FOR APPROVAL **PUBLIC** **OPEN SESSION**

TO:	Committee on Academic Policy and Programs
SPONSOR:	Nicholas Rule, Vice-Provost, Academic Programs
CONTACT INFO:	(416) 978-0490, vp.academicprograms@utoronto.ca
PRESENTER:	Same as above
CONTACT INFO:	
DATE:	February 2, 2026 for February 10, 2026
AGENDA ITEM:	4 (b)

ITEM IDENTIFICATION:

New Undergraduate Program Proposal: Major in Geographic Data Science in an existing undergraduate degree (HBSc), Faculty of Arts and Science (FAS)

JURISDICTIONAL INFORMATION:

The Committee on Academic Policy and Programs approves new undergraduate programs within an existing degree, as defined by the University of Toronto Quality Assurance Process *(AP&P Terms of Reference, Section 4.4.b.i.)*.

GOVERNANCE PATH:

1. **Committee on Academic Policy and Programs [For Approval] (February 10, 2026)**

PREVIOUS ACTION TAKEN:

The proposal for the Major in Geographic Data Science received approval from the Faculty of Arts and Science Faculty Council on December 10, 2025.

HIGHLIGHTS:

This is a proposal for a new Major in Geographic Data Science that will lead to an Honours Bachelor of Science (HBSc) degree. It will be offered by the Department of Geography and Planning at the Faculty of Arts and Science.

The proposed Major is designed to equip students with the skills and knowledge needed to analyze and interpret complex geographic and spatial data. A central objective of the

program is to integrate technical training with substantive geographic knowledge. It emphasizes the science of geographic data, including how spatial data are captured, organized, analyzed, visualized, and critically evaluated. Through this focus, the program seeks to develop students into critical thinkers who can use advanced analytical tools to address pressing geographic questions impacting socioeconomic, urban, and environmental systems across spatial scales.

The Major is limited enrolment. Students apply after the completion of their first 4.0 credits, and admission is based on grades achieved in selected courses. Students complete a total of 7.5 credits, including core courses in geography, methods, and geographic data science. The curriculum is complemented by three streams: Human Systems, Urban Systems, and Physical and Environmental Systems. Each stream requires students to complete non-technical coursework that provides theoretical depth and disciplinary context. This design ensures that students gain a well-rounded understanding of geography while developing the ability to apply data science methods within specific applied domains. The pedagogical rationale is to graduate students who can develop, ask, and answer important questions relevant to their chosen stream. The program also aims to provide opportunities for students to apply geographic data science methods to real-world cases through upper-level electives, research courses, and optional experiential learning opportunities.

Initial enrolment in the Major will be 30 students in the first year, with an increase of 10-15 students each year, achieving a total enrolment, across all years, of 190 students in steady state by 2031-32.

The Major responds to the growing importance of spatial data and geospatial technologies across social, urban, and environmental systems, as well as increasing student demand for training in geographic data science. The program reflects recent growth in faculty expertise and developments in geographic data science as an established subfield rooted in the discipline of geography. Geographic data science is a growing field across North America and globally. There is an increasing use of geospatial analytics across many industries. Many sectors in Canada, including finance, urban development, and natural resources, rely on geospatial analytics. In addition, enrolments in the existing Geographic Information Systems Minor have grown by ~37% from November 2018 to November 2024, demonstrating sustained student interest in this area. Comparator programs across Ontario, Canada, and internationally further illustrate strong demand for undergraduate programming in this field, while the

proposed Major is distinguished by its required streams that provide domain-specific expertise alongside technical skills.

Consultation outside the Faculty of Arts and Science occurred with Woodworth College, University of Toronto Scarborough, University of Toronto Mississauga, Faculty of Information, Temerty Faculty of Medicine, Faculty of Applied Science & Engineering, John H. Daniels Faculty of Architecture, Landscape & Design, Joseph L. Rotman School of Management, Dalla Lana School of Public Health, Ontario Institute for Studies in Education, the Tri-Campus Deans group, and the Provost's Advisory Group. All were supportive and any feedback was incorporated into the proposal.

The proposal was subject to external review on September 22, 2025, by: Professor Trisalyn Nelson, Jack and Laura Dangermond Chair of Geography and Director, Center for Spatial Studies and Data Science, University of California, Santa Barbara; and Professor Shaowen Wang, Associate Dean for Natural and Mathematical Science, College of Liberal Arts and Sciences, University of Illinois, Urbana-Champaign,. The external reviewers expressed support for the program; they also made several recommendations that resulted in very minor changes to the proposal, as reflected in the Dean's response to the review report.

FINANCIAL IMPLICATIONS:

The financial obligations resulting from this program will be met at the divisional level.

RECOMMENDATION:

Be It Resolved:

THAT the proposed Major in Geographic Data Science, which will confer the existing HBSc degree, as described in the proposal from the Faculty of Arts and Science dated November 25, 2025, be approved effective September 1, 2026.

DOCUMENTATION PROVIDED:

- New Program Proposal Package: Major in Geographic Data Science, Faculty of Arts and Science (External Review Report Plus Site Visit Schedule, Unit's Administrative Response, Dean's Administrative Response, VPAP Administrative Response, New Program Proposal)

External Reviewers' Report (October 14, 2025)

UTQAP
New Program Review Report

Framework for UTQAP Reviews

University of Toronto Quality Assurance (UTQAP) processes support a structured approach for creating, reflecting on, assessing and developing plans to change and improve academic programs and units in the context of institutional and divisional commitments and priorities.

The University of Toronto (U of T), in its Statement of Institutional Purpose (1992), articulates its mission as a commitment "to being an internationally significant research university, with undergraduate, graduate, and professional programs of excellent quality." Thus “quality assurance through assessment of new program proposals and review of academic programs and units in which they reside is a priority for the University…:

> The quality of the scholarship of the faculty, and the degree to which that scholarship is brought to bear in teaching are the foundations of academic excellence. More generally, all of the factors that contribute to collegial and scholarly life —academic and administrative complement, research and scholarly activity, infrastructure, governance, etc.—bear on the quality of academic programs and the broad educational experience of students. (*Policy for Approval and Review of Academic Programs and Units* (2010))

The University’s approach to quality assurance is built on two primary indicators of academic excellence: the quality of the scholarship and research of faculty; and the success with which that scholarship and research is brought to bear on the achievement of Degree Level Expectations.

These indicators are assessed by determining how our scholarship, research and programs compare to those of our international peer institutions and how well our programs meet their Degree Level Expectations.

Program(s) under review:	Major in Geographic Data Science
Commissioning officer:	Professor Stephen Wright, Interim Dean, Faculty of Arts & Science
Date of scheduled review:	Monday September 22, 2025 [virtual site visit]
Reviewers' names and affiliations:	Professor Trisalyn Nelson, Jack and Laura Dangermond Chair of Geography Director, Center for Spatial Studies and Data Science University of California Santa Barbara Professor Shaowen Wang Professor and Associate Dean for Natural and Mathematical Sciences, College of Liberal Arts and Sciences University of Illinois- Urbana Champaign

New Program Review Report

Please provide a joint Report evaluating the standards and quality of the proposed program.

- Respect the confidentiality required for all aspects of the review process.
- Append the site visit schedule to the report.

Note: Issues that are addressed through existing, specific University procedures are considered **out of scope** for UTQAP reviews (e.g., individual Human Resources issues, specific health and safety concerns). **Any such issues raised at any point during a review process** (site visit, review report) **must immediately be brought to the attention of the commissioning officer and routed through appropriate University channels for resolution**.

A. Summary

Reviewers are asked to:

- Address the substance of the New Program Proposal.
- Comment on the adequacy of existing physical, human and financial resources, based in part on the external reviewers' assessment of the faculty members' education, background, competence and expertise as evidenced in their CVs.
- Acknowledge any clearly innovative aspects of the proposed program together with recommendations on any essential or otherwise desirable modifications to it.

The proposed Major in Geographic Data Science is an integration of GIS, data science, and thematic streams (urban systems, social systems, environmental/physical systems). The

program is well articulated and clear. Discussions with students, faculty, and staff all indicate enthusiasm for this program and indicate that there is latent demand for this content. It fits well within the disciplinary trends and needs, as it integrates data science skills, geography, and related domain knowledge to train students to be capable of asking and answering questions of relevance to society. A strength of the proposal for the Major in Geographic Data Science is that it primarily leverages capacity, curriculum, space, and advising resources that already exist. Cognate units and programs were consulted and are supportive of this program.

This major is timely. Geographic Data Science is a rapidly growing field at the intersection of geography, computer science, statistics, and data analytics. Advances in spatial data and AI are opening new possibilities for understanding complex social, environmental, and urban systems at unprecedented scales. The increasing demand for spatial data expertise in industry, government, and research makes this a dynamic and high-impact area, offering students unique opportunities to engage with cutting-edge technologies for addressing real-world challenges.

B. Recommendations

Please endeavour to distinguish between observations or suggestions (which can be included in "Findings") and formal recommendations (which should be included here). **The Dean and unit/program will be required to provide a public response to every recommendation listed in this section.**

Advising and Program Structure

There are several opportunities to help the major succeed that will benefit from communication and coordination among advising staff across campus.

- Geography programs all tend to be found majors, with students discovering them after they have arrived on campus, so developing mechanisms to link students to the program through advising support across the colleges and campus will be important.
- It could be helpful to make sure there are onramps for students to find the program at different stages.
- Consider also if additional streams with other departments could increase the potential for new enrollments. It could be possible to have a fourth stream that enables students to combine with a variety of majors.
- Consider messaging about what is distinctive about this program so that it can be branded within an increasingly crowded landscape provincially.

Resourcing and Faculty

While most of the faculty needed for this major are in place there are potential gaps.

- Recent retirements in remote sensing have left curricular gaps that will need to be filled in order to facilitate the programs as presented. A Geographic Data Science major needs remote sensing because it provides critical tools for capturing large-scale, up-to-date information about the Earth's surface and atmosphere. Remote sensing enables the extraction of features, detection of change, and monitoring of environmental and social phenomena that are not easily measured on the ground. Integrating these skills equips students to work with diverse data sources and apply advanced analytics to pressing global challenges.
- The program will need a leadership team, ideally multiple faculty champions to provide consistency through time. A board of advisors may be an effective approach in the first few years of the program, building a team of people to provide intellectual growth as the program builds and the field continues to advance rapidly.
- As well, the university needs to be prepared to support faculty recruitment in AI and geospatial AI (GeoAI) are areas where emerging expertise will be needed.

Integration of AI

AI and GeoAI are integrating spatial data and rapidly creating new areas of research and teaching. For example, GeoAI will lead to more accurate predictions, automated feature extraction, and innovative applications in fields such as urban planning, environmental monitoring, and disaster response, and the major will require faculty to address this emergent area.

- More consideration is needed on how AI will be integrated into the curriculum and how it will evolve in the field of Geographic Data Science.
- Given the rapid evolution of the field, consider how to keep a refreshed curriculum in geographic data science. Support could be provided through engagement with other professionals via workshops, panel discussions, and retreats.

Experiential Learning and External Relations

More could be done with this major to advance experiential learning opportunities such as internships, fieldwork, and community-based projects. These experiences could also be a great way to grow industry and community partnerships. Collaborating with industry, government, or nonprofit partners also helps students understand professional workflows and build career networks.

- **Build staffing capacity to support student success**
  Establish dedicated roles or expand existing staff to focus on career development, internship coordination, and cultivating external partnerships that enhance student opportunities.
- **Collaborate with cooperative education programs**
  As the program grows, partnering with co-op education initiatives can provide valuable hands-on learning experiences and strengthen ties with industry and community partners.
- **Consider integrating required experiential components**
  Introducing mandatory internships or capstone projects could enrich the curriculum and ensure students gain practical, real-world experience aligned with their academic goals.
- **Establish a New Experiential Learning Office**
  Strengthen connections with the new Arts & Science Experiential Learning Office to access resources, guidance, and institutional support for scaling experiential opportunities across the program.

C. Program Evaluation Criteria

Please provide commentary on the following evaluation criteria. In some cases, it may be preferable to address multiple criteria holistically. In such cases, please clarify which criteria are relevant to the comments.

1 Academic rationale and program objectives

a) Clarity of the program's objectives.
b) Appropriateness of degree or diploma nomenclature given the program's objectives.
c) Consistency of the program's objectives with the institution's mission and the University of Toronto's/the division's/unit's academic plans, priorities and commitments, including consistency with any implementation plans developed following a previous review.
d) Evidence that the following have been substantially considered in the development of the program and its associated resources:
    1. Universal design principles and/or the potential need to provide mental or physical disability-related accommodations, reflecting the University's Statement of Commitment Regarding Persons with Disabilities
    2. Support for student well-being and sense of community in the learning and teaching environment, reflecting the work of the Expert Panel on Undergraduate

Student Educational Experience and the commitment to establishing a Culture of Caring and Excellence as recommended by the Presidential and Provostial Task Force on Student Mental Health

3. Opportunities for removing barriers to access and increasing retention rates for Indigenous students; for integrating Indigenous content into the curriculum in consultation with Indigenous curriculum developers; and for addressing any discipline-specific calls to action, reflecting the commitments made in Answering the Call: Wecheehetowin: Final Report of the Steering Committee for the University of Toronto Response to the Truth and Reconciliation Commission of Canada (PDF)
4. Opportunities for removing barriers to access and increasing retention rates for Black students; for promoting intersectional Black flourishing, fostering inclusive excellence and enabling mutuality in teaching and learning, reflecting the commitments made in the Scarborough Charter and consistent with the recommendations of the Anti-Black Racism Task Force Final Report
5. Opportunities for fostering an equitable, diverse and inclusive teaching and learning environment, reflecting the values articulated in existing institutional documents such as the Statement on Equity, Diversity, and Excellence, the Antisemitism Working Group Final Report, the aforementioned reports, and future institutional reports related to equity, diversity and inclusion.

e) Unique curriculum or program innovations, creative components, significant high-impact practices, where appropriate.

The proposed Geographic Data Science program is well articulated and thoughtfully constructed, offering a strong and well-supported rationale for its relevance within the broader field and its alignment with the academic mission of the University of Toronto. The program's structure—including its learning objectives and course offerings—is logically organized and accessible, providing clarity for prospective students, faculty, and academic advisors.

Feedback from students, instructors, and advisors indicates strong interest in the program. It is positioned to significantly expand the undergraduate curriculum within the Department of Geography, addressing a recognized need and serving as a key driver for future enrollment growth.

2 Program Requirements

a) Appropriateness of the program's structure and the requirements to meet its objectives and program-level learning outcomes, including the structure and requirements of any identified streams (undergraduate), fields or concentrations (graduate).
b) Appropriateness of the program's structure, requirements and program-level learning outcomes in meeting the institution's applicable undergraduate or graduate Degree Level Expectations.
f) Appropriateness of the proposed mode(s) of delivery (i.e., means or medium used in delivering a program; e.g., lecture format, distance, online, synchronous/asynchronous, problem-based, compressed part-time, flexible-time, multi-campus, inter-institutional collaboration or other non-standard forms of delivery) to facilitate students' successful completion of the program-level learning outcomes.
g) Ways in which the curriculum addresses the current state of the discipline or area of study and is appropriate for the level of the program.

The program requirements are appropriate for the field of geographic data science. The proposed concentrations in urban systems, human systems, and physical and environmental systems are well supported within the University of Toronto's Department of Geography & Planning and build on areas of established strength. The learning objectives, requirements, and evaluations are aligned with both disciplinary standards and the academic culture of the University. The program structure has also been carefully designed to fit within the university's tradition of encouraging students to pursue multiple majors, minors, or specialty areas. Faculty and advising staff bring extensive experience supporting students with diverse needs, drawing on the foundation of the existing minor in this field.

Looking ahead, the addition of new courses focused on spatial AI would strengthen the program. Updating existing courses to integrate geospatial machine learning and related tools is also encouraged, with initiatives such as the LEAP program offering useful pathways for innovation and support. The program's strong focus on human geography can be leveraged to enhance flexibility and broaden its appeal to a wide range of students. Moreover, students with GIS skills already have access to summer employment opportunities, which can further enrich their learning experience.

Experiential learning remains a key area for growth in this proposed major. Given the increasing demand for geographic data science expertise in both industry and government, there is

considerable potential to expand partnerships that foster workforce development and research impact. Students are already engaging with generative AI, learning to coordinate team-based tasks, and seeking additional support for foundational skills. Standardizing learning objectives across the program could help address variability in skill development and strengthen preparation for upper-level courses.

In terms of pedagogy, students indicate that in-person group work has proven especially valuable for many students, and opportunities for collaborative learning are desirable. Longer labs and more intensive hands-on experiences could provide students with greater depth of technical expertise. Finally, students have expressed interest in expanded opportunities to engage with cartography, which would further complement their geographic data science training.

3 Program Requirements for Graduate Programs Only

a) Clear rationale for program length that ensures that students can complete the program-level learning outcomes and requirements within the proposed time.
b) Evidence that each graduate student in the program is required to take all of the course requirements from among graduate-level courses.
c) For research-focused graduate programs, clear indication of the nature and suitability of the major research requirements for degree completion.

N/A

4 Admission Requirements

a) Appropriateness of the program's admission requirements given the program's objectives and program-level learning outcomes.
h) Sufficient explanation of alternative requirements, if applicable, for admission into a graduate, second-entry or undergraduate program, e.g., minimum grade point average, additional languages or portfolios and how the program recognizes prior work or learning experience.

The proposed program requirements are well aligned with the field of geographic data science. The concentrations in urban systems, human systems, and physical and environmental systems

are supported by the Department of Geography & Planning and build on established strengths. Learning objectives, requirements, and evaluations are appropriate to the discipline and consistent with the University's academic culture. The program structure is thoughtfully designed to fit within the University's tradition of multiple majors, minors, and specialty areas, supported by experienced faculty and advisors with a strong record from the existing minor.

Curricular innovation offers opportunities for further growth. New courses in spatial AI and the integration of geospatial machine learning into existing courses are recommended, with initiatives such as the LEAP program providing a pathway for support. The program's grounding in human geography enhances its flexibility and broadens student appeal, while summer employment opportunities for GIS-trained students strengthen experiential learning.

5 Assessment of Teaching and Learning

a) Appropriateness of the methods for assessing student achievement of the program-level learning outcomes and degree level expectations.
b) Appropriateness of the plans to monitor and assess:
    1. The overall quality of the program
    2. Whether the program is achieving in practice its proposed objectives
    3. Whether its students are achieving the program-level learning outcomes
    4. How the resulting information will be documented and subsequently used to inform continuous program improvement.

The program employs a robust, evidence-based assessment strategy aligned with program-level learning outcomes and degree-level expectations. Direct measures include assignments, projects, and reviews evaluated with common rubrics, while indirect measures such as student surveys and alumni feedback provide complementary insights. A curriculum map ensures systematic coverage and data collection across the course sequence.

Program quality and achievement of objectives will be monitored through a regular assessment cycle that reviews student performance, retention, and post-graduation outcomes, supported by existing data resources. Each year, selected learning outcomes will undergo in-depth analysis, with results documented in annual reports. Findings will inform faculty discussions and guide curricular refinements, ensuring continuous improvement and alignment with disciplinary standards. This structured approach can support the program's commitment to maintaining high quality and fostering student success.

Curricular pilots in Computer Science are exploring the integration of AI into coding instruction. Building on these efforts, collaborative discussions with Statistics and Computer Science can help shape a roadmap for incorporating AI thoughtfully into the Geographic Data Science curriculum. In this context, AI is viewed as a learning assistant rather than a replacement for human judgment and critical thinking. The proposed major emphasizes the uniquely human skills—such as spatial reasoning, ethical decision-making, and domain expertise—that AI cannot replicate. Many students already use generative AI for coding; the challenge is to guide them in leveraging these tools to deepen understanding rather than bypass learning. Structured strategies, such as AI-assisted problem-solving exercises, reflective assignments, and assessments that emphasize conceptual mastery, will help students use AI responsibly and improve performance on evaluations.

6 Resources

Given the program's planned/anticipated class sizes and cohorts as well as its program-level learning outcomes:

a) Participation of a sufficient number and quality of core faculty who are competent to teach and/or supervise in and achieve the goals of the program and foster the appropriate academic environment.

i) If applicable, discussion/explanation of the role and approximate percentage of adjunct and sessional faculty/limited term appointments used in the delivery of the program and the associated plans to ensure the sustainability of the program and quality of the student experience (see QAF Guidance).

j) If required, provision of supervision of experiential learning opportunities

k) Adequacy of the administrative unit's planned utilization of existing human, physical and financial resources, including implications for the impact on other existing programs at the University.

l) Evidence that there are adequate resources to sustain the quality of scholarship and research activities produced by students, including library support, information technology support and laboratory access.

m) If necessary, additional institutional or divisional resource commitments to support the program in step with its ongoing implementation.

The proposed major in Geographic Data Science is expected to increase student enrollment in geography & planning with relatively few additional resources required. Overall, in terms of administration, space, and most faculty teaching loads, the Department has sufficient capacity

to accommodate growth. The Department should be commended for the careful planning undertaken to prepare for this proposal and for designing a program that leverages existing strengths and resources.

Faculty resources will be central to the program's long-term success. While current faculty expertise is strong— though contributions from Michael Weidner and Don Boyes are focused on administration—the upcoming retirement of remote sensing faculty creates an immediate need for replacement. There is also likely an emerging need to expand expertise in spatial AI to align with advances in the discipline.

Physical and administrative infrastructure to support the program is already developed. Computer labs have been established to meet student needs, and a full-time undergraduate assistant has been added to provide day-to-day program support. The Department has significant experience working with potential students through the existing GIS minor, and current advising practices include assistance with internship applications. Additional teaching assistant support may be required as internship opportunities expand.

Student-facing resources also appear largely in place. While the Department does not have dedicated space for student interaction, the University, Faculty of Arts & Science, and Colleges provide programs and activities to support student engagement. One of the strengths of the proposal is that procedures, space, and staffing have been carefully considered, creating a solid foundation for growth. At the same time, leadership will be essential to guide the program through implementation and ensure it remains well integrated into the broader institutional and disciplinary landscape. With two senior faculty currently serving in the Dean's office, the identification of faculty who will step into program leadership roles remains a priority.

7 Resources for Graduate Programs Only

Given the program's planned/anticipated class sizes and cohorts as well as its program-level learning outcomes:

a) Evidence that faculty have the recent research or professional/clinical expertise needed to sustain the program, promote innovation and foster an appropriate intellectual climate.
b) Where appropriate to the program, evidence that financial assistance for students will be sufficient to ensure adequate quality and numbers of students.
c) Evidence of how supervisory loads will be distributed, in light of qualifications and appointment status of the faculty.

N/A

8 Quality and Other Indicators

a) Evidence of the quality of the faculty (e.g., qualifications, funding, honours, awards, research, innovation and scholarly record; appropriateness of collective faculty expertise to contribute substantively to the program and commitment to student mentoring)
    1. The quality of the scholarship of the faculty, and the degree to which that scholarship is brought to bear in teaching.

n) Any other evidence that the program and faculty will ensure the intellectual quality of the student experience.

o) Any additional indicators of quality identified by the division or academic unit.

p) How the proposed program compares to the best in its field among international peer institutions.

It could be important for the Department to clearly articulate the unique strengths and focus of this Geographic Data Science program relative to other geospatial data science programs in Canada and Ontario. Defining and communicating the program's distinctive brand will help prospective students understand how it differs from other offerings and why it represents a particularly strong fit for their academic and career goals. Emphasizing the integration of spatial data science, human geography, and emerging areas such as spatial AI can help highlight the program's unique position within the broader landscape of GIScience education.

The faculty associated with this program are of very high quality and provide comprehensive coverage across the key thematic streams identified in the proposal. The existing faculty expertise supports the program's concentrations in urban systems, social systems, and environmental/physical systems. The immediate area requiring attention is remote sensing, where an expected retirement will create a gap that will need to be addressed to maintain program strength and ensure continuity in core methodological instruction. Addressing pending gaps in remote sensing will be critical for sustaining the program's academic excellence and for supporting its long-term reputation and future growth.

9 Commissioning Officer Acceptance

After receiving the report from the reviewers, the commissioning officer formally accepts the final report and fills in the table below.

<table>
<tr><td colspan="2">As Commissioning Officer, I confirm that:
✓ The New Program Proposal and all relevant faculty CVs were provided to the reviewers to support their assessment of the new program.
✓ The Report addresses the program evaluation criteria, as required by the UTQAP.
✓ I have brought to the attention of the reviewers any clear factual errors in the report and the reviewers have corrected these.
✓ I have brought to the attention of the reviewers any omitted UTQAP requirements.
✓ I have attached the site visit schedule to the report.</td></tr>
<tr><td>Commissioning Officer*: Professor Stephen Wright, Interim Dean, Faculty of Arts & Science</td><td>Report Accepted as Final on October 14, 2025 by Gillian Hamilton, Vice-Dean, Academic Planning, on behalf of Dean Wright</td></tr>
</table>

UNIVERSITY OF TORONTO
FACULTY OF ARTS & SCIENCE

New Program Review Itinerary

Proposed Major in Geographic Data Science (GDS)
within the Department of Geography & Planning
Faculty of Arts & Science, University of Toronto

Monday, September 22, 2025

11:00 am-7:00 pm EDT/10:00 am-6:00 pm CDT/8:00 am-4:00 pm PDT

Location: Held online on Zoom

Reviewers
Professor Trisalyn Nelson Professor Jack and Laura Dangermond Chair of Geography Director, Center for Spatial Studies and Data Science University of California Santa Barbara
Professor Shaowen Wang Professor and Associate Dean for Life and Physical Sciences, College of Liberal Arts and Sciences University of Illinois- Urbana Champaign

Contacts:

- Department of Geography & Planning Host:
  - **D. Charles Taylor, Assistant to the Chair, Department of Geography & Planning**
- Dean's Office Host:
  - **Natasha Kolos, Executive Assistant to the Vice-Deans, Dean's Office**

Participant Notes:
 The host will enter the meeting at the beginning to ensure all participants have arrived, and enter again 5 minutes before the conclusion of the meeting to stay on schedule
 These meetings will not be recorded
 Please remember to mute yourself on the call when not speaking
 Please turn your camera on at the start of the meeting to introduce yourself to the external reviewers
 Please use virtual hand raising or chat to indicate if you have a question or comment
 If you experience any technical difficulties, please contact the relevant meeting host by phone, who will then contact IIT

Monday, September 22, 2025			
11:00 am-11:45 am EDT **10:00 am-10:45 am CDT** **8:00 am-8:45 am PDT**	Welcome to the Faculty of Arts & Science, University of Toronto Briefing with Office of the Dean **45 minutes**	▪ Professor Stephen Wright, Interim Dean, Faculty of Arts & Science ▪ Professor Gillian Hamilton, Vice-Dean, Academic Planning ▪ Professor Randy Boyagoda, Vice-Dean, Undergraduate	Dean's Office Host: **Natasha Kolos**
11:45 am-12:30pm EDT **10:45 am-11:30 am CDT** **8:45 am-9:30 am PDT**	Department of Geography & Planning Leadership **45 minutes**	▪ Professor Matthew Farish, Interim Chair, Geography & Planning ▪ Professor Paul Hess, Associate Chair, Undergraduate	Unit Host: **D. Charles Taylor**
12:30 pm-1:00 pm EDT **11:30 am-12:00 pm CDT** **9:30 am- 10:00 am PDT**	*Break* **30 minutes**		
1:00 pm-2:00 pm EDT **12:00 pm- 1:00 pm CDT** **10:00 am-11:00 am PDT**	GGR Faculty (GIS and Remote Sensing) **1 hour**	▪ Dr. Ignacio Tiznado Aitken, Contractually Limited Term Appointment (CLTA), Geography & Planning ▪ Dr. Karen Chapple (tentative), Professor and Director, School of Cities ▪ Dr. Kristian Larsen, Sessional Lecturer III, Geography & Planning ▪ Dr. Jane Liu, Professor, Geography & Planning ▪ Dr. Lindsey Smith, Assistant Professor, Tenure Stream, Geography and Planning ▪ Dr. Michael Widener, Professor, Geography & Planning	Unit Host: **D. Charles Taylor**
2:00 pm-2:30 pm EDT **1:00 pm-1:30 pm CDT** **11:00-11:30 am PDT**	Admin Staff **30 minutes**	▪ Kathy Giesbrecht, Undergraduate Advisor, Geography & Planning ▪ Stacy Ann Palmer, Business Officer, Geography & Planning	Unit Host: **D. Charles Taylor**
2:30 pm-3:00 pm EDT **1:30-2:00 pm CDT** **11:30 am-12:00 pm PDT**	*Break* **30 minutes**		

3:00 pm-3:30 pm EDT **2:00 pm-2:30 pm CDT** **12:00 pm-12:30 pm PDT**	Cognate Associate Chairs **30 minutes**	▪ Professor David Liu, Associate Chair, Undergraduate, Department of Computer Science ▪ Professor Nathan Taback, Associate Chair, Undergraduate, Department of Statistical Sciences	Unit Host: **D. Charles Taylor**
3:30 pm-4:00 pm EDT **2:30 pm-3:00 pm CDT** **12:30 pm-1:00 pm PDT**	Undergraduate Students **30 minutes**	▪ Kate B. (Year 3) ▪ Kaylee H. (Year 4) ▪ Shawn K. (Year 3) ▪ Kelly T. (Year 4)	Unit Host: **D. Charles Taylor**
4:00 pm-4:30 pm EDT **3:00 pm-3:30 pm CDT** **1:00 pm -1:30 pm PDT**	Graduate students and TAs **30 minutes**	▪ Ibrahim G. ▪ Eryn M. ▪ Paromita N. ▪ Amanda N. ▪ Joao P. ▪ Kevin R.	Unit Host: **D. Charles Taylor**
4:30 pm-5:00 pm EDT **3:30 pm-4:00 pm CDT** **1:30 pm-2:00 pm PDT**	**GDS Faculty** **30 minutes**	• Michael Widener, Professor, Geography & Planning and A&S Vice-Dean, Academic Operations • Don Boyes, Professor, Teaching Stream, Geography & Planning and A&S Associate Dean, Teaching & Learning	Unit Host: **D. Charles Taylor**
5:00-5:15pm EDT **4:00-4:15pm CDT** **2:00-2:15pm PDT**	*Break* **15 minutes**		
5:15 pm-5:45 pm EDT **4:15 pm-4:45 pm CDT** **2:15 pm-2:45 pm PDT**	Reviewers debrief amongst themselves **30 minutes**	Reviewers only – Professors Nelson and Wang	
5:45 pm-6:15 pm EDT **4:45 pm-5:15 pm CDT** **2:45 pm-3:15 pm PDT**	Debrief with Chair, Geography & Planning **30 minutes**	▪ Professor Matthew Farish, Interim Chair, Geography & Planning	Unit Host: **D. Charles Taylor**

6:15 pm-7:00 pm EDT **5:15 pm-6:00 pm CDT** **3:15 pm-4:00 pm PDT**	Debrief with Office of the Dean, Faculty of Arts & Science **45 minutes**	▪ Professor Randy Boyagoda, Vice-Dean Undergraduate ▪ Professor Gillian Hamilton, Vice-Dean, Academic Planning	Dean's Office Host: **Natasha Kolos**

Note: A short video showing computer lab spaces to be used in the GDS program has been provided to reviewers under separate cover.

Chair's Administrative Response (November 4, 2025)

Geography & Planning
UNIVERSITY OF TORONTO

November 4, 2025

Professor Stephen Wright
Interim Dean, Faculty of Arts & Science
University of Toronto

Re: New Program Review for the Proposed Major in Geographic Data Science (GDS)

Dear Dean Wright,

We are writing to respond to the review report prepared by Professors Trisalyn Nelson, Jack and Laura Dangermond Chair of Geography and Director, Center for Spatial Studies and Data Science, University of California, Santa Barbara, and Shaowen Wang, Associate Dean for Natural and Mathematical Science, College of Liberal Arts and Sciences, University of Illinois, Urbana Champaign, regarding our proposed Geographic Data Science (GDS) Major, following their virtual site visit on September 22, 2025. Their report was informed by the program proposal and accompanying meetings held during the virtual visit, including meetings with: myself, as departmental Interim Chair and the Associate Chair, Undergraduate; teaching faculty in the 'GDS space', graduate and undergraduate students, and departmental staff in the Department of Geography and Planning; the Associate Chairs, Undergraduate from the Departments of Computer Science and Statistical Sciences; and with leadership in the Dean's Office of the Faculty of Arts and Science (FAS).

We thank the reviewers for their thoughtful and generous engagement with our proposal. We are glad to learn that they saw the proposed Major as "well articulated and clear," backed by faculty, student, and staff "enthusiasm" and "demand." We also note that reviewers see this proposed Program of Study as intellectually and professionally "timely," fitting "well within disciplinary trends and needs," and that it "primarily leverages capacity, curriculum, space and advising resources that already exist" in the Department of Geography and Planning.

In our response below, we directly address the reviewers' suggestions and concerns.

The reviewers suggest that we deepen and formalize communication and coordination among advising staff across campus to support student wayfinding and recruitment.

Importantly, the reviewers note that Geography Programs of Study are often "found," meaning that many students come to them or discover them after they arrive at the University of Toronto. In the months ahead, as Chair and Associate Chair, and with the contributions of teaching faculty, cognate Chairs and Associate Chairs (who collectively could be the members of an Advisory Committee, discussed below), we will craft a strategy for program advertising and advising. We see that strategy as containing at least three key components:

1. Full use of existing student supports (College advising, FAS communications, the FAS Office of the Faculty Registrar, along with advising and support within the Department of Geography and Planning), specifically to advertise the new program at Colleges and in other spaces.
2. Connections with the developing landscape of Data Science across FAS, including the recently added Applied Data Science Minor, in the FAS Calendar, Data Science-related web content, and other recruitment material.
3. Developing our own messaging (website-based video, social media content, etc.) that will 'brand' the new Major as both visible and distinctive. This matters within the University but also, as the reviewers note, within an increasingly crowded provincial field of equivalent programs.

The reviewers' suggestion regarding "onramps…at different stages" is a particularly valuable one. This points to the importance of **GGR172H1**, Digital Earth, a relatively new course that will serve as the central gateway to the Major. As part of our strategy for promoting the new Major we will place specific emphasis on this course – for example, highlighting exciting assignments and specific instructional components on our website.

The reviewers emphasized the need for a consistent faculty cohort to support the Major.

The reviewers note that most of the faculty resources are in place but observe that a potential gap exists in the area of remote sensing due to retirements (our colleague Professor. Jing Chen is in the final year of his three-year phased retirement). It is important to stress that we will continue to offer our existing remote sensing courses (specifically, **GGR315H1**, Environmental Remote Sensing and **GGR415H1**, Advanced Remote Sensing), for the foreseeable future under the leadership of our colleague Professor Jane Liu. We also have strong connections to the Department of Earth Sciences, where we share several joint Geography-Earth Sciences courses, and where we can leverage additional expertise and teaching resources around remote sensing.

However, it is our strong desire to gain approval for a faculty position with a focus in remote sensing that will also more directly contribute to one of the three streams proposed for the program. An example would be a position that focuses on the use of remote sensing in the analysis of urban systems. Thus, with the retirement of Professor Chen, we are preparing to submit such a proposal to the Faculty Appointments Committee in November 2025.

The reviewers also suggest that we consider building additional faculty capacity in geospatial AI. We agree. We will add this as a desired skill set to our faculty request of a remote sensing position and in the medium term we will pursue additional expertise in geospatial AI as the Major evolves. This could certainly be an additional hiring priority as opportunities arise. We will also seek to leverage expertise in cognate units.

The reviewers make a recommendation for supporting program leadership.

One of the key recommendations of the reviewers is to establish a formal leadership team – an Advisory Committee – to monitor the Major as it consolidates in its early years. We strongly welcome this recommendation and will move to do this in the next six months: alongside senior Geography faculty, we will reach out to cognate Chairs and Associate Chairs (in Earth Sciences, as well as the Departments of Statistical Sciences, and Computer Science), with whom we have developed good relationships, to join this Advisory Committee. Establishing this committee will also

allow us to maintain strong connections with other units amid the larger landscape of Data Science in FAS and student interest in Data Science and Geographic Data Science across the Faculty of Arts & Science.

The reviewers stress the importance of integrating Artificial Intelligence (AI) into the new Major.

The program is designed, first and foremost, to leverage existing departmental teaching resources, where we are already engaged with how to integrate the potential and challenges of AI into our curriculum and pedagogical practices. Our existing faculty are highly aware that geospatial AI is a quickly evolving area and they are already addressing the use of geospatial AI in courses such as **GGR274H1**, Introductory Computation and Data Science for the Social Sciences. As the reviewers suggest, we will engage with other professionals in the area of GDS and geospatial AI through events such as panel discussions and retreats. Indeed, we are planning a collaborative speaker and panel series on the topic of quantitative AI and ongoing research cluster discussions on the topic.

Additionally, the department is working broadly to help faculty to develop improved teaching practices around AI, including an initiative led by Prof. Alana Boland to work with faculty on AI related to the Geography and Planning curriculum. Of course, these efforts sit alongside substantial discussions across the University, from the recent release of the AI Task Force Report to the many practical workshops offered through the Centre for Teaching Support and Innovation. We agree with the reviewers that this is an important issue and one with clear links to the analysis of geospatial data.

The Department plans to invite Chairs and Associate Chairs from the Departments of Earth Sciences, Statistical Sciences, and Computer Science to join the Advisory Committee to better collaborate on ways of integrating AI into the new program's curriculum. Integrating AI will also be considered at the Department's regular curriculum meetings, that are part of the Department's ongoing curricular review and renewal. This is when learning outcomes will be reviewed, within the context of our goal of continuous curricular improvement, as a way of keeping the new program aligned with developments in the growing field of AI.

The reviewers recommended several possible future directions for the Major, including: adding a fourth stream, and expanding opportunities to develop technical skills through engagement with spatial AI, geospatial machine learning, cartography, collaborative learning, and longer labs.

The reviewers' suggestion of adding a fourth stream to the program is an intriguing option, and one that could be implemented, in the future, as we watch the new Major develop. At present, the program's three streams are calibrated to align with our existing curriculum and teaching capacity. Core courses in the proposed Major build on an existing GIS Minor, and the three streams draw from courses in our strong existing undergraduate programs, particularly in Environmental Geography, Human Geography, and Urban Studies. Once the new Major is established, we will be able to forge additional connections with other departments and consider other streams. We intentionally designed the program from a crux of departmental strengths while remaining cognizant of wider changes and interest across FAS. The Department's faculty are aware of the importance of geospatial AI as a key direction in the field and are already

integrating geospatial AI into their courses. For example, **GGR274H1**, introduces students to geospatial AI.

As the Major consolidates, the Department and its Advisory Committee will consider how to integrate expertise in spatial AI and geospatial machine learning from cognate units to address this growing field. This consideration will include further curricular development of geospatial AI and machine learning. As noted above, we hope to develop further expertise in these areas as part of our faculty complement as well, which would support such an effort.

In terms of lab time, we understand that students, especially at the introductory level, require substantial hands-on instruction to succeed in some technical courses. We believe our introductory courses are currently well resourced. Except for some summer sessions and one fall section of **GGR272H1**, Geographic Information and Mapping I, additionally offered in-person in the winter, these classes are taught in-person and have significant support with Teaching Assistants. In speaking with instructors, we have found that students have sufficient opportunity for direct feedback as they are learning software and analytical techniques.

As a department and field with a long tradition in cartography, we appreciate the reviewers' comment on enhancing opportunities to learn cartographic skills. Indeed, in previous decades we operated a fully staffed Cartography Office. While this is no longer possible, we carry some of this tradition in courses that we currently offer such as **GGR172H1** Digital Earth and **GGR472H1**, Developing Web Maps, that continue to place emphasis on cartography and its importance for communicating complex relationships with maps. We will further explore how we can enhance cartographic training in other courses.

The reviewers advocate for more fulsome attention to experiential learning opportunities within the proposed Major.

We are actively assessing our programs and courses to enhance experiential learning opportunities. The reviewers may not have been aware of the role of the FAS Office of Experiential Learning and Outreach Support (ELOS) where most leadership and staffing in experiential learning occurs. There are further opportunities to establish strong connections between the Major, its courses, and ELOS. In one case, **GGR472H1**, the instructor, Dr. Lindsey Smith, has integrated the course with ELOS's Sandbox Initiative. ELOS's Sandbox is an experiential learning program where students are matched to real-world problems identified by industry professionals or external organizations, and Dr. Smith's students have worked collaboratively with the Toronto District School Board (TDSB) to develop a web map focused on promoting active school travel. We are interested in expanding these kinds of experiences for students. We are also working to build other existing student opportunities, including in **GGR493Y1**, Geography Professional Experience, which makes student placements in outside organizations and firms and is well suited to students who would major in GDS.

The Urban Studies program, which was moved to Geography and Planning from Innis College last year, also has a strong ethos of experiential learning. It makes student placements for many students in one of its required second year courses, **URB236H1**, A Multidisciplinary Introduction to Urban Studies II: Urban Challenges and Theoretical Application, along with a fourth-year course, **URB437Y1**, Urban Experiential Learning in Toronto and the GTA. As part of the program's integration into the department, we have funded a Collaboratory for Engaged Learning that will allow the co-directors, Profs. David Roberts and Aditi Mehta, to further develop

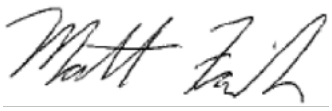
experiential learning opportunities. As we continue to integrate our Urban Studies curriculum into our wider offerings, we will pay particular attention to developing further experiential learning opportunities for GDS students.

The Faculty of Arts & Science established the A&S Internship Program (ASIP) 2021 (administered by ELOS). Departments partner with ASIP to create streams within their programs that involve a co-op element. The Department of Geography & Planning does not currently have any programs participating in ASIP, but the GDS program is an excellent candidate for incorporating a student co-op element. We will discuss the possibility of the GDS major participating in ASIP with the Dean's Office once the program is established, with the advice and consultation of the new program's Advisory Committee.

Finally, we know that industry needs around GDS are substantial. With the aid of the Advisory Committee, over the next 2-3 years we will determine how to build on our existing efforts to expand experiential learning opportunities in line with the reviewers' recommendation including consideration of adding required experiential learning elements to the program.

In closing, we would once again like to express our gratitude to the reviewers. We were delighted by their positive response and found their comments very helpful as we consider how to enhance the program.

Sincerely,



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Dean's Administrative Response (November 10, 2025)

UNIVERSITY OF TORONTO
FACULTY OF ARTS & SCIENCE

November 10, 2025

Professor Nicholas Rule
Vice-Provost, Academic Programs
Office of the Vice-President & Provost, University of Toronto

RE: Administrative Response to the New Program Review for the Proposed Major in Geographic Data Science (GDS)

Dear Professor Rule,

I am very pleased to respond to the new program review report from Professor Trisalyn Nelson, Jack and Laura Dangermond Chair of Geography and Director, Center for Spatial Studies and Data Science, University of California, Santa Barbara, and Professor Shaowen Wang, Associate Dean for Natural and Mathematical Science, College of Liberal Arts and Sciences, University of Illinois, Urbana-Champaign, regarding the Geographic Data Science (GDS) Major proposed by the Department of Geography & Planning in the Faculty of Arts & Science at the University of Toronto. Their report was informed by the program proposal and the accompanying volume of faculty CVs, and the series of meetings held during the virtual site visit on September 22, 2025. I met with the two reviewers along with the Vice-Dean, Academic Planning, and the Vice-Dean, Undergraduate. The reviewers also met with the Department's undergraduate and graduate students, faculty members, and leadership (Interim Chair of the Department and Associate Chair, Undergraduate), as well as Associate Chairs, Undergraduate, from two cognate units (Departments of Statistical Sciences and Computer Science).

We are very grateful to the reviewers for their thorough and constructive report, which states that "the proposed Geographic Data Science program is well articulated and thoughtfully constructed" with a "strong and well-supported rationale for its relevance within the broader field and its alignment with the academic mission of the University." The reviewers state two principal benefits of the proposed GDS Major for students: 1) It will "train students to be capable of asking and answering questions of relevance to society." 2) It will "[offer] students unique opportunities to engage with cutting-edge technologies for addressing real-world challenges."

The reviewers also emphasized the need and the demand for the program: "this major is timely" and "positioned to significantly expand the undergraduate curriculum within

the Department of Geography, addressing a recognized need and serving as a key driver for future enrollment growth." The reviewers also noted that "[f]eedback from students, instructors, and advisors indicate strong interest in the program."

I appreciate the deep engagement of the Interim Chair, and Associate Chair, Undergraduate, of the Department of Geography & Planning, who have prepared a thoughtful and thorough response to the reviewers' report, in consultation with my office. The Department submitted their response letter to me on November 4, 2025, and it has substantively informed my response below, in which I address the reviewers' principal feedback and suggestions for the GDS major.

Recommendations for Communication, Student Advising/Wayfinding, and Recruitment

The reviewers note that students typically discover Geography programs after arriving at the University and they make recommendations to support student wayfinding and recruitment, as follows:

- Develop mechanisms to link students to the program through advising support, and ensure there are onramps where students can access the program at different stages.
- Consider how to message the distinctiveness of the program to students, including through identifying its unique strengths and weaknesses relative to other geospatial data science programs, and articulating why the program represents a strong fit for students' academic and career goals.

The Faculty of Arts & Science (A&S) will leverage existing student advising services and communications from the Office of the Faculty Registrar to announce the program's creation across College and unit-level advising networks. The new program will be promoted within the context of information about other A&S programs and the data science landscape, which is particularly useful for students seeking multiple programs of study (such as two majors).

We also support the Department's plan to craft a strategy to refresh their messaging to brand the new Major as visible and distinctive to students at all levels as well as their plan to showcase the unique aspects of the principal 'onramp' course, GGR172H1, Digital Earth. The Department will enhance the new program's visibility through departmental website updates, newsletters, and social media content. They plan to work with cognate units to consider how to effectively advertise to prospective students in these units. Faculty in the Department will be encouraged to promote the program through their own communication outlets, i.e., in their courses, labs, and social media. The program proposal has been updated to outline this plan in Section 8, **Enrolment** (page 45).

Recommendations for faculty resources

The reviewers highlight that a strength of the proposed new major is that it "primarily

leverages capacity, curriculum, space and advising resources that already exist." They also make two recommendations:

- An expected faculty retirement in remote sensing will create a gap in an area that is critical to the program; this gap should be addressed to support the program as it is designed.
- AI and geospatial AI are emerging areas in the discipline; the University should support faculty recruitment in these areas.

The Department acknowledges the pending retirement in remote sensing, but they note that there is another faculty member who can teach in this area (e.g., in GGR315H1, Environmental Remote Sensing and GGR415H1, Advanced Remote Sensing), and they confirm they will be able to offer the remote sensing courses for the foreseeable future. In addition, they plan to leverage their strong connections with the Department of Earth Sciences and their joint Geography-Earth Sciences courses to provide offerings in remote sensing.

The unit will apply for a new line in the area of remote sensing, related to the upcoming retirement, through the Faculty Appointments Committee (FAC) in November 2025. All requests for new positions across the Faculty of Arts & Science are submitted to FAC, which includes representation across its sectors (Humanities, Social Sciences, and Sciences) and from the Colleges. FAC reviews all requests for new positions and recommends to the Dean which requests should be granted. The Dean's office recognizes the importance of a new faculty line to the future success of the new GDS major and is supportive of Geography and Planning's submission of a request for an appointment in line with this proposal, through the competitive FAC process.

In line with the reviewers' recommendation to consider "expanding expertise in spatial AI," the Department will include expertise in geospatial AI as a desired skill in their pending FAC request in the area of remote sensing. The Department suggests expertise in cognate units may also be drawn upon in this area. The new program proposal has been updated, in Section 10.1.1, All New Programs (page 60) to provide more detail on this planned request to FAC.

Recommendations for supporting program leadership

The reviewers highlight the importance of program leadership, noting it will be essential for guiding the program. They recommend establishing a leadership team consisting of multiple faculty champions and suggest that the identification of faculty who will step into leadership roles should be a priority for the department. They also suggest that establishing a "board of advisors" would be an effective approach at the start.

The Department strongly welcomes the reviewers' suggestion for a formal leadership team or advisory board (which will be referred to as an advisory committee), to monitor the Major as it consolidates in its early years. The Department plans to convene this group in the next six months and will reach out to cognate Chairs and Associate Chairs to join this committee.

The Dean's office supports the Department's plan to form a leadership team to monitor the health of the new program. As the Department notes, such an advisory committee will help foster collaboration with cognate units amid the larger landscape of Data Science in the Faculty. An advisory committee also has broader potential, such as providing holistic advice on curricular planning, enrolment challenges and opportunities, and the program's pedagogical success.

There are no changes to the proposal resulting from this recommendation.

Recommendations for integrating Artificial Intelligence (AI) into the Major program

The reviewers made a number of recommendations around integrating AI into the Major, as follows:

- Give more consideration to how AI will be integrated into the curriculum and how it will evolve in the field of geographic data science.
- Consider how to keep a refreshed curriculum in geographic data science; support could be provided through engagement with other professionals via workshops, panel discussions, and retreats.
- Students are already engaging with generative AI; consider standardizing learning objectives across the program to address variability in skill development and strengthen preparation for upper-level courses.
- Hold collaborative discussions with the Departments of Statistical Sciences and Computer Science to support thoughtful incorporation of AI into the program.

We commend the reviewers' timely and important recommendations. A&S is working in concert with, and taking direction from, the University's broad initiatives regarding AI in higher education. Just as the reviewers emphasize integration and deepening learning, the University's AI Task Force (launched in 2024) is focused on ways to leverage AI to enhance our research expertise, support student success and engagement in rewarding learning, and co-curricular experiences and services [see AI Task Force reports]. This is an active and ongoing priority of the University and its divisions. Work is currently underway to develop divisional guidelines for the use of AI to assess student work, which will help inform Geography & Planning's integration of AI in both its assessments and learning materials. The University provides considerable support for instructors at the Centre for Teaching Support and Innovation, with regular workshops and webinars on teaching with generative AI and adapting teaching and assessments with consideration of Generative AI.

More directly, the Department is focused on using existing departmental teaching resources for the new program, and they will be working to help faculty to develop improved teaching practices around AI. The Unit response highlights that faculty are already engaged in integrating AI – as both a potential tool and challenge – into their pedagogical practices; for example, the Department's course GGR274H1, Introductory Computation and Data Science for the Social Sciences, teaches the use of geospatial

AI. The GGR274H1 course is one of 3 methods courses listed in the calendar, to fulfill one of the GDS program requirements.

The Department is greatly supportive of the reviewers' suggestion to keep the curriculum up to date through engagement with other professionals and will work to pursue further opportunities. For example, they will be hosting a speaker and panel series on Quantitative AI to foster further research discussion on the topic. In addition, the Department will invite Chairs and Associate Chairs from the Departments of Earth Sciences, Statistical Sciences, and Computer Science to join the program's advisory committee in order to create space and opportunity to hold collaborative discussions on ways of integrating AI into the new program's curriculum. The Department also plans to explore the offerings at the University's Data Sciences Institute for fruitful areas of overlap. This will be part of the continuous curriculum renewal recommended by the reviewers.

The Department holds regular curriculum meetings which provide a forum for ongoing curricular review and renewal. These meetings, combined with the proceedings of the new program's advisory committee, will allow time to consider the program's learning outcomes and objectives with an eye to making curricular refinements to align with new developments in the field of geographic data science, particularly around the rapidly growing field of AI.

There are no changes to the proposal resulting from these recommendations.

Recommendations for future directions for curriculum

The reviewers made a number of recommendations around future directions for the structure of the program, as follows:

- Consider adding a fourth stream that enables students to combine the Major with a variety of majors.
- Consider adding new courses in spatial AI and integrating geospatial machine learning into existing courses.
- Consider expanding opportunities to engage with cartography, and in-person group work and collaborative learning
- Provide longer labs and more intensive hands-on experiences.

As noted in the Unit response, the suggestion of a fourth stream is a helpful one, which the Department will consider in the future as they observe enrolment patterns in the new Major and other academic units' programs. The three proposed streams mimic the streams that exist in the Department's other programs and build naturally on the existing GIS Minor. As such, the three-stream structure will be well supported by the Department's existing offerings and administrative resources. Over time, the program's advisory committee can consider the reviewers' recommendation as they steward the program through its first few years. They will be attentive to programs that are commonly combined with the GDS major and consider whether there are possibilities

for a robust and sustainable fourth stream.

The reviewers mentioned the positive responses they received from students about in-person learning and longer labs. The Department is gratified that students expressed a preference for in-person learning and hands-on instruction as the courses in the GDS major require substantial in-person instruction in order to succeed in technical courses. In fact, nearly all classes are taught in-person with significant support from Teaching Assistants, so that students have sufficient opportunity for direct feedback as they learn software and analytical techniques.

The Department also appreciated the reviewers' comment on engaging with cartography. The Department continues to feature cartography in two courses currently (GGR172H1, Digital Earth and GGR472H1, Developing Web Maps) but will explore the possibility of enhancing cartographic training in other courses as the program gets underway, and under the direction of the new program's advisory committee.

As for integrating new courses in geospatial AI, the Department's faculty are aware of the importance of geospatial AI as a key direction in the field and are integrating geospatial AI into their existing courses. For example, the course, GGR274H1, Introductory Computation and Data Science for the Social Sciences, introduces students to geospatial AI. The Department will also continue to build in this direction, for instance, as they plan their pending FAC request to include expertise in geospatial AI as a desired skill. In the meantime, the Department and its advisory committee will consider how to integrate expertise in geospatial AI and geospatial machine learning from cognate units to address this growing field.

There are no changes to the proposal resulting from these recommendations.

Recommendations for experiential learning

Finally, the reviewers made a number of recommendations focused on advancing experiential learning opportunities, as follows:

- Collaborate with industry, government, and nonprofit partners; there is considerable potential to expand partnerships that foster workforce development and research impact.
- Collaborate with cooperative education initiatives to provide hands-on learning experiences and strengthen ties with industry and community partners.
- Establish dedicated roles or expand existing staff to focus on career development, internship coordination, and cultivating external partnerships.
- Establish an Experiential Learning Office or strengthen connections with the Arts & Science Experiential Learning Office to access resources, guidance and institutional support for scaling experiential opportunities across the program.
- Consider integrating required experiential components into the program, for example through mandatory internships or capstone projects.

The Department has considered the reviewers' recommendation to integrate required experiential components or mandatory internships into the program, and they have decided not to add a required component at this time. One of the strengths recognized by the reviewers is that the proposed new program is designed to draw on existing resources in the Department. The Department will leverage the staff resources and expertise in the A&S Office of Experiential Learning and Outreach Support (ELOS) to offer experiential learning opportunities to students in a sustainable way. The Dean's Office supports this plan, as launching and expanding experiential learning opportunities is an academic priority of Arts & Science.

Indeed, the Department has been and continues to work with the Faculty of Arts & Science's Office of Experiential Learning & Outreach Support (ELOS), which operates the Arts and Science Internship Program (ASIP) and other EL opportunities, as it is keen to enhance experiential learning opportunities wherever practical and possible. For example, the Department has engaged fruitfully with ELOS to create and support courses with experiential learning (EL) components that can be taken as electives that count toward the requirements of all the streams of the proposed Major. In the case of two such courses, GGR472H1, Developing Web Maps, and GGR493Y1, Geography Professional Experience, students are presented with opportunities to apply their learning to the workplace. Professor Lindsey Smith in GGR472H1 participated in the ELOS "Sandbox" program. ELOS's Sandbox is an experiential learning program where students are matched to real-world problems identified by industry professionals and external organizations. Students learn to apply their knowledge and collaborate across disciplines while building connections with industry partners and other workplaces. In GGR472H1, students developed usable interactive online maps for the Toronto District School Board that were designed to inform parents and students about active transportation. In 2024-25, this course expanded to include a range of organizations including the Clean Air Task Force. The Department's plan to work with ELOS will enable them to build connections with industry, government, and nonprofit partners.

Furthermore, the Department recognizes that the addition of Urban Studies programs to Geography & Planning has brought a strong ethos of experiential learning, which has led to the founding of a Collaboratory for Engaged Learning that will allow for further development of experiential learning opportunities in the Department.

Finally, there is ASIP, which first began in 2021 for students enrolled in specific participating programs of study. Each year, we have expanded the number of participating programs, which now cover a broad range of arts, social science, and science programs, but still a minority of our existing programs. We build capacity with data-informed analysis of student demand and employer opportunities, ensuring an excellent student experience. When the GDS program is established, we would be pleased to work the Department on an application to participate in ASIP and review the

nature of the experiential requirements in their new program.

There are no changes to the proposal resulting from these recommendations.

In summary, the reviewers highlighted a number of strengths in the proposed Geographic Data Science Major and made clear suggestions about communicating the program's distinctiveness to undergraduates at every level and ensuring that AI and opportunities for experiential learning are integrated into the curriculum. The advice to support program leadership through an Advisory Committee was a helpful direction for the Department of Geography & Planning as they move forward to implementation. The reviewers' support for advancing experiential learning, maintaining faculty strength and complement, and integrating geospatial AI and machine learning, echo the Department and Faculty priorities for this program.

Sincerely,

Stephen Wright,
Interim Dean, Faculty of Arts and Science
Professor, Department of Ecology & Evolutionary Biology

cc: Professor Matthew Farish, Interim Chair, Department of Geography & Planning
Professor Paul Hess, Associate Chair, Undergraduate, Department of Geography & Planning

Vice-Provost, Academic Programs' Response (Nov. 11, 2025)

UNIVERSITY OF TORONTO

OFFICE OF THE VICE-PROVOST,
ACADEMIC PROGRAMS

November 11, 2025

Professor Stephen Wright
Interim Dean, Faculty of Arts & Science
University of Toronto

Re: Review Report, Proposed Major in Geographic Data Science

Dear Dean Wright,

I am pleased to receive the external review report for the proposed Major in Geographic Data Science. Your administrative response to the report nicely summarizes the report and addresses the specific recommendations and suggestions made by the reviewers.

The reviewers express support for the program, noting it is timely, well-articulated, and thoughtfully constructed, with "a strong and well-supported rationale for its relevance within the broader field and its alignment with the academic mission of the University of Toronto" (*Report*, pg. 6). The reviewers also make several recommendations, which broadly fall into six areas: student wayfinding; faculty resources; program leadership; integrating artificial intelligence; future curricular directions; and experiential learning.

Student Wayfinding

The reviewers note that students typically discover geography programs only after they begin their undergraduate studies, stressing the importance of developing effective communication and advising to support student wayfinding. They also suggest that messaging the distinctiveness of the program will be important, as will ensuring that there are multiple onramps where students will be able to access the program.

In your response, you indicate the Faculty of Arts and Science (A&S) will leverage existing student advising services, as well as communications from the Office of the Faculty Registrar to broadly announce the program's creation. You also indicate the Department of Geography and Planning (Department) will refresh their messaging to students, including through social media, to enhance the program's visibility and highlight its distinctiveness. In terms of ensuring there are many onramps to the program, you point to the course, GGR172H1, Digital Earth, which will function as the

central gateway to the Major, and note the program will also be promoted through other courses and labs offered by the Department.

Section 8 (Enrolment), on page 45 of the proposal, has been revised to add a paragraph outlining these plans.

Faculty Resources

The reviewers caution that a planned retirement in the area of remote sensing may create a teaching gap in a key program area. They suggest that addressing this potential gap will be critical for sustaining the program's excellence. They further recommend the University of Toronto (University) support faculty recruitment in artificial intelligence (AI) and geospatial AI.

As you note in your letter, the reviewers highlight in their report that a strength of the proposed Major is that it primarily leverages existing teaching and research capacity, curriculum, space, and advising resources. Regarding the planned retirement in remote sensing, you confirm that there is another faculty member in the Department who teaches remote sensing (for example, in GGR315H1, Environmental Remote Sensing, and GGR415H1, Advanced Remote Sensing), who will be able to offer remote sensing courses for the foreseeable future. You also note that the Department will work with cognate units like the Department of Earth Sciences to provide offerings in remote sensing.

Your letter further states that the Department will be applying for a new faculty line in the area of remote sensing through A&S's annual Faculty Appointments Committee process; this request will include expertise in geospatial AI as an additional skillset. You have signalled your support for the Department's plan to submit this request to the Committee. You further note that, as the Major evolves, the Department will continue to leverage expertise in cognate units and consider further future hiring requests.

Section 10.1.1 (All New Programs), on page 60 of the proposal, has been revised to add a paragraph providing more detail on the planned new faculty request.

Program Leadership

The reviewers highlight the importance of program leadership and suggest creating a leadership team, consisting of multiple faculty champions, to guide the program and provide consistency.

You note that the Department welcomes this recommendation and will be convening an advisory committee in the next six months to monitor the program; they will contact cognate Chairs and Associate Chairs to join the committee. You further note that the planned committee will have broader potential, such as providing holistic advice on curricular planning, enrolment challenges and opportunities, and the program's pedagogical success.

There are no changes to the proposal resulting from this recommendation.

Integrating Artificial Intelligence

The reviewers state that more consideration should be given to integrating artificial intelligence (AI) into the program. They note that students are already engaging with generative AI and suggest that standardizing learning objectives across the program would be beneficial. They recommend engaging in collaborative discussions with the Departments of Statistical Sciences and Computer Science to support the thoughtful incorporation of AI into the program. They further suggest that the proponents consider how to keep a refreshed curriculum in geographic data science in the program and indicate that support could be provided through engagement with other professionals via workshops, panel discussions, and retreats.

Your letter highlights that establishing guidelines and best practices around the integration and use of AI by students and faculty is a priority at the University, and that considerable support is available through the Centre for Teaching Support and Innovation. You indicate that A&S is leveraging the expertise of, and taking direction from, the University's AI Task Force to enhance research expertise and to support student success and engagement. You confirm that A&S is working on the development of divisional guidelines for the use of AI in student assessment and note that this will inform the integration of AI into learning materials. You also highlight the efforts being made by the Department, including: developing improved teaching practices around AI, integrating AI as a tool and challenge into pedagogical practices (e.g., in GGR274H1, Introductory Computation and Data Science for the Social Sciences), and exploring the offerings of the Data Sciences Institute for fruitful areas of overlap.

You note that the Department strongly supports the recommendation to keep the curriculum up to date through engagement with other professionals and that it will pursue opportunities as they arise. For example, the Department will be hosting a speaker and panel series on Quantitative AI to foster further discussion and will invite Chairs from cognate units to join the program's advisory committee to facilitate collaborative discussions on ways of integrating AI into the Major's curriculum. The

Department will also hold regular curriculum meetings, which will provide a forum for continuous improvement, and in which they will consider the program's learning objectives and program-level learning outcomes with the goal of aligning new developments in geographic data science and AI.

There are no changes to the proposal resulting from these recommendations.

Future Curricular Directions

The reviewers make several recommendations for future curricular directions, specifically: adding a fourth stream to the program that might increase program enrolments; adding new courses focused on spatial AI and expanding opportunities to engage with cartography; integrating geospatial machine learning into existing courses; and providing opportunities for in-person group work and other collaborative learning, plus longer labs and more intensive hands-on experiences.

In your letter, you highlight that the proposed program is designed to build on the success of existing programs such as the GIS Minor and that the three-stream structure leverages the teaching and research strengths of the Department. The suggestion of adding a fourth stream is a helpful one, however, and the Department will monitor enrolment patterns in the program and will be attentive to programs that are commonly combined with the Major to determine where there are possibilities for a robust and sustainable fourth stream.

With regarding to adding courses in geospatial AI and cartography, your letter highlights the course GGR274H1, Introductory Computation and Data Science for the Social Sciences, which introduces students to geospatial AI, as well as GGR172H1, Digital Earth, and GGR472H1 Developing Web Maps, which feature cartography. The Department will continue to explore other ways to enhance opportunities for students to engage with these areas of study in the program.

Finally, as for the recommendations to provide opportunities for collaborative learning(including through in-person group work, longer labs and more hands-on experiences), your letter highlights that the Department greatly values in-person learning and notes that most courses in the program are already taught in-person with significant support from teaching assistants so as to ensure that students have sufficient opportunity to receive direct feedback as they learn software and analytical techniques.

There are no changes to the proposal resulting from these recommendations.

Experiential Learning

The reviewers state that more can be done to advance experiential learning opportunities such as internships, fieldwork, and community-based projects in the program; they recommend integrating required experiential learning components into the program; collaborating with industry, government and non-profit partners to expand partnerships that foster workforce development and research impact; establishing dedicated roles or expanding existing staff roles to focus on career development, internship coordination, and cultivating external partnerships; and creating an Experiential Learning Office or strengthening connections with the A&S Experiential Learning Office to access resources, guidance, and institutional support for scaling experiential learning opportunities.

In your letter, you emphasize that expanding experiential opportunities is an academic priority at A&S. You note that the Department appreciates the reviewers' recommendation to include a required experiential learning opportunity into the program and confirm that they will consider such a change once the program is established. You highlight that the Department recognizes the value to students of providing experiential learning opportunities and state that they will leverage the staff resources and expertise provided through the Faculty's Office of Experiential Learning and Outreach Support (ELOS) to offer experiential learning opportunities to students in a sustainable way. For example, the Department has worked with ELOS to create GGR472H1, Developing Web Maps, and GGR493H1, Geography Professional Experience, in which students are provided with opportunities to apply their learning to the workplace.

You also speak to the recent addition of Urban Studies to the Department, which has brought with it a strong ethos of experiential learning and the founding of a Collaboratory for Engaged Learning that will allow for development of new experiential learning opportunities.

Finally, your letter highlights the A&S Internship Program (ASIP) which supports the development of streams with a co-op component within existing programs. You note the number of ASIP offerings is expanding and now cover a broad range of arts, social science, and science programs. You explain that, as A&S builds capacity (and with data-informed analysis of student demand and employer opportunities), the proposed Major will be considered for participation in ASIP.

There are no changes to the proposal resulting from these recommendations.

I will be very pleased to recommend this new Major to governance for approval, following approval at the divisional level.

Sincerely,

Nicholas Rule
Vice-Provost, Academic Programs
Professor of Psychology

cc:
Gillian Hamilton, Vice-Dean, Academic Planning, Faculty of Arts & Science
Randy Boyagoda, Vice-Dean, Undergraduate, Faculty of Arts & Science
Erin Macnab, Director, Academic Operations & Strategic Initiatives, Faculty of Arts & Science
Caitlin Burton, Senior Manager, Governance, Academic Planning & Reviews, Faculty of Arts & Science
Lachmi Singh, Director, Academic Programs, Planning & Quality Assurance, Office of the Vice-Provost, Academic Programs
Jennifer Francisco, Academic Change Specialist, Office of the Vice-Provost, Academic Programs
Annette Knott, Academic Change Specialist, Office of the Vice-Provost, Academic Programs

New Program Proposal

UNIVERSITY OF TORONTO

University of Toronto Proposal: New Undergraduate Program

Full name of proposed program: (i.e., Specialist in Historical Studies; Master of Arts in History)	Major in Geographic Data Science
Degree name and short form: i.e., Honours Bachelor of Science, HBA; Master of Arts, MA;	Honours Bachelor of Science, HBSc
Program name: i.e., History; Sustainability Management	Geographic Data Science
Professional program (yes or no):	No
Unit (if applicable) offering the program: i.e., site of academic authority. Where a program is housed elsewhere (in physical terms), this should also be indicated. For graduate, if a new graduate unit is contemplated, please indicate here.	Department of Geography & Planning
Faculty/division:	Faculty of Arts & Science (A&S)
Dean's office contact:	Gillian Hamilton, A&S Vice-Dean, Academic Planning
Proponent:	Matthew Farish, Interim Chair, Department of Geography & Planning
Version date (please change as you edit this proposal):	November 25, 2025

Framework for UTQAP New Programs

The University of Toronto Quality Assurance Process (UTQAP) supports a structured approach for creating, reflecting on, assessing and developing plans to change and improve academic programs and units in the context of institutional and divisional commitments and priorities.

The University of Toronto (U of T), in its Statement of Institutional Purpose (1992), articulates its mission as a commitment "to being an internationally significant research university, with undergraduate, graduate, and professional programs of excellent quality." Thus “quality assurance through assessment of new program proposals and review of academic programs and units in which they reside is a priority for the University…:

> The quality of the scholarship of the faculty, and the degree to which that scholarship is brought to bear in teaching are the foundations of academic excellence. More generally, all of the factors that contribute to collegial and scholarly life — academic and administrative complement, research and scholarly activity, infrastructure, governance, etc. — bear on the quality of academic programs and the broad educational experience of students. (Policy for Approval and Review of Academic Programs and Units (2010))

The University’s approach to quality assurance is built on two primary indicators of academic excellence: the quality of the scholarship and research of faculty; and the success with which that scholarship and research is brought to bear on the achievement of Degree Level Expectations. These indicators are assessed by determining how our scholarship, research and programs compare to those of our international peer institutions and how well our programs meet their Degree Level Expectations.

The University of Toronto embraces academic change as a critical part of maintaining and enhancing programs of outstanding quality through a process of continuous improvement.

New Program Proposal

The New Program Approval Protocol applies to new undergraduate or graduate degrees, undergraduate specialists and majors within approved degrees, and to graduate degree programs, offered in full or in part by the University of Toronto or by the University of Toronto jointly or conjointly with institutions federated or affiliated with the University. New for-credit graduate diplomas and new standalone degree programs arising from a long-standing field in a master's or doctoral program go through the Expedited Approval Protocol (see UTQAP section 2.8). All proposed new programs except graduate diplomas are subject to external appraisal.

This template aligns with UTQAP requirements and will help to ensure that all evaluation criteria established by the Quality Council are addressed in bringing forward a proposal. Divisions may have additional requirements that should be integrated into the proposal.

Development and Approval Steps	**Date (e.g., of external appraisal site visit, final signoff, governance meeting, Quality Council submission, Ministry submission)**
New program consultation meeting	September 30, 2024
Consultation Proponents/Dean's Office/Provost's Office	
Provost's Advisory Group	June 18, 2025
External appraisal	September 22, 2025
Decanal Signoff *In signing off I confirm that I have ensured appropriate:* ✓ compliance with the evaluation criteria listed in UTQAP section 2.3 ✓ consultation with the Office of the Vice-Provost, Academic Programs early in the process of proposal development ✓ consultation with faculty and students, other University divisions and external institutions	Stephen Wright, Interim Dean, Faculty of Arts & Science Date of Signoff: July 16, 2025
Provostial signoff *In signing off I confirm that the new program proposal:* ✓ is complete ✓ includes information on all the evaluation criteria listed in UTQAP section 2.3	Nicholas Rule, Vice-Provost, Academic Programs Date of Signoff: June 26, 2025
Unit-level approval (if required)	March 7, 2025
Faculty/divisional governance	Sciences Undergraduate Curriculum Committee: November 19, 2025 Social Sciences Undergraduate Curriculum Committee:November 20, 2025 Arts & Science Council: December 10, 2025
Submission to Provost's Office	
AP&P	February 10, 2025
Academic Board	N/A
Executive Committee of Governing Council	N/A

The program may begin advertising as long as any material includes the clear statement that, “No offer of admissions will be made to the program pending final approval by the Quality Council and the Ministry of Colleges and Universities (where the latter is required).”	
Ontario Quality Council	March, 2026
Submitted to the Ministry (in case of new graduate degrees and programs, new diplomas)	N/A

New Program Proposal

Geographic Data Science Major
Department of Geography & Planning
Faculty of Arts & Science

Table of Contents

1 Executive Summary

Please provide a brief overview of the proposed program summarizing the key points from each section of the proposal.

Response:

The Department of Geography & Planning in the Faculty of Arts & Science at the University of Toronto is proposing a new Major in Geographic Data Science, leading to the existing Honours Bachelor of Science (HBSc) degree.[1] The introduction of this proposed Major, which builds on the success of the existing Minor in Geographic Information Systems (GIS), is driven by the increasing demand for expertise in geospatial technologies and data science, reflecting the growing importance of spatial data in various sectors. The new major will offer three streams—human systems, urban systems, and environmental and physical systems—that integrate well with other Faculty of Arts & Science (A&S) programs and priorities, fostering a multidisciplinary approach. The new program is proposed to start on September 1, 2026, with enrolment requests beginning in the second round of enrolments in Summer 2026.

The proposed Geographic Data Science Major aims to equip students with the skills and knowledge to analyze and interpret complex spatial data, addressing critical societal challenges in urban, environmental, and social systems through innovative and inclusive education that emphasizes areas of strength already existing in the Department of Geography & Planning.

The program will be limited enrolment; minimum admissions requirements ensure students with the appropriate skills are admitted to the program, and limited enrolment will help guarantee sufficient course capacity for enrolled students to complete the program in a timely manner. The structure of the program begins with a set of core methods and theory courses that all students take. In addition, electives at the 3rd and 4th years help students customize their experience, while stream requirements provide students with a well-rounded understanding of sub-fields within the discipline of

[1] The Geographic Data Science Major is proposed as a science program and would lead to the HBSc degree. However, in A&S, students enrolled in the major who also complete a major, a specialist, or two minors in an arts area would be given the choice of graduating with an HBSc or an HBA degree. For more information, refer to the Faculty of Arts & Science Academic Calendar's page on degree requirements.

geography. Importantly, all courses for this major already exist and are regularly offered by the department (i.e., the program does not require the creation of new courses).

The program will be delivered in-person, primarily via synchronous courses, with a mix of lecture and smaller computer lab-based classes. The platform-agnostic design of our curriculum will help address the state of the discipline by enabling students to take the geographic data science skills they acquire and apply them in a range of computational and software environments. Students will be able to leverage optional experiential learning opportunities, however, experiential learning is not a required component of the curriculum. Additional innovative pedagogical approaches will be incorporated into the program over time.

Students in the program will engage with a range of assessment types that align with program learning outcomes and that allow students with different learning styles to demonstrate their knowledge. The Department of Geography & Planning's Chair, Associate Chair Undergraduate, and undergraduate curriculum committee will continue to monitor students' grades and course evaluations each term to ensure the program continues to offer high-quality content. In addition, the undergraduate committee will monitor enrolments to understand if students are leaving the program due to possible issues in the classroom. This work will be done annually and corresponds with the Department of Geography & Planning's practice to monitor all our programs' enrolments and marks each term to ensure we are delivering top-quality programs. Exit surveys of the first several cohorts of students to graduate will also provide valuable feedback into ways the program can be continuously approved.

The proposed program differentiates itself from other geographic data science and geographic information science programs found across Canada and the United States through its incorporation of streams that require students to take a set of non-technical courses that add theoretical depth to their experience. The pedagogical rationale is to graduate students who can develop, ask, and answer important questions relevant to the stream they choose. The skills, methods, and theories they learn in the new program will enable them to be competitive job seekers in a market that is seeing increased demand. Employees using geographic data science are employed by a range of industries and make wages of approximately $68,000 to $118,000 per year.

Enrolments in the program are expected to gradually increase over a six-year period, at which point they will reach a steady state of approximately 190 students. We anticipate that students will pair the Geographic Data Science Major with a range of majors and

minors across the social sciences, physical and life sciences, and humanities. We also anticipate students who are interested in computation, but are not enrolled in computer science or statistics programs, will find our new program appealing.

Consultations on the program can be traced back to the Department of Geography & Planning's 2021 Unit-level Academic Plan, which discusses the development of a new major in geographic information science. Since this time, a Department retreat in 2024 helped guide the proposed program's structure and development, and subsequent feedback from faculty and administrators in cognate units has been solicited. Units whose courses have been listed as requirements (Computer Science, Statistical Sciences, and Earth Science) were extensively consulted and are all supportive of the new program. Additional consultations occurred with the A&S Chairs, Principals, & Academic Directors (CPAD) group, the A&S Data Sciences Planning Committee, the Tri-Campus Deans group, and cognate divisions.

The proposed program relies on existing, permanent academic staff complement, and existing courses. The Department of Geography & Planning's faculty, who teach in the area of geographic data science, have won multiple teaching and research awards and are some of the most highly regarded scholars in geographic data science in the world. The Department has also recently invested in computer lab renovations, enabling it to offer high quality instructional spaces to its students.

2 Effective Date and Date of First Review

Response:

The new program will start on September 1, 2026. Students will be able to first request enrolment in the new program as of the second round of program enrolments in Summer 2026 (i.e., starting in early July 2026).

First date degree program will undergo a UTQAP review and with which unit[2]:
The program will first be externally reviewed with the Department of Geography & Planning no later than 2033-34, which is within 8 years of initial enrolment.

[2] Programs that are inter- and multidisciplinary must identify a permanent lead administrative division and identify a commissioning officer for future cyclical program reviews.

3 Academic Rationale and Program Objectives

3.1 Program Objectives

a) List the program's objectives.

Response:

Program objectives are clear and concise statements that describe the broad goals of the program.

The program objectives of the Geographic Data Science Major, regardless of the stream that students complete, are:

1. To develop students into critical thinkers who can use an advanced analytical toolkit with geospatial data to answer pressing geographic questions impacting socioeconomic, urban, and environmental systems across spatial scales,
2. To build domain expertise by ensuring students have a deep understanding of either a) urban systems, b) social systems, or c) environmental/physical systems, by their completion of a stream in one of these areas and
3. To provide students with opportunities to apply technical skills to answer questions about real-world cases relevant to broader questions being pursued by geographers and planners via experiential and research course offerings.

3.2 Academic Rationale

Provide the academic rationale for the proposed program considering the prompts below.

b) Discuss the appropriateness of degree or diploma nomenclature given the program's objectives.
c) Discuss the consistency of the program's objectives with the institution's mission and U of T's/the division's/unit's academic plans, priorities and commitments, including consistency with any implementation plans developed following a previous review.
d) Evidence that the following have been substantially considered in the context of developing the changes to the program and its associated resources:

1. Universal design principles and/or the potential need to provide mental or physical disability-related accommodations, reflecting the University's Statement of Commitment Regarding Persons with Disabilities
2. Support for student well-being and sense of community in the learning and teaching environment, reflecting the work of the Expert Panel on Undergraduate Student Educational Experience and the commitment to establishing a Culture of Caring and Excellence as recommended by the Presidential and Provostial Task Force on Student Mental Health
3. Opportunities for removing barriers to access and increasing retention rates for Indigenous students; for integrating Indigenous content into the curriculum in consultation with Indigenous curriculum developers; and for addressing any discipline-specific calls to action, reflecting the commitments made in Answering the Call: Wecheehetowin: Final Report of the Steering Committee for the University of Toronto Response to the Truth and Reconciliation Commission of Canada
4. Opportunities for removing barriers to access and increasing retention rates for Black students; for promoting intersectional Black flourishing, fostering inclusive excellence and enabling mutuality in teaching and learning, reflecting the commitments made in the Scarborough Charter and consistent with the recommendations of the Anti-Black Racism Task Force Final Report
5. Opportunities for fostering an equitable, diverse, and inclusive teaching and learning environment, reflecting the values articulated in existing institutional documents such as the Statement on Equity, Diversity, and Excellence, the Antisemitism Working Group Final Report, the aforementioned reports, and future institutional reports related to equity, diversity and inclusion.

e) Unique curriculum or program innovations, creative components, significant high impact practices, where appropriate

Response:

Rationale

The Department of Geography & Planning is proposing a new Geographic Data Science Major, leading to the Honours Bachelor of Science; geographic data science is an established subfield rooted in the discipline of Geography. The department currently offers a Geographic Information Systems Minor. Recent growth in our faculty, related minor, and developments at the University and in A&S provide us with the opportunity to launch the proposed Major.

The computer mapping of spatial data is pervasive in our modern life. Geospatial technologies like global positioning systems (GPS) and geographic information systems (GIS) are in our phones and cars, and used strategically by industry, governments, non-profits and researchers across many fields. Geography has been a core contributor to the development of the theories, science, and technologies that drive computer mapping, as well as the necessary critiques that help us understand how these tools impact our society and environments.

This expertise is highlighted by the subfields of “geographic information science” and “spatial data science,” where geographers develop and use methods and theories that drive powerful analyses of increasingly large and complex spatial information that describes the world around us. The Department of Geography & Planning’s Geographic Information Systems Minor is currently doing well. Consistent with student need and demand for programming in this area, program enrolments in the GIS Minor have grown 36.8% from November 2018 (125 students) to November 2024 (171 students).

There are two primary reasons driving the development of the proposed Major. First, the field of geography has evolved such that there is an increasing reliance on spatial datasets that describe social systems, urban systems, and environmental systems, and new technologies and methods (e.g., A.I.) are used to understand these data. Second, there is a need for students to be fluent in how geographic and spatial data are captured, analysed, and interpreted when seeking jobs in both the private and public sectors, as well as for those pursuing careers in research. The current Geographic Information Systems Minor does not provide the depth and breadth required to meet this student need.

A) Appropriateness of degree program nomenclature given program’s objectives

The nomenclature of in the proposed program “Geographic Data Science Major” is appropriate because it accurately signals to students the type of curriculum they will be engaged with and connects to the history of data science work within the discipline over the past half century. The proposed name including “data science” as opposed to “information systems” better reflects the evolution of the field, the Department’s collaboration with the Department of Computer Science and Department of Statistical Sciences, and is a more forward-looking descriptor that allows us to capture future developments in a quickly evolving landscape powered by advances in A.I.

The structure of this new program is designed to expose students not only to geographic data science methods and tools, but also to electives where these

approaches are applied to real world scenarios (e.g., GGR372H1, GIS for Public Health and GGR377H1, Urban Data Analytics) that help contextualize when and why these methods are important. As well, students must complete broader coursework via one of three streams (human systems, urban systems, and environmental/physical systems) that are core to the discipline of geography.

It is appropriate that the proposed Geographic Data Science Major leads to the Honours Bachelor of Science (HBSc) because the curriculum emphasizes the science of geographic and spatial data at the undergraduate level, including how and why it is captured, quantitative and scientific methods that allow it to be analyzed, and ways it can be used to answer a range of questions relevant to the discipline of Geography.

B) Consistency of objectives with U of T's mission and Arts & Science academic plans, priorities, and commitments

The proposed Geographic Data Science Major, which is outlined in the Department's 2021 Unit-Level Academic Plan, aligns with the department's priority to define areas of specialization that are unique to the Department of Geography & Planning within A&S and at U of T. It will provide students interested in data science and social and environmental sciences with a legible pathway and accessible courses that prepare them for both careers and post-bachelor's degrees and graduate programs in Geography, Planning, Environmental Studies, and other related disciplines.

The proposed Geographic Data Science Major also aligns closely with the *2020-25 A&S Academic Plan* by developing new opportunities for students in computation and data analytics, and especially aligns with Priorities 2 and 5.

Priority 2 (Enhancing Academic Programming and Student Experience)

The new major will provide a new computation and data science option to A&S students that is distinct from many other current offerings. It will be a key data science-oriented program in the social sciences at U of T, and will provide opportunities to develop expertise in quantitative and computational approaches directly applied to the important societal issues our faculty members specialize in, including climate change, transportation, equity, and health. The Department of Geography & Planning has long maintained courses in this area and helped to achieve the Dean's vision of offering introductory-level data-intensive courses for students within the social sciences through our course GGR274H1, Introductory Computation and Data Science for the Social Sciences, launched in 2022.

Priority 5 (Building Partnerships with our Local and Global Communities)
As previously noted, geographic data are pervasive and an important component to the operations of a wide range of local and international organizations in the *public and private sectors*, *NGOs*, and in *government*. Our initial work with the A&S Office of Experiential Learning & Outreach Support (ELOS) signals the Department of Geography & Planning's willingness to establish direct connections with these organizations throughout the curriculum. A key goal is to have students engage with communities and partners early in the program and find professional opportunities that will set them up for success after they graduate.

Beyond these specific priorities, this new program also aligns with the University of Toronto's wider priorities (per the University's "3 Priorities," 2015), including leveraging our urban location (via our urban systems stream) and re-imagining undergraduate education (via creating an interdisciplinary program that connects students to both data science skills contextualized in the social and environmental sciences). In addition, the proposed major contributes to the University's mission, per its *Statement of Institutional Purpose*, by offering a degree that "responds selectively to new fields of research as they emerge," demonstrating a commitment "to being an internationally significant research university, with undergraduate, graduate and professional programs of excellent quality," exploiting "the advantages of size by encouraging scholarship in a wide range of disciplines in the humanities, social sciences, sciences and the professions," "responding to the needs of a diverse student population," and "providing for breadth and depth in all undergraduate programs."

C) Evidence that the following have been substantially considered in the context of developing the changes to the program and its associated resources…

Universal Design Principles
We take seriously accessible learning environments and universal design principles. As one example relevant to our proposed new program, we offer different modes of learning, including offering our introductory course to geographic information in both online asynchronous and in-person format. Instructors are also trained to encourage flexibility when it comes to engaging in course materials and deliverables. The Department also encourages faculty to post as much lecture material (e.g., slides or code) as possible online for students to review on their own time. Finally, most courses in the geographic data science core curriculum use a scaffolded structure, ensuring

students build skills throughout the course, earning credit and experience along the way.

Support for Student Well-Being
Our undergraduate office reviews syllabi to ensure they are AODA compliant and we will make sure this practice is standardized in the 2025-2026 academic year, including a test text-to-voice listening session for all syllabi. All our undergraduate syllabi include resources for students related to accommodations, disability, and mental health. The Department also provides access to a “Math Help Centre” for all students enrolled in our courses to enable students who need extra contact hours to understand quantitative methods are provided the time and space to learn. This centre will be useful for the proposed new Major.

Removing Barriers to Access and Fostering an Equitable, Diverse, and Inclusive Teaching and Learning Environment
The Department of Geography & Planning is committed to ensuring access to learning for all students across all its programs. We have a decades-long standing committee on equity and diversity, which emerged out of a collective desire for a more just, inclusive, and diverse department. This committee consults and provides guidance on a range of departmental matters related to curriculum planning, faculty recruitment and retention, department culture, and mental health and well-being. For more see our Equity and Diversity Statement here: *https://www.geography.utoronto.ca/about-us/our-department/equity-diversity-statement*.

The Department also takes seriously the incorporation of diverse perspectives, including those from Indigenous and Black communities, in its curriculum. As one example connected to this proposed major, GGR172H1 Digital Earth discusses Indigenous traditions of mapping, as well as the ethics of using geographic information and how digital cartography has historically been used to surveil racialized people.

Finally, faculty in the Department actively engage in outreach in equity-deserving groups and diverse communities. For example, one member of faculty has done geographic data science workshops with the Rexdale Community Hub’s STEM club, located in one of Toronto’s most diverse inner suburbs, annually since 2017. This work was written up one year in the Hub’s 2019-2020 report - see page 9: *http://www.rexdalehub.org/wp-content/uploads/2021/09/RCH_2019-2020_Report.pdf*.

D) Unique curriculum or program innovations

Finally, the new major in Geographic Data Science will incorporate an innovative curricular design that provides experiential learning opportunities and multidisciplinary education.

Experiential Learning

Given the applied nature of many of the foundational courses and electives, the department will work with the A&S Office of Experiential Learning and Outreach Services (ELOS) to develop additional experiential learning opportunities that complement the opportunities already offered. In the Geographic Data Science Major, we will draw on and build upon recent innovative practices in our geographic data science curriculum. For example, in 2023-2024, Professor Lindsey Smith and her class GGR472H1, Developing Web Maps, participated in A&S's Experiential Learning and Outreach Support's "Sandbox". Students programmatically developed useable interactive online maps for the Toronto District School Board that were designed to inform parents and students about active transportation (see: *https://www.artsci.utoronto.ca/faculty-staff/experiential-learning/curriculum-integrated/sandbox*). For 2024-2025, participation in the Sandbox program will continue at a larger scale, with opportunities for GGR472H1 students to partner with a range of organizations, including the Clean Air Task Force.

Multidisciplinary Education

The proposed Geographic Data Science Major will have three streams that focus on different substantive areas and will pair well with other offerings in A&S, like the new Minor in Applied Data Science, or various programs in the Social Sciences, Physical and Life Sciences, and Computer and Statistical Sciences. The intention to offer this program only as a major (and to not include a "specialist" option) is by design, as the methods and theories students will engage with are being used in a range of fields, and majors are intended to be taken alongside other programs.

4 Calendar Copy

Insert calendar copy, including the program description.

Response:

Geographic Data Science Major (Science Program) - ASMAJ1XYZA, B, and C

The Geographic Data Science (GDS) Major equips students with the theoretical, technical, and applied foundations necessary for mastering the unique challenges of using geographic and spatial data to formulate and answer questions relevant to a range of fields. The curriculum encompasses methods for spatial data production, analysis, and presentation, utilizing tools such as geovisualization, spatial analysis and statistics, geocomputation, and remote sensing. Emphasis is placed on problem-solving and project design, particularly in upper-level courses where students apply learned theories and techniques to address specific geographic questions.

The GDS program offers three distinct streams: Human Systems, Urban Systems, and Physical and Environmental Systems. Each stream allows students to dive deeper into a particular area of interest, enabling them to develop more nuanced understandings of the topics to which they apply geographic data science. The Human Systems stream focuses on the spatial aspects of human activities and their impacts across spatial scales (e.g., economic systems, migration, political geography). The Urban Systems stream delves into the complexities of urban environments and infrastructure (e.g., housing, transportation, urban utilities). The Physical and Environmental Systems stream emphasizes the natural environment and its processes (e.g., changes in climate, agriculture, human-environment interactions). This structure ensures that students gain comprehensive knowledge and skills tailored to their specific interests and career goals connected to geographic data science, while also exposing students to non-technical theories and ways of knowing.

Students may only complete one stream in the Geographic Data Science Major.

Enrolment Requirements

This is a limited enrolment program. Students must have completed 4.0 credits and meet the requirements listed below to enrol.

Variable Minimum Grade
A minimum grade is needed for entry. This minimum changes each year depending on available spaces and the number of applicants. Eligibility is based on the following criteria:

- Completion of GGR172H1 with a grade of at least 70%, or
- Completion of GGR272H1 with a grade of at least 67%, or
- Completion of one of CSC108H1/CSC110Y1 with a grade of at least 60% and 0.5 credit in a Geography & Planning course, including joint courses, at the 100- or 200-level, with a minimum grade of at least 70%

To ensure that students admitted to the program will be successful, applicants with a final grade or grade average lower than the minimum grades stated above will not be considered for admission. Please note that obtaining this minimum final grade does not guarantee admission to the program.

Completion Requirements (by stream)

Geographic Data Science Major: Human Systems Stream

Completion Requirements
(7.5 credits)

1. GGR172H1

2. *Core Geography Course*: 0.5 credit from JEG100H1, ESS262H1, GGR101H1, GGR107H1, GGR112H1, GGR124H1, GGR196H1, GGR197H1, GGR198H1, GGR199H1.

Note: A 200 or 300-level Geography & Planning course, including joint courses, may also be used to meet this requirement. Please contact the Undergraduate Administrator (undergraduate.geography@utoronto.ca) if you wish to request a substitution for requirement 2.

3. Methods Courses: GGR270H1, GGR271H1, GGR274H1

4. Core Geographic Data Science Courses: GGR272H1, GGR273H1, GGR373H1, GGR315H1

5. Geographic Data Science Electives: 1.0 credit from GGR372H1, GGR375H1, GGR376H1, GGR377H1, GGR386H1, CSC271H1, STA272H1

6. *Fourth-year Geographic Data Science Elective*: 0.5 credit from GGR415H1, GGR462H1, GGR472H1, GGR473H1, STA465H1.

Note: 0.5 credit from GGR493Y1 can be used to meet this requirement, based on suitability of the placement for this program and approval by the department. 0.5 credit from GGR491Y1, GGR492H1, GGR497H1, GGR498H1, or GGR499H1 can be used to meet this requirement, based on suitability of the research topic for this program and approval by department. Please contact the Undergraduate Administrator (undergraduate.geography@utoronto.ca) if you wish to request a substitution for requirement 6.

7. *Human Systems Stream Electives*: 1.5 credits from GGR221H1, GGR240H1, GGR246H1, GGR251H1, GGR252H1, GGR254H1, GGR320H1, GGR324H1, JUG325H1, GGR326H1, GGR327H1, GGR328H1, GGR329H1, GGR332H1, GGR340H1, GGR341H1, GGR342H1, GGR343H1, GGR344H1, GGR354H1, GGR360H1, GGR363H1, GGR382H1, GGR389H1, GGR421H1, GGR424H1, GGR429H1, GGR430H1, GGR431H1, GGR432H1, GGR433H1, JGC439H1, JIG440H1, GGR456H1.

Note: Special Topics courses, Research Opportunity courses, and Research Excursion courses from Geography & Planning can be used to meet this requirement, based on suitability of the topic or research for this stream and approval by the department. Please contact the Undergraduate Administrator (undergraduate.geography@utoronto.ca) if you wish to request consideration of these courses for requirement 7.

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Geographic Data Science Major: Urban Systems Stream

Completion Requirements
(7.5 credits)

1. GGR172H1

2. *Core Geography Course*: 0.5 credit from JEG100H1, ESS262H1, GGR101H1, GGR107H1, GGR112H1, GGR124H1, GGR196H1, GGR197H1, GGR198H1, GGR199H1.

Note: A 200 or 300-level GGR course (or joint courses like JEG, JGI, JGE, JGU) may also be used to meet this requirement. Please contact the Undergraduate Administrator (undergraduate.geography@utoronto.ca) if you wish to request a substitution for requirement 2.

3. Methods Courses: GGR270H1, GGR271H1, GGR274H1

4. Core Geographic Data Science Courses: GGR272H1, GGR273H1, GGR373H1, GGR315H1

5. Geographic Data Science Electives: 1.0 credit from GGR372H1, GGR375H1, GGR376H1, GGR377H1, GGR386H1, CSC271H1, STA272H1

6. *Fourth-year Geographic Data Science Elective*: 0.5 credit from GGR415H1, GGR462H1, GGR472H1, GGR473H1, STA465H1.

Note: 0.5 credit from GGR493Y1 can be used to meet this requirement, based on suitability of the placement for this program and approval by the department. 0.5 credit from GGR491Y1, GGR492H1, GGR497H1, GGR498H1, or GGR499H1 can be used to meet this requirement, based on suitability of the research topic for this program and approval by department. Please contact the Undergraduate Administrator (undergraduate.geography@utoronto.ca) if you wish to request a substitution for requirement 6.

7. *Urban Systems Stream Elective*: 1.5 credits from JGU216H1, GGR217H1, GGR259H1, GGR336H1, GGR339H1, JGU346H1, GGR357H1, GGR359H1, GGR374H1, GGR424H1, GGR434H1, JGU454H1, GGR458H1, GGR460H1, GGR482H1.

Note: Special Topics courses, Research Opportunity courses, and Research Excursion courses from Geography & Planning can be used to meet this requirement, based on suitability of the topic or research for this stream and approval by the department. Please contact the Undergraduate Administrator (undergraduate.geography@utoronto.ca) if you wish to request consideration of these courses for requirement 7.

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Geographic Data Science Major: Physical and Environmental Systems Stream

Completion Requirements
(7.5 credits)

1. GGR172H1

2. *Core Geography Course*: 0.5 credit from JEG100H1, ESS262H1, GGR101H1, GGR107H1, GGR112H1, GGR124H1, GGR196H1, GGR197H1, GGR198H1, GGR199H1.

Note: A 200 or 300-level GGR course (or joint courses like JEG, JGI, JGE, JGU) may also be used to meet this requirement. Please contact the Undergraduate Administrator (undergraduate.geography@utoronto.ca) if you wish to request a substitution for requirement 2.

3. Methods Courses: GGR270H1, GGR271H1, GGR274H1

4. Core Geographic Data Science Courses: GGR272H1, GGR273H1, GGR373H1, GGR315H1

5. Geographic Data Science Electives: 1.0 credit from GGR372H1, GGR375H1, GGR376H1, GGR377H1, GGR386H1, CSC271H1, STA272H1

6. *Fourth-year Geographic Data Science Elective*: 0.5 credit from GGR415H1, GGR462H1, GGR472H1, GGR473H1, STA465H1.

Note: 0.5 credit from GGR493Y1 can be used to meet this requirement, based on suitability of the placement for this program and approval by the department. 0.5 credit from GGR491Y1, GGR492H1, GGR497H1, GGR498H1, or GGR499H1 can be used to meet this requirement, based on suitability of the research topic for this program and approval by department. Please contact the Undergraduate Administrator (undergraduate.geography@utoronto.ca) if you wish to request a substitution for requirement 6.

7. *Physical and Environmental Systems Stream Electives*: 1.5 credits from JEG201H1, GGR203H1, JEG205H1, JEG206H1, GGR223H1, JEG301H1, JEG305H1, JEG308H1, GGR314H1, JUG320H1, JGE321H1, JIG322H1, GGR323H1, JGE331H1, GGR332H1, GGR334H1, GGR338H1, GGR347H1, GGR348H1, GGR349H1, GGR387H1, GGR388H1, JEG406H1, GGR413H1, GGR416H1, GGR418H1, GGR419H1, GGR438H1, JGE481H1.

Note: Special Topics courses, Research Opportunity courses, and Research Excursion courses from Geography & Planning can be used to meet this requirement, based on suitability of the topic or research for this stream and approval by the department. Please contact the Undergraduate Administrator (undergraduate.geography@utoronto.ca) if you wish to request consideration of these courses for requirement 7.

5 Rationale for Program as Designed

5.1 Rationale for Admission Requirements

f) Discuss the appropriateness of the program's admission requirements as they are articulated in the calendar entry above, given the program's objectives and program-level learning outcomes.
g) Provide a sufficient explanation of alternative requirements, if applicable, for admission into a graduate, second-entry or undergraduate program, e.g., minimum grade point average, additional languages or portfolios, and how the program recognizes prior work or learning experience.

A) Appropriateness of admission requirements, given program objectives and program-level learning outcomes

Response:

The Geographic Data Science Major will be a limited enrolment program. Entry requirements will be a minimum of 70% in GGR172H1 (Digital Earth) or a minimum of 67% in GGR272H1 (Geographic Information and Mapping I) or a minimum of 60% in one of CSC108H1/CSC110Y1 and a 70% in any 0.5 credit 100- or 200-level Geography & Planning (GGR) course (or joint course like JEG, JGE, JGI, JGU). These entry requirements will ensure that students are prepared for courses that require substantial quantitative skills and working with spatial data. The program completion requirements, which are structured such that students take 4.5 credits out of 7.5 credits in courses that explicitly use quantitative and data science tools and methods, are also intended to prepare them for challenging quantitative courses. If demand is different than anticipated, the Department will adjust these requirements via its Undergraduate Curriculum Committee to ensure the program is reaching interested and properly prepared students. As a rule, the program will be open for students to request enrolment in both rounds of program enrolment (i.e., apply between early March to late April or between early July to mid-August). It is expected that the proposed program will first be open for the second round of program enrolment in summer 2026 (i.e., apply between early July to mid-August 2026), and this will be communicated clearly to students. The courses listed as admission requirements are offered regularly throughout the academic year and should not present any challenges for students seeking admission into the program.

In addition, starting with limited enrolment ensures sufficient course capacity for enrolled students to complete program requirements in a timely manner. For instance, the program size is constrained by access to computer labs necessary for most geographic data science courses. The department owns its own computer lab with 32 seats and uses Learning Space Management to book additional labs when necessary.

5.2 Rationale for Program Structure

5.2.1 All New Programs

In a **single** response, please discuss the new program requirements, by considering the program relative to the following criteria:

h) Discuss the appropriateness of the program's structure and requirements as stated in the calendar to meet its objectives and program-level learning outcomes, including the structure and requirements of any identified streams (undergraduate), fields or concentrations (graduate). Please include a discussion of the program's planned/anticipated class sizes.

i) Appropriateness of the program's structure, requirements and program-level learning outcomes in meeting the institution's applicable undergraduate or graduate Degree Level Expectations

j) State the proposed mode(s) of delivery of the program. Discuss the appropriateness of the mode(s) of delivery (i.e., means or medium used in delivering a program; e.g., lecture format, distance, online, synchronous/asynchronous, problem-based, compressed part-time, flex-time, multi-campus, inter-institutional collaboration or other non-standard forms of delivery) to facilitate students' successful completion of the program-level learning outcomes.

k) Discuss the ways in which the curriculum addresses the current state of the discipline or area of study and is appropriate for the level of the program.

l) Please provide details on any experiential learning that is part of the program, including confirmed and interested partners, duration of experiential learning component in a program, and anticipated number of placements.

Response:

Appropriateness of program structure given PLOs

Program Learning Outcomes

Upon completion of the program, students will be able to:

- **PLO1**: Demonstrate Knowledge of Geographic Data Science (GDS) Concepts: Understand and articulate key concepts in geographic data science, including spatial data, geospatial technologies (e.g., geographic information systems [GIS], global positioning systems [GPS]), and their applications across various fields.
- **PLO2**: Understand the Historical and Theoretical Foundations of GDS: Demonstrate knowledge of the historical development and theoretical foundations of geographic data science, including key contributions from the field of geography.
- **PLO3:** Apply Quantitative and Computational Methods: Apply established quantitative and computational tools, techniques, and frameworks—such as spatial analysis using geographic information systems, statistical analysis, machine learning models, and data visualization techniques—to solve spatial problems.
- **PLO4:** Develop and Implement Workflows: Design, develop and implement comprehensive workflows that transform raw spatial data into actionable outputs, including data cleaning, integration, analysis, visualization, and the creation of final cartographic or analytical products, with an emphasis on reproducibility.
- **PLO5**: Demonstrate Proficiency Across Platforms: Show competency in applying a range of geographic data science methods and theories across multiple platforms and software packages such as, for example, the use of scripting, web-based mapping applications, and mobile GIS.
- **PLO6**: Critically Evaluate Spatial Data and Technologies: Critically assess the accuracy, reliability, and ethical implications of spatial data and results from geographic data science methods, considering their impact on society and the environment.
- **PLO7**: Promote Ethical and Responsible Use of Spatial Data: Advocate for the ethical and responsible use of spatial data and geospatial technologies, considering issues of privacy, equity, accessibility, and social justice.
- **PLO8**: Integrate Multidisciplinary Approaches Using Geographic Data Science: Apply multidisciplinary approaches to solve complex problems in human, urban, or physical/environmental systems (depending on stream) using geographic data science.
- **PLO9**: Visualize and Interpret Spatial Data: Create effective visualizations of spatial data and non-spatial data to support decision-making and communicate

insights to various audiences, including but not limited to community, government, and industry stakeholders.

- **PLO10**: Communicate Effectively: Communicate complex geographic data science concepts and findings clearly and effectively to diverse audiences, including but not limited to community, government, and industry stakeholders, including the use of text, visuals, and oral presentations.
- **PLO11**: Design and Conduct Research: Design and conduct academic or applied research projects via courses or experiential learning opportunities that utilize geographic data science methods to address significant societal and/or environmental issues.

Stream Specific PLOs:
Upon completion of the stream, students will be able to:

Human Systems Stream

- **PLO12**: Demonstrate Knowledge of the Subfield of Human Geography: Understand and articulate key concepts in human geography, including methods and ways of knowing about social, cultural, and economic spatial systems that contextualize findings produced via data science.

Urban Systems Stream

- **PLO12**: Demonstrate Knowledge of the Subfields of Urban Studies and Planning: Understand and articulate key concepts in urban studies/planning, including methods and ways of knowing about cities and how they function that contextualize findings produced via data science.

Physical and Environmental Systems Stream

- **PLO12**: Demonstrate Knowledge of the Subfields of Physical and Environmental Geography: Understand and articulate key concepts in physical and environmental geography, including methods and ways of knowing about environmental systems and earth surface processes that contextualize findings produced via data science.

The proposed major will be centred around a set of core methods and theory courses related to geographic data science, including 2 general geographic methods courses (GGR270H1 and GGR271H1) and 5 geographic data science methods courses (e.g., GGR272H1, GGR273H1, GGR274H1, GGR373H1, and GGR315H1) and geographic

data science-oriented electives (consisting of a selection from another 9 GGR courses at the 3rd and 4th year, excluding independent research or placement courses (e.g., GGR372H1, GGR473H1), and an additional 2 courses related to the new Applied Data Science Minor, approved by the Undergraduate Associate Chair, Computer Science and the Undergraduate Associate Chair, Statistical Sciences (e.g., CSC271H1, STA272H1). The calendar copy in Section 4 outlines all these courses, which are already well established and regularly offered. In addition, students will fulfill requirements that provide them with a well-rounded understanding of the discipline of geography, including completion of one stream in either human geography, urban systems, or environmental and physical systems.

Table 1 below links PLOs to DLEs and requirements.

Generally, the curriculum will rely on courses in geographic data science, spatial analysis, and digital cartography already offered within the department to achieve the program learning outcomes listed below. The three streams (human systems, urban systems, and environmental and physical systems) will rely on our extensive catalogue of existing courses within the department. Three electives outside of the department that help students master PLOs 4 and 5 will also be available to students to supplement GGR courses. CSC271H1, Computational Principles and Methods in Data Science, or STA272H1, Models in Data Science, (2-4 priority enrolments for students in the Geographic Data Science Major has been confirmed from the Department of Statistical Sciences to the Department of Geography & Planning) are new courses linked to the Applied Data Science minor, and after discussions with the Department of Computer Science and the Department of Statistical Sciences, we have been approved to list these in our requirements. STA465H1 will also be available to students in the program as a fourth-year elective (confirmed with the Department of Statistical Sciences). Additionally, we will partner with the Department of Earth Sciences to include some of their courses (including a suite of 7 courses currently being administratively transferred from the Department of Geography & Planning, strengthening existing interdisciplinary connections) in the environmental and physical systems stream, helping to achieve PLO3.

Table 1: Degree Level Expectations, Program Learning Outcomes and Requirements

Degree-Level Expectations	Program Learning Outcomes	How the Program Design/Structure Supports the Degree Level Expectations
Expectations: The Honours Bachelor of Science (HBSc) Degree Program is awarded to students who have demonstrated the following program objectives:		
1. Depth and Breadth • Depth – Students will achieve mastery of a topic which is characterized by several of the following traits: understanding of advanced subject material as determined by those in the discipline or interdisciplinary area of study; command of increasingly advanced material that progressively probes (as aspect of) the subject more thoroughly; competence in using scholarly methods and research tools relevant to the discipline or interdisciplinary areas of study; ability to produce a substantial research or inquiry-based work; and capacity to draw together a broad range of prior learning	Depth and breadth of knowledge is defined in the Geographic Data Science Major as possessing a comprehensive knowledge of how geospatial data is collected, organized, and applied, with an emphasis on how this is done within their chosen stream. This is reflected in students who are able to: • Demonstrate Knowledge of Geographic Data Science Concepts (PLO1)	The program design and requirement elements that ensure these student outcomes for depth and breadth of knowledge are: Students begin with a high-level course (GGR172 Digital Earth) which provides a broad overview of geospatial technologies and how they relate to important social and environmental issues (e.g., privacy, climate change, etc.), helping to satisfy PLOs 1 and 2. Next, students would enrol in our two research methods courses (GGR270, GGR271) and a suite of core methods and theory courses in geographic data

Degree-Level Expectations	Program Learning Outcomes	How the Program Design/Structure Supports the Degree Level Expectations
and apply it to a challenging problem or topic. • Breadth – Students will gain an appreciation of the variety of modes of thinking, methods of inquiry and analysis, and ways of understanding that underpin different intellectual fields. They will further develop an understanding of how various areas of study intersect and allow for complementary insights on common issues or problems.	• Understand the Historical and Theoretical Foundations of GDS (PLO2) • Demonstrate Knowledge of a Subfield in Geography (PLO12)	science (GGR272, 273, 274, 315, and 373) which link to PLOs 1 and 2. Electives will help achieve further breadth by having students apply their knowledge and skills to domain specific courses – e.g., GGR372 (GIS for Public Health) – that focus on how geographic data science is used in multidisciplinary topics, linked to PLOs 1 and 3. Finally, the streams in the program will help with breadth (PLO3).
2. Knowledge of Methodologies • Students will have a working knowledge of different methodologies and approaches relevant to their studies and will be able to justify their choices among them when addressing questions that arise in their area of study.	Knowledge of Methodologies is defined in the [Geographic Data Science Major] as…ensuring students gain necessary background in a wide variety of methods and tools that are used to acquire, organize, analyze, and interpret geospatial data, while understanding broader conceptual issues in which the data are applied.	The program design and requirement elements that ensure these student outcomes for knowledge of methodologies are: Through the many methods courses students are required to take (e.g., requirements 3-6 in the draft calendar entry, PLOs 3 and 5) students will have a range of tools and approaches to answer

Degree-Level Expectations	Program Learning Outcomes	How the Program Design/Structure Supports the Degree Level Expectations
	This is reflected in students who are able to: • Apply Quantitative and Computational Methods (PLO3) • Develop and Implement Workflows (PLO4) • Demonstrate Proficiency Across Platforms (PLO5)	questions relevant to pressing issues in the stream they select. Methods courses are designed so that they begin with relatively straightforward and simple methods (E.g., GGR270 Analytical Methods and GGR272 Geographic Information and Mapping 1) and progress toward more complex methods and applications (e.g., GGR472 Developing Web Maps or GGR473 Geospatial Big Data) where students must develop and implement complex workflows (PLO4).
3. Application of Knowledge • Students will be able to apply their knowledge and understanding in such activities as: analyzing and evaluating material in their areas of study; developing effective arguments or interpretive approaches; forming hypotheses and posing questions relevant to their fields; crafting solutions to	Application of Knowledge is defined in the Geographic Data Science Major as using geospatial data and geographic data science methods to answer questions in a range of topics. This is reflected in students who are able to:	The program design and requirement elements that ensure these student outcomes for application of knowledge are: More advanced applications and approaches to solving problems are introduced in a scaffolded way throughout our series of elective courses

Degree-Level Expectations	Program Learning Outcomes	How the Program Design/Structure Supports the Degree Level Expectations
problems, collecting appropriate data, or interpreting novel situations and materials.	• Critically Evaluate Spatial Data and Technologies (PLO6) • Integrate Multidisciplinary Approaches Using Geographic Data Science (PLO8) • Design and Conduct Research (PLO11)	(e.g., GGR372 GIS for Public Health and GGR377 Intro. to Urban Data Analytics) which help students learn how to apply their knowledge (PLO6 and PLO8). All students will take courses with an independent research component where they form hypotheses, ask research questions, and design approaches and research methods to answer them (PLO11). Additionally, courses like GGR172 Digital Earth help students think critically about using appropriate data and ethical and responsible use of spatial data (PLO6).
4. Communication Skills • Students will be able to: organize ideas into coherent arguments supported by appropriate kinds of evidence; structure their communications for varying audiences and contexts; produce effective written work; present their work orally or visually where appropriate to the area of study.	Communication skills are defined in the Geographic Data Science Major as being able to convey complex geographic data science concepts and findings clearly and effectively to diverse audiences, including the use of text, visuals, and oral presentations.	The program design and requirement elements that ensure these student outcomes for communication skills are: Specific courses like GGR376H1, Geovisualization, are geared toward enabling students to effectively communicate spatial data via figures and visuals, and to communicate and

Degree-Level Expectations	Program Learning Outcomes	How the Program Design/Structure Supports the Degree Level Expectations
	This is reflected in students who are able to: • Visualize and Interpret Spatial Data (PLO9) • Communicate Effectively (PLO10)	constructively critique these visualization products via text and oral presentations (PLO9). Multiple courses also require students to communicate (PLO10) their findings effectively (e.g., GGR472, Developing Web Maps, has a final group presentation where students present an interactive web map they programmed using JavaScript and GGR172 Digital Earth involves short presentations by students about maps they create).
5. Awareness of Limits of Knowledge • Students will gain an understanding of the limits to their own knowledge and to the knowledge within their areas of study. They will also gain an appreciation of how uncertainty and ambiguity might influence analyses and interpretations.	Awareness of Limits of Knowledge is defined in the Geographic Data Science Major as a student being able to critically assess the accuracy, reliability, and ethical implications of spatial data and results from geographic data science methods, considering their impact on society and the environment, as well as geographic data science's impact on important topics like privacy and equity.	The program design and requirement elements that ensure these student outcomes for awareness of limits of knowledge are: Our foundational course, GGR172 Digital Earth, spends substantial time considering ethical and equity related questions linked to using spatial data and geographic data science. Issues like privacy and past/current surveillance of racialized populations are discussed. All

Degree-Level Expectations	Program Learning Outcomes	How the Program Design/Structure Supports the Degree Level Expectations
	This is reflected in students who are able to: • Critically Evaluate Spatial Data and Technologies (PLO6)	our methods courses emphasize the limits to spatial data, with many considering topics like the modifiable areal unit problem (for example, in GGR272 and GGR373), which is linked to PLO6.
6. Autonomy and Professional Capacity • Students will develop competencies critical to their pursuit of further study, employment, community involvement, and other activities that require life-long learning, decision-making, and personal and social responsibility.	Autonomy and Professional Capacity is defined in the Geographic Data Science Major as being able to develop relevant questions and understanding where and how to find the information needed to answer them. This is reflected in students who are able to: • Promote Ethical and Responsible Use of Spatial Data (PLO7)	The program design and requirement elements that ensure these student outcomes for awareness of autonomy and professional capacity: Students in this major will be able to critically evaluate spatial data and technologies in a way that promotes ethical and responsible use of spatial data (PLO7), helping them be responsible employees and community members (explicitly covered in courses like GGR172 Digital Earth, GGR272 Geographic Information and Mapping I, and GGR376 Geovisualization). The

Degree-Level Expectations	Program Learning Outcomes	How the Program Design/Structure Supports the Degree Level Expectations
	• Communicate Effectively (PLO10)	program will also enable students to be effective communicators that can position them to highlight the many methods and skills they've developed to help them progress in their chosen career paths or further study (PLO10)

Proposed program mode of delivery

The program mode of delivery will be in-person. Most courses will be in-person, synchronous courses. Early courses in the program (e.g., GGR172H1, Digital Earth, and GGR272H1, Geographic Information & Mapping 1) will be delivered via a lecture format, or in a lecture format with break out sections in a computer lab environment where instructors can help students apply the concepts covered in class. Some options for asynchronous online learning will also be available at this level. Currently we offer GGR272H1 as both an in-person lecture as well as an asynchronous online course. As students advance, courses will have smaller enrolments and involve active learning strategies (in-person synchronous), mostly happening in computer lab environments. For example, GGR 373H1, Advanced Geographic Information Systems, typically begins with a lecture on a particular method or approach, then shifts to an individual or group activity focused on the content of the lecture and concludes with students implementing the method or approach on a computer, with interactive support from the instructor. In teaching many of these courses for over a decade, instructors have found the active learning, in-person, synchronous format allows students to ask questions and receive answers in real-time, while helping instructors deal with any software or hardware issues that might keep a student from progressing. This aligns with the goal of creating greater learning variability, flexibility, and adaptability, in line with universal design principles. This method of delivery enhances student engagement, whereby students are more meaningfully engaged with course material, take a more active role in their own learning, and build a sense of community in the classroom

How the curriculum addresses the state of the discipline

The established courses in this program have been designed to tackle the current state of the discipline by focusing on modern approaches and systems. For example, our courses GGR274H1 (Introductory Computation and Data Science for the Social Sciences), GGR375H1 (Introduction to Programming in GIS), and GGR473H1, Geospatial Big Data, focus on the tools, methods, and theories being applied in the private, public, and research sectors. A course like GGR372H1, GIS for Public Health, applies geographic data science methods to the topical area of mapping health (the importance of which was made clear during the recent COVID-19 pandemic). Finally, our course descriptions have been written to remain platform agnostic – meaning that we can update the technical approach as they evolve. For example, we do not name specific software packages (e.g., ArcGIS) or scripting languages (e.g., Python), as we know these may be replaced over time.

Experiential Learning

As previously noted, we will draw on and build on experiential learning opportunities and innovative practices in our current geographic data science curriculum. For example, in 2023-24, students in GGR472H1, Developing Web Maps, participated in A&S's Experiential Learning and Outreach Support's (ELOS) "Sandbox," where they helped develop useable interactive online maps to inform TDSB students and parents about how they can use active transportation (see: https://www.artsci.utoronto.ca/faculty-staff/experiential-learning/curriculum-integrated/sandbox). Our GGR493Y1 Geography Professional Experience course often places students with companies or government agencies where students can apply the skills and knowledge acquired through the Geographic Data Science Major.

Courses with experiential learning are currently electives and can count toward the requirements of all the streams. If students wish, they can complete the program without engaging in courses with a major experiential learning component. We aim to further these offerings in time by working with ELOS, dependent on resources.

6 Assessment

a) Discuss the appropriateness of the methods for assessing student achievement of the program-level learning outcomes and degree level expectations.

m) Discuss the appropriateness of the plans to monitor and assess the following:

1. The overall quality of the offering's structure
2. Whether the program and/or the offering within the program is achieving in practice its proposed objectives
3. Whether its students are achieving the program-level learning outcomes
4. How the resulting information will be documented and subsequently used to inform continuous program improvement.

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Response:

PLO List	[Exams]	[Written Papers]	[Oral Presentations]	[Labs/Case Studies]	[Practice Observation]
PLO1: Demonstrate Knowledge of Geographic Data Science (GDS) Concepts: Understand and articulate key concepts in geographic data science, including spatial data, geospatial technologies (e.g., geographic information systems [GIS], global positioning systems [GPS]), and their applications across various fields.	x	x	x	x	x
PLO2: Understand the Historical and Theoretical Foundations of GDS: Demonstrate knowledge of the historical development and theoretical foundations of geographic data science, including key contributions from the field of geography.	x	x			
PLO3: Apply Quantitative and Computational Methods: Apply established quantitative and	x	x		x	x

computational tools, techniques, and frameworks—such as spatial analysis using geographic information systems, statistical analysis, machine learning models, and data visualization techniques—to solve spatial problems.					
PLO4: Develop and Implement Workflows: Design, develop and implement comprehensive workflows that transform raw spatial data into actionable outputs, including data cleaning, integration, analysis, visualization, and the creation of final cartographic or analytical products, with an emphasis on reproducibility.		x		x	
PLO5: Demonstrate Proficiency Across Platforms: Show competency in applying a range of geographic data science methods and theories across multiple platforms and software packages such as, for example, the use of scripting, web-based mapping applications, and mobile GIS.	x			x	
PLO6: Critically Evaluate Spatial Data and Technologies: Critically assess the accuracy, reliability, and ethical implications of spatial data and results from geographic data science methods, considering their impact on society and the environment.	x	x	x	x	
PLO7: Promote Ethical and Responsible Use of Spatial Data: Advocate for the ethical and responsible use of spatial data and geospatial technologies, considering issues of privacy, equity, accessibility, and social justice.		x	x	x	x
PLO8: Integrate Multidisciplinary Approaches Using Geographic Data Science: Apply multidisciplinary approaches to solve complex problems in human, urban, or physical/environmental systems (depending on stream) using geographic data science.		x		x	x
PLO9: Visualize and Interpret Spatial Data: Create effective visualizations of spatial data and non-spatial data to support decision-			x	x	x

making and communicate insights to various audiences, including but not limited to community, government, and industry stakeholders.					
PLO10: Communicate Effectively: Communicate complex geographic data science concepts and findings clearly and effectively to diverse audiences, including but not limited to community, government, and industry stakeholders, including the use of text, visuals, and oral presentations.		x	x		x
PLO11: Design and Conduct Research: Design and conduct academic or applied research projects via courses or experiential learning opportunities that utilize geographic data science methods to address significant societal and/or environmental issues.		x		x	x
PLO12: Demonstrate Knowledge of a Subfield in Geography: Understand and articulate key concepts in human geography, urban studies/planning, or physical/environmental geography (depending on stream), including methods and ways of knowing that go beyond data science.	x	x			

We strategically employ a wide range of assessments in our established geographic data science courses that we have refined as the courses have evolved. For instance, some PLOs, like PLO1 (demonstrate knowledge in geographic data science concepts) will be assessed using all five assessment types. For others, it makes sense to assess students' learnings via exams and lab work (e.g., PLO6, demonstrate proficiency across platforms).

A typical example of lab work would involve a demonstration of a process by the instructor using example data. Then students would be required to take a new example dataset and apply the process independently.

Exams in this program would require students to write about workflows, write short answer responses to questions about how spatial data are used, and to express

whether students understand key concepts (e.g., map projections and their impacts on distance measurements).

Written papers and research projects would take the shape of reports, where students must introduce an applied question, discuss the data and methods being used to answer the question, present results from their analysis, and discuss what their findings mean. Projects like this may also involve students producing maps and supporting narrative text in various formats such as web pages and posters, as well as an oral presentation component where students must communicate their process and findings verbally.

Finally, some students will take a professional experience course or engage in experiential learning. These opportunities will provide students with practice-based assessments, where they must complete tasks relevant to the organization they are working with.

Monitoring the Quality of the Program

The Department of Geography and Planning's Chair, Associate Chair Undergraduate, and undergraduate curriculum committee will continue to monitor students' grades and course evaluations each term to ensure our established classes continue to offer high-quality content. In addition, the undergraduate committee will monitor enrolments to understand if students are leaving the program due to possible issues in the classroom. This work will be done annually and corresponds with the Department's normal practice to monitor all program enrolments and course marks each term to ensure we are delivering top-quality programs.

Finally, the department will conduct an exit survey with several of the first cohorts of graduates to assess the extent to which they feel the program learning outcomes were achieved and learn what they found helpful and what might need improving. Results from these surveys will be assessed by our undergraduate curriculum committee to make recommendations about how we structure our courses and program requirements, as well as considering possible minor changes to the program (for example, adjusting the minimum grades for entry). These recommendations will be considered by the Department's St. George Council, who will advise the Chair on changes that should be implemented.

Beyond this, the UTQAP cyclical review process will help us identify potential issues and opportunities every eight years.

7 Need and Demand

a. Provide a brief description of the need and demand for the proposed program, including information on student demand and internal cognate and external comparator programs. Please fill out and refer to the table in Appendix D listing the comparator programs.

Response:

With many industries in Canada using geospatial analytics (e.g., occupations in sectors like finance, urban development, and natural resources, to name only a few), a faculty complement actively engaged in cutting edge Geographic Data Science research and pedagogy, and a related minor that has experienced recent growth, there is clear rationale for the Department of Geography & Planning to launch this new offering for our students.

There is a consensus among market research firms that geographic data science is a growing field across North America and globally. One report from Fortune Business Insights projects a compound annual growth rate of 12.8% from 2021 to 2028, with the global geospatial analytics market size increasing from USD 56.98 billion in 2020 to USD 147.58 billion in 2028.[3] Another financial report -states geospatial solutions market revenue will grow rapidly, led by growth in the North American market through 2036.[4]

At the University of Toronto, the closest comparator programs are the Geospatial Data Science (Major and Minor) at University of Toronto Mississauga, and the Geographic Information Science (Minor) at University of Toronto Scarborough. UTM's Geospatial Data Science Major (formerly called the Geographic Information Science Major), is very similar to the proposed Major with the exception that students are not required to complete a stream or take courses in an area of specialization. This is unique to the

[3] https://www.fortunebusinessinsights.com/geospatial-analytics-market-102219
[4] https://finance.yahoo.com/news/geospatial-solutions-market-revenue-hit-113000431.html

proposed Major. UTSC's GIS Minor is focused on geographic information science methods but being a minor offering has a more limited scope

The proposed major program has several close comparator programs in Ontario, Canada, and beyond, illustrating the demand for undergraduate programming in this field. **Toronto Metropolitan University** (TMU) offers a **BA program in Geographic Analysis**, which encourages students to study interactions between people and their natural and built environments through analyzing data. The proposed Major has a heavier emphasis on computation compared to TMU's program – requiring students to take courses like GGR274H1 (data science for social scientists) that teach data management and analysis using coding languages such as Python. It also lists courses like GGR375H1(Introduction to Programming in GIS) as electives to further develop skills in computational methods, providing a greater focus on data science than TMU's program offers. In this aspect, **Western University's Honours Specialization in Geographic Information Science – BSc** is more similar to the proposed Major since it includes computer science courses and teaches data science methods. The proposed Major is differentiated from Western's program through its unique requirement for students to complete 1 stream or area of specialized knowledge. Indeed, none of the closest comparator programs to the proposed Major offer streams that allow students to focus on a curated area of specialization. This enables students to graduate with a strong foundational knowledge in methods and theories in a specific applied area in addition to the technical skills they will gain. The pedagogical rationale here is to graduate students who can develop, ask, and answer important questions relevant to their respective streams.

The University of Waterloo, Carleton University, and University of Calgary offer **Bachelor programs in Geomatics**, which include a shared emphasis on computer science and data-driven solutions with our proposed Major, but these are more oriented towards physical and environmental science and do not offer students an opportunity to explore social systems, whereas the proposed Major is rooted in the social sciences. None of these 3 programs are structured to require completion of a stream.

The situation is similar for our international comparators: **University of Illinois Urbana-Champaign** offers a **GIS Concentration (BSc) program** with in-depth GIS training and examination of environmental and social systems, but the streams in urban, human, or environmental/physical geography of our proposed Major make it unique. The same is true of **Ohio State University's BS, Geographic Information Sciences. UC Santa Barbara's BA in Geography with a Geographic Information Science Emphasis**

requires students to complete work in 3 concentration areas, ensuring broad coverage of the field. This approach is different to the proposed Major, which offers an opportunity for a student to focus on a core part of the discipline of geography, and is a distinctive aspect of the proposed program.

In addition to these close comparators, programs that fit generally within the disciplinary area, but are not viewed as close comparators, are found at Texas A&M University, and the University of Maryland. The complete list of comparators can be found in **Appendix D**, below.

b) In 500 words or less, discuss the labour market demand for the program, including three occupations that graduates from the proposed program may be employed in, the demonstrated demand for employment the professions and employment prospects.

Response:

To assess labour demand, we identified a number of relevant job categories using the Government of Canada's job bank and US equivalent (O*NET OnLine).[5]

We considered five job categories in the Government of Canada's job bank: Data Analyst – Informatics and Systems (NOC 21223), Geographic Information Systems Analyst (NOC 22214), Spatial Information Systems Engineer (NOC 21300), Business Analyst, Informatics (NOC21221), and Environmental Science Manager (NOC 20011). These categories are chosen as they align with job titles of our alumni who pursued careers in geographic data science and who are members of our U of T GIS alumni LinkedIn group. Median hourly wages for these positions ranged from $32.82 CAD to $57.00 CAD (roughly equivalent to $68,000 to $118,000 per year).

The job bank reports that job prospects in Ontario are "good" for Data Analyst, Spatial Information Systems Engineer, Business Analyst, and Environmental Science Manager, and "moderate" for Geographic Information Systems Analyst. The job bank also reports there is a shortage for Data Analyst, Spatial Information Systems Engineer, and

[5] Research was conducted August 2024 using the Federal Government of Canada's Job Bank Explorer: https://www.jobbank.gc.ca/trend-analysis and US Data was compiled using U.S. Department of Labor's O*Net Online tool: https://www.onetonline.org/.
The Government of Ontario's Career Explorer shows similar data: https://www.services.labour.gov.on.ca/labourmarket-ui/search.

Business Analyst. There is a note that there is a “surplus” for Geographic Information Systems Analyst, but our program aims to provide students with skills more aligned with the other career pathways, for instance students may apply their data science skills in urban planning, environmental consulting, or alternative energy roles that require the ability to consider spatial variables when making important decisions.

We considered three job categories from O*NET OnLine to assess job prospects in the US market: Geographic Information Systems Technologists and Technicians (15-1299.02), Cartographers and Photogrammetrists (17-1021.00), and Data Scientists (15-2051.00). This job bank considers all three to have a ‘bright outlook’ and demand for employees in this space will grow rapidly. They also report a median wage (in USD) of $104,920 for Geographic Information Systems Technologists and Technicians, $108,020 for Data Scientists, and $76,210 for Cartographers and Photogrammetrists.

8 Enrolment

c) Please provide details regarding the anticipated in-take by year, reflecting the expected increases to reach steady state. Include approximate domestic/international mix. This table should reflect normal estimated program length. (Please adjust the table as necessary.)
d) Please provide an explanation of the numbers shown and their relation to the Faculty/division's enrolment plan. Please be specific where this may differ from approved enrolment plans.

Response:

Table 2: Enrolment Projections

Year of Study	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33
Year 1	0	0	0	0	0	0	0
Year 2	30	45	60	70	70	70	70
Year 3	0	27	40	54	63	63	63
Year 4	0	0	24	36	49	57	57
Total	30	72	124	160	182	190 (steady state)	190

We anticipate the major will steadily grow, from its launch in 2026 until 2031, when it will reach a steady state of 190 students in the program (with annual intake cap of 70 students). We assume a ~10% attrition rate as students progress through the degree.

Students in this program will be drawn from A&S's current divisional enrolment envelope, as opposed to net new enrolments to the Faculty. We anticipate that students taking this program may be drawn from other Department of Geography & Planning programs, including the Geographic Information Systems Minor, programs in Human Geography, Environmental Geography, Urban Studies, or Physical and Environmental Geography (enrolment in the programs in Physical and Environmental Geography is currently administratively suspended). In addition, students who have an interest in applications of computer science or statistical sciences may decide to pursue the new Geographic Data Science Major. To complete their degree, students will have to pair

with proposed Major with other programs. We anticipate pairings with programs like Earth Science and Environmental Studies, or programs in the social sciences (e.g., Sociology, Anthropology, Economics). Finally, students taking the Digital Humanities Minor may find the new program appealing and would be able to take both.

To facilitate student wayfinding and students' awareness and understanding of the new program in context of the Department's existing programs, the department will refresh their messaging to brand the new Major as visible and distinctive and to showcase the unique aspects of the principal 'onramp' course, GGR172H1, Digital Earth. The Department will enhance the new program's visibility through departmental website updates, newsletters, and social media content. They plan to work with cognate units to consider how to effectively advertise to prospective students in these units. Faculty in the Department will be encouraged to promote the program through their own communication outlets, i.e., in their courses, labs, and social media.

9 Consultation

a) Describe consultation with internal (faculty, students, cognate units, etc., as appropriate) and external stakeholders (alumni, community or professional organizations, etc., as appropriate).

Response:

Internal consultation

The initial consultations for this new program occurred when the department did its 2021 Unit-level Academic Plan. Section 2.2.2.3. discussed the potential for a new major in geographic information science.

Further consultation occurred during a Department of Geography & Planning retreat focused on our undergraduate programs on May 15th, 2024. A new Geographic Data Science Major was discussed as a part of a "Strengths, Opportunities, Aspirations, and Results" analysis at the retreat that considered all of the Department's current and future programs. Additionally, the entire Department held a session at the retreat devoted specifically to the structure of the new Major. In these discussions, faculty considered the value of incorporating streams into the Geographic Data Science Major, and we agreed that this approach would enable students to both learn innovative ways to use and analyze spatial data in addition to asking interesting geographic questions. There was unanimous support for moving forward with the new Major.

A draft proposal was written in the fall term of 2024 by the Department's chair, who was in regular contact with the Vice Dean Academic Planning's office. An update on the draft proposal was given at the Department's St. George Council meeting, which includes all faculty and student representatives, on November 19th, 2024.

A draft document was shared with department faculty who teach courses related to geographic data science on November 27th, 2024, with feedback received on December 9th 2024. After incorporating feedback from these faculty, the draft was sent to the office of the Vice Dean Academic Planning for further feedback, on December 11th.

A revised draft document was shared with all department faculty in the Department of Geography & Planning on February 7th, 2025 with feedback and concerns due back by

March 7th, 2025. Two faculty replied with minor edits and suggestions, and all of these were incorporated.

The proposed Major was discussed at all four faculty meetings held in the Department of Geography & Planning during the 2024-2025 academic year. No concerns were raised through these discussions.

Consultation with cognate units at A&S and across the wider University of Toronto

In November and December of 2024, we reached out to the chairs who lead cognate units, or units where we have included a course in our course requirements. A&S units that have a course in our requirements include the Departments of Computer Science, Statistical Sciences, and Earth Sciences. Other relevant units contacted include the Munk School of Global Affairs & Public Policy, the Department of Sociology, the Department of Ecology and Evolutionary Biology, the Department of Economics, the School of Environment, the Centre for Criminology and Sociolegal Studies, Woodsworth College (because of their minor in Digital Humanities), and across the wider University the Department of Geography, Geomatics and Environment at UTM.

We shared our draft calendar copy that described the new major and a draft of the completion requirements with specific courses that would be included in the program. We also offered to meet to discuss the new major in more detail. The table below outlines who was contacted, when they were contacted, and their response.

Of the units that responded, all were supportive of the new Major moving forward. The Departments of Computer Science, Statistical Sciences, and Earth Sciences all agreed to have their courses listed in our course requirements. Statistical Sciences also agree to 2-4 priority enrolments (i.e., space for 2 to 4 students in the proposed Major) in STA272H1. Note, STA272H1 is not a required course, so it will not produce a bottleneck for students' progress through the program.

The table below summarizes these consultations performed by the Chair of Geography & Planning in Fall 2024 and Winter 2025.

Unit	Contact(s)	Date of First Contact	Date of Second Contact	Response

Statistical Sciences, A&S	Nathan Taback, Sebastian Jaimungal	2024-11-06	N/A	Supportive, happy for us to include STA272H1 and include 2-4 priority enrolment seats for students in GDS
Computer Science, A&S	David Liu, Eyal de Lara	2024-11-06	N/A	Supportive, happy for us to include CSC271H1; happy for us to use CSC108H1 and CSC110Y1 as a pathway into the program.
Munk School of Global Affairs & Public Policy, A&S	Janice Stein	2024-11-06	N/A	Supportive, follow up conversation with Wilson Prichard 2024-12-04
Sociology, A&S	Shyon Baumann	2024-11-06	N/A	Supportive
Ecology & Evolutionary Biology, A&S	Joel Levine, Nicole Mideo	2024-11-25	N/A	Supportive
School of Environment, A&S	Steve Easterbrook	2024-11-06	2024-12-04	Supportive
Woodsworth College	Carol Chin	2024-11-06	2024-12-04	Supportive, follow up conversation scheduled for 2025-06-05 to discuss further collaboration
Economics, A&S	Ettore Damiano	2024-11-06	2024-12-04	Chair of Economics was supportive in discussion with Chair of Geography & Planning
Criminology and Sociolegal Studies, A&S	Kamari Clarke	2024-11-06	2024-12-04	Supportive
Earth Sciences, A&S	Sarah Finkelstein	2024-11-06	2024-12-04	Supportive
Geography, Geomatics &	Laura Brown	2024-11-06	2024-12-04	Supportive

Environment (UTM)				
Department of Physical and Environmental Sciences – DPES - (UTSC)	George Arhonditsis	2025-03-13		The Chair of GGR shared program description with the Chair of DPES. The Chair of DPES felt there may be some overlap with their undergraduate major in Environmental Science. The Chair of GGR shared a full draft proposal and clarified the ways that the two programs, offered on two different campuses, are different.
Department of Human Geography (UTSC)		2025-03-13	2025-05-23	Supportive

On March 13, 2025, a brief overview of the proposal was presented by the A&S Vice-Dean, Academic Planning, to the Tri-Campus Deans group. The Vice-Dean noted that a draft proposal would be circulated in April to UTM and UTSC Dean's Offices for feedback from their Offices and from cognate units they can share the proposal with. Comments from the group at the Tri-Campus Deans meeting were supportive.

Also on March 13, 2025, the Chair of Geography & Planning emailed the Chair of the Department of Human Geography and the Chair of Department of Physical and Environmental Sciences (DPES) at UTSC sharing a description of the proposed program. The Chair of DPES felt there may be some overlap with their undergraduate major in Environmental Science. The Chair of Geography & Planning provided a full draft proposal and clarified the ways that the two programs, offered on two different campuses, are different. No response was received from the Department of Human Geography.

A March 14 draft proposal was shared with A&S's Data Sciences Planning Committee in advance of their March 18, 2025, meeting, for discussion and feedback. Per the Committee's terms of reference, its primary goal is to, "ensure a coherent landscape in

computing & data science education by reviewing and making recommendations to units bringing forward computing and/or data science education proposals, so that new proposals and modifications are consistent with other courses and programs across the Faculty of Arts & Science and fill existing A&S data science education gaps." At the meeting, the Chair of the Department of Geography & Planning presented a brief overview of the proposal and took questions from the group. Comments were overall positive and supportive. Questions prompted the addition of language to the proposal about which rounds of program enrolments the program will be available for, and when the courses required for admission in the program are offered throughout the academic year.

The March 14 draft was also shared with A&S's Chairs, Principals, and Academic Directors (CPAD) group in advance of their March 21, 2025, meeting. The Vice-Dean, Academic Planning, presented a brief overview of the proposal. No questions or comments were received at the meeting.

On April 2, 2025, an April 2 draft was sent to the Dean's Offices of cognate divisions for information and feedback from parties in their Dean's Offices and/or cognate units. The divisions contacted were UTM; UTSC; the Faculty of Information (iSchool); Temerty Faculty of Medicine; the Faculty of Applied Science & Engineering; the John H. Daniels Faculty of Architecture, Landscape & Design; the Joseph L. Rotman School of Management (RSM); the Dalla Lana School of Public Health; and Ontario Institute for Studies in Education. Feedback was requested by April 14, 2025. Responses were received from RSM, the Faculty of Applied Science & Engineering, the iSchool, and UTSC, and feedback was broadly supportive. UTSC's Department of Physical & Environmental Sciences noted they had previously queried the potential appearance of overlap between the Geographic Data Science Major and UTSC's Major in Environmental Sciences but appreciated the correspondence they received from the Chair of Geography & Planning in March 2025 that clarified and reiterated the primacy of geographic data science in the proposed Major and the fact that physical and environmental geography is one of three streams within it. On May 30, 2025, feedback on the April 2 draft was received from UTM's Department of Geography, Geomatics and Environment. The Department stated that they believe the new Major in Geographic Data Science at St. George will make the tri-campus Esri Centre of Excellence stronger, which would benefit all GIS programs at all campuses. They praised the application of geospatial data in social science as a unique direction compared to other GIS programs and that the new program's aims to engage underrepresented groups aligns with U of T's priority. They also shared some ideas for courses that might strengthen the

program. As of June 12, no concerns have been raised by Temerty Faculty of Medicine; John H. Daniels Faculty of Architecture, Landscape & Design; Dalla Lana School of Public Health; and the Ontario Institute for Studies in Education.

Consultation with students

The Department also consulted Geography & Planning undergraduate students, hosting a Town Hall on February 12, 2025, with representation from the Toronto Undergraduate Geography Society (TUGS) and the Urban Studies Student Union (URSSU). The plans for the new Major were shared with students, followed by a Q&A period. Feedback on the idea for the Major was positive. The plans for and development of the new Major have also been shared at Department meetings (Department Council), which include a meeting each term that has student representation.

10 Resources

10.1 Faculty

Please fill out the table below. In a separate appendix provide all CVs of all faculty in the table.

Table 3: Faculty Complement (please list alphabetically by category)

Name	Unit of Primary Budgetary Appt and %	Unit of Other Budgetary Appt and % (if applicable)	Graduate Faculty Membership Status (e.g., Associate/ Full privileges)	Commitment to Other Programs (Please list other programs in which the person routinely teaches/ supervises.)	Nature of Contribution to This Program (Course instructor [CI], thesis supervision [TS], clinical or practice supervisor [C/PS]. Please list the courses each member will teach.)
Tenure Stream: Full					
Karen Chapple	Geography & Planning, A&S, 100%	NA	Full	Human Geography (MI, MA, SP), Geographic Information Systems (MI)	CI, PS - GGR377H1

Name	Unit of Primary Budgetary Appt and %	Unit of Other Budgetary Appt and % (if applicable)	Graduate Faculty Membership Status (e.g., Associate/ Full privileges)	Commitment to Other Programs (Please list other programs in which the person routinely teaches/ supervises.)	Nature of Contribution to This Program (Course instructor [CI], thesis supervision [TS], clinical or practice supervisor [C/PS]. Please list the courses each member will teach.)
Jing Chen	Geography & Planning, A&S, 100%	NA	Full	Environmental Geography (MI, MA, SP), Physical and Environmental Geography (MI, MA, SP), Geographic Information Systems (MI)	CI, PS – GGR315H1, 415H1
Sarah Wakefield	Geography & Planning A&S, 100%	NA	Full	Human Geography (MI, MA, SP), Environmental Geography (MI, MA, SP)	CI – GGR271H1
Michael Widener	Geography & Planning, A&S, 100%	NA	Full	Human Geography (MI, MA, SP), Environmental	Chair, CI, PS - normally GGR172H1, 270H1, 274H1, 372H1, 472H1;

Name	Unit of Primary Budgetary Appt and %	Unit of Other Budgetary Appt and % (if applicable)	Graduate Faculty Membership Status (e.g., Associate/ Full privileges)	Commitment to Other Programs (Please list other programs in which the person routinely teaches/ supervises.)	Nature of Contribution to This Program (Course instructor [CI], thesis supervision [TS], clinical or practice supervisor [C/PS]. Please list the courses each member will teach.)
				Geography (MI, MA, SP), Physical and Environmental Geography (MI, MA, SP), Geographic Information Systems (MI)NA	currently course release for chair role
Jane Liu	Geography & Planning, A&S, 50% (part-time)	NA	Full	Environmental Geography (MI, MA, SP), Physical and Environmental Geography (MI, MA, SP), Geographic Information Systems (MI)	CI, PS – GGR315H1, 415H1
Tenure Stream: Associate					

Name	Unit of Primary Budgetary Appt and %	Unit of Other Budgetary Appt and % (if applicable)	Graduate Faculty Membership Status (e.g., Associate/ Full privileges)	Commitment to Other Programs (Please list other programs in which the person routinely teaches/ supervises.)	Nature of Contribution to This Program (Course instructor [CI], thesis supervision [TS], clinical or practice supervisor [C/PS]. Please list the courses each member will teach.)
None					
Tenure Stream: Assistant					
Alex Ramiller	Geography & Planning, A&S, 100%	NA	Associate	Planning MScPL, Urban Studies (MI, MA, SP), Human Geography (MI, MA, SP), Geographic Information Systems (MI)	CI - GGR274H1
Lindsey Smith	Geography & Planning, A&S, 100%	NA	Associate	Human Geography (MI, MA, SP), Environmental Geography (MI, MA, SP), Physical and Environmental	CI, PS – GGR272H1, 273H1, 372H1, 376H1, 472H1, 473H1

Name	Unit of Primary Budgetary Appt and %	Unit of Other Budgetary Appt and % (if applicable)	Graduate Faculty Membership Status (e.g., Associate/ Full privileges)	Commitment to Other Programs (Please list other programs in which the person routinely teaches/ supervises.)	Nature of Contribution to This Program (Course instructor [CI], thesis supervision [TS], clinical or practice supervisor [C/PS]. Please list the courses each member will teach.)
				Geography (MI, MA, SP), Geographic Information Systems (MI)NA	
Teaching Stream: Full					
Don Boyes	Geography & Planning, A&S, 100%	NA	Associate	Human Geography (MI, MA, SP), Environmental Geography (MI, MA, SP), Physical and Environmental Geography (MI, MA, SP), Geographic Information Systems (MI)NA	CI, PS – GGR272H1, 273H1, 373H1, 462H1; currently course release while Assoc Dean

Name	Unit of Primary Budgetary Appt and %	Unit of Other Budgetary Appt and % (if applicable)	Graduate Faculty Membership Status (e.g., Associate/ Full privileges)	Commitment to Other Programs (Please list other programs in which the person routinely teaches/ supervises.)	Nature of Contribution to This Program (Course instructor [CI], thesis supervision [TS], clinical or practice supervisor [C/PS]. Please list the courses each member will teach.)
Non-Tenure Stream (i.e., CLTA)					
Caitlin Cunningham (Teaching Stream CLTA)	Geography & Planning, A&S, 100%	NA	None	Human Geography (MI, MA, SP), Environmental Geography (MI, MA, SP), Physical and Environmental Geography (MI, MA, SP), Geographic Information Systems (MI)NA	CI, GGR172H1, 272H1, 273H1, 373H1, 376H1, 462H1
Ignacio Tiznado-Aitken (Non-tenure Stream CLTA)	Geography & Planning, A&S, 100%	NA	Associate	Human Geography (MI, MA, SP), Environmental Geography (MI, MA, SP), Physical and	CI, GGR270H1, 375H1, 386H1

Name	Unit of Primary Budgetary Appt and %	Unit of Other Budgetary Appt and % (if applicable)	Graduate Faculty Membership Status (e.g., Associate/ Full privileges)	Commitment to Other Programs (Please list other programs in which the person routinely teaches/ supervises.)	Nature of Contribution to This Program (Course instructor [CI], thesis supervision [TS], clinical or practice supervisor [C/PS]. Please list the courses each member will teach.)
				Environmental Geography (MI, MA, SP), Geographic Information Systems (MI)NA	
Sessional Lecturer					
Kristian Larsen (SL3)		NA	NA	Human Geography (MI, MA, SP), Environmental Geography (MI, MA, SP), Physical and Environmental Geography (MI, MA, SP), Geographic	CI – GGR272H1, 273H1, 372H1, 462H1

Name	Unit of Primary Budgetary Appt and %	Unit of Other Budgetary Appt and % (if applicable)	Graduate Faculty Membership Status (e.g., Associate/ Full privileges)	Commitment to Other Programs (Please list other programs in which the person routinely teaches/ supervises.)	Nature of Contribution to This Program (Course instructor [CI], thesis supervision [TS], clinical or practice supervisor [C/PS]. Please list the courses each member will teach.)
				Information Systems (MI)NA	

10.1.1 All New Programs

Given the program's planned/anticipated class sizes and cohorts (enrolment section) as well as its program level learning outcomes please discuss:

e) Participation of a sufficient number and quality of core (i.e., appointed) faculty who are competent to teach and/or supervise in and achieve the goals of the program and foster the appropriate academic environment.

Response:

The Department of Geography & Planning is home to some of the world's top scholars in geographic data science, including award winning instructor Professor Don Boyes, two Canada Research Chairs (Professor Michael Widener and Assistant Professor Michelle Daigle), and other highly accomplished researchers and instructors.

The core geographic data science faculty complement that will support the proposed Geographic Data Science Major includes five tenure-stream faculty: three Professors at 100% (Chapple, Chen, and Widener), one Professor at 50% (Liu), and one Assistant Professor (Smith) at 100%. As noted below, Professor Chen is retiring (declared), and the Department has requested a replacement for his line at the 2025 Arts & Science Faculty Appointments Committee. The committee recommended submitting the request in the 2026 cycle after Professor Chen has officially retired. The Dean's office recognizes the importance of a new faculty line to the future success of the new GDS major and is supportive of the Department's submission of a request for an appointment in line with this proposal, through the competitive FAC process. The Department plans for this FAC request to include expertise in geospatial artificial intelligence (AI) as a desired skill, in order to expand the Department's expertise in spatial AI. In the teaching-stream, we have one Professor (Boyes) at 100%. The program will also be supported by two CLTAs at 100% (Tiznado-Aitken and Cunningham) with exceptional research and teaching records, comparable to tenure-track faculty at peer institutions and one sessional instructor.

Professors Boyes, Chapple, and Widener currently have reduced teaching loads due to administrative assignments; however, given the time-limited nature of academic administrative positions, it is anticipated that each faculty member will return to teaching in the unit and supporting the Geographic Data Science Major when their administrative assignments have ended. In 2024, Professors Tiznado-Aitken and Cunningham were

hired to cover Professor Boyes and Widener's courseloads. Professor Chapple teaches one course at the undergraduate level (GGR377H1 Intro to Urban Data Analytics). Both Professors Chapple and Widener still supervise students interested in completing independent research projects or reading courses. Other Department faculty who are qualitative researchers will contribute to the program by teaching the required qualitative methods course, GGR271H (Social Research Methods). In 2025-26, this will be taught by Professor Sarah Wakefield, tenured Professor and Graduate Chair.

Finally, the department recently hired a new Assistant Professor, Alex Ramiller, who will begin July 1st, 2025. We anticipate that Professor Ramiller will contribute one undergraduate course to our Geographic Data Science Major (scheduled for GGR274H1 in 2025-2026).

The current faculty mix is appropriate for this proposed Major because there is a good mix of more senior faculty with decades of experience teaching and researching in the area of geographic data science and more junior faculty who bring the latest methods and approaches to teaching geographic data science. In addition, because geographic data science is an applied data science it is appropriate to have mostly research-stream faculty supporting the Major, as they have experience applying these methods to real-world problems (e.g., how to use spatial data to measure how healthy cities are). The Department's teaching-stream faculty complement this applied focus by providing innovative pedagogical approaches to learning new geographic data science methods and developing exciting classroom opportunities that allow students to connect with the material.

The proposed Major will be well supported by these faculty for both launch and sustainability over time. No new faculty are required to support the program as we plan on expanding the enrolment caps of our existing sections to accommodate the anticipated growth. Because enrolment is limited, we are able to ensure that the level of faculty and TA support is appropriate and can accommodate the number of students admitted to the Major.

f) If applicable, discussion/explanation of the role and approximate percentage of adjunct and sessional faculty/limited term appointments used in the delivery of the program and the associated plans to ensure the sustainability of the program and quality of the student experience.

Response:

Our Sessional Lecturer 3, Kristian Larsen, works full time as a health geographer and provides valuable public sector experience in his teaching of courses like GGR 372H1 GIS for Public Health.

g) If required, provision of supervision of experiential learning opportunities.

Response:

Experiential learning is not a required component of the program structure, although students will have the opportunity to engage with experiential learning through electives that can be applied to the program completion requirements. The A&S Office of Experiential Learning and Outreach Services (ELOS) provides support for these activities.

h) Adequacy of the administrative unit's planned utilization of existing human, physical and financial resources, including implications for the impact on other existing programs at the University.

Response:

The Department of Geography & Planning has sufficient staff resources in place to support the proposed Major. The Department recently hired a new staff person, whose duties will include managing the new Major. In total the Department has 10 staff, with two staff focused on our undergraduate programs, including an Undergraduate Administrator and an Undergraduate Assistant. The Undergraduate Administrator will be the primary contact for students and will provide advising to students, in addition to administrative tasks, while the Undergraduate Assistant will assist with coordinating courses, admitting students into programs, and providing back-up support for our Administrator as needed. The Department also has sufficient financial resources to support the new Major; for example, their financial resources have been used to renovate the computer lab where many courses will hold their lab sections. No new space or renovation of existing space is needed to support the program at launch or for sustainability over time.

i) Evidence that there are adequate resources to sustain the quality of scholarship and research activities produced by students, including library support, information technology support, and laboratory access.

Response:

The Department of Geography & Planning has two computer labs which it controls. Sid Smith 620 seats 32 students and had renovations completed in December of 2024. This lab will primarily be used for the proposed Major and the existing GIS Minor. Sid Smith 6008 seats 20 and was renovated within the last five years. This room is primarily for Master's of Science in Planning students, but it can also be used by the proposed program. We also have historically used various A&S controlled computer labs for our geographic data science courses when needed, including Sidney Smith 561, Ramsay Wright 107, and Ramsay Wright 109.

The Department of Geography & Planning has a close relationship with the Map and Data Library, which provides resources and training for students interested in geographic information. They have a computer lab with relevant software and librarians with knowledge of geographic data science who can assist students outside of their classes.

The Department of Geography & Planning hosts a 'Department of Geography & Planning: Math Help Centre' for students who have general questions about quantitative work (which would include geographic data science) in any GGR course. This space is meant to be open and accessible, allowing students an opportunity to seek and receive help outside of their formal classes.

Please see the following appendices:

Appendix C: Library statement confirming the adequacy of library holdings and support for student learning.

Appendix D: Standard statement concerning student support services.

j) If necessary, additional institutional or divisional resource commitments to support the program in step with its ongoing implementation.

Response:

Not applicable.

11 Quality and Other Indicators

k) Evidence of the quality of the faculty (e.g., qualifications, funding, honours, awards, research, innovation and scholarly record; appropriateness of collective faculty expertise to contribute substantively to the program and commitment to student mentoring)
   1. The quality of the scholarship of the faculty, and the degree to which that scholarship is brought to bear in teaching.

l) Any other evidence that the program and faculty will ensure the intellectual quality of the student experience.

m) Any additional indicators of quality identified by the division or academic unit.

n) How the proposed program compares to the best in its field among international peer institutions.

Response:

The core faculty teaching geographic data science in our department maintain excellent research programs or are award winning teachers. **Professor Jing Chen** held a Tier 1 Canada Research Chair (CRC) and is a Fellow of the Royal Society of Canada. He has published over 400 highly cited articles (>50,000 on google scholar as of Feb 2025), and has received millions in research funds. **Professor, Teaching Stream Don Boyes**, Fellow of the Royal Canadian Geographical Society, has received numerous teaching awards including from the Canadian Association of Geographers and the University of Toronto President's Excellence in Teaching Award. **Professor Karen Chapple** has received numerous scholarly awards, including the Sir Peter Hall Award from the Regional Studies Association and was a Fullbright Global Scholar. Beyond this she has published widely, having been cited more than 4,580 times (google scholar as of Feb 2025), and has acquired millions in research funding. **Professor Michael Widener** holds a Tier 2 CRC, is a Fellow of the American Association of Geographers, is co-Editor in Chief of the journal Health & Place, has published over 80 papers (>3950 citations on google scholar as of Feb 2025), and has received millions in research funds. **Professor Jane Liu** has an active research program, having published well over 100 papers with over 10,000 citations (google scholar as of Feb 2025) and millions in research funding. **Assistant Professor Lindsey Smith** was hired in 2022, is a promising junior scholar who did their PhD at Cambridge University, UK. She currently has over 10 publications with more than 200 citations (google scholar as of Feb 2025) and is actively applying for research funding.

The Department of Geography & Planning is a thriving hub for geographic research. In subject rankings, geography scholarship at the University of Toronto ranks 13th in the world according to QS Rankings (2024) and 13th in the world by Shanghai Rankings (2024).

Compared to the best in the field, our department compares well. Our strong rankings, distinguished faculty, and strong teaching evaluations demonstrate we are a top destination for studying geographic data science. In Fall 2024, our unit received an institutional composite mean (ICM) score of 4.1 out of 5, indicating very high-quality courses. Notably, for the eight geographic data science courses offered in the fall term of 2024, the average ICM was substantially higher than the department's average at 4.38 out of 5.

Appendix A: Courses

Code	Course Name	Description	Existing?
GGR 101H1	Histories of Environmental Change	This course will investigate geological, biological and archaeological evidence of environmental change. We will examine the processes that have driven and will drive environmental change and how past societies have shaped and responded to these changes. The emphasis is on the current interglacial period, or Holocene, and how shifts in population and technologies have affected human-environment interactions. As language of the Holocene gives way, for many, to that the Anthropocene, the implications of environmental change for present and future human societies will be our concluding concern.	YES
GGR 107H1	Environment, Food and People	Examines the relations between food, nature, and society. Food is fundamental to human existence, and central to most cultures; it also has significant and widespread effects on the physical and social environments. Food is used as a lens to explore human-environment interactions locally and globally. Serves as an introduction to environmental and human geography.	YES
GGR 112H1	Geographies of Globalization, Development and Inequality	Economic growth, social change and environmental transformation are taking shape in an increasingly interconnected global context. This course introduces and examines critical geographic approaches to international development, economic globalization, poverty, and inequality. It pays particular attention to the	YES

		roles of rural-urban and international migration in shaping specific landscapes.	
GGR 124H1	Cities and Urban Life	Offers an introduction to North American cities and urbanization in a global context. It explores social, cultural, political and economic forces, processes, and events that shape contemporary urbanism. The course adopts the lens of 'fixity' and 'flow' to examine how the movement of people, ideas, goods, and capital, as well as their containment in the infrastructure and space of the city, give rise to particular urban forms.	YES
GGR 172H1	Digital Earth	This course examines the changing role of geographic information and maps in society. It considers how spatial information is produced, organized, and used in different historical, cultural, and political contexts. Topics examined include: the effects of the shift from print to digital mapping; implications of mobile spatial technologies and the geoweb; open source and open access; production and control of spatial data and information; and alternative cartographies. Introduces concepts of Geospatial Literacy, Critical Mapping and Critical GIS.	YES
GGR 196H1	The Yard: Micro-Geographies of Household Outdoor Spaces	A “yard” is the area of land immediately adjacent to a building, often a residence. By examining micro-geographies (that is, detailed empirical studies of a small, specific locale) of these ubiquitous, everyday spaces, the course explores how yards are intimately connected with broader ecologies, cultures, and social relations, all of which can be explored using geographic theories and techniques. The course also serves as an introduction to other subjects that are relevant to navigating post-secondary life, such as: critical reading;	YES

		conducting university-level research; presenting and communicating ideas in the classroom; teamwork, and how to benefit from it; and developing social networks. Restricted to first-year students. Not eligible for CR/NCR option.	
GGR 197H1	Nature, Conservation and Justice	Every day we read about climate change, species extinction, environmental degradation and the need for nature conservation. It is increasingly becoming apparent that the environmental problems that we face today arise from a deeper crisis relating to human ways of viewing and connecting to nature. This course asks how we can rework human ways of relating to nature, while querying the idea of “nature” and questioning the dominant approaches to nature conservation. It asks how can concerns for nature and for other species be balanced with that for human livelihoods and well-being? How can inequalities with regards to the distribution of environmental goods and bads be reduced? How are citizens and communities in the different parts of the world struggling against environmental injustice and to protect their local environments? How do these place-based movement demand justice and what visions do they articulate for a more just and sustainable world? How do indigenous worldviews offer conceptual resources for rethinking nature and our ways of relating to nature? The course will explore these questions using lectures, class discussion, videos and student presentations. Restricted to first-year students. Not eligible for CR/NCR option.	YES
GGR 198H1	Mobility and Borders	This course examines the political geographies of transnational migration. It asks how spaces	YES

		of migration and mobility are political, and how migration politics are tied to inequalities wrought through intersecting histories of race, class, and gender. It seeks to extend our understandings of migrants, borders, and mobility, and it explores the processes through which mobility is produced, delimited and structured. We will consider the transnational politics of migration, the militarization of border zones, and the political spaces of migrant displacement, dispossession, and dislocation. The seminar readings focus on classical paradigms as well as emerging approaches in immigration studies. Restricted to first-year students. Not eligible for CR/NCR option.	
GGR 199H1	Global Racial Capitalism in the 21st Century	This course uses the tools of political economy, decolonial and anti-colonial theory, and critical approaches to the study of racism to explore how the construction of racial categories continues to be integral to the working of capitalist systems. We will explore the reasons why capitalism was never meant to work for everyone by examining how and why racial categories have continued to matter since capitalism's earliest formations. Restricted to first-year students. Not eligible for CR/NCR option.	YES
GGR 270H1	Introduction Analytical Methods	Theory and practical application of elementary quantitative techniques in geography emphasizing descriptive, inferential and spatial statistical analysis, probability, and sampling.	YES
GGR 271H1	Social Research Methods	Practical course on field methods designed to enable students to carry out their own research projects. Behavioural observation, interviewing, questionnaire design, sampling theory, content analysis of written and graphic material, data coding and focus groups.	YES

GGR 272H1	Geographic Information and Mapping I	Introduction to digital mapping and spatial analysis using geographic information systems (GIS). Students learn how to use GIS software to find, edit, analyze and map geographic data to create their own maps, analyze geographic problems and use techniques that can be applied to a variety of subject areas.	YES
GGR 273H1	Geographic Information and Mapping II	Builds on GGR272H1 by providing students with practical spatial analysis methods and the underlying theory needed to understand how to approach various geographic problems using geographic information system (GIS) software and a variety of data types and sources.	YES
GGR 274H1	Introductory Computation and Data Science for the Social Sciences	Social scientists are increasingly working with big and complex datasets that contain spatial, group-level, and individual-level dimensions to answer questions about society. In this course, students will develop introductory programming knowledge and data acumen in order to create and run computer programs to explore where, when, and why social processes occur, drawing on theories from geography, linguistics, sociology, anthropology, economics, political science, and psychology. Instruction will focus on applying current data analysis libraries, communicating and translating data science methods to both researchers and the public, distinguishing causation from correlation and coincidence, and negotiating tradeoffs between different computational and statistical approaches.	YES
GGR 315H1	Environmental Remote Sensing	Principles of optical, active and passive microwave remote sensing; satellite orbit and sensor characteristics; image processing and analysis techniques and software; and environmental remote sensing applications.	YES

GGR 372H1	GIS for Public Health	The goal of this course is to leave students with appreciation of the power of Geographic Information Systems (GIS) to explore and analyze spatial health and medical data. The course will focus on organizing health data in a GIS, clustering detection methods, and basic spatial statistics. Other topics like agent-based models and visualization techniques will be touched upon. Lab work will provide hands on experience with example data, leaving students with a firm grasp of contemporary health and medical problems and a skill set of spatial analytical methods that can be used to solve them.	YES
GGR 373H1	Advanced Geographic Information Systems	Advanced theory, techniques, and applications in geographic information systems (GIS), including interpolation, geostatistics, modeling, and raster and vector analysis. GIS project design and implementation.	YES
GGR 375H1	Introduction to Programming in GIS	This course will introduce students to the fundamentals of programming, followed by an applied focus on using these skills in geographic information systems. Students will learn how to programmatically edit spatial data, automate common processes, and conduct complex spatial analyses. The course will emphasize open-source software that enriches geospatial data analysis alongside the data processing and analytical capabilities of existing GIS software. Classroom time will be a mix of short lectures and laboratory exercises.	YES
GGR 376H1	Geovisualization	Visualizing geographic information forms an important step in aiding visual thinking, generating hypotheses, and communicating findings relating to places. Geovisualization not only involves the display of spatial data through static maps, but also the process of creating	YES

		3D, dynamic, or interactive visualizations for data exploration, insights, and analysis. This course will introduce the foundations and capabilities of geovisualization for scientific communication, and students will learn techniques and tools to develop and critically appraise a range of geovisual outputs.	
GGR 377H1	Introduction to Urban Analytics	This course draws on census and economic data collection, processing, and analysis to teach written and visual storytelling about cities with data and maps, while exploring the uses of real-time data and analytics to solve urban problems. It provides a socio-economic and political context for the use of big data and the smart cities movement, focusing on data ethics and governance.	YES
GGR 386H1	Special Topics in Geographic Information Systems	Content in any given year varies by instructor. Students must meet the prerequisites set by the department (see the Geography website for details in May). Can be used towards GIS, Human Geography, and Environmental Geography programs.	YES
GGR 415H1	Advanced Remote Sensing	Building on GGR315H1 (formerly GGR337H1) Environmental Remote Sensing with advanced theories and techniques for land cover mapping, vegetation biophysical and biochemical parameter retrievals, optical and thermal remote sensing of urban environment, and application of satellite remote sensing to terrestrial water and carbon cycle estimation. Basic radiative transfer theories as applied to vegetation will be given in some detail as the basis for various remote sensing applications. Optical instruments for measuring vegetation structural parameters will be demonstrated in the field.	YES

GGR 462H1	GIS Research Project	Students work in groups to develop their own research project and then acquire, organize and analyze geographic data to complete it. Emphasis is placed on research design, project management and the application of GIS concepts and skills learned in previous courses to a practical problem.	YES
GGR 472H1	Developing Web Maps	Explores the power of web mapping and CyberGIS, with a focus on hands-on learning and open-source software. Students will learn about relevant software (exploring various APIs), data structures, methods, and cartographic and visualization techniques. Finally, students will work in groups to develop and deliver their own online web maps from scratch, on a topic of their choosing.	YES
GGR 473H1	Geospatial Big Data	Advances in sensing and mobile technologies have contributed to the increasing availability of large volume georeferenced data such as geo-tagged social media content, GPS traces, and crowdsourced maps. While geospatial big data provide a major source for innovation and analysis, challenges relating to data handling, processing, and interpretation have simultaneously arisen. In this course, students will build a critical understanding of the evolution, potential, and biases of geospatial big data. Knowledge of geo-computational techniques to handle geospatial big data and perform meaningful analysis will also be developed and applied.	YES
GGR 491Y1	Research Project	Specially designed for students wishing to gain experience in conducting research in their area of specialization. Of particular value for geographers interested in graduate study, or positions in government, planning and consulting firms where research skills may be	YES

		an asset. Students select a research problem and complete a project under the supervision of a faculty member. Enrolment requires written permission from a faculty supervisor and Associate Chair, Undergraduate; early discussion with a likely supervisor is encouraged. Enrolment may be completed at any time up to September; open to students in a Specialist or Major Program sponsored by the Department of Geography. Not eligible for CR/NCR option.	
GGR 492H1	Senior Practicum	Students design and implement an independent applied geography/planning project in consultation with an employer (paid or volunteer), who will act as their "client." Enrolment requires written permission from a staff supervisor and Associate Chair, Undergraduate. Only open to students who are enrolled in a Specialist or Major program sponsored by the Department of Geography. Not eligible for CR/NCR option.	YES
GGR 493Y1	Geography Professional Experience	Undertake professional placement matching academic interests and career goals. Students meet regularly during the year in class to cover topics such as: reflective writing, project management, career planning, and the application of academic skills in professional contexts. Research project required that connects a topic related to placement with academic literatures. Normally, one day per week spent at placement site. For students in their final year of a Geography major or specialist program of study, or the GIS Minor. Satisfies program requirements based on placement. Students must submit an application directly to the Department in the spring (see the Geography website for details in	YES

		March). Course may be limited by size. Not eligible for CR/NCR option.	
GGR 497H1	Independent Research	Independent research extension to one of the courses already completed in Environmental Geography. Enrolment requires written permission from a faculty supervisor and Associate Chair, Undergraduate. Only open to students who are in Year 3 or higher and who are enrolled in a Specialist or Major program sponsored by the Department of Geography. Not eligible for CR/NCR option.	YES
GGR 498H1	Independent Research	Independent research extension to one of the courses already completed in Physical Geography. Enrolment requires written permission from a faculty supervisor and Associate Chair, Undergraduate. Only open to students in Year 3 or higher and who are enrolled in a Specialist or Major program sponsored by the Department of Geography. Not eligible for CR/NCR option.	YES
GGR 499H1	Independent Research	Independent research extension to one of the courses already completed in a social science or humanities branch of Geography. Enrolment requires written permission from a faculty supervisor and Associate Chair, Undergraduate. Only open to students in Year 3 or higher who are enrolled in a Specialist or Major program sponsored by the Department of Geography. Not eligible for CR/NCR option.	YES
JEG 100H1	Introduction to Physical Geography and Earth Science	This introduction to Physical Geography and Earth Sciences examines the atmosphere, lithosphere, hydrosphere, cryosphere and biosphere, emphasizing processes, flows of energy and materials, and the interconnectedness of these Earth systems. Specific topics include weather and climate, earth materials, geological and geomorphic	YES

		processes involved in the genesis of landforms, river systems, glaciers, soils, and biomes.	
ESS 262H1	Earth System Processes	An introduction to how our planet works, focusing on physical processes that govern the nature and composition of Earth with an emphasis on the dynamic nature of the planet. Topics include surface processes (e.g., weathering and erosion, ocean and atmospheric circulation, weather and climate), crustal processes (e.g., plate tectonics, earthquakes, volcanoes, biogeochemical cycles), and earth-environment interactions (e.g., natural hazards, resource development, and sustainability).	YES
CSC 271H1	Computational Principles and Methods for Data Science	Computational tools and methods are a cornerstone of the data scientist's toolbox, useful in a variety of applications and disciplines. This course builds on introductory data science and computer programming skills to equip students with several of these tools and methods. Computational methods for gathering and storing data via web APIs or web scraping or other formats; data pre-processing methods useful in data science algorithms; using version control and other tools to implement reproducible data science workflows; using web tools to communicate data science results and build data science products; creating, distributing, and accessing open-source data science software libraries. This course assumes prerequisite experience in computer programming but does not require any additional knowledge or prior experience with any of the tools or methods covered.	YES

STA 272H1	Statistical Models for Data Science	Key areas of data science modeling including question formulation, data collection and cleaning, visualization, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, quantitative critical thinking, and exploratory data analysis, this class covers key principles and techniques of data science. These include algorithms for statistical models and machine learning methods including regression, classification, neural networks, and clustering; principles behind creating informative data visualizations; and statistical concepts of measurement error and prediction.	YES
STA465 H1	Spatial Data Analysis	Data acquisition in the environmental, physical, and health sciences are increasingly spatial, and novel in the sense that specialized methods are required for analysis. This course will cover different types of spatial and spatiotemporal data and their analytic methods. Students will learn a variety of advanced techniques for analyzing geostatistical, areal, and point referenced data. Focus will be placed on visualizing spatial data, choosing the correct method for a specific research question, and communicating analytic results clearly and effectively.	YES
Elective			
GGR 221H1	New Economic Spaces	Provides an introduction to economic geography and economic geography theory from the 1970s on, illustrating the different ways that geographers have conceptualized the restructuring of resource industries, manufacturing and services. The crisis of Fordism and the rise of new production models will be given particular attention, along with the reorganization of finance, the rise of cultural	YES

		industries and the globalization of commodity chains. New regimes of governance of the economy will also be considered.	
GGR 223H1	Environment, Society and Resources	Focuses on society-environment relations and different approaches to resource governance and management. This includes exploration of the spatial, social, and political economic origins and implications of humans' changing relations to nature. Drawing on debates from environmental governance and political ecology literatures, the course also investigates the ways that different actors and institutions have framed and sought solutions to environmental and resource challenges.	YES
GGR 240H1	Geographies of Colonialism in North America	This course considers the creation and consolidation of settler colonies in the region known to many as North America. With an eye to the colonial present, the course focuses on the period from the 15th century to the early 20th century. Cultural texts and place-specific cases are used to ground themes and processes that also bear on the wider field of historical geography, including narratives of discovery and possession; ecological imperialism and environmental transformation; the (re)settlement of land and colonial government; enslavement and industrialization; frontiers, borders, and resource extraction; and some of the Indigenous geographies that preceded, were transformed by and transformed, and exceeded the reach of colonial power. Potential field trip.	YES
GGR 246H1	Geography of Canada	Social and economic differences have been, and continue to be, a prominent feature of Canada’s geography. In this course these differences are examined at a regional and local scale. The course adopts a thematic	YES

		approach and considers issues such as historical development, urbanization, industrialization, immigration and population change, Canada's cultural mosaic and native issues. Emphasis will be placed on the evolution of social and economic policies and Canada's incorporation into a global economy.	
GGR 251H1	Geography of Innovation	Explores how new technologies and industries are generated and sustained, or failed to be. Focuses on the dynamics of leading technological sectors such as electronics, automobiles and biotechnology in their geographical and historical contexts. We critically scrutinize the iconic Silicon Valley along with other major innovative regions/nations, and investigate the key role of universities and finance in driving innovation and entrepreneurship.	YES
GGR 252H1	Marketing Geography	Geography matters in the success of both public and private sector organizations. Using mostly retail examples contemporary location problems are addressed. The geographies of demand and supply are analyzed and trade area and site selection techniques are applied. The relevance of the planning context and utility of geovisualization techniques such as GIS are also briefly considered.	YES
GGR 254H1	Geography USA	After a short historical overview of the making of America, this course focuses on contemporary issues in American society, economy, politics, race, regional distinctions and disparities, urban development.	YES
GGR 320H1	Geographies of Transnationalism, Migration, and Gender	This course examines recent changes in global migration processes. Specifically, the course addresses the transnationalization and feminization of migrant populations and various segments of the global labor force. The	YES

		coursework focuses on analyzing classical paradigms in migration studies, as well as emerging theoretical approaches to gender and migration. In addition, it traces the shifting empirical trends in gendered employment and mobility patterns. It uses in-depth case study material to query the frameworks employed in migration studies and to understand the grounded implications of gendered migration. It pays particular attention to the interventions made by feminist geographers in debates about work, migration, place, and space.	
GGR 324H1	Spatial Political Economy	This course aims to explore how economic agents act and interact in space and how this creates subdivisions within the global, national and regional political economy. In a largely conceptual and interdisciplinary manner, the course investigates the role of institutions in the relational economy and the spatial construction of the political economy. Institutions are viewed as formal or informal stabilizations of economic interaction. Questions which guide the analysis are related to how institutions are established, how they evolve, how they impact economic action, and how they are changed through political and economic action at different spatial scales. Through this, the course introduces a relational and spatial perspective to the analysis of economic action and institutions. This perspective is based on the assumption that economic action is situated in socio-institutional contexts, evolves along particular paths and, at the same time, remains fundamentally contingent. Topics to be discussed include the social construction of economic space, industrial organization and location, the establishment and maintenance of	YES

		economic networks, as well as processes of firm formation, learning and knowledge creation.	
GGR 326H1	Remaking the Global Economy	Examines links between global economic integration and geographically uneven economic development. Focuses on debates and empirical studies on global production networks (GPNs), and associated issues such as offshoring, outsourcing, and upgrading. Blends analysis of both theory and practice of business firms and regional development. Seeks to develop an in-depth understanding of the key actors driving contemporary global economic transformation, within the 'transnational space' constituted and structured by transnational firms, state institutions, and ideologies.	YES
GGR 327H1	Geography and Gender	Introduction to the work of feminist geographers. The course will explore the relationship between gender and space, emphasizing spatial cognition, architecture, and layout of the city.	YES
GGR 328H1	Labour Geographies	Explores changes in the nature of work and the structure and geography of labour markets. Topics will include globalization, lean production, flexibility and risk, industrial relations, workfare, the body at work, and gender and work.	YES
GGR 329H1	The Global Food System	Explores the changing global geographies of food by tracing international movements of food through both mainstream and 'alternative' supply chains. The implications for sustainability, food security, community autonomy and health are investigated.	YES
GGR 332H1	Social Geographies	Analyses the social and behavioural geographies of climate change, including: climate change communication (how we	YES

	of Climate Change	interpret and communicate climate science); climate change prevention strategies, from the macro to micro scale; and possibilities for climate change adaptation.	
GGR 340H1	Health Geography	An exploration of the aspects of health in which place or location matters. Particular attention will be paid to the role of environments (physical, social, etc.) in explaining differences in health between places, the structuring of health-related behaviour in place, and the development of health policy for places.	YES
GGR 341H1	The Changing Geography of Latin America	Seeks to develop a general understanding of present-day Latin America by focusing on human-environment interactions, past and present. Case studies are used to understand the diversity of Latin American landscapes (physical and cultural), and how they are changing within the context of globalization.	YES
GGR 342H1	The Changing Geography of Southeast Asia	Examines changes in the social, political and economic geography of Southeast Asian countries. Examples drawn from Thailand, Singapore, Indonesia, Vietnam and the Philippines as these emerging newly industrialized countries enter the 21st century. Emphasis on political-economy, urbanization and environment since 1950.	YES
GGR 343H1	The Changing Geography of China	The evolving social, political and economic landscape of China. Focus on development strategies and their effects on agriculture, industry, urbanization, city planning and the environment since 1949. Special attention paid to the interconnected development trajectories shaping urban and rural areas, together with the complex interactions between the built and social environments.	YES
GGR 344H1	Institutions and	The goal of this course is to explore the structure and geography of the German political	YES

	Governance: Germany in Comparative Perspective	economy in the context of economic globalization by systematically comparing institutional conditions with those in other countries. This perspective enables us to identify different capitalist systems and characterize Germany as a more socially balanced economic governance model compared with market-liberal systems in the US, UK and Canada. Drawing on the varieties-of-capitalism and other approaches, the main themes in the course address the institutional conditions for development. In a comparative perspective, the course explores topics, such as the role of collective agents and collective bargaining, corporate governance and finance, inter-firm co-operation and regional networks, social security systems, and population structure and immigration. To better understand the current challenges to the German governance model, the institutional opportunities and limitations are investigated under which different regional economies develop in unequal ways.	
GGR 354H1	Infrastructure	Infrastructure is the term that describes the transportation systems, sewers, pipes, and power lines that provide urban dwellers with necessary public services. In recent years, billions of dollars of public money have been spent upgrading existing infrastructure, and planning and delivering new facilities. Infrastructure has many impacts on the way that people in cities live. The way that infrastructure systems are planned, financed, and distributed impact on environmental sustainability, job creation, social equity, economic development, and urban livability. Moreover, infrastructure has the potential to	YES

		both serve existing populations and shape the way that future communities are built. Through lectures, discussions, workshops, readings of scholarly articles and case studies, the course will aim to engage students in the key topics and debates related to the provision of urban infrastructure. Topics to be covered will include: project planning, causes and cures for cost overruns, funding models, financing mechanisms such as public-private partnerships, and the politics of facility planning and management.	
GGR 360H1	Culture, History, and Landscape	The history of approaches to the idea of landscape. A consideration of the origins and uses of the term in geographical inquiry will be followed by a series of case studies, global in scope, from the Early Modern period to the present. Emphasis will be placed on the representational and lived aspects of landscapes, as well as struggles over their definition, interpretation, and use.	YES
GGR 363H1	Critical Geographies: An Introduction to Radical Ideas on Space, Society and Culture	Introduces a diversity of critical perspectives for geographers and others, including anarchism, Marxism, feminism, sexual politics, postcolonialism, anti-imperialism and anti-racism. In so doing it illustrates how such radical ideas about space, society and culture have contributed to our political thought and action.	YES
GGR 382H1	Field Course in Human Geography	Introduction to field studies in human geography. The course includes exercises and a project during a one-week field study in late August or early September, some preparation during the preceding summer and complementary practical work and/or seminars during the Fall Term. Each student is required to pay the costs of their transportation and	YES

		accommodation (field trip costs: $600). Students must submit an application directly to the Department in the spring (see the Geography website for details in March). Course may be limited by size. Not eligible for CR/NCR option.	
GGR 385H1	Special Topics in Geography	Content in any given year varies by instructor. Students must meet the prerequisites set by the department (see the Geography website for details in May). The program in which this course can be used depends on its content.	YES
GGR 389H1	Special Topics in Human Geography	Content in any given year varies by instructor. Students must meet the prerequisites set by the department (see the Geography website for details in May). Can be used towards Human Geography programs.	YES
GGR 398H0	Research Excursions	An instructor-supervised group project in an off-campus setting. Details at https://www.artsci.utoronto.ca/current/academics/research-opportunities…. Not eligible for CR/NCR option.	YES
GGR 398Y0	Research Excursions	An instructor-supervised group project in an off-campus setting. Details at https://www.artsci.utoronto.ca/current/academics/research-opportunities…. Not eligible for CR/NCR option.	YES
GGR 399Y1	Research Opportunity Program	Credit course for supervised participation in faculty research project. Details at https://www.artsci.utoronto.ca/current/academics/research-opportunities…. Not eligible for CR/NCR option.	YES
GGR 400H1	Special Topics in Geography I	Content in any given year depends on instructor. The program in which this course can be used depends on its context. Consult Departmental Office in April.	YES
GGR 401H1	Special Topics in Geography II	Content in any given year depends on instructor. The program in which this course can	YES

		be used depends on its context. Consult Departmental Office in April.	
GGR 421H1	Histories of Geographical Thought	The history of geography as an intellectual subject, focusing primarily on the modern period, and on the genealogies of central concepts. Disciplinary developments will be situated next to broader contexts, including imperialism and militarism, the relationship between culture and nature, and the shifting social role of the academy.	YES
GGR 424H1	Transportation Geography and Planning	Introductory overview of major issues in interurban and intraurban transportation at the local, national and international scale. Topics include urban transportation, land use patterns and the environment, causes of and cures for congestion, public transit, infrastructure finance, and transport planning and policy setting.	YES
GGR 429H1	Innovation and Governance	The course focuses on a broad range of topics related to innovation and governance, such as (i) technological change and its social and economic consequences, (ii) the spatial effects which result from this, and (iii) the necessities for economic policies at different territorial levels. Since international competitiveness of industrialized economies cannot be based on cost advantages alone, future growth in the knowledge-based economy will be increasingly associated with capabilities related to creativity, knowledge generation and innovation. As a consequence, questions regarding the performance in innovation and effectiveness of policy support become decisive at the firm level, regional level and national level. The first part of the course deals with conceptual foundations of innovation processes, such as evolutionary and institutional views of innovation. In the second part, national	YES

		configurations of innovation processes are investigated. The third part deals with innovation at the subnational level, focusing on regional clustering, institution building, multilevel governance, and regionalized innovation systems.	
GGR 430H1	Geographies of Markets	Focuses on actually-existing markets and their geographically-mediated formation and assemblage. Explores how markets are produced, stabilized, reshaped and fall apart at multiple geographic scales. We examine issues such as the debates on states versus markets, embeddedness of markets, neoliberalism and moral justification of markets, varieties of capitalism, regionally variegated capitalism, post-socialist market transitions, and the dynamic evolution of market institutions and economic landscapes.	YES
GGR 431H1	Regional Dynamics	Economic activity, and related indices of socioeconomic well-being and human capital, have always tended to concentrate in space, leaving specific regions to be classified as “creative”, “developed”, or “core” regions and others as “have-not”, “less-developed, “peripheral”, or “marginal” regions. As a result, regional economic change has been very difficult to fully explain (and certainly predict) using conventional (orthodox) theories and methods. This course examines the theoretical linkage between related trends in terms of globalization, vertical disintegration, specialization, innovation, and the locational behaviour of firms. We will focus on the seemingly counter-intuitive finding that regional economic change in a time of increasing global interdependence is increasingly dependent on the local context. Topics will include	YES

		evolutionary economic geography, path dependence, economic clusters, learning regions, the role of institutions, knowledge spill-overs, and the geography of innovation, among others. We will see why the economic activity is becoming ever more concentrated in space even as it globalizes. The course makes extensive use of empirical case studies from around the globe.	
GGR 432H1	China in the Global Political Economy	Set against the backdrop of the rise of China, and following the perspective of geographic political economy, this seminar course examines the interactions between and mutual transformations of the Chinese economy and the global economy. We will focus on the evolving political and institutional foundations of China's post-Mao, hybrid, hierarchical market-authoritarian system. Key sectors – telecoms, Internet, semiconductor, and automobile – will be examined to understand the nuances of China's integration into the global production through state-directed uneven domestic development, and in turn the challenges raised by escalating international conflicts.	YES
GGR 433H1	Built Environment and Health	Linking across fields that include public health, geography and planning, this course examines the growing evidence and ways in which human health is affected by the design and development of the built environment in which we live, work and play. The course considers how various planning and development decisions impact population and individual health, particularly in relation to chronic diseases, injuries, and mental health. Potential of several local field trips (transportation costs: approximately $20).	YES

GGR 456H1	Entanglements of Power: Race, Sexuality and the City	This course investigates the city as a space sculpted by particular configurations and relations of power, and productive of those forms. It considers shifting urban geographies of identity, economy and desire with a focus on race and racism, settler colonialism, empire, the laboring body, sexuality, and sexual identity. Course participants will engage a series of case studies of particular urban spaces and struggles, drawing on conceptual support from scholarship in urban geography, anti-colonial thought, political economy, black studies, feminist and queer theory, Indigenous and settler colonial studies, as well as literature and other artistic work.	YES
JUG 325H1	Landscapes of Violence in Canada	This course examines how violence is enacted in Canada, at various scales, and across domestic, urban, national, and international landscapes. We will interrogate what is meant by violence; examine its colonial, racial and patriarchal dimensions; explore the impact on people and communities; and attend to forms of resistance and repair.	YES
JGC 439H1	The Problem and Promise of Caribbean Freedom	This course surveys the institutional and ideological structures that have historically internally and externally governed the Caribbean; the patterns of uneven development and crisis they have produced and the forms of agency, resistance they have produced. Centering the social, economic, and spatial inter-connectedness of the Caribbean territorial region and its increasingly de-territorialized diaspora, we explore possibilities for economic, social and climate justice for all Caribbean communities.	YES
JIG 440H1	Indigenous Geographies	This course draws on theoretical texts of Indigeneity, with a primary focus on Indigenous	YES

		spaces in the Americas. Course participants will examine how core geographic concepts such as place, territory, land, movement and the scale of the body are sites of colonial dispossession and violence, as well as sites for decolonial and liberatory thought and practice. We will primarily engage with Indigenous-led scholarship within Geography and Indigenous Studies, and creative forms of knowledge production generated across Indigenous communities.	
GGR 217H1	Urban Landscapes and Planning	Considers the role of planning in shaping the urban landscape through historical and contemporary examples that illustrate the interplay of modernist and post-modernist approaches to city building. Traces the origins, competing rationalities and lingering effects of planning in the production of urban space. Broaches possibilities for engaging planning critically to address challenges of social and environmental justice in cities today.	YES
GGR 259H1	Urban Growth and Decline	The growth and decline of cities have been and continue to be preoccupations of scholars and practitioners alike. This course is an introduction to the causes and consequences of urban growth and decline at the neighbourhood, municipal, and regional levels. Special attention will be paid to North American cities, but others outside of that sphere will be discussed as well. Concepts and topics will include a consideration of the following: rural to urban migration; industrialization and deindustrialization; urban renewal; suburbanization; austerity and neoliberalism; racial avoidance and discrimination; gentrification; and capital switching and uneven development.	YES

GGR 336H1	Urban Historical Geography of North America	This course explores the emergence and reproduction of class and racial social spaces, the development of new economic spaces, and the growing importance of the reform and planning movements. Emphasis is on metropolitan development between 1850 and 1950.	YES
GGR 339H1	Urban Political Geographies	Investigates North American urban political geography, exploring conflicts over immigration, environment, gentrification, homelessness, labour market restructuring, ‘race’ and racism, urban sprawl, nature and environment, gender, sexuality, security, and segregation. Explores competing visions of city life and claims on urban space. The course investigates how these struggles connect to economic, social and environmental politics at larger spatial scales, and considers different theoretical frameworks that geographers have developed to make sense of both the persistence of old problems and the emergence of new ones. Potential field trip, cost: approximately $21.	YES
GGR 357H1	Housing and Community Development	Focuses on the importance of adequate housing and quality neighbourhoods. It roots theoretical explanations and policy debates in realities using Canada and Toronto as examples. Topics covered include the evolution of public policies relating to social housing, rental housing, homeownership, neighborhoods, and homelessness.	YES
GGR 359H1	Comparative Urban Policy	This course considers urban public policy. Urban policy is not natural or inevitable response to urban problems. It is actively produced (and contested) by an array of voices, institutions, and social forces. Actualized urban policies are thus best understood and evaluated as products of these influences. The	YES

		first half of the course will cover broad theoretical matters pertaining to the production of urban policy. The second half of the course will focus more intensively on one problem—urban decline—and explore the actualized approaches that have been brought to bear to manage it.	
GGR 374H1	Urban Dynamics	This course will focus on the social and economic repercussions associated with the formation and evolution of polynuclear urban regions in response to global economic restructuring. Foci will include the importance of knowledge and innovation in the process of economic development, social and economic polarization at multiple spatial scales, planning interventions to address these polarities, and strategies and tactics in the promotion of more sustainable urban-centred regional economies.	YES
GGR 385H1	Special Topics in Geography	Content in any given year varies by instructor. Students must meet the prerequisites set by the department (see the Geography website for details in May). The program in which this course can be used depends on its content.	YES
GGR 434H1	Building Community Resilience	Examines concepts of resilience as a way of building the capacity of communities to (a) respond to predicted disruptions/shocks associated with climate change, global pandemics, anticipated disruptions in global food supply, energy insecurity, and environmental degradation; and (b) nurture the development of alternative spaces that support the emergence of more life-sustaining structures and practices. Includes explicit attention to equity and public health, and explores issues such as: participatory governance of social-ecological systems, the nature of social change, complexity science,	YES

		the role of social movements, indigenous and political ecology perspectives.	
GGR 458H1	Selected Topics in Urban Geography	This course focuses on a special topic in urban geography and covers it with more depth than would otherwise be the case in a survey-oriented class. The aim is to utilize this single topic as a vehicle to understanding how urban geographical ideas are produced more widely. Check the department website for the theme (updated each year).	YES
GGR 460H1	Global Cities, Urban Planning, Critical Theory	This seminar addresses the relationship between urbanization and global economic, political, cultural, social, demographic, technological and ecological dynamics. It does so with an emphasis on the contested legacies of city planning, urban design, architecture and urban political activism, by drawing on historical studies of global cities as well as critical-theoretical perspectives on the 'production of space'. While broaching the question what's 'production of space' got to do with social justice, we explore—with reference to pioneering thinkers in the fields of planning, architecture and critical theory—such concepts as radical planning, the urban revolution and the right to the city.	YES
GGR 482H1	Toronto Field Course	Examines the production of urban landscapes, built environments and social spaces in Toronto and surrounding areas through in-depth case studies. Coverage will vary some depending on instructor. The course consists of local field trips and in-class seminars and lectures. Students must submit an application directly to the Department in the spring (see the Geography website for details in March). Course may be limited by size. Not eligible for CR/NCR option.	YES

		Field trip costs are normally low, but may go up to $150.	
JGU 216H1	Globalization and Urban Change	Focusing on the impacts that global flows of ideas, culture, people, goods, and capital have on cities throughout the globe, this course explores some of the factors that differentiate the experiences of globalization and urban change in cities at different moments in history and in various geographic locations.	YES
JGU 346H1	The Urban Planning Process	Overview of how planning tools and practice shape the built form of cities. This course introduces twentieth century physical planning within its historical, social, legal, and political contexts. Community and urban design issues are addressed at local and regional scales and in both central cities and suburbs. The focus is on Toronto and the Canadian experience, with comparative examples from other countries, primarily the United States. Transportation costs: $20.	YES
JGU 454H1	The Role of the Planner: Making a Difference	Focuses on the role of a planning practitioner in contemporary society using a wealth of examples drawn from recent issues and debates in Canadian cities and regions. The course will walk students through the demands made of planners in terms of both technical expertise as well as political necessity and ask them to think actively about how to prepare for the extraordinary growth of cities during the next century. Examples of issues that will be discussed in some detail include the myths surrounding the city vs. the suburbs, the creativity and passion involved in planning work and the need to see Toronto’s future from a regional perspective.	YES
JEG201 H1	Geomorpholo gy	This course introduces the principles of geomorphology, including the landforms and	YES

(formerly GGR 201H1)		processes associated with water, wind, waves, and ice, as well as the human impacts on earth surface processes. Laboratory sessions occur irregularly during the semester to introduce assignments and provide support. A local field trip may be offered (transportation and entrance cost: approximately $25).	
GGR 203H1	Introduction to Climatology	Introduction to the large scale processes responsible for determining global and regional climate and atmospheric circulation patterns, as well as the small scale processes responsible for determining the microclimates of specific environments.	YES
JEG205 H1 (formerly GGR 205H1)	Introduction to Soil Science	This course introduces the fundamentals of soil science, including the chemical, physical, and biological properties of soils as well as soil formation and development, the classification of soils, and the applications of soil science. A field trip may be offered (transportation cost: approximately $25).	YES
JEG206 H1 (formerly GGR 206H1)	Introduction to Hydrology	Introduction to the hydrologic cycle with emphasis on the physical processes, including precipitation, interception, evaporation, runoff, ground water and soil water. Basic hydrological models will be practiced. Potential field trip, cost: approximately $21.	YES
JEG301 H1 (formerly GGR 301H1)	Fluvial Geomorphology	Elements of drainage basin morphology and hydrology, classification of rivers, stream patterns and hydraulic geometry. Elements of open channel flow, sediment transport and the paleohydrology of river systems. River channel adjustments to environmental change, human impact and the management/design of river habitats. Exercises include experimentation in a laboratory flume. A field trip may be offered (at no cost). Course usually offered every other year.	YES

JEG305 H1 (formerly GGR 305H1)	Biogeography	Biogeography aims to identify and explain patterns of plant and animal distributions through space and time. This course considers topics including ecological and evolutionary dynamics, dispersal, migration, plate tectonics, speciation, extinction, paleoenvironments, and island biogeography. We will examine terrestrial and marine biomes, the meaning of biodiversity, conservation challenges, and recent biogeographic changes associated with human activities.	YES
JEG308 H1 (formerly GGR 308H1)	Canadian Arctic Environments	This course explores the unique physical geography of Canada's Arctic regions by covering topics on climate, the cryosphere, hydrology, geomorphology, and ecosystems. Throughout the course, we will consider the impacts of climate change in communities, landscapes, and ecosystems in Arctic regions.	YES
GGR 314H1	Global Warming	A comprehensive examination of the greenhouse warming problem, beginning with economic, carbon cycle, and climate model projections; impacts on and adaptive responses of agriculture, forests, fisheries, and water resources; options and policies to reduce greenhouse gas emissions.	YES
GGR 323H1	Commons, Commoning and Nature	This course examines the role of commons and commoning practices in rethinking how we share natural resources, nurture life-in-common and build more meaningful worlds. Topics covered include: the political and economic history of the commons and their erasure; social and environmental movements; geographies of commons governance; urban commons; more-than-human commons; and post-capitalist alternatives to address ecosystem emergencies. The course draws from Institutional and complexity theory;	YES

		feminist decolonial theory; Indigenous philosophy; Black feminist thought; new materialism and posthumanism to understand the challenges and possibilities of reviving commons and commoning practices.	
GGR 334H1	Water Resource Management	Managing demand and supply; linkages between water quality and human health. Case studies from the industrial world and from developing countries, rural and urban. Implications of population growth and climate change for water resource management.	YES
GGR 338H1	Social Transformation and Environment in the Majority World	This course draws upon a number of geographical theories, debates and case studies to explore the geographical implications of an increasingly interconnected global capitalist economy for interactions among the people and environments in places in the 'majority world'. Situated within the context of climate change this course examines the evolution of discourses of 'development' and their relationship to western (Anglo-American) racialized notions of progress and modernity.	YES
GGR 347H1	Efficient Use of Energy	Examines the options available for dramatically reducing our use of primary energy with no reduction in meaningful energy services, through more efficient use of energy at the scale of energy-using devices and of entire energy systems. Topics covered include energy use in buildings, transportation, industry, and agriculture. Offered alternate years from GGR348H1.	YES
GGR 348H1	Carbon-Free Energy	Examines the options available for providing energy from carbon-free energy sources: solar, wind, biomass, nuclear, and fossil fuels with capture and sequestration of CO2. The hydrogen economy is also discussed. Offered alternate years from GGR347H1.	YES

GGR 349H1	Managing Urban Natures	Recent calls to action by the Intergovernmental Panel on Climate Change and the World Wildlife Fund indicate we are at a crossroads in responding to accelerating global warming and biodiversity loss. Cities are often at the forefront of these transformations, both in feeling their effects but also initiating responses. How might we reimagine our cities in a way that promotes thriving and equitable ecosystems? What tools exist in the policy landscape to initiate needed changes? What innovative responses are emerging to confront the challenges of increased flooding, rising temperatures, habitat fragmentation, and food insecurity? How might we reimagine an urban commons? With a primary focus on Canadian cities, in this course we explore the ways divergent conceptualizations of urban-nature have informed policies and practices drawing largely from critical, political ecology, and Indigenous perspectives; the policy landscape that informs current urban planning; and new and innovative approaches that help us to reshape and reimagine our relationships to urban nature, including initiatives led by municipalities, non-government organizations and citizens groups.	YES
GGR 387H1	Special Topics in Environmental Geography	Content in any given year varies by instructor. Students must meet the prerequisites set by the department (see the Geography website for details in May). Can be used towards Environmental Geography and Human Geography programs.	YES
GGR 388H1	Special Topics in Physical & Environmental Geography	Content in any given year varies by instructor. Students must meet the prerequisites set by the department (see the Geography website for details in May). Can be used towards Physical	YES

		& Environmental Geography and Environmental Geography programs.	
JEG406 H1 (formerly GGR 406H1)	Geomorphology and the Anthropocene	In this seminar course, we will use lectures, readings, and classroom activities to investigate the ways in which Earth's surface has been impacted by humans while considering the role of geomorphology as a science for understanding these changes.	YES
GGR 413H1	Watershed Hydroecology	Modern developments in hydrology and ecology, including form and process models, interactions of hydrology, ecology and geomorphology; the course emphasizes the use of computer simulation models of drainage basin processes.	YES
GGR 416H1	Environmental Impact Assessment	Environmental impact assessment (EIA) has emerged as a key component of environmental planning and management. EIAs are planning tools to predict and assess the potential costs and benefits of proposed projects, policies, and plans and avoid or mitigate the adverse impacts of these proposals. This course focuses on the origins, principles, scope, and purpose of EIA from theoretical and practical perspectives, emphasizing the Canadian context. We will also explore the various components of EIAs and critically evaluate techniques to assess, predict, and mitigate impacts. Through course readings, in-class activities, and assignments, we will engage critiques of EIAs, particularly as they relate to considerations of climate change, sustainability, long-term monitoring, meaningful public engagement, indigenous people's rights, dispossession and resettlement, and environmental justice. Case studies will allow students to learn about current practices in EIA and develop skills to examine and improve EIA processes.	YES

GGR 418H1	Geographies of Extraction	Examines political aspects of the appropriation of natural resources, including policy and regulation, environmental impacts, and social justice. Emphasis is placed on reading contemporary literature on the politics of resource access and control from geography and other social science disciplines.	YES
GGR 419H1	Environmental Justice	Examines how environmental problems affect people, communities and societies differentially and how marginalized communities and people often bear the brunt of environmental costs, while contributing little to their creation. It uses readings and case studies from across the globe to address the production of environmental injustice and the struggle for environmental justice.	YES
GGR 438H1	Environment and Development	Examines the implications of development – as an economic and social project – for how the environment is used, by whom, and to what ends. Draws on literatures in political ecology and critical development geography. Topics include: interpretations of scarcity and degradation, questions of consumption, and the greening of development. Examines expansion of and struggles over new forms of green infrastructure in urban and rural settings.	YES
JUG 320H1	The Canadian Wilderness	The idea of wilderness permeates narratives of Canadian national identity, while policy-makers seek to manage and contain natural areas. This course compares and contrasts historical and contemporary wilderness narratives in literature, painting and film with policies in areas such as conservation, urban planning, land claims and tourism.	YES
JGE 321H1	Multicultural Perspectives on	Diverse approaches to environmental issues in a variety of multicultural settings are introduced, compared and analyzed, using case studies.	YES

	Environmental Management	Perspectives on environmental management will be discussed as they emerge from contexts such as Latin America, Asia, or Africa.	
JIG 322H1	Indigenous Worlds, Worldviews and the Environment	Explores the diverse ways of understanding and responding to the world that emerge from indigenous cultures around the world. Examines how indigenous ways of being and relating to their natural environment can help us understand and address the current environmental crisis. Using examples of indigenous activism from Canada and around the world, examines how colonial histories shape dispossession and marginalization and inform visions for the future. Topics include traditional ecological knowledge, place-based social movements, environmental concerns of indigenous peoples, bio-cultural restoration and decolonization of nature-human relations.	YES
JGE 331H1	Resource and Environmental Theory	Introduction to and critical evaluation of major ideas and conceptual traditions underpinning environmental and natural resource politics and regulation. Topics include: parks and protected areas, market-based environmental regulation, property rights and conservation, Malthusianism, and biodiversity conservation. Emphasis is placed on critical reading of primary texts.	YES
JGE 481H1	Field Course in Environmental Geography	Introduction to field studies in environmental geography. The course may include individual assignments and group work. Field trips are concentrated during a one-week period in late August or early September. Some preparation during the preceding summer may be required. Periodic course meetings and shorter field trips continue, along with course work, during the Fall Term. Each student is required to pay the costs of their transportation and	YES

		accommodation (field trip costs: $102). Students must submit an application directly to the Department in the spring (see the Geography website for details in March). Course may be limited by size. Not eligible for CR/NCR option.	

Appendix B: Library Statement

University of Toronto Libraries Report for
Hons. BSc Major in Geographic Data Science, Faculty of Arts & Science, 2024

Context: The University of Toronto Library (UTL) system is the largest academic library in Canada and is currently ranked third among academic research libraries in North America.[6] The UTL has an annual acquisition budget of $42.4 million. Its research and special collections comprise over 12.8 million print volumes, 5.6 million microforms, and rich collections of manuscripts, films, and cartographic materials. The system provides access to more than 3.5 million electronic books, 200,000+ journals, and a rich array of online primary source materials.[7] Numerous, wide-ranging collections, facilities and staff expertise reflect the breadth of research and instructional programs at the University and attract unique donations of books and manuscripts from around the world, which in turn draw scholars for research and graduate work.

Major North American Research Libraries					
	2018-2019	**2019-2020**	**2020-2021**	**2021-2022**	**2022-2023**
ARL RANK	**UNIVERSITY**	**UNIVERSITY**	**UNIVERSITY**	**UNIVERSITY**	**UNIVERSITY**
1	Harvard	Harvard	Harvard	Harvard	Harvard
2	Yale	Yale	Yale	Yale	Yale
3	Columbia	**Toronto (3rd)**	**Toronto (3rd)**	**Toronto (3rd)**	**Toronto (3rd)**
4	**Toronto (4th)**	Columbia	Michigan	Michigan	Michigan
5	Michigan	Michigan	Columbia	Columbia	New York

Top 5 Canadian Universities in the ARL Ranking of Major North American Research Libraries				
2018- 2019	**2019-2020**	**2020-2021**	**2021-2022**	**2022-2023**
RANK/UNIVERSITY	**RANK/UNIVERSITY**	**RANK/UNIVERSITY**	**RANK/UNIVERSITY**	**RANK/UNIVERSITY**
4/Toronto	**3/Toronto**	**3/Toronto**	**3/Toronto**	**3/Toronto**
30/Alberta	39/Alberta	29/British Columbia	24/British Columbia	35/British Columbia
40/British Columbia	40/British Columbia	39/Alberta	39/McGill	41/McGill
47/McGill	51/McGill	42/McGill	42/Alberta	49/Alberta
62/Ottawa	75/Calgary	70/Calgary	58/Ottawa	71/York

Space and Access Services: The UTL's 40 libraries are divided into four administrative groups: Central, Departmental/local, Campus (UTM & UTSC) and Federated and Affiliated College Libraries. The UTL provides a variety of individual and group study spaces for students. Study space and computer facilities are normally

[6] As per Association of Research Libraries Statistics.

[7] Figures as of January 2023

available twenty-four hours, five days per week at one location, Robarts Library, with additional extended hours during study and exam periods at both UTSC and UTM. Web-based services and electronic materials are accessible at all times from campus or remote locations.

Equity, Diversity and Inclusion (EDI): EDI is a high priority at UTL. UTL has developed an EDI Statement, an Anti-Racism Statement and a Collections Diversity Plan. These statements are supported by a concrete action plan, which UTL is committed to achieving. UTL is prioritizing staff diversity, staff cultural competencies and awareness of systemic biases, building and improving relationships with Indigenous and other underrepresented communities, incorporating the principles of the Accessibility for Ontarians with Disabilities Act in its services, and working with the University's Equity Offices to remove barriers in support of our community members who seek to fulfill their academic, research, and employment goals. In support of the Department of Geography & Planning, the library is actively enhancing the diversity of its collection by acquiring more works that represent marginalized groups and prominently featuring them in curated displays to promote inclusivity and broaden perspectives.

Teaching, Learning & Research Support: Libraries play an important role in the linking of teaching and research in the University. To this end, information literacy instruction is offered to assist in meeting Geographic Data Science degree level expectations in the ability to gather, evaluate and interpret information. Librarians collaborate with instructors on assignment design, provide student research consultations, and offer just-in-time student research help in person, by phone, or through online chat. Librarians are also available to support curriculum mapping initiatives. Special initiatives, such as the Libraries Undergraduate Research Prize, and an annual forum for student journal editors, extend information literacy beyond the classroom. These services align with the Association of College and Research Libraries (ACRL) *Framework for Information Literacy for Higher Education*.[8]

Program Specific Instructional Support: Instruction occurs at a variety of levels for Geographic Data Science students and is provided by the faculty liaison librarian for the Department of Geography & Planning. The Robarts Library facilitates formal instruction integrated into the class schedule and hands-on tutorials related to course assignments. The Map and Data Library also offers relevant workshops related to spatial and statistical analysis in ArcGIS, R, Python and other platforms. The Library, through its liaison librarians, customizes feeds of library resources which appear prominently in Portal/Blackboard course pages. Further, liaison librarians created course specific material in the form of Quercus modules for GGR205 Introduction to Soil Science. Other notable resources curated by librarians include: a Geography Research Guide, Map & Data Library Tutorials, and Map & Data Library Workshops.

[8] Association of College & Research Libraries. Framework for Information Literacy for Higher Education. ACRL, 2016. http://www.ala.org/acrl/sites/ala.org.acrl/files/content/issues/infolit/Framework_ILHE.pdf

Collections: Many college and campus libraries collect materials in support of Geographic Data Science; the largest collection of materials is centrally located in Robarts Library. Collections are purchased in all formats to meet the variety of preferences and styles of our current students and faculty. The University of Toronto Library is committed to collecting both print and electronic materials in support of Geographic Data Science at the University of Toronto.

Journals: The Library subscribes to 25 of the top 25 journals listed in Journal Citation Reports (JCR)[9] in subject area Geography. Of these titles, 25 are available electronically to staff and students of the University. We prioritize acquisition of online journals where possible.

Monographs: The UTL maintains comprehensive book approval plans with 39 book vendors worldwide. These plans ensure that the Library receives academic monographs from publishers all over the world in an efficient manner. In support of Geographic Data Science, we specifically receive books through plans with GOBI. Individual librarian selectors also select unique and interesting scholarly material overlooked by approval plans. These selections include contributions to the collections of the Thomas Fisher Rare Book Library, special requests from faculty, and individual e-books and e-book packages, including complete collections of e-books from the following publishers: Oxford University Press, Cambridge University Press, major US university presses and Canadian university presses.

Preservation, Digitization, and Open Access: The UTL supports open access to scholarly communication and research information through its institutional research repository (known as T-Space), its Downsview print repository, its open journal services, subscriptions to open access publications, and support for preservation of research materials in all formats. In addition to acquiring materials in support of Geographic Data Science, the Library has digitized its monograph holdings published before 1923. These books are available without charge to any Internet user. The Map and Data Library is also engaged in collaborative projects to digitize, openly disseminate, and preserve historical data and maps; these open data sources are used as inputs to geographic data science research.

Knowledge Synthesis: Libraries are key partners in research through their collaborations with faculty in completing knowledge syntheses projects, Systematic and Scoping Review Collaboration (SSRC), and providing consultations to faculty and students on comprehensive searching for method driven reviews.

Key Databases:

- Scholars Geoportal

[9]2024 Journal Citation Reports® (Thomson Reuters, 2024)

- Scopus

Special Collection Highlight: The Map and Data Library houses a collection of geospatial and numeric data that supports Geographic Data Science, including land use, environmental, socioeconomic and many other types of data. The Map & Data Library also provides GIS & statistical software access and support.

Current Gaps: None to report.

Other Library-departmental engagement: Liaison librarians across all three campuses actively engage in graduate orientations for the Department of Geography & Planning, and for a graduate workshop on writing, the liaison librarian created a handout on incorporating research into academic writing, which was subsequently adopted by faculty for use in their courses.

Prepared by: Cathryn Copper, Head, Eberhard Zeidler Library and Faculty Liaison to the Geography & Planning Department and Leanne Trimble, Acting Head, Map & Data Library, December 6, 2024

Submitted by: Larry Alford, Chief Librarian, University of Toronto Libraries, May 26, 2025

Appendix C: Student Support Services

Student Services Statement
St. George Campus

All University of Toronto undergraduate and graduate students have access to student services on all three campuses, Mississauga, St. George (downtown Toronto), and Scarborough, regardless of their 'home campus'. The services and co-curricular educational opportunities provide a complement to the formal curriculum by engaging and challenging students to reach their full potential as learners, leaders and citizens. At the University of Toronto (St. George Campus) these services are organized by Student Life, the academic division registrar and local student life offices, and the School of Graduate Studies. All these services combine to support the success of our students from the time they are admitted through degree completion and beyond.

Students have access to comprehensive **physical and mental health care** on campus, including a medical clinic, travel medicine services, immunization, contraception and sexual health education. Counselling and treatment options for psychological and emotional concerns include psychotherapy, group therapy and pharmacotherapy, as well as specialized assault counselling services provided both by the Health and Wellness Centre and the Sexual Violence Prevention and Support Centre. In addition, a large number of wellness programs are provided, such as mindful meditation, workshops on coping skills and stress management. All students on all campuses have access to UofT MySPP, a multilingual immediate and/or ongoing confidential, 24-hour counseling support for any school, health or general life concern at no cost to students.

Housing needs, including residence application assistance, off-campus housing listings, and resources for students on the rental housing search, tenant rights and responsibilities, as well as assistance with finding temporary/urgent overnight accommodation, are met through the Housing Services.

Coaching and education in the development of key **learning skills** — from time management to reducing exam anxiety — is provided through **Academic Success**. Academic Success also partners with faculty to integrate success strategies and support into the curriculum.

Students can explore what to do with their degree, discover job opportunities and further education by accessing programs, services and resources designed and delivered by **Career Exploration & Education**. Through workshops, appointments, events and job shadowing opportunities students can identify goals, navigate career decisions, build job searching skills and develop meaningful connections with employers and alumni. Career Exploration & Education also works with faculty and instructors to integrate career learning into their courses and curriculum.

International learning opportunities (study, research and professional experiences outside of Canada) for all students on all campuses enable the development of global fluency in academic, personal and career spheres. Opportunities are catalogued at learningabroad.utoronto.ca. Student **Safety Abroad** support is provided to all students on all university activity abroad. Opportunities for the development of global fluencies and skills are available to all students through on campus international learning co-curricular and experiential learning.

Specialized services are provided for **international students** including but not limited to pre-arrival, transition to Toronto, study and work permit advising, health insurance for international students and their dependents who are residents of Ontario, impact of lived experience and previous academic culture on teaching and learning expectations and peer resources for life as a U of T student. Specialized services are also available for all students whose health or disability impacts their functioning (academic accommodations, systems navigation, referrals, resources, skill development, peer programming and support) students with **children or other family responsibilities** (advising, resources, subsidized child care), **Indigenous students** (culturally relevant academic support, financial counselling) and **lesbian, gay, bisexual and transgender** students (counselling, referrals, equity outreach and engagement).

Participation in **campus life** and **experiential learning** are facilitated through Hart House (clubs, committees, events), the Centre for Community Partnerships (community-engaged learning and research opportunities , the Multifaith Centre (engage with religious diversity including spiritual and non-religious perspectives, interfaith programs, meditation and yoga, providing space for prayer, cultural and spiritual practices), and Clubs and Leadership Development (leadership development, equity education, recognition and support for student groups, activities, office, meeting and activity space for clubs). **Sport and recreational facilities and programs** are provided to all students through both Hart House and the Faculty of Kinesiology

and Physical Education. **Campus involvement** is supported actively through Orientation, Transition and Engagement (co-curricular record).

Support for the transition into life as a student are facilitated through Orientation, Transition and Engagement (transition programs, orientation coordination and support, outreach, parent and supporter resources) as well as **Mentorship and Peer Programs** (events for equity-seeking communities, 1:1 peer support, workshops). Programs and services designed to support Black, Latin American, Southeast Asian and First Generation students are offered through Mentorship and Peer programs.

Gradlife is a comprehensive suite of programs, services and initiatives offered across the Division of Student Life that are developed with a graduate student audience in mind. Gradlife includes skills development, social, academic and community building activities to support a holistic graduate student experience.

Appendix D: Comparator Programs

Please list U of T and external comparators and provide a short summary of the programs and highlight any differences between the degree programs and what is proposed. Please remove the examples from the table below.

Institution and Unit	Degree and Program (including URL)	Domestic Tuition	Program Description	Differences Between This Program and What is Proposed
University of Toronto Comparators				
University of Toronto Mississauga	Honours BSc Geospatial Data Science (Major, Minor) (formerly Geographical Information Systems) https://www.utm.utoronto.ca/geography/undergraduate/geographical-information-systems/gis-major-science	$6100 CAD for 2025-26	The UTM Geospatial Data Science Major program offers an analytical perspective on geographical information. In depth studies beyond basic geography include mapping, spatial analysis, digital databases with specializations in modeling, statistical analysis and remote sensing.	Very similar, but streams in urban, human, env/physical geog make the UTSG program distinct, since students will graduate with depth of expertise in one of these three areas.

Institution and Unit	Degree and Program (including URL)	Domestic Tuition	Program Description	Differences Between This Program and What is Proposed
University of Toronto Scarborough	Minor (Arts) in Geographic Information Science https://utsc.calendar.utoronto.ca/minor-program-geographic-information-science-gis-arts-scmin1800	$6100 CAD for 2025-26	GIS is based on the integration of digital spatial data, mapping software, and spatial analysis tools. GIS has been a core method in Geographical research for almost two decades, but is also rapidly growing in importance outside Geography, in part because of the huge amounts of new spatial data being generated by ubiquitous sensors such as smartphones with GPS locators. A growing number of research areas and careers require knowledge of GIS and cartographic presentation skills. This minor program provides training in the theory and practical application of Geographic Information Science and systems for spatial analysis, spatial data management, and cartographic representation, and is an excellent	UTSC only offers a minor in this area. The focus is on students gaining basic and intermediate technical skills related to geographic information science. The proposed major has more depth and also incorporates streams that allow students to focus on urban, social, or environmental systems.

Institution and Unit	Degree and Program (including URL)	Domestic Tuition	Program Description	Differences Between This Program and What is Proposed
			option for students pursuing Human Geography, City Studies, Critical Development Studies, Historical and Cultural Studies, Sociology, Political Science, Anthropology, Environmental Studies and Environmental Science.	
Ontario Comparators				
Toronto Metropolitan University	Honours BA Geographic Analysis https://www.torontomu.ca/calendar/2023-2024/programs/arts/geographic/	Approximately $7300 CAD (for Co-op) https://www.torontomu.ca/current-students/tuition-fees/undergraduate/#!accordion-1654626307170-domestic-ontario-fee-rates	“Exploring and analyzing the complex interconnections between people and their natural and built environments is the focus of geographic inquiry. Toronto Metropolitan University's Geographic Analysis program is uniquely positioned to prepare students for the professional workplace using state-of-the-art technology in geographic information systems (GIS) and remote sensing.”	Very similar, but more focus on data science in ours with links to CS and Stats (e.g., via GGR274H1 and the CS and Stats electives). The streams in urban, human, env/physical geog make the UTSG program distinct. TMU also has a pathway that is more business/retail focused, which is not a part of the UTSG proposal.
Western University	Honours BA/BSc Geographic	$6,050 CAD for 2024-25	“Geographic Information Science is data science for spatial data (digital content with geographic information	Similar, but streams in urban, human, env/physical geog make the UTSG program distinct, since

Institution and Unit	Degree and Program (including URL)	Domestic Tuition	Program Description	Differences Between This Program and What is Proposed
	Information Science https://westerncalendar.uwo.ca/Modules.cfm?ModuleID=21037&SelectedCalendar=Live&ArchiveID=		attached). Spatial data is collected using drones, satellites, sensors and smartphones. GIScientists use computers to answer questions about: ▪ where things are ▪ why they are there ▪ when things are in specific places ▪ patterns and processes across space, and change over time We answer these questions using AI and machine learning, big data analysis, and mapping and data visualization.”	students will graduate with depth of expertise in one of these three areas.
Carleton University	Honours BA/BSc in Geomatics https://calendar.carleton.ca/undergrad/	Approximately $7,400 CAD for 2024/25	Our Geomatics program is for students who wish to focus on the acquisition, management, analysis, and display of geographic information. Various applications in planning, environmental and	Similar, but Carleton’s program offers very little application of geographic data science on social and urban systems. Streams in urban, human, env/physical geog also make the UTSG program distinct, since students will graduate with depth of expertise in one of these three areas.

Institution and Unit	Degree and Program (including URL)	Domestic Tuition	Program Description	Differences Between This Program and What is Proposed
	undergradprograms/geomatics/		resources management, hazard mapping, demographics, market analysis, and education will be explored. Practical experience will be gained in geomatics, cartography, remote sensing, and quantitative analysis.	
University of Waterloo	Geomatics (Bachelor of Environmental Studies – Honours) https://uwaterloo.ca/future-students/programs/geomatics	Approximately $9,000 CAD 2025-26	Geomatics combines computer science with geographic and environmental data analysis to devise data-driven solutions to complex problems. Waterloo is a leader in this field, ranking #1 in Canada for remote sensing (Academic Ranking of World Universities 2024).	Waterloo's program is taught from a department that is oriented towards physical and environmental science, whereas the proposed program is more social science focused.
Canadian Comparators				
University of Calgary	BSc Geomatics Engineering	$9,286.00 CAD (2024-25)	Geomatics engineering is a very fast-growing information technology discipline, which employs location	This is an engineering degree with a stronger focus on engineering and technical skills. The proposed Major is designed to teach students both about technical skills alongside why and how they should

Institution and Unit	Degree and Program (including URL)	Domestic Tuition	Program Description	Differences Between This Program and What is Proposed
	https://schulich.ucalgary.ca/future-students/undergraduate/programs/bsc-geomatics-engineering		and navigation systems, intelligent and autonomous systems, mobile mapping, geospatial information systems, integration of detection-and-localization sensors, smart infrastructure, artificial intelligence for geospatial solutions, remote sensing of the natural and built environments by satellite and unmanned aerial systems, virtual reality, geodesy and surveying - to name a few.	be used in the context of analyzing social, urban, and environmental systems.
International Comparators				
University of Illinois Urbana-Champaign	BSc, Geographic Information Science Concentration https://ggis.illinois.edu/academics/undergraduate-programs/bachelor-science/geographic-information-	$12,992.00 USD for 2025-26	The Geographic Information Science (GIS) concentration involves the creation and analysis of unique geographic information to examine economic, environmental, physical, and social phenomena. GIS students gather in-depth knowledge of GIS principles, and gain expertise with contemporary software packages to prepare for work in the GIS industry.	Similar, but the UIUC program has more environmental options, and fewer urban options. Streams in urban, human, env/physical geog also make the UTSG program distinct, since students will graduate with depth of expertise in one of these three areas.

Institution and Unit	Degree and Program (including URL)	Domestic Tuition	Program Description	Differences Between This Program and What is Proposed
	science-concentration			
Ohio State University	BS, Geographic Information Sciences, https://geography.osu.edu/undergraduate/undergraduate-majors/geographic-information-science	Approximately $13, 244 USD 2024-25	The Geographic Information Science (GIS) major provides you with advanced technical knowledge in data modeling, spatial data management, and map design. More than just a computer science degree, this major helps you communicate complex data and narratives in visual formats that help your audience see the world more clearly and accurately.	Similar to the proposed program but OSU does not have streams where students can focus on a core part of the discipline of geography.
University of California, Santa Barbara	BA in Geography with a Geographic Information Science emphasis, https://www.geog.ucsb.edu/academics/undergraduate/majors/geographic-information-science	Approximately $14,436 USD 2024-25	Geographic Information Science (GIScience) is data science for map data. Using GIScience, geographers study the earth, humans, and the interactions between people and the planet. The BA in Geography with an emphasis in Geographic Information Science is intended to equip students with powerful GIScience skills and knowledge of how to apply	Similar to the proposed program but UCSB does not have streams where students can focus on a core part of the discipline of geography. UCSB program offers 3 concentrations areas 1) Air Photos and Remote Sensing, 2) Geographic Information Systems and Cartography and 3) Quantitative Techniques and Theoretical Methods – and students must complete work in all 3. This is different to the proposed program in which students

Institution and Unit	Degree and Program (including URL)	Domestic Tuition	Program Description	Differences Between This Program and What is Proposed
			these tools to solve pressing societal questions from climate change to social equity. Students will learn how to acquire, model, and process spatial and temporal information relevant to themes in fields of sustainability, climate change, health, history, architecture, transportation, chemistry, and other disciplines. Students will also have an opportunity to gain skills in the related fields of remote sensing, photogrammetry, spatial analysis, global navigation, cartography, and spatial cognition. Students will choose a GIScience track and may combine tracks for breadth and depth, as well as pursue interests in particular technologies or applications. With the proliferation of map data from technology in everything from satellites to our phones, GIScience is a fast-growing	complete the same core courses but choose 1 of 3 streams to complete.

Institution and Unit	Degree and Program (including URL)	Domestic Tuition	Program Description	Differences Between This Program and What is Proposed
			field and graduates will be well prepared to start a career in any of the geographic information technology fields or to continue their education in graduate school.	
Texas A&M University	BS, Geographic Information Science and Technology, https://artsci.tamu.edu/geography/academics/undergraduate/gist-bs.html	$5,775.35 USD for 2024-25	The Bachelor of Science in Geographic Information Science and Technology (GIST) will give you a rigorous, modern-day education and training in GIST with applications in physical and human geography. The bachelor's degree in GIST is designed to: • Provide modern-day exposure to the rapidly changing field of GIST • Balance education and training with a focus on competency • Provide application and problem-solving experiences • Support student activities and research	Similar to the proposed program but Texas A&M does not have streams where students can focus on a core part of the discipline of geography. In addition, this degree requires an early course in physics, biology, chemistry, zoology, geology, or oceanography – which is not required in the proposed Major.

Institution and Unit	Degree and Program (including URL)	Domestic Tuition	Program Description	Differences Between This Program and What is Proposed
			• Provide students with professional experience • Produce high-quality geographers with strong GIST knowledge and skills	
University of Maryland	Geographical Sciences Major: Geospatial Data Science Specialization https://geog.umd.edu/undergraduate/geospatial-data-science	$7,449.80 USD 2025-26	Geomatics combines computer science with geographic and environmental data analysis to devise data-driven solutions to complex problems.	University of Maryland offers a Major in Geographical Science focused on human-environmental interactions, and geospatial data science is a specialization offered within this Major. This is different to the proposed Major which puts data science as a core part of the Major program, with areas of focus that go beyond “human-environment” interactions (i.e. through the three themes) which is reflected in the required courses.