscape Architecture	BLA	Required	
	LAND 241 History and Development of Landscape Architecture in North America	BLA	Required	
	LAND 431 Professional Practice	BLA	Required	
	LAND 111 Landscape Architecture Communications I	BLA	Required	
	LAND 112 Landscape Architectural Communications II	BLA	Required	
	LAND 211 Landscape Design I	BLA	Required	
	LAND 212 Landscape Design II	BLA	Required	
	LAND 311 Landscape Design III	BLA	Required	
	LAND 312 Landscape Design IV	BLA	Required	
	LAND 412 Landscape Design VI	BLA	Required	

	LAND 210 Microclimatic Urban Design: Cool Solutions for Hot Cities	BLA	Optional	
	LAND 231 Landscape Construction I	BLA	Required	
	LAND 232 Landscape Construction II	BLA	Required	
	URPN 220 Digital Communication I	BLA	Required	
	URPN 320 Digital Communication II	BLA	Required	
	URPN 325 Introduction to GIS in Urban and Regional Planning]	BLA	Optional	
Vehicular and pedestrian circulation/roadway alignment design	LAND 312 Landscape Design IV	BLA	Required	5
	LAND 412 Landscape Design VI	BLA	Required	
	LAND 231 Landscape Construction I	BLA	Required	
	LAND 232 Landscape Construction II	BLA	Required	
	LAND 331 Landscape Construction III	BLA	Required	

University/Program Reviewed: **Texas A&M University MLA**

Required/optional courses that cover any of the following topics:	**Course name(s)**	**Degree level(s)**	**Required or Optional?**	**Number of courses in topic required through all years of program**
Botany/Horticulture	LAND 614 Landscape Architectural Construction.	MLA	Required	3
	LAND 645 Practice Diversity in Landscape Architecture.	MLA	Required	
	HORT 608 Plants for Landscape Design	MLA	Required	
Construction Materials and methods	LAND 612 Landscape Architectural Site Engineering and Development	MLA	Required	4
	LAND 614 Landscape Architectural Construction.	MLA	Required	
	LAND 620 Open Space Development I.	MLA	Required	
	LAND 621 Open Space Development II	MLA	Required	
Ecology	LAND 614 Landscape Architectural Construction.	MLA	Required	8
	LAND 602 Landscape Architectural Design Theory and Application II	MLA	Required	
	LAND 620 Open Space Development I.	MLA	Required	
	LAND 621 Open Space Development II	MLA	Required	
	LAND 635/PLAN 635 Concepts in Ecological Planning and Design	MLA	Optional	
	LAND 693 Professional Study	MLA	Required	
	LAND 645 Practice Diversity in Landscape Architecture.	MLA	Required	
	ECCB 403 Population and Community Ecology	MLA	Required	
	HORT 608 Plants for Landscape Design	MLA	Required	
Engineering	LAND 612 Landscape Architectural Site Engineering and Development	MLA	Required	8
	LAND 614 Landscape Architectural Construction.	MLA	Required	
	LAND 602 Landscape Architectural Design Theory and Application II	MLA	Required	
	LAND 620 Open Space Development I.	MLA	Required	
	LAND 621 Open Space Development II	MLA	Required	
	LAND 640 Research Methods in Landscape Architecture.	MLA	Required	
	LAND 645 Practice Diversity in Landscape Architecture.	MLA	Required	
	LAND 646 Professional Practice.	MLA	Required	
	LAND 655 Landscape Architectural Communication.	MLA	Optional	
	PLAN 625 Geographical Information Systems in Landscape and Urban Planning,	MLA	Optional	
Geology	LAND 602 Landscape Architectural Design Theory and Application II	MLA	Required	2
	LAND 620 Open Space Development I.	MLA	Required	
Hydrology	LAND 612 Landscape Architectural Site Engineering and Development	MLA	Required	4
	LAND 614 Landscape Architectural Construction.	MLA	Required	
	LAND 602 Landscape Architectural Design Theory and Application II	MLA	Required	
	LAND 620 Open Space Development I.	MLA	Required	
Mathematics	LAND 612 Landscape Architectural Site Engineering and Development	MLA	Required	2
	LAND 614 Landscape Architectural Construction.	MLA	Required	
Stormwater management/drainage	LAND 612 Landscape Architectural Site Engineering and Development	MLA	Required	5
	LAND 614 Landscape Architectural Construction.	MLA	Required	
	LAND 602 Landscape Architectural Design Theory and Application II	MLA	Required	
	LAND 620 Open Space Development I.	MLA	Required	
	LAND 635/PLAN 635 Concepts in Ecological Planning and Design	MLA	Optional	
	LAND 645 Practice Diversity in Landscape Architecture.	MLA	Required	
Sustainability Studies	LAND 612 Landscape Architectural Site Engineering and Development	MLA	Required	10
	LAND 614 Landscape Architectural Construction.	MLA	Required	
	LAND 601 Landscape Architectural Design Theory.	MLA	Required	

	LAND 602 Landscape Architectural Design Theory and Application II	MLA	Required	
	LAND 620 Open Space Development I.	MLA	Required	
	LAND 621 Open Space Development II	MLA	Required	
	LAND 622/PLAN 622 Critical Place Studies: Theory, Research and Practice	MLA	Optional	
	LAND 632 Design for Active Living	MLA	Optional	
	LAND 635/PLAN 635 Concepts in Ecological Planning and Design	MLA	Optional	
	LAND 693 Professional Study	MLA	Required	
	LAND 603 Principles and Techniques of Land Development.	MLA	Optional	
	LAND 630 Development of Landscape Architecture	MLA	Required	
	LAND 640 Research Methods in Landscape Architecture.	MLA	Required	
	LAND 645 Practice Diversity in Landscape Architecture.	MLA	Required	
	LAND 655 Landscape Architectural Communication.	MLA	Optional	
	LAND 661 Visual Quality for Design and Planning.	MLA	Optional	
	LDEV 671 Sustainable Development	MLA	Optional	
	PLAN 625 Geographical Information Systems in Landscape and Urban Planning,	MLA	Optional	
Vehicular and Pedestrian Circulation/Roadway Alignment & Design	LAND 612 Landscape Architectural Site Engineering and Development	MLA	Required	6
	LAND 614 Landscape Architectural Construction.	MLA	Required	
	LAND 601 Landscape Architectural Design Theory.	MLA	Required	
	LAND 602 Landscape Architectural Design Theory and Application II	MLA	Required	
	LAND 620 Open Space Development I.	MLA	Required	
	LAND 621 Open Space Development II	MLA	Required	
	LAND 632 Design for Active Living	MLA	Optional	

University/Program Reviewed: **University of New Mexico**

Required/optional courses that cover any of the following topics:	Course name(s)	Degree level(s)	Required or Optional?	Number of courses in topic required through all years of program
Botany/Horticulture	Plants I + Plants II, Studios (5)	MLA	Required	7
Construction Materials and methods	Construction Materials + Methods, Studios (5)	MLA	Required	6
Ecology	Urban Ecology, Studio 502, Studio 503, Studio 504 Site + Environment	MLA	Required	5
Engineering	Grading + Drainage, History of LA, Studios	MLA	Required	5
Geology	Site + Environment, Design Studios 502, 504	MLA	Required	3
Hydrology	Grading + Drainage, Site + Environment, Studio 502	MLA	Required	3
Mathematics	Grading + Drainage, Site + Environment, Studios 502 503 504 505	MLA	Required	6
Stormwater management/drainage	Site + Environment, Design Studios 502, 504	MLA	Required	3
Sustainability Studies	Urban Ecology, Studios (5), Site + Environment, Theory	MLA	Required	7
Vehicular and pedestrian circulation/roadway alignment design	Site + Environment, Design Studios 502, 504	MLA	Required	3

University/Program Reviewed: **University of Pennsylvania MLA**

Required/optional courses that cover any of the following topics:	Course name(s)	Degree level(s)	Required or Optional?	Number of courses in topic required through all years of program
Botany/Horticulture	LARP 511 Workshop I: Ecology & Built Landscapes	MLA	Required	2
	LARP 512 Workshop II: Landform and Grading & Planting Design	MLA	Required	
	LARP 750 Topics in Construction, Horticulture, & Planting Design	MLA	Optional	
	LARP 755 Understanding Plants	MLA	Optional	
Construction Materials and methods	LARP 612 Workshop IV: Advanced Landscape Construction	MLA	Required	1
	LARP 750 Topics in Construction, Horticulture, & Planting Design	MLA	Optional	
Ecology	LARP 511 Workshop I: Ecology & Built Landscapes	MLA	Required	3
	LARP 512 Workshop II: Landform and Grading & Planting Design	MLA	Required	
	LARP 512 Workshop II: Spring Field Ecology	MLA	Required	
	LARP 761 Urban Ecology	MLA	Required	
	LARP 750 Topics in Construction, Horticulture, & Planting Design	MLA	Optional	
	LARP 760 Topics in Ecological Design	MLA	Optional	
	LARP 790/794 Natural Systems (for 3yr & 2yr students, respectively)	MLA	Required	

Engineering	LARP 611 Workshop III: Site Engineering & Water Management	MLA	Required	1
Geology	LARP 511 Workshop I: Ecology & Built Landscapes	MLA	Required	1
	LARP 512 Workshop II: Landform and Grading & Planting Design	MLA	Required	
Hydrology	LARP 511 Workshop I: Ecology & Built Landscapes	MLA	Required	1
Mathematics				
Stormwater management/drainage	LARP 611 Workshop III: Site Engineering & Water Management	MLA	Required	1
Sustainability Studies	LARP 760 Topics in Ecological Design	MLA	Optional	
Vehicular and pedestrian circulation/roadway alignment design				

University/Program Reviewed: **UW-Madison BLA**

Required/optional courses that cover any of the following topics:	**Course name(s)**	**Degree level(s)**	**Required or Optional?**	**Number of courses in topic required through all years of program**
Botany/Horticulture	Botany 130: Introduction to Botany (with lab)	BLA	Required	2
Construction Materials and methods	LA 354: Landscape Technology II	BLA	Required	1
Ecology	Bot 260: Introduction to Optionalcology	BLA	Required	2
	LA 361: Wetlands Optionalcology	MLA/BLA	Optional	
	LA 560: Plants and Optionalcology in Design	BLA	Required	
	LA 651: Plant Community Restoration Workshop	MLA/BLA	Optional	
	LA 668: Restoration Optionalcology	MLA/BLA	Optional	
Engineering	Mech Optionalng 160: Architectural Graphics;	BLA	Optional	
	Bio Systems Optionalng 201: Land Surveying Fundaments	BLA	Optional	
Geology	Geog 127: Physical Systems of the Optionalnvironment	BLA	Optional	1
Hydrology				
Mathematics	Gen Optional	BLA	Required	1
Stormwater management/drainage	LA 353: Landcape Technology I	BLA	Required	1
Sustainability Studies	LA 563: Designing Sustainable and Resiliant Regions	BLA	Required	1
Vehicular and pedestrian circulation/roadway alignment design				

University/Program Reviewed: **Utah State University**

Required/optional courses that cover any of the following topics:	**Course name(s)**	**Degree level(s)**	**Required or Optional?**	**Number of courses in topic required through all years of program (BLA)**	**Number of courses in topic required through all years of program (MLA)**
Botany/Horticulture	PSC 2620 Woody Plants	BLA	Required	2	0
	LAEP 3500 Planting Design	BLA	Required		
Construction Materials and methods	LAEP 2600 Landscape Construction	BLA, MLA	Required	3	1
	LAEP 4110 Landscape Construction II	BLA	Required		
	LAEP 3600 Landscape Materials	BLA	Required		
Ecology	WILD 2200 Ecology	BLA	Required	1	1
	LAEP 6110 Landscape Ecology	MLA	Required		
Engineering				0	0
Geology	Physical Sciences	BLA	Required	1	0
Hydrology				0	0
Mathematics	Math 1050	BLA	Required	1	0
Stormwater management/drainage	LAEP 2600 Landscape Construction	BLA, MLA	Required	1	1
Sustainability Studies				0	0
Vehicular and pedestrian circulation/roadway alignment design	LAEP 2720 Analysis & Design II	BLA, MLA	Required	1	1