**Preview Questions**

1. What are the proposed eight dimensions for GIS?
2. What are the key opportunities for GIS?
3. How will GIS become increasingly important in shaping research and educational agenda?

**Summary Notes**

Introduction

* The field of GIS is healthy and vibrant based on conventional metrics for measuring the development of a discipline:
  + Number of scholarly journals.
  + Number of textbooks.
  + Number of students.
  + Amount of research funding, etc.
* Articulate an agenda for the vision of an open GIS paradigm
  + Elements of the emerging open culture
  + Dimensions of open GIS
  + Research and educational opportunities
  + Challenges and barriers of open GIS

The Emerging Open Culture and the Meaning of Open GIS

* The GIS community has been practicing open GIS since its earliest days.
* Has predominantly focused on open software development.
* The open culture has multiple dimensions:
  + Open data
  + Open software
  + Open hardware
  + Open standards
  + Open publication
  + Open research
  + Open funding
  + Open education
* Open data refers to data that is open legally and technically (i.e., useful, usable, and used).
* Open Data Charter has the goal of making government data freely available.
* Principles of the Open Data Charter
  + Open data by default
  + Quality and quantity
  + Useable by all
  + Releasing data for improved governance
  + Releasing data for innovation
* Six criteria for open data
  + Free from restrictions (Legal)
  + Free of cost (Financial)
  + Free from administrative or procedural hurdles (Accessible)
  + Presented in a clean and structured format (Usable)
  + Proper metadata with meaningful field names (Understandable)
  + Data reliability and quality can be evaluated (Assessible)
* Open software is a driving force behind the open science paradigm.
* Free software has not only caught up with commercial software but has surpassed it in some areas such as minimizing development cycle time.
* In software, free has the same meaning as in “free speech”, not necessarily as in “free beer.”
* Free software entails that users have the freedom to access, modify, distribute, and connect the source code via various application program interface (API).
* Open hardware in the context of Open GIS refers to:
  + Open source hardware kits GIS users can download to build their own devices for GIS.
  + GIS operations are no longer confined to a single platform or hardware device.
* Open hardware relies on licensing similar to that for open source software.
* Key specifications for Open GIS software interfaces rolled out by the Open Geospatial Consortium (OGC):
  + Implementation specifications provide standard methods for systems to share and integrate data and geospatial information.
  + Catalog specifications provide standard methods for publishing and discovering geospatial data on the web.
* Standards must have broad appeal but remain adaptable to new developments.
* Defining characteristics of open science:
  + Increased scholarly collaboration.
  + Transparency in research methods.
* Open publication entails both open review and open access.
* Open review calls for reviews by specialists and non-specialists with vested interest in the research reported (versus traditional pre-publication peer-review by small number of experts).
* Peer-review continues post-publication and makes articles live and knowledge more iterative.
* Open access publication pushes to make scholarly publications available free of charge.
* In GIS, open publication means making data used available for both replication and continuing research.
* Open funding uses the Internet to solicit a large number of small contributions.
* Three models of crowdfunding:
  + Donation model
  + Reward model
  + Equity model
* Platforms devoted to fundraising for scientific research:
  + Microryza
  + Petridish
  + SciFund Challenge
* Open education refers to educating and training next generation GIS researchers, developers, and citizens.
* Dimensions of open education are:
  + Fostering an academic culture that values the core practices of open science.
  + Creating new cyber-infrastructure that facilitates and integrates all open science practices.
* Opportunities for Open GIS
  + The big data deluge is creating new challenges regarding its structure, collection, storage, distribution, and use.
  + There is a growing importance of geospatial information in decision making; we can know where everything is from the microscale to the macroscale.
  + The increasing trend of citizen science in GIS.
  + Strategic directions for understanding the changing planet from the U.S. National Research Council (NRC):
    - Earth science (How to understand and respond to environmental change)
    - Environmental geography (How to promote sustainability)
    - Traditional human geography
    - Geospatial technologies
  + Scholars from across disciplines are incorporating a geospatial perspective in their research.
  + Advances in technologies enable ordinary citizens with little training to participate in producing geographic data and knowledge.
  + There are various initiatives underway to increase the geospatial literacy of the public and policymakers.
    - Spatial thinking across curriculum
    - Geospatial workforce development
    - Geo-enabled research
    - Enterprise GIS infrastructure to support planning, operations, maintenance, and sustainability.
  + Impediments for Open GIS include:
    - The current academic culture and reward system does not incentive collaboration.
    - Laws regarding intellectual property impede open practices.
    - Issues related to privacy and security fuel social and political opposition.
    - Private sector increasingly knows more details about ordinary citizens.
  + Open culture is driving collaborative consumption.
  + Four factors needed for successful business model based on collaborative consumption:
    - Critical mass
    - Capacity
    - Belief in the commons
    - Trust and credibility between strangers
  + We don’t yet fully understand the environmental impacts of Open GIS.