45. Wang, Z. and J. Feyen, (Oral presentation). A criterion for design, evaluation and optimization of on-farm irrigation systems. 45th ICID Executive Council Meeting & 17th European Regional Conference on the theme "Effective and ecological sound use of irrigation waters with special reference to European countries", **Varna**, Bulgaria, May 16-22, 1994.
46. Wang, Z. and F. Zhu. (Oral presentation). Parabolic cutthroat flumes for open channel discharge measurement. International Conference on Agricultural Engineering, **Beijing**, China. Oct. 1992.

On-going Research Projects

1. **Department of Defense (DOD): Shallow Saline Aquifer Monitoring Program at NAS Lemoore.** 2010-1011 ($63,572). Principal Investigator: Z. Wang (hydrologist). The major objective is to develop a groundwater monitoring program in concert with parallel studies on plant and wildlife habitats at NSA Lemoore. A Rockwork model will be developed to study the saline groundwater dynamics and the geology of the aquifers. Based on that, MODFLOW and GIS models will also be created for trend analysis and predictions. Recommendations on water supply, plant and wildlife choices will be developed based on specific studies on the shallow saline groundwater aquifer, saline-sodic soil, irrigation water quality, plant suitability and wildlife habitats.
2. **California Department of Water Resources (CA-DWR): Upper F*resno River Watershed Assessment Project.* 2008-2010** ($187,366). Principal Investigators: Z. Wang (hydrologist) and S. Blumenshine (ecologist). Collaborators: Madera County and Central Sierra Watershed Committee. Major objectives are to develop GIS-based nutrient loading and vegetation distribution models that are capable of analyzing the fate and transport of nutrients and invasive plants in the Fresno River watershed. Using the data collected by the team, chart and quantify the septic systems, roads, water quality and species distribution within the watershed, identify watershed land use patterns associated with high nutrient loads and invasive weeds, and finally create a GIS-based geodatabase information system (web server) to help identify areas where nutrient input are highest, sources of point or non-point nature, and measures for watershed restoration.
3. **CA-DWR: Upper San Joaquin *River Watershed Assessment Project. 2008-2010*** ($94,778). Principal Investigator: John Suen (hydrgeologist), Co-PIs: Z. Wang (hydrologist) and S. Blumenshine (ecologist). Collaborators: Sierra Resources Conservation District and Central Sierra Watershed Committee. Major objectives are to conduct a comprehensive assessment of the watershed in the following areas: Evaluation of water quantity and quality concerning the Sierra Navada snow packs, streams, lakes and groundwater; Climate change effects on the snow packs and the entire ecosystems; Impacts of regional air pollution on water quality and vegetation in the watershed; Status of hydrogeology, topography, soils and other physical aspects; Status of forest, aquatic habitats, biodiversity, invasive species and groundwater dependent ecosystems; Elements of hydrologic cycle including precipitation, evapotranspiration, groundwater recharge and infiltration; and Policy and management issues pertinent to the long-term sustainability and environmental conservation of the watershed.

Recently Funded Research Projects

4. **US National Science Foundation (NSF): "Geoscience Mentoring, Education, Training, Research and Outreach (METRO) Center at CSU Fresno."** NSF OEDG (Opportunities for Enhancing Diversity in the Geosciences) program. PI: Alam Hassan; Collaborators: Zhi Wang et al. **Funded for $1.4 millions** to set up the METRO Center at CSU Fresno.
5. **NSF: Acquisition of an X-ray Diffraction Instrument.** 2004-2005. Total funding $148,421, PI: Keith Putirka, Co-PI: Z Wang. The range of research projects include: 1) issues in regional geology, volcanology and metamorphic petrology, 2) the identification of asbestiform minerals related to construction projects, 3) igneous barometery and the refinement of unit cell parameters of clinopyroxenes, 4) study of soil mechanics and soil contamination through the

analysis of clay minerals and gypsum mineral fractions in agricultural soils, 5) problems in groundwater flow, and the relationship between mineralogy and clay fraction on flow-rates and mode of water transport through soils, and 6) the analysis of dust particles produced from dairy operations, recognized as a significant health hazard in regard to air quality.

6. **California EPA: Fresno River-Hensley Lake Water Quality Monitoring.** 2003-04. Total funding $134,600. Principal Investigator: Z Wang and S. Blunmenshire. The main tasks include: Sampling and monitoring of water discharge, water quality (physical, nutrients, algae) and disease-causing bacteria concentrations along the main Fresno River, its 7 tributaries and the Hensley Lake with a total of 24 monitory sites.

Research Proposals and Funding History

7. **NSF: Resilience in an urban socioecological system: water management as a driver of landscape and biodiversity in Fresno-Clovis, California.** Submitted on July 7, 2009 to NSF ULTRA program. PIs: Madhusudan Katti et al.; Participants: Zhi Wang et al. The requested total budget was $299,232, **pending** for review and decision.
8. **CSUF-ARI (Agricultural Research Initiative): The Impact of Climate Change and Air Quality on Central San Joaquin Valley Agriculture** (Pre-proposal). Submitted on September 8, 2009. PI. Donald Hunsaker; Co-PIs: Fraka Humsen, Alam Hassan; Collaborators: Charles Krauter, Zhi Wang. The requested total funding was $450,000, **pending** for review and decision.
9. PI, **Measurement and Modeling of Unstable Flow in Soils**, NSF 2008, not funded. Collaborators: Ming Xiao (CSUF), Jiri Simunek (UC Riverside) and Atac Tuli (UC Davis).
10. PI, **Development of Sequentially Activated Micro-Flood Irrigation Systems to Reduce Agricultural Runoff.** CSU ARI, 2007-08, not funded (collaborating with CIT–Center of Irrigation Technology at CSU Fresno). We propose to develop and implement a Sequentially Activated Micro–Flood Irrigation System (SAMFIS) in which a low cost Sequential Irrigation Valve will be used as the critical water-flow control device. The new concept of surface irrigation technology will result in a scientifically designed and technically programmed system that can be achieved without changing the existing field layouts and without arbitrary human intervention.
11. PI, **Water and Nitrogen Management in Surface Irrigated Crop Production Systems in San Joaquin Valley**. California DWR – Water Use Efficiency Program. 2007-08, not funded. This project seeks to develop new design and management approaches and guidelines for improving the efficiencies of Irrigation and ferti-gation in San Joaquin Valley. A training program will be developed to teach and demonstrate effectiveness of using surface irrigation models to improve water use efficiencies. Application guidelines will be developed for field water and fertilizer management.
12. Co-PI, **Establishing a Water Coalition Support Center in CA's Central Valley**. USDA 2004-07, $1.2 million, not funded (Co-PIs: D. Wichelns and K. Longley). The goal is to establish a Water Coalition Support Center that will provide technical, scientific, and policy expertise required to support efforts to improve water quality under the Conditional Waiver Program.
13. PI, **Internal Grant from CSU Fresno: Assessment Proposal Funding Award**. Office of Institutional Research, Assessment and Planning ($5,000. Co-PI: Robert Dundas). This project was designed to conduct a comprehensive test on the prerequisite courses before students begin the field course (Geology 107- Advanced Field Methods, 3 units, 9 lab hours). This assessment will permit us to evaluate student preparedness for the culminating experience course and to identify areas where the Department could improve the curriculum and note areas where we are doing well.
14. PI, **Internal Grants from College of Science and Mathematics at CSUF**. Faculty Performance Award ($6,000) - 2003-2007; Faculty Research Equipment Awards ($66,686) including

Hydrology and Environmental Science Lab Setup: EasyChem Analyzer ($45,000), 2005-06, Dewpoint Water potentiometer-WP4-T ($7,242.29), 2004-05, Data acquisition system ($5,641), 2003-04, Portable TDR for measuring soil water content ($8,803), 2002-03; College Minigrants: Education-Assisted Measurement and Modeling of Watersheds and Groundwater ($2,500), 2005-06, Measurement and modeling of stormwater and contaminant flow ($2,500), 2004-05, Light transmission investigation of water and contaminant movement in soils ($2,500), 2003-04; College Scholarly and Creative Activity Award (24 WTUs), 2002-06; College Instructional Equipment award - ***GIS Lab upgrade***: 14 computers, one scanner and one plotter (~$40,000) 2004-05, 12 computers and monitors ($7,216) 2003-04; New Faculty Start-up fund ($20,000), 2002-03.

15. Co-PI, **Prediction of DNAPL Fate in Heterogeneous Aquifers Under Uncertainty.** (pending, collaborating with Los Alamos National Lab, UC Riverside and Colorado State University). DOE Environmental Management Program, 2004-06 (not funded). Develop an improved predictive capability of DNAPL fate in heterogeneous aquifers with uncertainties; Based on a systematic analysis of the microscale physics using the Lattice Boltzmann method. The small-scale dynamics will be integrated into macroscale descriptions using stochastic theory. Incorporate stochastic analysis into the linear instability criteria developed by Wang et al. [1998] for the description of finger flow formation, propagation, and persistence in heterogeneous media. The end product will be used to evaluate the performance of various remediation techniques employed at DOE sites.
16. Post-doc Soil Physicist, Characterization of **Preferential flow in spatially variable unsaturated field soils** (PI: Dr. William A. Jury). BARD,-The United States – Israel Binational Agricultural Research and Development Fund, 1998-2001. Dye tracing and multiple tracer experiments on undisturbed field plots to reveal information about the flow velocity, spatial prevalence, and time evolution of a preferential flow event. Numerical experiments to determine whether preferential flow observations are consistent with Richards' equation. Develop a flow model that incorporates preferential flow.
17. Post-doc Soil Physicist, **Sustainability of Long-term Reclaimed Wastewater Irrigated Cropland - A Field Evaluation of Soil Quality** (PI: Dr. Andrew Chang). The Kearney Foundation of Soil Science, 1998-2000. Field study for the effects of long term wastewater irrigation on soil's ability to sustain plant growth and to attenuate pollutants. Geostatistical analyses of soil physical, chemical and biological attributes to characterize soil qualities at two field sites outside the City of Bakersfield, CA. Development of integrated indicators of soil quality for assessment of soil and environmental degradation.
18. PI. **Dynamic Simulation of Liquid-Air Displacement and Preferential Flow in Porous Media.** Doctoral Full Scholarship and Research Fund, Bf720K/year, University of Leuven, Belgium, 1993-97. Experimental measurement and theoretical analyses of inter-displacement behaviors between air and an infiltrating liquid in unsaturated porous media; derivation of infiltration equations accounting for air entrapment effects; experimental study and theoretical prediction of unstable preferential flow in porous media.
19. PI. **Experimental and Numerical Simulation of Level Basin Irrigation Systems,** National Natural Science Foundation of China (NSFC 59209099), RMB¥50K, 1993-95. Theoretical and experimental study for the effect of air entrapment on water infiltration; Numerical modeling of the overland flow and subsurface infiltration hydraulics; optimization of system design variables based on soil and flow properties.
20. Co-PI. **Optimum Control of Flow in Irrigation Canal Systems** (PI: Dr. F. Zhu). Education Research Fund, Chinese Education Commission, RMB¥40K, 1990-92. Optimization of canal system operation and control regimes; Beneficial use of hyper-concentrated turbid flow; Development of a 0-1 programming model for optimal control of flow in irrigation canals.

21. Co-PI, **Water Control and Measurement Structures for Sediment-laden Flow** (PI: Dr. F. Zhu). Hydraulic Science Foundation, Water Resources Department of China, RMB¥30K, 1985-89. Development of Venturi type flowmeters and Flumes for discharge measurement in Trapezoidal and U-shaped open canals transporting sediment-laden flow.
22. Co-PI, **Utilization and Transportation of Hyper-concentrated Turbid Flow** (PI: Dr. F. Zhu). Hydraulic Science Foundation, Water Resources Department of China, RMB¥30K, 1986-89. Monitoring and prediction of floods in watersheds; Measurement of flow rate, sediment concentration and particle distribution; Transportation of turbid flow through canals; Fluid dynamics of turbid flow in canals and groundwater recharging fields.

Xiaoming Yang, Ph.D.

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(1) Education

Ph.D. Geographic Information System and Forest Resource Management; State University of New York, College of Environmental Science and Forestry, Syracuse, NY 1990 – 1994

MS Quantitative and statistical methods for forest resource management; State University of New York, College of Environmental Science and Forestry; Syracuse, NY 1986 – 1989

BS Forestry; Beijing Forestry University, Beijing, China 1978 – 1982

(2) Professional Experience

Senior Analyst **Geospatial Information Center, California State University Fresno. April 2010 – present**

- Supervises spatial analysis, photogrammetry and remote sensing projects; Data manager for spatial and non-spatial data for a NSF grant; development of two online GIS certificate classes; GIS web application development for the SJ river restoration project; GIS data development and analysis for The San Joaquin Valley Water Plan project.

Senior Analyst **Interdisciplinary Spatial Information Systems Center, California State University Fresno. Feb. 2001 – March 2010**

- Supervises 100+ spatial analysis, photogrammetry and remote sensing projects; manages The City of Reedley parcel digitization project, The San Joaquin Valley Crop, Water and Land Use Mapping Project and has a significant role in the Remote Sensing for Vineyard Management Project; participate in The San Joaquin Valley Water Plan project and the San Joaquin River Restoration project as leading GIS person, assist GIS training classes for an ESRI certified trainer.

Chief Analyst Resource Studies Center, Saint Mary's University of Minn., Winona, MN July '97 – Dec '00

- Supervised GIS analysts and GIS technicians; designed spatial databases for natural resource & land use management and planning; designed, implemented and managed GIS and digital photogrammetry projects, GIS data automation, and performed geo-statistical analysis; designed, programmed, and implemented decision support models for urban development, environmental impact analysis, and hazardous sites

monitoring; established QA/QC standards of GIS/digital photogrammetrical projects; taught graduate classes in remote sensing and GIS.

Technical Manager GIS/RS Center, Wilkes University, Wilkes-Barre, PA July '94 – July '97

- Coordinating all research projects involving GIS, remote sensing (RS), global positioning systems (GPS), and photogrammetry technologies; providing technical advice and training; designed and managed a GIS database for environmental monitoring; conducting research on GPS accuracy, water quality, watershed analysis, and economic development; applications; Conducting satellite imagery and aerial photo analysis and classification.

Senior Research Assistant State University of New York College of Environmental Science and Forestry, Syracuse, NY; June '93 – July '94

- Conducted spatial analysis on urban forest meteorology and meteorological morphology analysis on urban vegetation distribution; designed spatial database for research projects; geo-statistical analysis

Teaching / Research Assistant State University of New York College of Environmental Science and Forestry, Syracuse, NY; Sep '87 – May '93

- Integrated GIS, decision support system, and expert system technologies into a spatial decision support system (SDSS) for timber and wildlife management; Acquired and engineered an wildlife knowledge base for New York state; Designed and developed a wildlife expert system;

Special Training in remote sensing, GIS, and statistical software

Selected Projects and Grants:

- San Joaquin Valley Crop, Water, and Land Use Mapping Project, 2001-2002; funded by **CSU Agricultural Research Initiative**; $149,837, 100%
- Remote Sensing for Vineyard Management, 2001; funded by **CSU Agricultural Research Initiative**; $6,000, 10%
- Geo-spatial Technology Applications for Sun-Maid Growers of California, 2003; **Sun-Maid**, $50,000, 50%
- CIT Salinity, Selenium, and Drainage Mapping, 2004; funded by **Center for Irrigation Technology**; $10,000, 15%
- Streets and Roads Mapping of Fresno and Kings Counties, 2005-2006; Funded by **California Department of Forestry**; $45,000, 60%

Publications and Reports:

- **The San Joaquin Valley Crop, Water, and Land Use Mapping Project,** August 2002
- Annual Report: **Remote Sensing for Vineyard Management,** September, 2001

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Position: Professor

Date of Initial Appointment: January 1990

Highest Degree Earned and Year: Ph.D. in Business Administration (CIS) 1989

Current Classification: Professionally Qualified

EDUCATION

1989 Ph.D. Business Administration (Computer Information Systems), Arizona State University
1976 MA, Anthropology (Cultural Resource Management), University of Arizona
1972 BA, Anthropology, University of Colorado

WORK EXPERIENCE

Academic Experience

1990 to pres Professor of Information Systems/Decision Sciences - teaching undergraduate and graduate classes in Information Systems.

2002-present Associate Director, Interdisciplinary Spatial Information Systems (ISIS) Center

2000-2004 Director of Census Information Center, California State University Fresno (part of US Department of Commerce, US Census Bureau public outreach program)

1999-2002 Director, Interdisciplinary Spatial Information Systems (ISIS) Center. In charge of developing center, grant writing, contracting, community relations, development of regional data sharing agreement, chairing regional

conferences, chairing regional user group, supervision of analytical and technical support staff.

1986-1989 Teaching Assistant, Arizona State University; taught MBA Information Systems classes; assistant for Expert Systems, Decision Support Systems, and Statistics classes

1986 Lecturer, California State University, Fresno; taught undergraduate Information Systems classes (part-time)

Professional Experience (relevant to CIS and GIS)

1992-1993 Part-time professional leave without pay to gain industry experience. Director, Administrative Services Division of INFOTEC Research, Inc. In charge of Management Information Systems including information systems planning, design, selection, implementation, training, networking and information management.

1978-1986 Forest Archaeologist for Sierra National Forest, Fresno CA. In charge of all cultural resource management activities and legal compliance; planning team member for economics, social impact and cultural resources.

1977-1978 Assistant Regional Archaeologist, Intermountain Region of US Forest Service, US Department of Agriculture – director of cultural resource laboratory and artifact repository

1976-1977 Archaeologist, Western Archaeological Center, National Park Service, in charge of developing cultural resource management programs for Western Region mountain parks. Tucson, AZ Also member of Western Regional Planning Team for Yosemite, Sequoia-Kings and Lassen Volcanic national parks, Whiskey Town National Recreation Area and Lava Beds National Monument.

1973-1975 Project Archaeologist, Museum of Northern Arizona (Research Center), Flagstaff, AZ

1970-1972 University of Colorado Mesa Verde National Park Archaeological Research Center. Laboratory Director (72), Assistant Laboratory Director (71), student staff member (70)

Courses Taught (last five years):

- IS 52: Computer Concepts
- IS 52 Lab: Computer Concepts Lab
- IS 140: Geographic Information Systems for Business (lecture and lab)

- IS 150: End-user Computing (lecture and lab)
- IS 158: Database (lecture and lab)
- IS 166: Systems Analysis and Design (lecture and lab)
- MBA 250: End User Computing (lecture and lab)
- MPA 289T: Intro to GIS (Master's of Public Admin Hanford Off-Campus Program)
- Independent studies at graduate and undergraduate level

INTELLECTUAL CONTRIBUTIONS (last five years)

Peer Reviewed Journal Articles

Stengel, D; Chaffe-Stengel, P.; Mofitt, K. (2010); The impact of a tree virus on production, *Journal of Modeling in Management.* Vol 5:2 (194:209)

Research Monographs

Books

Chapters

Peer Reviewed Proceedings

Peer Reviewed Paper Presentations

- Geostatistical Analysis of Student Performance in Self-selected Seating with Dr. Balaji Sethuramasamyraja. CalGIS, Modesto, April 22-25, 2008, Recipient of Outstanding Poster Award.
- IS Curriculum Contributions to GIS Education, GIS Education Conference, San Diego, CA, Aug 5-8, 2006

Faculty Workshops

Non-Peer Reviewed Journals

Others

DEVELOPMENT ACTIVITIES (last five years)

Professional Experience

- Associate Director, Interdisciplinary Spatial Information Systems Center (ISIS), California State University Fresno

Consulting

Professional Development

Other Professional Activities

2009-2010

- Attended RSA Conference, San Francisco, CA Mar 3, 2010
- Judge, Third Annual Fresno County Office of Education Technology Competition, Mar 20 2010
- Attended Cloud Computing Summit, Santa Clara, March 17, 2010
- CIS Advisory Board, Fresno City College

2008-2009

- Attended Pearson-Prentice Hall Information Technology Symposium, Seattle WA April 17, 2009
- Attended RSA Conference, San Francisco, CA April 22, 2009
- Judge, Second Annual Fresno County Office of Education Technology Competition, jan 31, 2009
- Attended Oracle Open World, San Francisco, CA September 23, 2008

2007-2008

- Attended CalGIS, Modesto, CA April 22-25, 2008
- Attended RSA Conference, San Francisco, CA April 9, 2008
- Taught GIS workshops to the exchange students in the International Business Program, Nov 11, 2007 and Apr 18, 2008
- Judge, First Annual Fresno County Office of Education Technology Competition, Mar 1, 2008
- Attended GIS Day, ISIS Center, CSU Fresno, Nov 14, 2007
- Attended Oracle Open World, Nov 11, 2007

2006-2007

- Attended ESRI User Group Seminar, Fresno, CA, May 2, 2007
- Attended San Joaquin Valley Council of Governments (COG) Transportation Planning/CUBE May 1, 2007
- Attended CalGIS, Oakland, CA April 4-6, 2007 and was on the team that took 2nd place in the Geography Bee
- Attended University of California Geospatial Technologies in Agriculture Symposium Oakland, CA April 4-6, 2007
- Taught GIS workshops to the exchange students in the International Business Program, Nov 17, 2006 and Mar 23, 2007
- Attended GIS Day Conference, ISIS Center, CSU Fresno, Fresno, November 15, 2006
- Attended ESRI User Group Seminar, Fresno, CA, Sep 6, 2006
- Attended ESRI International User Conference, San Diego, July 25-29, 2005
- Attended ESRI Education User Conference, San Diego, July 23-24, 2005
- GIS Consultant, Tulare County Pest Control Board.

- GIS Consultant, University of California Agricultural Research Center, Lindcove, Citrus Tristeza Project, working with Research Center personnel, with Professors Donald N. Stengel and Priscilla Chaffe-Stengel

2005-2006

- Attended ESRI Business GeoInfo Summit, Boston, May 1-2, 2006
- Attended ESRI Business Educators Seminar, April 30, 2006
- Attended ESRI International User Conference, San Diego, July 25-29, 2005
- Attended ESRI Education User Conference, San Diego, July 23-24, 2005
- Attended San Joaquin Valley ESRI User Group Meeting, Fresno, September 7, 2005
- Attended GIS Day Conference, ISIS Center, CSU Fresno, Fresno, November 16, 2005
- Attended San Joaquin Valley ESRI User Group Meeting, Fresno, February 1, 2006
- Presentation on GIS to Woodward Park Rotary, November 8, 2005
- Taught GIS workshops to the exchange students in the International Business Program
- Presentations on GIS in numerous graduate and undergraduate classes to introduce students to GIS

SERVICE ACTIVITIES (last five years)

University, School, and Department Service

University

- Provosts Representative to University Information Security Committee
- CSB Rep to Academic Information Technology (AIT) 2003-
- Chair, University GIS Committee (not very active)
- Program Review Committee Geography 2004, 2009
- Database development and maintenance for Employee Assistance Program
- Associate Director, ISIS Center (2002-present)
- Cross College/School mentoring of new faculty member (B. Sethuramasamyraja, IT Dept, College of Agricultural Sciences and Technology)
- EEO Rep on searches in College of Science and Math
- Member search committee in College of Agricultural Sciences and Technology
- Member, committee formulating an online MS in Water Resources Management
- Member of thesis committee (Peter Schmidtz, Sarah Wallace)
- Member of RTP Committee for Department of Child, Family and Consumer Sciences
- Peer-reviewer for courses in two departments of the College of Agricultural Sciences and Technology

CSB

- Committee on Faculty 2005 to present (Chair 2005-present)
- GIS hands-on workshops for International Business Students (several times)
- Presentations on GIS to various classes and honors program

- CIS Advisory Board member
- Supervised honors thesis for Ms. Emily Pagan
- Cross-department mentoring of new faculty member (S. Geringer)
- Assisted MBA project teams with the GIS portions of the projects

ISDS

- Curriculum Committee
- Search committee for 2009 new hire
- Alpha Iota Delta, chapter founder and sponsor (not currently active)
- Association for Information Management (AIM – student club advisor when active)
- Student field trips to Oracle Open World (3 times – Moscone Center, San Francisco)
- Student field trips to RSA Conference (3 times – Moscone Center, San Francisco)
- Mentor, Dr. Sonya Zhang

Community and Professional Service

- GIS work (never ending)
- Volunteer for San Joaquin River Parkway and Conservation Trust (ongoing)
- Judge, Fresno Unified Technology Tournament (2008, 2009, 2010)
- Member, Fresno County Foster Care Technology Committee

AWARDS, HONORS, AND OTHER ACTIVITIES (last five years)

- Best poster at CalGIS 2008

Appendix C: Needs Assessment

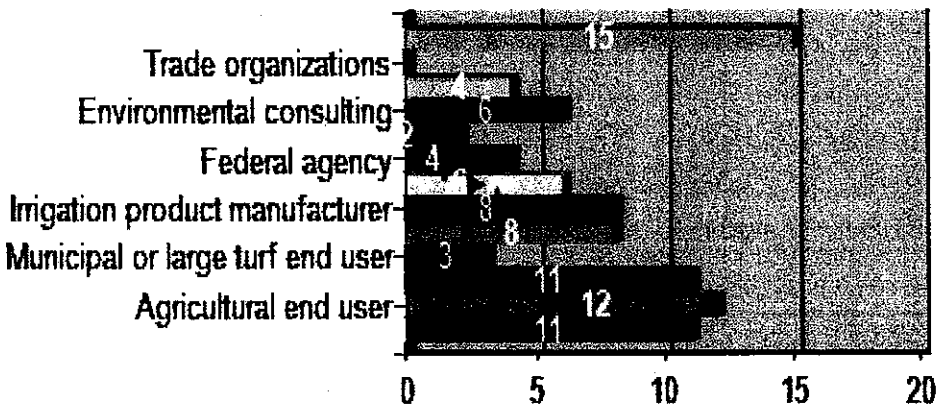
Needs Assessment

2009/2010 Survey

A survey was conducted in 2009/2010 to determine if regional and statewide employers saw a need for employees trained in GIS. Additionally the survey also asked about the training desired for new employees, internship opportunities, and job prospects for graduates. The survey was sent out to 154 stakeholders representing industry, business, or agency enterprises about the feasibility of GIS training at the graduate level. Ninety–one (91) responded and they strongly supported implementation of GIS coursework. When asked if they would need to hire someone with a GIS background in the next ten years, 69% responded that they would. The results of the survey were used in the development of the Advanced Certificate in GIS – a focus in science (especially water) and technology was implemented.

The respondents were divided into twelve categories, though the largest group (27 respondents) identified themselves as "other". Many viewed their area as changing in the near future, indicating the dynamic nature of the industry and the need for graduate level expertise to meet these challenges. Regarding internships: 55% of respondents currently offer internships and 78% were interested in offering internships in the future. Most were in science and technology rather than the business aspects of their industry.

What areas of water resource management best describe your company's or organization's CURRENT business?



	Choice	Response Percent	Response Total	Analytics

1	Agricultural- water district	22.00%	11
2	Agricultural end user	24.00%	12
3	Municipal- water district	22.00%	11
4	Municipal or large turf end user	6.00%	3
5	Wastewater	16.00%	8
6	Irrigation product manufacturer	16.00%	8
7	Irrigation product supplier	12.00%	6
8	Federal agency	8.00%	4
9	State agency	4.00%	2
10	Environmental consulting	12.00%	6
11	Environmental advocacy	8.00%	4
12	Trade organizations	0.00%	0
13	Other	30.00%	15

Mean	6.211
Standard Deviation	4.154
Standard Error	0.438
Variance	17.255

Fall 2010 Survey

Fong Strategy conducted additional market research in Fall 2010 to assess the demand for an Advanced Certificate in GIS. Eleven in-depth interviews with GIS professionals, planners, water resource professionals and others were conducted, and 77 Fresno State GIS knowledgeable graduates were sent an online survey (19% response rate). The key findings indicated demand for the proposed certificate with the expected growth rate for professions utilizing GIS about 19% during the next decade. Across the country, fifteen campuses offer a graduate certificate in GIS but none have a hydrology emphasis and only a few are fully online. Clearly there is a niche and growth opportunities.

Appendix D: Budget Proposal

Budget Proposal

The Following budget is proposed based on $525 per unit tuition and three levels of enrollment (15, 20 and 25 students).

GIS Graduate Studies Certif prog (12 units)

5/23/2011

$525 per unit

		15 @ $525	20 @ $525	25 @ $525
Revenue:				
1	Registration Fees	94,500	126,000	157,500
	Total Revenue	94,500	126,000	157,500
Expenditures:				
2	University Reimbursement	14,175	18,900	23,625
3	CO & SCO Reimbursement	4,725	6,300	7,875
4	DCGE Admin Cost Recovery	13,500	18,000	22,500
5	Graduate Studies	1,500	2,000	2,500
6	Faculty	19,812	26,412	31,872
6b	Fac Fringe Benefits	287	383	462
7	Program Director	5,000	5,000	5,000
7b	Fringe Benefits	73	73	73
8	Marketing	10,000	10,000	10,000
9	Supplies, Software, etc.	0	0	0
10	Travel	5,000	5,000	5,000
11	Misc.	0	0	0
	Total Expenditures	74,072	92,067	108,907
Balance		**20,428**	**33,933**	**48,593**
MOU Split:				
	60% to College of Sci & Math	12,257	20,360	29,156
	40% to DCGE	8,171	13,573	19,437
		20,428	33,933	48,593

Notes:
1. Registration Fees Estimated at $ 525 per unit. Total units for completion of the program is 12.
2. University Administrative Overhead (Reimbursement) is calculated at 15% of revenue.
3. Chancellor's Office and State Controller's Office Reimbursement is calculated at 5% of revenue.
4. The Division of Continuing and Global Education charges $75 per unit to cover operating expenditures. (12 units x 20 students x $75 = $18,000, etc.)
5. Graduate Studies charges $100 per student for the first course taken. After that there is no charge.
6. Faculty salaries are based on full professor faculty rank, special sessions.
6b. Faculty Fringe benefits calculated at 0.0145.
7. Program director stipend for one cohort.
8. Web marketing
9. Travel
10. Miscellaneous