Cartography 2003

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Cartography 2003 is a rich and awesome topic. I am presenting here a sort of potpourri of topics and images that characterize the field in 2003. Not everything that is referred to is strictly from this year, but then, not everything we are or see today was invented or even updated in 2003!

My comments are in five parts: *enduring content* (that is, the stuff of the discipline that "stays with us" and is not new to the field in 2003), *the definition of cartography* (some general observations about how it has shifted over the years rather than any attempt at an airtight definition), *maps today* (which does distinguish contemporary cartography from earlier years), *ICC 2003* (a few comments about the International Cartographic Conference 2003 because it was indeed an event of this year and a significant one), and finally a few words about *where from here* (one modest observation in the grand scheme of where things might go from here that may be worth sharing).

"Cartography 2003 is a rich and awesome topic."

Everyone in cartography knows that it is a constantly changing discipline. I remember a white-haired, but definitely not old, British colleague, Harold Fullard, once commenting that he had lived from the Stone Age to the computer age. What he meant, of course, was that he started out in cartography when limestone lithographic printing plates were still around and he was still in the business as computers were becoming the tools for making and even displaying maps. People in my general age group have lived from SYMAP, that first user-oriented mapping program, to palm tops, map-bearing cell phones, and ubiquitous mapmaking -- or at least more or less ubiquitous map access.

". . . cartography . . . is . . . constantly changing . . ."

In its ever-changing condition, some components of cartography simply go away. Color separation techniques such as scribing and peelcoats are gone, as is the construction of projections from tables and formulas, a cartographic activity that is far more likely to elicit groans than nostalgic comments from those who remember. But those are technical things; we expect that principles are more enduring, and they are. The principles of matching symbol dimensions with data characteristics, choosing mapping methods, and manipulating data in sound ways for display are still largely associated with the term cartography. Certainly presentation mapping is in the bailiwick of the discipline, as is map design, at least if it is considered explicitly. Map projections, even since the post renaissance splitting of disciplines, have never been exclusively cartographic territory, but choosing them has been with us for many decades. Map appreciation, by which we are generally referring to knowledge about maps as opposed to skill in making maps, is also a part of cartography.

". . . the definition of the field has changed . . ."

This list of components is not exhaustive, but I mention these things because the definition of the field has changed and there are also things cartography no longer owns. It might be helpful to consider the very simple definition of cartography that I generally use in talking to my lower-level class about what it means. I say that, in simplest terms, cartography is "the body of knowledge about maps." This definition is short and it expresses cartography as an intellectual discipline rather than a skill or technique or

the activity of mapmaking. There are indeed skills and techniques that are part of cartography and we do make maps, but it is the head full of knowledge that skilled people bring to the execution of maps that makes them good at what they do. And there are theoreticians of cartography as well as practitioners, and intellectually they have a lot in common. It used to be, however, that just about anything to do with maps was called cartography. That has changed in recent decades. We now share a lot of territory with GIS and (geo)visualization.

"We now share a lot of territory with GIS and (geo)visualization."

This sharing of territory brings up the question of whether cartography is dead. Mapping certainly is not, and a rose by any other name is still a rose. There is, in fact, a lot of exciting mapping going on these days, and there is a lot of knowledge about maps as well, spread over more people, not fewer. Michael Goodchild has stated that cartography (as a discipline) is being marginalized (Goodchild, 2000). We can hardly deny that. In higher education there are fewer and fewer courses labeled cartography, and at my institution, at least, when we put such a label on the class, few sign up. We also find evidence when we look at the jobs being advertised in geography. A few years ago, I tracked the advertisements for positions in Jobs in Geography, published by the Association of American Geographers (AAG, various dates). The results are shown in Figures 1 and 2. These are primarily academic jobs, not all jobs associated with cartography, but they reflect what is going on in the incubators for cartographers.

". . . cartography [jobs] peaked in '84-85 . . ."

The years covered were from 1981-82 through 1996-97. Figure 1 shows all new postings (top line) and the ones referring to cartography, GIS, and remote sensing. The total for all three of those areas is the highest of four lower lines, but it is not the addition of the separate numbers because many ads mentioned more than one of these areas. They are counted for each of the individual categories mentioned (the three lowest lines) but only once for the line representing all of three of them. The three areas accounted for a substantial portion of all ads, especially in the '90s. Individually, cartography peaked in '84-85, declined, and leveled out; GIS rose from first entries to the dominant of the three; and remote sensing remained relatively flat.

Figure 2 shows the proportion of all jobs mentioning any of these areas, and the shifting dominance is even more pronounced. Cartography declines, GIS rises, remote sensing fluctuates and levels off.

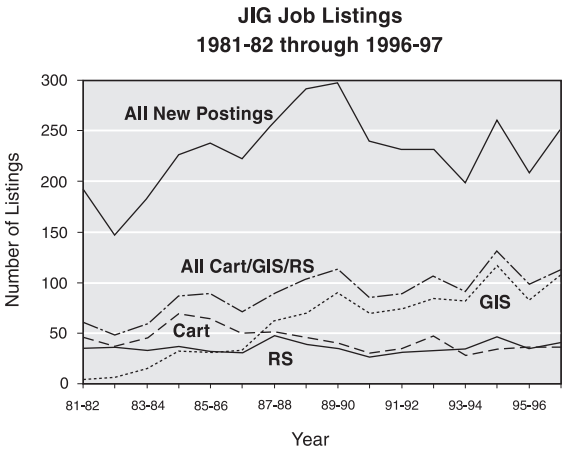

Figure 1. Jobs in Geography *(JIG) job listings, 1981-82 through 1996-97. The top line indicates the total number of new postings, the next one the number of ads mentioning cartography, GIS, and/or remote sensing. The remaining three lines indicate the numbers for each of cartography, GIS, and remote sensing; an ad mentioning more than one is counted in more than one line. Source: AAG, various dates. Acknowledgement: Amy Lobben assisted in the compilation.*

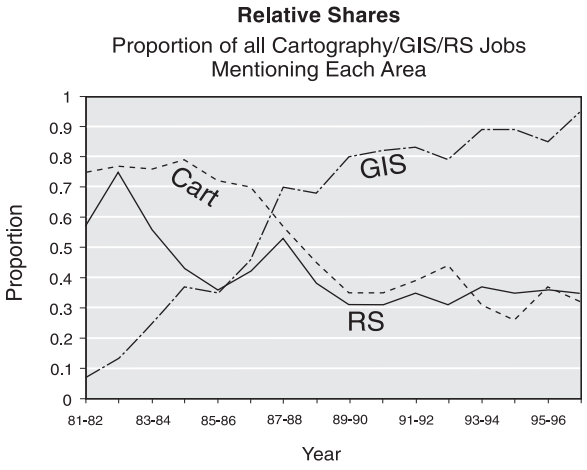

Figure 2. Relative shares. The values in Figure 1 are converted to proportion of all cartography, GIS, and remote sensing listings. Values do not add to 100% because some ads list more than one of these areas.

I was going to update this set of data to take the graphs through 2003, but that is not a straightforward thing to do. I recall that some of the ads in the time period of the graphs mentioned terms that were not explicitly geographic information systems, cartography, or remote sensing, and I may even have forgotten how complicated the vocabulary was. But here is some of the phrasing in 2002-2003:

Geographic Information Science…with a focus on visualization or health applications. (AAG, 38:7, p. 27)
Digital Technology and Communication (35:7, p.22)
Spatial Data Laboratory Supervisor/Instructor (38:7, p. 27)
Society and Information Technology (35:7, p. 22)
Assistant Professor GIS/Remote Sensing, PhD in forestry or related discipline. (38:7, p. 27)
Postgraduate Researcher..(diseases; fieldwork)…. A Bachelor's Degree in economics…preferred…knowledge of GIS and image analysis and spatio-temporal model(ing)…. (38:6, p. 18)

"The lexicon . . . has changed in recent years."

The lexicon, it seems, has changed in recent years. Yes, cartography does still appear in some of the job ads, as does GIS and certainly remote sensing, but many of the traditional terms have been replaced with new ones, reflecting new ways of looking at how geography is subdivided, and, more accurately, at the way departments are looking at the packages of knowledge and skills wanted in individual faculty members. The old terms (including GIS) do not have the cache they did a few years ago.

Whether all this is good or bad is open to interpretation. The relative number of new PhDs and new faculty members who identify explicitly with cartography dropped drastically enough in the '90s that it showed up as an age gap—a degree age gap that is, the length of time since someone completed their terminal degree. When the U.S. National Committee for ICA (International Cartographic Association; see ICA, 1999 and USNC, 2003) solicited applicants for travel funding to the International Cartographic Conference-Beijing 2001, the old guard, that is, those with older PhDs, were interested in going to the Conference, as were a cadre of young graduate students and assistant professors who might think of themselves as associated with GIScience, visualization, or cartography. But the mid-career applicants were largely missing—noticeably enough that for the next ICC (Durban, August, 2003), NSF granted funds not only for young scholars (as they have in the past) but to support a few mid-career cartographic scholars as well. Unfortunately, we could not get enough of them to Durban to use up the funds so allocated. Finding young scholars was no problem. Cartography might have become a marginalized term in recent years, but people are recognizing the common mapping interests among a variety of labels, and we are becoming comfortable with defining ourselves with multiple labels. Cartographer, GIScience person, visualization scientist, planner with interests in mapping and spatial data—we probably all have some combination of such labels at this point.

". . . we probably all have some combination of . . . labels at this point."

Though the changing definition is important, and the jobs data are interesting, there are many more things going on in cartography and they are of far broader interest and visibility. Here are some examples of trends that characterize what is going on in the field at the moment, in other words, that characterize what has grown out of the recent history of the discipline. (1) Cartographic visualization and the use of maps for discovery has definitely come into its own and is inspiring a considerable

amount of the research at this point. Research on presentation maps, on the other hand, is far less prominent than it once was. (2) Cartographic critique, the application of critical theory within the discipline, is a prominent part of our literature and thinking. Brian Harley's (1989) seminal article is now but one of many examples as cartographers and critics have followed his lead. (3) "Publication" is now as likely to mean that something is being put onto the Web or onto some other digital medium, as it is to mean that it is being put into print. (4) Mapmakers have shifted to "almost anyone", although some of the "mapmaking" is a lot more like ordering a map than making one. (5) Agencies traditionally associated with the production of maps are now far more involved in producing and delivering data. *The National Map* might be considered a case in point for delivering data but actually takes us a step further. It is the digital replacement of our very aging topographic map series in the U.S. and is not just a large database coming from an agency, but is envisioned as "public domain core geographic data…that other agencies can extend, enhance, and reference as they concentrate on maintaining other data that are unique to their needs." (USGS, 2003-11-06). In other words, cartographic conceptualization is serving up infrastructure and is not simply delivering a set of data, much less producing a map in the traditional sense.

As we are making these transitions in our cartographic ways, we can point to many products and practices that give us more concrete images of cartography in 2003. Again I am being selective, but notice how these are knitted into the broad social context, and are not internal matters in our profession.

Anyone with an Internet connection can now get detailed location maps, and such products as the ones generated on <www.mapquest.com> are good examples of how people "order" maps instead of make them. One can change scale and location and a few other things but one does not need to make a whole lot of cartographic decisions. And when we have our (Mapquest™) map up on the screen, we can click on the air photo tab and see what the area looks like from that perspective.

In 2003, we take for granted the ability to find public domain reference maps on the web. A good example of a site with such maps is as *The World Factbook* (CIA, 2003). Figure 3 shows the CIA's map of Azerbaijan. With a reasonable printer we can produce our own paper copy and it will generally exceed the quality of anything we produced on the copy machine using the library's copy.

We can also use Google™ or other search engines to find most any place, including, say, a remote game reserve in Africa, and find just where it is. Last summer, for example, I found a map of South Africa showing Phinda, a private game reserve in South Africa, to share with member of my family curious as to where I was going on my way to the International Cartographic Conference in Durban.

In 2003 we can probably find out more about some stranger's property than most of us would think appropriate. Cabarrus County (2001), in North Carolina, for example, has a website that shows property configuration (Figure 4), and by clicking on the property we can find out who owns it, when they bought it, how much they paid, and various other pieces of information. On some property map websites, we can even pull up a map of the resident's polling place if we want to know where they vote. Fortunately, law protects their ballots! On some of these sites, the property maps come with background air photos. All of this information has long been "public" in the U.S., but why everyone in the world with an Internet connection should have such convenient and instant access to it is an appropriate question to ask. Cartography and related disciplines in

Figure 3. A public domain reference map of Azerbaijan. Source: CIA Factbook, 2003. (see page 65 for color version)

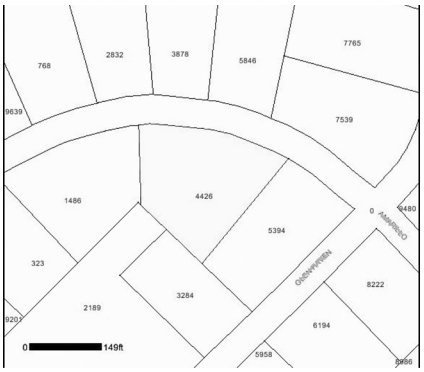

Figure 4. A property map on the web. Source: Cabarrus County, 2001. (see page 65 for color version)

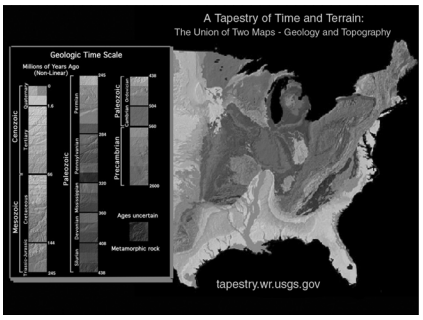

Figure 5. Excerpts from "A Tapestry of Time and Terrain." Image has been rearranged for this illustration. Source: Vigil et al., 2003. (see page 65 for color version)

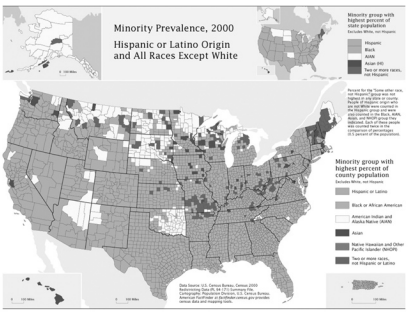

Figure 6. A map from *Mapping Census 2000*. Source: Brewer and Suchan, 2001. (see page 65 for color version)

2003 have some serious issues related to privacy and the balance between individual and public good (Curry, 1999).

As an example of the beauty and flexibility of modern mapping, "A Tapestry of Time and Terrain" (Vigil *et al.*, 2003) serves very well, even if it has been on the Internet for a few years now. A combination of the King and Beikman (1974) geologic map of the US and the Thelin and Pike (1991) landforms map, it is a stunning visual piece (Figure 5). Anyone with enough memory chips, a high quality printer, and a connection to the Internet can have a copy of it. Having helped a local theatre recently to decorate its stage and lobby for a production of *Lonely Planet* (Dietz, 1994), the play about AIDS that is set in a map store, I was especially interested to watch people during the intermission reacting to the patterns on this artful but reekingly-scientific map, which we had posted in the lobby.

After a dearth of thematic maps with the 1990 Census, we can now go onto the web and find *Mapping Census 2000* (Brewer and Suchan, 2001) (Figure 6), and we can print out high-quality copies on our local color printer. As an instructor in classes, it is refreshing to be able to print out multiple copies of high-quality maps of census data for students to use in class exercises and exams. The way in which we approach the teaching of map-related courses is, in fact, worlds away from a decade ago, in part because of the maps we can access, not just because we have different facilities for making maps.

And speaking of teaching, there are downloadable tools and materials on the web such as those from John Carnes's site on utilizing map grids (Carnes, 2002). His grid for zeroing in on UTM locations on topographic maps is a very useful tool for getting across to students the fundamental reason for using rectangular coordinate systems—convenience and speed. This little grid fits any one-km grid cell printed on any 1:24,000 topographic map in the US that is on the UTM projection (Figure 7), and the search-and-rescue mission example that Carnes uses to demonstrate the point is a captivating application and readily available.

We also have tools on the Internet for making maps rather than reading them. That sticky problem of selecting colors for maps is eased with ColorBrewer, with which one can select a reasonable set of colors with a few mouse clicks (Brewer, 2002). Select, say, 5 classes and her colorful red-yellow-blue scheme as illustrated in Figure 8, and the user can see it on the prototype map, learn that it should be fine for folks with color

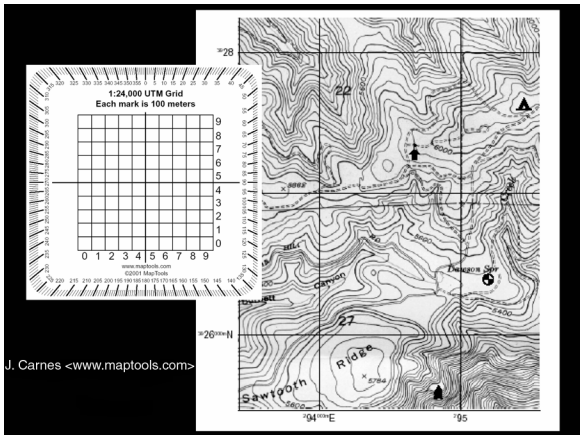

Figure 7. The location grid and example excerpt from a topographic map. The grid can be printed on transparent medium and placed over the map. Source: Carnes, 2002. Used with permission.

impaired vision (the eye icon, left column in lower left frame of the web page), will not photocopy well (second icon), will be fine on an LCD projector, laptop, or CRT (third to fifth icons), and might give problems on a color printer (sixth icon). Further, the user can display the specifications that should be used to print it with process colors or to display it on the computer screen with various software in common use by people making maps.

Animation has become a part of the arsenal of techniques in cartography, and Jill Hallden's population change in the U.S. is a fascinating example (Hallden, 1997; Hallden, 1999). It shows the progression of population across the U.S. from 1790 to 1960 and can be played through at a constant rate or one can click on the year of interest. Figure 9 shows the map image for 1910.

As to recent developments that are guaranteed to wow us, we only have to go to David Rumsey's website and look at the flyby over Yosemite Valley as depicted on an historical map draped on a digital elevation model (Rumsey, 2003) (Figure 10). Flying over an historic landscape is an experience indeed.

The wonders of modern technology are also mind boggling in the new Shuttle Radar Topography Mission results (USGS, 2003-09-25; JPL, 2003). In just 11 days in February 2000, this mission gathered elevation data for nearly 80% of Earth's land area. An example product is shown in Figure 11. Think of all the effort that went into collecting and mapping elevation since the inception of such elevation measurement and what early topographic surveyors would say if they knew about this 11-day mission! The form of land in areas where landform maps have never been made can now be portrayed with remarkable detail. In a similar category of wonderment is LIDAR, another radar technology that can be used to map even building form (TerraPoint, 2000).

Current cartography is also represented in the maps that win awards at the International Cartographic Association's map exhibit. Hundreds of current products are on display during the ICA's biennial conference, and in August of 2003, two of the awards went to U.S. mapmakers. NOAA won in the mapping-with-satellite-imaging category for their global coverage of nighttime lights (NOAA, 2000), a compilation of images based on data from the Defense Meteorological Satellite Program. Visitors to their website can interactively access the nighttime lights map of each continent. Figure 12 shows an easily recognized excerpt from the North America map.

The other U.S. award was in the CD/DVD category and went to Jim Meacham and Erik Steiner for the electronic version of the *Atlas of Oregon* (Meacham and Steiner, 2002). The still image in Figure 13 only hints at the nature and quality of their CD-Rom, which represents the state of the art of this type of medium. It has time sequences, rollovers, and flexible access; and it combines these interactive features with superb attention to the traditional aspects of maps such as color selections and mapping methods.

Anything entitled "Cartography 2003" must also address the matter of ICC 2003 (International Cartographic Conference and General Assembly) held in August of 2003 with a few points about its significance. It was the 21st such conference, and for the first time in its history was held on the continent of Africa. ICA met in Durban, South Africa, and as you can imagine, now that multiculturalism is the local theme instead of apartheid, the complexion of the conference was quite different from past ones. ICA elected its first Black African vice president (one of 7 vice presidents, elected every 4 years), Kenyan Haggai Nyapola. And a sort of mini confer-

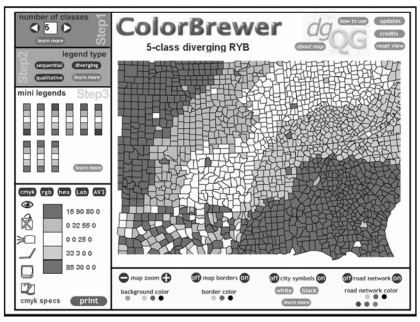

Figure 8. The layout of a Colorbrewer page. A diverging 5-class scheme is illustrated here. Source: Brewer, 2002. Used with permission. (see page 66 for color version)

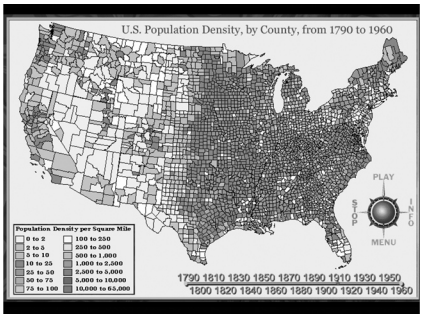

Figure 9. The 1910 population image in Jill Hallden Harsha's U.S. population animation. Used with permission. (see page 66 for color version)

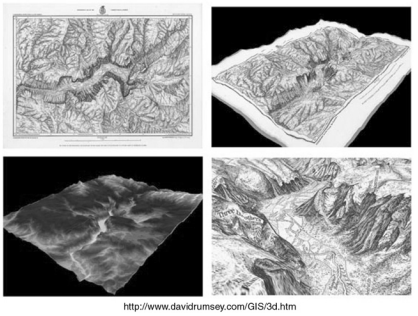

Figure 10. An historical map of Yosemite Valley, the current-day digital elevation model (DEM) of the same area, and the historical map draped over the DEM. The image in the lower right is a scene as one flies over the area. Source: Rumsey, 2003. Used with permission. (see page 66 for color version)

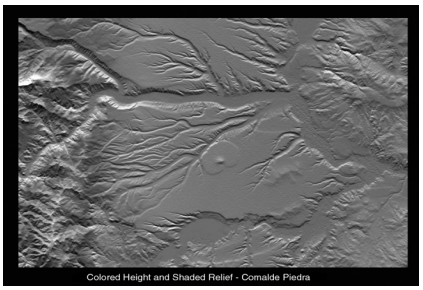

Figure 11. An image created from Shuttle Radar Topography Mission data. Source: JPL, 2003. (see page 66 for color version)

Figure 12. The southeastern U.S. excerpted from the North America segment of Nighttime Lights of the World. Source: NOAA, 2000.

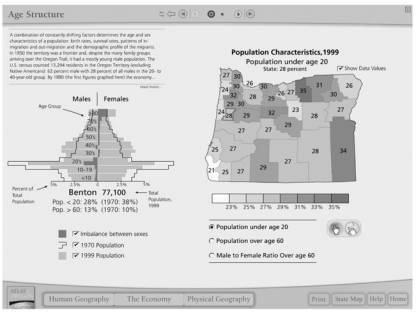

Figure 13. A screen capture of a page in the interactive Atlas of Oregon. Used with permission. Source: Atlas of Oregon *CD-ROM, Copyright 2002, University of Oregon Press. (see page 66 for color version)*

ence within the event resulted in something called the Durban Statement on Mapping Africa for Africans (GOOS, 2003), with a working group formed to continue the efforts started with that document. ICA has long had a policy of supporting developing nations, but the relationship took a very positive turn with the Durban conference. ICC Durban is likely to go down in history as a highly significant event.

I have referred now to everything from enduring content in the field of cartography to its decline as a recognized academic discipline (at least so far as use of the term in job ads is concerned) to the marvelous access and products that characterize cartography in 2003, which by whatever name(s) is a thriving enterprise. Much of the content has concerned the "whiz-bang" side of the field, but there are many things that could be described as such and they serve as the icons of current cartography and the benchmarks to be bettered in the future.

In looking to the future, however, I will not try to describe what the icons will be. Rather I will return to academia for a moment. Cartography is being done and we might say more and more of it is being done, but as an explicit topic of courses it seems to be appearing less and less. I began to realize recently that it is very much in the position that geography was in within the K-12 school system for many years. Geography was absorbed into social studies in much the same way cartography (and even GIS) are absorbed into geographic information science, visualization, and other descriptors. Cartography may be making somewhat of a comeback; I find my fellow GIS instructors at MSU anyway actually wanting cartographers to teach more cartography. But we are not going to return soon to the identity and acceptability that we enjoyed in the early to mid '80s. What happens, then, to the subject matter, the content of cartography? Do cartographic principles simply go by the wayside, to be rediscovered from time to time? I suspect that one step we need to take is to be creative and work it into other courses. Some of it is already taught that way, but not always very well. To take the step of increasing the quantity and quality of its teaching in other courses is not necessarily "giving up" on raising interest in more explicitly cartographic courses. It *could* just help to spur interest. GIS is being included across the curriculum and perhaps we need to include more cartography across the curriculum as well--in physical and cultural courses, in GIS and GISci, in regional geography, and perhaps even in related other departments such as geology, resource development,

"ICC Durban is likely to go down in history as a highly significant event."

"[we need to] work [cartography] into other courses."

soil science, and fisheries and wildlife. The entire educational model is changing anyway toward increased online and distance learning and mixed models of classroom and online learning. Cartography, like other areas, is adapting. Some good thinking into the sharing of materials, exercises, and ideas in new and creative ways is much in order in this transition.

There are ways to involve both academics and practitioners in making such adjustments. Practitioners have a tremendous store of knowledge and skill that academics have no time to acquire. As modules are produced for distance learning and mixed classroom/online learning courses, perhaps we all have an opportunity.

". . . we move forward toward Cartography 2004 and beyond."

To wrap up, I am both impressed with Cartography in 2003 and concerned about where we go from here. I will close simply by stating my opinion that NACIS has certainly grown to be one of the most important organizations facilitating the discipline and I expect it to continue its innovative and resourceful ways as we move forward toward Cartography 2004 and beyond.

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