

The Department of Geography at the University of California, Santa Barbara: History, Curriculum, and Pedagogy

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ABSTRACT

While the Association of American Geographers celebrates its 100th anniversary in 2004, the Department of Geography at the University of California, Santa Barbara, celebrates its 30th. This paper is a summary of the history of the department, as gleaned from written records and interviews with many of the protagonists. Included is a discussion of the curricula for the BA, BS, MA, and PhD programs, with special attention paid to the pedagogy of approach. The paper concludes with an examination of the highlights of the department's mission statement, which shows the common departmental philosophy toward the discipline and the highly interdisciplinary treatment of geography at UCSB.

Introduction

As PART OF THE Association of American Geographer's centennial celebrations during 2004, the Association has constructed a Web-based timeline of the history of North American Geography (<http://home.gwu.edu/~icheung/gat/gat.html>). Inspired by the AAG timeline, the Department of Geography at the University of California, Santa Barbara (UCSB), celebrating its own 30th anniversary in 2004, also has constructed a timeline (UCSB 2003). Gathering information for the timeline led to further interest in the history of the department. Supplemental investigative interviews and research by the authors resulted in both a Web-based informal departmental history and the more formal version presented in this paper. We believe that the documentation of the events of the department's first 30 years is important now, not only because many of the primary sources are still available for interview but also because there

is knowledge to be gained for the discipline as a whole from the UCSB experience.

The rise of the program at UCSB is remarkable in itself. From humble origins as the provider of a few geography service classes within UCSB's undergraduate program, the department has risen to join the legion of the highest-ranked graduate programs in the nation, according to the National Research Council (NRC 1995), in only 30 years. This meteoric rise has not been the result of chance. Sound early program design after formally becoming a department in 1974, clearly defined departmental goals, a common philosophy of geography among the UCSB faculty, careful strategic faculty hiring, a highly integrative interdisciplinary approach to teaching and research, and a flexible-yet demanding-curriculum at the undergraduate and graduate levels have been the foundations of success.

In this article, we document the chronology of the department, focusing on the early history and the elements that forged the program as it exists today. We consider the curriculum, how it developed, and how it is structured, including the critical role of computing. We conclude with a discussion of the department's goals, the pedagogy that drives the department's approach to the discipline, and prospects for the future as the department reaches the peak of its growth curve and develops new long-term strategies. This information is offered in the spirit of sharing with the discipline as a whole, as we believe that elements of the program are duplicable, and can be useful in building new and effective academic geography programs elsewhere. In particular, the department's treatment of geography as a scientific field that bridges the natural, physical, and social sciences has resulted in a disciplinary paradigm that we believe places geography at the forefront among the sciences for the integrative science called for in many national level research initiatives.

Chronology

The roots of UCSB lie in the California State Teachers' College, where a sprinkling of geography classes were taught by faculty from departments such as geology and economics. This practice continued when the Teachers' College became a campus of the University of California in 1944. With university status, UCSB broadened in

educational scope and grew to two campuses. One was on the Santa Barbara Riviera, now a movie theater and business park; the other on Santa Barbara's Mesa, now Santa Barbara City College. In 1954, UCSB consolidated by moving to a World War II Marine Base 9 miles west of the city in Goleta. The 408-acre tract, in a picturesque setting just south of Santa Barbara Airport, has approximately a mile of coastline and an extant loop of a stream canyon that now is a lagoon. The site had been the location of extensive asphalt mining operations and later the locations of fields and orchards prior to the major alterations that a Marine base entailed.

In 1961, the first lecturer was hired to teach geography exclusively; a second came in 1962. In 1963, the geography "program," which had been administered first by the Department of Social Sciences, then the Department of Sociology-Anthropology, was put under the direct charge of the dean of the College of Letters and Science (Golomb 1967). The dean hired two new lecturers. One of these was Berl Golomb from UCLA, who remained until 1971, struggling to build a department without the autonomy, funds, and tenure-advancing power that a departmental structure brings. At this time, the program was located in a marine barracks building, a two-story wood frame "temporary" bungalow known simply as Building 406.

In fall 1966, the geography program began offering a Bachelor of Arts degree. The *UCSB Catalog* description of the study of geography reflected the liberal arts and teaching history of geography:

Geographers investigate the surface of the earth as the home of man. The discipline of Geography is focused on a broad range of man-and-environment interactions, and encourages a variety of investigative approaches to problems of the ecology of man. Because of the breadth of integration in the physical, biological and social sciences, undergraduate Geography training provides a basic and useful liberal education. Graduate studies in Geography permit specific training in a number of scholarly and technical fields.

By spring 1967, 23 majors were enrolled and three graduated. In the 1967-68 school year, Geography thrived. There were seven faculty: two visiting assistant professors; two acting assistant professors; and two lecturers, all headed by Golomb, who was by then an assis-

tant professor. Thirty classes were offered, which included the usual general geography classes, regional classes (for example, "Middle East" and "Southeast Asia"), plus some methods classes (for example, "Microclimatology and Climatology Field Methods") and, for the first time, "Geographic Map and Photo Interpretation."

As in many parts of the nation, the late 1960s were marked by campus unrest. At UCSB, African-American students took over the campus computer center in North Hall. Students protested the Vietnam War. In the UCSB student bedroom community of Isla Vista, students burned down the Bank of America. At the same time, the birth of America's environmental movement was taking place. On January 29, 1969, in the Santa Barbara Channel, a blowout at the Union Oil "Platform A" spread 200,000 gallons of crude over 800 square miles, fouling UCSB's own beaches (Clarke and Hemphill 2002). Geography faculty and students became involved in the environmental issues (Mason and Kuhn 1970); for example, Norman Sanders required students to write a press release and go on a field trip to the Diablo Canyon nuclear plant. Sanders returned to Tasmania in 1974, became a senator, and received a special lifetime award for environmental activism in 2001.

Golomb hired John "Jack" Estes in 1969 after he completed a geography degree at UCLA. Estes taught air photo interpretation and was the sole survivor of the reinvention of the program in 1974. Estes had worked for government intelligence services, interpreting air photos in 1963 and 1964. When Estes was hired by UCSB, this technology was beginning to spread to civilian applications, and the 1969 oil spill cemented the value of the technologies for environmental use (Figure 1). That same year, Geography moved to its current location, Ellison Hall, which included classrooms, labs, and offices. There were eight faculty members, but significant turnover. A possible fallout from the department's environmental activism was that the chance of gaining self-governance and departmental status from the College of Letters and Science dimmed. The more academically ambitious faculty saw that without departmental status, tenure was unattainable. The program was sinking, partially because of reduced budgets during Governor Reagan's tenure, the start of "Reaganomics."



Figure 1. California Governor Jerry Brown visiting Dr. Jack Estes at the UCSB Remote Sensing Research Unit in the late 1970s.

In 1973, a change in deanship altered the role of Geography significantly. Chemistry professor Bruce Rickborn became associate dean of the College of Letters and Science. Acknowledgment was made that the geography program to date had been poorly run by the administration. At the time Rickborn became dean, Geography had six faculty positions, one of which was unoccupied. Some members of the academic senate not only vied

for the vacant faculty slot, but advocated terminating Geography. Rickborn had to decide whether Geography would have a future at UCSB. He assembled a committee of three extramural geographers who spent 6 to 8 months researching the study of Geography, reading articles, and listening to geographers.

Rickborn concluded, "Eighty-five percent of Geography departments were moribund.... 'This tribe occupies this area, and this is what they grow and eat.'" Geography as an extension of grammar school curriculum was not going to fly at UCSB. However, Rickborn respected the kind of geography that Estes was doing, reassuring Estes that "We could build something based on remote sensing." Rickborn had to convince the vice chancellor of the viability of a modern, technological geography department, and also had to address the opposition to geography in the academic senate. To ensure greater likelihood of the future chair being able to create the department Rickborn envisioned, he thought it best to reinvent the current program. "I had the unfortunate job of telling all except Estes that they had to leave." So, in the early 1970s, UCSB Geography died, the sole surviving spark carried on by Estes' work on aerial photography and remote sensing. This period is colloquially referred to as the "night of the long knives."

A chair search committee sought a professor with demonstrated stature who was committed to a remote-sensing emphasis. The short list of candidates included David Simonett, Reginald Golledge, and

Harm de Blij, all highly respected geographers. In an interview,

Rickborn stated 'Originally, I thought zero of social geography – until I met Reg. The economics professor on the search committee

also knew of work in economic geography, and also respected Golledge. Nevertheless, the committee chose Simonett.

Simonett had long wanted to build a forward-looking, progressive geography department featuring a well-funded remote-sensing research center. The seeds of this interest were evident early in his studies. In the 1940s, while a student at the University of Sydney (Australia), he was introduced to land use mapping. The first person to graduate from any Australian university with a PhD in geography, Simonett had focused his doctoral research on applying scientific methods to land use mapping. He worked at the University of Sydney, the University of Maryland, and the University of Nottingham before finally joining the Department of Geography at the University of Kansas, where he remained for 15 years. All the while, he was developing expertise in remote sensing. In 1966, he was appointed associate director of the University of Kansas Remote Sensing Laboratory. In 1970, he returned to the University of Sydney, hoping to contribute to his alma mater. Compared to the research funding he had come to expect in the United States, Australia's funding seemed insufficient to build the kind of program in remote sensing that he sought. Consequently, in 1972, Simonett became director of the Washington-based Earth Satellite Corporation, where he was working when he learned of the opening for a founding chair of Geography at UCSB. "Although at last a senior scientist in a large remote sensing establishment, David retained his dream of one day developing his own research institution with a University environment," wrote Trevor Langford-Smith (1991).

Simonett was hired and took over as the first chair of the new department when it came into formal existence on July 1, 1974. As soon as Simonett was hired, he began pursuing Golledge, someone he knew had been a rival candidate for chair. Simonett's strategy for building a department was to carve out portions of geography, both human and physical, that were connected by the common use of measurement and analysis. The goal was to seek accomplished people for each focal area, then to infill with junior faculty. Golledge

was seen as key to one of the areas that would become UCSB's strength, human behavioral geography. Simonett was an aggressive recruiter, even making personal trips to persuade senior hires to come. Among the early recruits were Golledge, Waldo Tobler, and Terry Smith.

During the 1970s and 1980s, Simonett followed a consistent hiring strategy based on clusters of faculty with reinforcing interests, jump started with initial senior hires. This strategy attracted to UCSB a group of young, energetic scholars that he not only personally tutored in grantsmanship, but also encouraged, pressured, and steered closely through academic promotion and tenure. Among these was Jeffrey Dozier, who stated, "A lot of the credit has to go to Simonett. We thrived because of two of Simonett's characteristics. One, he talked to everybody. In other words, he kept everyone up to date on what everybody else was doing; he helped professors cross-pollinate. And two, he had the least contentious ego. He took genuine pleasure in others' achievements; he didn't need to take credit."

In 1980, Simonett made his last hire as chair: Richard Church, a young assistant professor, to bolster human geography. Simonett then stepped down as chair. With fewer duties, he was prevailed upon to take over the role of dean of Graduate Studies at UCSB in 1981, although he still remained highly active in the department; he died in 1990. Golledge became the second chair.

At the end of the 1980s, an opportunity presented itself for the department to take a leading role in the rapidly maturing field of GIS, with NSF's call for proposals for a National Center in GIS research. "The proposal for the National Center for Geographic Information and Analysis (NCGIA) was the first major proposal where almost the entire department was involved in writing it," said Richard Church, who succeeded Golledge as chair. Even Simonett, then dean of Graduate Studies, was a key member of the team. The NSF's call for proposals was the first competition for a national center outside the traditional fields of science and engineering, and competition was intense. Teaming with Maine and Buffalo was critical, as was bringing Michael Goodchild to UCSB from the University of Western Ontario. UCSB's proposal involved several writing sessions in Santa Barbara and one in Buffalo. Simonett, Terry Smith, Estes, and Church flew to New York from Santa Barbara, and

Goodchild joined them from Canada. The 3 months of work on the proposal was rewarded when NSF funded the NCGIA. The consortium was established in 1988 and played a major role in shaping GIS research, teaching, and expertise-building during the 1990s, with several rounds of NSF funding, and continues to play a role in the field. The NCGIA featured in the genesis of the far broader UCGIS, a multi-member university consortium that today plays a national role in guiding GIS policy, research, and education (Goodchild and Mark 1993).

During the 1990s, the department continued to grow, approximately doubling in size over the decade. An innovative addition to the program was the founding of a joint doctoral program in geography with San Diego State University in 1991. This program has grown and thrived over the years, and includes a period of 1 year of residence at UCSB for all students. By pooling faculty expertise and resources from the two programs, a far broader student community is able to be served. The program has awarded 17 PhDs to date. As the program has matured, it has been the location of numerous research and professional meetings, including dozens of research meetings for NCGIA at Santa Barbara's Upham Hotel, and professional meetings of the Association of Pacific Coast Geographers, the Western Regional Science Association, and the National Council for Geographic Education.

Central to the coordination of this growth has been a rigorous planning process. Annual faculty retreats now use a 10-year planning horizon for faculty recruitment, while curriculum is revisited regularly. Earlier chairs accomplished much in defining the role for geography as a stepping stone between the hard and soft sciences, in teaching evaluation, in achieving equality in faculty workload, and in getting recognition for the remarkably successful geographical research taking place at UCSB. By 2001, UCSB Geography had become the largest grant-receiving unit on campus, with an astonishing average of over \$400,000 per faculty member per year, a ratio that has since been sustained. Numerous research units were formed and solid ties made with other units on campus. Geographers were instrumental in establishing the UCSB Bren School of Environmental Science and Management, the Marine Sciences Institute, the Institute for Computational Earth System Science, and the National

Center for Ecological Analysis and Synthesis. With such a broad base, many Geography faculty were hired with the PhD from outside geography, including such fields as geology, civil engineering, and geophysics. A remaining issue is to consolidate into a single campus location, the goal being to counteract the accumulated impact of fragmentation caused by such rapid growth.

Academic Programs

Between 1977 and 1980, the department established both the master's and doctoral programs. Simonett, Estes, Golledge, Tobler, Dozier, and Smith submitted a proposal for the master's program in 1977, shortly after Golledge and Tobler arrived. The program was speedily approved. The first students to earn a master's were Thomas Logan and Douglas Stowe in the spring of 1978. Even before receiving formal approval for the master's program, the same team wrote a proposal for a doctoral program. It was approved in less than 2 years by a one-vote margin of the faculty legislature. The PhD program was in place in 1980. The first PhD student to graduate was G. Donald Richardson, in the summer of 1982. As of spring 2003, the department had awarded 269 master's degrees and 123 PhDs in geography.

Additional new faculty clusters in the 1980s included oceanography, cartography, and the brand-new geographic information systems. In each case, the cluster was built upon a set of undergraduate and graduate classes, research funding in the area, and a group of graduate students, usually supported by that funding. The role of funding was growing in importance. After 1980, the department began to receive some of the overhead money generated by the research directly, and staff positions were added for research-grant management. This staff quickly integrated computers and data bases into administration, using core faculty knowledge for practical purposes and streamlining grants administration. This tight integration between research, administration, and teaching has remained a feature of the department, to the extent that functions are sometimes impossible to classify uniquely.

The undergraduate and graduate curricula at UCSB are determined by a standing curriculum committee, which includes student representation and reports to the faculty at large. Adding new classes

and revising content is comparatively simple, with UCSB faculty senate and College Executive Committee approval required. Significant help in curriculum design and assessment is available to UCSB faculty through the instructional improvement program, which gives grants to help Geography in pioneering new instructional methods, along with content and delivery mechanisms. The department offers a few classes at the lower-division undergraduate level, but has the most variety and depth of content at the upper-division and graduate levels.

The department offers the BA in Human Geography and the BS in Physical Geography, and hopes soon to offer the BS in Human Geography. UCSB operates on the quarter system, with an expanded summer quarter becoming increasingly important. For the BA degree, 20 units are required at the lower-division level (freshman/sophomore), including classes in Oceanic and Atmospheric Processes, Land Surfaces Processes, and Introductory Human Geography; and core classes from other departments, including biology, geology, anthropology, economics, environmental science, political science, psychology, and sociology. A statistics class is also required. At the upper-division level, majors for the BA take 36 units from the advanced classes in the department, largely reflecting the research interests and graduate teaching of the faculty. These are complemented by 4 units in human systematics; 8 units in techniques, including remote sensing, GIS, cartography, and spatial statistics; and 4 units in regional classes, emphasizing the United States and California. Another 16 units of upper division electives are required, with a maximum of 8 from outside of geography.

The BS in geography involves 53 units, including core classes at the lower-division level, as for the BA, plus basic core classes in mathematics, basic calculus, physics, or chemistry. Classes in computer literacy and programming are highly recommended. At the upper-division level, BS students take 10 units of physical geography fundamentals, 12 units of techniques classes, 12 units of introductory systematics classes, and 12 units of specialized physical geography. These include oceanography, hydrology, fluvial

geomorphology, global system science, soil science, and biogeography. The geography BS major is therefore 53 units total, with 46 required at the upper-division level.

The Geography Department at UCSB offers the master's and PhD degrees in three broad areas: earth system science; human-environment relations; and modeling, measurement, and computation. Earth system science emphasizes the measurement, analysis, and modeling of hydrologic, atmospheric, oceanic, and terrestrial systems and their interactions. A large proportion of the problems addressed involve large regions, mathematical and computational models, and large, spatially indexed datasets. Human-environment relations covers the major components of human geography offered by the department, including: human spatial behavior; spatial decision-making and decision support; spatial and geographic cognition; urban and regional modeling, planning and policy; human movement and transportation systems; resource and environmental management; environmental ethics; and human responses to a changing environment.

The study of geographical techniques, including GIS, falls under the modeling, measurement, and computation theme. This area is intended to develop, explore, and test new methods of analysis, statistics, and computation for the modeling of the complex, geographic phenomena that are the subject of investigation in the other themes. Important sub-areas include numerical modeling, spatial statistics, remote sensing, computational modeling, and database systems (including GIS) and visualization, all of which are increasingly dependent on a knowledge of computational theory and practice. Students can also participate in interdisciplinary programs, including Cognitive Science or Quantitative Methods in the Social Sciences (QMSS), marine sciences, and earth processes. Interdisciplinary programs involve faculty from many UCSB departments and give students an appreciation of the interdisciplinary study of thinking, perception, and intelligent behaviors, as determined jointly by the nature of the environment and by the internal architecture of the intelligent agent, whether human, animal, or machine.

Students are admitted in the fall quarter only for the PhD, the MA/PhD sequence, and occasionally for a terminal MA. Selection among the applicants is by the department Graduate Committee, composed of seven faculty members and the Graduate Program assistant. Selected applications are then made available for review to the entire department faculty. If a faculty member is interested in

"sponsoring" an applicant, the Graduate Committee will proceed to admit the student, should the graduate school requirements be met and the sponsorship appropriate.

The master's program offers two plans: the thesis (Plan I) and the examination (Plan II) alternatives. Plan I requires 34 graduate units; Plan II, 46. At the graduate level, courses required of all students include Seminar in Geography, Introduction to Geographic Research, Analytical Methods in Geography, and Introduction to Geographic Data Analysis. All teaching assistants must take a specialized class in teacher training. All PhD students must major in a systematic area of study and are expected to develop great depth in one or more techniques areas, but are tested in only one technical area. For advancement to candidacy, the Geography Department requires a diagnostic interview, a written comprehensive examination, an approved dissertation proposal, and an oral qualifying examination.

The Digital Revolution and the Curriculum

Jeffrey Dozier and Alan Strahler team-taught the first department computer course in spring 1975: Geography 170, "Univariate Statistics." The course used an IBM mainframe, a PDP-11 minicomputer, and remote terminals. A group of students, including undergraduate Jim Frew, cleared out some space acquired by Simonett, an unused laboratory in the Engineering building that happened to be next to a computer running UNIX. Dozier and Frew taught themselves how to use this early machine. Frew recalls that "this is where the computerized aspect of the department [research] took off." Beyond the statistics group, early computing support was weak at best. Tobler described the UCSB computing environment when he arrived in 1977:

When I arrived here, the computing facilities were abominable. [Chancellor] Cheadle had turned computing over to an administrator who promised to curb the rapid growth in costs that were occurring. This he did, with disastrous results. One of the professors in engineering had established an Internet-like arrangement, with interactive graphics and computing, far in advance of most other places. This was not supported by the university. It was

actually squelched, and the professor in charge left. The computer administrator at UCSB let IBM dictate the type of computing available to faculty with rather awful rituals and clumsy software. I did most of my computing via telephone back to Ann Arbor on a teletype machine, using their Amdahl machine and the interactive MAD language.

Golledge, while chair, acquired two VAX 11 /750 machines, one for research, one for teaching. This was, in effect, a declaration of independence from central university computing, a philosophy that has stood the test of time. The two VAXs added to the larger VAX in the Remote Sensing Research Unit, which had been in use since 1978. Faculty networked to the hulking, early UNIX machines through workstations, including some of the very first Sun workstations ever shipped, with serial numbers around "100." The instructional machine was used for statistics courses and also for document preparation with UNIX troff, because a laser printer was hooked up to it. In addition to Geography's VAXs, in 1980 the university made available to faculty and students a computer center with IBM 360 Model 65 clones. At this time, only a few faculty had garnered their own computers through grants.

By 1988 the department was completely weaned from the university computing system, and faculty all had either their own PC or a workstation hooked to Geography's UNIX system. Computerization of the department changed the teaching of cartography. In 1984, student labs had been set up with drafting tables, pens, compasses, protractors, and lettering sets. By 1988, paper and pens were gone. The labs were set up with workstations and ESRI's ArcInfo. After many years of change, the department has settled on a strategy of two large teaching laboratories, one based on Intel and Windows, and one based on UNIX workstations. Most graduate students are assigned offices and their own computers of choice, usually purchased on research projects and grants. The UNIX laboratory, called the Descartes Laboratory, was funded with assistance from the NSF's Instrumentation and Laboratory Improvement program. The department continues to support extensive suites of software, including ESRI's ArcInfo, ENVI, ERDAS, MATLAB, and many others.

Teaching Pedagogy

David Simonett left more than a management approach at UCSB; he also left a unified teaching pedagogy. Critically aware that the future of Geography lay in the integration of analytical method and tools, the scientific approach, and integrative cross-curriculum approaches to teaching, he established a framework for structuring the department, its faculty, research, and curriculum, around what became known as the Simonett "cube." At first, the cube was simply a three-dimensional space, with axes representing human geography, physical geography, and methods. Faculty and students would map into this space at a point, a cluster of points, or a zone. The pedagogy dictated that as a small department, coverage of the entire space of the cube was impossible and that, instead, clusters of faculty and their students should fill the space of the cube with overlapping, mutually reinforcing specialties. This meant that the single senior/multiple junior faculty clusters could work in self-regulating isolation using the standard research laboratory structure so common in physics, chemistry, and biology. Strong affiliations between students, faculty, and their "units" built over time, and persist today (for example, Estes' Remote Sensing Research Unit, whose "unitoids" had a strong identity within the department).

With the growth and development of the department over time, both larger and more clusters were possible. In a later version of the cube (Figure 2), the three dimensions were recast as geographical techniques, geographical specialty or theme, and the type of modeling used, numerical, mathematical, or statistical. To a great extent, this version of the cube is no longer a three-dimensional space but a three-dimensional matrix, each cell representing a combination of skills, expertise, and research combined across disciplines. For example, mathematical models for the remote sensing of oceans share expertise with mathematical models used in remote sensing for hydrology. Proximity or adjacency in the new cube implies common approaches and interdisciplinary opportunities among the faculty of the department, and with other disciplines across campus. Two of the methodological dimensions of the cube map onto graduate and undergraduate courses required or expected of most students. The only variant is the theme.

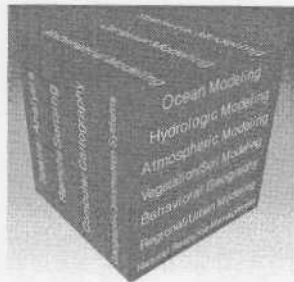


Figure 2. The Refined Version of Simonett's Cube.

The cube has been an effective vehicle for communicating the common mission of the department, especially to new faculty. Nevertheless, a growing department has faced decisions for which this pedagogy provides only minimal guidance. By 2004, the department hopes to have 24 faculty in 23 FTE, two active professors emeriti, and five affiliated faculty (zero time appointments from other departments) (Figure 3). Among this group are three members of the

National Academy of Science. In 2000, the department devoted a considerable amount of time at the annual faculty retreat to developing a mission statement and goals for the next era. The mission statement itself is posted on the department's Web site and has been incorporated into numerous internal planning documents. The original author was Michael Goodchild.



Figure 3: The UCSB faculty and student representative at the 2003 faculty retreat at Coal Oil Point, Goleta, CA. Photo by Susanna Baumgart.

Mission Statement

The 2000 faculty retreat produced a simple one-page document containing three paragraphs, which condense to three goals. The first deals primarily with what geography is, and what type of ge-

ography is taught at UCSB. While acknowledging the human/physical division within the discipline as a whole, the emphasis is placed

on what can be achieved using an interdisciplinary approach. The conditions for success are divided into two, based on (1) assembling people whose interests cross the human/physical divide and (2) providing an infrastructure for learning within this context:

We will build an extraordinary community for creating new knowledge about planet Earth and its inhabitants. The Department of Geography aims to be the intellectual home of choice for studies of Earth as the home of humanity.

This goal is close to that of the 1966 student catalog, which stated that geographers investigate the surface of the earth as the home of man. This goal recognizes that other disciplines study both people and the planet, but stresses geography's integrative role in these studies. This goal also reflects the mission of the Center for Spatially Integrated Social Science (Goodchild 2001), in that "analyzing social phenomena in space and time enhances our understanding of social processes." CSISS has taken an active role in building interdisciplinary infrastructure for geographic techniques in the social sciences beyond geography, thus expanding on the integrative role that the discipline and its methods can play.

The second paragraph stresses geographic information science specifically as a highly integrative approach that covers all aspects of geography and builds links to related disciplines. It acknowledges the role of information and databases, of technology, but also of dynamic modeling methods that form the basis of integrative science. It also establishes advanced modeling, data exploration, and visualization as future directions.

We will create new methods and models to advance geographic information science....we anticipate a steady shift from our current emphasis on the infrastructure for sharing data and tools to a greater emphasis on the sharing of knowledge of dynamics, particularly in the form of computational models.

In the third paragraph, the theme of spatio-temporal dynamics is raised, and an approach to their study advanced, that of integrative science. A small but influential literature has emerged around the term "integrative science," spanning psychology, education, bi-

ology, medicine, chemistry, physics, and ecology (Barrett and Odum 1998; Massaro 2000; Cairns 1993; Martin-Cantarino 1999). The University College of Cape Breton (n.d.) in Canada defines integrative science as "a transdisciplinary 'bringing together of knowledges' that involves informed awareness about consciousness and the various modes, patterns and processes of thinking about *scientific knowledge*, irrespective of whether the intent is to learn science, conduct scientific thinking, or apply science to problems." A common view of integrated science is that it bridges the hard sciences and their quantitative methods and the study of human cognition, where qualitative methods commonly complement quantitative methods. From a UCSB perspective, we distinguish between interdisciplinary study, which uses components of different specific disciplines in a new context; multidisciplinary study, in which groups of scholars bring their skills and expertise together to solve problems; and integrative science, where methods and approaches freely flow between disciplines to create new research and knowledge both within and between disciplines. An advantage of this approach is that transdisciplinary problems can be tackled. The UCSB Geography mission statement continues with:

We will use integrated science to better understand spatio-temporal dynamics. Study of the Earth system also requires access to knowledge of dynamic processes that range from those that operate in the oceans and atmosphere, to migration processes that redistribute humans across the landscape, and to processes of land use change. In our vision, Geography will include specialists in all of the major processes that influence the Earth system at human timescales, and who are committed to integrating their knowledge with others to solve problems. To maximize the value of our studies and to minimize duplication of effort, we are firmly committed to an interdisciplinary collaboration with process specialists in other departments.

The spatio-temporal dynamics component is a unifying theme for much of the research and scholarship that takes place in the department. This has led the department's faculty to favor methods of simulation and modeling in addition to the more traditional emphasis on measurement, description, and analysis. Another deliberate choice is the emphasis on problem-solving, which implies

a strong science and engineering perspective in what might be termed elsewhere a positivist orientation. In this respect the *geography as science* orientation of the department, a theme that has led to past debate within the discipline as a whole (Golledge *et al.* 1982), is seen as a logical progression from the work of Varenus through William Morris Davis's vision for the Association of American Geographers as the "cultivation of the scientific study of geography in all its branches," to the geographical information science tradition that the department still leads today (Goodchild *et al.* 1999; Goodchild 1992). With the nature of scientific research changing, and the era of highly specialized scientific laboratories that focus narrowly on only one scientific goal at a time, we believe that the UCSB Geography Department is well positioned for the anticipated era of integrated science. This is true of the discipline of geography as a whole.

Conclusion

From rather simple origins, the Department of Geography at the University of California Santa Barbara has risen from a simple program, teaching geography to teachers, to one of the foremost graduate and research institutions in the discipline in the United States. Central to this rise to prominence has been a strong central vision for the program, strategic recruiting of faculty around that vision, response to leading emerging themes within the discipline, a persistent view of geography as science, and a high level of integration with other disciplines that study the earth and its inhabitants. This has led to a program that is integrative across the curriculum, and has largely dissolved the artificial human-physical divide that is so common in geography departments worldwide. The department is celebrating its 30th anniversary as the AAG celebrates its centennial. It shares its own vision as one that can lead to success elsewhere, just as academic geography enters its second century in the United States.

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