

2023

U.S. National Report

TO
THE
ICA

Cartography and GIS in the United States, 2019–2023

Compiled by the U.S. National Committee (USNC) for the International Cartographic Association (ICA), this year's National Report to the ICA recounts significant advancements and activities in cartography and GIS in the United States of America over the last four years. This report is made available to the public via the [ICA website](#) and the [CaGIS website](#) to allow everyone to gain an overview of national and global activities within the cartography and GIScience community. The 2023 report will be presented in August to the ICA General Assembly at the International Cartographic Conference in Cape Town, South Africa.

A NOTE ABOUT THE FORMAT

The 2023 National Report incorporates a draft template that the ICA may use to solicit future reports. The template is reflected in the Contributor Profiles at the end of this report.



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Non-profit Organizations and Societies

There are a variety of non-profit societies and associations that focus on cartography and GIS in the United States. Each has a different strength. For example, [CaGIS](#) focuses its support on cartographic research in academia and the government. [NACIS](#) supports commercial and academic cartography, as well as map librarians. The [AAG CSG](#) supports cartography within academic geography. [UCGIS](#) supports GIS in higher education. The [IMIA](#), while international, provides support for U.S. map making, publishing, and distributing companies and agencies. These non-profit organizations often work together to support cartography and GIS in the U.S.

CAGIS

The [Cartography and Geographic Information Society](#) (CaGIS) supports research, education, and practice to improve the understanding, creation, analysis, and use of maps and geographic information for effective decision-making and to improve the quality of life. The

concepts, techniques, approaches, and experiences by those who design, implement, and use cartography, GIS, and related geospatial technologies.

NACIS

The [North American Cartographic Information Society](#) (NACIS) is an organization of specialists in the field of geographic information. Founded in 1980, NACIS has grown into a vibrant society with membership throughout North America and the world. NACIS welcomes new members from traditional as well as emerging professions that define geographic information science today.

AAG CSG

The [Cartography Specialty Group](#) (CSG) of the [American Association of Geographers](#) (AAG) encourages cartographic research and promotes education in cartography and map use. It facilitates the exchange of ideas and information about cartography, promotes interest in and correct utilization of maps, promotes and facilitates the cartographer's role within the geographic profession, and promotes and coordinates activities and directions with other professional organizations involved with cartography.

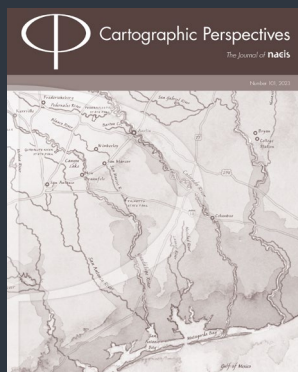
Spotlight: CaGIS

Cartography and Geographic Information Science (CaGIS) is the official publication of the Cartography and Geographic Information Society. Published six times per year, the journal may be accessed online via the [Taylor and Francis website](#) and members can access the journal online via the [CaGIS website](#).



Spotlight: Cartographic Perspectives

[Cartographic Perspectives](#) (CP) is the free, open-access journal of NACIS, devoted to the study and practice of Cartography in all of its diversity. It is published three times a year. The [100th issue](#) was released in January 2023!



Non-profit Organizations and Societies

bring cartography and GIS community members together to share their work and plan for the future.

UCGIS

The [University Consortium for Geographic Information Science](#) (UCGIS) is a non-profit organization that creates and supports communities of practice for GIScience research, education, and policy endeavors in higher education and with allied institutions. It is the professional hub for the academic GIS community in the United States, with partnerships extending this capacity abroad.

IMIA

The [International Map Industry Association](#) (IMIA) is dedicated to fostering the growth of the mapping industry through the exchange of ideas and information, the education of industry trends and technologies, and access to a wide spectrum of mapping leaders. Our global organization is one collective group with one voice advocating for the growth and success of the international mapping industry. Connecting the business of maps worldwide is our number one priority.

Map Librarians

The American Library Association maintains an online guide to [U.S. map collections](#). It also provides a list of national and international professional [organizations concerned with maps](#). The Western Association of Map Libraries (see spotlight at right) provides a similar list of national and international [map library organizations](#). However, corporate libraries are often overlooked.

Esri Library

The Esri Library serves as a research destination for Esri employees working on software development, educational training and industry applications of GIS. The Esri Library is also committed to contributing GIS information to educators, students, and the GIS community through the publicly accessible [Esri GIS Bibliography](#). The Esri Library collection has grown to over 100,000 items, including print and electronic materials.

Spotlight:

The Western Association of Map Libraries

The Western Association of Map Libraries (WAML) is an independent association of map librarians and other people interested in advancing geospatial excellence in the libraries of western North America and beyond.

[The Information Bulletin](#) (IB) is the official journal of the Western Association of Map Libraries. It is an open access journal issued three times each year.

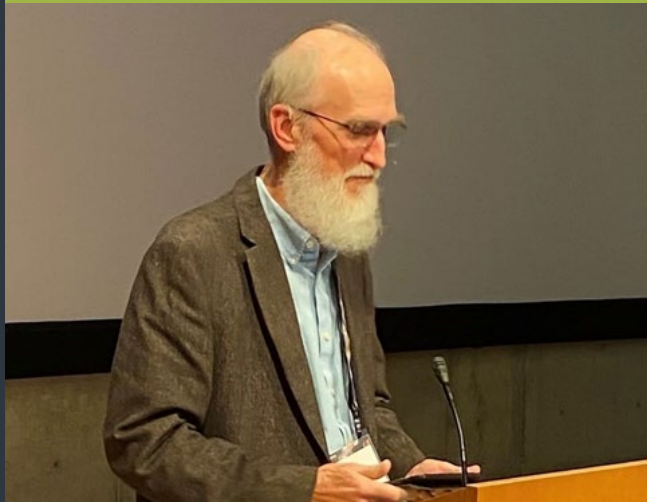
The [WAML Annual Conference](#) provides a great opportunity for students and new/transitioning librarians to learn, network, and develop themselves and the profession of Map and GIS librarianship.

WAML also offers scholarships and distinguished service award (see page 7 for more details).

Spotlight: Penn State Geography

The [Department of Geography](#) at The Pennsylvania State University is committed to building a resilient and just world by bridging the subfields of geography to identify innovative and creative social, environmental, and spatial solutions. It seeks these solutions through its teaching, research, and service by advancing the vision of how to sustain landscapes and livelihoods, respond to the climate crisis, and make data science spatial. The department sees these as grand challenges for Penn State Geography.

In 2021, the [ICA Carl Mannerfelt Gold Medal](#) was awarded to Alan M. MacEachren (shown above right), Professor Emeritus of Geography at Penn State University. Alan is the founding director of the Geo-VISTA Center, one of the premier research and design laboratories in cartography, geovisualization, and GIScience in the U.S. Alan is an internationally recognized leader in these areas, pioneering methods to interact and collaborate in real-time exploratory analyses and visualizations of geographic data sets. Alan was named an Honorary Fellow of the ICA in 2005, but the scope, and impact of his scientific contributions led the ICA to [award him the Mannerfelt Medal](#).



According to College Factual with its information about 2023 [schools with degrees in Geography and Cartography](#), there are 8 associate, 216 undergraduate, 115 master's, and 47 doctoral degree schools in the U.S. [Online programs in cartography](#) in 2021 are also listed.

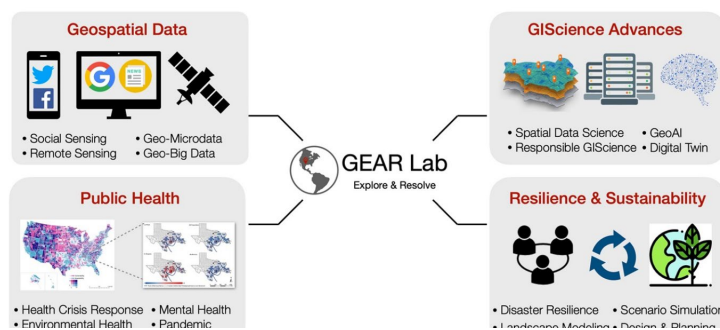
University of Oregon

The CartoFish Lab, directed by Dr. Carolyn Fish, is focused on research at the intersection of cartography and environmental communication. They research how to effectively communicate climate change through maps and the ways in which maps are used in climate change discourse. They use a combination of quantitative and qualitative methods

and analysis to illustrate how the media and scientists create and design maps that balance communication and scientific accuracy.

Texas A&M University

The mission of the Geospatial Exploration and Resolution (GEAR) Lab in the Department of Geography at Texas A&M University is to build a healthy, resilient, and sustainable future for human communities amidst changing climates and environments through spatial and responsible thinking, novel data, and intelligent algorithms. They aim to explore diverse geospatial data and analysis methods, advance GIScience theories and algorithms, and resolve real-world challenges and societal needs (see figure below).



Academic Programs

Often found within geography departments, cartography remains a strong discipline in U.S. academia.

Spotlight: Smithsonian Institution

The [Smithsonian Institution](#) (SI) is the world's largest museum, education, and research complex. It includes 21 museums, the National Zoo, and eight research centers.

The [SI Vision](#): "Through our unparalleled collections and research capabilities, and the insight and creativity we foster through art, history, and culture, the Smithsonian strives to provide Americans and the world with the tools and information they need to forge Our Shared Future".

The Institution was founded in 1846 with funds from the Englishman James Smithson (1765–1829) according to his wishes "under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge."

Spotlight: GeoGraphics Lab – PSU

Located in the Penn State University Department of Geography, the [GeoGraphics Lab](#) provides cartographic design, production, and research services using industry-grade equipment (as shown at the right). Its clients include commercial, nonprofit, and government organizations, members of the central Pennsylvania community, as well as PSU Geography students and faculty. The lab offers professional geospatial visualization services, including map design, production, and research. The lab's specialty is static print and digital maps, but it offers solutions for interactive digital maps as well.

The lab is currently working with Dr. Cynthia Brewer to design maps for a renovation of the 2nd and 3rd floors of the building that houses the PSU Department of Geography. The centerpiece will be a series of large (16 to 28 square foot), illuminated resin panels mounted to the wall (shown below right). Each map will feature a different continent, dataset, and themes in geography while at the same time illustrating relationships between humans and the environment.



University Cartography/ GIS Labs

serve a wide variety of clients
and provide myriad functions.

Cartography & GIS Labs on University Campuses

NACIS maintains a list of some forty [university laboratories of Cartography, GIS, and Remote Sensing](#), as well as university staff cartographers and geographic services.

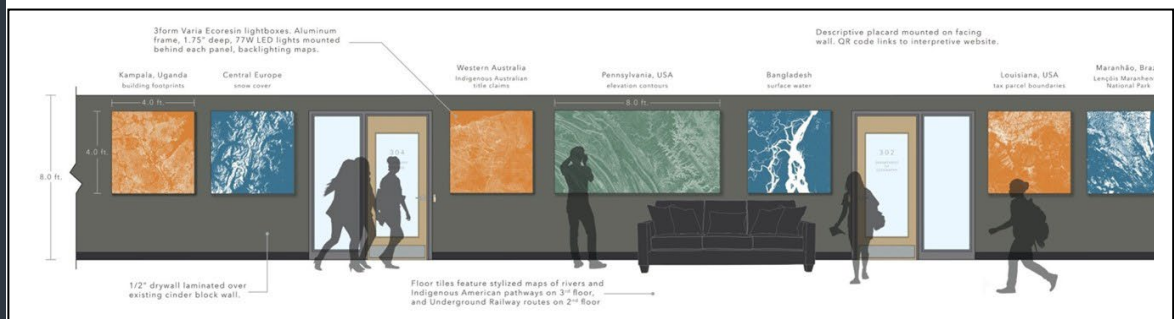
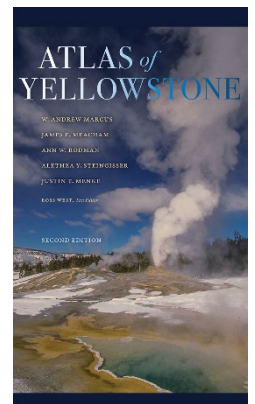
GAMLab – University of Colorado, Denver

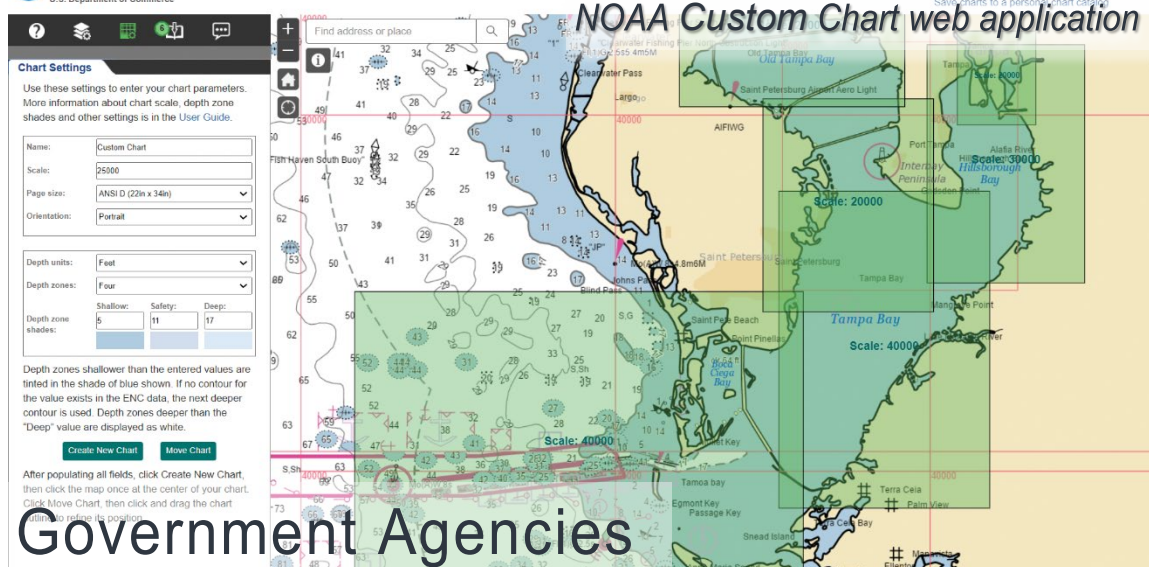
The [Geospatial Analysis and Mapping Laboratory](#) (GAMLab) is a newly established research and service center in the Department of Geography and Environmental Sciences (GES) at the University of Colorado Denver (CU Denver). The GAMLab provides resources and services to visualize, explore, analyze, and propose solutions to human-environmental challenges using GIScience and Technology. The GAMLab enables and supports the geospatial research activities of CU Denver's GES faculty and students. The GAMLab offers services, including map production, informational graphics, digitizing, data compilation, spatial analysis, and consulting, to both internal and external clients.

InfoGraphics Lab – University of Oregon

The InfoGraphics Lab (IGL) is a center of excellence and innovation in geospatial research and cartography at the University of Oregon. As a hybrid research and practice community, the IGL seeks to advance basic research in diverse domains and develop high quality interactive and print products that evoke, inspire, and communicate. Ongoing research projects highlight the integral role—both technical and theoretical—that data and design play in advancing knowledge and making a meaningful impact on society and the planet.

Recent accomplishments include *The Atlas of Yellowstone, 2nd Edition*, three USGS reports on ungulate migration, and more than a dozen collaborations with faculty in a variety of disciplines within the university and beyond.





Government Agencies

There are many U.S. government agencies involved in mapping and cartography, including the [USGS](#) (topographic mapping), [Census Bureau](#) (demographic data and maps), [NOAA](#) (nautical charting), as well as mapping by the NPS, FEMA, USFS, BLM, FWS, and others for the lands and programs that they oversee. Many of these agencies also provide GIS data, often for free. The University of Buffalo maintains an extensive list of [maps and mapping resources from U.S. government agencies](#).

USGS CEGIS

The [U.S. Geological Survey Center of Excellence for Geospatial Information Science](#) (USGS CEGIS) advances geospatial knowledge through cutting-edge research, innovative technologies, and collaborative partnerships. They aim to build a sustainable future by harnessing the power of geospatial information to support informed decision-making, scientific discovery, and environmental stewardship. CEGIS is in the Research Arm of the National Geospatial Program, part of the National Geospatial Directorate in the Department of the Interior (DOI).

CEGIS aims to guide [The National Map](#) (TNM) towards an intelligent National Map (INM) in the next five years. The INM will utilize interactive tools to aid scientific discovery and inform decisions. It will be accessible to USGS scientists, DOI personnel, federal land managers, state and tribal government officials, non-government organizations, and the general public. The INM will support advanced retrievals based on geographic location, layers, feature names, and selection. It will also support mobile, download, and offline access.

Spotlight: NOAA

Office of Coast Survey

NOAA electronic navigational charts (ENCs) are vector files of chart features available in S-57 format. NOAA ENC® products support marine navigation by providing the official data used in ECDIS and in electronic charting systems. Starting in 2019, the NOAA Office of Coast Survey, Marine Chart Division (MCD) began the process of rescheming (i.e., redesigning the scheme of) their ENC suite, initially based on legacy chart extents digitized from paper nautical chart products to a rectangular tiled grid.

An additional goal of redesigning the ENC schema was to improve the overall useability of the ENC products in preparation for the cancellation of NOAA's paper chart suite. As of August 2023, NOAA has discontinued nearly 50% of its paper charts. To support users who still wish to have hard-copy nautical charts, NOAA has implemented the NOAA Custom Chart web application (shown at the top of this page) which allows mariners to create paper charts derived from ENC data.. Learn more at <https://nauticalcharts.noaa.gov/>.

Spotlight: Census Bureau

The [U.S. Census Bureau](#) and the Geographic Support Program (GSP) supports and maintains the geographic and cartographic infrastructure necessary for the Census Bureau's data collection processing, tabulation, and dissemination programs for the United States, Puerto Rico, and Island Areas.

The GSP aims to provide the most current, accurate, and complete address, feature, imagery, and boundary data to the Census Bureau's customers and data users and build the geographic foundation for every economic and social data product produced by the Census Bureau. This program provides the geographic reference files that are needed for all Census Bureau programs, censuses, surveys, and related field operations, such as the Economic Census, Current Demographic Statistics program, Intercensal Demographic Estimates program, American Community Survey (ACS), and Decennial Census.

The Census Bureau integrates high-quality data provided by more than 40,000 tribal, federal, state, and local government partners to validate and update address, feature, and boundary information in the Census' MAF/TIGER GIS database.



Commercial cartography has never been stronger in the U.S. NACIS maintains a list of over forty of its members with [commercial ventures that specialize in producing maps](#) for clients. IMIA also provides information about commercial cartography companies with information on its [members in the international mapping industry](#). Also of great importance, but not listed, are the many U.S. independent cartographers!

Treeline Terrains

Inspired by their shared love of skiing in Vermont, Treeline Terrains founders Jacob, Nathaniel, and Alex searched for a creative way to capture their outdoor winter

Using satellite mapping technology, they brought their idea to the woodshop to create perfectly accurate 3D models. Today, Treeline Terrains captures the topography of the places in its wood-carved models (as shown below).



Spotlight: Independent Cartographer, Darren Sears

My artistic watercolor maps are “fractured” into multiple landscapes inspired by my own photography, conveying immersive spatial experiences of natural environments in ways that individual aerial views cannot. These multi-faceted compositions accentuate the contrasts (generated by substrate, climate, or land use) that define ecological islands and archipelagos—geographies that feel to me like compressed, empoweringly “knowable” versions of natural spaces and phenomena that we typically think of as “larger-than-life”. The works are increasingly inspired by real (vs. imaginary) places worldwide, but they are abstract in not only sharpening contrasts but in distorting scales and orientations to reflect my real-world experiences (shown at the top of this page).

The “world-at my-fingertips” sensation originally motivating these maps has recently evolved into a more preservation-minded urge as ecological edges and islands are degraded and obliterated by climate change and other threats. By continuing to emphasize separation and insularity, this emphasis on fragility represents a similar yearning for control—in this case relying on a simplistic idea of nature as historically isolated from change, human-caused and not, in time and space. This illusion of stability is only becoming more illusory, and my maps—grasping onto these endangered ecological slivers like precious objects—reveal my difficulty in accepting that reality.

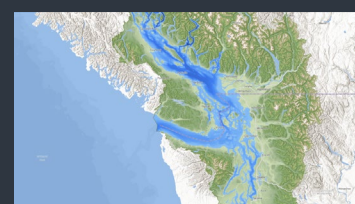
Spotlight: Esri

Esri is the global market leader in geographic information system (GIS) software, location intelligence, and mapping. Since 1969, it has supported customers with geographic science and geospatial analytics—what Esri calls The Science of Where. Esri takes a geographic approach to problem-solving, brought to life by modern GIS technology. The company is committed to using science and technology to build a sustainable world.

Esri mapping and analytics software inspires positive change across industries such as [National Mapping](#). These organizations maintain information using GIS technology to effectively collect, manage, produce, and share base data for their nations.

Esri Map Galleries

[Esri's expansive collection](#) of beautiful, innovative maps contains works created by its global user community. These works showcase the powerful capabilities of GIS technology and tell unique and informative stories.



2022 Esri UC: Climate of the Salish Sea Bioregion by Aquila Flower



A Note from the Editor

Cartography can be looked at from many angles. The ICA defines cartography as the discipline dealing with the art, science and technology of [making and using maps](#), but I feel that cartography encompasses more than that. It involves any activity in which the map is the central intellectual unit. It includes the business of maps—production, printing, selling, and distribution. It involves research and teaching about maps. It also encompasses collecting, protecting, and archiving maps.

In this report, our goal was to cover this entire scope. Our contributors are certainly not the only ones involved, but they are representative of the many individuals, organizations, agencies, companies, programs, departments, and labs that contribute to our nation's cartographic and GIS advancements and achievements every day.

Please send comments / questions to abuckley@esri.com.

Contributor Profiles

The profiles on the following pages provide additional information about the contributors to this report.

Non-profit Organizations

AAG-CSG
CaGIS
IMIA
NACIS
UCGIS

Map Librarians

Esri Library
WAML

Academic Programs

Penn State Geography
Smithsonian Institution
Texas A&M
University of Oregon

University Labs

GAMLab – University of Colorado, Denver
GeoGraphics Lab – Penn State University
Infographics Lab – University of Oregon
Western Illinois University GIS Center
University of Wisconsin Cartography Lab

Government Agencies

Census Bureau
NOAA Office of Coast Survey
USGS CEGIS

Commercial Cartography

Darren Sears
Esri
National Geographic Society
Treeline Terrains



Compiled by the U.S. National Committee for the ICA, a standing committee of the Cartography and Geographic Information Society.

Spotlight:

National Geographic Society

The 1:1M map of Ukraine (shown below), included in the June 2023 issue of *National Geographic* magazine, continues the National Geographic Society's tradition of depicting conflict in Europe. It introduces a new map policy note for Southeastern Ukraine and illustrates National Geographic's *de facto* approach to cartographic depictions of territorial control. Delineations mark the estimated maximum extent of Russian advances, territorial claims, and the approximate frontline a calendar year after the full-scale invasion.





Peace World by Addison Chrzanowski, Age 8, 2023

Spotlight:

Children's Map Competitions

The annual [Children's Map Competition](#) is a map competition for all children ages 15 years or younger. The goal of the contest is to promote the creative representation of the world in graphic form by children. It is offered annually to celebrate the creativity, imagination, artistry, and wisdom of child mapmakers.



New and Improved by Crosby Price & Isabella Wilfling, Age 14, 2023

Six entries from the U.S. national competition are chosen to represent the United States in the international [Petchenik Children's World Map Drawing Competition](#). This competition, now in its 28th year, was created by the ICA to honor Dr. Barbara Bartz Petchenik.

Honors and Awards

Many U.S. organizations offer awards and honors to both students and professionals in cartography and GIS to support and recognize their work.

CaGIS

The Cartography and Geographic Information Society provided a number of awards in 2023, including [Map Design Competition Awards](#); [Children's Map Competition Awards](#); [Student Scholarships](#); and Student Assistant Scholarships to attend AutoCarto 2022. CaGIS also presented two [Distinguished Career Awards](#).

- **CaGIS Rising Grants**

In 2021, CaGIS initiated a new grant program, [CaGIS Rising](#), to provide funding to research or outreach projects that have the potential to transform global challenges into new opportunities that advance and promote Cartography and GIScience. Creativity, novelty, and the potential for broader impacts to society constituted key criteria for evaluating these proposals. These grants at approximately \$10,000 each.

- **UCGIS**

The University Consortium for Geographic Information Science [Awards Program](#) identifies and honors members of the geospatial community who have extraordinary records of accomplishments, including service to the mission of UCGIS. UCGIS offers two research awards: the [Research Award](#) and the [Early/Mid-Career Research Award](#). UCGIS offers two education awards, for [Lifetime Achievement](#) and for [Innovation](#), which alternate biennially. The society also offers the [Carolyn Merry Mentoring Award](#) and the [UCGIS Service Award](#).

- **NACIS**

The North American Cartography and Geographic Information Society [Undergraduate Student Scholarship](#) is awarded annually to an accomplished undergraduate student who is majoring in geography or a closely related field while concentrating their course work in cartographic or visualization design or research. This award recognizes that, through the student's coursework, they will have demonstrated excellence in print or digital cartography, involvement in cartographic research, or activity in cartographic outreach. The NACIS [Student Map and Poster Competition](#) has two competition categories: cartographic design quality and cartographic research quality.

- **AAG CSG**

One of the primary missions of the American Association of Geographers [Cartography Specialty Group](#) is to support student scholarship in cartography. The CSG sponsors and co-sponsors student awards and competitions to promote excellence in both cartographic research and excellence in map production. Its awards include the [Master's Thesis Research Grant](#), [Cartographies of Change Paper Competition](#), [Student Guided Poster Competition](#), [Avenza Competition for Cartographic Design](#), and [Travel Grants for Underrepresented Groups](#).

- **WAML**

The goal of the [WAML Scholarship program](#) is to advance WAML's efforts toward being a more inclusive organization and to support the professional development of library-workers from diverse backgrounds. The WAML Distinguished Service Award is offered in recognition of exemplary efforts toward the betterment of the Association.