GIS in Higher Education Summit: April 24, 2009
(Compiled Notes from Sophia Linn, Jamie Fuller, and Joel Murray)

**Guiding Question:**
How can we, as educators, researchers, and academics in geospatial technologies, best contribute to the overall improvement of our state?

1. **Welcome**
   - Melinda Laituri, Associate Professor, Forest, Rangeland, and Watershed Stewardship
   - Patrick Burns, CSU Vice President for Information Technologies and Interim Dean of Libraries

2. **State of affairs: GIS in Higher Ed in Colorado** (Melinda)
   (Slides: [http://welcome.warnercnr.colostate.edu/images/docs/cltl/StateofAffairs_Laituri.pdf](http://welcome.warnercnr.colostate.edu/images/docs/cltl/StateofAffairs_Laituri.pdf))

   **Who are we?**
   - Variety of interpretations. Do we need some consistency or agreement?
   - NCGIA core curriculum. *Body of Knowledge* document: a guideline for curriculum development. This should be the basis for any attempts at organizing curriculum/certificates/content, etc. Ten knowledge areas included; articulation.
   - *Geographer’s Craft* (Ken Foote’s online resource for teaching geographic concepts, etc.)
   - Integrate geography at K-12 level
   - Look at current curriculum and training
   - Look at tech programs
   - Build on NCGIA core curriculum to match; find common ground
   - What does a ‘certificate’ in GIS really mean? Is there any standard?

   **Comments:**
   - Check out NSF resource online—“Distributed Graduate Seminars,” National Center for Ecological Analysis and Synthesis (NCEAS)
   - Work with Career Centers at each institution. Include our link on their websites. Also, for our website, be able to search by degrees offered, etc.
   - Check out [www.geotechcenter.org](http://www.geotechcenter.org). Eventually this will have as its home page a map of ALL community colleges in the U.S.

3. **Results of online survey: “GIS in Higher Ed in Colorado” Google Map Application (Jamie Fuller)**
   - Presentation of prototype for a statewide online map of GIS programs at institutes of higher education.
   - Data for the map were gathered using an online survey (via Survey Monkey). All participants were asked to complete the survey about the GIS programs at their institutions.
   - Where will this ultimately reside? Who will provide upkeep? To be determined.
   - Questions/Comments:
     - How are the schools in the presentation linked to their career centers?
     - Degree or certification field? – will be completed soon
     - The group liked the page and agreed it should be maintained.
     - Jim mentioned that his group is looking into long-term funding for websites.
     - It is difficult to find information about CSU GIS stuff (!)

3. **Comments from the field**
a. Jon Gottsegen: Status of GIS at the State Level—Role of Institutes of Higher Education
(Slides: Gottsegen, part 1 & Gottsegen, part 2)

- Chief Information Officer (CIO) is now a cabinet position. Talks directly to governor.
- Issue is “how to organize??” More consolidation? Enterprise approach. First must FIX the organization before anything else can be done.
- State CIOs KNOW ABOUT GIS, and generally are very supportive.
- “GIS Culture”—could be detrimental, because often viewed as separate not integrated. Must become more integrated with IT; it may be ‘special/spatial’ but it must become ubiquitous.
- Stewardship of authoritative data sets. Who manages what? We WILL work together as a state. “Data governance”
- How can/should states and universities work together? State is not funding anything now. It’s ‘bare bones’ and underfunded. Difficult to keep up with technology. Universities could help with this.
- NAIP: could CSU be analysis provider?? Skills ARE needed; not just concepts.
- There was a comment that GIS may be fragmented because the sciences are fragmented themselves.
- Big words from this presentation: Integration and Governance

Discussion
- There was a question about how the state complies with standards. There WILL be standard practices, but no authority yet.
- There was a comment by the TNC rep who agreed that GIS is not a ‘special’ technology and treating it as such is disservice to the field.
- Fragmentation of sciences. Comment from Microbiology Prof: In class, he displays a 3-D graph, by scale, topic and organism type (interesting idea). Where are there commonalities and differences within the field?

b. Ken Foote, University of Colorado at Boulder: Cancelled due to illness

c. Esther Worker and Joseph Kerski, ESRI

- CSU has been involved with GIS from the early days (customer number 149).
- Education Portal within the educational community that lists curriculum, training and events. You can use your Global ID to specify your interests; allows for greater networking.
- Higher ed must market to its FEEDER COMMUNITY (middle and high schools). Invite them on campus; go do presentations.
- Poudre School District has a WIRED grant.
- Rocky Mountain High School—“Mapping Technologies” course
- Kids don’t care if it’s called “GIS”; they just think it’s cool technology and like to play with it.
- “Visual Informatics” in Denver as part of ArtStreet—GIS and web design; integrated with other technologies; one tool on the ‘tool belt.’
- Huge growth in GIS in business schools.
- District licenses in Denver Public Schools and Aurora schools. Soon students will expect GIS to be in all of their classes at college/universities. Utah is most progressive on this front.
- Non-formal education has ‘blown the top off’ GIS in K-12 (e.g., 4-H clubs)
- Real life experiences for learners:
  - community mapping
  - key for connections with: professionals, opportunities, jobs, etc.
- General consensus: Graduates coming out of universities are not ready for jobs.
• ESRI Development Centers: developers are coming out of computers science departments.
• Re: ‘cookbook approach’ to training. This is unrealistic. Training has to be ‘non-linear.’
• Universities should have “Industry Advisory” sessions at least once or twice a year to ensure that what is being taught is what is needed. Enlist ‘community visionaries’ to anticipate the needs of the industry a few years down the road.
• Fundamental geography (and spatial thinking) should be an essential part of K-12 education U.S. curriculum.
• GIS is taught in all levels at the U.S. Air Force Academy. All students are required to take it.
• GIS in the Rockies—Sept. 15-17 in Loveland. Have a continued discussion

4. Panel discussion:

Panelists, made up of GIS professionals from a variety of organizations, were asked to address the following:
• Your position and organization.
• How your organization/industry uses geospatial technologies (briefly!)
• What positions you have in your office/organization for GIS professionals. What are they expected to do?
• What skills and knowledge you expect from new hires.
• Your thoughts on how best to prepare these students.
• How you view institutes of higher education with respect to their contributions to the GIS profession.

a. Steve Holmes, City of Loveland:
• Some programming is key
• FUNDAMENTAL skills: reading, writing, math, basic communication, problem solving, etc.

b. Scott Steigerwald, Idea Integration:
• Exclusively IT consultants.
• ALL staff are programmers: Python, object oriented; C#; SQL server.
• Consultants must be EXPERTS and the only way to become that is through experience.
• SQL server spatial and Virtual Earth; they prefer VE over Google.
• PROJECT MANAGEMENT—Agile approach to project management (SEL: Here’s an interesting overview of agile project management: http://www.ccpace.com/Resources/documents/AgileProjectManagement.pdf)

c. Jeffrey Evans, The Nature Conservancy (TNC):
• Science-based organization. Scientific rigor; publishing.
• Levels of GIS staff:
  o Interns - narrow to specific projects
  o Technicians - compile data/support staff; question the data – GIS skills
  o Analysts – know more about data analysis and be able to process and handle complex ecological models
  o Modeling/spatial statistics (integrative; “R” (an open source version of S+); massive spatial library)
  o Domain knowledge is key, not all GIS skills

d. Heather Stanton, NPS:
• Soil, vegetation, geology inventories; produce data for all parks.
• Data models already developed.
• They employ interns to specialists: some need programming skills, others project management skills.
• Specialists in a discipline are needed—WITH GIS skills.
• More support needed for GIS integration into other subjects.
• NPS has in-house GIS support group.
• Service wide consistency; all data via one portal.

e. Important Job Skills - SUMMARY
• Programming
• Project Management
• Knowledge of the scientific method (scientific rigor)
• Ability to interpret results from an analysis
• Modeling, geostatistical analysis
• Experience with remotely-sensed data
• File Management (“What did I name it and where did I put it??”)
• Problem solving
• Self-thinkers, self-starters, equipped with collaboration skills
• More real-world experience (i.e. internships, collaboration between university/corps-orgs).
• Quantitative skills: Rigor, discipline, deal with numbers (without fear!); problem solving. Avoid “5 minute error”—that is, someone will notice your errors within five minutes of looking at your work.

f. Discussion
• Most don’t understand the underlying geography with GIS to begin with. (e.g., terrible campus map of CSU)
• Importance of communicating data; graphic display of spatial and other data
• There should be a fundamental return to cartography
• One needs to identify the product and customer base.
• Mass misunderstanding of GoogleEarth/Map type stuff; they are tools for VISUALIZATION, not data analysis.
• Virtual Earth (VE) is grounded in photogrammetry NOT visualization.
• Legal implications of data. Is this discussed? It’s in Body of Knowledge document.
• We need to move away from the idea that maps are discrete objects, because in GIS we do not need to define concrete boundaries.
• Note to instructors:
  o Let go! Let students solve problems - ‘teach’ problem solving. (“Guide on the side; not sage on the stage”—same discussion in K-12 GIS)
  o Teach a critical approach to the nature of information
• How can Community Colleges prepare students?
  o Basic skills: math, algebra, vector/raster, concepts/buttons, cartography, map use
  o Not necessarily specialty in one field or another.
  o Basics like “what’s a loop” or “conditional statements”.
  o Basic scripting. How to define consistent domains; basic database design principles. True critical thinking about information.
• Spectrum: DEEP specialists \rightarrow lay public

LUNCH

5. Concerns/interests in GIS (individual responses)
Before dividing into breakout groups, each participant was asked to express any particular issue/concern/topic that they felt was important to discuss with the group. The list below summarizes the comments.

• Reduction in the redundancy of lesson plans. Look at Arc Lessons. You can still ‘do your own thing’ but you can look at what others have done with the same topic/problem/issue.
• Integration of GIS and online degrees.
• Students need more programming skills.
• Professional development for GIS and non-GISers alike
• Faculty exchange and/or guest lecture program, across and within campuses
• Integration of GIS in high school and middle school. Make sure middle and high schools know about GIS as an option for study.
• GIS curriculum development.
• Clarify direct transfer of courses; robust courses vs. rules for articulation.
• Where does GIS belong in institutions and how to properly integrate into the sciences?
• Difference between basic and advanced GIS skills.
• How do we establish performance-based competency in GIS?
• Separation of GIS ‘niches’ among all types of colleges.
• Continue to develop relationships across the state
• Number of credits required for a ‘professional’ certification.
• Acknowledgement that remote sensing and GPS are a part of GIS.
• Need for a national organizing body for GIS certification. (See http://www.gisci.org/)
• How to properly sequence GIS courses.
• How to attract students to GIS courses.
• The need for students to have more real-world experience which should be provided in the form of internships by the industry.
• Teach GIS from a discipline perspective not from a GIS fundamentals perspective.
• Mapmatics: Realize the ‘numbers’ behind the map, possible name geotechnologies.
• How should the state and universities work together
• Specialty in Discipline vs. specialty in GIS
• What is geography
• How to get people to understand more about ‘geography for their discipline
• How to populate advanced classes
• Public domain for sharing information
• Self-paced courses are good.
• URISA certificates (See: http://www.urisa.org/about/gisci)

5. Breakout Sessions

a. Sharing Resources
• Why doesn’t Colorado have a ‘single stop’ data portal for state data?
• Need to use data that is relevant (i.e. Colorado data).
• Save time and resources. What’s the best way?
• Virtual campus. OK, but cook-booky.
• A lot in public domain for intro to GIS – need more advanced topics
• Emphasis placed on academic honesty and a code of ethics.

What is the most useful format for a virtual (guest) lecture?
1. Have the lecture available beforehand and let students know what to expect.
2. Embedding spatial analysis questions into the lecture.
3. Packet the data and give guiding questions (because students do not like to read).
4. Possibly have a video clip of instructions.
5. Provide background information about the data (i.e. source, projection, etc.).
6. Categorize the lectures by skill level (i.e. beginner, advanced).
7. Develop something that is uniquely paired to concepts.
8. Have labs and assignments (homework that the students actually have to think about) that are topical.

Three prong approach to sharing:
1. Listserv for profs or something of the sort (listserv tends to get overlooked – podcast, wiki)
2. Repository for actual lectures/teaching materials
3. Utilize technologies (web) for guest lecturers via Skype

Articulation:
- 60+60.
- How to discern course numbers with actual competencies; statewide consistency of name and course number.
- Terminal vs. transfer degrees?
- Consortium of community colleges—Career & tech.
- Need to meet more regularly.

Skill Sets/Competencies:
- Need to recognize GIS is taught both horizontally AND vertically across disciplines to focus on skills/competencies of that discipline.
- Standardize a Certificate
- USE Body of Knowledge as guiding document
- Integrate computers into Geography
- Hook non-profits for collaboration
- Teach Geography in Computer Science
- Basic vs. specialized courses across disciplines
- Statistics is a model of how to integrate across disciplines
- Faculty education on GIS to integrate across campus/advertize guest lecturer
- Three types of Certificates
  - Intro level
  - Technician
  - Programming/technician/advanced
- Levels of competency:
  - Technician
  - Specialist
  - Programmer/Senior Analyst
  - Academic/researcher

6. Final comments:
- Plan further discussions and session for GIS in the Rockies, September 2009
- Keep connected with one another; plan future meetings at other institutions.
- Create website? Where? Who manages?