I. PROGRAM NAME, DESCRIPTION and CIP CODE

A. DEGREE(S), DEPARTMENT AND COLLEGE AND CIP CODE

Bachelor of Science; Department of Geography and Regional Development; College of Social and Behavioral Sciences; CIP CODE: 45.0701

B. PURPOSE AND NATURE OF PROGRAM

Geographers study spatial distributions of physical and human phenomena over Earth's surface and the interrelationships of humans and the natural environment. Their work ranges from description and mapping, through scientific analysis and explanation, to forecasting and planning. Geography thus has a broad scope and integrates elements from the social and natural sciences. Two principal divisions of geography exist - human geography and physical geography - linked by a common background, mutual concern for humans and the environment, and a body of related theory and methodology. The Department of Geography and Regional Development (GRD) at the University of Arizona currently offers two degrees: a Bachelor of Arts in Geography, which includes concentrations in Environmental Geography, Social and Cultural Geography, and Development Studies, and a Bachelor of Science in Regional Development, which focuses on Demography, Economic Geography, Urban and Regional Development, and Planning. GRD also offer Minors in Geography, Regional Development, and Geographic Information Science.

We have designed the proposed Bachelor of Science in Geography to emphasize development of quantitative skills (math, computer science, statistics) and enhance background in the natural sciences. The new degree would have three concentrations: Physical Geography, Geographic Information Science (GISci) and Water, Environment & Society: The Physical Geography concentration would provide majors rigorous training in Earth and environmental science, emphasizing quantitative and scientific approaches to studying Earth's physical environment. Students would be expected to complement coursework in physical geography with relevant courses from allied disciplines (see list below). The GISci concentration would prepare students for employment opportunities and research in environmental analysis, assessment and management, map making, remote sensing, geovisualization, regional analysis, economic and urban spatial analysis, and teaching. The emphasis will not only be on training students in the use of GISci technologies (e.g., geographic information systems; remote sensing; research methods), but also on the theory and proper application of GISci tools. The Water, Environment & Society concentration would prepare students for resource planning careers in the public sector, non-governmental organizations, city and state governments and private industry.
We offer four compelling reasons for adding a Bachelor of Science in Geography:

1. A concentration in **Physical Geography** will focus on spatial pattern and process associated with climate, biota and landforms—all key topics in Earth System Science. The comparative rigor of the B.S. will attract science-oriented students, who recognize the competitive advantage of a B.S. in the marketplace (e.g., many federal resource management jobs require a Bachelor of Science). Our motivation stems also from a growing focus on physical geography within the UA Geography Department over the last decade, exemplified by the addition of physical scientists in both the core faculty (Andrew Comrie, John Kupfer, and Stephen Yool) and affiliate faculty (Julio Betancourt, Katherine Hirschboeck, Vance Holliday, Jon Pelletier, Tom Swetnam). This faculty has extensive training and professional reputations in natural sciences outside Geography (e.g., atmospheric science, botany, ecology, geology, and water resources) and publish regularly in related journals.

2. A dedicated **Geographic Information Science (GISci)** concentration within Geography will train students in applications of information technology. Geographic information science (including GIS, geovisualization and remote sensing) is an area of high growth and market demand for our majors, as well as a targeted area within Focused Excellence Information Technology efforts at the UA. Recent GRD recruitments in GISci (Keiron Bailey), addition of a Staff Cartographer and another GISci/water policy colleague in the near term, plus ongoing information technology projects by GRD faculty members Stuart Marsh, Stephen Yool, Chuck Hutchinson (Director, Office of Arid Lands Studies) Gary Christopherson (Director, Center for Applied Spatial Analysis), and Willem van Leeuwen demonstrate we are expanding GISci offerings. We have, accordingly, added three years ago an undergraduate Minor in GISci and, beginning AY 2005-2006, offered a graduate certificate in GISci.

3. A concentration in **Water, Environment & Society** will expose students to the broad scope of water supply and demand. This theme has emerged as a key planning issue in the Western United States, thus prompts the need for trained geographers. Three colleagues (Dr. Carl Bauer and Dr. Christopher Scott and Dr. Connie Woodhouse) comprise the core faculty for this concentration. They are joined by distinguished affiliate faculty (Dr. Bonnie Colby, Professor Kathy Jacobs, and Dr. Sharon Megdal) all of whom are leaders in the Arizona water policy arena.

4. GRD is one of the largest departments in the U.S., with over 350 students split between our two majors. GRD undergraduates have been extremely successful in recent years (e.g., recent winners of the Centennial Achievement Undergraduate Awards, College of Social and Behavioral Sciences/Arizona Foundation Outstanding Senior Award, and Secretary General for the 2004 United Nations Association of the USA Model United Nations Conference). We are a Top 20 program as ranked by the National Research Council. Following suggestions from a successful external review, we have been working on reorganizing our undergraduate curriculum. Among the primary suggestions of the reviewers was the addition of a B.S. in geography, an upgrade the department had long discussed. A current review of peer departments shows most offer both a B.A. and a B.S.,
and a handful offer only a B.S. Few offer only a B.A. Given the increased growth in
departmental expertise in physical geography and information technology, we believe the
B.S. in Geography is the next logical step in our growth.

C. PROGRAM

Proposed Bachelor of Science in Geography (36 Units)

**Concentration: Physical Geography**

Core: (15 units) (identical to Bachelor of Arts in Geography)

- Introduction to Human Geography course (GEOG 210, 251, 256) (3 units)
- Introduction to Physical Geography course (GEOG 220, 230, 240) (3 units)

Methods courses (GEOG 303, 330, 357, 416A, 416C, 416D, 416E, 417, 419, 420, 422,
424, 457, 483, 484) (6 units)
- Non-US Regional Geography course (GEOG 369, 409, 411, 412, 413, 460) (3 units)

Advanced coursework: (15 units)

- Additional Introduction to Physical Geography course (GEOG 220, 230, 240) (3 units)
- Additional Methods courses (GEOG 303, 330, 357, 416A, 416C, 416D, 416E, 417, 419,
420, 422, 424, 457, 464, 483, 484) (3 units)
- Advanced physical geography coursework (GEOG 430, 431, 438, 450, 478, RNR 406L/R;
RNR 438, RAM 382) (9 units)

Electives: (6 units)

- Additional 200 or 300 level units to be selected from geography or other natural science
courses as approved by Faculty Advisors.

**Concentration: Geographic Information Science (GISci)**

Core: (18 units)

- Intro to Human Geography course (GEOG 210, 251 or 256) (3 units)
- Intro to Physical Geography course (GEOG 220, 230, or 240) (3 units)
- Geographic Information Science Core Classes (GEOG 330, 416A, 417 and 457) (12 units)

Advanced coursework: (9 units)

- Additional GIS coursework (GEOG 303, 357, 416C, 416D, 416E, 419, 420, 422, 424, 483,
484) (9 units)

Electives (9 units)

- Additional 200 or 300 level units to be selected from geography or other natural science
courses as approved by Faculty Advisors.

**Concentration: Water, Environment & Society**

Core: (18 units)

- Intro to Human Geography course (GEOG 210, 251 or 256) (3 units)
- Intro to Physical Geography course (GEOG 220, 230, or 240) (3 units)
- Geographic Information Science Core Classes (GEOG 330, 416A, 417 and 457) (12 units)
Advanced coursework: (9 units)
Additional coursework (GEOG 304, 440, 458) (9 units)
Electives (9 units)
Additional 200 or 300 level units to be selected from geography or other natural science courses as approved by Faculty Advisors.

The curriculum proposed above for the B.S. differs significantly from the B.A. The B.S. trajectory offers students much greater disciplinary depth and methodological rigor in physical geography and geospatial information technology than required for the B.A. degree.

D. CURRENT COURSES AND EXISTING PROGRAMS

All of the courses for the proposed B.S. are offered currently by Geography and Regional Development or as crosslists with other departments on the UA campus. We have developed via cross listings with other units a rich menu of courses to complement the GISci concentration. All our GISci courses are for example cross-listed with the School of Natural Resources (SNR). SNR collaborates also on our joint GIS Certificate, contributing the following courses: GEOG 417 (Intro GIS), GEOG 419 (Cartographic Modeling), GEOG 420 (Advanced GIS), and GEOG 422 (Resource Mapping).

E. NEW COURSES NEEDED

New courses are needed and approved for the Water, Environment & Society concentration. We have made 3 hires (Bauer, Scott & Woodhouse) and incumbent no-cost affiliates (Jacobs and Megdal), who will all teach the following new courses:

AZ Water Policy (Megdal/Jacobs): Focuses on regional institutions and their roles in planning sustainable water supplies in arid lands. Offered in spring Bauer and Scott will assist by teaching one module/session each next spring.

Intro to Water Resources Policy (Scott) focusing on international cases that bring together resources, management and policy should be offered a fall course.

Comparative and International Water Policy (Bauer): Focuses on legal frameworks, property rights, international comparative) would alternate with Intro to Water Resources Policy.

Applications of hydrologic and water resource models (Woodhouse): Surveys mechanisms of the hydrologic cycle and the fate of moisture in hydrologic systems.

The Woodhouse hire in Physical Geography gives GRD flexibility to maintain its current climate courses (GEOG230 and GEOG430/530) while expanding simultaneously the proposed concentration in Water, Environment & Society.
Current faculty service includes the courses proposed for the Geographic Information Science concentration, but we have no-cost flexibility to expand these offerings through collaborations in place with colleagues in the School of Natural Resources.

**F. REQUIREMENTS FOR ACCREDITATION**

No accreditation is needed for Geography programs.

**II. STUDENT LEARNING OUTCOMES AND ASSESSMENT**

**A. What are the intended student outcomes?**

Student learning outcomes are identified in three areas:

1. Gain a full breadth of knowledge in the field of Geography.
2. Understand concepts required for success in a Geography or Geography-related profession.
3. Understanding geographic basis for regionalization and globalization
4. Be able to analyze and model demographic processes.
5. Understand theories and processes of growth and planning.
6. Understand theories of environmental justice, with application to social, cultural and economic geography.
7. Understand relationships between human activities and environmental/health sustainability.
8. Understand factors influencing climate patterns over Earth’s surface.
9. Understand processes that determine spatial patterns of species and ecosystems.
10. Understand physical factors responsible for shaping Earth’s landforms.
11. Understand causes and effects of regional and global environmental change.
12. Acquire the methodological skills required to act successfully on this knowledge base.

**B. Provide a plan for assessing intended student outcomes.**

We will use an exit survey to assess student outcomes (Appendix B). We will archive results to track effects of future curriculum changes.

**III. STATE'S NEED FOR THE PROGRAM**

**A. How does this program fulfill the needs of the state of Arizona and the region?**

General college enrollment pressure is high in Arizona (Figures 1 & 2). More compelling still are the favoring in-state tuition rates, suggesting more graduating seniors will attend Arizona universities (Figure 3). The proposed B.S. in Geography is consistent with the UofA Focused Excellence initiative. Focused Excellence means excellence by familiar national academic standards. It requires distinction as a student-centered research university created by a culture of imagination and discovery. Focused excellence demands a stimulating learning environment both broadly inclusive of talent and characterized by intellectual distinction. Because resources will always be limited and true excellence is
expensive, it is necessary for the University of Arizona to focus available resources of time and money in specific domains across the spectrum of university activities, preserving a healthy balance among the arts, sciences, humanities, social sciences, professions that improve the human condition--resisting the temptation to offer every academic subject and meet every societal need. The B.S. in Geography, with its foci in physical geography and GISci, addresses the Earth Sciences and Environmental Programs theme identified in the UA Focused Excellence initiative. Statistics shown in Figures 1, 2 and 3 argue for increasing college enrollments.

Figure 1. Arizona high school graduates exceed WICHE and US numbers (Source: WICHE)

Figure 2. Arizona resident fees favor continued growth in in-state enrollments (Source: WICHE)
Implement - Duplicative Program - Page 7

Figure 3. Significant college enrollment growth is expected in the next decade (Source: WICHE)

B. Were sufficient student demand for the program?

1. What is the anticipated student enrollment for this program? (Please utilize the following tabular format).

<table>
<thead>
<tr>
<th></th>
<th>1st yr.</th>
<th>2nd yr.</th>
<th>3rd yr.</th>
<th>4th yr.</th>
<th>5th yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Student Majors</td>
<td>60</td>
<td>66</td>
<td>76</td>
<td>91</td>
<td>114</td>
</tr>
</tbody>
</table>

What is the local, regional and national need for this program? Provide evidence of the need for this program. Include an assessment of the employment opportunities for graduates of the program during the next three years.

Numerous employment opportunities for Geographers will continue with federal/state/local government planning, mapping, resource management, economic development and transportation agencies (Figure 4). Examples include NOAA, NASA, National Imagery and Mapping Agency, USDA Forest Service, Environmental Systems Research, Inc, as well as in private-sector consulting firms, elementary and secondary schools.
Figure 4. The GISci track of the proposed B.S. provides the skill set required in most of these job growth areas (Source: WICHE)

2. Beginning with the first year in which degrees will be awarded, what is the anticipated number of degrees that will be awarded each year for the first five years? (Please utilize the following tabular format).

| PROJECTED DEGREES AWARDED ANNUALLY |
|-------------------------------|----------------|----------------|----------------|----------------|----------------|
|                               | 1st Year | 2nd Year | 3rd Year | 4th Year | 5th Year |
| No. Degrees                   | 30       | 36       | 43       | 52       | 62       |

IV. APPROPRIATENESS FOR THE UNIVERSITY

Much has been written about the University of Arizona Focused Excellence Strategy in response to the Changing Directions Initiative of the Arizona Board of Regents. When the President of the Arizona Board of Regents announced the ABOR Changing Directions Initiative in the annual Flagstaff retreat in August of 2002, the three university presidents were asked to propose visionary plans that could be implemented if ABOR did not constrain all three universities to a common destiny. ABOR realized financial burdens arising from the withdrawal of state funds threatened permanent damage to Arizona's public universities. They reasoned that by relaxing constraints they would empower effective use of scarce resources. UofA answered with a Focused Excellence strategy.

Focused Excellence means concentrating and reallocating resources at every level into top programs and priorities. The Provost has accordingly identified five thematic targets of
Focused Excellence: Life Sciences, Earth Sciences and Environmental Programs, Cognitive Sciences and the Neurosciences, and Cultural, Ethnic, Gender and Area Studies. The B.S. in Geography, with its foci in physical geography and GISci, falls under the Earth Sciences and Environmental Programs theme. The B.S. Geography is conceived as an accessible student centered curriculum integrated with a world-class faculty focusing on earth sciences and environment. Our curriculum emphasizes hands-on applied research and field-based data collection and analysis. At its core therefore lies the preparation of students who will act intelligently in a diverse and technological world to improve the quality of life in Arizona or wherever their career paths lead them.

V. EXISTING PROGRAMS AT OTHER CAMPUSES

A. EXISTING PROGRAMS IN ARIZONA

1. Arizona University System

<table>
<thead>
<tr>
<th>CIP CODE</th>
<th>PROGRAM</th>
<th>LOCATION ARIZONA UNIVERSITY SYSTEM</th>
<th>PROGRAM ACCREDITATION YES/NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>45.0701</td>
<td>ASU</td>
<td>Tempe, Arizona</td>
<td>Yes</td>
</tr>
<tr>
<td>45.0701</td>
<td>NAU</td>
<td>Flagstaff, Arizona</td>
<td>Yes</td>
</tr>
</tbody>
</table>

2. Other Institutions

There are no other programs at the same academic level currently offered by private institutions in the state of Arizona.

3. Programs offered in other WICHE States

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>WICHE INSTITUTION &amp; LOCATION</th>
<th>NAC ACCREDITATION? (Y or N)</th>
<th>PROGRAM ACCREDITATION? (Y or N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS</td>
<td>Univ of AK, Anchorage</td>
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<td>N</td>
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<tr>
<td>BS</td>
<td>AZ State Univ, Tempe</td>
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<td>Northern AZ Univ, Flagstaff</td>
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<tr>
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<td>2</td>
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<tr>
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<td>New Mexico State Univ</td>
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<tr>
<td>BS</td>
<td>So Oregon Univ</td>
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<td>So Dakota State</td>
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<tr>
<td>BS</td>
<td>Utah State Univ</td>
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<tr>
<td>BS</td>
<td>Weber State Univ</td>
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<td>N</td>
</tr>
<tr>
<td>BS</td>
<td>Univ of Wyoming</td>
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</tbody>
</table>
B. JUSTIFICATION FOR DUPLICATIVE PROGRAM

1. Basic Academic Subject

The inherent interdisciplinary nature of Geography qualifies it for a number of academic themes. We find as a consequence that Geography Departments may be associated with Colleges of Arts and Letters (e.g., UC, Santa Barbara), Social and Behavioral Sciences (e.g., University of Arizona). Most major academic institutions have Geography programs, and many have stand-alone Geography departments. These Geography Departments are distributed across the U.S., favoring the eastern U.S. There are comparatively few Geography programs in the West (Figure 6).

Figure 5. Geography Departments of North America (BS/BA = squares; MS/MA = circles; PhD = triangles)

2. Long-term Student Demand That Cannot be Met Satisfactorily by Existing Program(s)

<table>
<thead>
<tr>
<th>EXISTING PROGRAMS: ARIZONA UNIVERSITY SYSTEM*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical Data: Degrees Awarded For The Past 5 Years</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>No. Degrees</th>
<th>5th yr. Past 98/99</th>
<th>4th yr. Past 99/00</th>
<th>3rd yr. Past 00/01</th>
<th>2nd yr. Past 01/02</th>
<th>1st yr. Past 03/04</th>
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</thead>
<tbody>
<tr>
<td>ASU</td>
<td>39</td>
<td>42</td>
<td>45</td>
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<tr>
<td>NAU</td>
<td>38</td>
<td>40</td>
<td>48</td>
<td>40</td>
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<tr>
<td>TOTAL</td>
<td>77</td>
<td>82</td>
<td>93</td>
<td>97</td>
<td>114</td>
<td></td>
</tr>
</tbody>
</table>
### Existing Programs: Arizona University System

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>No. Student Majors</th>
<th>1st Year</th>
<th>2nd Year</th>
<th>3rd Year</th>
<th>4th Year</th>
<th>5th Year</th>
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</thead>
<tbody>
<tr>
<td>ASU</td>
<td>115</td>
<td>127</td>
<td>146</td>
<td>175</td>
<td>219</td>
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<tr>
<td>TOTAL</td>
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</tbody>
</table>

### New Program

**5-Year Projected Enrollment**

<table>
<thead>
<tr>
<th>No. Student Majors</th>
<th>1st Yr.</th>
<th>2nd Yr.</th>
<th>3rd Yr.</th>
<th>4th Yr.</th>
<th>5th Yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60</td>
<td>66</td>
<td>76</td>
<td>91</td>
<td>114</td>
</tr>
</tbody>
</table>

3. Nontraditional, Older, or Part-Time Student Demand

We have developed a program that is sufficiently flexible to serve non-traditional students. Of our 53 Geography majors, 23 (43%) are female; 5 (22%) are 25 or older. Of the 30 (57%) male Geography majors, 10 (33%) are 25 or older. We believe we serve non-traditional students adequately, that these proportions have stabilized, and that no special resources are required to meet this demand.

4. Alternate Delivery Systems

   a. Geography is by nature oriented towards field-based data collection and analysis. Proposed concentrations in Physical Geography and GIS are no exception. We therefore believe it to be sound pedagogically to include field methods in many of these courses. We do not believe computer-assisted instruction, proximate or distant, can substitute for field data collection, analysis and synthesis. Because ‘geography is learned through the soles of one’s boots’ we advocate for this B.S. a strong, engaging on-campus curriculum that supports off-campus field instruction.

   b. Addressed in 4a above.

5. Collaborative Efforts

We propose for this B.S. courses for which we have reliable faculty teaching support. From a budgetary perspective, there is no apparent benefit from joint degrees, shared courses or team teaching.
6. Effect on Existing Program(s)

Establishing the B.S. in Geography will produce a balanced curriculum that gives our students flexibility that translates into increased career options. We will by this action join the other B.S. Geography programs at ASU and NAU, completing the cycle and strengthening overall the market position of the 3 Arizona state universities. Our proposed B.S. complements the existing B.A., which itself has no apparent adverse affects on existing B.A. programs. We believe the B.S. Geography will affect existing programs positively: We are confident the B.S. Geography would in intellectual rigor match our existing B.S. in Regional Development. Based on feedback from students and faculty advisors, we can by adding the B.S. anticipate movement among all programs: Some students in the B.A. Geography will upgrade to the B.S Geography, while others in the B.S. Regional Development will transfer into either the B.S. or B.A. Geography. Our strategy overall is to offer the B.A and B.S. degrees in Geography and retain the B.S. in Regional Development—achieving in 5 years a balanced program with approximately 100 majors in each degree.

7. Resources Already Available

Courses proposed under the B.S. Geography are all offered by existing faculty—they are already available under the B.A., Geography, and the B.S., Regional Development. We are confident any changes, including new courses or more sections, can be achieved through internal reallocation of existing faculty resources. We have, moreover, established strong and enduring ties with the School of Natural Resources, enabling us to offer the full range of methods courses for the GIS concentration. A new hire (Woodhouse) will support existing and new courses in climate and climate change under the Physical Geography concentration. New hires in water resources (Bauer and Scott) enable us to offer a concentration in Water, Environment & Society. It is on the basis of both cross-campus affiliations and new faculty that we do not therefore anticipate significant additional costs for implementing this program.

VI. EXPECTED FACULTY AND RESOURCE REQUIREMENTS

A. FACULTY

1. Current Faculty

<table>
<thead>
<tr>
<th>Core Faculty</th>
<th>Assistant Professor</th>
<th>Ph.D.</th>
<th>GRD 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keiron Bailey</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Carl Bauer</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Andrew Comrie</td>
<td></td>
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<tr>
<td>Stuart E. Marsh</td>
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<tr>
<td>Christopher Scott</td>
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<td></td>
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<tr>
<td>Willem van Leeuwen</td>
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<tr>
<td>Marvin Waterstone</td>
<td></td>
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<tr>
<td>Connie Woodhouse</td>
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<td></td>
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<tr>
<td>Stephen Yool</td>
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<td></td>
</tr>
</tbody>
</table>
Affiliated faculty
Julio Betancourt  Professor  Ph.D.
Katherine Hirschboeck  Associate Professor  Ph.D.
Vance Holliday  Professor  Ph.D.
Charles Hutchinson  Professor  Ph.D.
Thomas Swetnam  Professor  Ph.D.
Margaret Wilder  Assistant Professor  Ph.D.

2. Additional Faculty
None.

3. Current FTE Student and Faculty
Undergraduate students  277 students (225 Reg Dev, 52 Geography)
Graduate students  68 students (38 Ph.D., 30 M.A.)
Faculty FTE   12.9 FTE

4. Projected FTE Students and Faculty
Undergraduate students:  290 students
Graduate students:  72 students
Faculty FTE   14.4 FTE

Please see Appendix A for faculty Curriculum Vitae of Participating Faculty

B. LIBRARY

1. Current Relevant Holdings

The University of Arizona currently holds almost five million volumes in its collection to accommodate the needs of its diverse population. The Library supports the Department of Geography and Regional Development at both the undergraduate and graduate levels and faculty research needs.

Funding for Geography resources is allocated through the Geography and Physical Geography fund lines. According to the 2003-2004 fiscal year breakdowns, the University of Arizona spent $17,289 on monographic purchases, $35,238 on serials purchases, and $12,250 on maps. In addition, we purchased data sets for use by students and faculty. Any faculty or student can easily obtain any book, journal article, dissertation, or map that is not accessible in the Library at no cost through Inter-Library Loan. In addition, the Library subscribes to several key journal indexes of interest to the discipline, including GeoBase and Geo Ref.
The Library has recently developed a new web site: Arizona Electronic Atlas, http://atlas.library.arizona.edu/. It is an innovative interactive atlas that allows creation, manipulation, and downloading of accurate and current maps and data, and includes resources to assist instructors in creating assignments that use the Arizona Electronic Atlas. The Atlas combines Geographic Information Systems (GIS) and online mapping technology, makes spatial data readily accessible, and eliminates the need for users to store and manage large amounts of data. In addition, it is a valuable tool for developing geographic literacy and for strengthening users' critical thinking and problem solving skills.

2. Additional Acquisitions Needed

The B.S. Geography can be launched and sustained using library acquisitions available and continuing currently.

C. PHYSICAL FACILITIES AND EQUIPMENT

1. Existing Physical Facilities

GRD supports a large network of computer teaching labs, research labs, graduate computing facilities, mobile teaching resources, and a large array of web, ftp, and file servers in addition to individual faculty, student, and staff computing resources. We consider these facilities adequate to support courses within the B.S. Geography.

The Spatial Analysis Laboratory is a technology teaching laboratory for GISci and (remote sensing instruction. The lab features 30 Intel-based workstations with Microsoft Windows and flat panel displays. To facilitate data (format) acquisition and storage, each workstation is outfitted with a DVD/CD-RW and a front USB drive. Network storage space is available for instructional data warehousing and personal project storage. The lab is configured with ESRI GIS products such as ArcGIS Desktop, Workstation, and ArcView. Remote sensing software includes Leica Imagine and Clark Labs IDRISI. The GIS and remote sensing software packages are complemented by SPSS for statistical analysis, Microsoft Office, and several climate simulation packages.

The Spatial Analysis Lab also features fifteen desktop digitizing tablets and one large, free-standing digitizing tablet for data input. Two high-capacity Hewlett-Packard laser printers are available in the lab; a monochrome letter/legal size laser printer, and a color letter/medium format size printer with duplex capability. A digital video projector with a wireless mouse, overhead projector, and large screen are available for presentations.

For instruction and presentation outside of the department, a laptop computer and video projector are available. Overhead projectors and slide projectors are available for use both in and out of the department. Stereoscope glasses and GPS devices are also available.

The department features several facilities available to research members with specialized software such as GIS and mathematical modeling software and hardware such as medium and large format printers, digital cameras, scanners, and GPS devices. The grant-funded
labs include the Pyrogeography Research Lab, Advanced Climate and Environmental Simulation Lab, and the Geovisualization Lab.

2. Additional Facilities Required or Anticipated

Having completed a technology refresh in 2004, we anticipate a new refresh in 2008.

**D. OTHER SUPPORT**

1. Other Support Now Available

None.

2. Other Support Needed, Next Three Years

None.

**VII. FINANCING**

**A. SUPPORTING FUNDS FROM OUTSIDE SOURCES --**

This is a $0 request. GRD has the resources to implement the proposed B.S in Geography.

**B. NEW ACADEMIC DEGREE PROGRAM BUDGET PROJECTIONS FORM**

Not applicable.

**IV. OTHER RELEVANT INFORMATION**

None.
Appendix A:

Brief Curriculum Vitae of

Principal Faculty
KEIRON BAILEY

Education
2002: Ph.D., Geography, University of Kentucky (USA)
1996: M.A., Geography, University of Hawaii (USA)
1991: B.Sc. (Honors), Geography, University of Birmingham (England)
1988: B.Sc. (Honors), Mechanical Engineering, University of Birmingham (England)

Publications
Funding
$75,000. Transportation Research Board. 2001. Transit-IDEA T-33 "Community Design of a Light Rail Transit Oriented Development" (with Grossardt, T)

Awards

Research Interests

(SPI)
I am interested in how social theory helps to understand the properties of advanced geovisual and geospatial technologies. This research overlaps geography, planning, decision science and geoinformatics. Structured Public Involvement, or SPI, seeks to improve public satisfaction with planning and design of transportation related infrastructure by fitting appropriate technologies to the social context. This research has been funded by the National Academies and a range of state and local agencies.

Economic Geographies of Internationalization
My second research area is economic geographies of internationalization with a special focus on the Pacific Basin and East Asia. This research seeks to understand how specific economic and cultural transformations are wrought by the interaction of complex global flows of money, power and cultural meaning with local practices, customs and economies.
EDUCATION

B.A. (1983) Geology, Yale University, New Haven, CT.

EMPLOYMENT

2006-Present  Associate Professor, Dept. of Geography & Regional Development, and Associate Director, Water Resources Research Center, Univ. of Arizona.
1999-2006  Fellow, Resources for the Future, Washington, DC.
2004  Visiting Professor, Diego Portales Univ. Law School, Santiago, Chile.
2002  Visiting Professor, Catholic Univ. Law School, Santiago, Chile.
1998  Lecturer, Dept. of Geography, Univ. California-Berkeley.
1996-98  Independent consultant on water law, policy, and economics to various international organizations, Oakland, CA.
1995  Lecturer, Dept. of Environmental Science, Policy, & Management, Univ. California-Berkeley.
1993, '95  Visiting Professor, Institute of Mining & Water Law, Univ. of Atacama, Santiago, Chile.

EXPERTISE / RESEARCH AND TEACHING INTERESTS

Comparative and International Water Law and Policy – Political Economy of Water and Water Reform
- Water rights and water markets
- Privatization, regulation, and courts
- Hydropower and river basin governance
- Environmental flows
- Regional expertise in U.S. and Latin America
- Water issues, institutions, and policy debates in other parts of the world

Interdisciplinary Environmental Studies – Law, Geography, and Political Economy
- Human / environment relations
- Environmental law, policy, and regulation
- Property rights and institutions
- Law and economics; institutional economics
- Qualitative and historical analysis

HONORS AND AWARDS

2003  Fulbright Scholar Award for Lecturing / Research, U.S. Dept. of State and Council for International Exchange of Scholars, for a semester at National Univ. of Cuyo, Dept. of Political and Social Sciences, Mendoza, Argentina.
2001-02  Visiting Scholar, Center for Applied Economics, Univ. of Chile, Santiago, Chile.


1985-86 Wisconsin Alumni Research Foundation Fellowship, Univ. of Wisconsin-Madison.

SELECTED PUBLICATIONS


PROFESSIONAL SERVICE AND OUTREACH

Non-Academic Presentations
Numerous invited talks to government and public audiences in Latin America, Europe, and the U.S.

International Consulting
United Nations, World Bank, Inter-American Development Bank, Global Water Partnership, Danish and Swedish International Development Agencies

Short Courses for Professionals in Latin America
Water law and economics

Membership in Professional Associations
Association of American Geographers, International Water Resources Association, Law and Society Association, and others
JULIO L. BETANCOURT

EDUCATION

Ph.D. Geosciences, University of Arizona, 1989
M.S. Geosciences, University of Arizona, 1983
B.A. Anthropology/Geography College, University of Texas, 1975

PROFESSIONAL AND ACADEMIC EXPERIENCE

Senior Scientist and Research Hydrologist, USGS 1989-present
Adjunct Professor, Depts. of Geosciences, Geography, University of Arizona, current

2006 PUBLICATIONS

For full CV, see http://wwwpaztcn.wr.usgs.gov/julio_cv.html


SYNERGISTIC ACTIVITIES

Innovations in teaching and contributions to the science of learning: As a USGS scientist, I do not teach formal courses. However, I annually support and mentor an average of 1 postdoc, 3 graduate and 3 undergraduate students. I regularly participate as a mentor and source of funding for undergraduates in the NASA Space Grant Internship Program and the Undergraduate Biology Research Program. In 1996-2000, I led an NSF-InterAmerican Institute program to develop late Quaternary vegetation histories of arid South America drawing on my own experience in arid North America. The main objective of the program was to provide field and laboratory training for professionals and students from Argentina, Bolivia, Chile and Peru. I've continued this tradition in my subsequent work in Chile. Two of my Chilean Ph.D. students currently occupy professorships in prominent Chilean universities.

Communication of research results to the general public: In my capacity as a federal scientist, I strive to assume leadership in response to emerging regional and national, environmental issues of environmental concern. For example, in 1997-1999, I coordinated a series of field visits by USGS interdisciplinary team to various National Park Service and USDA Forest Service Districts across the western U.S. to consider the effects on increasing wildfires on western watersheds. In 2003-2004, I gave over 30 presentations across the country on the climatic and historical context of the 1999-2004 drought, including keynote talks at several drought summits and workshops organized in western and Great Plains states. Beginning in 2004, I initiated a demonstration and outreach project to promote eradication of an invasive species (buffelgrass) in the Sonoran Desert. I also grant frequent interviews for national, regional and local print, radio, and television media.

Refinement of research results: I have coordinated key national and international workshops, such as the Pacific Climate (PACLIM) Workshops in 1989-1991 (http://meteora.ucsd.edu/paclim/); "Advances in Central Andes Paleoclimatology" in 2001 (http://wwwpaztcn.wr.usgs.gov/pcaw/); "Improving the Application of Science in Western Drought Management & Planning" for the Western Governor's Association in March 2004; "Role of NEON in Addressing Ecological Implications of Climate Change" for AIBS in August 2004 (http://www.neoninc.org/documents/neon-climate-report.pdf), and the workshop to begin organizing the USA-National Phenology Network in August 2005.I serve on the Editorial Board of Diversity and Distribution and was a Founding Member of the International Biogeography Society. I currently serve on the NAS-NRC-Water Science Board Committee on Science needs for Colorado River Water Management, and also just completed a stint on the subcommittee that collated the U.S. Government review of the IPCC Fourth Assessment Report.

Broadening the participation of groups underrepresented in science: I came up through USGS as a graduate student under the DOI Minority Participation in the Earth Sciences Program, and have myself mentored several MPES students. I also make it a point to give lectures at local high schools with predominantly Hispanic student bodies.
ANDREW C. COMRIE

Education
1992 Ph.D., Geography, The Pennsylvania State University
1988 M.Sc. Environmental and Geographical Science, University of Cape Town
1985 B.Sc.(Honours), Atmospheric Science, University of Cape Town
1984 B.Sc., Geography, University of Cape Town

Employment
1999 Associate Professor, Geography and Regional Development, University of Arizona.
Joint appointments: Arid Lands Resource Sciences, Global Change, Remote Sensing and
Spatial Analysis, Atmospheric Sciences.
1992 Assistant Professor, Geography and Regional Development, University of Arizona.

Selected Honors, Awards and Positions
Editorial Advisory Board of the international journal *Atmospheric Environment*, 2000-present.
Chair, Climate Specialty Group, Association of American Geographers, 2002-2004.
Faculty Appreciation Award, Business and Public Admin. Student Council, Univ. of Arizona, 1997.
Visiting Fellow, Udall Center for Studies in Public Policy (with fellowship support from the Institute for the
Study of Planet Earth), University of Arizona, 1996/97.
First Place, Faculty Best Article Competition (in College), University of Arizona, Social and Behavioral
Sciences Research Institute, 1995.
Award for Research Support in General Education, College of Arts and Sciences, University of Arizona,
E. Willard Miller Award for Best Graduate Student Paper, Department of Geography, The Pennsylvania
State University, 1991.
Best Poster Presentation (Air Pollution), American Meteorological Society Annual Meeting with the Air
Hans Neuberger Award for Outstanding Teaching, Dept. of Meteorology, The Pennsylvania State
University, 1989.
W.M. Talbot Trophy for Outstanding Contributions to the Department of Geography, Univ. of Cape Town,
1984.

Selected Publications
Comrie, A.C., 1990: The climatology of surface ozone in rural areas: a conceptual model. *Progress in
Physical Geography* 14, 295-316.
Comrie, A.C., 1991: The Climatology of Rural Ozone Pollution. Ch. 9 in Majumdar, S.K., Miller, E.W. and
Cahir, J. (eds.), *Air Pollution: Environmental Issues and Health Effects*. Easton, PA: Pennsylvania
Academy of Science, 121-135.
Comrie, A.C., 1992: A procedure for removing the synoptic climate signal from environmental data.
*International Journal of Climatology* 12, 177-183.
Comrie, A.C., 1992: An enhanced synoptic climatology of ozone using a sequencing technique. *Physical
Geography* 13, 53-65.


### Selected Grants & Contracts

- **Converging NASA Mission Measurements and Products with the Rapid Syndrome Validation Project (RSVP) Decision Support System** to validate and benchmark public health medical alerts and early warning forecasts. National Aeronautics and Space Administration ($3.2 million total over 5 years, UA $1,209,610 sub to U. New Mexico, S. Morain PI), UA co-PI with W. Sprigg, K. Thome, 2004-2008.

- **Tailored Drought Planning for Arizona. TRIF (Prop. 301; $95,000 over 2 years), co-PI with G. Garfin and B. Morehouse, 2003-2005.**

- **Integrated Epidemiological Study of Valley Fever. Arizona Disease Control Research Commission ($690,339 over 3 years; consultant/collaborator), with M.K. O’Rourke, J. Tabor, M. Orbach, L. Shubitz et al., 2002-2005.**

- **Research Experience for Undergraduates (REU) – HERO project. National Science Foundation ($80,000 per year for 4 years with Penn State et al.; UA ~$15,000/yr, 35% PI), with D. Liverman, R. Merideth and R. Varady, 2002-2006.**

- **Human-Environment Research Observatory (HERO) Infrastructure Development. National Science Foundation ($2,500,000 with Penn State et al.; UA $290,000 over 5 years, 35% P.I), with D. Liverman, R. Merideth and R. Varady, 2000-2005.**

- **Determination of Climatological Criteria for Natural Dust Events in Arizona. Arizona Department of Environmental Quality ($25,000; 100% PI), 2000-2001.**

- **Updating the Department of Geography and Regional Development’s Spatial Analysis Laboratory. Learning Technologies Partnership, University of Arizona ($15,000, 33% co-P.I.), with A. Esparza and S. Yool, 1999.**

- **Public Access to Environmental Monitoring Data in Tucson, Arizona. U.S. Environmental Protection Agency, EMPACT program, in collaboration with Pima County Department of Environmental Quality ($485,000, University of Arizona portion $175,000, 33% co-P.I.), with M.K. O’Rourke and J. Burgess, 1999-2001.**

- **Climate Data Analysis for Southern Africa. National Oceanic and Atmospheric Administration, with ASU Office of Climatology and the National Climatic Data Center ($75,000, 5% co-P.I.), with R. Vose and T. Peterson, 1999.**

- **Climate Variability, Social Vulnerability, and Public Policy in the Southwestern United States: A Proposal for Regional Assessment Activities. National Oceanographic and Atmospheric Administration**
($4,600,000 over 6 years, 10% co-P.I.), with R. Bales, S. Sorooshian, D. Liverman, T. Finan, M. Hughes, et al., 1998-2001.
Ozone Modeling Assessment Study. Pima Association of Governments ($10,000, 100% P.I.). June 2 to September 1, 1997.
Downscaling Regional Climate Data to Local Scales. Office of the Vice-President for Research, University of Arizona ($4,000, 100% P.I.), 1996.
Development of Carbon Monoxide Forecasting Models for Phoenix, Arizona. Arizona Department of Environmental Quality, Office of Air Quality ($25,000, 100% P.I.). January 3 to December 1, 1996.
A Virtual Communication and Spatial Analysis Laboratory. National Science Foundation, Instrumentation and Laboratory Improvement Grant ($89,000; 50% Co-P.I.), 1994, with S. Yool and D. Plane.
A Virtual Communication and Spatial Analysis Laboratory. University of Arizona, Instructional Computing Grant Program ($19,000; 75% Co-P.I.), 1994, with S. Yool.
A Synoptic Climate Database for Air Pollution Studies in the US-Mexico Border Region. University of Arizona, Social and Behavioral Sciences Research Institute, Small Grant ($1,500; 100% P.I.), 1993.
Assessing Air Pollution Transport to Wilderness Areas: The case of Tucson and the Saguaro National Monument. University of Arizona, Social and Behavioral Sciences Research Institute, Summer Stipend Grant for Proposal Development ($5,000; 100% P.I.), 1993.
Climatological evaluation of proposed Gansbaai/Agulhas nuclear reactor site. Contract with Environmental Evaluation Unit, University of Cape Town (R100; 75% Co-P.I.), with L. Loewenheim, 1987.
Masters Research Grant. Department of Environmental and Geographical Science (R500; 100% P.I.), University of Cape Town, 1986.
KATHERINE KRISTIN HIRSCHBOECK

CHRONOLOGY OF EDUCATION

Rosary College, River Forest, Illinois (attended 1969-70)
University of Wisconsin - Madison, B.S. in Geography, minor in Geology (1973)

MAJOR RESEARCH & TEACHING FIELDS

*Climatology* -- with emphasis on variations in synoptic atmospheric circulation systems, the climatology of extreme events, and mechanisms of climatic change.

*Hydroclimatology and surface water hydrology* -- with emphasis on flood analysis, flood hydroclimatology, and the response of geomorphic and hydrologic systems to spatial and temporal variations in climate.

*Dendroclimatology* -- with emphasis on synoptic dendroclimatology and the link between atmospheric circulation processes and regional tree-growth patterns.

EMPLOYMENT

Associate Professor of Climatology, Laboratory of Tree-Ring Research, University of Arizona, 1991 - present.

*Other University of Arizona Appointments*:
  Chair, Global Change Graduate Interdisciplinary Program, University of Arizona, 2004 - present
  Member of Arid Lands Resources Sciences Graduate Interdisciplinary Program (GIDP) Faculty
  Member of Global Change Committee / Global Change Minor GIDP Faculty Member

Associate Professor, Department of Geography and Anthropology, Louisiana State University, August 1990 - August 1991.

Assistant Professor, Department of Geography and Anthropology, Louisiana State University, August 1985 - August 1990.

Instructor, Department of Geography and Anthropology, Louisiana State University, August 1984 - August 1985.

Visiting Assistant Professor, Department of Geography, University of Oklahoma, January-May, 1984.

HONORS AND AWARDS

Provost’s General Education Teaching Award, 2003.

American Meteorological Society Editor's Award for the *Journal of Hydrometeorology*, 2001.

Nominated by Provost Sypherd to be the University of Arizona faculty representative to: *Project Kaleidoscope - Faculty for the 21st Century* (PKAL), a national network of science educators in higher education, 1996. *(PKAL faculty are recognized as those 'emerging as leaders within their campus community and who have been identified by their deans as having the potential of making a significant contribution to undergraduate science, mathematics, engineering, and technology education into the next century.)*
Warren Nystrom Award, 1987. Association of American Geographers, First Place. *(The Nystrom Award recognizes excellence in research. It is awarded for an outstanding written and oral presentation of a paper based on a recent dissertation)*

National Science Foundation Travel Award, 1989. (For scholarly exchange with Bulgarian geographers).

**PUBLICATIONS**

**Referred Chapters in Scholarly Books**


**Referred Journal Articles**


Non-refereed Technical Reports & Proceedings Publications


Southwest Environmental Service, 1980. Flood and Erosion Hazards in Tucson. Report prepared as part of a Floodplain Education Project supported by the National Science Foundation, Southwest Environmental Service, Tucson, Arizona, 116 pp. (contributing author)


GRANTS AND CONTRACTS


A New Frost-Ring Initiative: Understanding the Mechanistic Basis for the Santorini Connection, 2003  P.I. K.K. Hirschboeck. The Institute for Aegean Prehistory. $9,529


SERVICE: CITIZENSHIP

Extramural


Member of: American Meteorological Society (national and local chapters), Association of American Geographers, American Geophysical Union, American Institute of Hydrology; American Water Resources Association, Geological Society of America, The Tree-Ring Society, Phi Kappa Phi.


Grant reviewing service for: NSF, NOAA Global Change Program, DOE WESTGEC
Advisory Panel service: National Science Foundation/Environmental Protection Agency Water and Watersheds peer review panel, July 14-17, 1996.

Intramural
Chair, Global Change Interdisciplinary Program (GCIDP) executive committee (2004- present)
Global Change Interdisciplinary Program (GCIDP) executive committee (2003-2004)
University-wide Committee on Global Change (1992-present)
College of Science Awards Committee (2002-2004)
College of Science Millennium Project Committee (2003-2004)
Graduate College Graduate Student Orientation workshop on Mentoring (2000 - 2004)
General Education Assessment Committee (1999), Chair of Natural Sciences Team Computer Technology Committee, Dept of Geography & Regional Development (2003-2004)
Desert Laboratory Committee, College of Science (1993 - 1996)
Natural Science Core Curriculum Development Committee, College of Science (1995)
Committee to Recruit and Retain Women in Science, College of Science (1993 - 1995)
Search Committee for Desert Laboratory Faculty Position (1994)
Search Committee for School of Renewable Natural Resources Faculty Position (1995)
Office of International Programs Awards Committee

**Departmental**
Laboratory of Tree-Ring Research (LTRR) Curriculum Coordinator (2003-2004)
LTRR Post-Tenure Review Committee (2001-2004)
Chair, Search Committee for faculty position, Laboratory of Tree-Ring Research (2000, 2001)
Search Committee member for faculty position, Laboratory of Tree-Ring Research (1999-2000)
Organizer of “1998 Tree Ring Day” for the LTRR
Promotion & Tenure Review Committee, Tree-Ring Laboratory (1993 – 1994)
International Tree Ring Conference Committee, Tree-Ring Laboratory (1993 -1994)
Climate data & Computer Support Committee, Tree-Ring Laboratory (1992 - 1994)
VANCE T. HOLLIDAY

APPOINTMENTS
2002 - present: **Professor**, Departments of Anthropology, Geography/Regional Development and Geosciences, University of Arizona, Tucson
2002 - present: **Executive Director**, Argonaut Archaeological Research Fund, Department of Anthropology, University of Arizona, Tucson.
1995 - present: **Full Professor**, Department of Geography, The University of Wisconsin-Madison.
1986 - 1990: **Assistant Professor**, Department of Geography, The University of Wisconsin-Madison.
1984 - 1986: **Visiting Assistant Professor and Assistant Professor**, Departments of Geography and Anthropology, Texas A&M University.

HONORS

AWARDS and GRANTS
National Science Foundation (Surficial Processes Program), 1988-1990, to study late Quaternary valley fills and paleoenvironments on the Southern High Plains, $177,000.
National Science Foundation (Geologic Record of Global Change Program), 1993-1995, to study the genesis and paleoenvironmental significance of dunes on the Southern High Plains, $140,000.
Recipient of the 1996 Gladys W. Cole Memorial Research Award (Geological Society of America) to study the origin and evolution of small playa basins on the Southern High Plains, $12,000.
National Science Foundation (Earth Sciences Program/Earth System History), 1998-2000, to study the late Quaternary paleoenvironmental record of small playa basins on the Southern High Plains, $140,000.

SELECTED PUBLICATIONS -- BOOKS, ARTICLES and CHAPTERS


CHARLES F. HUTCHINSON

EDUCATION

1972 - 1973 M.A. University of California, Riverside (Geography)
1970 - 1972 B.A. University of California, Riverside (Geography, magna cum laude)
1967 - 1970 Riverside City College (Computer Science)

HONORS AND AWARDS

1996 First Prize, John J. Davidson President’s Award for Practical Papers. American Society for Photogrammetry and Remote Sensing.
1973-74 University of California Regents Fellowship
1970-72 Joseph Hunter Foundation Scholarship
1970-71 Mary E. Jaskey Award (Riverside City College)

EMPLOYMENT

University of Arizona (3/04 – present). Director, Office of Arid Lands Studies, College of Agriculture and Life Sciences. Responsible for administering an interdisciplinary research group focused on the sustainable use of arid and semiarid lands (8 faculty, forty staff, 35 students).
National Aeronautics and Space Administration (5/01 – 4/02). Acting Director, Applications Division, Office of Earth Science, Headquarters. Seconded by University of Arizona to direct operations of the Applications Division of the Office of Earth Science.
National Aeronautics and Space Administration (1/98 - 12/98). Visiting Senior Scientist, Office of Earth Science (formerly Mission to Planet Earth), Headquarters. Seconded by University of Arizona to assist in planning a new Applications and Outreach Division of the Office of Earth Science.
University of Arizona (6/87 - present). Associate Professor and Professor (1995), Office of Arid Lands Studies, College of Agriculture; Adjunct Professor, Department of Geography and Regional Development and School of Renewable Natural Resources.
University of Arizona (11/83 - present). Associate Director, Office of Arid Lands Studies. Responsible for assisting in the supervision and administration of a multidisciplinary research organization (approximately 50 staff).
University of Arizona (2/81 - 4/86). Assistant Research Scientist, Arid Lands, and Adjunct Assistant Professor, Geography and Regional Development, and Soils, Water and Engineering. Responsible for introductory and advanced courses in remote sensing and remote sensing applications (2 courses per year).
University of Arizona (1/80 - present). Director, Arizona Remote Sensing Center, Office of Arid Lands Studies. Responsible for operation and support of a remote sensing laboratory (3 faculty, 2 staff, 10 students) and develop research initiatives (see sponsored research).
California Institute of Technology (3/78 - 1/80). Member, Technical Staff, Jet Propulsion Laboratory, Systems Analysis Section. Responsibilities included: 1) performing environmental analysis of new
energy technologies; and 2) developing remote sensing and geographic information system research initiatives in environment and natural resource management.


**University of California, Riverside** (1/73 - 12/76). Teaching and Research Assistant, Department of Earth Sciences. Assisted in the presentation of courses in physical and plant geography. Assisted in research projects in: remote sensing applications; soil survey; and historical land use impacts on vegetation.


**Environmental Systems Research Institute**, Redlands, California, (10/73 - 3/74). Resource Analyst. Gathered and analyzed field and archival information for development planning in Japan using remote sensing and geographic information systems.

**SPONSORED RESEARCH, 1995 - present**


SELECTED PUBLICATIONS, 1995-present


STUART E. MARSH

Positions:
Professor and Chair Arid Lands Resource Sciences
Professor Geography and Regional Development
Director Arizona Remote Sensing Center

Education:
Stanford University  Ph.D.  1979  Applied Earth Sciences
Stanford University  M.S.  1975  Applied Earth Sciences
George Washington University  B.S.  1973  Geology

Professional – Academic Activity:
2004 – Present  Director Arizona Remote Sensing Center
2002 – Present  Chair, Arid Lands Resource Sciences Ph.D. Program
2001 – Present  Professor University of Arizona
1988 – 2004  Associate Director Arizona Remote Sensing Center
1988 – 2001  Associate Professor University of Arizona
1986 – 1988  Manager, Geoscience Computer Services, Sun Exploration & Production
1981 – 1983  Senior Geologist, Sun Exploration & Production Company
1980 – 1981  Research Geologist, Gulf Oil Corporation
1979 – 1980  NRC Resident Research Associate, Jet Propulsion Laboratory

Honors and Awards:
American Society for Photogrammetry and Remote Sensing - Presidential Citation (1999)
J. William Fulbright Senior Scholar Award for research/lecturing in Australia (1996/1997)
John I. Davidson ASPRS President's Award for Practical Papers (1996)
Elected Fellow, Arizona-Nevada Academy of Sciences (1996)
President, Arizona-Nevada Academy of Sciences (1995)
NASA Certificate of Recognition (1983)
National Research Council (NRC) Post-Doctoral Fellowship (1980)

Active Grants and Projects:
City of Tucson and The Arizona Water Protection Fund (with C.F. Hutchinson).

Raytheon (with B. Orr, W. van Leeuwen, B. Hutchinson, C.F. Hutchinson, L. Howery, G. Ruyle).

Establishing a Basis for Carbon Management Policy at the State Level: Carbon Dynamics at Site,
Hutchinson, M. Karpiscak, S. McLaughlin, M. McClaran, J. DeSteiguer, R.C. Izaurralde, E. Perry, and N.
Rosenberg).

$74,996. International Arid Lands Consortium (with B. Hutchinson, B. Orr, M. Baker).

Recent Publications:


CHRISTOPHER A. SCOTT
Assistant Professor
Department of Geography and Regional Development
University of Arizona
410 Harvill Building, Tucson, Arizona 85721
Phone: (520) 621-1652 Fax: (520) 621-2889
Email: cascott@email.arizona.edu

EDUCATION
1994-97 Cornell University, Ph.D. Major Field: Hydrology
Cornell University, M.S. Major Field: Hydrology
1981-85 Swarthmore College, B.S. Major Field: Engineering; B.A. Major Field: Asian Studies

TEACHING, SUPERVISING AND ADVISING
Teaching Assistant, Irrigation & Drainage Design
Supervised one postdoctoral researcher and 6 Masters and Ph.D. students

ACADEMIC APPOINTMENTS AND EMPLOYMENT
Assistant Professor of Geography and Regional Development (2006- ), University of Arizona
Assistant Research Professor of Water Resources Policy (2006- ), Udall Center for Studies in Public Policy, Univ. of Arizona; affiliated with the Institute for the Study of Planet Earth.
Senior Project Specialist – Hydrometeorology (2005-06), National Oceanic and Atmospheric Administration, National Weather Service, International Activities, Silver Spring, MD.
Principal Researcher - Hydrology; Director for Asia (2001-05), International Water Management Institute (IWMI), Hyderabad, India.
Senior Researcher, Mexico Program Leader (1997-2000), IWMI, Guanajuato, Mexico.
Research Associate (1994-97), New York City Watershed Project, Cornell Univ., Ithaca, NY.
Project Manager (1992-94), Catholic Relief Services, Tegucigalpa, Honduras.
Intern - Watershed Management (1990), The Ford Foundation, New Delhi, India.
Coordinator - Watershed Management and Small-scale Irrigation (1987-89), Seva Mandir (an NGO), Udaipur, Rajasthan, India.
Consultant - Appropriate Shelter (1987), Development Alternatives, New Delhi, India.
Assistant Engineer (1985-87), Baker Engineers, Alexandria, VA.

PUBLICATIONS – Selected Refereed Journal Articles


**PUBLICATIONS – Selected Books/Edited Volumes**


*Contributed to the following chapters in this volume:*


**PUBLICATIONS – Selected Research Reports**


**SCHOLARLY PRESENTATIONS**


**GRANTS and CONTRACTS (P.M = PROJECT MANAGER; P.I. = PRINCIPAL INVESTIGATOR)**

**Mexico River Forecasting.** (P.M.) $0.36 million collaborative grant from the Comisión Nacional del Agua (CNA) Gerencia de Aguas Superficiales e Ingeniería de Ríos (2005-06).

**India Climate Forecast Systems (Component of the Disaster Management Support Project).** (P.M.) $0.56 million collaborative grant from USAID/ New Delhi (2005-06)

**Romania Destructive Waters Abatement and Management.** (Co-P.M.) $0.72 million collaborative grant from the Romanian Ministry of Environment & Water Management (2005-06)

**Health & Food Safety from Expanding Wastewater Irrigation, South Asia.** (P.I.) $1.05 million competitive grant from German Cooperation Ministry (BMZ) (2004-05).

**Urban & Peri-Urban Agriculture, South Asia.** (P.I.) $0.85 million merit-based grant from Netherlands Cooperation Department (DGIS) and Canadian International Development Research Centre (2004-05).

**Agricultural Water Productivity in the Krishna Basin.** (P.I.) $0.96 million competitive grant from Australian Centre for International Agricultural Research (2004-05).

**Linking Forest and Irrigation Management in the Himalayas.** (Co-P.I.) $0.3 million competitive grant from Consultative Group on International Agricultural Research, Challenge Program on Water and Food (2004-05).

**Water-Energy Nexus in Agriculture.** (P.I. for $0.73 million IWMI subcontract under prime contractor P.A. Consulting) $6 million, GSA schedule, 2-phase competitive grant from USAID (2002-05).

**Livestock-Environment-Watershed Interactions.** (P.I.) $0.29 million merit-based grant from Swiss Development Cooperation and U.N. Food and Agriculture Organization (2002-04).

**Pro-poor Irrigation Interventions.** (Research Supervisor) $0.11 million competitive grant from Asian Development Bank (2002-03).

**Irrigation Management, Mexico.** (Project Manager) $1.5 million multi-phase merit-based grant from the Ford Foundation (1997-2000).

**New York City Watershed Water Quality.** (Research Associate). Conducted Ph.D. research on this project funded by NY City Dept. of Environmental Protection (1994-97); worked with P.I. Tammo Steenhuis to secure Role of Subsurface Drainage in Transport of Cryptosporidium Parvum Oocysts grant (USDA, $0.184 million).
THOMAS W. SWETNAM

EDUCATION

- University of New Mexico, B. S., 1977, General Biology, Chemistry
- University of Arizona, M. S., 1983, Ph.D. 1987, Watershed Management, Dendrochronology

EMPLOYMENT

- 2000 to Present: Director & Professor of Dendrochronology, Laboratory of Tree-Ring Research; joint appointments in School of Renewable Natural Resources, Ecology & Evolutionary Biology, and adjunct appointment in Geography and Regional Development
- 1994-1999: Associate Professor of Dendrochronology, Laboratory of Tree-Ring Research
- 1988-1994: Assistant Professor of Dendrochronology, Laboratory of Tree Ring Research
- 1987-1988: Research Associate, Laboratory of Tree-Ring Research, University of Arizona
- 1980-1987: Graduate Assistant in Research, subsequently Graduate Associate in Research, Laboratory of Tree-Ring Research, University of Arizona
- 1978-1980: Forestry Technician, Gila Wilderness, New Mexico, U. S. Forest Service

AWARDS & HONORS

- A. E. Douglass Award University of Arizona (1983)
- Visiting fellow at Aldo Leopold Wilderness Research Institute, Missoula Montana (1994)
- Walter Orr Roberts Lecturer, Aspen Global Change Institute, Aspen Colorado (1999)
- Weaver Lecturer, School of Forestry and Wildlife Science, Auburn University (2000)
- W. S. Cooper Award, Ecological Society of America (2001)

10 SELECTED PUBLICATIONS (approximately 80 total)


**SERVICE/OUTREACH** (2000-present):

- Ecological Society of America Annual Meeting Local Host (Tucson, 2002), Program Chair (2003-2004)
- Member, Board of Trustees, Valles Caldera National Preserve, 4-year term (2001-present), appointed by President William J. Clinton
- Member, Arizona Governor Janet Napolitano’s Forest Health Advisory Council (2003-present).
- Member, Science Advisory Board, Malpais Borderlands Group, Animas New Mexico
- Member, Board of Advisors, Institute for Natural Resource Management, NSF-EPSCOR Program, New Mexico, 2003-present
- Member, Board of Advisors, International Multiproxy Paleofire Database, National Climate Data Center, NOAA, 2002-present.
- Testimony to Congress on fire ecology and fire management issues (testimony presented to two Congressional hearings in 2000, and a briefing to senate staffers in 2002).

**Editorial:**

- Associate Editor, International Journal of Wildland Fire, 1993-present
- Editor, Tree-Ring Research (formerly Tree-Ring Bulletin) 2000-2001
- Associate Editor, *Canadian Journal of Forest Research*, 1998
- Advisory Council, *Dendrochronologia*, 2002-present
- Co-Editor with J. Dean and D. Meko on special issue of *Radiocarbon*, 1996
Willem J.D. van Leeuwen
University of Arizona
Office of Arid Lands Studies & Geography and Regional Development
1955 E. 6th Street, Tucson, AZ 85719  tel: 520-626-0058 fax: 520-626-8063
E-mail: leeuw@ag.arizona.edu

Education:
University of Arizona, Tucson, AZ, USA Ph.D. 1995 Soil, Water & Environmental Science
Agricultural Univ. of Wageningen, NL M.S. 1988 Soil Science and Remote Sensing
Agricultural Univ. of Wageningen, NL B.S. 1986 Soil Science and Soil Fertility

Professional Appointments – Academic Activity:
2005 – present  Assistant Professor, Office of Arid Lands Studies and Geography and Regional Development, University of Arizona, Tucson.
1999 – 2002 Research Scientist, Météo France, Centre Nationale de la Recherche Scientifique and Centre National de Recherches Météorologiques Toulouse, France. SEVIRI Land Satellite Application Facility Team Member (France; adjunct)
1995 – 1999  Assistant Research Scientist, Department of Soil, Water and Environmental Science, University of Arizona, Tucson. (MODIS satellite Land Science Team Member; adjunct)
1990 – 1995  Research Associate, Department of Soil and Water and Environmental Science, University of Arizona, Tucson

Professional Associations:
Association of American Geographers (AAG)
American Society of Photogrammetry and Remote Sensing (ASPRS)
American Geophysical Union (AGU)
IEEE Geoscience and Remote Sensing Society (IGARSS)
International Association for Landscape Ecology (IALE)
National Science Teachers Association (NSTA)
Netherlands Society for Earth Observation and Geo-Information (BCRS)
Committee for Remote Sensing and Spatial Analysis (CRSSA – UA)

Publications:


Research Synergistic Activities:
- Dryland Vegetation Dynamics and Landscape Vulnerability to Wildfire. 2004-2006 (IALC grant)
- Vegetation phenology of desert ecoregions and sky islands
- Assimilation of Science Results and Data into National Decision Support Systems. 2002-2007 (NASA Grant).

Graduate Postdoctoral Advisors:
A. Huete – Ph.D. – University of Arizona, Tucson AZ
A. Huete – Postdoctoral advisor – University of Arizona, Tucson AZ

Thesis and Dissertation Advisor To:
None

Current Advisees (all graduate students including masters students and postdoctoral scientists): Grant Casady (PhD, ALRS), David Fornander (PhD, GEOG), Jahan Kariyeva (PhD, GEOG), Youngwook Kim (PhD, SWES), Phillip O. Leckman (PhD, Anthro), Amy McCoy (PhD, ALRS), Elisabeth vanderLeeuw (MA, GEOG),
Advisees (degree completed): Casey Thornbrugh (MA, GEOG), Chris Uejio (MA, GEOG), Michael Kline (MS, GEOG)
CONNIE A. WOODHOUSE

NOAA Paleoclimatology Branch, National Climatic Data Center, 325 Broadway St., Boulder, CO 80305; phone: (303) 497-6297, fax: (303) 497-6513; e-mail: connie.woodhouse@noaa.gov

EDUCATION

Ph.D. (December 1996) Department of Geosciences, The University of Arizona, Tucson, Arizona
MS (March 1989) Department of Geography, University of Utah, Salt Lake City, Utah
BA (May 1979) Prescott College, Prescott, Arizona

PROFESSIONAL POSITIONS

Physical Scientist (Apr. 2000-present), Paleoclimatology Branch, NOAA National Climatic Data Center, Boulder, CO
Research Scientist III, Fellow (Mar. 2004-present), Institute of Arctic and Alpine Research, University of Colorado, Boulder
Adjunct Assistant Professor (Feb. 2001-present), Department of Geography, University of Colorado, Boulder, CO
Faculty Affiliate (2004-2008), Department of Civil Engineering, Colorado State University, Fort Collins, CO
Research Scientist II (Mar. 1999-Mar. 2004), Institute of Arctic and Alpine Research, University of Colorado, Boulder
Visiting Scientist (May 1998-Apr. 2000), Paleoclimatology Program, NOAA National Geophysical Data Center, Boulder, CO
Research Scientist I (Jul. 1997-Feb. 1999), Institute of Arctic and Alpine Research, University of Colorado, Boulder
National Research Council Associate (Jan. 1997- Apr. 1998), Paleoclimatology Program, NOAA National Geophysical Data Center, Boulder

PUBLICATIONS, last 3 years


**PROFESSIONAL ACTIVITIES**

Tree-Ring Society, Vice President
International Tree-Ring Data Bank, chairperson of advisory board
International Multiproxy Paleofire Database, advisory board member
Rocky Mountain Hydrologic Research Center Board of Trustees,
Associate Editor, *Dendrochronologia*
National Academy of Sciences, Member of Committee on the Scientific Bases of Colorado River Basin Water Management

**GRADUATE STUDENT COMMITTEES**

Karen Eisenhart, University of Colorado, Geography
Zeyad Tarawneh, Colorado State University, Civil Engineering
Shelly Rayback, University of Texas (Austin), Geography

**POST DOC ADVISOR**

Nichole Barger, University of Colorado, INSTAAR

**COLLABORATORS**

P. Brown (Rocky Mountain Tree-Ring Research, Inc.), B. Udall (U. CO), E. Cook (Lamont Doherty Earth Observatory), S. Gray (UWY), H. Grissino-Mayer (UTK), H. Hartmann (UAZ), R. Heim (NCDC), E. Heyerdahl (USDA-FS), K. Hirschboeck (UAZ), M. Hughes (UAZ) M. Kaye (Penn State), S. Jackson (UWY), K. Kipfmueller (UMN), J. Lukas (U. CO), D. Meko (UAZ), G. Pederson (MT State), J. Salas (CO State U.), M. Salzer (UAZ), T. Swetnam (UAZ), R. Thompson (USGS), C. Whitlock (MT State)
STEPHEN YOOL

I. PROFESSIONAL PREPARATION
Undergraduate Institution: California State University, Hayward
Major: Management and Biological Science, 1969
Graduate Institution: California State University, Hayward
Major: Public Administration and Environmental Policy
Degree and Year: M.A., 1973
Graduate Institution: University of California, Santa Barbara
Major: Geography
Degree and Year: Ph.D., 1985

II. APPOINTMENTS
2001-Present: Assoc. Prof., Geography, The University of Arizona
2001-Present: Adjunct Associate Professor, Planning, The University of Arizona
1996- 2001: Adjunct Assistant Professor, Planning, The University of Arizona
1995- 2001: Assistant Prof., Geography, The University of Arizona
1992 - 1995: Research Assistant Professor, Geography, The University of Arizona
1985 - 1989: Physical Scientist, Naval Ocean Systems Center, San Diego, California
1979 - 1985: Research Associate, Remote Sensing Unit, U.C., Santa Barbara
1978: Instructor, Environmental Studies, De Anza Community College

III. SELECTED PUBLICATIONS
**IV. SYNERGISTIC ACTIVITIES**
1. Creation and Transfer of Knowledge: Wildfire Alternatives Biophysical Database, found at http://walter.arizona.edu
2. Teaching/Training: Interactive Learning Modules for self-paced learning of undergraduate/graduate Computer Cartography

**V. COLLABORATORS & OTHER AFFILIATIONS**

**a. Collaborators and Co-Editors**
Mary Henry, Geography, Miami University of Ohio, Oxford, OH  
Jay Miller, U.S.D.A., Tahoe National Forest, Sacramento, CA  
John Rogan, School of Geography, Clark University, Worcester, MA

**b. Graduate and Postdoctoral Advisors**
Daniel Botkin, U.C. Santa Barbara  
Frank Davis, U.C. Santa Barbara  
Alan Strahler, Boston University

**c. Thesis Advisor and Postgraduate-Scholar Sponsor**
John D. All, Ph.D., University of Western Kentucky  
Calvin Farris, Ph.D. Candidate, University of Arizona  
Mary Henry, Ph.D., Miami University of Ohio  
Peter Johnson, Ph.D. Candidate, University of Arizona  
Derrick Lampkin, Ph.D. Candidate, University of Arizona  
Michael Medler, Ph.D., Western Washington University  
Erick Sanchez, Ph.D. Candidate, University of Arizona  
Cynthia Wallace, Ph.D., U.S.G.S., Tucson, Arizona

Number of graduate students advised (28)
Appendix B:

Student Outcomes Assessment for the

Bachelors of Science, Geography
GEOGRAPHY AND REGIONAL DEVELOPMENT
STUDENT OUTCOMES ASSESSMENT, BA and BS

Student Name:                                     Date:

I. Background Information

1. When you complete your bachelors degree, how many years will you have attended college? ______

2. How many of these years were at the University of Arizona? ______

3. What was your classification when you became a geography major (freshman, sophomore, junior, senior)? ______

4. What courses, if any, convinced you to change your major to geography/regional development?

5. What other factors influenced your decision? Specific GRD faculty members? College advisors? Elementary or secondary school teachers?

6. What other majors have you had?

7. Do you plan to search for a job that is in your major field of study? If no, what do you intend to do when you graduate?
   Yes    No

8. Where do you hope to live once you graduate? (be as specific as possible: city, state, region or country)?

9. As a geography/regional development major, what knowledge/skills do you feel will be most valuable in obtaining and performing your first job?

10. Have you considered graduate school or some sort of post graduate professional program
    Yes    No
    If yes:
    In what field?
    When would you expect to start this program?
    At what school (include a list if you are not yet decided)?

11. Were you in a specific concentration? If so, which one?
II. Knowledge Areas in Geography:

We expect our majors to develop some broad understandings of physical and human geography. Assess your knowledge of topics associated with the following topics using the scale:

1. I understand this topic extremely well
2. I understand this topic well
3. I have some understanding of this topic
4. I know the basic concepts associated with this topic
5. I do not understand this topic

Regionalization and globalization, including global economic and political processes

Economic geography, including location theory and spatial analysis of economic activity

Analysis and modeling of demographic processes

Urban growth and development, including theories and processes of growth and planning

Theories of social justice with application to social, cultural, and economic geography

Relationship between human activities and environmental health/sustainability

Factors determining climatic patterns over the earth’s surface

Factors influencing spatial patterns of species and ecosystems

Physical factors acting to shape the Earth’s landforms

Causes and effects of global and regional environmental change
III. Skills in Geography

1. One of our goals is to help you improve your proficiency in writing, quantitative methods, computer literacy, and techniques of data collection and analysis. For each of the skills below, rank your improvement since entering our program on the following scale:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considerable Improvement</td>
<td>Good Improvement</td>
<td>Some Improvement</td>
<td>A little Improvement</td>
<td>No Improvement</td>
</tr>
</tbody>
</table>

Area Circle One

Proficiency in writing: 1 2 3 4 5
Which courses (if any) were especially helpful in improving your writing proficiency?

Quantitative methods: 1 2 3 4 5
Which courses (if any) were especially helpful in improving your quantitative skills?

Computer skills: 1 2 3 4 5
Which courses (if any) were especially helpful in improving your computer literacy?

Methods of data collection and analysis: 1 2 3 4 5
(including library, web-based and/or field data)
Which courses (if any) were especially helpful in improving these skills?

Geographic research methods 1 2 3 4 5
Which courses (if any) were especially helpful in improving these skills?

Ability to apply geographic concepts to “real world” problems/issues 1 2 3 4 5
Which courses (if any) were especially helpful in improving your field methods skills?
2. Are there any courses that you would have liked to have taken in your major that are not currently offered?

3. Another goal of ours is to help you to develop proficiency in one or more specific geographic skill areas. Evaluate your proficiency in these four areas. Tell us if you feel you are highly proficient, somewhat proficient, not proficient but at least familiar with the field, or no knowledge of the skill.

<table>
<thead>
<tr>
<th>Area</th>
<th>Proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Highly Proficient</td>
</tr>
<tr>
<td>Cartography</td>
<td></td>
</tr>
<tr>
<td>Statistical Analysis</td>
<td></td>
</tr>
<tr>
<td>Remote Sensing</td>
<td></td>
</tr>
<tr>
<td>GIS</td>
<td></td>
</tr>
</tbody>
</table>

IV. Contact Information

Now to wrap things up, we want to be able to get in touch with you after you have graduated. Please give us an address that will be good for at least a few months following graduation.

Your Name

Address (street)

City, State, Zip

Phone    Fax    E-mail

We would like to know about your first job! Ask your advisor for his/her business card. This will give you a convenient way of getting in touch with us. As soon as you land a job, send us a copy of your business card so we will have a better idea of where you are and what you are doing.

If you have any other comments, please include them below. We hope you have enjoyed your association with the department. Stay in touch and good luck!